www.JCRonline.org *Just CERFing*, Vol. 7(9), September 2016 www.cerf-jcr.org

Just CERFing

The Coastal Education and Research Foundation, Inc. (CERF)
Official publisher of the *Journal of Coastal Research* (JCR)

Acceleration in U.S. Mean Sea Level? A New Insight using Improved Tools

Dr. Charles W. Finkl
Editor-in-Chief
Just CERFing

Dr. Christopher Makowski
Deputy Editor-in-Chief
Just CERFing

Barbara Russell
Managing Editor
Just CERFing

IN THIS ISSUE

CERF Regional Vice Presidents

Acceleration in U.S. Mean Sea Level? A New Insight using Improved Tools

Sea Surface Temperature Trends in Venice Lagoon and the Adjacent Waters

Beach Renourishment: Book Review

The Block Island Bluff Image Project: Using Google Earth™, Spreadsheet Mapper, and Google Drivee to Build a Database of Spatially Located Field Images of Coastal Bluffs

Geoscience Research Resource Work Award

Encyclopedia of Marine Geosciences

Lakes of the World (CRL)

Coastal Research Library (CRL)

Hypsometry of Cape Cod Salt Marshes (Massachusetts, USA) and Predictions of Marsh Vegetation Responses to Sea-Level Rise

4th International Rip Current Symposium

Forecasting the Potential Effects of Climatic and Land-Use Changes on Shoreline Variation in Relation to Watershed Sediment Supply and Transport

JCR Special Issue #75

Spatial Variability of Hydrodynamic Timescales in a Broad and Shallow Estuary: Mobile Bay, Alabama

The Influence of Morphology on Sinkhole Sedimentation at Little Salt Spring, Florida

Membership Options

CERF Website

Publish Your Photos

CERF Board of Directors

JCR Editorial Board

CERF Lifetime Members

CERF Patron Members

New CERF Members

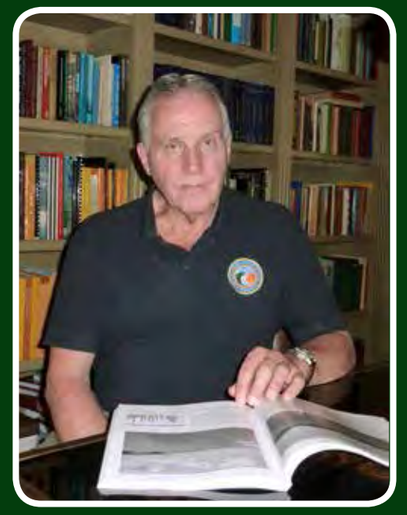
Current CERF Members

JCR Outside Reviewers 2015

JCR Current Issue, Cover Photo

Coastal Education & Research Foundation, Inc. [CERF]

Officers of the Foundation



President & Executive Director
Dr. Charles W. Finkl
Cfinkl@cerf-jcr.com

Senior Vice President & Assistant Director
Dr. Christopher Makowski
Cmakowski@cerf-jcr.com

Secretary
Heather M. Vollmer

Executive Assistant
Barbara A. Russell
Barbara@cerf-jcr.com

Coastal Education and Research Foundation *[CERF]* is pleased to announce our newly appointed Regional Vice Presidents (RVP), who throughout the international scientific community continue to provide outstanding representation of our coastal research society. Please join us in honoring the following individuals for their tremendous service and support of CERF and the JCR.

CERF Regional Vice Presidents

Southeast Asia
Nobuo Mimura, D.Eng.

North America
James R. Houston, Ph.D.
Victor V. Klemas, Ph.D.
Orrin H. Pilkey, Jr., Ph.D.

South America
Omar Defeo, D.Sc.

Western Europe
Carlos Pereira da Silva, Ph.D.
Michael Phillips, Ph.D.
Marcel J.F. Stive, Ph.D.

Eastern Europe
Kazimierz K. Furmańczyk, D.Sc.

Oceania
Charles Lemckert, Ph.D.
Vic Semeniuk, Ph.D.
Andrew D. Short, Ph.D.

CERF RVP (Southeast Asia)

Nobuo Mimura, D.Eng.

Nobuo Mimura, D.Eng., is currently serving as the President of Ibaraki University. His academic areas of expertise are global environmental engineering, coastal engineering, and adaptation policy to climate change. Dr. Mimura has also been a member of the advisory committees for Ministry of Foreign Affairs, Ministry of Infrastructure, Land and Transportation, Ministry of the Environment and Ministry of Education, Culture, Sports, and Science and Technology.

CERF RVP (North America)

James R. Houston, Ph.D.

Jim Houston, Ph.D., is Director Emeritus of the U.S. Army Engineer Research and Development Center (ERDC), which includes all the research and development laboratories of the Corps of Engineers. He managed one of the most diverse research organizations in the world – seven laboratories at four geographical sites, with over 2,000 employees and an annual program budget of $1.3 billion. Dr. Houston has published over 130 technical reports and papers and has received several honors and awards including three Presidential Rank Awards and the National Beach Advocacy Award.

Vic Klemas, Ph.D.

Vic Klemas, Ph.D., is Professor Emeritus in the University of Delaware's College of Earth, Ocean, and Environment. He directed UD's Applied Ocean Science Program from 1981-98, and he has co-directed UD's Center for Remote Sensing for more than 30 years. Dr. Klemas has served on six scientific committees of the National Research Council and received a number of awards, including, in November 2010, the Science Prize of the Republic of Lithuania. The honor recognized his lifetime achievements in applying remote sensing and other advanced techniques to study coastal ecosystems.

Orrin H. Pilkey, Jr., Ph.D.

Orrin H. Pilkey, Ph.D., is a James B. Duke Professor Emeritus of Geology within the Division of Earth and Ocean Sciences and Director Emeritus of the Program for the Study of Developed Shorelines (PSDS) in the Nicholas School of the Environment and Earth Sciences at Duke University. Since 1965, Dr. Pilkey has been at Duke University with one-year breaks with the Department of Marine Science at the University of Puerto Rico, Mayaquez, and with the U.S. Geological Survey in Woods Hole, Massachusetts. His research career started with the study of shoreline/continental shelf sedimentation, progressed to the deep sea with emphasis on abyssal plain sediments, and back to the nearshore with emphasis on coastal management. Dr. Pilkey has published more than 250 technical publications and has authored, coauthored, or edited 39 books.

Continued on Next Page

CERF RVP (South America)

Omar Defeo, D.Sc.

Omar Defeo, D.Sc., is a professor in the Marine Science Unit at the Universidad de la República in Uruguay. He is also among a select group of ecologists worldwide working on sandy beach ecosystems and how they are threatened by climate change. For the past 15 years, Prof. Defeo has also been involved in artisanal shellfisheries, ecology, and conservation of coastal marine invertebrate biodiversity research in Latin America, primarily in Mexico and Chile.

CERF RVP (Western Europe)

Carlos Pereira da Silva, Ph.D.

Carlos Pereira da Silva, Ph.D., is the Director of e-GEO within the Research Centre for Geography and Regional Planning at the Universidade Nova de Lisboa, Portugal. Dr. Pereira da Silva's research interests are mainly focused on coastal zone management, with specific emphasis in beach management, public participation studies, and carrying capacity. A long time supporter of CERF and the JCR, in April 2009, he served as the local Chair and Co-organizer of the 10th International Coastal Symposium (ICS) that took place in Lisbon, Portugal.

Michael Phillips, Ph.D.

Professor Mike R. Phillips (BSc, PGCE, MSc, PhD, MIEnvSc, FRGS) serves as Pro Vice-Chancellor of Research, Innovation, Enterprise, and Commercialization at the University of Wales Trinity Saint David (Swansea Metropolian). Professor Phillips research expertise includes coastal processes, morphological change and adaptation to climate change and sea-level rise. Consultancy includes beach replenishment issues and developing techniques to monitor underwater sediment movement to inform beach management. He is widely published and recently organized a session on Coastal Tourism and Climate Change at UNESCO Headquarters in Paris as part of his role as a member of the Climate Change Working Group of the UNEP Global Forum on Oceans, Coasts, and Islands.

Marcel J.F. Stive, Ph.D.

Until 2010, Marcel Stive, Ph.D., was Scientific Director of the Water Research Centre Delft, which is now embedded in the Delft Research Initiative Environment. He currently holds the positions of: Chair of Coastal Engineering in the Section of Hydraulic Engineering and Department Head of Hydraulic Engineering at Delft University of Technology. Dr. Stive was recently appointed Knight in the Order of the Dutch Lion in theatre the Rijswijkse Schouwburg in Rijswijk. He was presented with this award for his outstanding record as a top researcher, much consulted expert, distinguished engineer, and inspiring teacher.

CERF RVP (Eastern Europe)

Kazimierz K. Furmańczyk, D.Sc.

Kaz Furmańczyk, D.Sc., is currently Full Professor at the University of Szczecin and the Head of the Remote Sensing and Marine Cartography Unit at the Institute of Marine and Coastal Sciences. Author and co-author of over 100 scientific publications including books (2) and chapters, journal articles, abstracts, and conference papers. Contributions are mainly in the disciplines of remote sensing, coastal sciences, hydrology, and oceanography. In May 2011, he served as the local Chair and Co-organizer of the 11th International Coastal Symposium (ICS) that took place in Szczecin, Poland.

CERF RVP (Oceania)

Charles Lemckert, Ph.D.

Charles Lemckert, Ph.D., is the Head of Discipline of Civil Engineering at Griffith University's School of Engineering. He has active research interests in the fields of physical limnology, coastal systems, environmental monitoring techniques, environmental fluid dynamics, coastal zone management, and engineering education. Along with his postgraduate students and research partners, Dr. Lemckert is undertaking research studies on water treatment pond design (for recycling purposes), the dynamics of drinking water reservoirs, the study of whale migration in southeast Queensland waters, and ocean mixing dynamics. In 2007, he served as the local Chair and Co-organizer of the 9th International Coastal Symposium (ICS) along the Gold Coast of Australia.

Vic Semeniuk, Ph.D.

Vic Semeniuk, Ph.D., is a natural history research scientist, specialising in coastal, estuarine and wetland environments, and mangrove and tidal flat environments. He has 45 years experience in scientific research in Australia, Europe, Canada, the USA, Ireland, the United Kingdom, and South Africa. Dr. Semeniuk is currently the Director of the Research & Development Firm, the V & C Semeniuk Research Group, and has over 130 publications in refereed scientific journals. He also has a proactive interest in conservation and coastal management, and has published multiple scientific works directly and indirectly leading to this objective.

Andrew D. Short, Ph.D.

Andy Short, Ph.D., served as the Director of the Coastal Studies Unit at The University of Sydney and has been the National Coordinator of the Australian Beach Safety and Management Program in cooperation with Surf Life Saving Australia. Dr. Short is mainly interested in the processes and morphology of coastal systems. His present research focuses on the beach and barrier systems of Australia, as it relates to the morphodynamics of representative systems in variable wave and tide environments, and in the nature, hazards, and usage of all Australia beach systems.

Acceleration in U.S. Mean Sea Level? A New Insight using Improved Tools

Phil J. Watson

School of Civil and Environmental Engineering
University of New South Wales
Sydney, NSW 2052, Australia

ABSTRACT

The detection of acceleration in mean sea level around the data-rich margins of the United States has been a keen endeavour of sea-level researchers following the seminal work of Bruce Douglas in 1992. Over the past decade, such investigations have taken on greater prominence given mean sea level remains a key proxy by which to measure a changing climate system. The physics-based climate projection models are forecasting that the current global average rate of mean sea-level rise (≈3 mm/y) might climb to rates in the range of 10–20 mm/y by 2100. Most research in this area has centred on reconciling current rates of rise with the significant accelerations required to meet the forecast projections of climate models. The analysis in this paper is based on a recently developed analytical package titled "msltrend," specifically designed to enhance estimates of trend, real-time velocity and acceleration in the relative mean sea-level signal derived from long annual average ocean-water-level time series. Key findings are that at the 95% confidence level, no consistent or substantial evidence (yet) exists that recent rates of rise are higher or abnormal in the context of the historical records available for the United States, nor does any evidence exist that geocentric rates of rise are above the global average. It is likely that a further 20 years of data will identify whether recent increases east of Galveston and along the east coast are evidence of the onset of climate change induced acceleration.

ADDITIONAL INDEX WORDS: *Climate change, velocity, acceleration, improved measuring approaches.*

INTRODUCTION

Sea-level rise is well recognized as one of the primary facets of climate change that will have profound impacts on global coastal populations (McGranahan, Balk, and Anderson, 2007; Nicholls and Cazenave, 2010). Based on a range of population-growth projection scenarios to the year 2060, Neumann *et al.*(2011) estimated the global population living within areas determined at threat from a 1-in-100–year storm-surge event, coupled with 210 mm of projected sea-level rise, to be of the order of 315 to 410 million people. Within this estimate, some 6.5 to 8 million people are within the Northern American region.

While the scale of these projected statistics are indeed confronting from an overall global adaptation perspective, the domestic economic threat posed by sea-level rise is also daunting. The Third National Climate Assessment report provides a detailed examination of the range of climate impacts affecting the United States (Melillo, Richmond, and Yohe, 2014). This assessment advised that in 2010, economic activity in shoreline counties around the United States accounted for approximately 66 million jobs and USD 3.4 trillion in wages (NOAA, 2012) through diverse industries and commerce. In many instances, economic activity is fundamentally dependent on the physical and ecological characteristics of the coast.

Moser *et al.* (2014) estimated more than 15,000 km^2 and more than USD 1 trillion of property and structures are at risk of inundation from sea-level rise of approximately 600 mm (or 2 ft) above current sea level around coastal

 Continued on Next Page

United States. In addition, coastal recreation and tourism comprises the largest and fastest-growing sector of the U.S. service industry, accounting for 85% of the USD 700 billion annual tourism-related revenues, making this sector especially vulnerable to increased impacts from climate change (Moser *et al.*, 2014).

While the aforementioned assessments predominantly deal with projections and estimates, it is worth noting that 2015 experienced the highest number of global natural catastrophes (198), the highest ever recorded in 1 year (Swiss Re, 2016) on a steadily upward trending trajectory. Of the total economic losses caused by disasters in 2015 (USD 92 billion), some 75% were attributable to natural catastrophes, of which storms and floods comprised around 90%. Further, of the 40 most costly global disasters since 1970, nearly 50% are directly or partially related to floods (Swiss Re, 2016). Flooding more generally will of course be substantially exacerbated by forecast sea-level rise into the future, foreboding an increasingly ominous threat from natural disasters.

Improved understanding of how and when climate change impacts will occur and evolve over time will be critical to developing robust strategies to adapt and minimise risks (Watson, 2016b). The prominence of the climate change issue has placed more emphasis on examination of the extensive global repository of relative mean sea-level records (Holgate *et al.*, 2012), which along with temperature and carbon dioxide, remain the key proxy data sets used to monitor and quantify changes in the global climate system. In particular, there has recently been renewed, energetic scientific discussion in the literature over the prospect of a measurable acceleration in ocean-water-level records, a feature central to physics-based projection models built upon the current knowledge of climate science (IPCC, 2013).

This paper provides an updated appraisal of acceleration in mean sea-level records around the continental United States through use of a recently developed analytical package titled "msltrend" (Msltrend, 2016) within the R Project for Statistical Computing (R Development Core Team, 2015). The msltrend package has been specifically designed to substantially enhance estimates of trend, real-time velocity, and acceleration in relative mean sea level derived from contemporary ocean-water-level data sets, based on unprecedented time series research, development, and analysis (see "Background").

The outputs of this research tool provide a more consistent, transparent appraisal of acceleration in mean sea-level records around the continental United States, overcoming many of the evident shortcomings from the wide body of scientific literature on this topic (refer "Discussion").

Backround

The complexity of the broad range of physical influences embedded within monthly and annual average ocean-water-level data sets used for sea-level research determines that such records are not able to be definitively deconstructed or parametrically modelled to precisely estimate mean sea level at a given point in time or location. Inevitably, the corroboration of a range of alternative techniques is relied upon to converge on an estimate of the mean sea-level trend and associated velocities and accelerations (Watson, 2016b).

Thus, the complexity of the dynamic influences and noise embedded within ocean-water-level time series has led sea-level research toward successively more sophisticated analytical techniques to estimate the trend over various time periods. In the absence of an absolute knowledge of the mean sea-level signal (or trend) for a particular record, the accuracy of the trend has increasingly been inferred from the assumed sophistication of the underpinning approach applied. Although each analytic is underpinned by its own research and peer-reviewed publications, the inherent bias and limitations, particularly with trend estimation near the ends of the time series, is generally unknown in the context of its application to ocean-water-level data and the complex signal structures comprised within. This reality spawned an innovative and transparent process to identify the most efficient technique for isolating the mean sea-level signal through systematic testing against synthetic (or custom built) data sets with a known mean sea-level signal (Visser, Dangendorf, and Petersen, 2015; Watson, 2015).

The synthetic data set described (Watson, 2015) is based on complex randomly sampled signals that mirror real-world attributes of key dynamic components embedded within ocean-water-level data added to a fixed, nonstationary, nonlinear signal of mean sea level. This data set, comprising 20,000 unique monthly average time series, provides a robust tool to test analytics

 Continued on Next Page

for their utility to isolate the known mean sea-level signal (or trend) with improved temporal resolution.

Using this data set, Watson (2016b) provides the most extensive appraisal yet of time series analysis techniques for their specific utility to isolate the trend with improved temporal accuracy from conventional, long, individual ocean-water-level data sets. A key intent of the exercise was to search for an analytic that could be upscaled into an analytical tool for general application in any global setting. A broad range of techniques were tested, including linear and polynomial regression, robust locally weighted regression smoothing, smoothing splines, moving averages, structural models, digital filters, singular spectrum analysis (SSA), empirical mode decomposition, and wavelets and their respective derivatives. Sensitivity testing around key parametrization was undertaken to optimize performance of each of the analytics specifically for application, with conventional monthly and annual average ocean-water-level data.

In total, some 1450 separate analyses were applied to the synthetic data set, resulting in 29 million individual time series analyses. In addition to quantitatively measuring accuracy, a further six criteria were used in the form of a multicriteria analysis to assess each analytic for utility in facilitating and enhancing trend resolution. Key findings from this body of work included the fact that enhanced accuracy in resolving the temporal resolution of the trend is achieved through the use of longer, annual average data, coupled with the use of so-called data adaptive analytics, in particular, SSA and multiresolution wavelet decomposition. The SSA is more instructive and convenient for the process at hand given the technique provides a superior capability to separate key harmonic components of the time series.

The SSA is a powerful data adaptive technique capable of decomposing the observed time series into the sum of interpretable components with no *apriori*-information about the time series structure (Alexandrov *et al.*, 2012; Golyandina and Zhigljavsky, 2013). More specifically, the method decomposes the original record into a series of components of slowly varying trend, oscillatory components with variable amplitude, and a structureless noise (Golyandina, Nekrutkin, and Zhigljavsky, 2001), with components ranked in the order of their contribution to the original time series. This approach agrees well with the complex signal structures that exist within annual average ocean-water-level data sets.

Based upon detailed analysis of numerous long records in the Permanent Service for Mean Sea Level (PSMSL) data holdings, the parameterization and performance of SSA has been specifically optimized within the msltrend package to isolate the mean sea-level (or trend) signal from long ocean-water-level data sets with improved temporal resolution and accuracy (see "Methods").

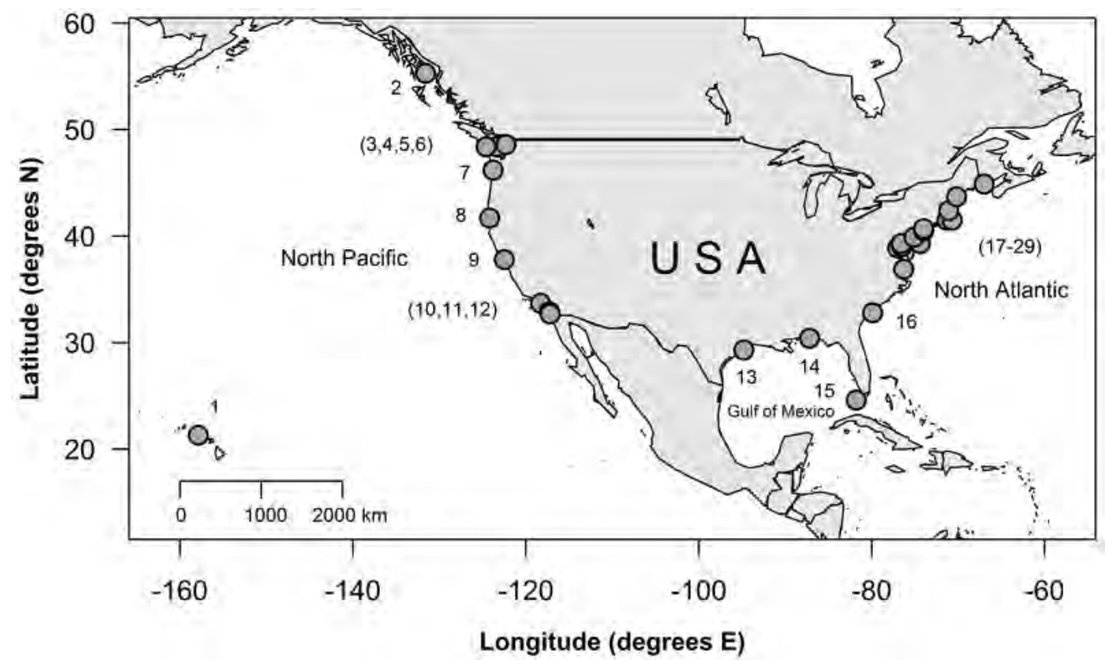


Figure 1. Location of tide gauge records analysed for this study. Each record is denoted by a Station ID with further details provided in Table 1.

 Continued on Next Page

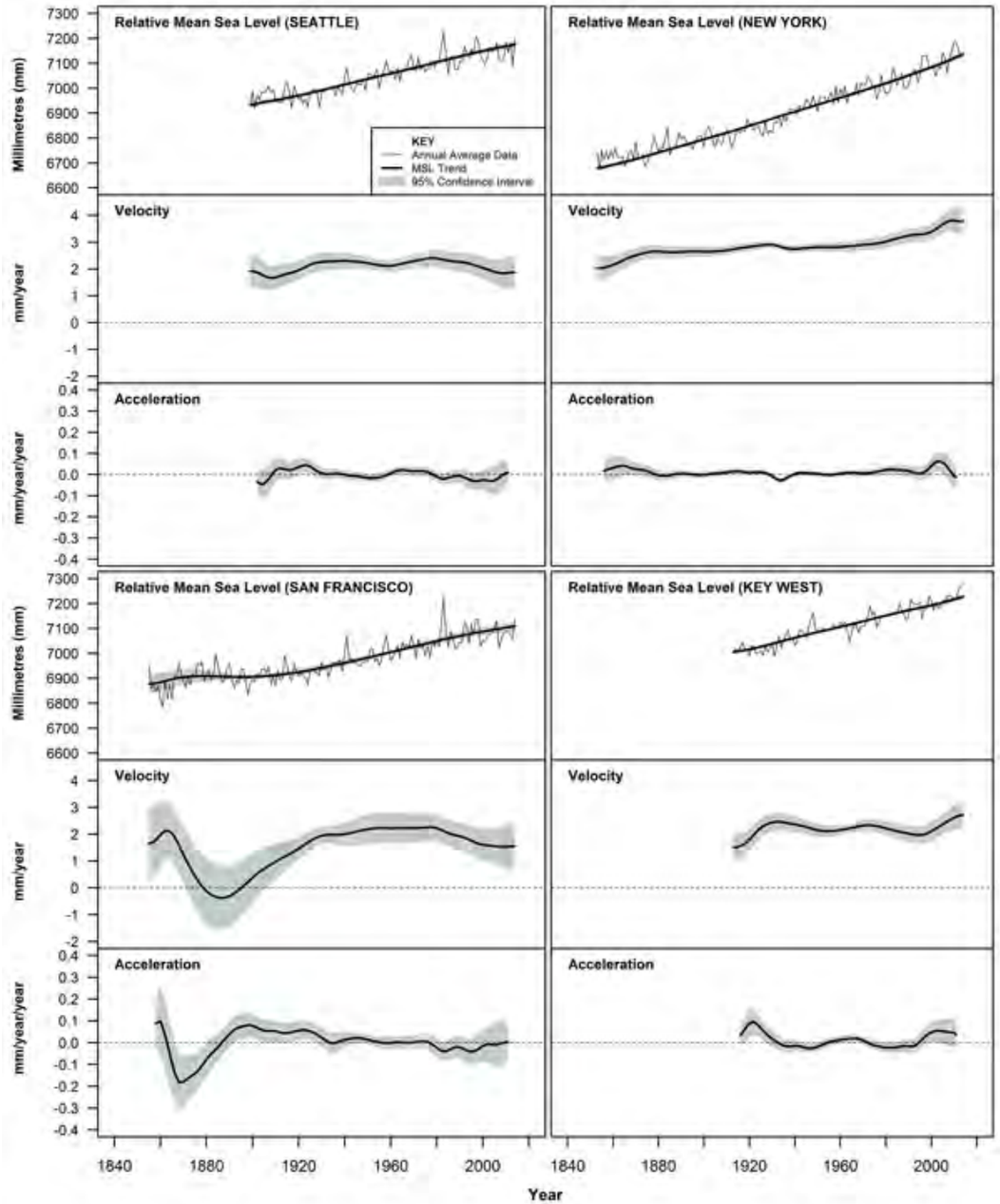


Figure 2. Temporal characteristics of mean sea level at selected sites (Seattle, San Francisco, New York, and Key West). Each site is depicted by a three-panel plot of mean sea level, velocity, and acceleration. The respective scales are identical for all stations for direct comparative purposes.

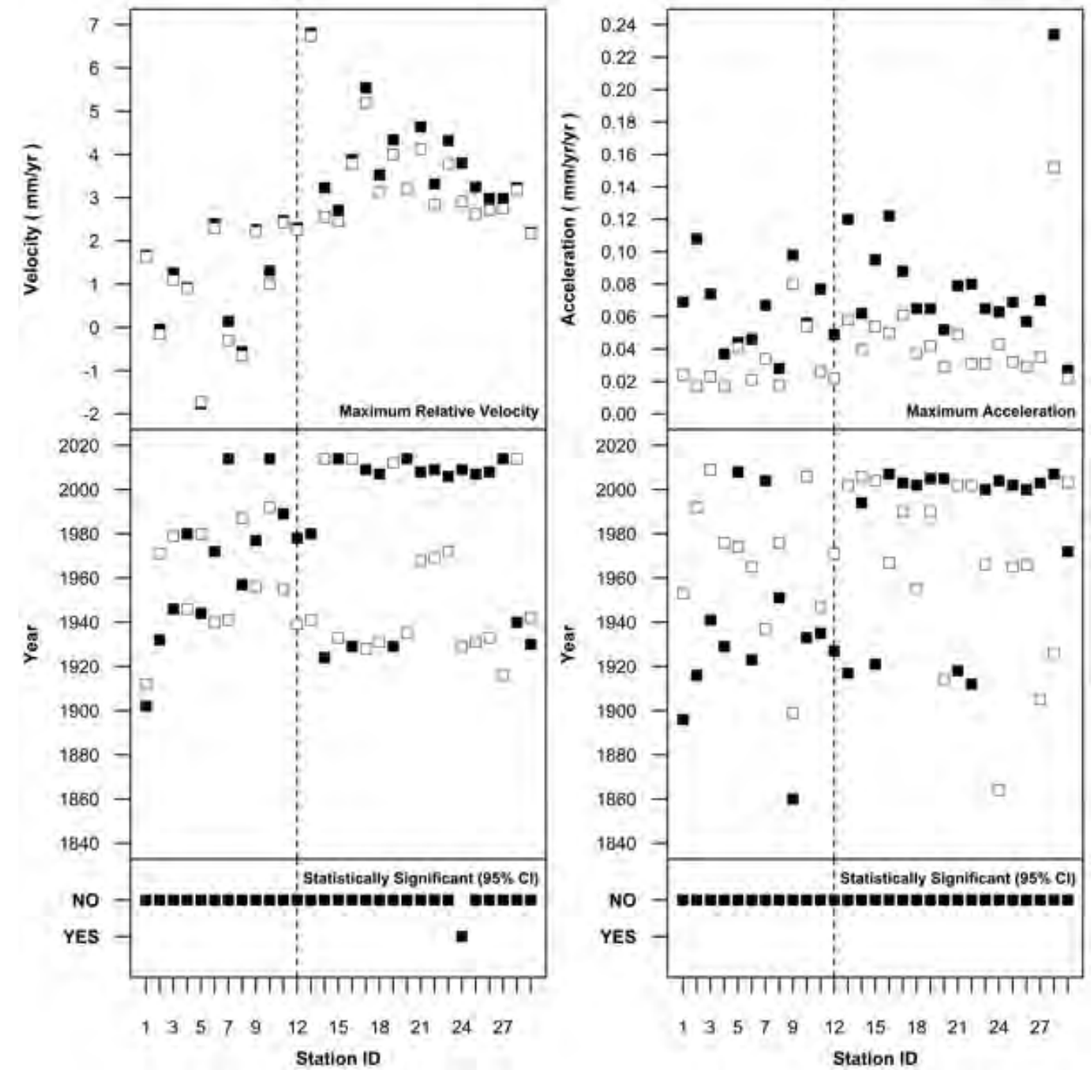


Figure 3. Peak estimates of velocity and acceleration for all stations. Peak metrics are denoted as filled boxes, while secondary peaks are denoted by clear boxes. The centre panels indicate the year in which the respective peaks occurred. A vertical dashed line corresponding to Station 12 (San Diego) denotes the spatial limit of the Central Pacific and west coast records. The bottom panel provides an indication as to whether or not the peak metric is statistically different (in this case higher) than all others in the context of the historical record at the 95% confidence level. Station ID references are summarised in Table 1.

 Continued on Next Page

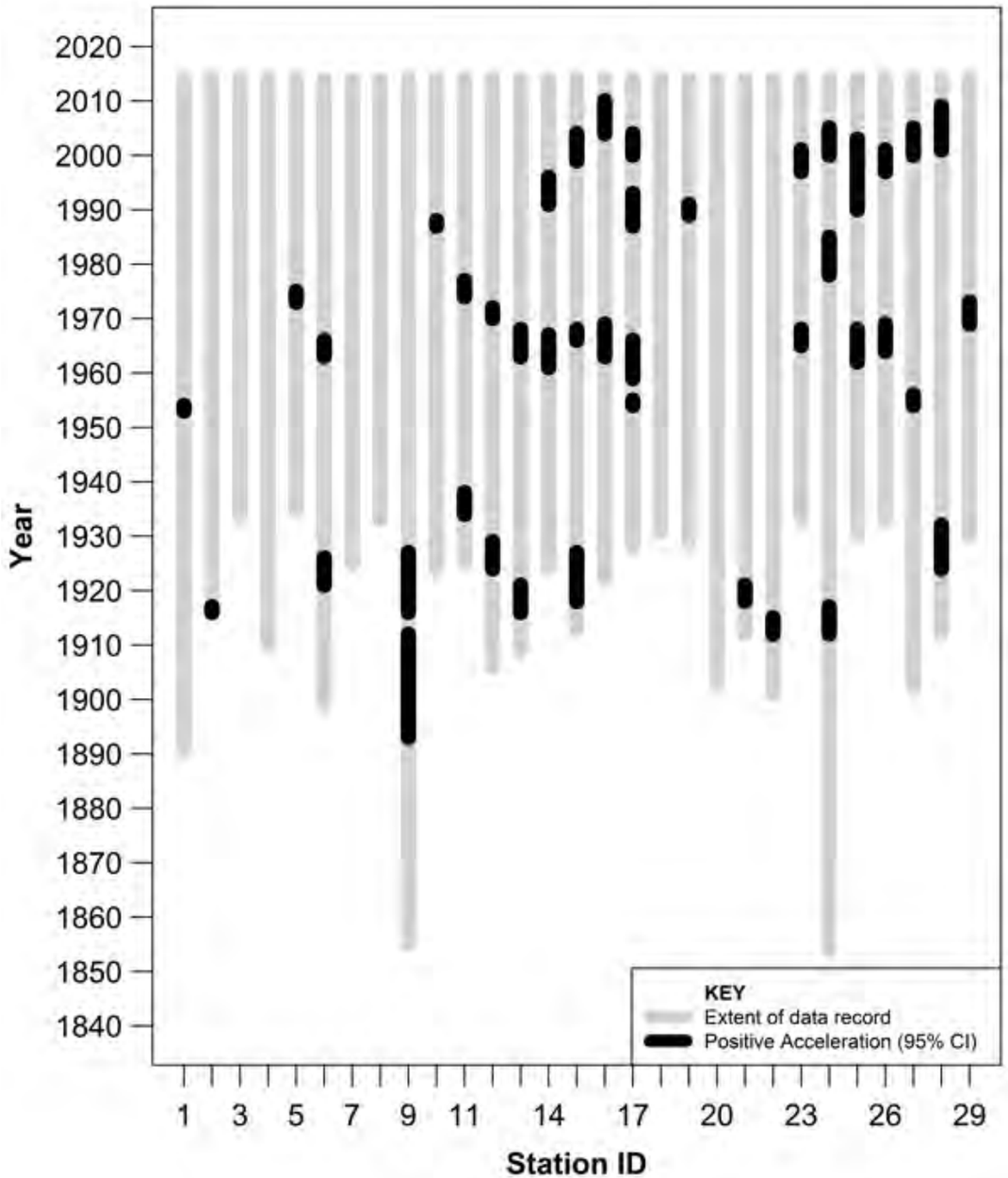


Figure 4. Summary of periods of positive acceleration (95% CI).

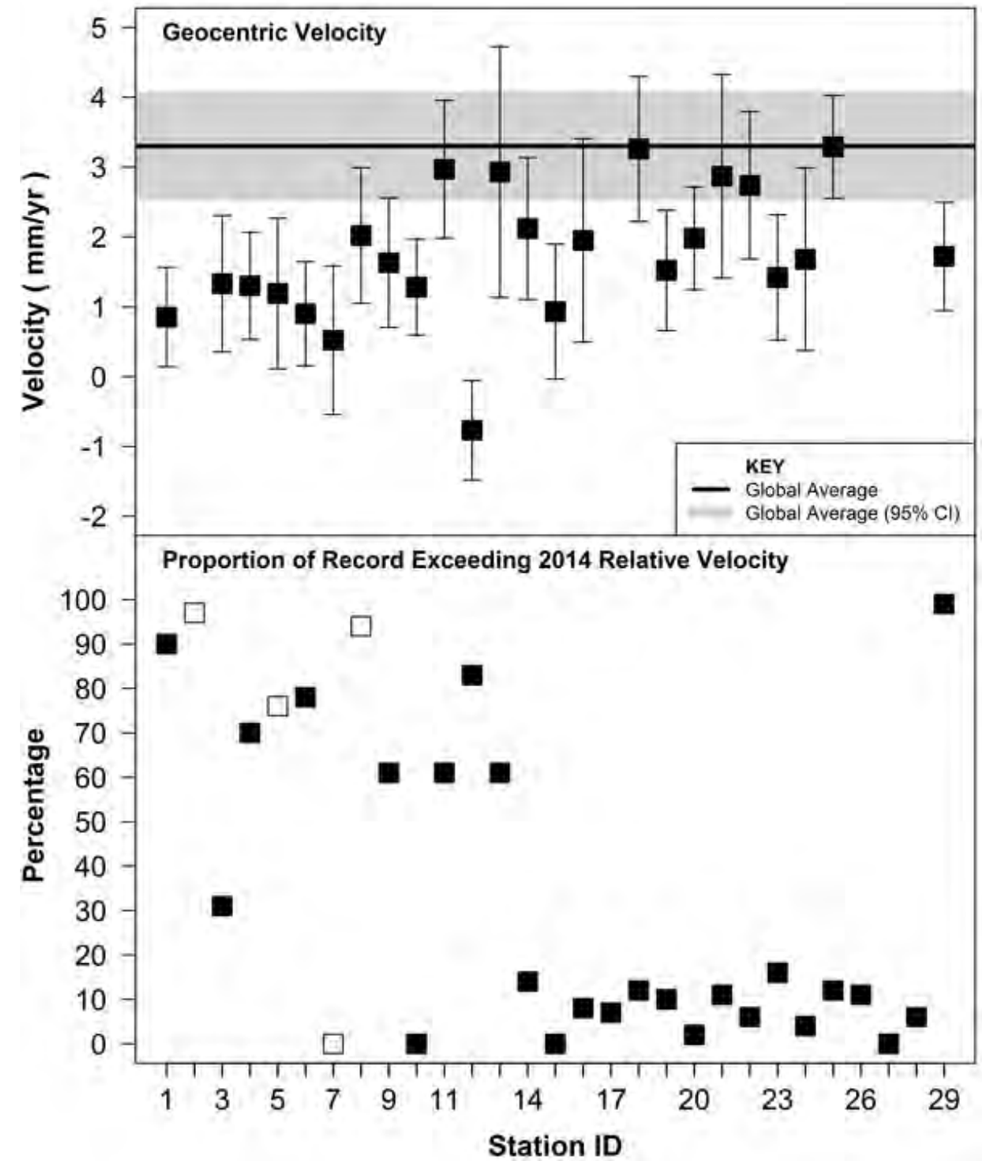


Figure 5. Current (2014) estimates of geocentric rate of sea-level rise (95% CI). Estimates based on real-time relative velocity derived from msltrend decomposition corrected by vertical land movement velocities provided by SONEL. Clear boxes in the bottom panel represent stations in which there is evident relative sea-level fall over the course of the record. Data sources and station ID references are summarised in Table 1.

Continued on Next Page

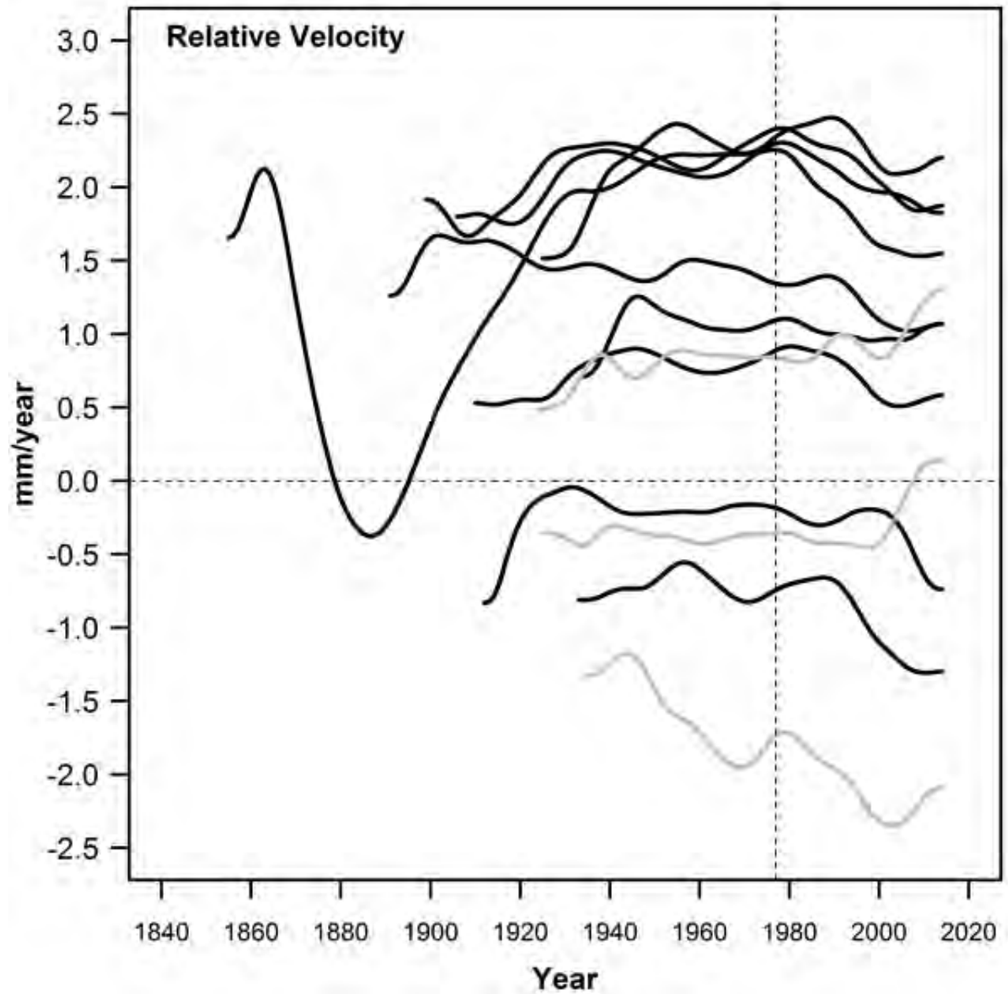


Figure 6. Relative velocity time series for Central Pacific and west coast U.S. station records. A vertical dashed line denotes the commencement of the Pacific regime shift (Miller *et al.*, 1994). Grey time series denote those indicating a noticeable increase in velocity post 2000 (Neah Bay, Washington; Astoria; and Los Angeles).

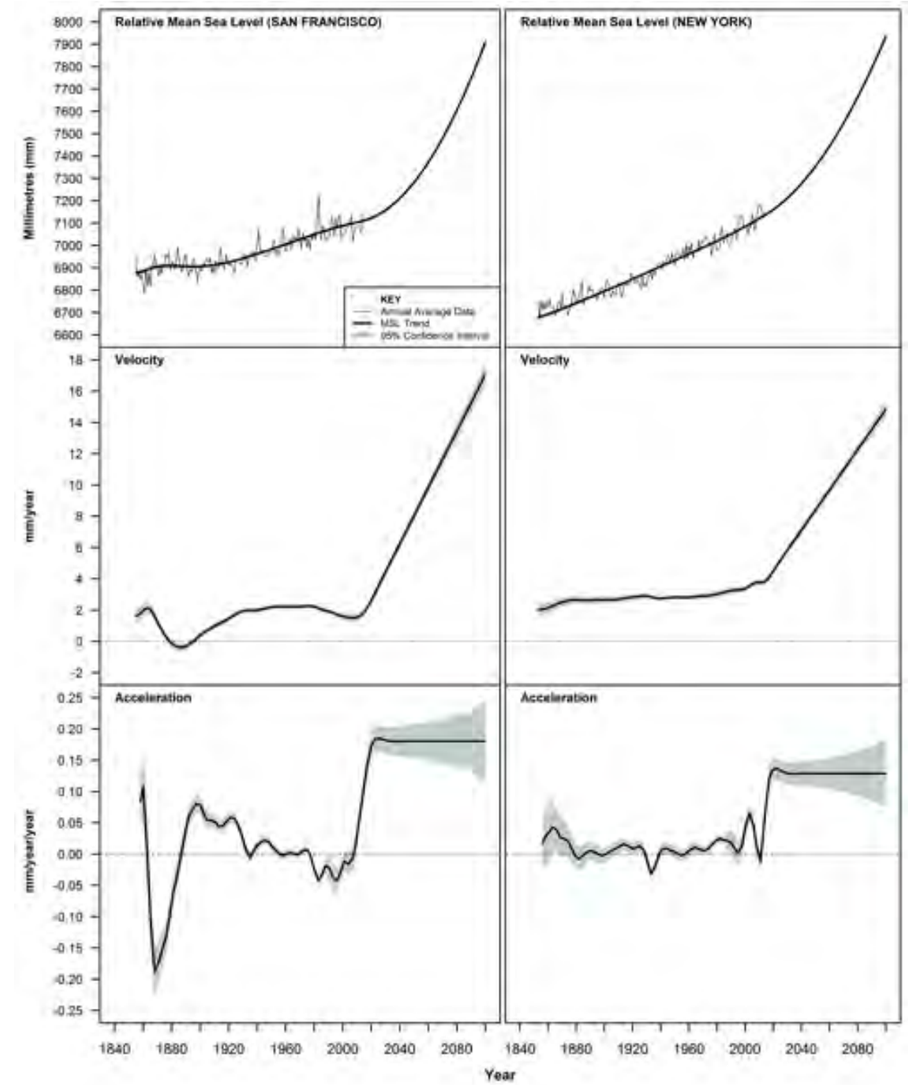


Figure 7. Indicative implications of projected sea-level rise of 800 mm at San Francisco and New York from present (2014) to 2100. Projections based on simple equations of motion with uniform acceleration. Error margins noted are 95% confidence levels.

To access this full JCR Review Article, please visit:

http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-16-00086.1

Sea Surface Temperature Trends in Venice Lagoon and the Adjacent Waters

Sea Surface Temperature Trends in Venice Lagoon and the Adjacent Waters

Carl L. Amos[†], G. Umgiesser[‡], M. Ghezzo[‡], H. Kassem[†], and C. Ferrarin[‡]

[†]Ocean and Earth Sciences
National Oceanography Centre
Southampton University of Southampton
Southampton, England, U.K.

[‡]ISMAR-CNR (Instituto di Scienze
Marine-Consiglio Nazionale delle Ricerche)
Castello, Venezia, Italy

ABSTRACT

Two coastal lagoons and coastal waters in the northern Adriatic region, Italy, were examined to assess the anthropogenic impact on coastal sea surface temperature (SST). The first lagoon was the highly altered Venice lagoon, and the second was the largely natural Marano-Grado lagoon. There are converging lines of evidence for air warming in the Venice region since 1910 at a long-term rate of 0.095°C/decade. Since 1980, the warming has accelerated to 0.65°C/decade in the centre of Venice. The acceleration in air warming is also evident in the MOHAT4 data set from the northern Adriatic Sea, although the rate of warming is less (0.36°C/decade). This warming trend is mimicked in the HadISST1.1 data set of SST for the northern Adriatic Sea (0.33°C/decade), whereas no trend was detected before 1980. SST and air temperature in both Venice and Marano-Grado lagoons are highly correlated (r^2 = 0.8): SST is on average 2°C cooler than the northern Adriatic Sea is, although differences appear to be diminishing because of rapid warming in Venice lagoon since 2008 (up to 1.75°C/decade). The warming in the lagoons appears to be greatest during winter months. By contrast, the greatest (post-1980) warming in the northern Adriatic Sea occurs during summer months. Moderate Resolution Imaging Spectroradiometer (nighttime; MODIS) SST data shows that, on average, the Venice lagoon is 5% warmer than Marano-Grado lagoon is. This equates to a summertime mean temperature difference of 1.2°C. This difference is within the scatter of the data and suggests that there is no appreciable heat retention in the waters of the Venice lagoon because of local anthropogenic activity.

ADDITIONAL INDEX WORDS: *Urban heat, Adriatic Sea, Marano-Grado lagoon.*

INTRODUCTION

It has been argued that coastal sea surface temperature (SST) is linked to the heat budget within the adjacent coastal hinterland (Joshi *et al.*, 2008). In most cases, air temperature is used as a proxy for this heat budget (Hanna *et al.*, 2006; Lebassi *et al.*, 2009;) and is often correlated with SST and interpreted as a dependent parameter of it (Oda and Kanda, 2009; Shearman and Lentz, 2010) or as a local driver of SST (Al Rashidi *et al.*, 2009). However, considerable variability exists in such links; much of which has been attributed to urbanization in the coastal zone (Maul, 2005). The heat budget in the coastal zone of the northern Adriatic region is controlled by a series of sources and sinks (Ferrarin *et al.*, 2010); many of which are influenced by urbanization. The coastal zone is a region of rapid expansion in urbanization (Bulleri and Chapman, 2010; Hanson *et al.*, 2011) and associated increases in population density (Nicholls and Lowe, 2004). It is estimated that the European coastline is 324,000 km long and is home to 287 million people (Duedall and Maul, 2005). Coastal urbanization can lead to the well-known urban heat-island effect described by Oka (1973). There is growing evidence to suggest that heat from coastal urban development is measurably influencing SST in coastal water masses (Amos *et*

 Continued on Next Page

al., 2015; Miyazaki, 2009; Nixon *et al.*, 2004; Yanagi, 2008). Fallmann and Emeis (2013) have reviewed model results from a European urban heat island (UHI) project. They predicted systematic heating of European metropolitan regions (by 2050) of up to 1.9°C, and significant warming in Padua (upstream from Venice lagoon) of up to 0.9°C. Is there evidence for similar influences in the coastal zone of the Mediterranean Sea, which has seen an expansion of its tourist industry of 400% since 1990, and is estimated to draw 287 million tourists by 2030 (Lanquar, 2013)? This study offered the opportunity to examine local heating of coastal waters in the Venice lagoon: a coastal region strongly altered by urban development (Figure 1A). The temperature trends in the Venice lagoon were examined against those of the northern Adriatic Sea, where shoreline influences should be less evident (Rizzoli and Bergamasco, 1983). As well, SST trends in a second lagoon (Marano-Grado), located approximately 45 km east of Venice lagoon, were examined and compared with the Venice lagoon. The second lagoon is similar to the Venice lagoon in shape, size, and marine setting. It differs from the Venice lagoon in that it is largely natural and thus has suffered much less urban development, forming part of the Natura 2000 network (http://www.regione. fvg.it/rafvg/cms/RAFVG/ambiente-territorio/tutela-ambiente-gestione-risorse-naturali/FOGLIA203/FOGLIA120). This study examined SST data for the two lagoons and adjacent water masses of the northern Adriatic Sea. It was expected that evidence of any anthropogenic sources of heat in Venice lagoon would become clear by anomalies in SST trends in the study regions. The method used herein closely follows that used successfully by Hanna *et al.* (2006) to study SST trends in the coastal waters of Iceland.

The Study Regions

The juxtaposition of Venice and Marano-Grado lagoons is ideal for a comparison of SST to examine local (anthropogenic) sources of heat. The bordering Northern Adriatic Sea offers a baseline for such comparison. Hanna *et al.* (2006) suggested that heat anomalies and trends in coastal waters are best examined by comparisons with data outside the coastal belt (as defined by Alvera-Azcárate *et al.*, 2005). The following is a description of these regions of study.

Venice Lagoon

Venice lagoon is a large (55,000 ha), shallow lagoonal system bordering the northern Adriatic Sea. It has been studied in detail over many years and is the subject of at least three special issues in the scientific published literature (Amos *et al*, 2010; Fletcher and Spencer, 2005; Gačičand Solidoro, 2004), as well as a series of science-based volumes published by CORILA (http://www.corila.it). The lagoon has a mean depth of 1.5 m and a mean semidiurnal spring tidal range of 1 m; thus, it hosts one of the largest tides in the Mediterranean Sea. Approximately 5 million people live in the Veneto region; and about 260,000 of them live around or within the lagoon (2014 estimate; http://www.city-population. de/php/italy-veneto.php?adm2id=027). Venice lagoon may be considered as an engineered coastal environment, particularly in light of the almost-completed MOSE (Modulo Sperimentale Elettromeccanico) Storm Gate development (https://www.mosevenezia.eu/progetto) and the impact of about 23 million visitors to the lagoon annually adding to the energy requirements of the city. This energy is generated in Porto Marghera (Figure 1A, site 3) which is also situated in the lagoon and is considered to enhance local SST by up to 10°C (Despini and Teggi, 2013). The tidal prism of Venice lagoon is 3.6 x10^8 m^3 (spring tides) and is about one-half of this volume on neap tides (Fontolan *et al.*, 2007). Waters in the lagoon have a mean residence time of 3 days, although the variation is high (varying from 0.5 days at the inlets to 10 days at the head; Cucco and Umgiesser, 2006). The waters are largely well mixed by strong tidal flows and wave action (often anthropogenic). The residence time around the City of Venice is 3 days, whereas that of the Marghera industrial region (the site of a power plant suppling energy to Venice) is 7 to 10 days. Water exchange is strongly influenced by Bora (ENE) and Scirocco (SE) winds (Mancero-Mosquera, Gacic, and Mazzoldi, 2010). Of these, the Bora wind is the most effective and can ventilate the entire lagoon within 1–2 days. Bora winds also have a (latent heat) cooling of up to 3°C in the northern Adriatic Sea (Crisciani, Ferraro, and Ortu, 1989). The average SST of the lagoon is 17.6°C; however, the seasonal variation in SST is large. Crowsley (2010) showed that mean air temperature in the lagoon was generally lower than SST by 2–6°C. Unpublished, mean monthly SST maps of Venice lagoon for 2005

 Continued on Next Page

have been produced using the hydrodynamic model SHYFEM (Umgiesser *et al.*, 2014) for nonurban heat sources (ISMAR, 2014). These heat sources/sinks are defined in Ferrarin *et al.* (2010). Average January water temperatures fall to about 5°C (Table 1) and are coldest in the shallow margins of the lagoon (Figure 2). By May, the monthly average SST is warmest (21°C) over the inner tidal flats and coolest in the inlets (Figure 2; note the cooling influence of Lido inlet on the city of Venice). Peak SST occurs in July and is greatest (26°C) in the Marghera industrial complex (Morin *et al.*, 2000). By October/November, the shore-normal temperature gradient has reversed to the winter pattern of cooler waters over the tidal flats. River influences on SST are small because discharges are low (70–80 m^3/s). However, Alvera-Azcárate *et al.* (2005) showed that the discharge of the Po River enhances summertime SST in the region of study. Despini and Teggi (2013) examined the impact of industrial heating of the Venice lagoon using the satellite Advanced Spaceborne Thermal Emission and Reflection (ASTER). They found thermal plumes around the port of Marghera and a 1–2°C anomaly around the City of Venice. *In situ* SST measurements made at five sites in Venice lagoon showed mixed results (both warming and cooling) with large variations between stations. Generally, the greatest warming was evident during winter, and the greatest cooling was in summer (Crowsley, 2010). The MOSE scheme (*ante operam*) was predicted to have little effect on the residence times in northern Venice lagoon and might shorten them in the south (Ghezzo *et al.*, 2010). Whether the storm gates will significantly influence SST within the lagoon during periods of closure remains to be seen.

Marano-Grado Lagoon

Marano-Grado lagoon is an estuarine system very similar to Venice and is situated off the northern Adriatic Sea within the Friuli-Venezia Giulia region (Figure 1A). The principal forcings of the lagoon are tides and wind (Ferrarin *et al.*, 2010). It is smaller than the Venice lagoon (16,000 ha), but has a similar semidiurnal spring tidal range (0.86 m, Fontolan *et al.*, 2012). A tidal prism of 6.6×10^6 m^3 passes through six tidal inlets, yielding a tidal exchange proportionate to that of the Venice lagoon. According to Ferrarin *et al.* (2010), the seasonal range in SST is similar to the Venice lagoon, and water temperature is homogenous with depth. The coastal population of Marano-Grado is much less that of the Venice region (83,000 people live in the region; Ramieri *et al.*, 2011), and there are no major population centres. The average temperature is 17.1°C: As in the Venice lagoon, direct river influence on the SST is small, although the plume of the Po River may enhance summertime SSTs.

The Northern Adriatic Sea

The northern Adriatic Sea is a shallow and enclosed portion of the Mediterranean Sea characterised by a cyclonic gyre that brings warm waters in summer to the north coast of Italy in which the two lagoons are situated (Gačič *et al.*, 1997; Malanotte-Rizzoli and Bergamasco, 1983). This is evident in the MODIS mean monthly SST plots in Figure 3 for the spring, summer, and winter seasons of 2013. The thermal character of the northern Adriatic Sea is strongly seasonal and characterised by cold/dry Bora events during the winter, which mixes the water column and causes a net annual (latent) heat loss. There is a large year-to-year variability in SSTs. However, some general trends were found by Alvera-Azcárate *et al.* (2005), Gačič *et al.* (1997), and Maggiore *et al.* (1998), based on AVHRR imagery. The coastal boundary has a lower temperature during winter (by several degrees; see Figure 3–December) and is warmer during summer (Figure 3–September), largely because of freshwater discharges dominated by the Po and Tagliamento rivers. The coastal water mass moves southward along the Italian coast in a well-defined coastal belt (the Western Adriatic Current). The winter is dominated by a longitudinal SST gradient: the inner Adriatic Sea is 5°C cooler than the southern extreme. As a result, the Adriatic Sea is generally warmer than the Venice lagoon in the winter by about 1°C (Solidoro *et al.*, 2009). This temperature gradient is inverted in spring and summer because of heating by the entering freshwater. SST trends, between 1985 and 2009 immediately outside the Venice lagoon and the northern Adriatic Sea, were examined by Crowsley (2010) using monthly mean AVHRR data (see Figure 1 for location). Significant warming (up to 0.42°C/decade) was reported near the lagoon for the month of May: no clear trends were evident at other times of the year.

 Continued on Next Page

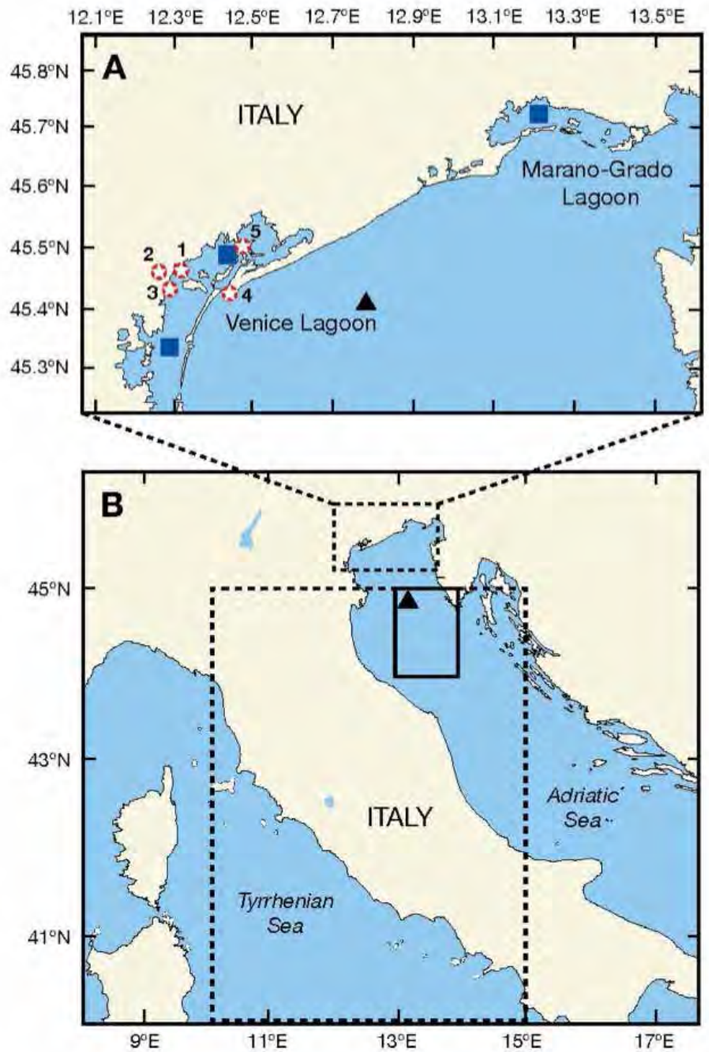


Figure 1. (A) Location diagram of the Venice and Marano-Grado lagoons, northern Italy. Also shown are the stations in the Venice lagoon from which sea surface temperature is monitored. The stars show the five SST monitoring sites, the squares are the MODIS SST sites, and the triangles denote the AVHRR data ("inner" and "outer" (panel B) of *Crowsley*, 2010). (B) Northern Italy and the northern Adriatic Sea. The HadISST1.1 data were extracted from the region shown by the solid black box; the HADCRUT4 data were extracted from the region shown in the dotted black box.

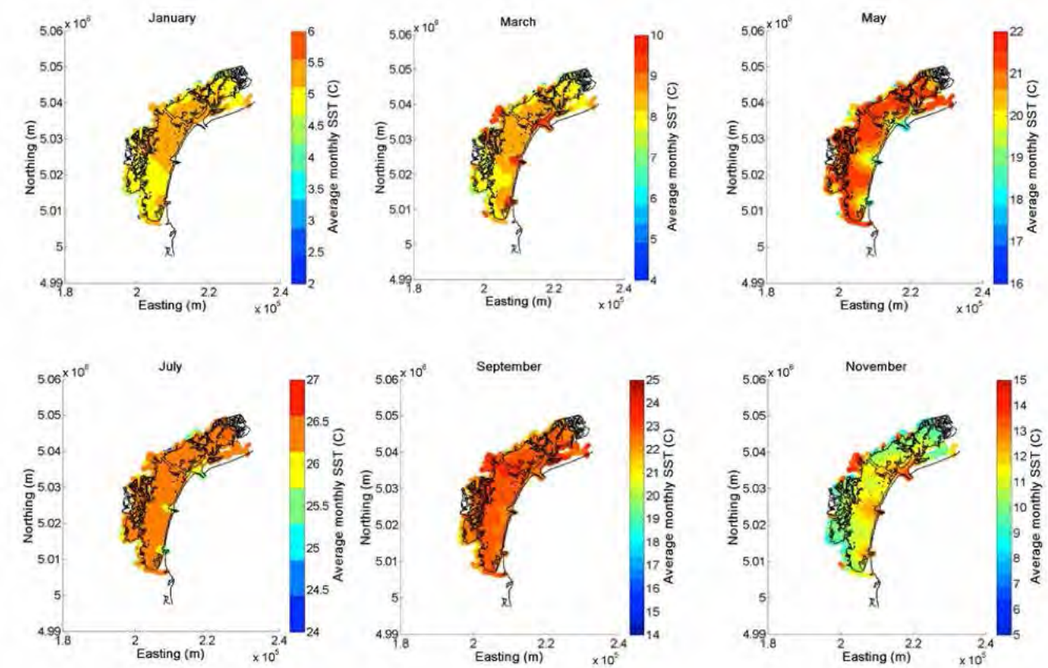


Figure 2. Sea surface temperature maps (bi-monthly) of the Venice lagoon based on output from the hydrodynamic model SHYFEM for 2005 (ISMAR-CNR, *unpublished data*, 2014). Notice the relative warming of the inner lagoon during May to July and the relative warming of the inlets during other seasons.

Continued on Next Page

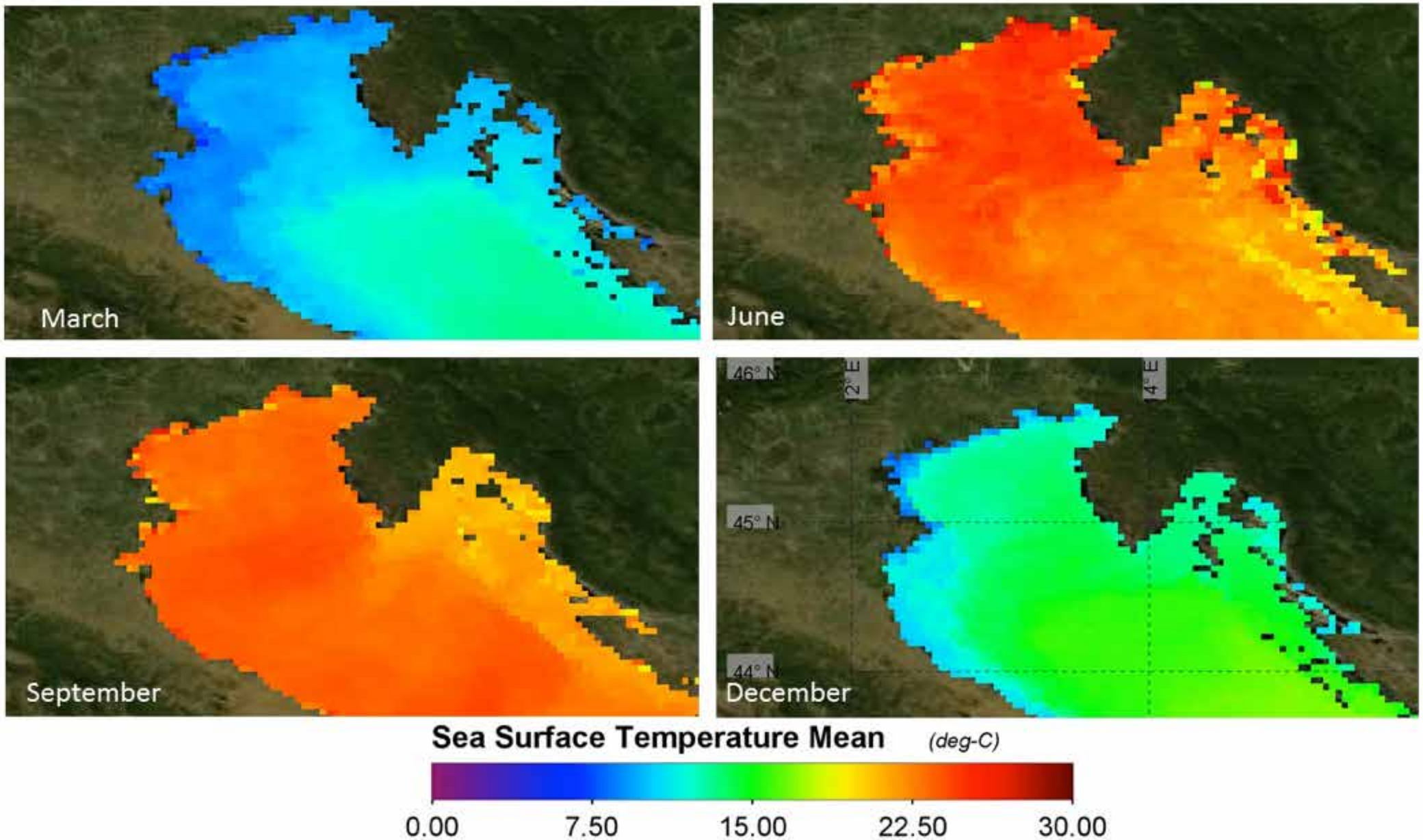


Figure 3. Thematic plots of SST for the inner Adriatic Sea derived from MODIS Terra nighttime imagery (11 µm wavelength) during 2013. Pixel resolution is 1 km. Latitude and longitude lines have been left in the December image for reference purposes. Notice the strong heating near the Venice lagoon and the general cooling of the coastal waters during summer months. This trend is reversed during winter months.

Continued on Next Page

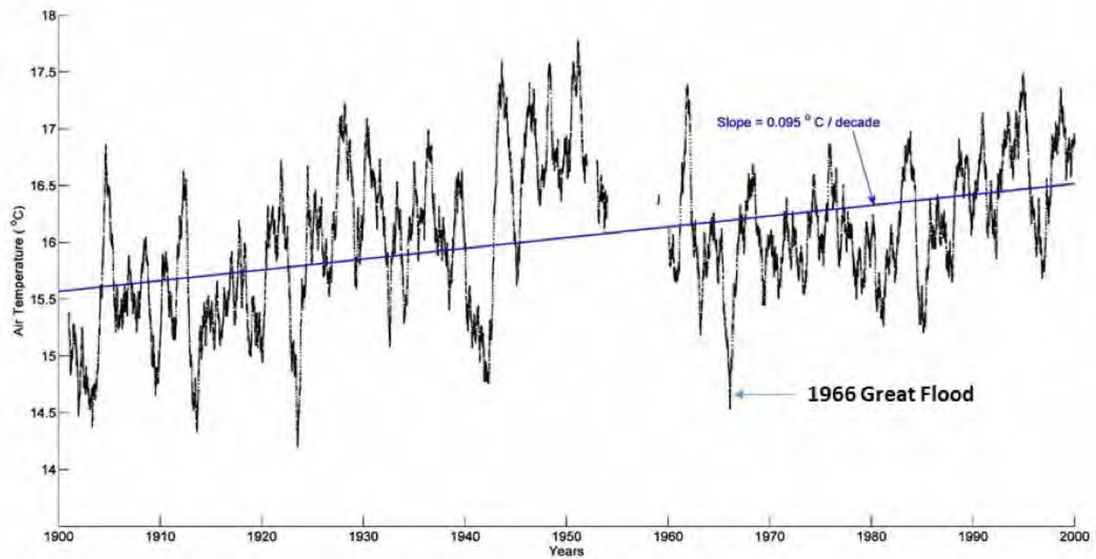


Figure 4. The long-term trend of air temperature recorded at Istituto Cavanis, Venice, from 1900 to 2000. The record has been deseasoned and smoothed to examine the trend. The solid line shows the best-fit (least-squares) line fitted to the smoothed data. The slope shows a long-term temperature increase of 0.095°C/decade. The timeseries shows a period of warming from 1910 to circa 1950, cooling from circa 1960 to 1980 (phase I), and finally warming again after 1980 (phase II). Note the 1966 "Great Flood" of Venice is apparent as an anomalously cold year.

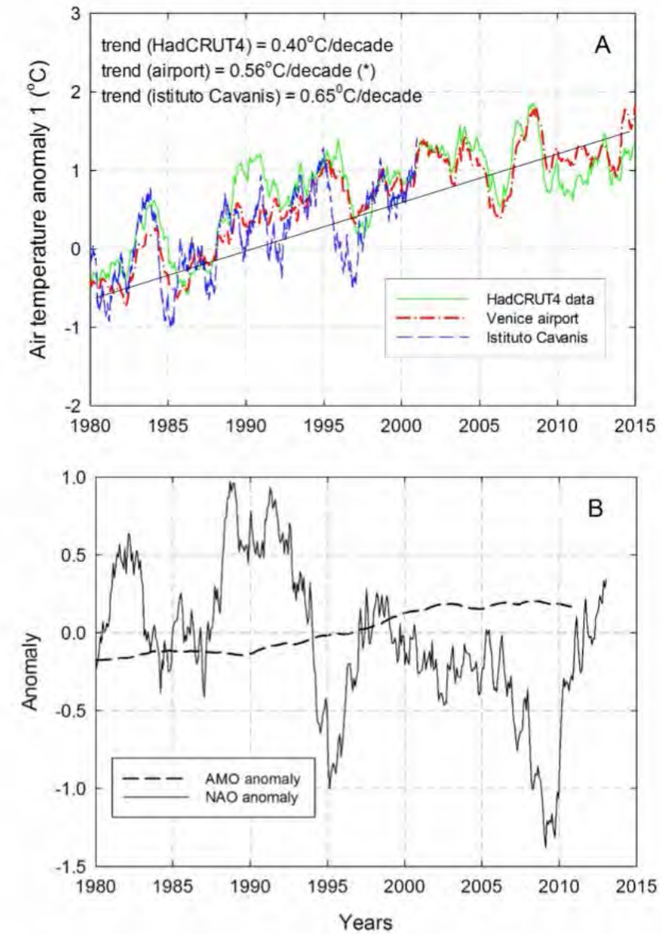


Figure 5. (A) Mean monthly air-temperature anomaly from the HadCRUT4 data set (source: http://hadobs.metoffice.com/hadcrut4/data) for a 58358 region of northern Italy and the study region (centred on Lat: 42.5N; Lon: 12.5E) for the period 1980 to 2015, from Venice Marco Polo airport, source: www.weatherspark.org for the period 1960 to 2015, and from the Istituto Cavanis, Venice (1960 to 2000). The data has been filtered by applying a 2-y smoothing process to the data to remove seasonality. A least-squares, best-fit line has been applied to the data after 1980. The slope indicates an increase in the anomaly at a regional scale of 0.40°C/decade. This trend appears to increase in the vicinity of Venice. A decadal fluctuation is evident throughout the time series that masks the long-term trends. (B) The Atlantic Multidecadal Oscillation anomaly and the North Atlantic Oscillation anomaly for the period 1980 to 2015.

Continued on Next Page

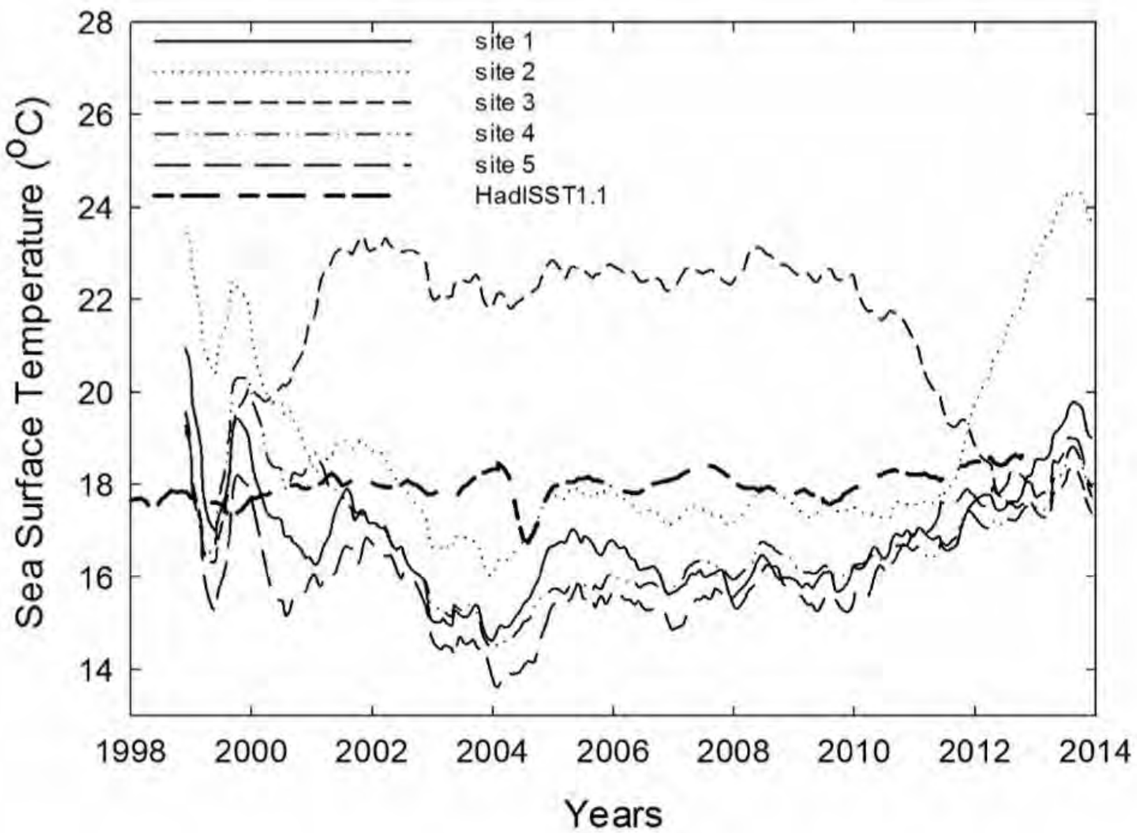


Figure 6. Mean monthly SST data for five monitoring sites in the Venice lagoon for the period 1998 to 2014 (see Figure 1A for locations). The HadISST1.1 data set for the northern Adriatic Sea region (see Figure 1B) has been added for reference purposes. The data has been deseasoned using a 2-y smoothing process. Note that Fusina (site 3) is consistently 4°C to 6°C warmer than other sites. Also notice that the warming trend appears to have accelerated after 2008 (significant trends at site 1: 1.28°C/decade; site 4: 1.75°C/decade; site 5: 1.50°C/decade).

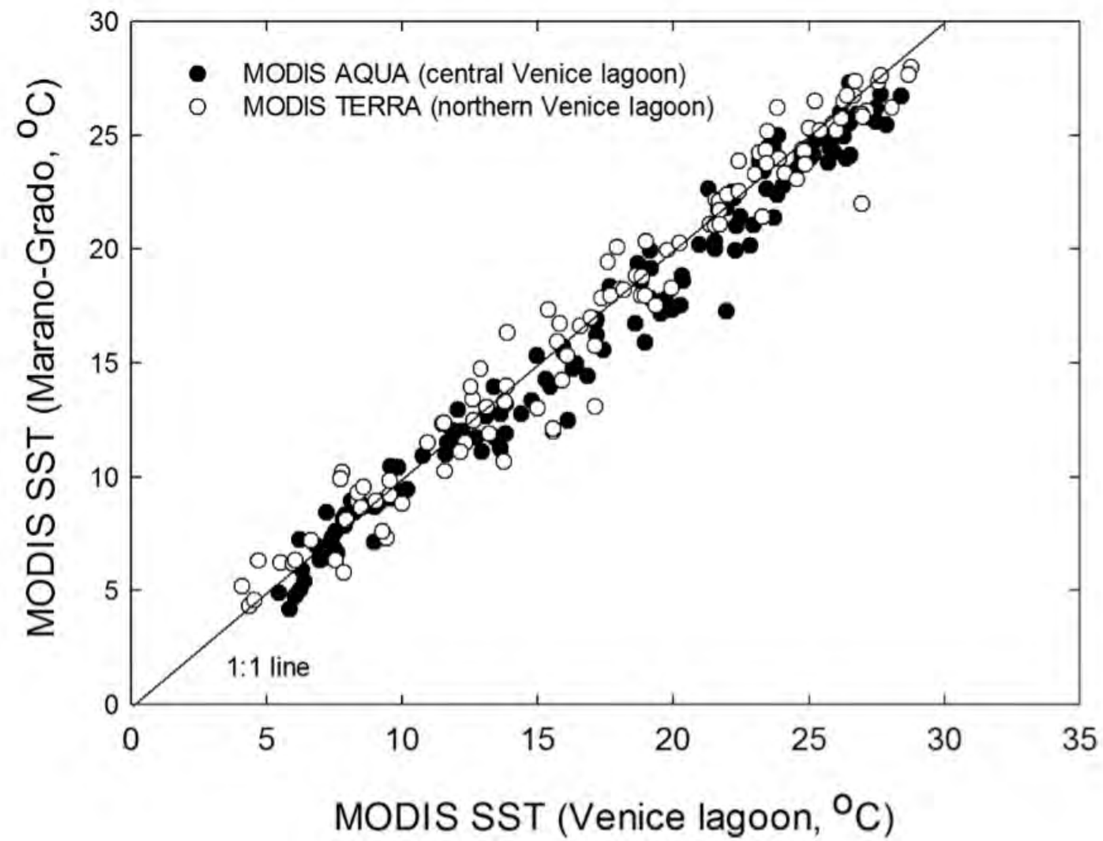


Figure 7. A comparison of mean monthly nighttime SST (131 km) from the MODIS (Aqua and Terra) satellites for the Venice and Marano-Grado lagoons for the period 2002 to 2015. Notice the strikingly similar trends in temperature, irrespective of season. The best-fit lines for Aqua and Terra show a 1:1 correlation with no clear bias in the scatter. These results suggest that there appears to be no clear temperature enhancement within the heavily populated and industrialised Venice lagoon over the more natural Marano-Grado lagoon.

Continued on Next Page

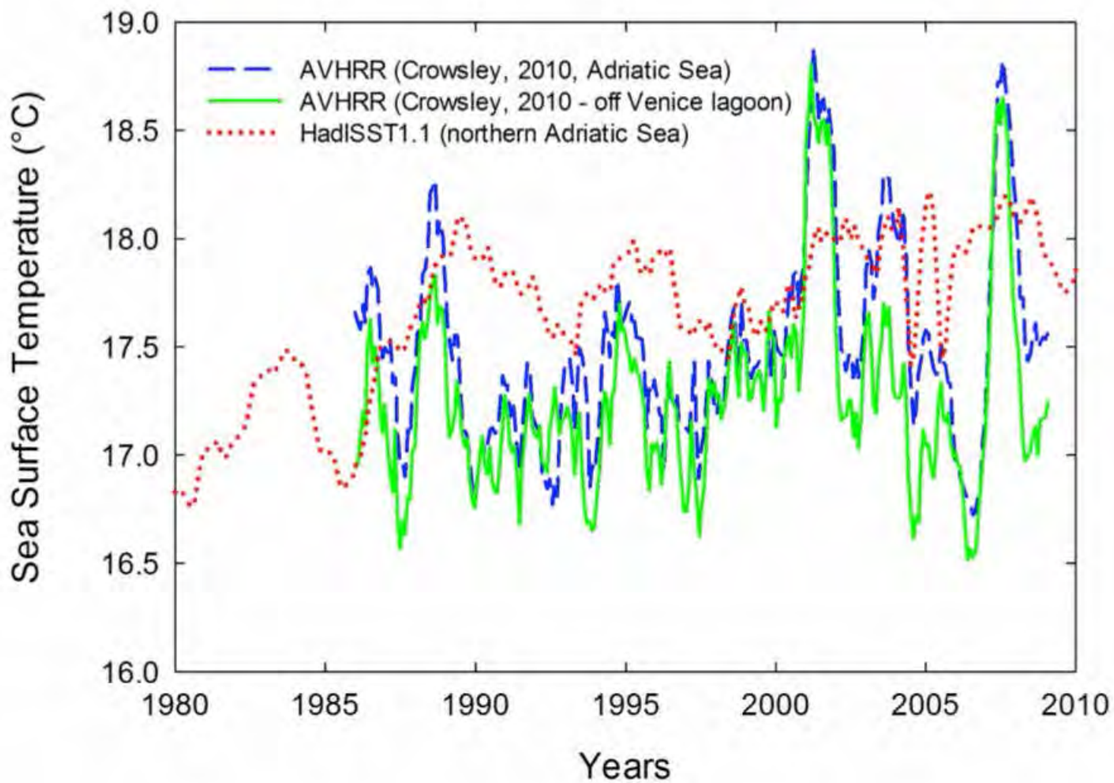


Figure 8. The deseasoned mean monthly AVHRR SST data for the northern and central Adriatic Sea (after Crowsley, 2010) and the deseasoned HadISST1.1 data set of the northern Adriatic Sea (see Figure 1A). A post- 1980 warming of 0.57°C/decade is evident in the AVHRR data, although there is considerable scatter in the Crowsley data, with anomalously warm summers of 2001 and 2007.

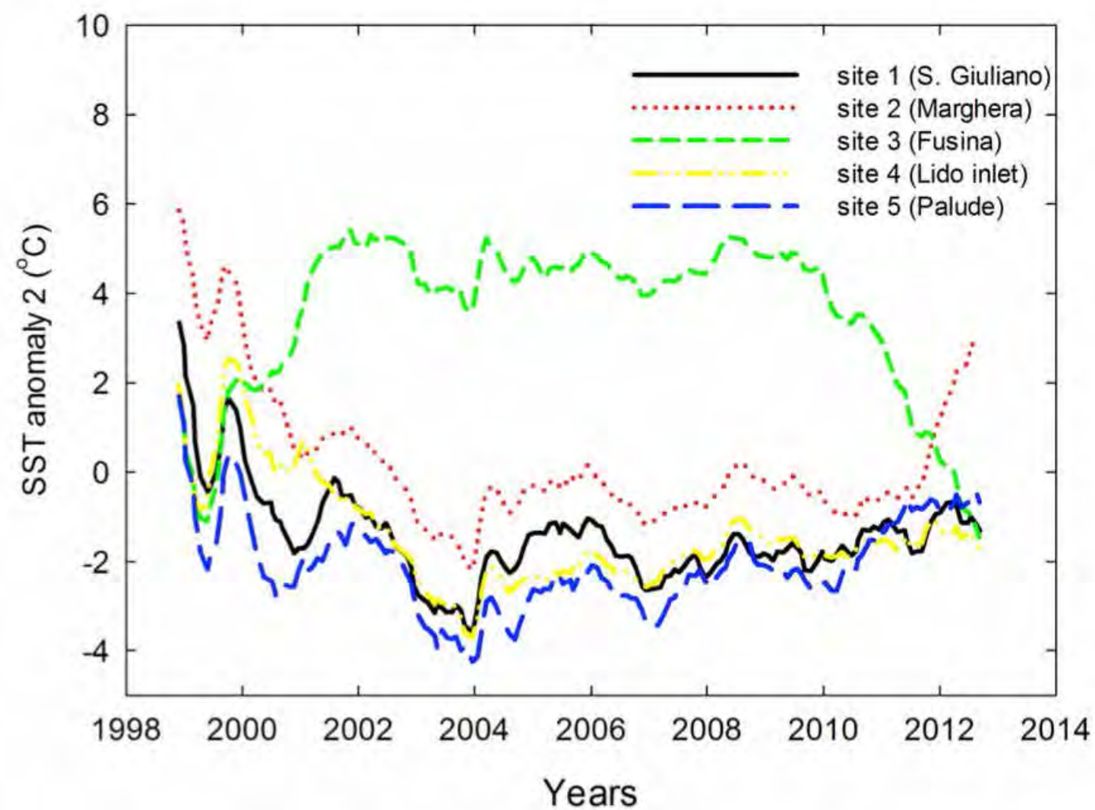


Figure 9. The difference in deseasoned mean monthly average SST between the Venice lagoon and the HadISST1.1 SST for the northern Adriatic Sea (1999–2012). Site 3 (Fusina) shows a slight positive anomaly at times from local heating in the Marghera industrial area. All other sites show strong negative anomalies (relatively cool). The cooling appears to have continued to 2004. Subsequently, there has been a strong relative warming and a convergence of SST with that of the Adriatic Sea.

Continued on Next Page

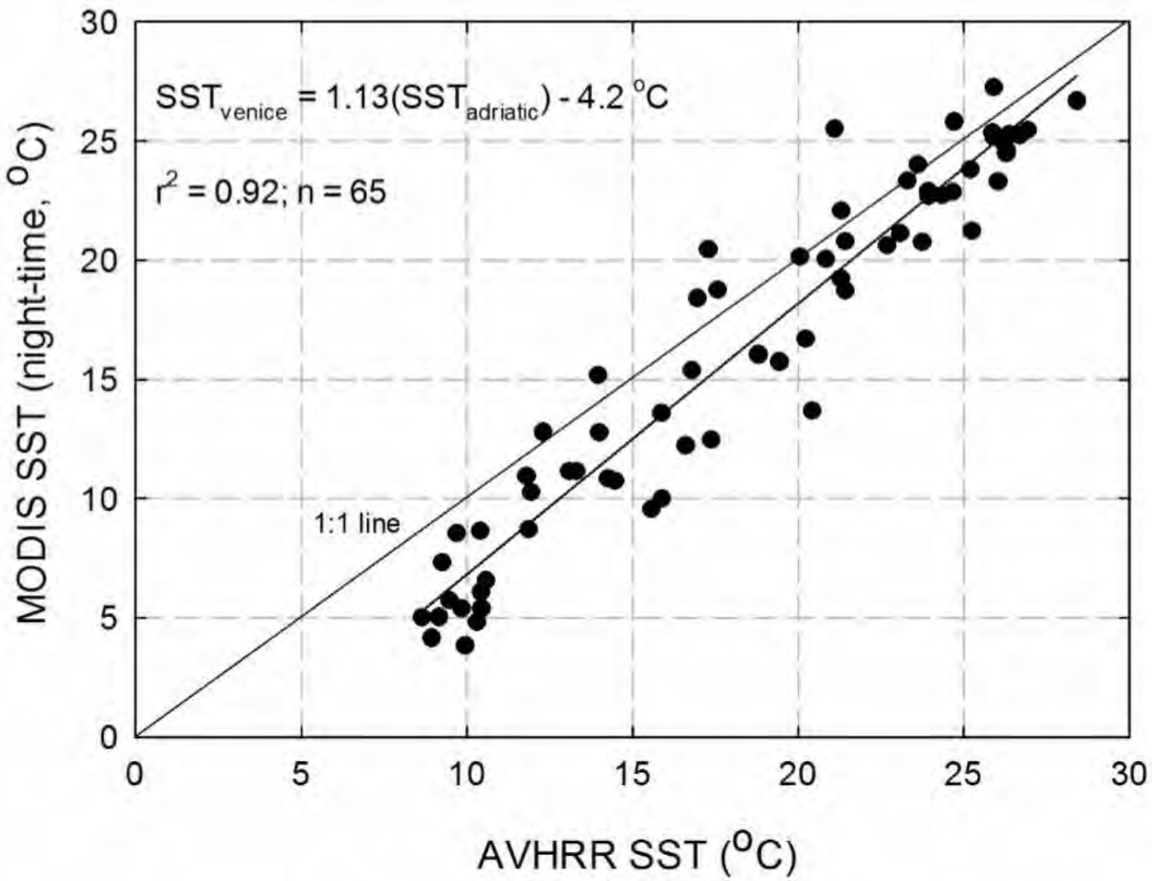


Figure 10. A comparison between deseasoned mean monthly SST for the northern Adriatic Sea (following Crowsley, 2010) and deseasoned mean monthly MODIS (nighttime) SST measured in the Venice lagoon (herein) for the period 2002 to 2008. A high correlation between data sets suggests that SST in the Venice lagoon is dominated by regional or larger forcing and that the two data sets are broadly similar, despite differences in satellite sensor, overpass location, and the sampling time of day.

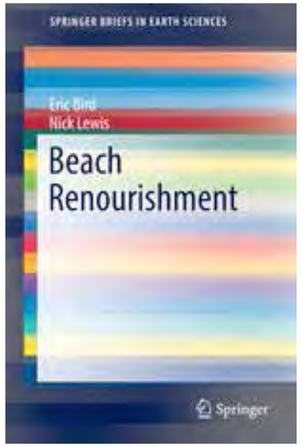
To access this full JCR Research Article, please visit:

http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-16-00017.1

BOOK REVIEW

Bird, E. and Lewis, N., 2015. ***Beach Renourishment.*** Dordrecht, The Netherlands: Springer, 135p. Paperback with color illustrations, ISBN: 978-3-319-09727-5.

Available at: http://www.springer.com/us/book/9783319097275



This is a neat little book by Eric Bird and Nick Lewis, both of whom are experienced coastal researchers. Although the volume is only 135 pages long as part of Springer Briefs in Earth Sciences series, the authors manage to hit most of the highlights and critical issues surrounding beach renourishment. Having said that, it means that no particular topic gets exhaustive treatment, as that is not the point of Springer Briefs. The coverage is, however, sufficient to give the reader a first glimpse of the issues and practices associated with this predominantly shore protection technique that is sometimes referred to as "soft stabilization or engineering." This term is applied in opposition to hard stabilization, which deploys engineering structures such as seawalls, groins, revetments, breakwaters, *etc*. instead of sand. The sand that is applied to eroding shores is regarded as sacrificial in the sense that it needs to be replaced, as it becomes "lost" to the offshore or downdrift coastal segments.

The book starts out by discussing the most commonly encountered cause of beach erosion, which is loss of sediment from the beach to such a degree that the dry beach width is reduced. The process is commonly referred to as shoreline retreat, as this is what most people observe or experience, notwithstanding the fact that beach sand can move offshore to the submerged part of the beach. This is the right place to start the book, as sediment supply is the crux of the matter. The principles of beach renourishment are next briefly discussed to advantage, emphasizing the importance of preliminary investigations, sand searches (sources of sediment for renourishment), methods of emplacement along the shore, and design considerations confronting coastal engineers.

Not to be forgotten is the process of monitoring changes over time after placement of the sand on the shore. This is a critical phase of the process because this is where lessons are learned. That is to say, this phase of renourishment projects attempts to ascertain why projects perform well or poorly. Assessment of project performance is critical to increased understanding of why some projects fail or do not perform as well as intended (as determined from the design life of the beach), and lessons are learned from such analyses to avoid the same pitfalls in future projects. It is a learning experience, and the authors bring out many ancillary aspects of the process that are related to potential environmental impacts of dredging alongshore on the seabed, loading and transport of the sand from offshore to the beach, and impacts associated with emplacement of sand on the shore.

Every beach renourishment project is unique because coastal segments differ from one another and require careful study before, during, and after completion. And many countries approach the process in slightly different ways to match their resources (biophysical and socioeconomic) and needs. Hence, there is discussion of different approaches to beach renourishment in various geographic regions.

In the opinion of the reviewer, who has hands-on experience working on many beach renourishment projects, the authors have done a laudable job of summarizing key points and issues. This book thus may well serve as a primer for those not initiated into the beach renourishment experience. This paperback is handsomely produced, and diagrams and color illustrations support the text. As a quick introduction to a complex process, this book provides effective oversight and relevant perspectives that are not biased pro or con for a process that is not without controversy.

I recommend the book to those researchers and workers who are just starting out in the field and who wish to get an overview of the subject. And for those of us who are or have been involved with aspects of beach renourishment, this handy book will serve as refresher. In many ways, this book is like an apophoreta and is indeed something to be savored before the main course of investigation into the ins and outs of beach renourishment. For coastal managers, this book would seem to be a "must have" because it succinctly presents most aspects of beach renourishment in understandable terms without invok-ing technical jargon that is so familiar to practitioners. I recommend *Beach Renourishment* unreservedly to consultants, politicians, managers, students, and members of the academy in professorial ranks.

Charles W. Finkl
Fletcher, North Carolina, U.S.A.

The Block Island Bluff Image Project: Using Google Earth™, Spreadsheet Mapper, and Google Drive™ to Build a Database of Spatially Located Field Images of Coastal Bluffs

The Block Island Bluff Image Project: Using Google Earth™, Spreadsheet Mapper, and Google Drive™ to Build a Database of Spatially Located Field Images of Coastal Bluffs

Bryan A. Oakley, Mike A. Manzi, Brandan J. Sumeersarnauth, and Samantha Boyle

Department of Environmental Earth Science
College of Arts and Sciences
Eastern Connecticut State University
Willimantic, CT 06226, U.S.A.

ABSTRACT

Spatially located field photography provides a mechanism to gather and share images for the purposes of creating virtual fieldtrips, examining change, and conducting outreach. Uploading images to Google Earth™ or other commercial sites is a common way of sharing images; however, these images are not accessible in a central, organized location, and the spatial control is limited. This paper presents a method of providing quick access to spatially located images using standard equipment (*i.e.* camera and GPS) and then linking these images to Google Earth™ using Spreadsheet Mapper, a free tool developed by Google. This technique allows image locations to be shared via a single small >10 kB file, and individual images can be viewed and downloaded as needed. A systematic approach was developed to photograph and mosaic a large number of locations, but this technique could also be applied to individual images (to examine change at one site over time) or to images collected using unmanned aerial systems.

ADDITIONAL INDEX WORDS: *Photomosaic, shoreline change, field images, repeat photography.*

INTRODUCTION

Field-based photography has become a common way of displaying data and interpreting change. Digital images provide detailed visual material for analyzing changes to an environment and provide an outlet for developing outreach and educational materials (virtual field trips) (Çaliskan, 2011; Dordevic *et al.*, 2015; Husson, Hagner, and Ecke, 2014; Meezan and Cuffey, 2012; Piatek *et al.*, 2012; Schott, 2009). Google Earth™ has been recognized as an interactive mechanism for sharing geologic data in a manner useful to scientists and the public (Whitmeyer, Nicoletti, and De Paor, 2010). The U.S. Geological Survey has even begun to use Google to crowd source the interpretation of coastal aerial photographs as part of the iCoast project (Liu *et al.*, 2014). Ground-based digital images can be especially useful in coastal environments for quickly examining shoreline change and damage to shoreline protection structures and other infrastructure that occurred during a storm. Ground level photographs can also be an important component that supports coastal mapping efforts in conjunction with a GIS-based mapping program (Friedland, 2009; Gittman *et al.*, 2014; Husson, Hagner, and Ecke, 2014; Kelley and Dickson, 2000; Pilz *et al.*, 2005; Reimers, Griffiths, and Hoffman, 2014). This paper presents a method providing quick access to spatially located digital images using commonly available equipment (*i.e.* digital camera and GPS) and free Google software.

While there are many services to share photographs across the Web (Picasa Web Albumse, Panoramioe photo-sharing community, to name a few), these services are largely accessed as individual images or albums uploaded and spatially located by a user either by entering coordinates (if known) or by selecting

 Continued on Next Page

an approximate location on a map. End users of these images have to download individual images, trusting the spatial location is accurate. The technique outlined here, using Spreadsheet Mapper to link images to a location in Google Earth™, provides a simple method for an end user to download a single Google Earth™ file

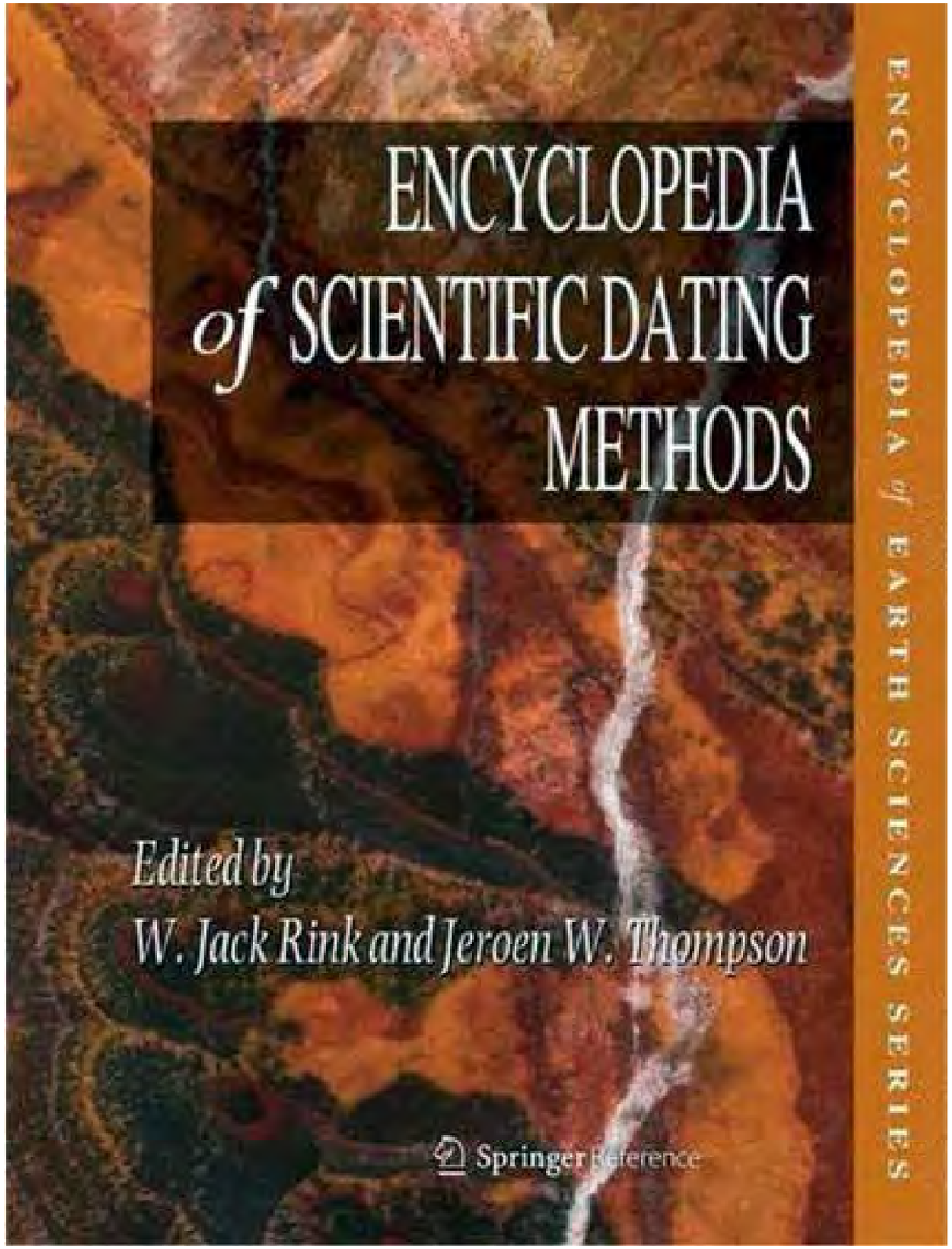
Figure 1. (A) Extent of compiled photomosaics in Google Earth™ for the Block Island Bluff Photo Database. Green placemarks represent discrete stationsinthis project. Each placemark is hyperlinked to photograph(s) that can be viewed in Google Earth™. (B) Once a placemark is selected, the placemark expands and gives users the choice of orientation *(i.e.* east or west) of the images, and optionally multiple additional images that are linked to the same location. (C) Google Earth™ screen capture of station 204E (view east). The image can be opened within a browser window to full resolution and can also be downloaded. A 1 m scale bar is mounted on field assistant's backpack. (2015 Google Inc., used with permission. Google and the Google logo are registered trademarks of Google Inc.)

 Continued on Next Page

Figure 2. Photomosaic of station 208 (41.1496°, -71.5646°; view west) along the south side of Block Island. Note the 1 m scale bar mounted on field assistant's backpack (red arrow).

To access this full JCR Research Article, please visit:

http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-15-00216.1

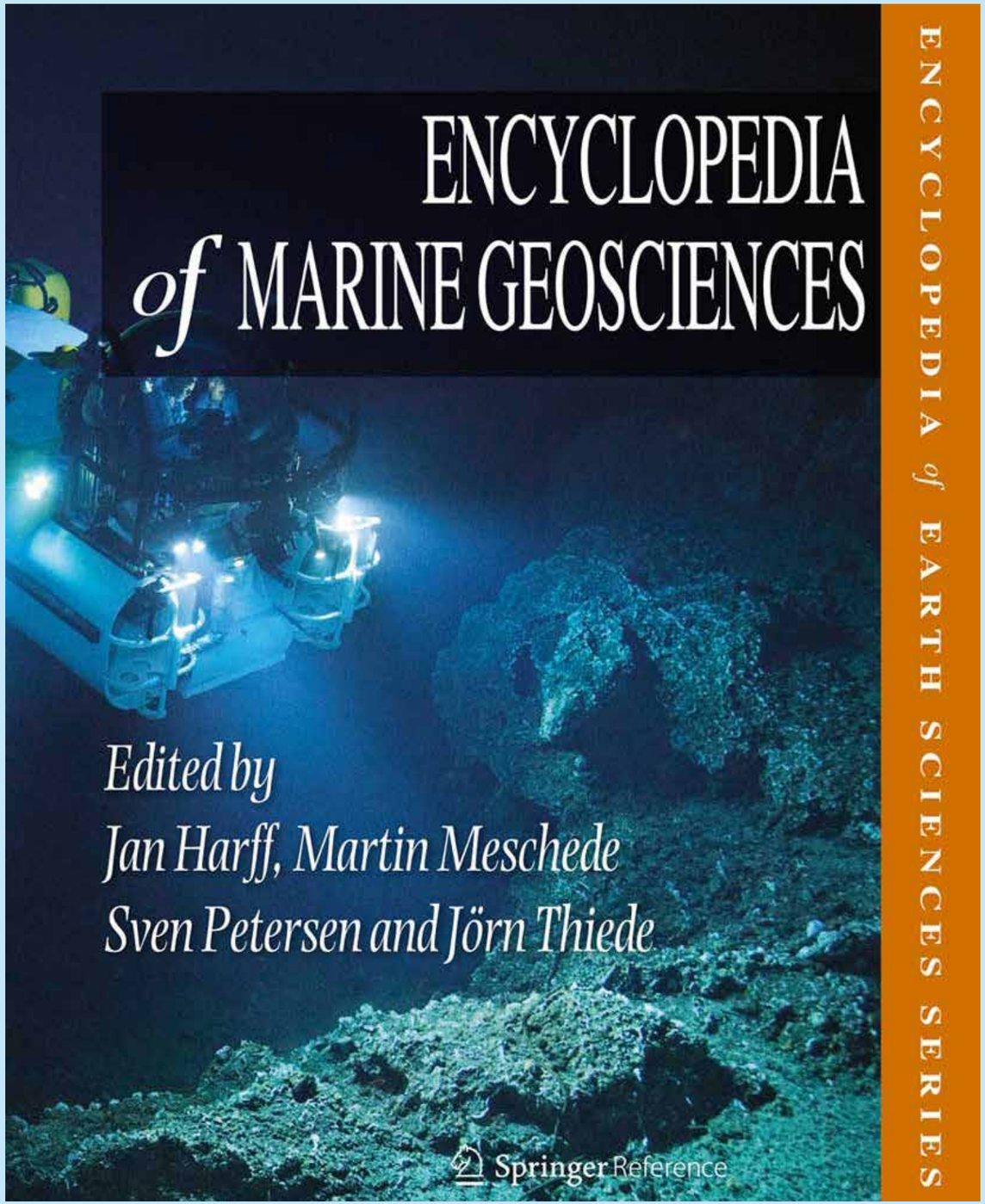


Geoscience Information Society (GSIS) 2016 Mary B. Ansari Best Geoscience Research Resource Work Award

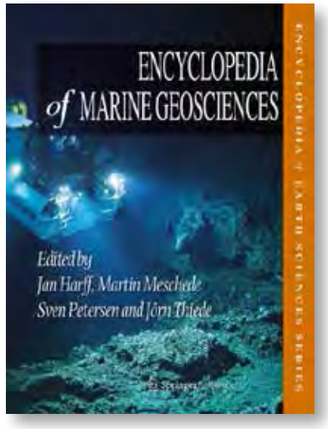
This volume provides an overview of (1) the physical and chemical foundations of dating methods and (2) the applications of dating methods in the geological sciences, biology, and archaeology, in almost 200 articles from over 200 international authors. It will serve as the most comprehensive treatise on widely accepted dating methods in the earth sciences and related fields. No other volume has a similar scope, in terms of methods and applications and particularly time range. Dating methods are used to determine the timing and rate of various processes, such as sedimentation (terrestrial and marine), tectonics, volcanism, geomorphological change, cooling rates, crystallization, fluid flow, glaciation, climate change and evolution. The volume includes applications in terrestrial and extraterrestrial settings, the burgeoning field of molecular-clock dating and topics in the intersection of earth sciences with forensics. The content covers a broad range of techniques and applications. All major accepted dating techniques are included, as well as all major datable materials.

For more information about Springer's Encyclopedia of Earth Science Series, please visit: http://www.springer.com/series/5898

Just Published



Continued on Next Page



1st ed. 2016, XXXIII, 961 p. 458 illus., 344 illus. in color.

SPRINGER REFERENCE

Print (Book)
- **399,00 € | £359.50 | $549.00**
- ***426,93 € (D) | 438,90 € (A) | CHF 531.50**

eReference
- **399,00 € | £359.50 | $549.00**
- ***474,81 € (D) | 399,00 € (A) | CHF 558.50**

Print+eReference
- **499,00 € | £371.50 | $689.00**
- ***553,69 € (D) | 548,90 € (A) | CHF 548.00**

Just Published

J. Harff, M. Meschede, S. Petersen, J. Thiede (Eds.)

Encyclopedia of Marine Geosciences

Series: Encyclopedia of Earth Sciences Series

- Offers an overview of the oceans' and marginal seas' geo-resources
- Presents an interdisciplinary synopsis of the whole scale of marine geosciences
- Incorporates geology, geophysics, hydrography, biology, climatology, ecology, and economic geology
- Integrates knowledge in basic and applied sciences, connecting natural and engineering sciences
- Addresses some 195 topics through the work of international specialists

This Encyclopedia comprises the current knowledge in marine geosciences whereby not only basic but also applied and technical sciences are covered. Through this concept a broad scale of users in the field of marine sciences and techniques is addressed, from students and scholars in academia to engineers and decision makers in industry and politics.

Globally growing demand of energy and mineral resources, reliable future projection of climate processes and the protection of coasts to mitigate the threats of disasters and hazards require a comprehensive understanding of the structure, ongoing processes and genesis of the marine geosphere. Beyond the "classical" research fields in marine geology in current time more general concepts have been evolved integrating marine geophysics, hydrography, marine biology, climatology and ecology. As an umbrella the term "marine geosciences" has been broadly accepted for this new complex field of research and the solutions of practical tasks in the marine realm.

Order online at springer.com ► or for the Americas call (toll free) 1-800-SPRINGER ► or email us at: customerservice@springer.com. ► For outside the Americas call +49 (0) 6221-345-4301 ► or email us at: customerservice@springer.com.

The first € price and the £ and $ price are net prices, subject to local VAT. Prices indicated with * include VAT for books; the €(D) includes 7% for Germany, the €(A) includes 10% for Austria. Prices indicated with ** include VAT for electronic products; 19% for Germany, 20% for Austria. All prices exclusive of carriage charges. Prices and other details are subject to change without notice. All errors and omissions excepted.

Distribution rights for Bahrain, Kuwait, Oman, Qatar, United Arab Emirates: Pan World General Trading LLC, Sharjah, United Arab Emirates

Springer springer.com

The Editors:

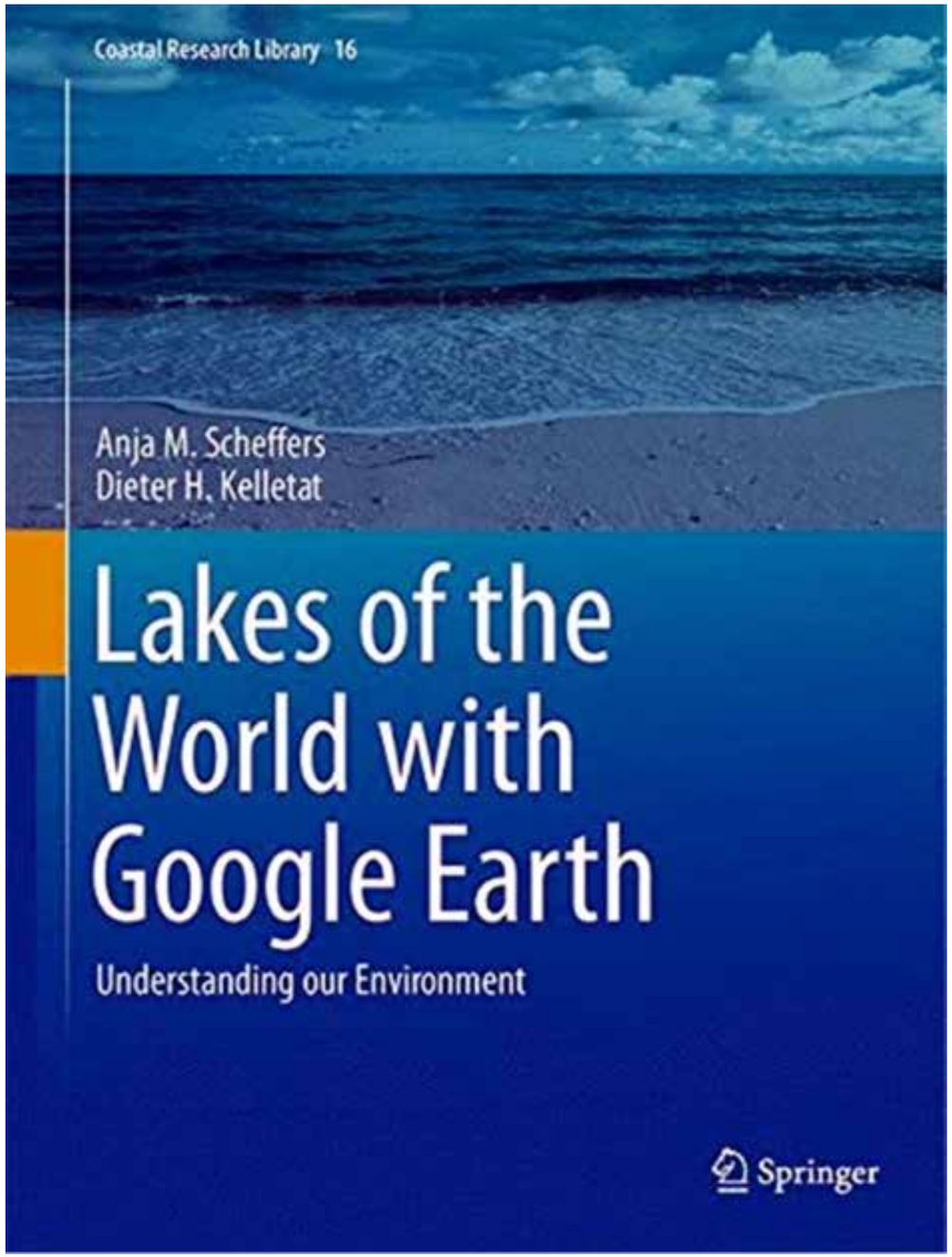
Jan Harff is Professor of Geosciences and Seafloor Geology at the University of Szczecin, Poland. His previous research focused on sedimentary basin analysis at the Central Institute for Physics of the Earth (ZIPE, subsequently the GeoForschungs Zentrum, GFZ), Potsdam, and marine geology at the Leibniz Institute for Baltic Sea Research Warnemünde and the University of Greifswald, Germany.
He cooperates, on a permanent basis, with marine research institutes of the Chinese Academy of Sciences, Chinese universities and the Guangzhou Marine Geological Survey, Guangzhou, China. His research interests concern marine geology in general, sedimentology, coastal geology, palaeo-oceanography, palaeoclimatology, mathematical geology and basin modelling. In addition to having authored and co-authored numerous research papers and having served as editor of other scientific publications, he acted as corresponding editor of "Modeling of Sedimentary Systems" (Springer, 1999) and "The Baltic Sea Basin" (Springer, 2011).

Martin Meschede is Professor of "Regional and Structural Geology" at the Institute of Geography and Geology, University of Greifswald, Germany. His research interests focus on geodynamic processes at plate margins, subduction, large igneous provinces, exhumation, paleogeography, paleoclimatology, basin evolution, and glacial tectonics. He participated in several marine research expeditions, among these are the Joides Resolution of IODP and a diving cruise with Shinkai 6500. Besides a number of scientific publications, he is author and coauthor of several textbooks on plate tectonics, structural geology, and regional geology of Germany.

Sven Petersen is a senior researcher at GEOMAR, Helmholtz Centre for Ocean Research Kiel in Germany. His research focuses on understanding the processes that form and change seafloor hydrothermal systems and associated mineral deposits with time. He participated in more than 30 research cruises to submarine hydrothermal systems in the Pacific, Atlantic, and Indian Ocean. Major aims of his research are to understand their chemical variability, the use of mobile drilling techniques and geophysical methods to investigate their sub-seafloor extent as well as the use of autonomous underwater vehicles for their exploration.

Jörn Thiede is the leader of the KÖPPEN-Laboratory of the Institute of Earth Sciences of Saint Petersburg State University. He worked 1967-1987 at the universities of Aarhus (Denmark), Bergen (Norway), Oregon State University in Corvallis (USA), Oslo (Norway) and Kiel (Germany) and learned to sail the world's oceans to understand their history. Afterwards he pursued the foundation of GEOMAR. In 1997 he joined The Alfred Wegener Institute-Helmholtz Centre for Polar and Marine Research. In 2008 he served at the Geocenter Denmark as well as at UNIS (Longyearbyen/Svalbard) and in 2011 was invited to join the St. Petersburg State University (Russia).

Recently Published in the Coastal Research Library (CRL)



Featuring satellite imagery from Google Earth, this guide provides a unique, highly visual tour of lakes across the globe, from the simple to the complex, the nearby to the remote. Clear text accompanies each image and identifies important aspects of each lake along with such information as its coordinates, scale, and altitudes, if relevant.

Anja M. Scheffers is Professor of Geoscience, Southern Cross University, School of Environment, Science and Engineering, NSW, Australia. She has a M.Sc. from University of Bonn, a Ph.D., from University of Duisburg-Essen, and a Habilitation (D.Sc.) from the University of Duisburg-Essen. She authored and co-authored more than 100 publications with main emphasis on the Physical Geography of coasts (palaeotsunamis and palaeostorms, general palaeoclimatology, sea level histories, Quaternary geochronology based on ESR and U-series dating, and multi-proxy study of corals), based on fieldwork in the Mediterranean, the Caribbean, SE-Asia, Australia and Ireland. Anja Scheffers was awarded the prestigious ARC (Australian Research Council) Future Fellowship 2009-2013.

Dieter H. Kelletat is Professor Emeritus in the Department of Geography at the University of Duisburg-Essen (Germany) and currently Lecturer at Cologne University. He has a Dipl.-Geogr. and Ph.D., from Göttingen University and Habilitation (D.Sc.) from Technical University of Berlin. He was also Associate Professor at the University of Braunschweig and Professor at the University of Hannover. His expertise is Physical Geography with emphasis on the geomorphology of coasts, high mountains, glaciers and climate change. He authored, co-authored and edited more than 250 scientific publications including textbooks and books for a wider audience, based on fieldwork on five continents from the tropics to the Arctic.

For more information about Springer's Coastal Research Library (CRL), please visit:

http://www.springer.com/series/8795

Coastal Research Library

Series Editor: Charles W. Finkl

Publish your next book in this series and benefit from being part of the largest eBook collection in Earth and Environmental Sciences

Aims and Scope

The aim of this book series is to disseminate information to the coastal research community. The Series covers all aspects of coastal research including but not limited to relevant aspects of geological sciences, biology (incl. ecology and coastal marine ecosystems), geomorphology (physical geography), climate, littoral oceanography, coastal hydraulics, environmental (resource) management, engineering, and remote sensing. Policy, coastal law, and relevant issues such as conflict resolution and risk management would also be covered by the Series. The scope of the Series is broad and with a unique cross-disciplinary nature. The Series would tend to focus on topics that are of current interest and which carry some import as opposed to traditional titles that are esoteric and non-controversial. Monographs as well as contributed volumes are welcomed.

Guidelines for submission The Series Editor welcomes proposals for series inclusion. Topics could include; geological sciences, biology (incl. ecology and coastal marine ecosystems), geomorphology (physical geography), climate, littoral oceanography, coastal hydraulics, environmental (resource) management, engineering, and remote sensing. Guidelines for submission can be obtained from the Series Editor Charles Finkl, email **cfinkl@cerf-jcr.com** and the publisher Petra van Steenbergen, Senior Publishing Editor, Earth Sciences and Geography, email **petra.vansteenbergen@springer.com**

Titles published:

Global Change and Baltic Coastal Zones Edited by G. Schernewski, J. Hofstede and T. Neumann, ISBN 978-94-007-0399- 5, 296 p., 2011
The Coastlines of the World with Google Earth By A. Scheffers, S. Scheffers, and D. Kelletat, ISBN 978-94-007-0737-5, 293 p., 2012
Pitfalls of Shoreline Stabilization Edited by J.A.G. Cooper and O.H. Pilkey, ISBN 978-94-007-4122-5, 333 p., 2012
Sand Dune Conservation, Management and Restoration By P. Doody, ISBN 978-94-007-4730-2, 303 p., 2012
Coastal Hazards Edited by C.W. Finkl, ISBN 978-94-007-5233-7, 840 p., 2013
Groundwater in the Coastal Zones of Asia-Pacific Edited by C. Wetzelhuetter, ISBN 978-94-007-5647-2, 382 p., 2013
Coastal Karst Landforms Edited by M.J. Lace and J.E. Mylroie, ISBN 978-94-007-5015-9, 429 p., 2013
Remote Sensing and Modeling: Advances in Coastal and Marine Resources Edited by C.W. Finkl and C. Makowski, ISBN 978-3-319-06325-6, 502 p., 2014
Environmental Management and Governance: Advances in Coastal and Marine Resources Edited by C.W. Finkl and C. Makowski, ISBN 978-3-319-06304-1, 472 p., 2015
Sediment Fluxes on Coastal Areas Edited by Mohamed Maanan and Marc Robin, ISBN 978-94-017-9259-2, 227 p., 2015
Estuarine Morphodynamics of the Sunderbans By Gautam Kumar Das, ISBN 978-3-319-11342-5, 211 p., 2015
Sand and Gravel Spits Edited by G. Randazzo, D. Jackson and A. Cooper, ISBN 978-3-319-13715-5, 344 p., 2015
Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments Edited by C.W. Finkl and C. Makowski, ISBN 978-3-319-25119-6, 293 p., 2016
Tsunamis and Earthquakes in Coastal Environments Edited by V. Santiago-Fandino, H. Tanaka and M. Spiske, 978-3-319-28526-9, 222 p., 2016
Brazilian Beach Systems Edited by Andrew D. Short and Antonio H.F. Klein, 978-3-319-30392-5, approx. 400 p., 2016
Lakes of the World with Google Earth By Anja M. Scheffers and Dieter H. Kelletat, ISBN 978-3-319-29615-9, approx. 280 p., 2016

Titles in press:

Rhodolith/Maerl Beds: A Global Perspective Edited by R. Riosmena-Rodriguez, W. Nelson and J. Aguirre, ISBN 978- 3-319-29313-4, approx. 450 p., 2016

Titles under development:

Coastal Environments: Biophysical Zones and Habitats By C.W. Finkl, C. Makowski and H. Vollmer
Ecological Coastal Engineering Edited by M. Sedat Kabdaşlı , V. Ş. Özgür Kırca, Nilay Elginöz and M. Adil Akgül
The Siak, a blackwater river in Sumatra, Indonesia Edited by Tim Rixen, Wolfgang Balzer and Joko Samiaji
Ground-Penetrating Radar Applications in Coastal Research By I. Buynevich
World Coastal Heritage Sites By Vanda Claudino-Sales
Modeling with Digital Ocean and Digital Coast Edited by Xin Zhang, Lei Wang, Xiaoyi Jiang and Changming Zhu
Under the Sea: Archaeology and Paleolandscapes Edited by G.N. Bailey, J. Harff and D. Sakellariou
Coastline changes of the Baltic Sea from South to East - past and future projection Edited by J. Harff, K. Furmanczyk and H. von Storch
Coastal Wetlands: Alteration and Remediation Edited by C.W. Finkl and C. Makowski
Advances in Marine Vertebrate Research in Latin America: Technological Innovation in Ecology and Conservation Edited by M.R. Rossi-Santos and C.W. Finkl
Threats to Mangrove Forests: Hazards, Vulnerability, and Management Edited by C. Makowski and C.W. Finkl

When you publish with Springer your work gets the attention it deserves:

- Seamless submission, review and tracking
- Dedicated and professional editorial guidance
- Immediate global visibility and availability *e.g.* through SpringerLink, our eContent platform visited more than 450 million times per year

Make your book available in all feasible formats
Springer makes your book available in all formats your readers could possibly want - be it as a printed copy, an eBook (for Kindle and other applications), or a MyCopy.
MyCopy - a new dimension for your book
In addition to the original printed version and eBook version of your works, a third unique format is made available: MyCopy. Designed to broaden the visibility of your book and to widen its reach, it allows library patrons to order their own personal soft cover copy of your work for 24,95 EUR/USD, provided their library has access to Springer's eBook Collection.

As a Springer eBook your research becomes:

- accessible 24/7
- available worldwide
- fully hyperlinked and integrated with other online publications
- searchable on and downloadable by book chapter level
- conveniently searchable via keywords

All Books are also Available as a Traditional Printed Copy

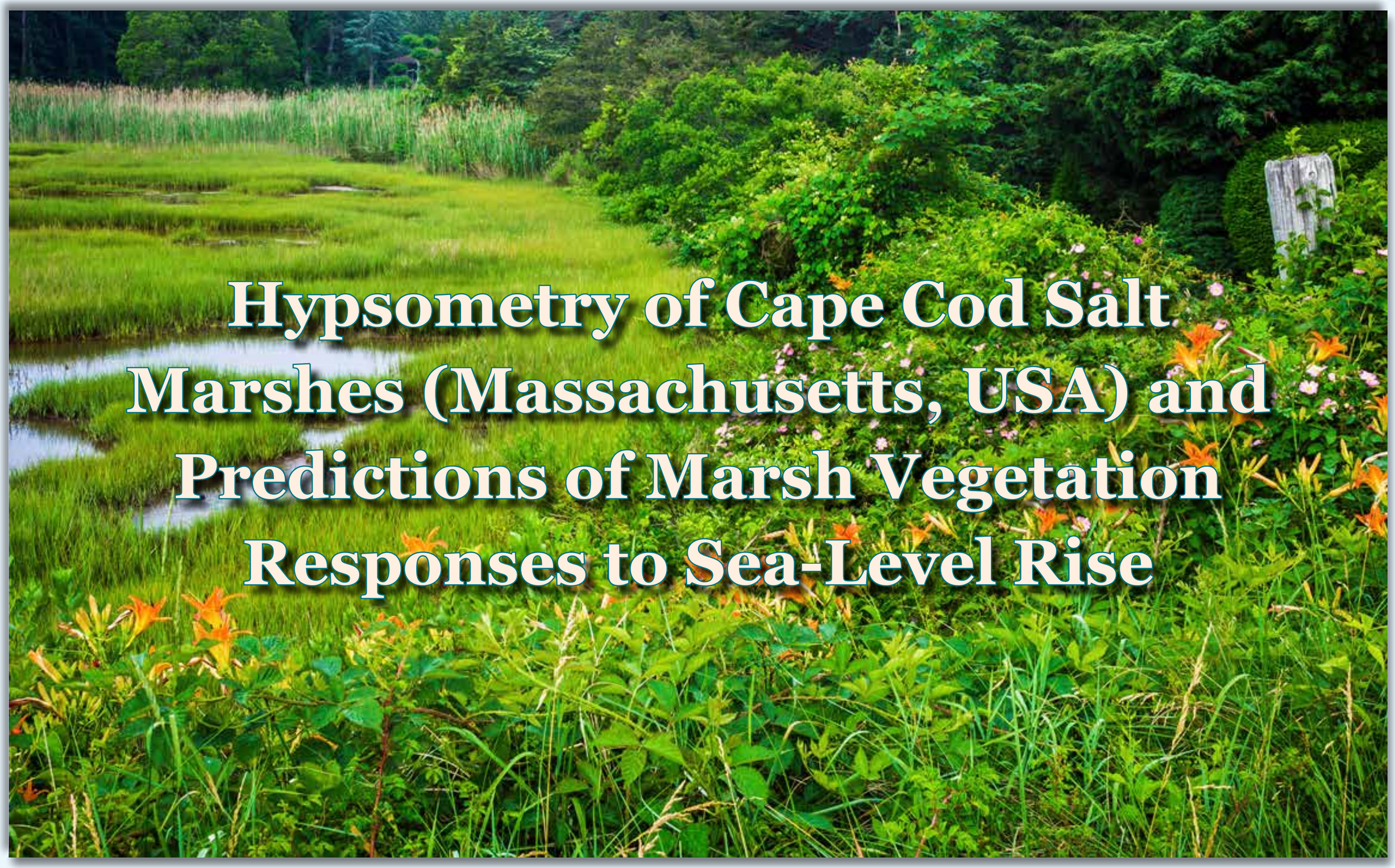
Why publish your book in the Coastal Research Library?

- **A dynamic new book series presenting volumes of a unique cross-disciplinary nature**
- **Topics include all aspects of coastal research**
- **Multi-format publication – Hardback, paperback (via MyCopy) and eBook**

More information about the series and its titles: springer.com/series/8795
We look forward to receiving your book proposal for The Coastal Research Library

Please contact:

The Series Editor: Charles Finkl cfinkl@cerf-jcr.com
The Publisher: Petra van Steenbergen petra.vansteenbergen@springer.com



Hypsometry of Cape Cod Salt Marshes (Massachusetts, USA) and Predictions of Marsh Vegetation Responses to Sea-Level Rise

Hypsometry of Cape Cod Salt Marshes (Massachusetts, USA) and Predictions of Marsh Vegetation Responses to Sea-Level Rise

Stephen M. Smith[†], Megan Tyrrell[‡], Kelly Medeiros[†], Holly Bayley[†], Sophia Fox[†], Mark Adams[†], Catalina Mejia[§], André Dijkstra[††], Sarah Janson[‡‡], and Michael Tanis[†]

[†]National Park Service
Cape Cod National Seashore
Wellfleet, MA 02667, U.S.A.

[‡]U.S. Fish and Wildlife Service
Hadley, MA 01035, U.S.A.

[§]EA Engineering Science & Tech
Warwick, RI 02886, U.S.A.

[††]Greenterweg 43
Kampen 8262BD, The Netherlands

[‡‡]E.B. Forsythe National Wildlife Refuge
Oceanville, NJ 08231, U.S.A.

ABSTRACT

The structure and functioning of salt marsh ecosystems are being impacted by sea-level rise, and a major determinant of their vulnerability to this aspect of climate change is their ground surface elevation relative to tide heights (hypsometry). In this study, a comprehensive real-time kinematic (RTK) global positioning system (GPS) survey was conducted within four salt marshes at Cape Cod National Seashore (CCNS) to create digital elevation models, and *in situ* water-level loggers were used to collect tidal data within each system. From these data, marsh surface elevations were calculated relative to mean high tide elevations for 2013 and projected elevation change rates with 50 cm and 100 cm of sea-level rise. Vegetation responses to these scenarios were then modeled based on the relationship of high and low marsh zones to relative elevation. The results suggest that (1) CCNS marshes sit low within their tidal frames, unlike the majority of salt marshes in New England, (2) high marsh areas will be most affected with sea-level rise, with 90–100% losses under both 50 cm and 100 cm sea-level rise scenarios, and (3) total marsh losses of up to 30% could ensue with 100 cm of sea-level rise. Such changes, should they occur, would substantially impact the coastal environment on Cape Cod and profoundly impact the ecosystem services provided by these systems.

ADDITIONAL KEY WORDS: *High marsh, low marsh, elevation, hypsometry, inundation, NW Atlantic, RTK.*

INTRODUCTION

Salt marshes are some of the most productive ecosystems in the world, and they provide a wide variety of well-documented ecological and socio-economic services (Adam, 1993; Costanza *et al.*, 1998; Nixon, 1982; Nixon and Oviatt, 1976; Shepard, Crain, and Beck, 2011; Teal, 1986; Valiela *et al.*, 2002). Unfortunately, salt marshes have suffered dramatic losses during the last century due to tidal restrictions and various forms of human development (Gedan, Silliman, and Bertness, 2009). These systems are also being impacted by climate change, particularly sea-level rise (SLR; Craft *et al.*, 2009; Reed, 1990).

Hydrology is the primary abiotic factor regulating the structure and function of salt marshes. The extent and duration of tidal flooding control almost every aspect of these systems, including plant species composition, productivity and biomass, carbon sequestration, biogeochemistry, and the movements and distribution of fauna (Bertness, 1991; Kathilankal *et al.*, 2008; Mendelssohn and Morris, 2000; Naidoo, McKee, and Mendelssohn, 1992; Nuttle and Hemand, 1988; Rozas, 1995; Silvestri, Defina, and Marani, 2005; Watson *et al.*, 2014). Thus, changes in hydrology due to SLR will likely have substantial ecological and physicochemical impacts.

The vegetation of salt marshes generally exhibits distinct zonation that is related to species tolerance to flooding. High marsh plants, which are comparatively flood intolerant, tend to occupy elevations between the mean high and spring high tide lines, while low marsh species dominate between mean

 Continued on Next Page

low and mean high tides (Bertness, 1991; Bertness and Ellison, 1987). To a certain extent, salt marshes can adjust to SLR by vertical elevation gain (often referred to as accretion) through organic matter (peat) accumulation and sediment deposition (Baustian, Mendelssohn, and Hester, 2012; van Wijnen and Bakker, 2001). However, when accretion rates are at a deficit with respect to increasing water elevations, high marsh will be replaced by low marsh, and the boundary between these zones will shift upslope (Brinson, Christian, and Blum, 1995). With further SLR, plant production will slow (McKee and Patrick, 1988; Mendelssohn and Burdick, 1988; Morris *et al.*, 2002), or marshes may be eradicated quickly due to rapid die-off.

The Intergovernmental Panel on Climate Change (IPCC) predicts a global rise in sea level of 52–98 cm by the year 2100 under a high CO_2 emissions scenario (IPCC, 2013), which is equivalent to a rate of ~6–11 mm/y. Of course, vertical elevation gain during any period of SLR will continuously alter ground elevations relative to tides. While salt marsh accretion rates are highly variable, reported values from the northeast United States range from 1 to 6.4 mm/y, with most values around 2–3 mm/y (Bricker-Urso *et al.*, 1989; Carey *et al.*, 2015; Chmura *et al.*, 2001; Donnelly and Bertness, 2001; Erwin *et al.*, 2006; Orson, Panageotou, and Letherman, 1985; Richard, 1978; Turner, Swenson, and Milan, 2000; Warren and Neiring, 1993).

In marshes of the northeastern United States, the process of vertical elevation gain is mainly attributed to the production of belowground biomass, while inorganic sediment deposition plays a minor role. This is due to the fact that sediment concentrations in tidal waters of this region are typically very low compared to southeastern and Gulf Coast states (Chapman, 1960; Weston, 2014). For example, organic matter accumulation in a Rhode Island marsh accounted for >90% of vertical elevation gain according to Bricker-Urso *et al.* (1989). Turner, Swenson, and Milan (2000, 2002) stated that organic accumulation is five times more important than inorganic accumulation for East Coast salt marshes. Similarly, in the nearby Plum Island Estuary, Massachusetts, Cavatorta *et al.*(2003) suggested that belowground plant production is mainly responsible for marsh accretion. Total suspended solid concentrations on incoming tides have been measured at Cape Cod National Seashore (CCNS) and are in the range of 0.2–18 mg/L, averaging 2.9 mg/L (Stephen Smith, unpublished data), with the higher end of the range generally representing a single marsh that is experiencing crab-related vegetation losses (Smith, 2009) and marsh cannibalism (*cf.* Stevenson, Ward, and Kearney, 1988). The inorganic fractions of these loads are similar to the Plum Island Estuary values of ~20% (Wigand *et al.*, 2015). Furthermore, suspended sediment concentrations are generally decreasing along the Atlantic Coast as a result of best management practices in agriculture, urban development, and vegetation succession on the landscape (Carey *et al.*, 2015; Kennish, 2001; Kirwan and Murray, 2007; Syvitski *et al.*, 2005). As such, they are likely to contribute even less to accretion the future.

Apart from vertical growth, current salt marsh elevations relative to sea level (hypsometry) will be critical to their responses to future SLR (Couvillion and Beck, 2013; Kirwan *et al.*, 2010). Those at higher elevations relative to tidal range theoretically have a greater potential to survive for a longer period of time—a concept known as "marsh capital" (Cahoon and Guntenspergen, 2010). In this study, the hypsometry of four salt marshes within CCNS was analyzed using real-time kinematic global positioning system (RTK GPS) elevations and *in situ* water-level data. The current hypsometry was then used to calculate new hypsometric profiles under scenarios of +50 cm and +100 cm of SLR (IPCC, 2013) combined with elevation change rates calculated from parabolic curves describing the relationship between plant productivity and elevation relative to mean high tide (hereafter referred to as E_{mht}), and CCNS sediment elevation table (SET) data. These projections were used to predict total losses of marsh as well as changes in the relative extents of high and low marsh.

 Continued on Next Page

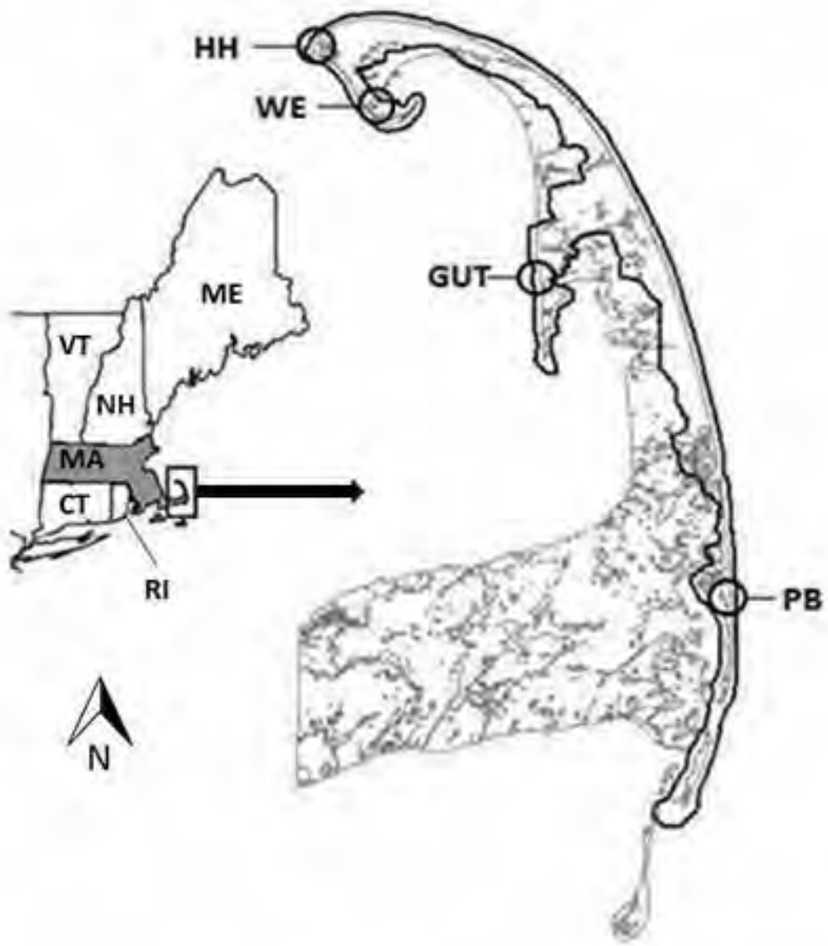


Figure 1. Map of the northeast United States, Massachusetts (shaded), and Cape Cod (within box). A larger view of the enclosed area shows the boundary of Cape Cod National Seashore (dark polygon), within which are the study marshes (HH = Hatches Harbor, WE = West End, GUT = the Gut, PB = Pleasant Bay).

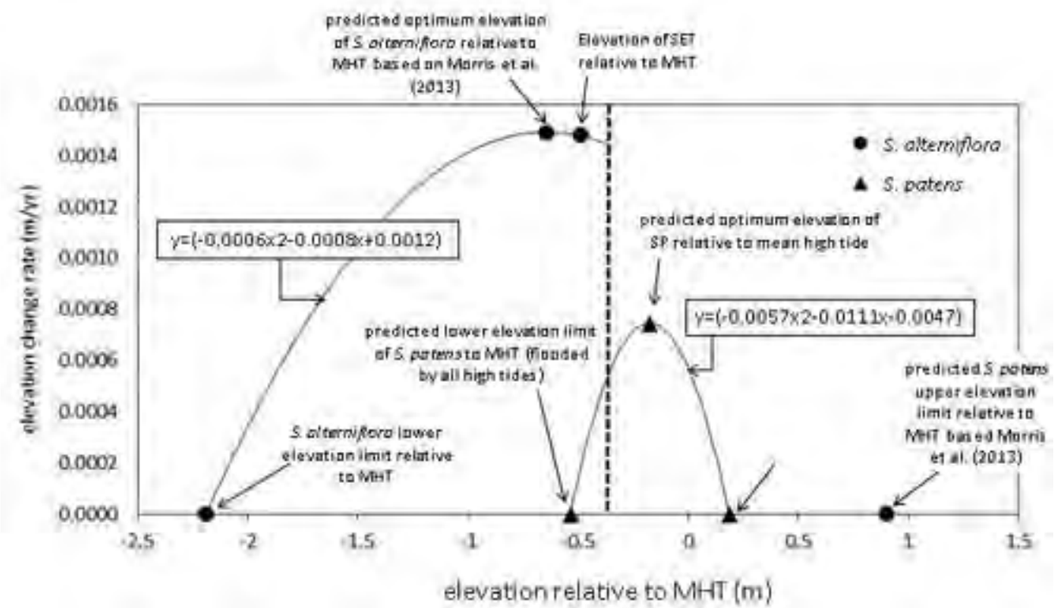


Figure 2. Example of an elevation change rate parabolic curve for the Gut within the *S. alterniflora* and *S. patens* zones. The curve for *S. alterniflora* was set by the field-determined lower limit, the measured accretion rate within *S. alterniflora* at the corresponding SET site (with a known E_{mht}), and a maximum accretion rate that corresponds to 60% of the MHT elevation. The curve for *S. patens* was determined by a theoretical lower limit (elevation that is flooded by every high tide), an accretion rate half that of *S. alterniflora*, and a maximum accretion rate occurring at the midpoint elevation of its range.

Continued on Next Page

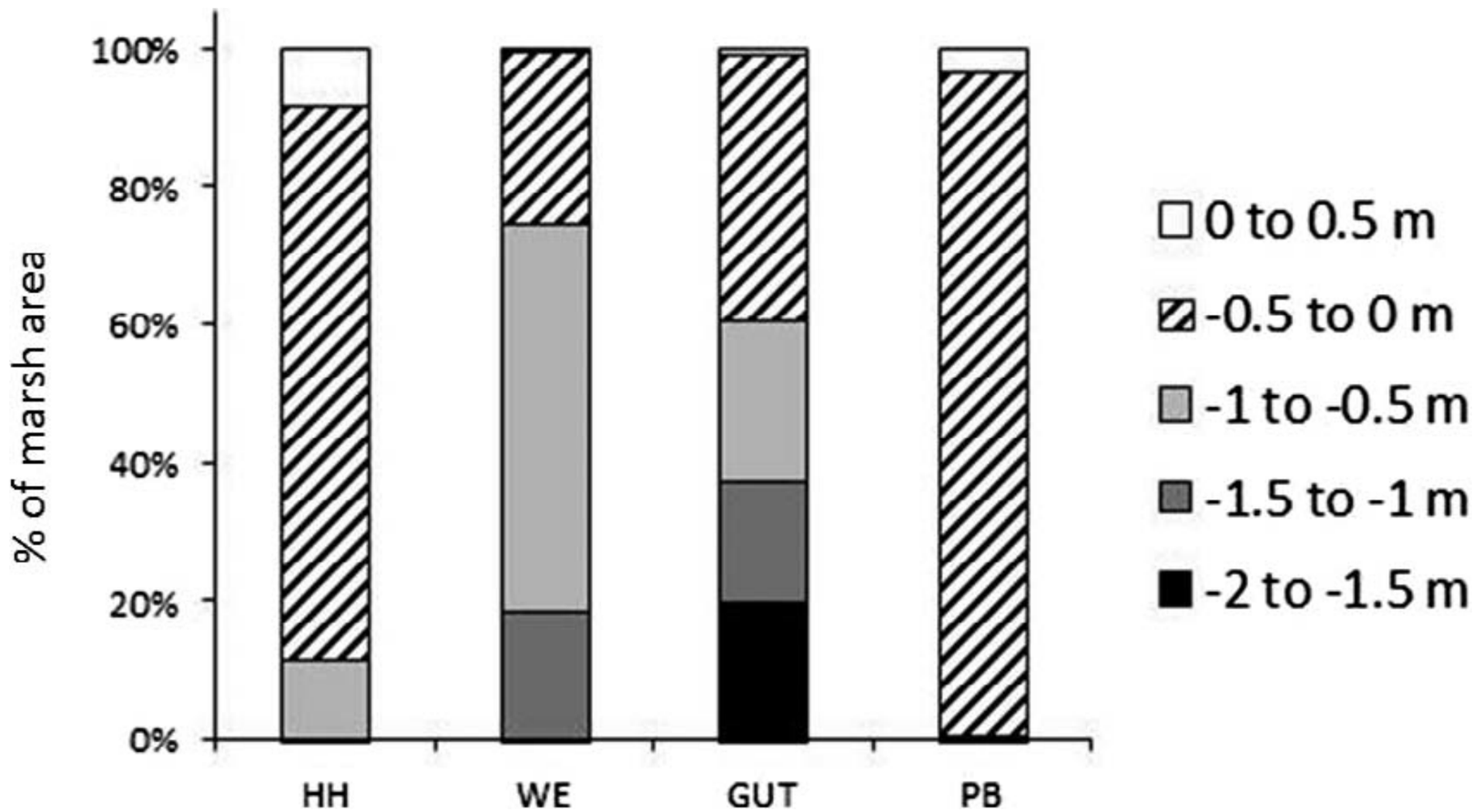


Figure 3. Percentages of marsh area by site in 2013 within 0.5 m E_{mht} interval categories (total range of -1.5 m to 0.5 m relative to MHT).

Continued on Next Page

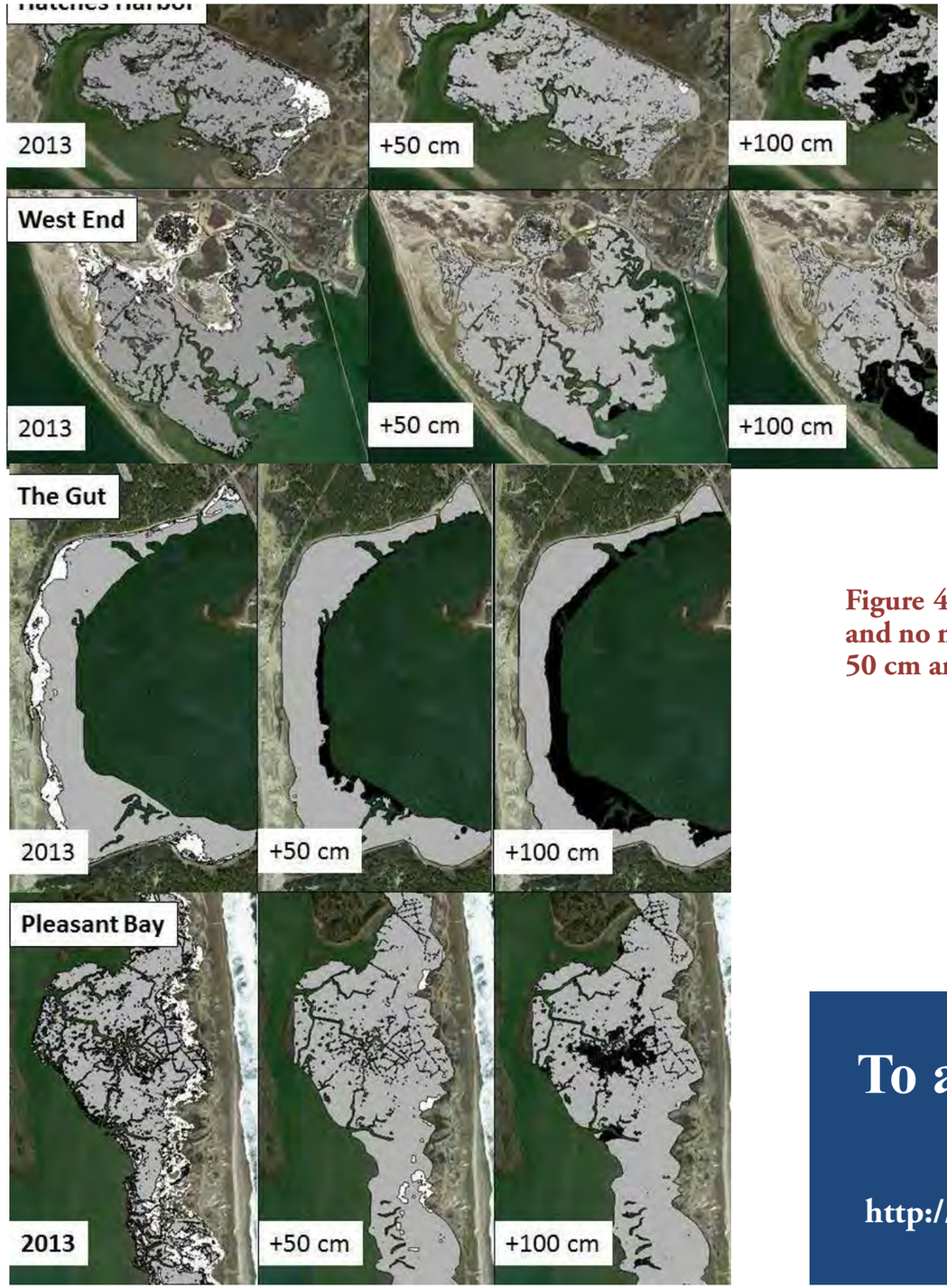


Figure 4. Maps of high marsh (white), low marsh (gray), and no marsh (marsh loss; black) by site in 2013 and after 50 cm and 100 cm of SLR.

To access this full JCR Research Article, please visit:

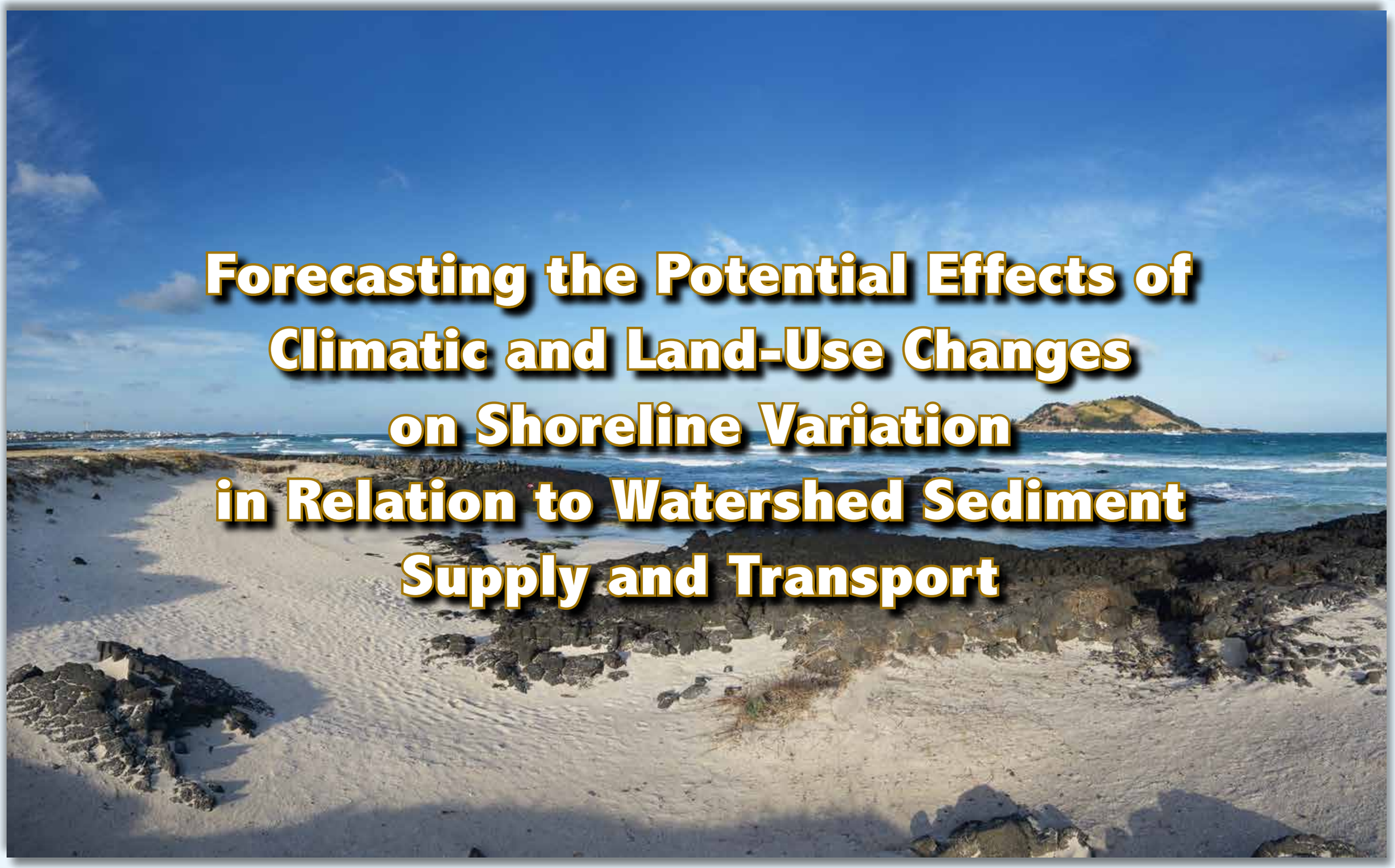
http://www.jcronline.org/doi/abs/10.2112/JCOASTRESD1500153.1

Call for Abstracts:

4th International Rip Current Symposium - Nov. 4-6, 2016 in Qingdao, China

The abstract deadline for the 4th International Rip Current Symposium has been extended to 25 September 2016. This unique meeting of rip current scientists, engineers and beach safety professionals seeks to identify advancements in rip current research that will improve understanding of this dangerous phenomena and to enhance communication of the threats to the public. The symposium will occur as a session at the 5th World Congress of Ocean 2016 (http://www.bitcongress.com/WCo2016/scientificprogram.asp) held from Nov. 4-6, 2016 in Qingdao, China.

Please contact the session chairs Dr. John Fletemeyer (jfletemeyer@aol.com) or Dr. Brian K. Haus (bhaus@rsmas.miami.edu) to ensure prompt attention to your abstract.



Forecasting the Potential Effects of Climatic and Land-Use Changes on Shoreline Variation in Relation to Watershed Sediment Supply and Transport

Forecasting the Potential Effects of Climatic and Land-Use Changes on Shoreline Variation in Relation to Watershed Sediment Supply and Transport

Jinsoo Kim, Jisun Choi, Chuluong Choi, and Changsu Hwang

Department of Spatial Information Engineering
Pukyong National University
Busan 608-737, South Korea

ABSTRACT

This study investigated the potential effects of future climatic and land-use changes on sediment supply and shorelines in the Hoeya River estuary, Korea. Historical shoreline variations were determined along Jinha and Solgae Beaches for the period 1975–2013 using the Digital Shoreline Analysis System. Sediments during future periods were simulated in this watershed under the Representative Concentration Pathways 4.5 and 8.5 scenarios using the soil and water assessment tool model. Subsequently, this study analyzed the correlations between the beaches and the sediment supply. For the natural beaches BS-I (0.805) and BS-II (0.700) in 1975–2013, the river-supplied sediment was closely correlated to shoreline changes. The area of beach sediment for future periods was assessed based on *R*-squared values. The artificial beach BS-III (0.203), which had remained relatively stable in 1975–92, showed shoreline erosion following this period. This beach is now artificially supplied with sediment because of a training dike. In 1986, because of the presence of a dam, a decrease in the discharge volume of suspended solids from the watershed caused a clear erosional trend in artificial beach BS-IV (0.432) from 1975. Artificial activity in the study area has caused major changes to the shoreline, but the *R*-squared values are relatively low. In the future, the area of the natural beach will increase during spring and winter and will decrease during summer and autumn. Furthermore, these seasonal trends in future periods may be amplified by seasonal variability in the wave direction. Our results are expected to improve understanding of shoreline changes that contribute to sediment supply and transport in river watersheds, which has significant implications for the effective management of the coastal environment.

ADDITIONAL INDEX WORDS: *Coastline, deposition, climate change, RCP, DSAS, SWAT.*

INTRODUCTION

Shoreline changes are mostly associated with suspended solids from watersheds, coastal engineering factors (waves, tides, currents, *etc.*), natural factors (wind direction and speed, sea-level rise, *etc.*), and artificial factors (primarily dam, harbor, and training dike construction, *etc.*; Cowell and Thom, 1994; Paskoff and Clus-Auby, 2007). Erosion of beaches affects about 75% of sandy shorelines globally (Bird, 1996), a situation that is likely to worsen as climate change causes sea levels to rise and causes increasingly stronger storms (Defeo *et al.*, 2009). On an intermediate time scale (decades), the factors influencing shoreline changes are more complex and interrelated, including natural causes. Previous studies have analyzed the potential relationships between the spatial patterns or dynamics of sea-level rise and shoreline changes (Bird, 1985; Ford, 2013; Gratiot *et al.*, 2008; Gutierrez, Plant, and Thieler, 2011; Le Cozannet *et al.*, 2014; Morton, 2008; Romine *et al.*, 2013; Webb and Kench, 2010; Yates *et al.*, 2013).

Over the last century, reduction in river sediment load has become a global

 Continued on Next Page

concern and has led to erosion that now affects many estuaries and deltas (Li *et al.*, 2014). According to Syvitski *et al.* (2003), about 90% of the sediment contributing to the coastal sediment budget originates from upstream watersheds. Coastal retreat has major implications for human habitat and is directly influenced by reduction in river-supplied sediment (Syvitski *et al.*, 2005). Changes in sediment supply can greatly influence the benthic environment of coastal estuaries, coral reefs, and seagrass communities (McLaughlin *et al.*, 2003; Restrepo *et al.*, 2006; Syvitski *et al.*, 2005; Wolanski and Spagnol, 2000). Syvitski *et al.* (2005) and Syvitski and Saito (2007) provided an initial database of key environmental factors associated with representative deltas and refined their database. The Community Surface Dynamics Modeling System (CSDMS) is a community of earth scientists promoting the modeling of earthsurface processes by developing and disseminating integrated software modules that predict the movement of fluids and the flux of sediment and nutrients in landscapes and their sedimentary basins (Syvitski and the CSDMA Community, 2008). The CSDMS allows full coupling of the terrestrial and coastal fields through numerical modeling. Ashton *et al.* (2013) reported preliminary results for coupling of the coastline evolution model with fluvial models via the CSDMS component modeling tool.

The principal sources of sediment transport to the coastline are rivers and streams (Komar, 1998). Climate and land-use changes in the watershed can affect the supply of sediment to beaches and, consequently, shoreline erosion (Inman, 1976; Kuhn and Shepard, 1983). Many previous studies have investigated the potential effect of future changes in climate and land use on soil erosion in watersheds and sediment delivery by rivers to the ocean under various climate change scenarios (Boardman and Favis Mortlock, 1993; Favis Mortlock and Boardman, 1995; Ward *et al.*, 2009). Climate change can affect sediment availability by altering precipitation and locally driven runoff or, more importantly, by altering runoff from watersheds to the coastal zone (Bates *et al.*, 2008). Land-use changes can directly affect the sediment in coastal watersheds, impacting the downstream sediment supply to river channels and coastal areas. For long-term coastal planning and management, it is crucial to understand the potential effects of climate and land-use changes on sediment availability in river watersheds and adjacent coastal areas. Samaras and Koutitas (2014a,b) provided a detailed description and analysis of actual case studies to investigate the impact of climate and land-use changes on coastal morphology in a coupled watershed-coast system using an integrated approach and numerical modeling. Kim *et al.* (2013) evaluated the impacts of changes in climate and land use on runoff in the Hoeya River watershed using land-use scenarios that are consistent with the specific assumptions under the Representative Concentration Pathways (RCP) scenarios of the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). Few studies exist, however, on the effects that future river supplied sediment will have on shoreline changes considering climatic and land-use changes under various climate change scenarios.

This study examined historical shorelines and the potential effects of future climate and land-use changes on sediment supply and shorelines in the Hoeya River estuary, Korea. The primary steps and contributions of this study are summarized as follows.

Historical shoreline changes in the study area were assessed using orthorectified aerial photographs and multispectral satellite images during 1975–2013 using the Digital Shoreline Analysis System (DSAS).

An urban growth model using logistic regression (LR) was selected to estimate future land use under the RCP 4.5 and 8.5 scenarios. This study applied the soil and water assessment tool (SWAT) model. The new model simulated the sediment supply under two climate change scenarios to evaluate land-use changes on watershed sediments.

Analysis of the correlation between past shoreline changes and river-supplied sediment was conducted for the study area, assuming no construction of additional artificial structures. Based on this relationship, future sediment supply to the coastal zone, according to the SWAT model, was used to predict future shoreline changes.

Study Area

The study area, the Hoeya River watershed in the Republic of Korea, spans the coastline from the metropolitan city of Ulsan to the city of Yangsan (Fig-

 Continued on Next Page

ure 1a). The average elevation of this watershed is 174.1 m above sea level, and the average slope is 17.58; more than 69% of the watershed area is mountainous. River-supplied sediment in this watershed enters the East Sea through the Hoeya River estuary, and this serves as the main sand sources for Solgae (BS-I) and Jinha (BS-II, beach south lower; BS-III, beach south upper; BS-IV, beach north) sandy beaches south of the watershed (Figure 1b). Jinha Beach is 1000-m long and has an average width of 40 m and area of approximately 53,000 m^2.

Myeongseon Island is located approximately 160-m offshore near the center of this beach, and a tombolo has formed between the island and the mainland. The island serves as the point where Jinha Beach is divided into north and south. Additionally, the southern section of Jinha Beach was divided into BS-II, which is not affected by artificial construction, and BS-III, which is a site of artificial construction.

The main course of Hoeya River empties past the north beach (Figure 1b); however, river discharge has been severely reduced since 1986 because of dam construction in this watershed. This has caused a serious blockage of the Hoeya River estuary. From 1997 to 2004, a 156-m training dike was constructed to mediate this blockage (Figure 1c); however, not only has sedimentation progressed in this estuary, but continuous erosion has also occurred on the southern segment of Jinha Beach. Therefore, every year, the local government dredges sediment from the estuary and applies it as artificial augmentation to the eroding beach (Figure 1d). Solgae Beach (area approximately 12,000 m^2) is a typical natural sandy beach, 320 m south of Jinha Beach, which is unaffected by artificial structures and is controlled by sediment circulating naturally from the Hoeya River watershed.

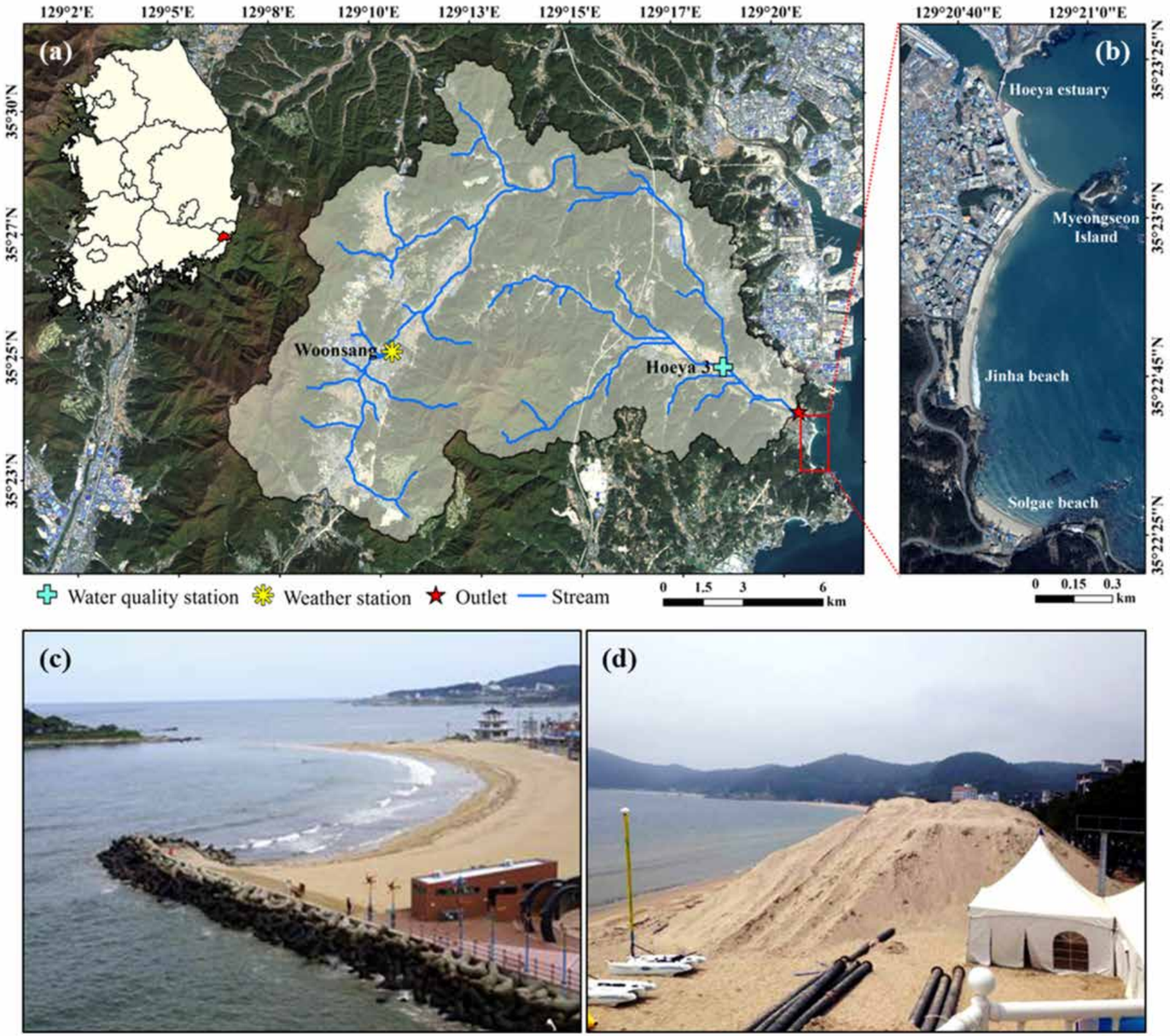


Figure 1. Study area: (a) Location of the Hoeya River basin; (b) Hoeya River estuary, Jinha beach, and Solgae beach; (c) training dike constructed at the mouth of the Hoeya River; (d) sand dredged from the Hoeya River estuary for artificial supply.

Continued on Next Page

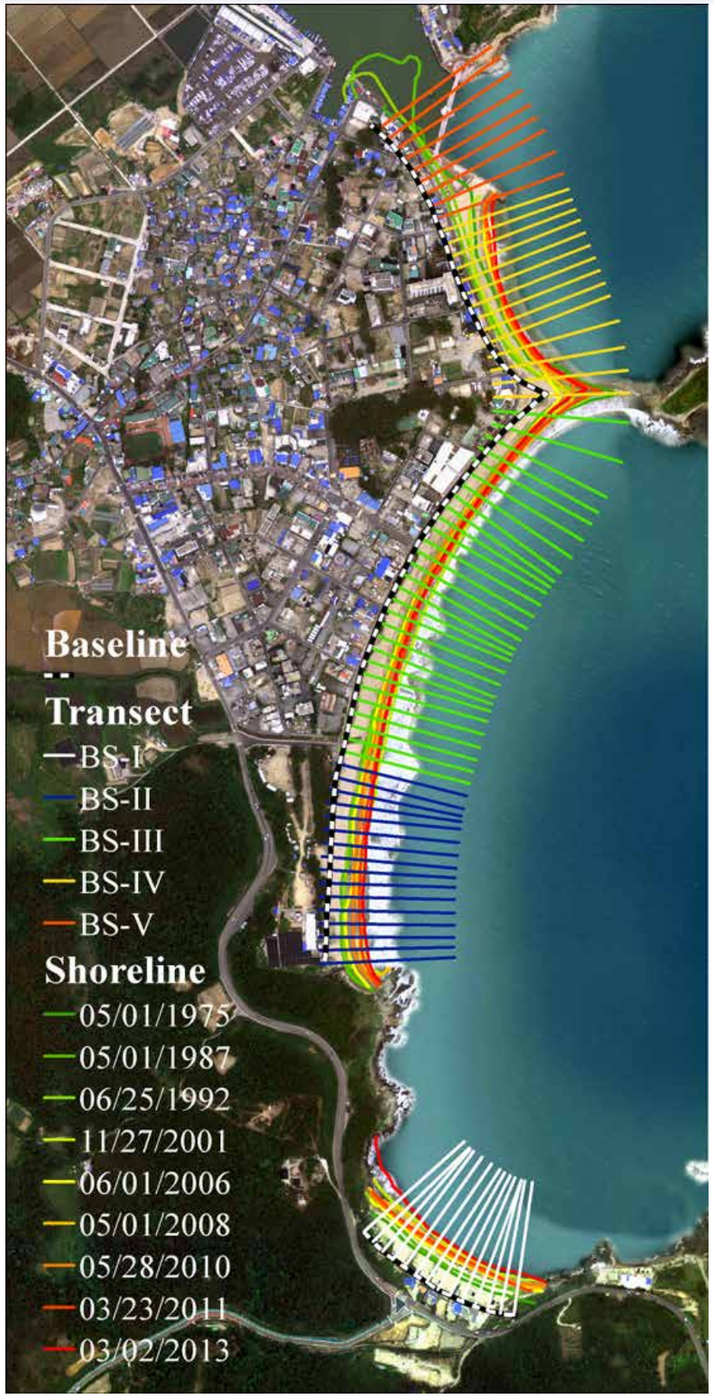


Figure 2. Location of transects used for shoreline change analysis for each section.

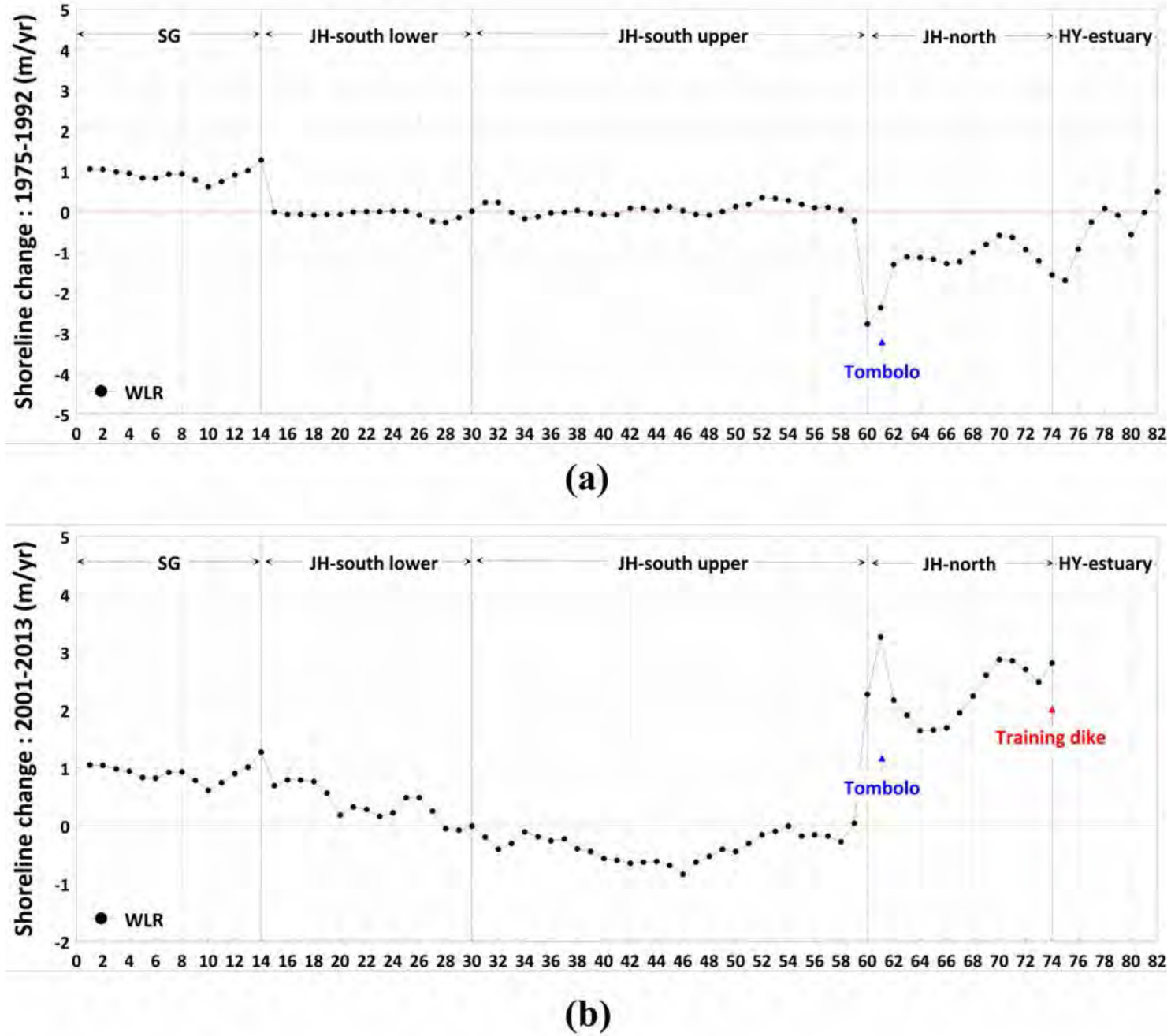


Figure 3. Statistical analysis of shoreline changes. (a) Rate of change in the shoreline position, expressed as WLR during the period prior to training dike construction (1975–92); (b) the WLR during the period after to training dike construction (2001–13).

Continued on Next Page

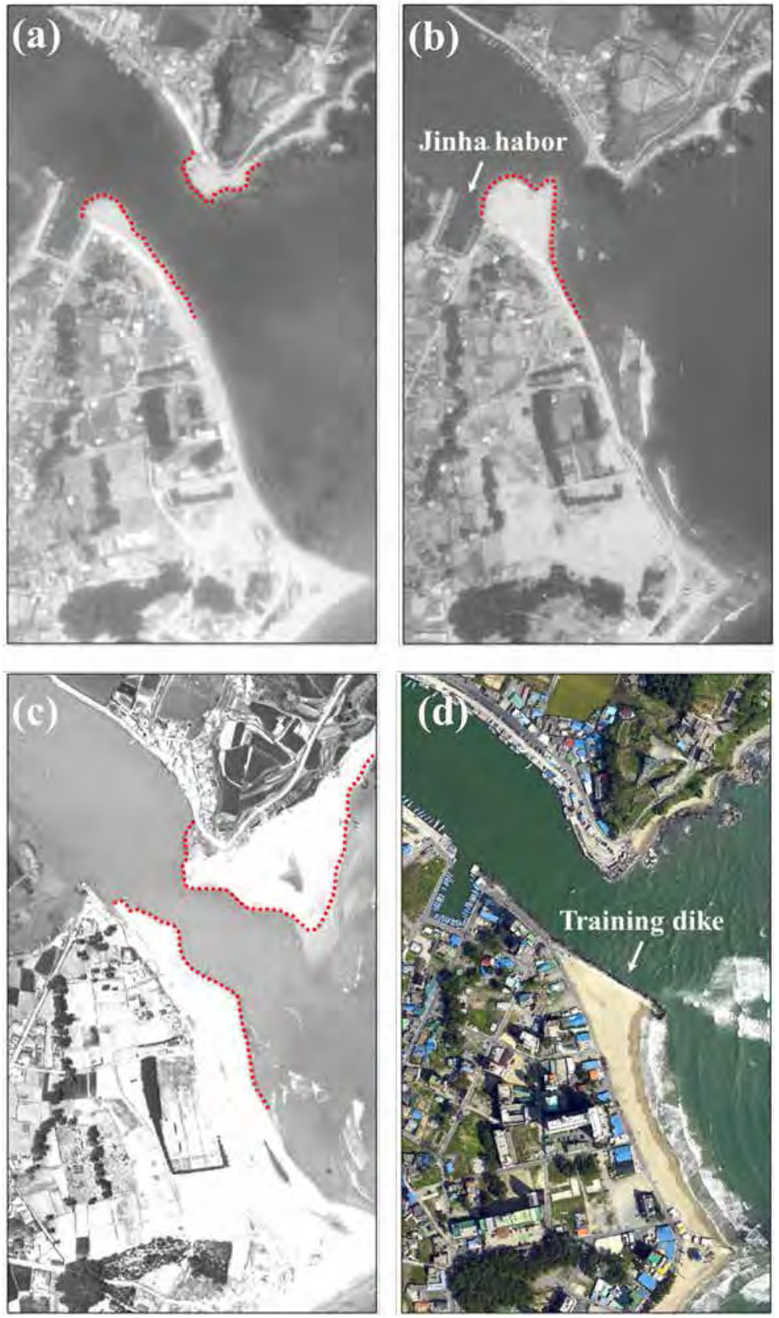


Figure 4. Change in occlusion within the estuary before and after training dike construction: (a) 1975, (b) 1987, (c) 1992, (d) 2006. Dotted line indicates border of sedimentation.

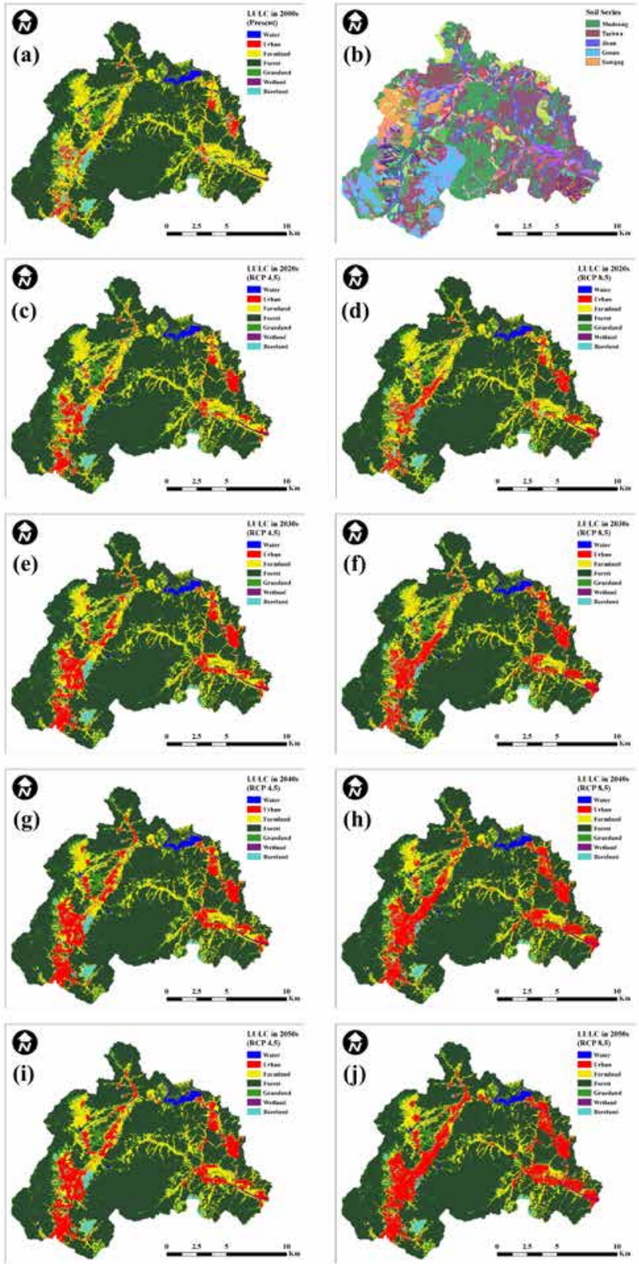
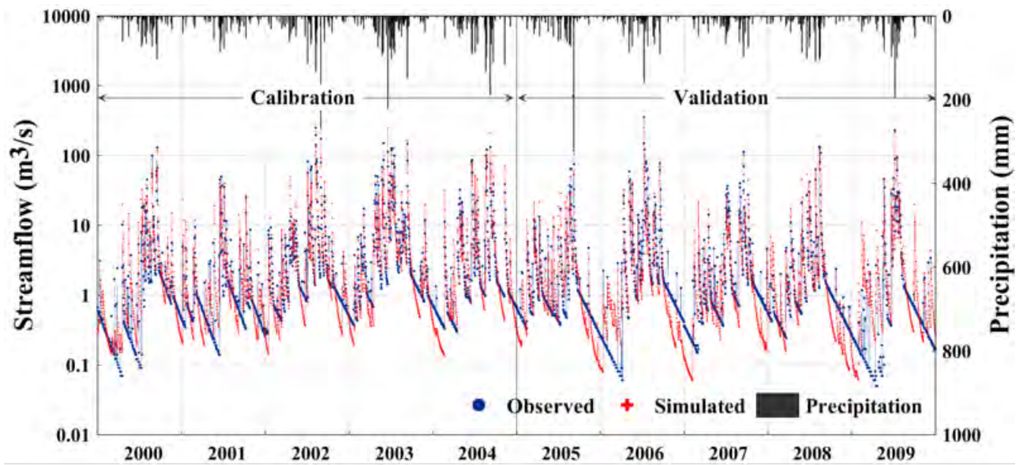
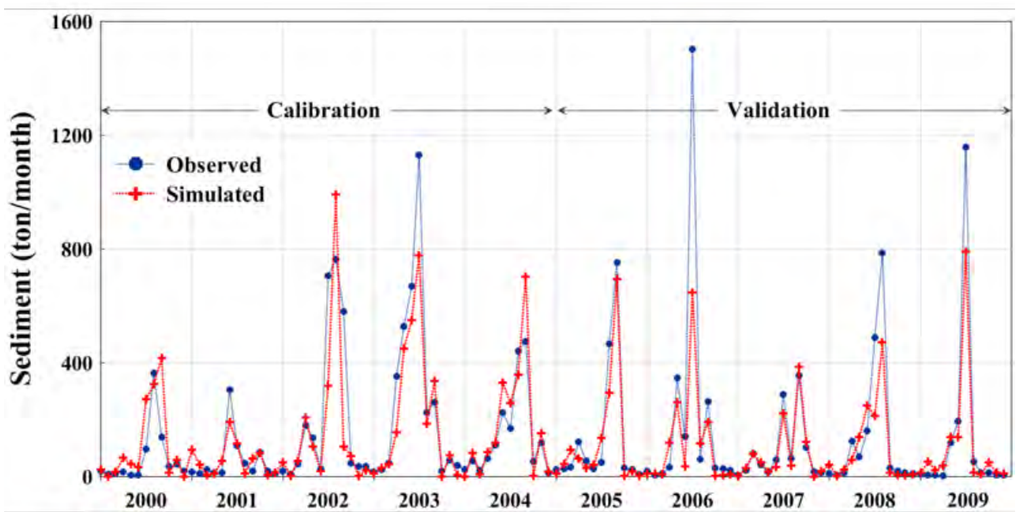


Figure 5. Land-use map in 2000 for (a) soil map and (b) future land-use maps for each scenario. The maps are arranged from top to bottom in order from 2020 to 2050 (c), (e), (g), (i) under the RCP 4.5 and (d), (f), (h), (j) under the RCP 8.5.

Continued on Next Page

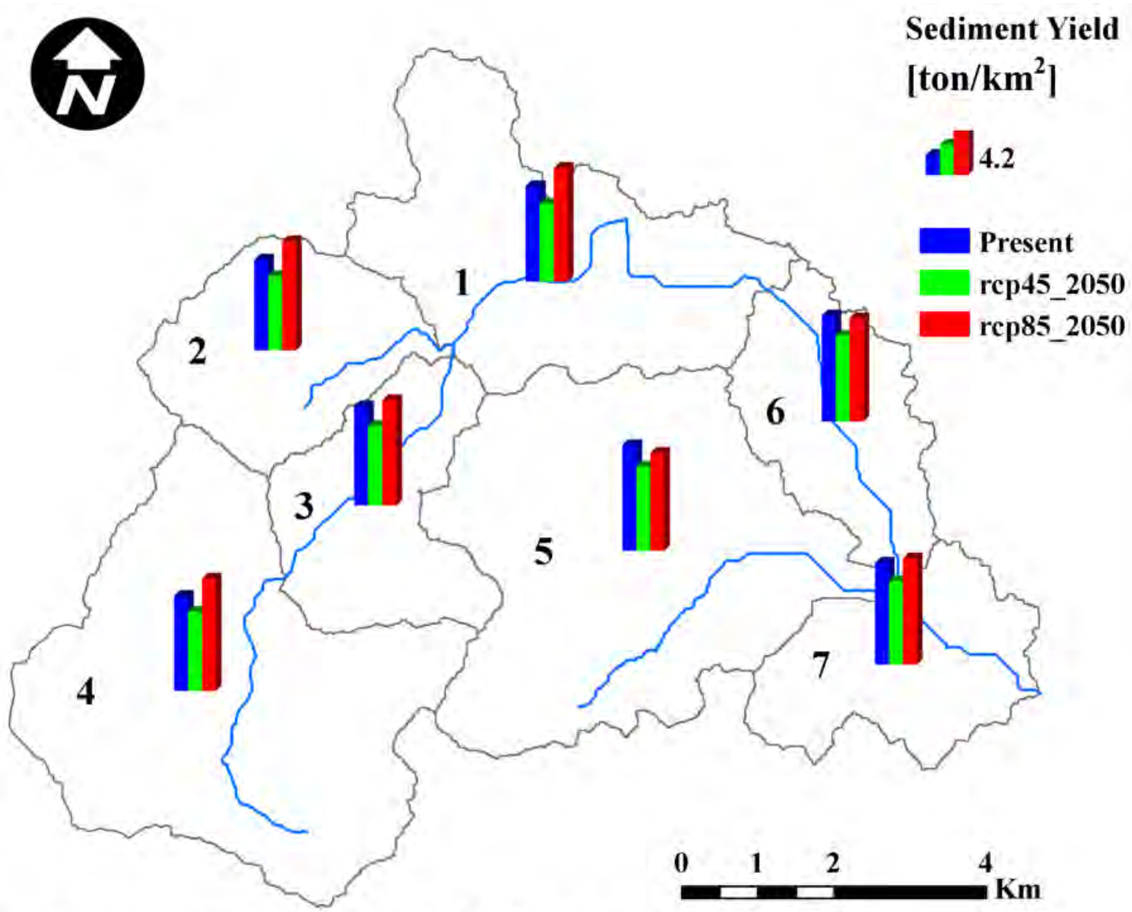


(a)



(b)

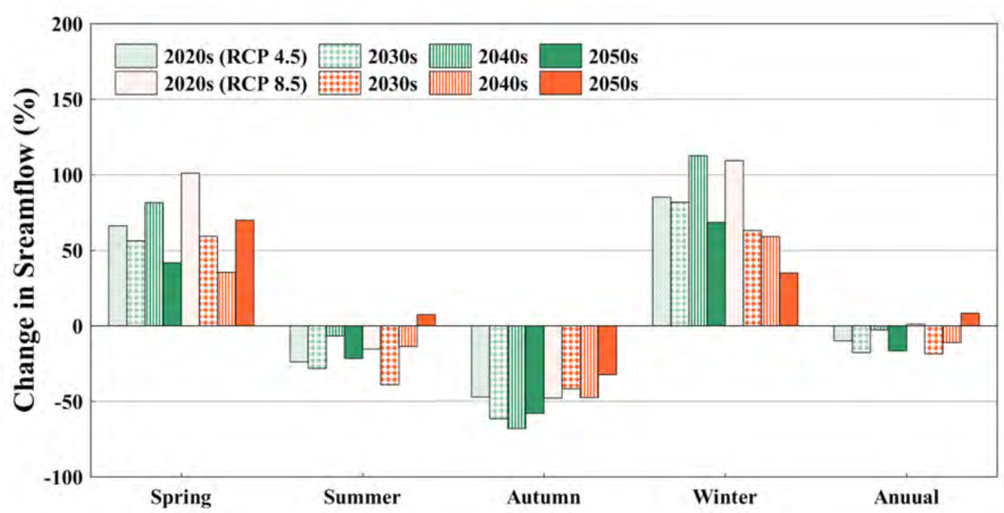
Figure 6. Observed and simulated daily streamflow and monthly sedimentation for the calibration and validation periods during 2000–09: (a) daily streamflow and (b) monthly sedimentation.



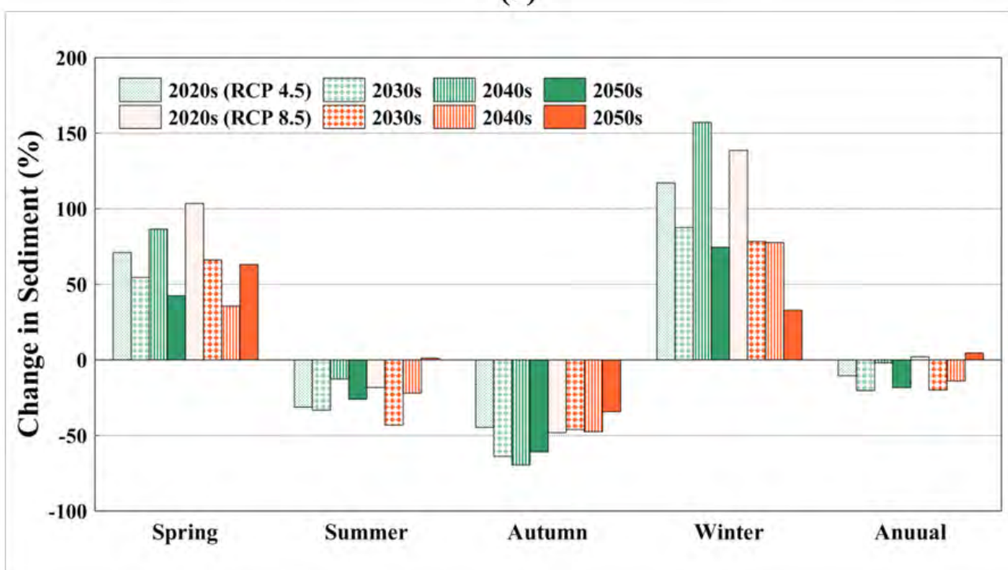
Average annual watershed sediment yield
Present (2000s) = 7.00 [ton/km^2]
RCP45 (2050s) = 5.69 [ton/km^2]
RCP85 (2050s) = 7.97 [ton/km^2]

Figure 7. Changes in the streamflow and sediment for the future period relative to the baseline period: (a) changes in mean seasonal and annual streamflow; (b) changes in mean seasonal and annual sediment.

 Continued on Next Page



(a)



(b)

Figure 8. Sediment simulation results for the present (2000s) and the RCP scenario (2050s).

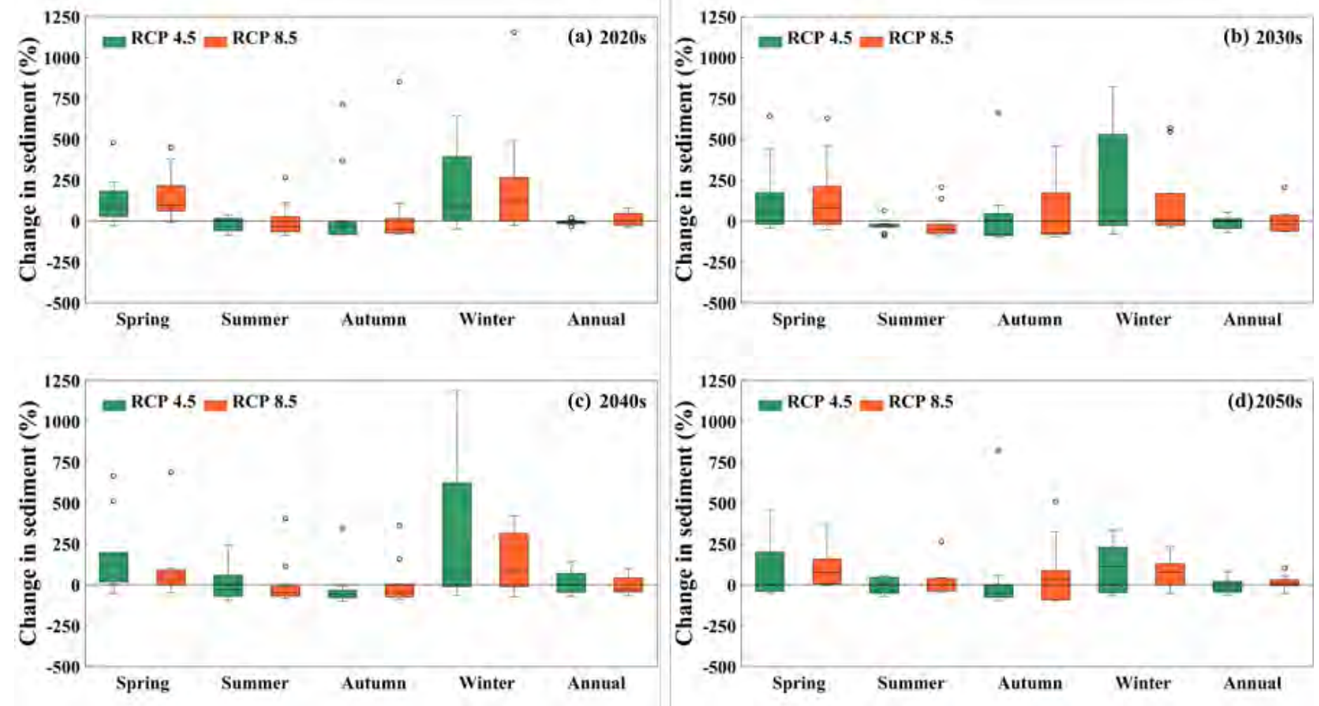


Figure 9. Box and whisker plots for changes in seasonal and annual sediment.

Continued on Next Page

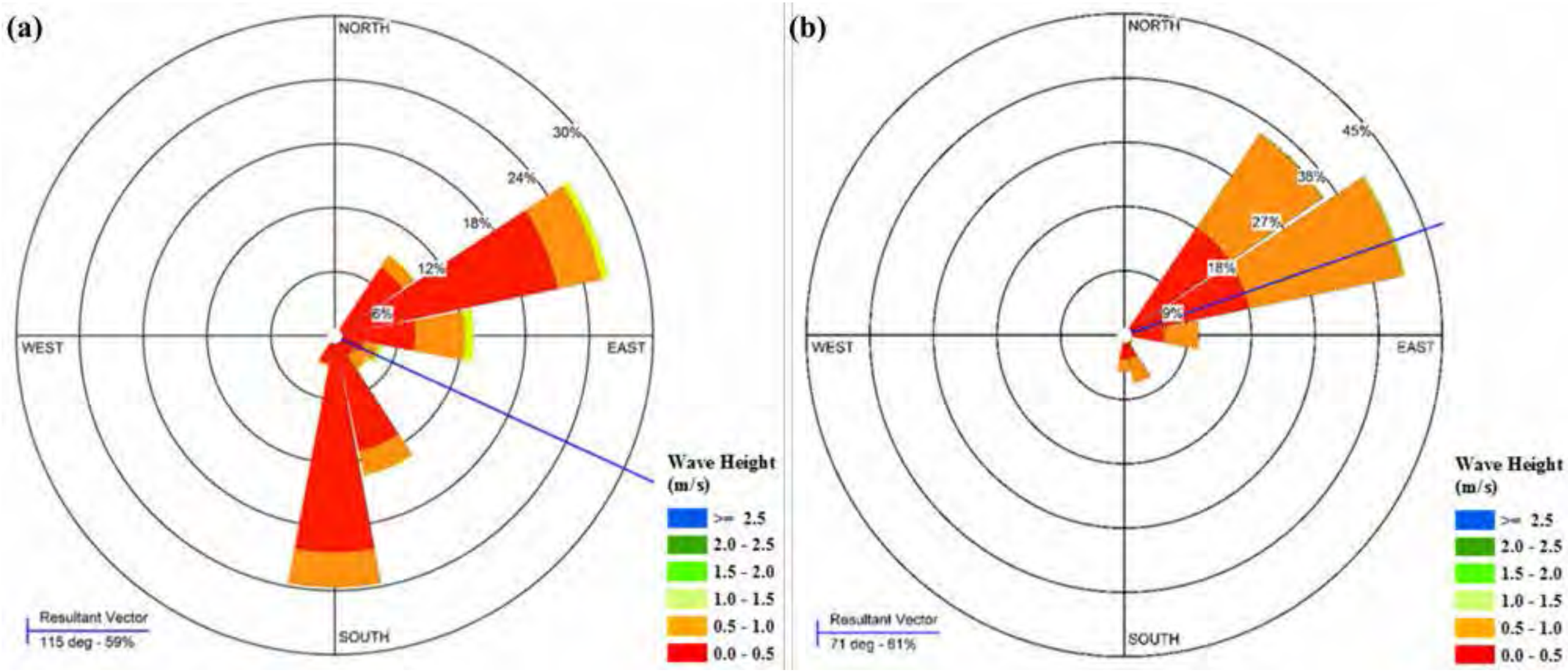
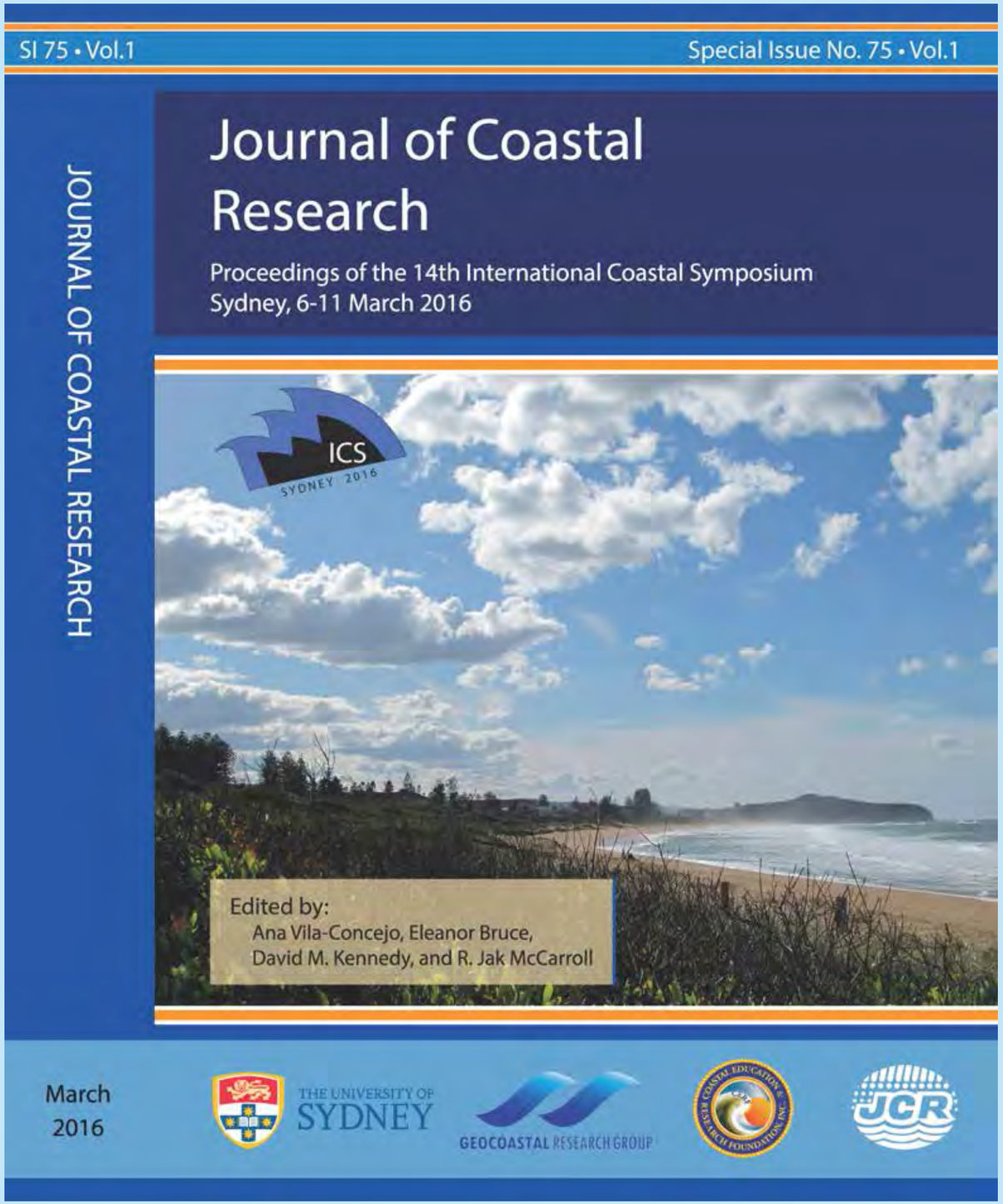


Figure 10. Seasonal wave direction and significant wave height in (a) summer and (b) winter, as observed at ADCP in 2012.

To access this full JCR Research Article, please visit:

http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-15-00088.1



Now Available

JCR Special Issue #75

Please visit our official online JCR website to view this content:

http://www.jcronline.org/toc/coas/75/sp1

Spatial Variability of Hydrodynamic Timescales in a Broad and Shallow Estuary: Mobile Bay, Alabama

Spatial Variability of Hydrodynamic Timescales in a Broad and Shallow Estuary: Mobile Bay, Alabama

Bret M. Webb[†] and Chris Marr[‡]

[†]Department of Civil Engineering
University of South Alabama
Mobile, AL 36688, U.S.A.

[‡]Arcadis
Mobile, AL 36602, U.S.A.

ABSTRACT

Residence, exposure, and flushing times are examples of hydrodynamic timescales that describe the physical mass transport within a water body. The response and spatial variability of these measures to tides and discharge were investigated through hydrodynamic model simulations of Mobile Bay, Alabama using a two-dimensional depth-integrated circulation model coupled with a Lagrangian particle tracking model. Hydrodynamic timescales were estimated and analyzed using the particle tracking results. Flushing of the estuary was found to transition from tidally enhanced to river dominated for $Q > 1715\ m^3\ s^{-1}$. A simple power law regression was found to accurately represent the spatially averaged timescales ($R^2 > 0.99$) for tidal and river forcing. Spatially averaged timescales generally ranged from 4 to 130 days, with large deviations related to particle initial position, magnitude of river discharge, and local winds. The longest timescales were found in areas where adverse pressure gradients contributed to water retention as a result of separated flow and closed-cell circulation. Increasing river discharge enhanced the barotropic pressure gradient, which dominated the along- and across-estuary momentum balances in all but the minimum flow scenario where the across-estuary balance was geostrophic. Meteorological forcing was found to increase the spatial variance in hydrodynamic timescales by as much as 60% as compared with cases with discharge and tides only. The increased spatial variability was a result of inhibited flushing due to enhanced northerly flows along the shorelines and expanded regions of closed-cell circulation in the eastern portion of the estuary.

ADDITIONAL INDEX WORDS: *Residence time, exposure time, flushing, hydrodynamics, discharge, modeling, particle tracking, ADCIRC, Gulf of Mexico, circulation, inlet.*

INTRODUCTION

Hydrodynamic timescales are useful in describing water, pollutant, or biota retention within a region, as well as the potential for them to be removed or diluted. Examples of timescales include residence time, exposure time, freshwater transit time, age, and flushing time. Unfortunately, these unique timescales are used interchangeably in some studies, and often are not defined, which leads to confusion (Monsen *et al.*, 2002; Wolanski, 1994). Regardless of the terminology used, the utility of these timescales is often hampered by the manner in which they are developed. For example, analytical methods provide a representative value for the entire system that is, in many cases, sensitive to assumed quantities (Sheldon and Alber, 2006).

The objective of this study is to describe the spatial variability of residence and exposure times in a large, shallow, microtidal estuary, as well as their sensitivity to river discharge and local winds. The reasons for doing so are generally related to a lack of understanding of such processes in the study area, Mobile Bay, Alabama, but also to provide insight for future finfish and shellfish restoration projects in the estuary. This study finds that as river discharge increases,

 Continued on Next Page

the barotropic pressure gradient dominates the across- and along-estuary momentum balances and drives the subtidal estuarine flow seaward. However, local bay geometry and meteorological forcing are found to substantially regulate flushing in some parts of the system.

Hydrodynamic Timescales

Residence time is the time required for a fluid parcel, starting at a specific location, to leave a discrete region through one of its defined boundaries (Figure 1a). In other words, residence time is a measure of water-mass retention within a specific boundary. Estimates of residence time are useful in determining water contamination and nutrient levels (Boynton *et al.*, 1995), distributions of organisms, and their spatiotemporal variations in bays and estuaries (Aikman and Lanerolle, 2005).

The measure of exposure time is used to describe a fluid parcel that leaves a region but then returns some time later, perhaps multiple times, until it leaves the region permanently (Figure 1b). Exposure time is defined as the accumulated time spent by water parcels in a specified region (Zimmerman, 1976).

The concept of flushing is used in the literature to describe the reduction of some initial material concentration to or by a specific amount (Figure 1c). Examples include the 50% flushing time, 10% flushing time, and a more general flushing time related to the e-folding time of the estuary (Choi and Lee, 2004). Here, the flushing time is calculated as the amount of time required to reduce some initial concentration to 1/e (e = 2.71828; 1/e ~ 0.37) of its initial value (Dyer, 1973; Ketchum, 1951).

Hydrodynamic timescales may be estimated through empirical studies using tracers (*e.g.*, salinity or dye), box models, and descriptive analytical models (Hagy, Sanford, and Boynton, 2000; Miller and McPherson, 1991; Sheldon and Alber, 2002, 2006; Signell and Butman, 1992). The application of sophisticated one-dimensional, two-dimensional (2D), and three-dimensional (3D) hydrodynamic models to describe estuarine timescales is becoming more commonplace (Burwell *et al.*, 2000; Huang, 2007; Kämpf and Ellis, 2015; Meyers and Luther, 2008; Pokavanich and Alosairi, 2014; Safak *et al.*, 2015; Shen and Haas, 2004; Sheng *et al.*, 2008). This study uses hydrodynamic and particle tracking models to determine the estuarine timescales of interest.

Residence time and other similar timescales are not new concepts, and have long been recognized as important parameters in water-quality characterization. The estimation of hydrodynamic timescales in a coastal bay or estuary is a useful tool and may demonstrate the rate of removal of pollutants, contamination and nutrient levels, distributions of organisms, and their spatiotemporal variations. Previous studies of these timescales with relation to Mobile Bay are limited and this study's application of a hydrodynamic model to quantify these descriptive variables is unique.

Study Area

Mobile Bay is a broad, shallow, drowned river-valley estuary located on the northeastern coast of the Gulf of Mexico (Figure 2). The estuary receives freshwater discharge primarily from the Alabama and Tombigbee rivers within a drainage basin of 115,467 km^2 (Quinn *et al.*, 1986). These two rivers merge north of the estuary, but their combined flows are later distributed between the Mobile and Tensaw rivers, which enter at the west and east of the estuary head, respectively (Figure 2). The bay is relatively large, approximately 50 km in length (N-S) and 14–34 km in width (E-W), has a surface area of 985 km^2, and the estuarine volume is estimated as 3.2 billion m^3 (Dinnel, Schroeder, and Wiseman, 1990; Quinn *et al.*, 1986). The mean depth in Mobile Bay is approximately 3 m. Its connections to the Gulf of Mexico and Mississippi Sound, Main Pass, and Pass aux Herons (Figure 2), respectively, are narrow and shallow with exception of the navigation channels in each pass (Schroeder and Wiseman, 1986). Existing literature states that Main Pass accounts for 64–85% of estuary–gulf exchange, with Pass aux Herons accounting for the other 15–36% of bay water exchange with Mississippi Sound (Austin, 1954; Dinnel, Schroeder, and Wiseman, 1990; Kim and Park, 2012; Schroeder, 1978).

Circulation in the estuary is regulated by freshwater inflow, local winds, and tides. This microtidal system has a diurnal (mean) tide range of about 0.4 m, with some spatial variation. The most prominent bathymetric feature of Main Pass (Figure 2) is a narrow (~2 km), deep (15 m) ship channel that regulates much of the exchange flow (Lee *et al.*, 2013). A western branch of the ship

 Continued on Next Page

channel exists around the mid-bay location and a man-made spoil island (Gaillard Island) is found at the intersection of the channels (Figure 2).

In terms of discharge, Mobile Bay is the fourth largest estuary in the continental United States with an average daily freshwater input of approximately 1715 $m^3 s^{-1}$ (Dzwonkowski *et al.*, 2011). The Mobile River system carries the combined flows of the Alabama and Tombigbee rivers, which account for approximately 95% of the freshwater input into Mobile Bay (Schroeder, 1978). Daily discharge can vary from less than 250 $m^3 s^{-1}$ to over 15,000 $m^3 s^{-1}$ (Dinnel, Schroeder, and Wiseman, 1990). Low flow is considered to be less than 500 $m^3 s^{-1}$ and flood discharge to be greater than 7000 $m^3 s^{-1}$ (Schroeder, 1978; Schroeder and Lysinger, 1979).

Related Work

Although some values of hydrodynamic timescales exist for Mobile Bay, their spatial variability is largely unknown. Anecdotal evidence (*e.g.*, water quality, sediment characteristics, *etc.*) suggests that some areas of the estuary have longer timescales and are more poorly flushed than others. Seasonal wind directions and freshwater input are thought to play a role in regulating water quality in the system. Published values of flushing times vary from 17 to 50 days (on average), with reported ranges from 3 to 166 days (Pennock, Sharp, and Schroeder, 1994). A very early, but comprehensive, study by Austin (1954) estimated a flushing time of 50 days on the basis of a 6-day-long survey of Mobile Bay in October 1952, during which the average river discharge was 382 $m^3 s^{-1}$. The river discharge corresponding to the estimated flushing time of 20 days by Wiseman, Schroeder, and Dinnel (1988) is unclear; however, Wiseman, Schroeder, and Dinnel (1988) base their value on an assumed mean velocity through the upper layers of Main Pass, and Austin (1954) on a modified tidal prism method. Other published values that are similar in magnitude to the flushing time estimate of Wiseman, Schroeder, and Dinnel (1988) include that of Pennock, Sharp, and Schroeder (1994) at 17 days for an average discharge of 2245 $m^3 s^{-1}$ and an earlier estimate of "replacement time" by Schroeder (1978) of 21 days for a discharge of 1750 $m^3 s^{-1}$.

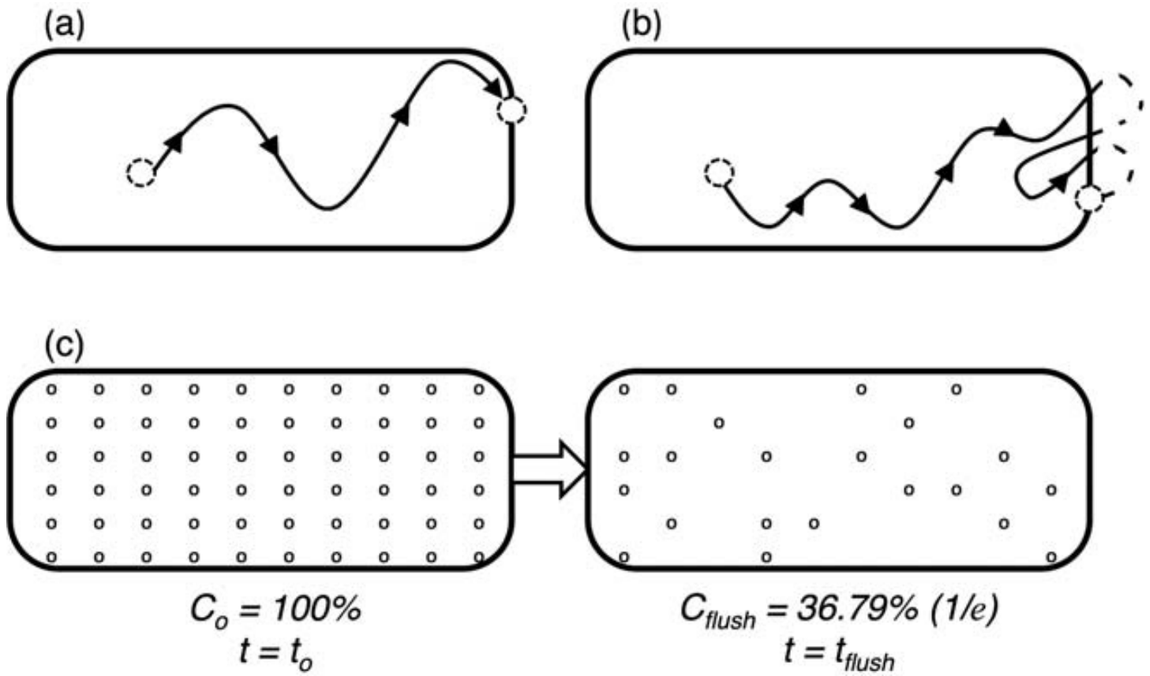


Figure 1. Illustrated depiction of a particle's (a) residence time, (b) exposure time, and (c) flushing time. The system is defined by the gray area. Points A and B represent the particle position in the system when particle tracking begins and ends, respectively. The black arrows and line depict the particle trajectory and time spent within the system.

 Continued on Next Page

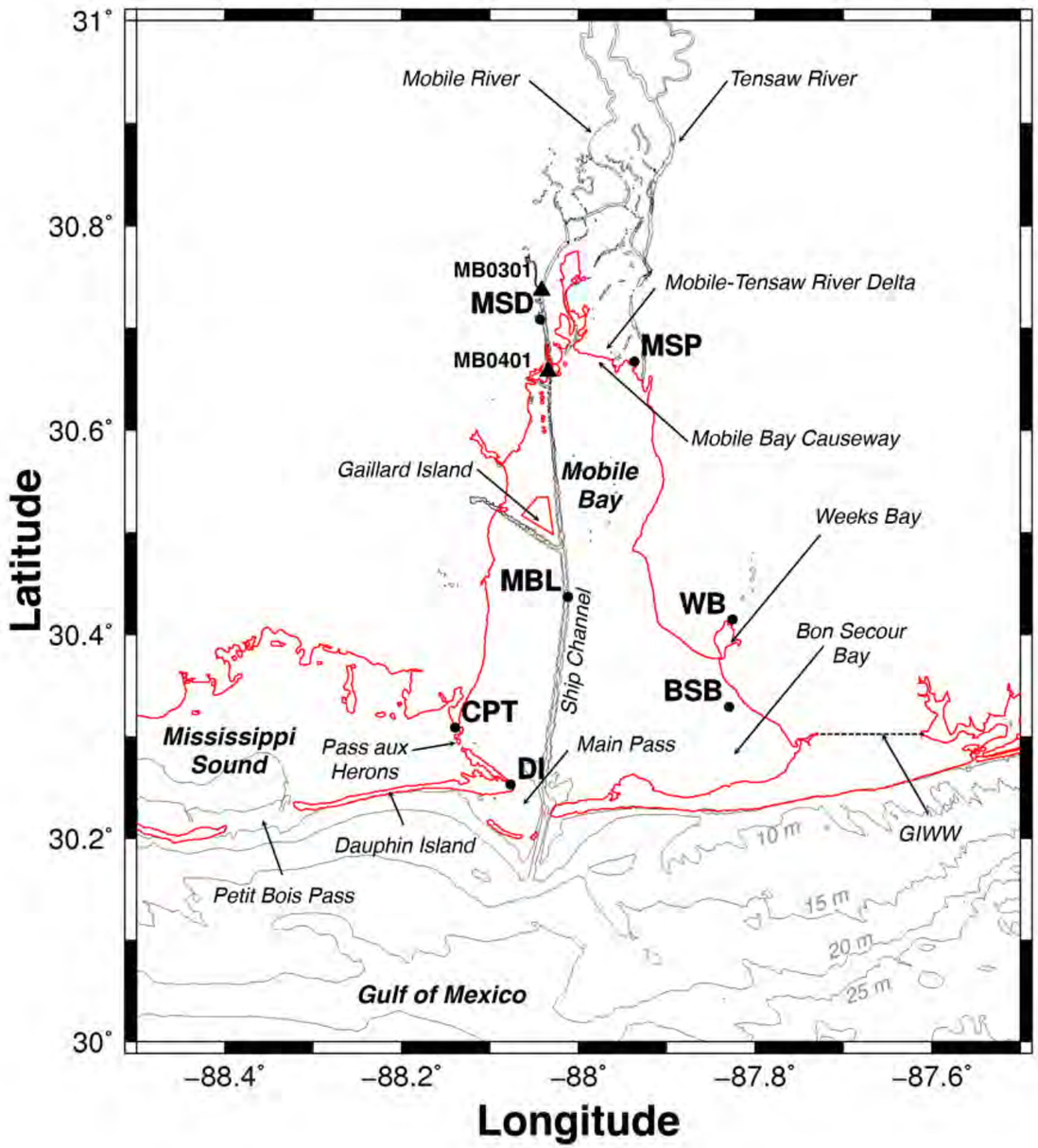


Figure 2. Study area map of Mobile Bay, Alabama with pertinent locations identified. Tide gauge (MSD, MSP, WB, BSB, CPT, DI) and ADCP locations (MB0301, MB0401) used for validation. Bathymetric contours are shown using intervals of 5 m.

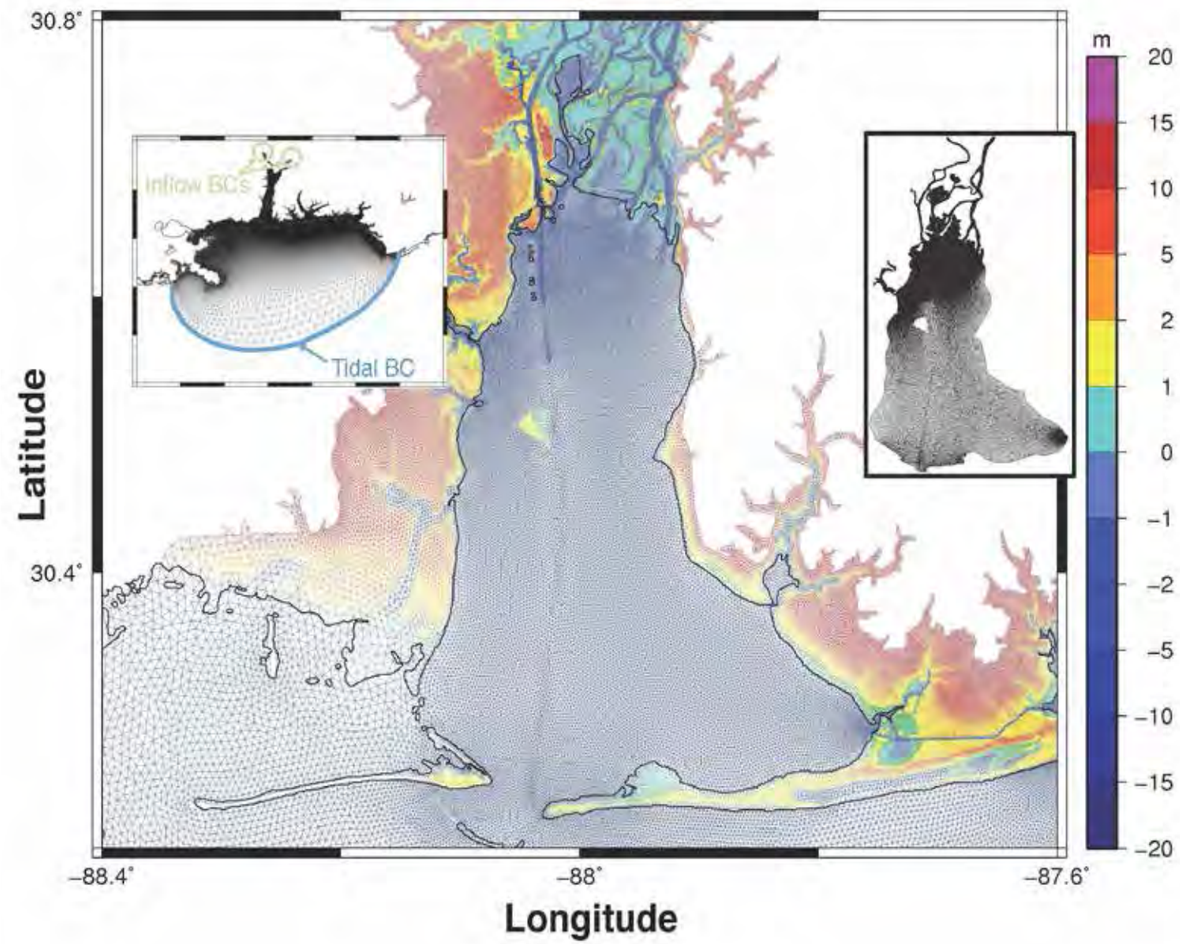


Figure 3. Distribution of triangular mesh elements and nodal elevations in the study area. The inland coverage for the watersheds of Mobile Bay, and some parts of Florida, extends to the +30-m contour. The mesh resolution varies from O(10 m) to O(10 km). The inset panel at left shows the mesh coverage relative to the Gulf of Mexico basin and location of boundary conditions. The inset panel at right shows the spatial coverage (shading) of LPTM particle initial positions.

Continued on Next Page

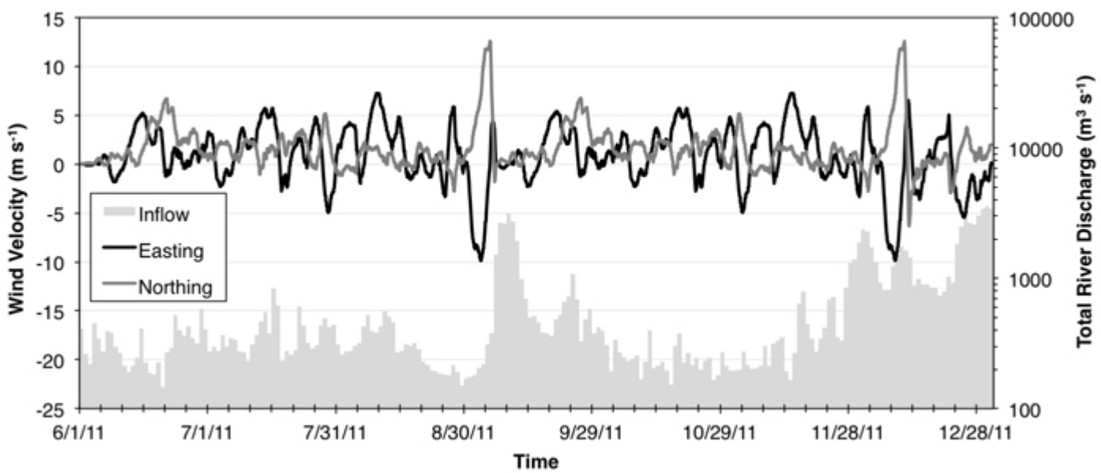


Figure 4. Time history of measured winds at Dauphin Island (DI) and the sum of the gauged inflows from the Alabama River and Tombigbee Waterway for the model hindcast period.

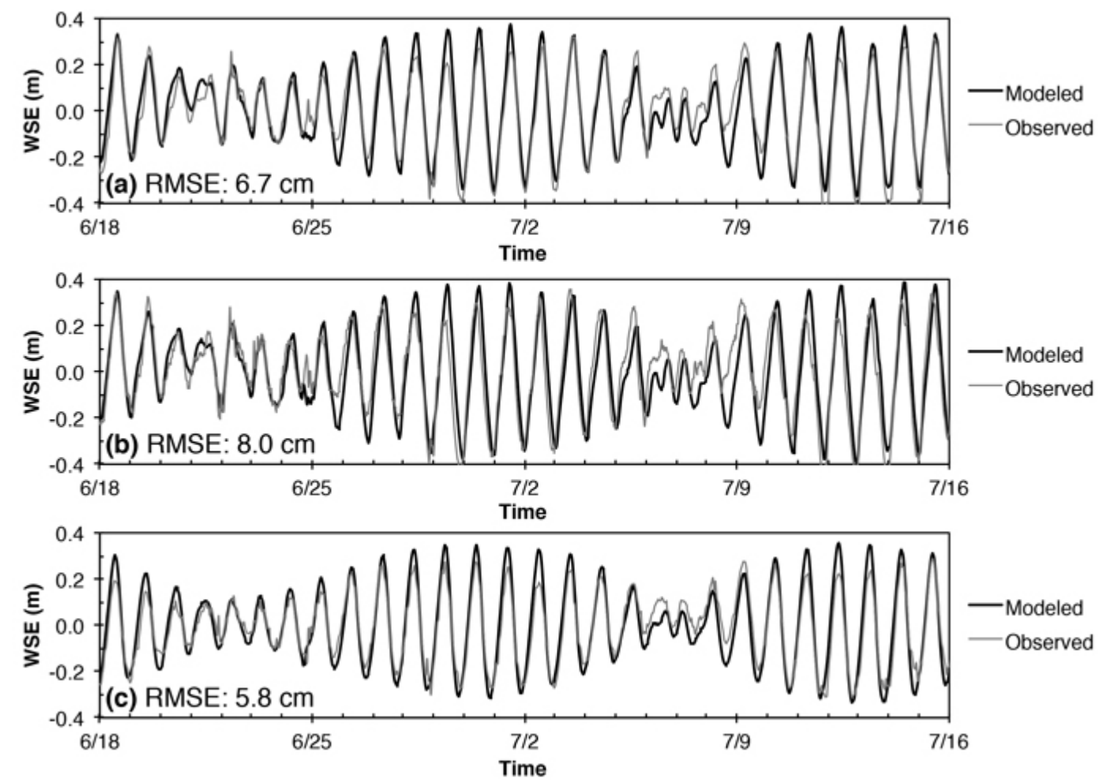


Figure 5. A comparison of modeled (black) and observed (gray) water levels at (a) Mobile State Docks, (b) Meaher State Park, and (c) Dauphin Island.

Continued on Next Page

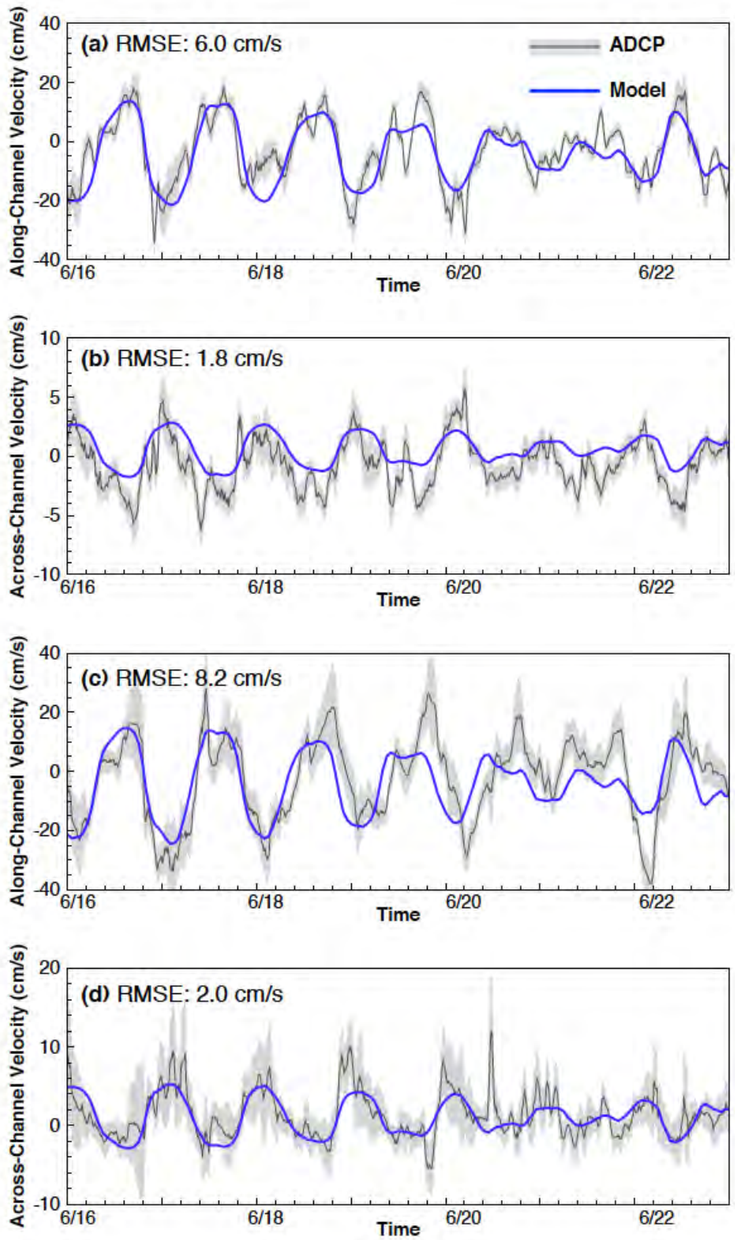


Figure 6. A comparison of modeled (black) and observed (gray) velocity at (a–b) Mobile State Docks (MB0301) and the (c–d) Mobile Container Terminal (MB0401). Along- and across-channel flows are positive (negative) to the north and east (south and west), respectively. The gray shading corresponds to ± 1 standard deviation from the profile-averaged ADCP measurements.

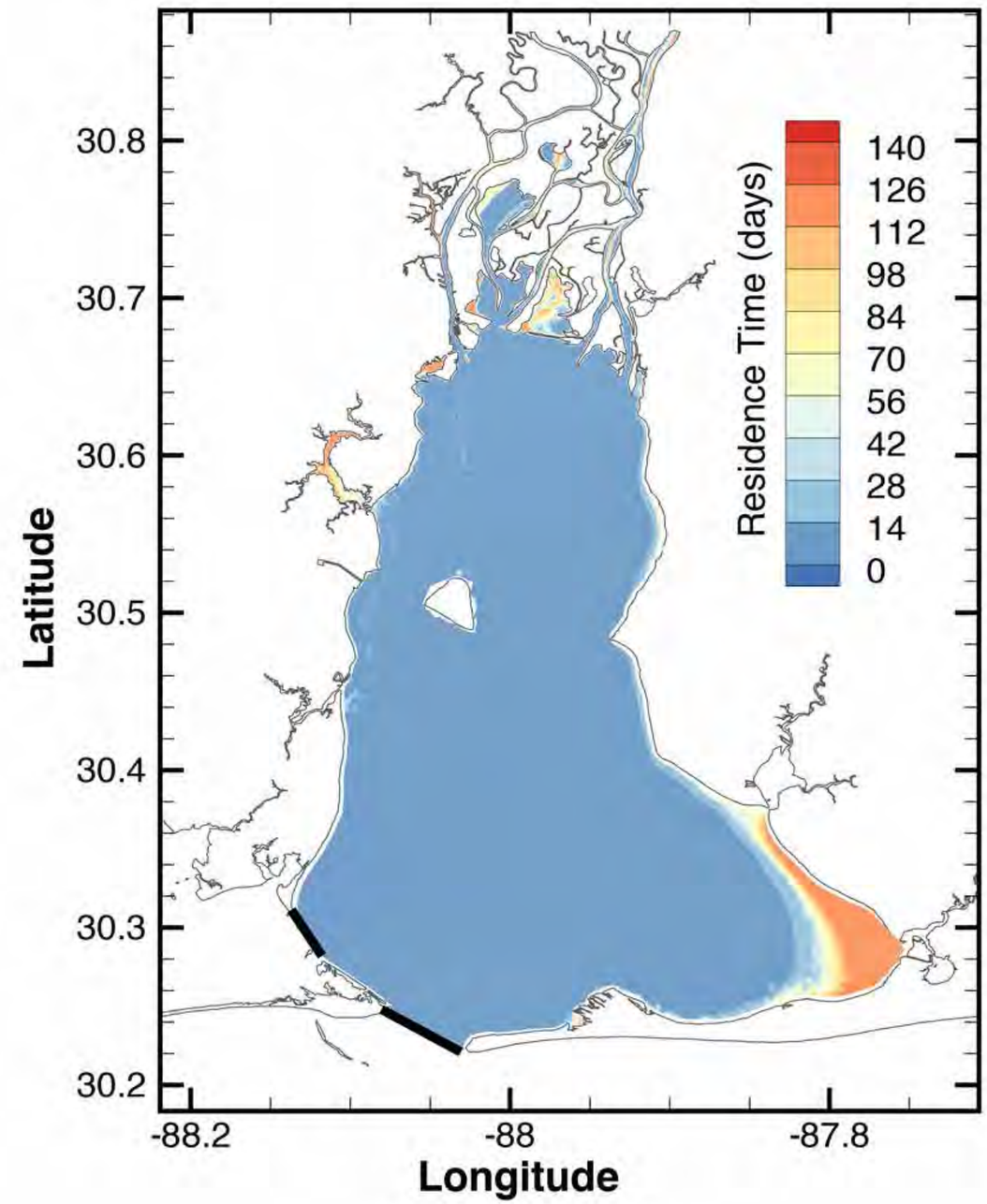


Figure 7. Spatial variability of residence time for the maximum flow condition of 6747 $m^3 s^{-1}$. Exit boundaries are indicated by thick black lines.

Continued on Next Page

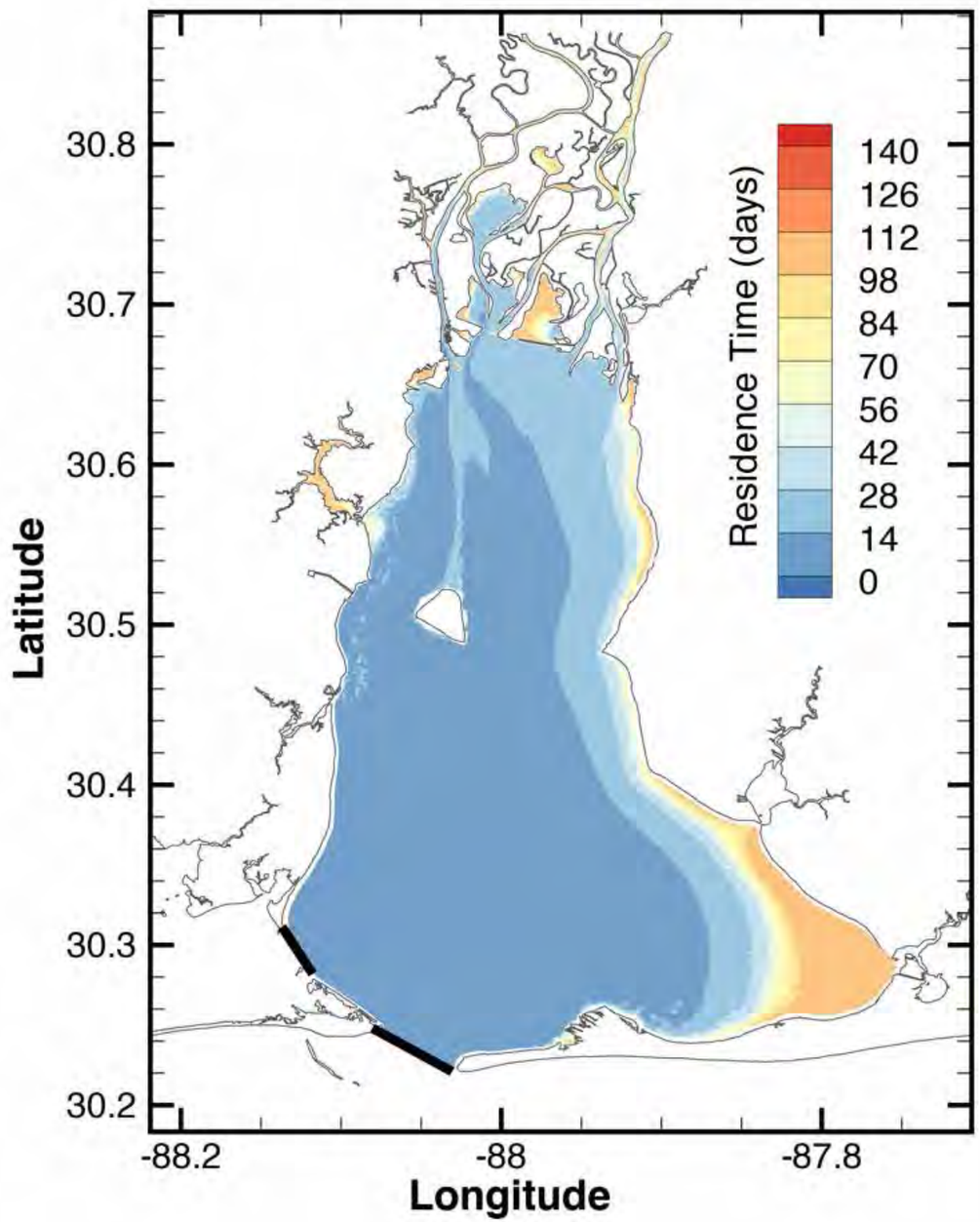


Figure 8. Spatial variability of residence time for the mean flow condition of 1715 $m^3 s^{-1}$. Exit boundaries are indicated by thick black lines.

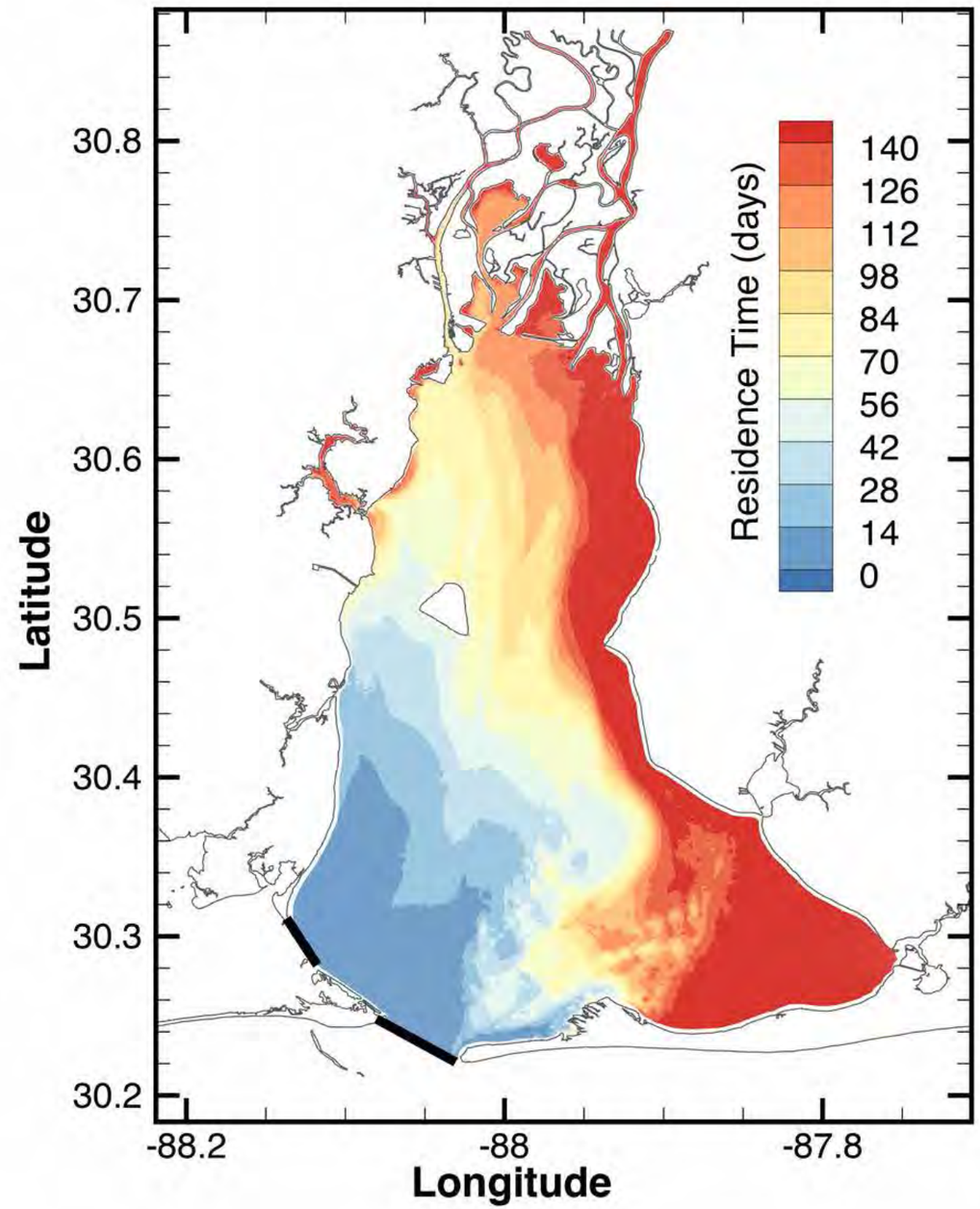


Figure 9. Spatial variability of residence time for the minimum flow condition of 246 $m^3 s^{-1}$. Exit boundaries are indicated by thick black lines.

Continued on Next Page

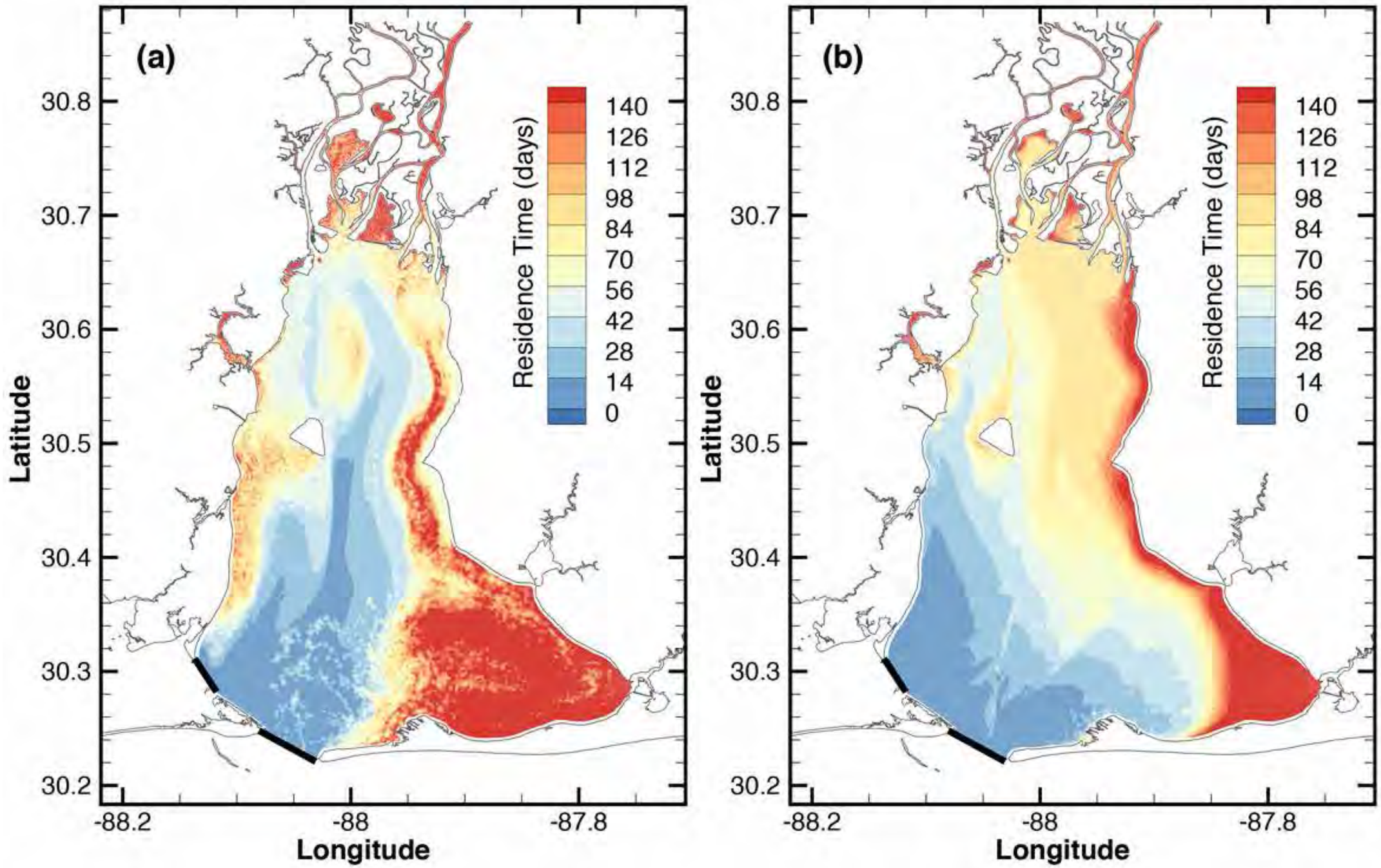


Figure 10. Spatial variability of residence time for the hindcast simulation (a) with local winds and (b) without local winds. Exit boundaries are indicated by thick black lines.

Continued on Next Page

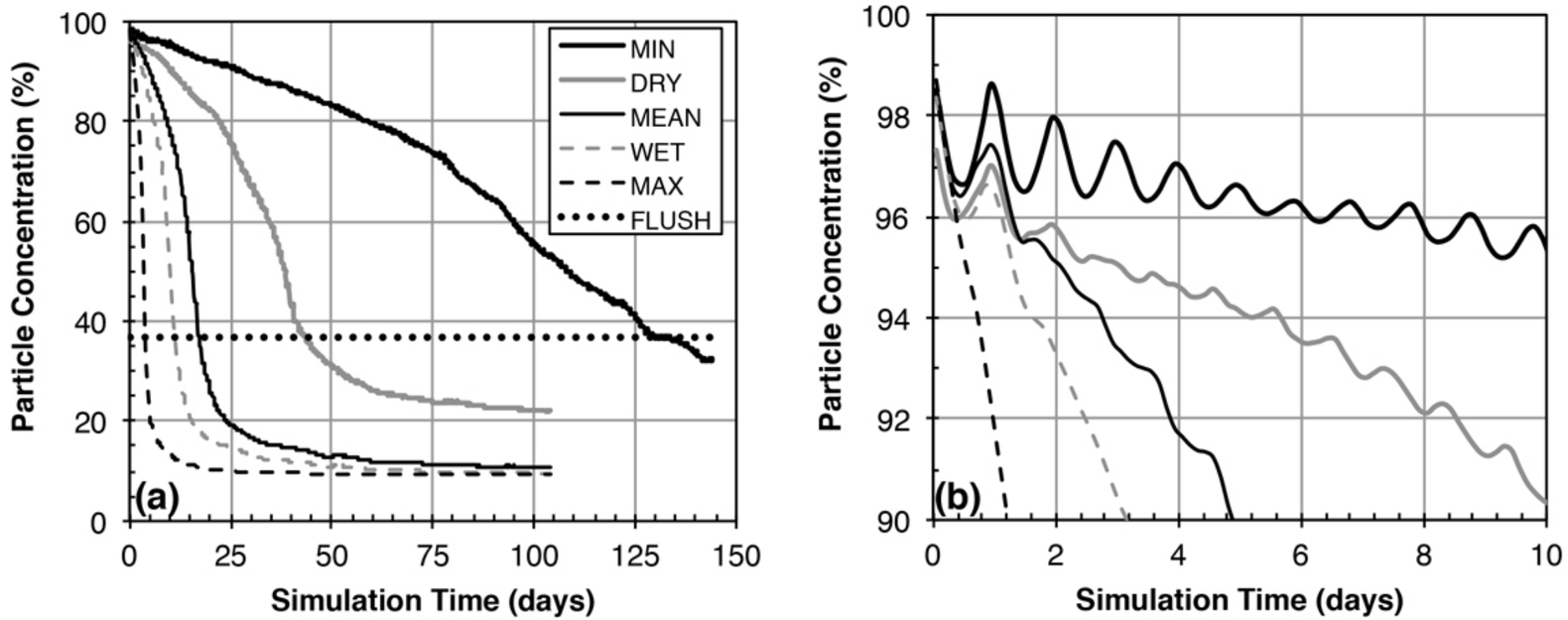


Figure 11. Particle concentration (%) plotted as a function of LPTM particle tracking time (days) for (a) the entire simulation and (b) a detailed view of the first 10 days.

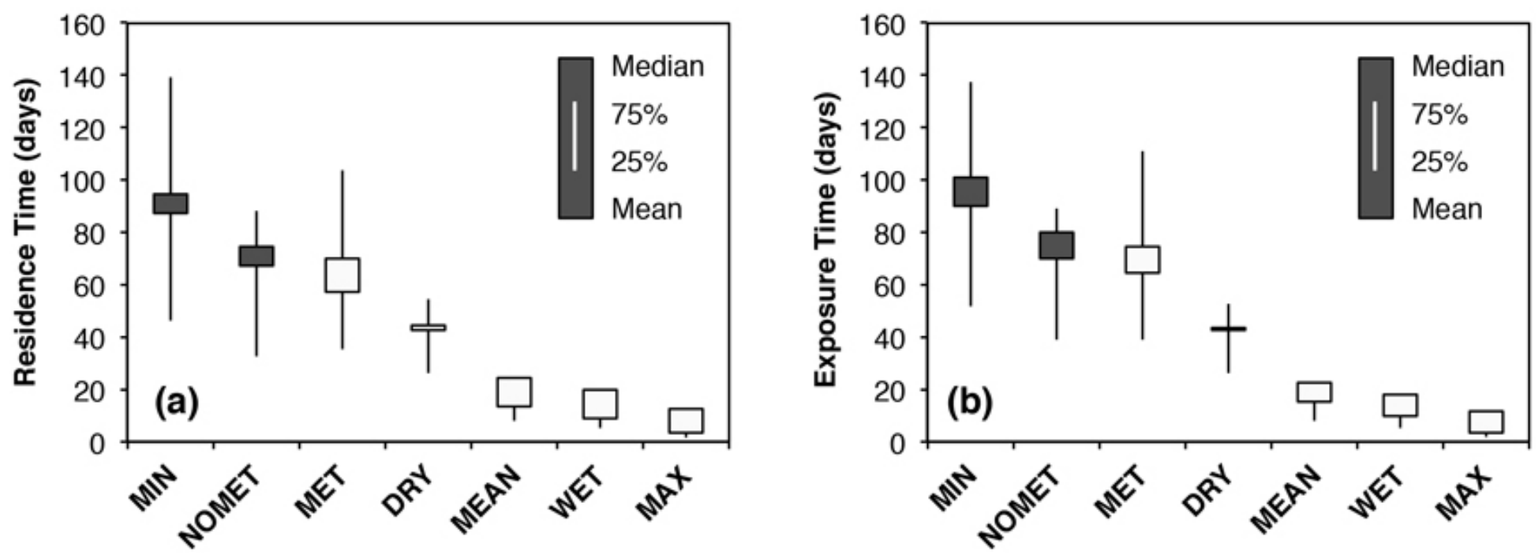


Figure 12. System-wide statistical analysis of (a) residence time and (b) exposure time showing the mean, median, first- (25%), and third- (75%) quartile values. Boxes are filled (empty) when median values are greater (less) than mean values.

Continued on Next Page

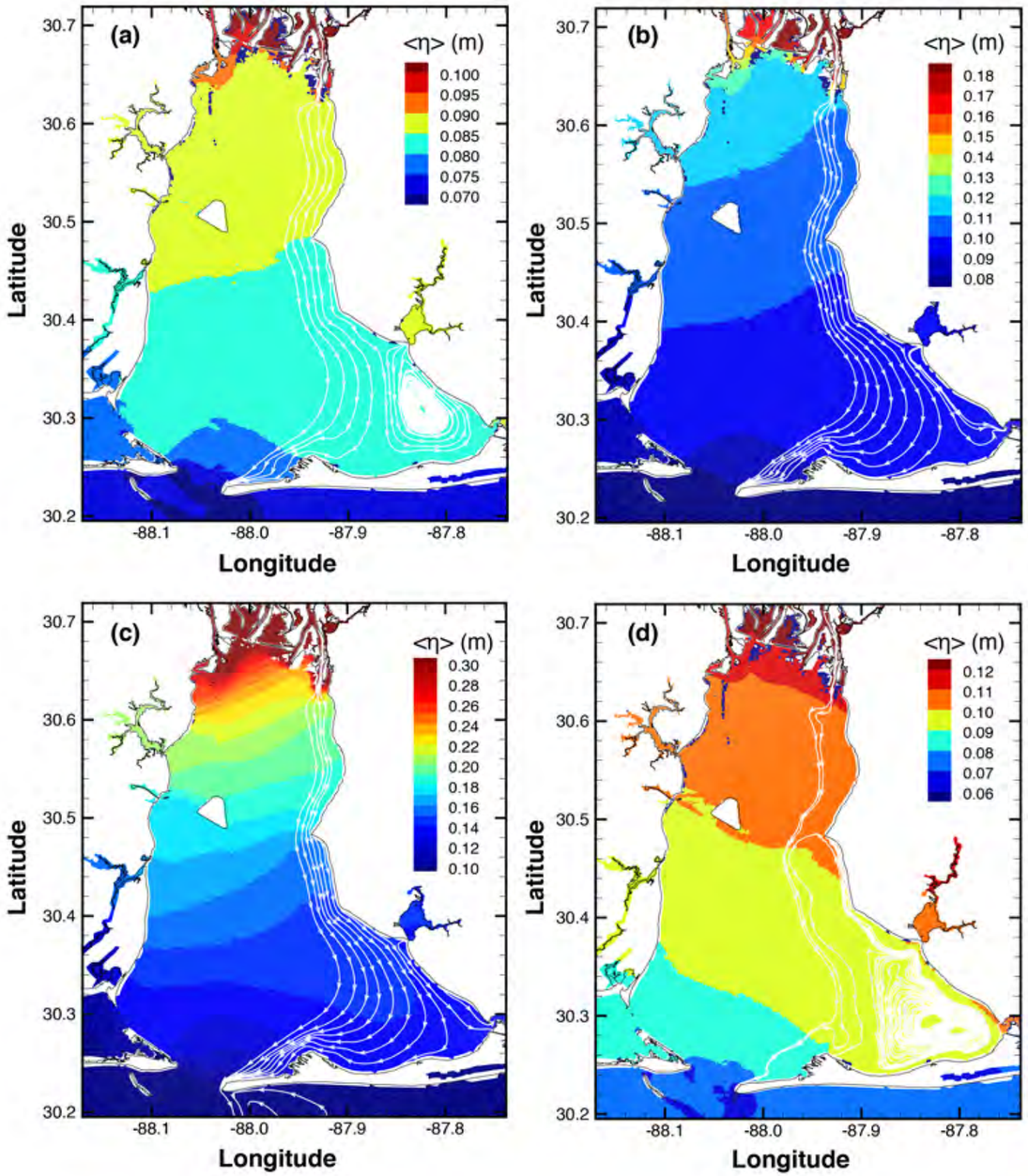


Figure 13. Contoured intervals of subtidal water levels and streamlines of subtidal velocity for the (a) minimum, (b) mean, and (c) maximum discharge scenarios as well as the (d) model hindcast period. The contour interval is 0.5 cm for (a) and 1 cm for panels (b)–(d).

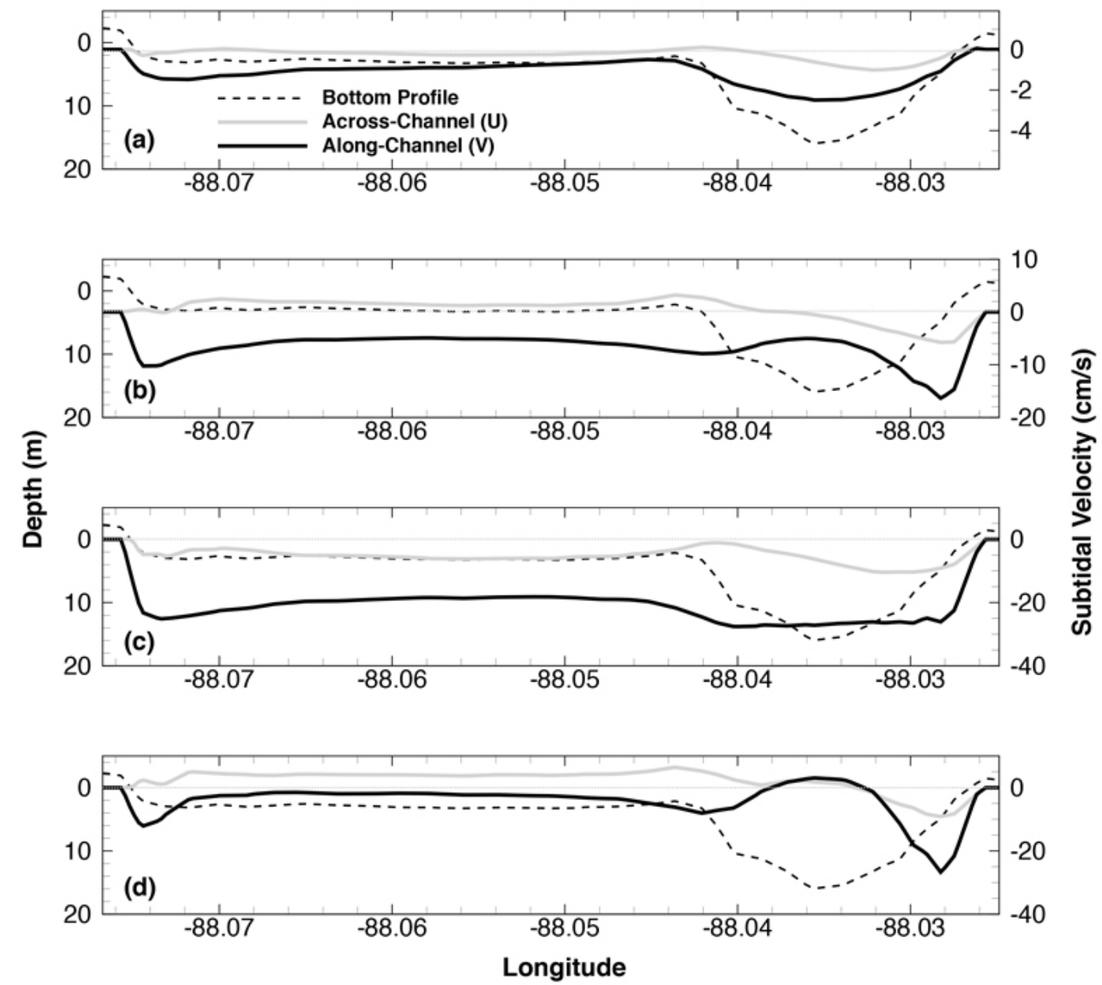


Figure 14. Distribution and magnitude of across-channel (*U*) and along-channel (*V*) subtidal velocity (cm s^{-1}) at Main Pass for the (a) minimum, (b) mean, and (c) maximum discharge scenarios as well as the (d) model hindcast period. View is of an observer looking into the estuary. The channel profile is indicated by the dashed line.

 Continued on Next Page

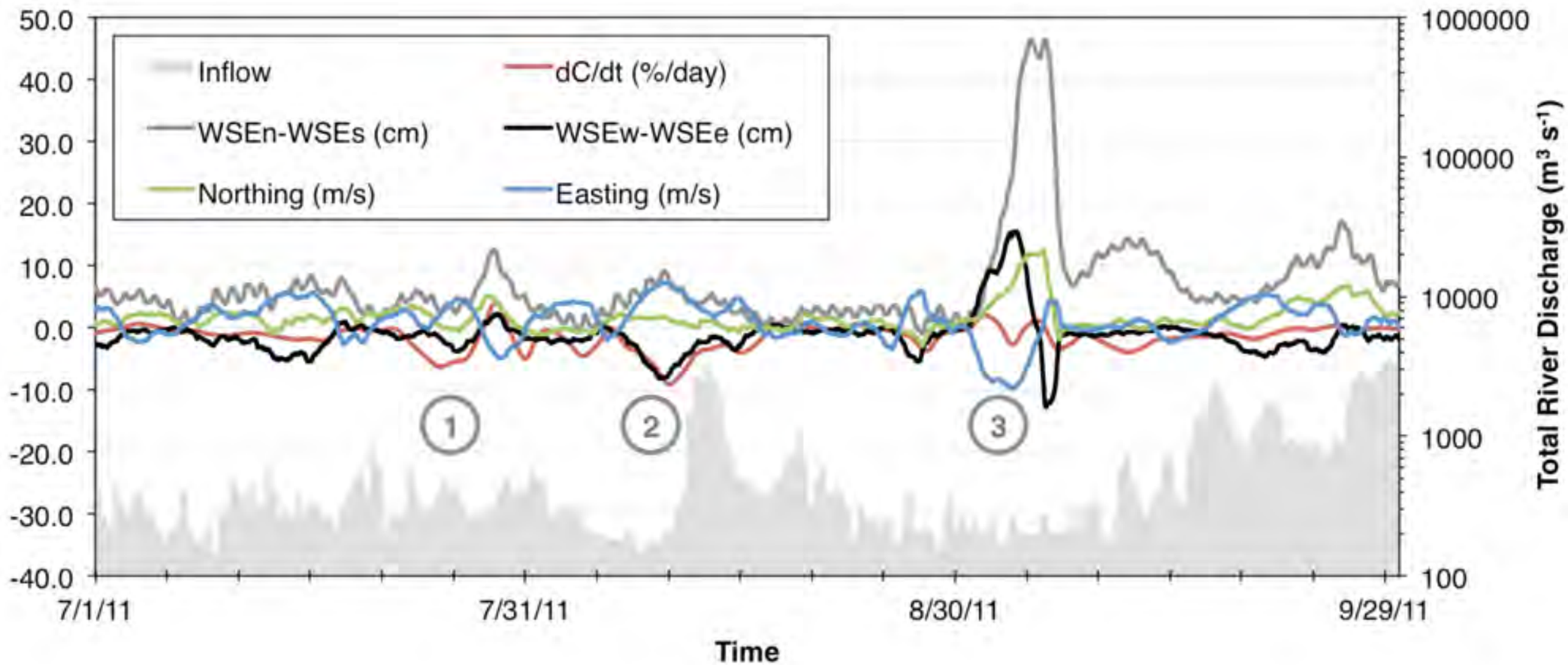


Figure 15. A 3-month record of observed winds (northing=along-estuary; easting=across-estuary) at station DI and measured total river discharge is shown in comparison with model hindcast results of along-estuary (WSEn–WSEs) and across-estuary (WSEw–WSEe) water level slope and the daily change in particle concentration (d*C*/d*t*). The d*C*/d*t* term is scaled by a factor of 5 for the purpose of comparison.

Continued on Next Page

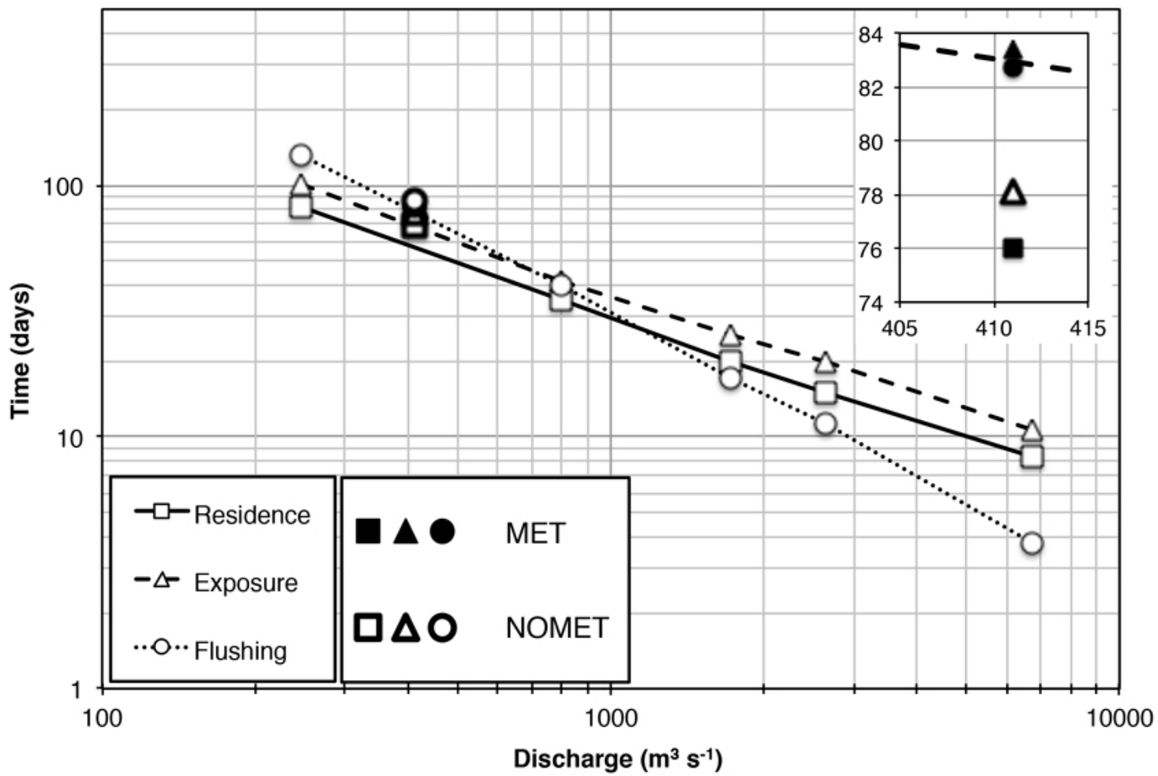


Figure 16. Regression analysis of system-wide average residence (□), exposure (Δ), and flushing (○) times for the constant discharge simulations. Shown for comparison are the average values for the NOMET and MET (inset panel detail) cases.

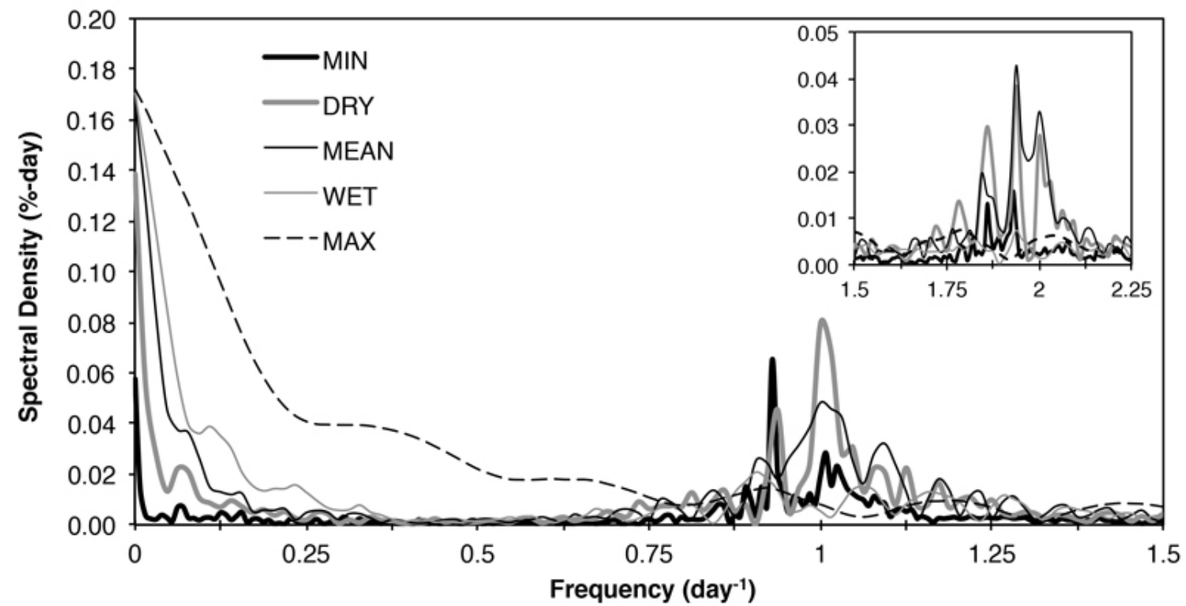


Figure 17. Harmonic analysis of particle concentration time series showing spectral density as a function of harmonic frequency (d^{-1}). The inset panel shows the spectral density content near 2 d^{-1} (12 h), which is analogous to the semidiurnal tidal harmonic response.

To access this full JCR Research Article, please visit:

http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-15-00181.1

The Influence of Morphology on Sinkhole Sedimentation at Little Salt Spring, Florida

The Influence of Morphology on Sinkhole Sedimentation at Little Salt Spring, Florida

Braden R.B. Gregory[†], Eduard G. Reinhardt[†], and John A. Gifford[‡]

[†]School of Geography and Earth Sciences
McMaster University
Hamilton, ON L8S 4L8, Canada

[‡]College of Marine Science
University of South Florida
St. Petersburg, FL 33701, U.S.A.

[*]Present address: Department of Earth Sciences
Carleton University
Ottawa, ON K1S 5B6, Canada

ABSTRACT

Sedimentary processes are important for understanding sinkhole records of climate and sea-level change. This study examines Little Salt Spring (LSS), an hourglass-shaped sinkhole near the SW coast of Florida, to determine the influence of sinkhole morphology on sedimentation. An 8.27-m core recovered from LSS was subsampled at 2-cm intervals for particle-size, loss-on-ignition, and stable-isotope analyses ($\delta^{13}C$, $\delta^{15}N$, and C:N ratios). Nineteen radiocarbon dates provide chronology and sediment accumulation rates over the past approximately 13,500 cal. YBP. Particle size shows alternating periods of coarse and fine sediment from 6600 to 13,500 cal. YBP and coarser sediment from 0 to 6600 cal. YBP. Organic matter (OM) and carbonate content (CC) are initially low (<5%) but increase after about 10,000 cal. YBP to 60 and 15%, respectively. High C:N ratios (δ^{35}), low $\delta^{15}N$ (7.5‰), and low $\delta^{13}C$ (–25‰) values were found between approximately 9000 and 13,500 cal. YBP but decreased afterward. Based on these sedimentary characteristics, sedimentation is classified into two phases. In Phase 1 (8000–13,500 cal. YBP), water level is low, with sedimentation dominated by input of allochthonous clastic sediment from surrounding areas. In Phase 2 (present–8000 cal. YBP), a higher water level and an increasingly sunlit open water area encouraged productivity, resulting in deposition of autochthonous, organic-rich sediment. Comparisons between the LSS site and an idealized model of sinkhole sedimentation forced solely by water level shows that both water level and karst basin physiography in LSS have influenced deposition.

ADDITIONAL INDEX WORDS: *Particle-size analysis, C:N ratio, early Holocene, sinkhole, Little Salt Spring, coastal karst basin.*

INTRODUCTION

Sediment records in karst basins are increasingly being used for the study of Caribbean paleoclimate and sea-level change. Hydrologically closed or leaky lake basins are used for paleoclimate archives (*e.g.*, Curtis and Hodell, 1996; Fritz *et al.*, 2011; Hodell, Curtis, and Brenner, 1995; Hodell *et al.*, 1991, 2005; Holmes *et al.*, 1995; Malaizé *et al.*, 2011), while open-system basins, such as sinkholes (also known as cenotes in the Yucatan, Mexico), blue holes, and caves, are used for sea-level and hurricane studies (*e.g.*, Brown *et al.*, 2014; Collins *et al.*, 2015b; Gabriel *et al.*, 2008; Gischler *et al.*, 2008; van Hengstum *et al.*, 2011, 2014, 2015). The physiography of karst basins is relatively static on millennial timescales, changing with the slow dissolution of the surrounding limestone. These basins can be deep (.70 m) and have small surface areas, resulting in cylindrical or funnel-shaped longitudinal profiles. The depth and steep-sided nature of karst basins makes them ideal for preserving undisturbed sediment accumulations, because these characteristics minimize bottom currents and wave action that can resuspend sediment after deposition. In addition, karst basins often have anoxic bottom conditions because of limited water circulation and thus have minimal bioturbation. Although karst basin records

 Continued on Next Page

have great potential for a variety of paleoenvironmental studies, sedimentary processes in them are not fully known, with few studies examining the role of karst basin morphology on sedimentation patterns (*e.g.*, Collins *et al.*, 2015a, 2015c; van Hengstum *et al.*, 2011). In many anchialine settings, groundwater level in the porous karst is controlled by rising Holocene sea level, which can be a dominant control on sedimentation (van Hengstum *et al.*, 2011). However, other factors that might influence sedimentation, such as karst basin morphology, are not fully understood (Collins *et al.*, 2015a). Analysis of sediment from Little Salt Spring (LSS) shows how rising water level and the sinkhole profile cause a "change of state" (phase shift; Collins *et al.*, 2015a, 2015b) that affects not only the type and rate of sedimentation but also the biological productivity because of changing incident light and water body illumination.

Sinkhole Sedimentation

Previous studies show the influence of water level on sinkhole and cave sedimentation (Shinn *et al.*, 1996; van Hengstum *et al.*, 2011). A conceptual model for deposition (Figure 1) transitions through four phases. In Phase 1, the sinkhole is dry or inundated by shallow water, and sediment inputs are from erosive overland flow or slope failure around the periphery of the sinkhole (Alvarez-Zarikian *et al.*, 2005; Lane *et al.*, 2011). As the water level rises in Phase 2, emergent vegetation may colonize the central breakdown pile, depositing organic-rich mud or mangrove peat (Gabriel *et al.*, 2008; Kovacs *et al.*, 2013; Lane *et al.*, 2011). Continued water level rise in Phase 3 allows greater autochthonous productivity in the water column, which causes deposition of fine-grained, organic-rich sediments. Intercalations of coarser sediment generated during high-energy events (overland flow or over-wash during storm events) are common during this phase (Brown *et al.*, 2014; Gischler, Anselmetti, and Shinn, 2013; Gischler *et al.*, 2008; Lane *et al.*, 2011). In the final phase of deposition, water level rises above the sinkhole opening and sedimentation evolves toward one of two end members. Littoral sinkholes are drowned by rising sea level, becoming blue holes (Phase 4a); marine sands and offshore coastal deposits dominate sedimentation (Gischler, Anselmetti, and Shinn, 2013; Shinn *et al.*, 1996). Sinkholes farther inland, such as LSS, become sinkhole lakes, with the karst basin acting as a deep deposition center for sediment (Phase 4b).

Although this conceptual model functions well for interpreting sedimentation patterns, variations in karst basins morphology can have effects on the sedimentary record. Sinkholes with high width-to-depth ratios exhibit discontinuous bedding and heavily reworked sediment (Gischler *et al.*, 2008), whereas smaller sinkholes exhibit homogenous, draping sediment sequences across their width (Morellón *et al.*, 2009). Over-hanging walls can influence spatial distribution of sediment, resulting in piling of sediment underneath ledges, which may be reworked through mass movements (Brown *et al.*, 2014; Gischler *et al.*, 2008). Shallow sinkholes with good exposure to sunlight may have thick Phase 2 sequences caused by increased plant productivity (Kovacs *et al.*, 2013). In aquatic caves, the size and connectivity of sinkholes with the cave passages and the surrounding terrestrial vegetation influence sedimentation (Collins *et al.*, 2015a, 2015b). Collins *et al.*(2015c) found that downstream sedimentation in cave passages was related to sinkhole surface area and surrounding mangrove vegetation. Biological productivity in the open water sinkholes was enhanced in mangrove areas, causing increased sedimentation in downstream cave passages. Ceiling height and water level were found to affect when and where sediment was deposited in cave passages (Collins *et al.*, 2015c). These studies demonstrate the influence of karst basin morphology on sedimentation, but the magnitude and range of effects are still not fully understood.

Site Description

The LSS site is a cover-collapse sinkhole located near the SW coast of Florida in Sarasota County, 20 km inland from present-day Gulf of Mexico (Figure 2A). The sinkhole surface is roughly circular, with a diameter of 78 m and depth of 72 m. Water level in LSS is presently +5 m above mean sea level (msl), placing the bottom of the sinkhole at -67 m msl (Figure 2B). The LSS sinkhole is hourglass shaped; the upper basin slopes at a roughly 258 angle down toward a circular rim 25 to 30 m wide at -7 m msl. Below this lip, the sinkhole walls are overhanging, creating a narrow vertical cavity that connects the upper basin and lower cavern. Two distinct ledges occur in the narrow cavity at -13 and -21 m. The walls of the narrow cavity gradually expand below -29 m

 Continued on Next Page

msl to 60 m at the base of the sinkhole, creating a bell-like shape (Figure 2A; Clausen *et al.*, 1979).

Topography around LSS slopes gradually toward the SW (Figure 2C). To the NE of LSS is an erosional drainage way 425 m long and 30 to 90 m wide. The spring at the head of this drainage way is the main source of overland flow into the spring. Additional hydrological inputs into LSS include direct precipitation and lateral groundwater flow. Water is lost from the sinkhole through evaporation, groundwater seepage, and surface drainage *via* a shallow stream to the south (Alvarez-Zarikian *et al.*, 2005). A bayhead hammock, composed of *Persea borbonia* (redbay), local species of oak (*Quercus virginiana*), *Sabal palmetto* (cabbage palms), *Ilex* spp. (holly species), and several species of fern (*Archrostichum danaeaefolium*, *Osmunda regalis*, and *O. cinnamomea*), surrounds LSS and owes its existence to the sinkhole (Brown and Cohen, 1985). Dense mats of fresh-to-brackish water algae (*Chara* spp.) bloom seasonally around the circumference of the upper basin to a depth of about 3 m (Alvarez-Zarikian *et al.*, 2005).

The water column of LSS shows stratification near the water's surface. A seasonal oxycline exists roughly -2 to -3m msl, below which water is anoxic (NASA, 2012). The anionic composition of water at LSS is dominated by Na^+ (685 mg/L), followed by Ca^{2+} (178.5), Mg^{2+} (127 mg/L), and K^+ (22.5 mg/L). The cationic composition is dominated by Cl^- (1330 mg/L) and then SO^{2-4}(660 mg/L) and HCO^{3-} (156 mg/L; Alvarez-Zarikian *et al.*, 2005). In addition, δ D and $\delta\ ^{18}O$ are relatively enriched (δ D≈-2.5%, $\delta\ ^{18}O$ ≈-1.3%) compared to values in nearby Polk County (δ D ≈ -18%, $\delta\ ^{18}O$ ≈ -4.75%; Alvarez-Zarikian *et al.*, 2005). Together, the ionic and isotopic compositions suggest water in LSS is predominantly derived from groundwater.

Climate

Southern Florida is characterized by a humid subtropical climate with mild temperatures and abundant precipitation (Wiken, Francisco, and Griffith, 2011). The Ft. Myers weather station to the south of LSS exhibits a yearly temperature range between 18 and 29°C and an average yearly precipitation of 1425 mm (Florida Climate Centre, 2013). Most of the precipitation falls during Florida's wet season, which lasts from May to September. Hurricanes frequently occur near the end of summer, from August to October, during the transition from wet season to dry season (Watts and Hansen, 1994). Variations in precipitation in Florida correspond to changes in regional sea surface temperatures (SSTs), the position of the Inter-Tropical Convergence Zone (ITCZ), and El Niño–Southern Oscillation. Warmer Gulf of Mexico SSTs, partially driven by a northerly position of the ITCZ, correlate to higher precipitation in Florida during the Holocene (Donders *et al.*, 2011). In addition, elevated winter precipitation and decreased storm activity occur in Florida during El Niño events, whereas decreased winter precipitation and increased storm activity occur in Florida during La Niña events (Beckage *et al.*, 2003; Donders *et al.*, 2005; Schmidt *et al.*, 2001).

Hydrogeology

The LSS sinkhole intersects two of Florida's three main aquifer systems, the surface aquifer system (SAS) and the intermediate aquifer system (IAS). The sinkhole may also be influenced by upward leakage of mature water from the deepest aquifer, the Floridian aquifer system (FAS; Alvarez-Zarikian *et al.*, 2005). The SAS is composed of 12 to 21 m of unconsolidated fine sands and shelly marls of Holocene to Pliocene age (Hutchinson, 1992; Wolansky, 1983). The upper bounds of the SAS occur about 1.5 m below the surface sediment, although this varies with topography and seasonal influence (Hutchinson, 1992; Wolansky, 1983). The IAS, separated from the SAS by marls and sandy clays with poor permeability, is composed of discontinuous beds of sands, gravels, marls, limestones, and dolostones about 100 to 170 m thick that were deposited during the Pliocene to mid-Miocene (Sacks and Tihansky, 1996; Wolansky, 1983). The surface of the IAS in Sarasota County ranges from -20 to -50 m msl, with a potentiometric surface +3 to +10 m msl (Hutchinson, 1992). The FAS is the deepest and thickest aquifer, ranging from 425 to 580 m thick in the study area (Wolansky, 1983). The aquifer consists of limestones and dolostones of variable composition deposited during the Miocene to Eocene (Wolansky, 1983). The FAS is -180 m msl and is confined by the IAS in the study area; the potentiometric surface of the aquifer ranges from 10 to 20 m msl (Wolansky, 1983).

 Continued on Next Page

Previous Work

There have been numerous studies conducted in LSS because of its early and well-preserved archeological record. Initial surveys and excavations conducted at LSS between 1973 and 1979 revealed unique Paleoindian artifacts in the upper basin sediments and on the ledges below the drop-off of the sinkhole. Archaic material was also found adjacent to the sinkhole associated with burials in the natural drainage way to the NE (identified as a different site: 8So79; Clausen *et al.*, 1979). Radiocarbon dating of artifacts and ecofacts indicates two general periods of human activity: initially from 9000 to 11,000 cal. YBP (Late Paleoindian to Early Archaic transition) and then from 6000 to 7000 cal. YBP (Early to Middle Archaic; Clausen *et al.*, 1979; Gifford *et al.*, 2016).

In 1990, five sediment cores were retrieved using a submersible vibracorer (Rossfelder) in an E-W transect across the sinkhole opening. Analysis of ostracod and stable isotope geochemistry of LSS Core V (~11 m recovered length) documented the paleohydrology of LSS from the early Holocene to the present (Alvarez-Zarikian *et al.*, 2005). Changes in $\delta^{13}C$ recorded by ostracod carapaces in Core V show gradually increasing productivity throughout the Holocene, while $\delta^{18}O$ analysis suggests a dry, cool early Holocene; two periods of wet, warm conditions from 0 to 1500 and 4000 to 5700 cal. YBP; and a drier period from 1500 to 2600 cal. YBP coincident with a sharp increase in salinity (Alvarez-Zarikian *et al.*, 2005). Extremely well-preserved archeological and paleontological artifacts and a shift to stressed ostracod assemblages indicates anaerobic conditions existed in the upper basin of LSS by approximately 7000 cal. YBP (Alvarez-Zarikian *et al.*, 2005; Clausen *et al.*, 1979; Dietrich and Gifford, 1997). Palynological results from LSS Core IV, the core used in this study, indicate drier conditions during the Younger Dryas (~11,500–13,000 cal. YBP) and again around 10,600 cal. YBP, based on abrupt increases in oak and hickory pollen (Bernhardt, Willard, and Gifford, 2012). These results concur with the drier, cooler early Holocene inferred from stable isotopic data from LSS Core V.

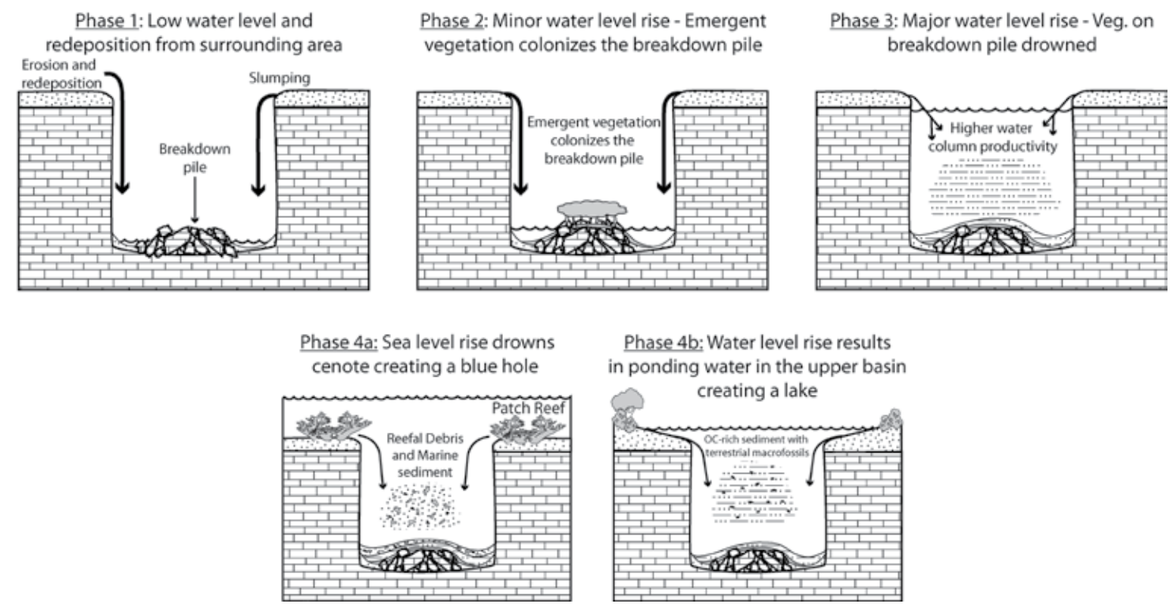


Figure 1. Conceptual depositional model for sinkholes with cuplike morphology during one cycle of water level rise. The sinkhole transitions through four phases corresponding to (1) shallow water and allochthonous deposition, (2) a slight increase in water level and colonization of the breakdown pile by emergent vegetation, (3) a deep water column with increased autochthonous productivity, and (4) two end member phases, depending on the location of the sinkhole relative to the coast. Coastal sinkholes are drowned by sea-level rise and gradually infilled by marine sediment and associated reef debris (Phase 4a). Inland or terrestrial sinkholes become sinkhole lakes, with the deeper sinkhole acting as a secondary sedimentary basin (Phase 4b).

Continued on Next Page

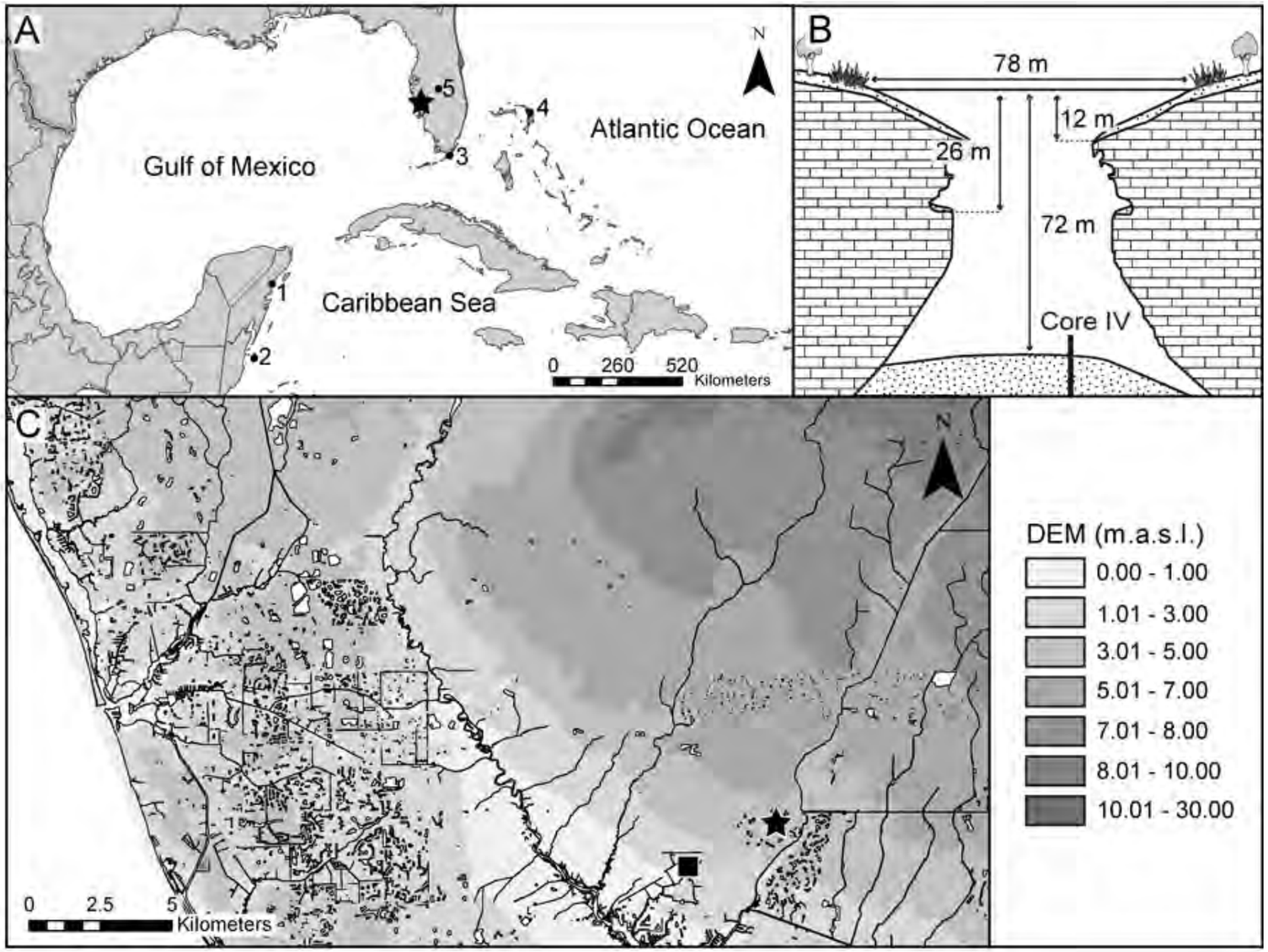


Figure 2. (A) Location of LSS in the context of the greater Caribbean; other study sites mentioned in this paper are shown as numbered black dots. The LSS site is denoted by the black star. Other locations include (1) Chumkopo, Yucatan Peninsula (Brown *et al.*, 2014); (2) Lighthouse Reef, Belize (Gischler, Anselmetti, and Shinn, 2013; Gischler *et al.*, 2008); (3) an unnamed coastal sinkhole, northern Florida Keys (Shinn *et al.*, 1996); (4) Great Abaco Island, Bahamas (Kovacs *et al.*, 2013); (5) Lake Tulane, Florida (Grimm *et al.*, 2006). (B) Cross-sectional diagram of LSS. Water level is about 5 m above msl; figure not to scale. (C) DEM of Sarasota County and position of LSS (black star) and Warm Mineral Spring (black square) relative to the Gulf of Mexico.

Continued on Next Page

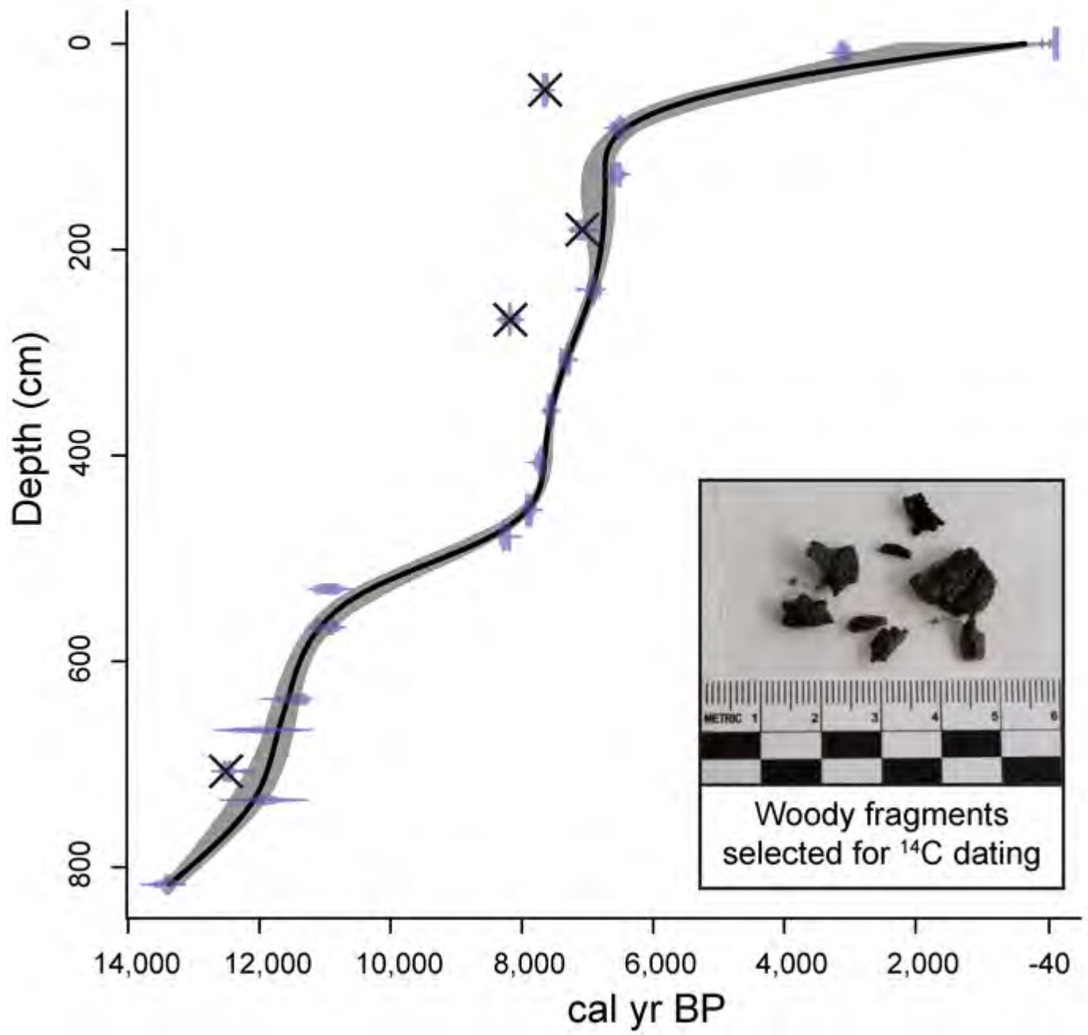


Figure 3. Age–depth model for LSS sediments generated with the Clam package for R statistical software. The black line represents the age-weighted mean value for a given depth. The gray shaded area corresponds to the 95% confidence interval for the age–depth model. Dated intervals are represented by the miniature blue graphs, which show the calibrated distribution of ages for a given date. Dates with a black X through them were removed before generation of the age model to minimize age reversals.(Inset) Example of mixed macrofossil fragments selected for radiocarbon dating.

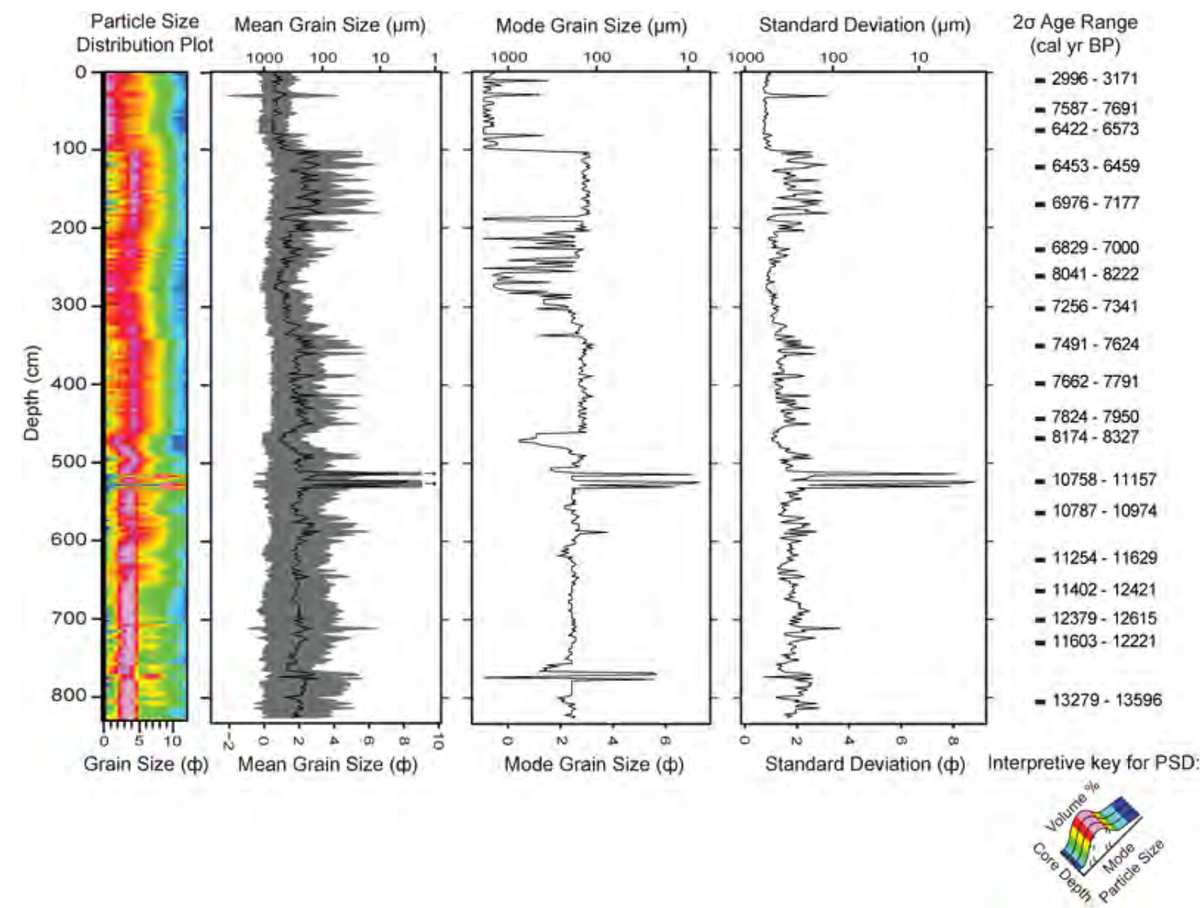


Figure 4. Summary figure for particle size (mean, mode, and SD) and interpolated PSD plot for LSS Core IV. The gray ribbon on the mean particle size represents the within-sample SD, and the black line represents the sample mean value. The x-axis of the PSD represent particle size (U), the y-axis represents depth in core, and the z-axis, represented with color, indicates percent volume of sediment. Warmer colors (pink and red) indicate a higher percent volume of sediment. See the identification key for a visual description of how to interpret PSD plots.

 Continued on Next Page

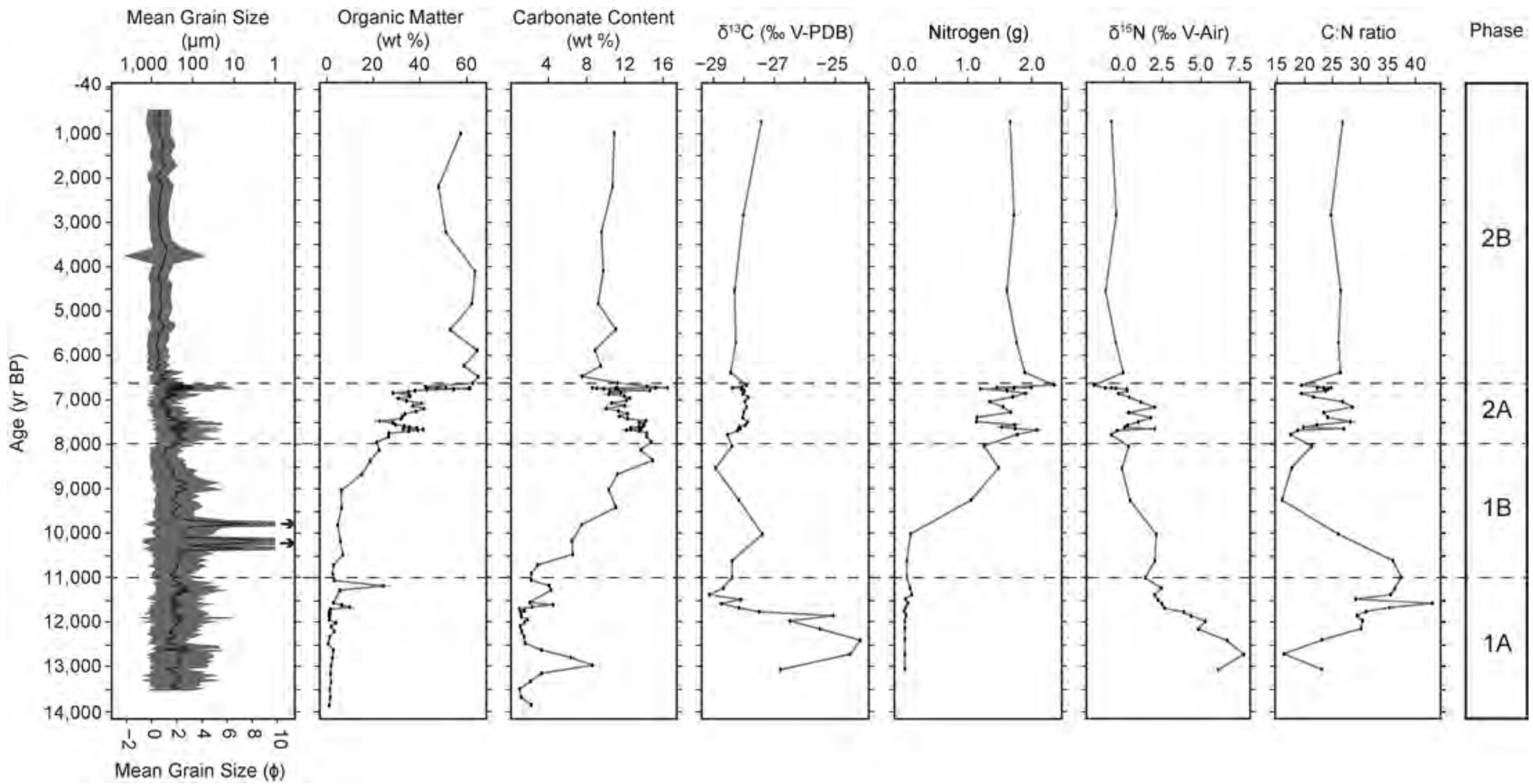


Figure 5. Summary diagram of mean particle size, loss-on-ignition results, and geochemical data for LSS Core IV. The gray ribbon on the mean particle-size data represents the within-sample SD in U. Black lines separate different phases of deposition.

Continued on Next Page

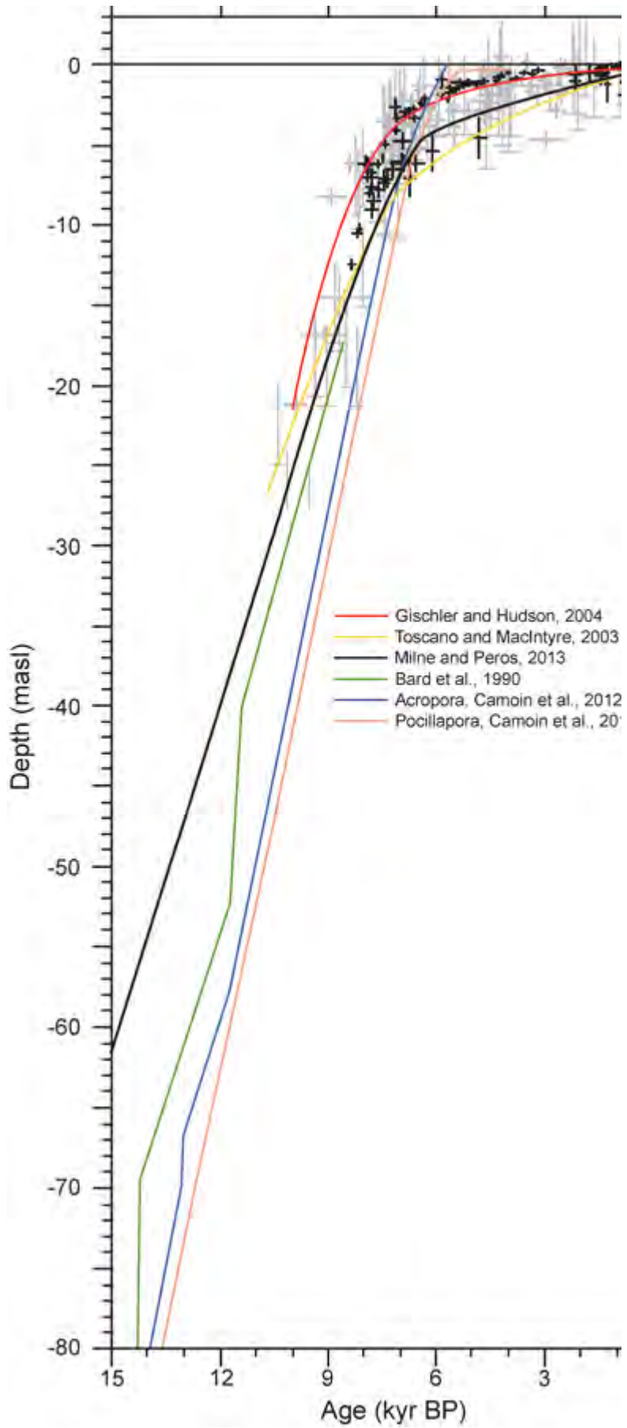


Figure 6. Several sea-level curves for the Caribbean based on coral and peat data. Sea-level curves are modified from their respective papers (see color legend for sources of data). Data points on the graph are reproduced based on the corrected dataset of Milne and Peros (2013). Crosses represent peat deposits, with vertical bars representing the range of sea level for each sample point and horizontal bars representing age-related error. Inverted Ts represent coral sea-level points, with the lower limit representing minimum sea level and horizontal bars representing age-related error.

Continued on Next Page

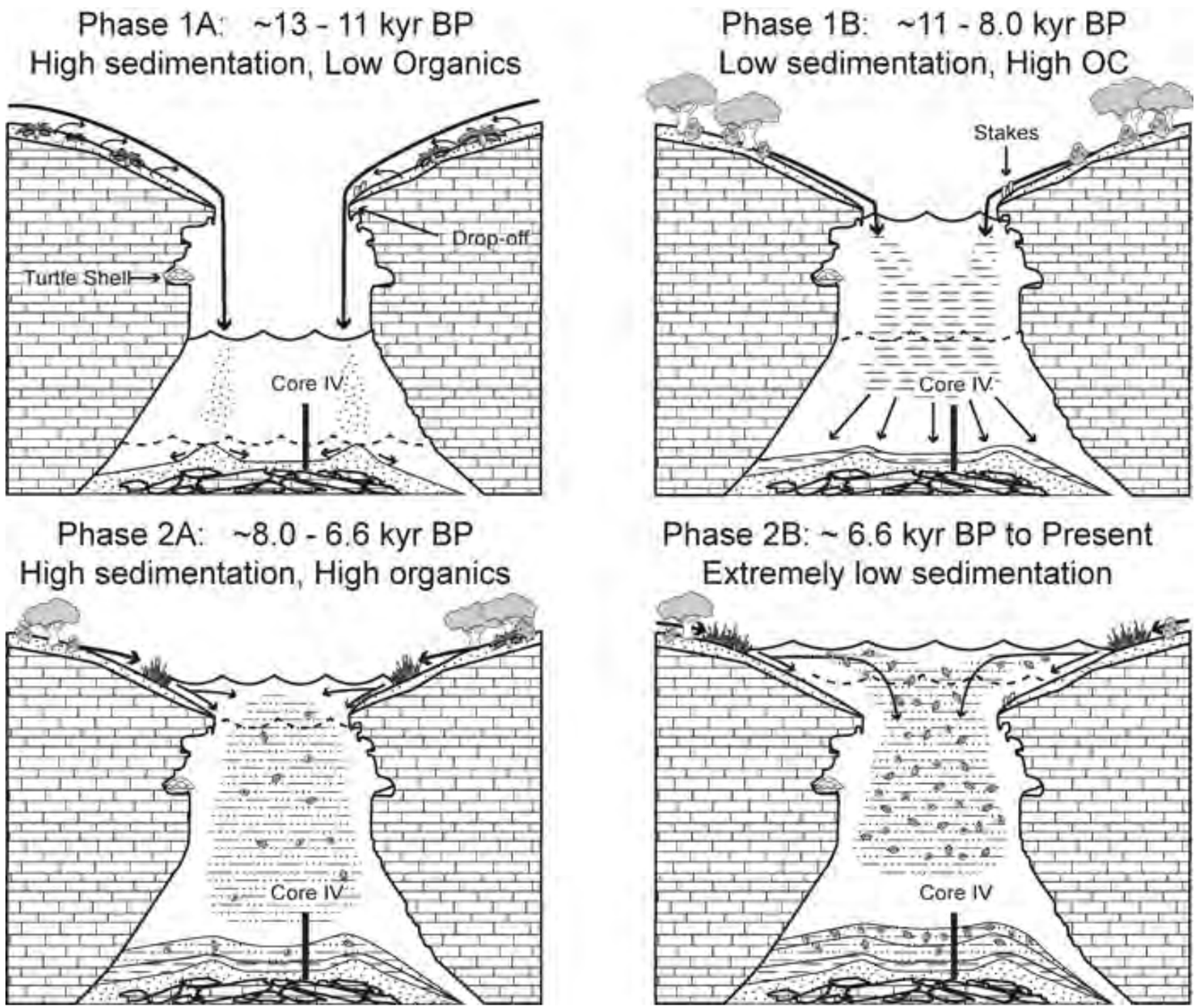


Figure 7. Depositional model for LSS showing the observed changes in sedimentation at LSS. The sinkhole transitions through two main phases with two subphases. Phase 1A (11–13.5 kcal. YBP) is characterized by low water level, allochthonous deposition from the surrounding area, and high sedimentation rate. In Phase 1B (8.5–11 kcal. YBP), water level reaches the restricted cavity, the sedimentation rate decreases, and autochthonous productivity begins to increase. As the water level reaches the upper basin, deposition shifts to Phase 2A (6.6–8.5 kcal. YBP), which exhibits a high sedimentation rate and OM-rich sediment because of vegetation in the upper basin. By Phase 2B (0–6.6 kcal. YBP), the water level has risen and deposition shifts to the upper-basin slopes.

To access this full JCR Research Article, please visit:

http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-15-00169.1

CERF-JCR Membership Options

1. Individual CERF Membership; ONLINE ONLY SUBSCRIPTION to the JCR

(1-year subscription; $95) (2-year subscription; $185*) (3-year subscription; $275*)

Includes:
- Official membership to the Coastal Education & Research Foundation (CERF)
- Full online permissions to www.JCRonline.org
- Ability to access the complete online archive of the JCR (over 30 yrs of coastal research publications)
- 2 free JCR Archived Regular Issues or Special Issues
- CERF society monthly newsletter, *Just CERFing*
- Official personalized CERF Member Certificate
- Notices and reduced registration fees for the International Coastal Symposium (ICS), the official meeting of CERF
- Registration into our manuscript submission website
- Reduced fees for manuscript submission, publication, and color charges
- Ability to submit coastal photographs for the purpose of publication in the JCR
- Participation & sharing with a distinguished international group of scholars and scientists

***2- and 3-year memberships can always add a JCR printed subscription (Please contact us at CERF@allenpress.com and mailing costs apply)**

2. Individual CERF Membership; ONLINE AND PRINTED SUBSCRIPTION to the JCR

1-year subscription; $125/Domestic; $135/International
2-year subscription; $245/Domestic; $265/International (Discounted Subscription)
3-year subscription; $365/Domestic; $395/International (Discounted Subscription)

Includes:
- Official membership to the Coastal Education & Research Foundation (CERF)
- Six (6) bimonthly printed versions of the *Journal of Coastal Research*
- Full online permissions to www.JCRonline.org
- Ability to access the complete online archive of the JCR (over 30 yrs of coastal research publications)
- 2 free JCR Archived Regular Issues or Special Issues
- CERF society monthly newsletter, *Just CERFing*
- Official personalized CERF Member Certificate
- Notices and reduced registration fees for the International Coastal Symposium (ICS), the official meeting of CERF
- Registration into our manuscript submission website
- Reduced fees for manuscript submission, publication, and color charges
- Ability to submit coastal photographs for the purpose of publication in the JCR
- Participation & sharing with a distinguished international group of scholars and scientists

3. CERF Patron Membership ($200)*An Honors Membership*

Includes:
- All the benefits of individual CERF membership
- Annual online and printed subscription to the JCR
- Recognition and announcement space on our internationally-viewed Foundation website http://www.cerf-jcr.org and in our society newsletter, *Just CERFing*
- Printed name acknowledgement in every JCR issue of that volume year
- Professional storyboard printout of each JCR cover for that volume year
- Greatly reduced fees for manuscript submission, publication, and color charges
- Official personalized CERF Patron Member Certificate

4. CERF Fellow Membership ($500)*An Honors Membership*

Includes:
- All the benefits of individual CERF membership
- Annual online and printed subscription to the JCR
- A full Fellow Member Profile webpage detailing your affiliation, research, and announcements on our internationally-viewed Foundation and JCR online websites http://www.cerf-jcr.org and http://www.JCRonline.org and in our society newsletter, *Just CERFing*
- Printed name acknowledgement in every JCR issue of that volume year
- Professional storyboard printout of each JCR cover for that volume year
- Greatly reduced fees for manuscript submission, publication, and color charges
- Official personalized CERF Fellow Member Certificate

5. CERF Lifetime Membership ($1000)*An Honors Membership*

Includes:
- Continuous benefits of individual CERF membership
- Lifetime subscription to the online and printed versions of the JCR
- A fully updateable Lifetime Member profile webpage detailing your affiliation, research, and announcements on our internationally-viewed Foundation and online journal websites http://www.cerf-jcr.org and http://www.JCRonline.org and in our society newsletter, *Just CERFing*
- A printed acknowledgement in every issue of the JCR
- Professional storyboard printout of JCR covers
- Greatly reduced fees for manuscript submission, publication, and color charges
- Official personalized CERF Lifetime Member Certificate

Continued on Next Page

CERF-JCR Membership Options

6. CERF Society Fee Membership; WITHOUT AN INDIVIDUAL JCR SUBSCRIPTION ($55)

Includes:
- CERF annual society membership
- 2 free JCR Archived Regular Issues or Special Issues
- CERF society monthly newsletter, *Just CERFing*
- Official personalized CERF Member Certificate
- Notices and reduced registration fees for the International Coastal Symposium (ICS), the official meeting of CERF

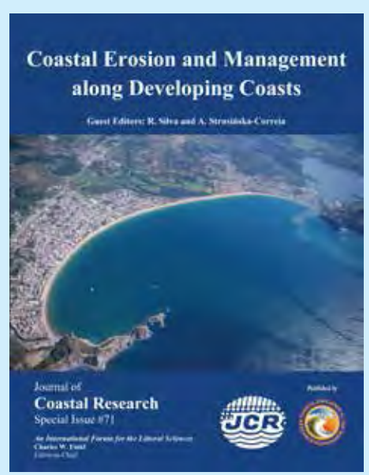
7. CERF Student Membership ($75*)

Includes:
- CERF annual student membership
- Full online permissions to http://www.JCRonline.org
- 2 free JCR Archived Regular Issues or Special Issues
- CERF society monthly newsletter, *Just CERFing*
- Official personalized CERF Member Certificate
- Notices and reduced registration fees for the International Coastal Symposium (ICS), the official meeting of CERF
- Registration into our manuscript submission website
- Reduced fees for manuscript submission, publication, and color charges
- Ability to submit coastal photographs for the purpose of publication in the JCR
- Participation & sharing with a distinguished international group of scholars and scientists

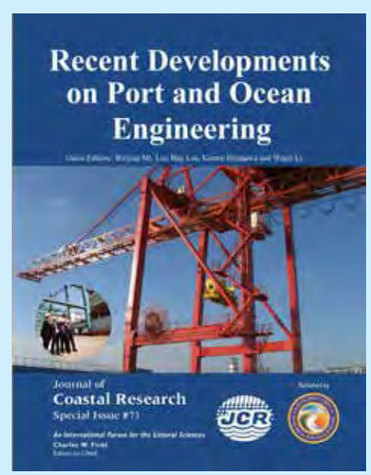
* JCR printed subscription can be added
(Please contact us at CERF@allenpress.com and mailing costs apply)

JCR 30(4)
July 2014

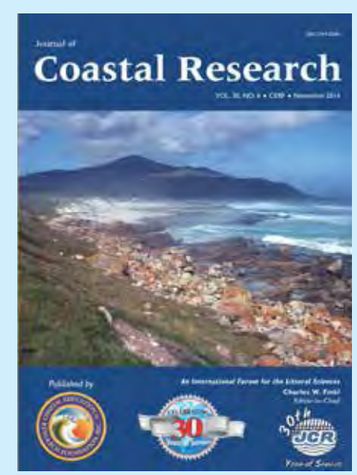
JCR 30(5)
September 2014



JCR Special Issue #71
Fall 2014



JCR Special Issue #73
Winter 2015



JCR 30(6)
November 2014

JCR 31(1)
January 2015

Introducing the new official website of the Coastal Education and Research Foundation (CERF)

Please visit www.cerf-jcr.org or Google Search: cerf-jcr to navigate through all our great new features

COASTAL EDUCATION & RESEARCH FOUNDATION, INC.

THE JOURNAL OF COASTAL RESEARCH

CERF-JCR INFORMATION | JCR CONTENT SPECIAL ISSUES, BOOK REVIEWS, & NEWSLETTERS | ICS & PROCEEDINGS | RESEARCH NEWS & PUBLICATIONS | BILLING & PAYMENTS

Home

search...

The *Journal of Coastal Research* (JCR) is the leading international journal for coastal studies and processes, and is officially published by the **Coastal Education and Research Foundation (CERF)**.

Toolinna Cove along Baxter Cliffs - member submission

The Coastal Education and Research Foundation (CERF) is a nonprofit scientific society dedicated to the advancement of the coastal sciences and is devoted to the multi-disciplinary study of the complex problems within and around the coastal zone. Our goal is to help translate and interpret coastal issues for the public and to assist in the development of professional coastal research programs. Our Society specifically supports and encourages field and laboratory studies on a local, national, and international basis. Through the mediums of renowned scientific papers, book and encyclopedia series, our monthly society newsletter (*JUST CERFing*), and the world wide web, CERF disseminates the latest research information to professors, specialists, researchers, and the general public in an effort to maintain or improve the quality of our planet's coastal resources.

We encourage you to navigate through our website and explore the many benefits and opportunities that CERF has to offer. One such benefit to CERF members is the internationally acclaimed, *Journal of Coastal Research* (JCR), which offers the most current published research from today's top coastal scientists.

Current Issue

JCR 31(1); January 2015

Please click the above JCR cover

CERF Links

- Officers
- Boards
- Members
- Portfolio
- Billing
- Contact Us

News & Events

- ICS 2011 (Poland); JCR SI #64 Front Matter & Table of Contents
- ICS 2016 Sydney, Australia
- ICS 2014 (South Africa); JCR SI #70 Cover & Front Matter
- ICS 2014 (South Africa); JCR SI #70 Table of Contents
- America's Best Beaches
- CERF Supporters
- Coastal Classifications

Publish Your Coastal Photographs in the JCR!

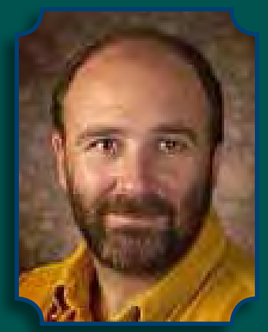
As a CERF member, you have the unique opportunity to become a published photographer in our internationally renowned journal!

All possible submissions must depict some coastal or underwater/marine scene and must be high-quality (>300 dpi) image files in either a jpg, tiff, or gif format. In addition, a short caption must accompany the photograph. The caption should include the specific location of the photograph, the date taken, the geological or coastal significance, and your CERF member contact information (full name, title, phone, email, and CERF member number). Example captions can be found on the Gallery page of this website.

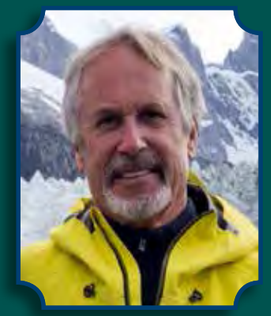
While most submissions will be selected for either the CERF website or inside the JCR, a chosen few will actually be selected to be the cover image of a JCR Issue! So dust off those cameras and submit your photos.

Submit your photo and information by email attachment to CMakowski@cerf-jcr.com

CERF Board of Directors (Trustees)



Andrew Cooper
University of Ulster
Coleraine, N. Ireland, U.K.



Gary Griggs
University of California
Santa Cruz, California, U.S.A.

Jim Houston
Coastal Hydraulics Lab, ERDC-SSE
Vicksburg, Mississippi, U.S.A.

Robert Huff
Robinson, Farmer, & Cox
Charlottesville, Virginia, U.S.A.

Joe Kelley
University of Maine
Orono, Maine, U.S.A.

Victor Klemas
University of Delaware
Newark, Delaware, U.S.A.

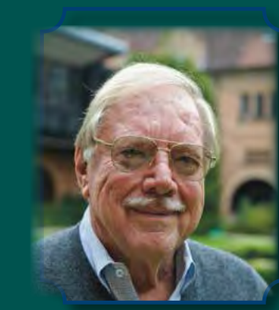
Continued on Next Page

CERF Board of Directors (Trustees)

Charles Lemckert
Griffith University
Southport, Qld, Australia

Mike Phillips
University of Wales: Trinity Saint David
Swansea, Wales, U.K.

Orrin Pilkey
Duke University
Durham, North Carolina, U.S.A.



Norb Psuty
Rutgers University
New Brunswick, New Jersey, U.S.A.

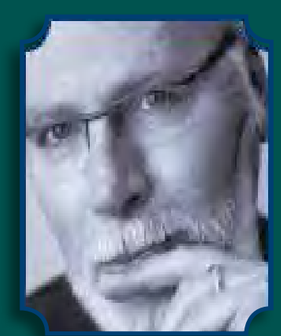
Elijah W. Ramsey, III
U.S. Geological Survey
Lafayette, Louisiana, U.S.A.

Vic Semeniuk
V & C Semeniuk Research Group
Perth, WA, Australia

Carlos Pereira da Silva
New University of Lisbon
Lisbon, Portugal

Andrew Short
University of Sydney
Sydney, NSW, Australia

Daniel J. Stanley
Smithsonian Institution
Washington, D.C., U.S.A.



Marcel Stive
Delft University of Technology
Delft, The Netherlands

Allan Williams
University of Wales: Trinity Saint David
Swansea, Wales, U.K.

Journal of Coastal Research (JCR) Editorial Board

Edward J. Anthony
Coastal Geomorphology, Beach Morphodynamics
Dunkerque, France

Kenneth Banks
Coral Reef Geomorphology, Habitat mapping
Fort Lauderdale, Florida

Patrick Barnard
Coastal Geomorphology
Santa Cruz, California

Lindino Benedet
Oceanography, Modeling
Florianopolis, SC, Brazil

David M. Bush
Coastal Geology & Hazards
Carrollton, Georgia

Ilya V. Buynevich
Coastal Geology
Philadelphia, Pennsylvania

Javier A. Carrió
Sediment Processes, Marine Geology
Valencia, Spain

Mark Crowell
Coastal Zone Management, Coastal Erosion
McLean, Virginia

Omar Defeo
Sandy Beach Ecology, Invertebrates
Montevideo, Uruguay

Joseph F. Donoghue
Coastal Morphology & Hazards
Orlando, Florida

Jean Ellis
Aeolian Sediment Transport
Columbia, South Carolina

Luciana Esteves
Coastal Flooding & Erosion
Bournemouth, England, UK

Oscar Manuel Ferreira
Storm Impacts, Beach Morphodynamics
Faro, Portugal

Duncan M. Fitzgerald
Sediment Transport, Numerical Modeling
Boston, Massachusetts

Chip Fletcher
Coastal Geology
Honolulu, Hawaii

Kazimierz Furmañczyk
Marine Cartography, Remote Sensing
Szczecin, Poland

Allen Gontz
Geophysics, Stratigraphy
San Diego, California

Gary B. Griggs
Coastal Engineering & Hazards
Santa Cruz, California

Pramod Hanamgond
Coastal Geomorphology, Sedimentology
Belgaum, India

Hans Hanson
Coastal Protection, Numerical Modeling
Lund, Sweden

Simon Haslett
Paleoceanography, Coastal Evolution
Swansea, Wales, UK

David Hill
Nearshore Hydrodynamics
Corvallis, Oregon

Michael Hilton
Dune Geomorphology & Ecology
Dunedin, New Zealand

Carl H. Hobbs, III
Coastal Geology, Sand Mining
Gloucester Point, Virginia

James R. Houston
Sea-Level Change, Coastal Hydrodynamics
Vicksburg, Mississippi

Wenrui Huang
Coastal Hydrodynamics & Hazards
Tallahassee, Florida

Michael G. Hughes
Coastal Morphodynamics, Shelf Processes
Canberra, ACT, Australia

Federico I. Isla
Sea-Level Change, Remote Sensing
Mar Del Plata, Argentina

Nancy L. Jackson
Coastal Geomorphology
Newark, New Jersey

Markes E. Johnson
Paleoshores, Coastal Sand Dunes
Williamstown, Massachusetts

Timothy R. Keen
Waves & Circulation, Numerical Modeling
Stennis Space Center, Mississippi

Dieter H. Kelletat
Coastal Geomorphology, Sea-Level Change
Essen/Cologne, Germany

Joseph T. Kelley
Sea-Level Change, Salt Marsh Ecogeomorphology
Orono, Maine

Vic Klemas
Remote Sensing, Global Environmental Change
Newark, Delaware

Nobuhisa Kobayashi
Coastal Engineering
Newark, Delaware

Vladimir N. Kosmynin
Coral Reefs, Coastal Ecology
Tallahassee, Florida

Joseph L. Kowalski
Estuarine Plant Ecology
Edinburg, Texas

Michael J. Lace
Coastal Landforms & Processes
West Branch, Iowa

Stephen P. Leatherman
Barrier Islands, Beach Erosion
Miami, Florida

Charles Lemckert
Environmental Fluid Dynamics
Southport, Qld, Australia

Continued on Next Page

JCR Editorial Board

Ioannis Liritzis
Geophysical Proxy Data
Rhodes, Greece

Jeffrey H. List
Shoreline Change Processes
Woods Hole, Massachusetts

Michel M. de Mahiques
Sediment Processes
São Paulo, Brazil

Gonzalo C. Malvárez-Garcia
Beach Morphodynamics
Seville, Spain

Ashish J. Mehta
Coastal & Oceanographic Engineering
Gainesville, Florida

Nobuo Mimura
Global Environmental Engineering
Ibaraki, Japan

Fatima Navas
Coastal Morphodynamics
Seville, Spain

Robert Nicholls
Global Climate Change, Sea-Level Change
Southampton, England, UK

Karl Nordstrom
Coastal Geomorphology
New Brunswick, New Jersey

Julian Orford
Gravel Beaches, Storm Events, Dunes
Belfast, Northern Ireland, UK

Phil D. Osborne
Sediment Dynamics, Beach Morphodynamics
Shoreline, Washington

Charitha B. Pattiaratchi
Physical Oceanography
Crawley, WA, Australia

Michael Phillips
Coastal Geomorphology
Swansea, Wales, UK

Orrin H. Pilkey, Jr.
Coastal Geology
Durham, North Carolina

Paolo A. Pirazzoli
Sea-Level Changes
Paris, France

Norbert P. Psuty
Coastal Geomorphology, Shoreline Erosion
New Brunswick, New Jersey

Ulrich Radtke
Coastal Geomorphology
Duisburg-Essen, Germany

Elijah W. Ramsey, III
Coastal Image Processing
Lafayette, Louisiana

Richard C. Raynie
Wetland/Marsh Restoration, Coastal Erosion
Baton Rouge, Louisiana

Kirt Rusenko
Sea Turtles, Dune Restoration
Boca Raton, Florida

Anja Scheffers
Coastal Evolution
Lismore, NSW, Australia

Vic Semeniuk
Coastal Sedimentation, Mangroves
Perth, WA, Australia

Andrew D. Short
Coastal Geomorphology, Beach Morphodynamics
Sydney, NSW, Australia

Pravi Shrestha
Coastal Engineering
Irvine, California

Carlos Pereira da Silva
Coastal Zone Management
Lisbon, Portugal

Alejandro J. Souza
Coastal & Sediment Processes
Liverpool, England, UK

Tom Spencer
Biogeomorphology, Wetland Morphodynamics
Cambridge, England, UK

Marcel Stive
Coastal Hydrodynamics, Sediment Dynamics
Delft, The Netherlands

Vallam Sundar
Coastal Engineering
Chennai, India

Adam D. Switzer
Coastal Hazards, Sea-Level Change
NTU, Singapore

E. Robert Thieler
Marine Geology
Woods Hole, Massachusetts

Arthur C. Trembanis
Coastal Morphodynamics
Newark, Delaware

Frank Van Der Meulen
Coastal Zone Management, Climate Change
Delft, The Netherlands

Ian J. Walker
Coastal Dunes & Sediments
Tempe, Arizona

Ping Wang
Beach Morphodynamics, Sediment Transport
Tampa, Florida

Allan Williams
Coastal Geology
Swansea, Wales, UK

Harry F. Williams
Hurricane Sedimentation, Paleotempestology
Denton, Texas

Colin D. Woodroffe
Coastal Geomorphology, Sea-Level Change
Wollongong, NSW, Australia

Robert S. Young
Coastal Processes & Management
Cullowhee, North Carolina

Guoliang Yu
Coastal Engineering, Sediment Transport
Shanghai, China

CERF Lifetime Members

Dr. Charles Lemckert

Dr. Yong-Sik Cho

Dr. Ya-Ping Wang

Dr. Nicholas K. Coch

Dr. Hany Elwany

Dr. Björn Kjerfve

Dr. Wei Zhang

Mr. Charles Thibault

Dr. Erik van Wellen

Dr. Frédéric Bouchette

A Special Acknowledgement To:
Associate Professor Dr. Charles Lemckert
CERF Lifetime Member

We are proud to acknowledge Associate Professor Dr. Charles Lemckert as the Coastal Education & Research Foundation's first ever Lifetime Member. Dr. Lemckert has always showed great support for CERF and the JCR, and even served as the Chair and Organizer of the 9th International Coastal Symposium (ICS) at Griffith University (Queensland, Australia) in 2007. We are honored to have Dr. Lemckert as a Lifetime Member and warmly recognize his devotion to our coastal research society.

Associate Professor Lemckert has active research interests in the fields of physical limnology, coastal systems, environmental monitoring techniques, environmental fluid dynamics, coastal zone management and engineering education. Along with his postgraduate students and research partners he is undertaking research studies on water treatment pond design (for recycling purposes), the dynamics of drinking water reservoirs, the study of whale migration in South East Queensland Waters, end ocean mixing dynamics.

Selected Publications:

Ali, A.; Lemckert, C.J.; Zhang, H., and Dunn, R.J.K., 2014. Sediment dynamics of a very shallow subtropical estuarine lake. *Journal of Coastal Research*, 30(2), 351-361.

Dunn, R.J.K.; Lemckert, C.J.; Teasdale, P.R., and Welsh, D.T., 2013. Macroinfauna Dynamics and Sediment Parameters of a Subtropical Estuarine Lake—Coombabah Lake (Southern Moreton Bay, Australia). *Journal of Coastal Research*, 29(6A), 156-167.

Ali, A.; Lemckert, C.J., and Dunn, R.J.K., 2010. Salt fluxes within a very shallow subtropical estuary. *Journal of Coastal Research*, 26(3), 436-443.

Brushett, B.A.; King, B., and Lemckert, C.J., 2011. Evaluation of met-ocean forecast data effectiveness for tracking drifters deployed during operational oil spill response in Australian waters. *Journal of Coastal Research*, 64, 991-994.

Lemckert, C.J.; Zier, J., and Gustafson, J., 2009. Tides in Torres Strait. *Journal of Coastal Research*, 56, 524-52.

For a complete list of Dr. Lemckert's publications or
his contact information, please visit:
http://www.griffith.edu.au/engineering-information-technology/griffith-school-engineering/staff/associate-professor-charles-lemckert

Continued on Next Page

A Special Acknowledgement To:

Professor Yong-Sik Cho
CERF Lifetime Member

We are proud to acknowledge Professor Yong-Sik Cho as a Lifetime Member of the Coastal Education & Research Foundation. Professor Cho, Yong-Sik received his bachelors and masters degrees from Hanyang University in February 1981 and August 1988 respectively, and his Ph.D. from the School of Civil and Environmental Engineering of Cornell University in January, 1995. The title of the thesis is "Numerical Simulations of Tsunami Propagation and Run-up" (Advisor: Professor Philip L.-F. Liu).

He had continuously worked at Cornell University as a Post-Doctoral Associate after graduation. From March of 1997, he had been employed as an Assistant Professor at the Department of Civil and Environmental Engineering at Sejong University and then moved to Hanyang University in March, 2000. From February 2003 to January 2005, he had served as the Chair of the Department of Civil and Environmental Engineering at Hanyang University. Professor Cho has served as the Director of Innovative Global Construction Leader Education Center, a government enterprises sponsored by the Ministry of Education, Science and Technology, and the Chair of Graduate Studies of the Department of Civil and Environmental Engineering since 2006.

Professor Cho has published 52 journal papers in prominent international journals registered in Science Citation Index such as *Coastal Engineering*, the *Journal of Coastal Research*, the *Journal of Fluid Mechanics*, the *Journal of Hydraulic Research*, *Physics of Fluids*, the *Journal of Geophysical Research*, the *Journal of Engineering Mechanics, and Ocean Engineering*. He has also published 120 papers in domestic journals and about 360 proceedings in international and domestic conferences. Professor Cho has also registered eight patents.

Selected Publications:

Kim, Y.-C.; Choi, M., and Cho, Y.-S., 2012. Tsunami hazard area predicted by probability distribution tendency. *Journal of Coastal Research,* 29(5), 1027-1038.

Cho, Y.-S., 2012. Numerical study for spreading of a pollutant material in coastal environment. *Energy Sources*, Part A, 34(16), 1459-1470.

Cho, Y.-S.; Kim, T.-K.; Jeong, W.-C., and Ha, T.-M., 2012. Numerical simulation of oil spill in ocean. *Journal of Applied Mathematics*, 2012, 1-15.

For a complete list of Professor Cho's publications or his contact information, please visit: http://civil.hanyang.ac.kr/coast/

 Continued on Next Page

A Special Acknowledgement To:

Professor Ya-Ping Wang
CERF Lifetime Member

MOE Key Laboratory for Coast and Island Development
Jiangsu Key Laboratory for Coast and Island Development
Department of Coastal Ocean Sciences
School of Geography and Oceanography
Nanjing University, China
Telephone: (+)86 25 3597308 (O)
Fax: (+)86 25 3592686
E-mail: ypwang@nju.edu.cn

DEGREES AND DIPLOMA

July, 2000: Ph.D. (Marine Sediment Dynamics), Institute of Oceanology, Chinese Academy of Sciences (China)
July, 1997: M.Sc. (Coastal Geomorphology and Sedimentology), Department of Geography, Nanjing Normal University (China)
July, 1994: B.Sc. (Geomorphology and Quaternary Geology), Department of Geo-Ocean Sciences, Nanjing University (China)

RESEARCH INTERESTS

Marine Sediment Dynamics; Benthic Boundary Layer Processes; Estuarine and Coastal Morphodynamics

RESEARCH PROGRAMMES (PI)

Monitoring and Development of support system on seabed topographical changes in Pearl River Estuary and Taiwan Shoal. Ocean special funds for scientific research on public causes (No. 201105001-2). 2011-2014. RMB 1,570,000 (about USD240,000).

Simulation on the evolution and realignment of North branch, Changjiang Estuary (No. BK2010050). Jiangsu Key NSF. 2010-2012. RMB 250,000 (about USD38,000).

Physical processes near bottom boundary layer in shallow seas with strong tides and high turbid water. China NSF (No. 40876043). 2009-2011. RMB 500,000 (about USD77,000).

Study and strategy on typical marine hazards of Hainan. Comprehensive Survey and Evaluation Program of Coastal Sea, Hainan Province (No. HN908-02-05). 2008-2011. RMB 250,000 (about USD38,000).

Sediment dynamics and associated environment response in intertidal area and estuary. Program for New Century Excellent Talents in University(No. NCET-06-0446). 2007-2009. RMB 500,000 (about USD77,000).

Wave-current dynamic processes and tidal basin system evolution over tidal flats. China NSF (No. 40576040). 2006-2008. RMB 380,000 (about USD58,000).

The estuary evolution by human activity impacts and associated hazards potential analysis. Jiangsu NSF (No. BK2006131). 2006-2008. RMB 75,000 (about USD12,000).

Siltation hazard and strategy on major embayment and estuary. National Comprehensive Survey and Evaluation Program of China Coastal Ocean (No. 908-02-03-08). 2005-2009. RMB 250,000 (about USD38,000).

Physical oceanography and marine meteorological survey in Jiangsu coastal sea. National Comprehensive Survey and Evaluation Program of China Coastal Ocean (No. JS-908-01-01). 2005-2009. RMB 921,000 (about USD140,000).

SELECT PUBLICATIONS; Refereed Publications (English papers only)

Huang, H; Wang, Y.P.; Gao, S.; Chen, J.; Yang, Y., and Gao J., 2012. Extraction of morphometric bedform characteristics from profiling sonar datasets recorded in shallow coastal waters of China. *China Ocean Engineering*, 26(3), 469-482.

Yunling Liu, Y.; Wang, Y.P.; Li, Y.; Gao, J.; Jia, J.; Xia, X., and Gao, S., 2012. Coastal embayment long-term erosion/siltation associated with P-A relationships: A case study from Jiaozhou Bay, China. *Journal of Coastal Research*, 28(5), 1236-1246.

Continued on Next Page

A Special Acknowledgement To:

Professor Nicholas K. Coch, Ph.D., C.P.G

CERF Lifetime Member

We are proud to acknowledge Professor Dr. Nicholas K. Coch as a Lifetime Member of the Coastal Education & Research Foundation. Dr. Coch received his Ph.D. in 1965 from Yale University with a specialization in sedimentology and coastal geology. In 1967, he joined the faculty at Queens College of the City University of New York (CUNY). He is now a Professor of Geology in the School of Earth and Environmental Sciences at Queens College of C.U.N.Y. and a member of the Doctoral Faculty of CUNY at the Graduate Center. He has co-authored two college geology textbooks (PHYSICAL GEOLOGY) and is the author of GEOHAZARDS (Pearson). In 2008, he received the President's Award for Teaching Excellence at Queens College and the John Moss Award For Excellence in College Teaching from the National Association of Geology Teachers. His research studies since 1967 have included sedimentation on the Moon, as a Principal Investigator in NASA's Lunar Sample Study Program, and shipboard studies of continental shelf, coastal and estuarine areas in the Northeast, as well as ground and aerial studies of the effects of hurricanes on coasts and urban centers.

His recent research deals with the effects of hurricanes on coasts, urban centers and inland areas, in predicting hurricane damage and in critically analyzing our coastal management policies in a time of sea level rise. He has carried out ground and aerial studies of most recent hurricanes as well as forensic studies of older (16th-20th century) hurricanes.

He is a Fellow of the Geological Society of America and a Member of The American Meteorological Society, Society of Sedimentary Geologists, National Association of Geology Teachers, American Association of Petroleum Geologists and is a Certified Professional Geologist.

Dr. Coch is an expert on Northern Hurricanes and has been a consultant to the N.Y. City Emergency Management Organization and the N.Y.S. Office of Emergency Management. He has presented hurricane seminars to emergency management and government officials in every county in southern New York as well as insurance, reinsurance and risk management groups nationwide. In 2003, he was chosen as a Sigma Xi Distinguished Lecturer for 2004-2007, and presented lectures on his research at educational and research facilities in the U.S. and Canada.

Programs including aspects of his hurricane research have aired on the CNN, PBS, Weather, Discovery, History and National Geographic Channels, and in local, national and international news programs and periodicals.

Selected Publications:

Coch, N.K., 2015. Unique vulnerability of the New York-New Jersey Metropolitan Area to Hurricane Destruction. *Journal of Coastal Research*, 31(1), 196-212.

Coch, N.K., 2013. A field course in tropical coastal geology. *Journal of Coastal Research*, 29(6A), 214-225.

Coch, N.K., 2006. The unique vulnerability of the Northeast U.S. to hurricane damage. Geologic Society of America, Abstract with programs, National G.S.A. Meeting (Philadelphia, Pennsylvania).

For a complete list of Dr. Coch's publications or his contact information, please visit:

http://www.qc.cuny.edu/Academics/Degrees/DMNS/sees/People/Pages/FacultyResearch.aspx?ItemID=23

CUNY The City University of New York

Continued on Next Page

A Special Acknowledgement To:

Hany Elwany, Ph.D.
CERF Lifetime Member

President, Coastal Environments
2166 Avenida de la Playa
La Jolla, California, U.S.A.

We are proud to acknowledge Dr. Hany Elwany as a Lifetime Member of the Coastal Education & Research Foundation. Dr. Elwany received a B.S. degree in Engineering from Alexandria University in 1971. In 1977, he completed his Ph.D. at the University of Dundee, United Kingdom. He obtained an additional B.S. degree in Mathematics and Statistics at Alexandria University in 1980. Dr. Elwany has extensive experience with nearshore oceanography, coastal processes, coastal engineering, and estuarine dynamics. He was the principal investigator for the physical oceanographic program of one of the largest environmental studies ever conducted on the U.S. west coast (at San Onofre). He has conducted in-depth studies of Nile Delta erosion, particularly since the construction of the Aswan Dam. His experience also includes projects involving optimization, numerical modeling, structural dynamic analysis, design of offshore structures, and data analyses, simulation, and dynamic modeling of ocean and coastal conditions. As an educator, both at Liverpool and Alexandria Universities, he taught courses in dynamics, statistics, numerical analysis, computer applications, and maritime engineering.

Dr. Elwany also serves as the President of Coastal Environments, a unique multi-disciplinary oceanographic, coastal engineering, and environmental consulting firm. Coastal Environments, founded in 1988, is comprised of over 30 professional associates, all experts in their respective fields. Technical specialties include coastal and ocean engineering, engineering geology, oceanography, marine biology and geology, environmental analysis, economics, statistics, and computer programming/modeling.

For more information about Dr. Elwany and Coastal Environments, please visit:

http://coastalenvironments.com/

 Continued on Next Page

A Special Acknowledgement To:

Björn Kjerfve, Ph.D., Chancellor

CERF Lifetime Member

American University of Sharjah
PO Box 26666, Sharjah
United Arab Emirates
http://www.aus.edu
bkjerfve@aus.edu

We are proud to acknowledge Dr. Björn Kjerfve as a Lifetime Member of the Coastal Education & Research Foundation. He is the former Dean of the College of Geosciences and was a Professor of Oceanography at Texas A&M University, 2004-2009. While at Texas A&M, he oversaw four academic departments, the Texas Sea Grant Program, and the Integrated Ocean Drilling Program (IODP), including the 475'ocean sciences drilling vessel, D/V JOIDES Resolution. Kjerfve was previously Professor of Marine and Geological Sciences at the University of South Carolina, 1973-2004, and served as the Director of the Marine Science Program, 2000-2004. He received Ph.D., M.S., and B.A. degrees from Louisiana State University (Marine Sciences), University of Washington (Oceanography), and Georgia Southern University (Mathematics), respectively.

Professor Kjerfve's expertise is coastal and estuarine physical oceanography. He has published some 12 books and 250 scientific journal papers, book chapters, and reports; has supervised 14 Ph.D. dissertations and 24 M.S. theses, and taught more than 6,000 oceanography students. His research includes problem-solving in estuarine and coastal waters as well as climate change and has attracted $20 million in research funding for 90 projects. Dr. Kjerfve's field research has taken place along the East and Gulf coasts of the USA, the Caribbean, Brazil, Mexico, Colombia, Chile, Thailand, Malaysia, the Persian Gulf, Papua New Guinea, and Australia. Dr. Kjerfve was elected as a corresponding member of the Academia Brasileira de Ciências, the Brazilian Academy of Sciences in 2012. Dr. Kjerfve has served as the President of the World Maritime University from 2009 to 2014. He now has the great honor of serving as the fourth Chancellor of the American University of Sharjah in the UAE.

Selected Publications:

Cavalcante, G.H.; Kjerfve, B.; Bauman, A.D., and Usseglio, P., 2011. Water currents and water budget in a costal mega-structure, Palm Jumeirah Lagoon, Dubai, UAE. *Journal of Coastal Research*, 27(2), 384-393.

Cavalcante, G.H.; Kjerfve, B.; Knoppers, B., and Feary, D.A., 2010. Coastal currents adjacent to the Caeté Estuary, Pará Region, North Brazil. *Estuarine Coastal and Shelf Science*, 88(1), 84-90.

Medeiros, C. and Kjerfve, B., 2005. Longitudinal salt and sediment fluxes in a tropical estuary: Itamaracá Brazil. *Journal of Coastal Research*, 21(4), 751-758.

Perillo, G.M.E. and Kjerfve, B., 2005. Regional estuarine and coastal systems of the Americas: An introduction. *Journal of Coastal Research,* 21(4), 729-730.

For a complete list of Dr. Kjerfve's publications or
his contact information, please visit: http://www.aus.edu

 Continued on Next Page

A Special Acknowledgement To:

Associate Professor Wei Zhang, Ph.D.
CERF Lifetime Member

State Key Laboratory of Hydrology-Water Resources
and Hydraulic Engineering
Hohai University
Nanjing 210098, P.R. China
http://www.hydro-lab.cn/index_english.asp

Dr. Wei Zhang works as an associate professor of Harbor, Coastal, and Offshore Engineering in State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University. He focuses on the tidal current, sediment and salinity movement and transportation laws of estuaries and coasts. Dr. Zhang has published over 20 papers in recent years, including five papers indexed by SCI and EI. He took part in one Key Project of National Nature Science Foundation of China, one 95th Year Key Science and Technology Project for the Ministry of Transport, and two Science and Technology Research Projects of Guangdong Province. He has also led youth projects for the National Nature Science Foundation.

Continued on Next Page

A Special Acknowledgement To:

Charles Thibault

CERF Lifetime Member

Department of Earth Sciences
The University of Memphis
109 Johnson Hall
Memphis, TN 38152, U.S.A.
http://www.memphis.edu/des/student.php

Chuck Thibault is currently a Ph.D. candidate at the University of Memphis and a Geologist for EarthCon, Inc. Mr. Thibault received his M.S. from the University of Washington (Geology) and a B.S. from the University of Memphis (Geology). His research interests include coastal and environmental hydrogeology and coastal geomorphology. His current research investigates the movement of storm surge generated saline water plumes through coastal surficial aquifers. Mr. Thibault's field research has taken place along the U.S. coasts of Mississippi, Louisiana, and Washington, and on the eastern coast of Kamchatka, Russia.

For more information, please contact Mr. Thibault at:
cthibalt@memphis.edu

 Continued on Next Page

A Special Acknowledgement To:
Dr. EUR ING Erik Van Wellen, CEng IntPE(UK) FICE FRGS MCIArb
CERF Lifetime Member

DEME Head Office
Haven 1025 – Scheldedijk 30
BE-2070 Zwijndrecht, Belgium
http://www.deme-group.com
van.wellen.erik@deme-group.com

We are proud to acknowledge Dr. Erik Van Wellen as a Lifetime Member of the Coastal Education and Research Foundation. Dr. Van Wellen received M.Sc. degrees from both the Artesis Antwerpen (Civil Engineering) and the University of Liverpool (Maritime Civil Engineering). In 1999 he subsequently received his Ph.D. from the University of Plymouth with a specialization in sediment transport modeling. He has authored several papers in prominent international journals and conference proceedings.

He has research interests in the fields of natural marine sediment dynamics and mechanically driven sediment transport, renewable energy, carbon-economics, operational optimization, data analyses and mathematical simulations. During his time on the EuDA (European Dredging Association) Environment Committee he fostered a keen interest in Integrated Coastal Zone Management strategies and how to best balance the competing interests of developments such as harbor facilities, coastal defenses, tourism infrastructures and coastal environment conservation; including how best to strike a balance with mitigation and compensation.

He has previously worked as a commercial diver; and since 1999 has worked for the DEME Group (Dredging, Environmental and Marine Engineering) where he has held several operational, technical and commercial roles in a worldwide setting and is currently employed as an international Project Director.

He is a Fellow of the Institution of Civil Engineers and a Fellow of the Royal Geographical Society, a Member of the Chartered Institute of Arbitrators and a Member of the CEntral Dredging Association. Dr. Van Wellen is a Registered Professional Engineer in continental Europe (EUR ING), the UK (CEng) and internationally IntPE(UK). He is considered an expert in such matters as Civil Engineering, Maritime Construction and Dredging; and has considerable knowledge in the field of contract law and alternative dispute resolution. He also has several patents related to aforementioned technical fields registered to his name.

When not working on engineering or maritime construction projects he can be found teaching diving as a Staff Instructor for the Professional Association of Diving Instructors or actively involved in conservation work such as Dive Against Debris or Project AWARE Shark Conservation. His outstanding underwater photographs have graced the cover of the *Journal of Coastal Research* (JCR) more than once.

For a complete list of publications and more information, please contact Dr. Van Wellen via Skype on: vanwellenerik.

 Continued on Next Page

A Special Acknowledgement To:

Frédéric Bouchette Ph.D.
CERF Lifetime Member

Associate Professor of Littoral Dynamics
Geosciences Montpellier
UMR 5243 – University of Montpellier / CNRS

Following a M.Sc. in physics and mechanics, Fred Bouchette received his Ph.D. in March 2001 from the University of Montpellier, South of France. The title of the thesis is "Wave/Seabottom Interaction: The Liquefaction Process" (free translation from French; advisor: Professor M. Séguret). After his Ph.D., Fred had been employed at the University of Montpellier as an associate professor in the department of Geosciences. From 2008 to early 2011, he had moved to the Institute of mathematics and modeling of Montpellier for a three years long stay. Then, until 2012, he has been hosted as an invited professor in the METOS laboratory at the University of Oslo, Norway. He is now back to the University of Montpellier in the same department of Geosciences.

From 2002, Fred was asked to build a scientific staff on littoral hydro-morphodynamics called GLADYS (www.gladys-littoral.org). From that time, the group GLADYS has grown progressively. At now, Fred co-leads the group GLADYS, which rallies most of the scientists working on littoral hydro-morphodynamics along the French Mediterranean Coast, with distinct approaches ranging from applied mathematics to geosciences.

The scientific activity of Fred Bouchette concerns the development of concepts and methods in relation with the dynamics of shallow water environments. He studies the domain that extends from a few tens of meters of water depth at sea to the coastal watershed onshore, with a strong emphasis on the littoral area and the shoreline itself. He has worked in Spain, Taiwan, Canada, Norway, Chad, Italy, Greece, Switzerland, Tunisia, in the French Alps and in the Gulf of Lions (Mediterranean Sea). As testified by his publications, his research combines various points of view from geophysics to geology, including applied mathematics, civil engineering, quantitative geomorphology, with a strong connection to coastal archeology and the analysis of littoral hazards. Nevertheless, his heart's passion still lies with geophysics and applied mathematics.

Presently, Fred Bouchette actively works on the conceptualization of the growth of long term shoreline instabilities such as cuspates or sand spits. On that topic, his last contribution for the *Journal of Coastal Research* (JCR) is the following proceeding:

Bouchette, F.; Manna, M.; Montalvo, P.; Nutz., A.; Schuster, M., and Ghienne, J.-F., 2014. Growth of cuspate spits. *In*: Green, A. and Cooper, J.A.G. (eds.), *Proceedings from the International Coastal Symposium (ICS) 2014 (Durban, South Africa)*. *Journal of Coastal Research*, Special Issue No. 70, pp. 47-52.

Fred Bouchette has published>50 papers and short papers in international journals such as *Coastal Engineering*, *Journal of Coastal Research*, *Discrete and Discontinuous Dynamical Systems*, *Journal of Geophysical Research, Sedimentology, Continental Shelf Research*, *Quaternary Research, Ocean Engineering, Marine Geology, and Climate Research*. Most of his works were performed with and for students. He has contributed to more than 80 proceedings in international or domestic conferences. Fred Bouchette also heads the scientific development of a HPC numerical platform for coastal engineering (www.mirmidon.org).

For a complete list of publications and more information, please visit:
www.bouchette.org

CERF Patron Members

Norbert P. Psuty

Professor Emeritus
Institute of Marine and Coastal Sciences
Rutgers University
Newark, New Jersey, USA
psuty@marine.rutgers.edu

Timothy W. Kana

President
Coastal Science & Engineering (CSE)
Columbia, South Carolina, USA
tkana@coastalscience.com

Carl H. Hobbs III

Emeritus Professor of Marine Science
Virginia Institute of Marine Science
Gloucester Point, Virginia, USA
hobbs@vims.edu

Luis Antonio Buenfil-lopez

Instituto Politécnico Nacional
CIIEMAD
Tlalnepantla, Edo. Mexico
la.buenfil@gmail.com

Robert S. Young

Professor of Geology
Department of Geosciences and Natural Resources
Director, Program for the Study of Developed Shorelines
Western Carolina University
Cullowhee, North Carolina, USA
ryoung@email.wcu.edu

Georges Chapalain

Directeur de Recherches
CETMEF-laboratoire de Génie Côtier et Environnement
Plouzane, France
georges.chapalain@developpement-durable.gouv.fr

The Coastal Education and Research Foundation (CERF) proudly welcomes the following new members to our coastal research society:

Aboobacker Mamun, Basil
Amarjouf, Najat
Aranguena, Edorta A.
Armono, Haryo
Balouin, Yann
Barnett, Joel
Barreto, Maritza
Belknap, Daniel
Bilgili, Ata
Bologna, Paul
Bouchette, Frédéric
Bui, Trong Vinh
Campbell, Foster
Caudle, Tiffany
Chapalain, Georges
Chen, Jianfang
Chun, Hwusub
Claudino-Sales, Vanda
Cornwell, Jeffrey
Currin, Carolyn
Dahm, Jim
Dai, Heng Non
Dai, Peng
Dally, William
Do, Duc
Donnangelo, Alejandro
Douglass, Scott
Escobar, Carlos
Ezer, Tal
Ferina, Nicholas
Fitchen, William M.
Fitzgerald, Tom
Flampouris, Stylianos
Funderburk, William
Gonzalez Leija, Mariana
Gonzalez-Alvarez, Sergio
Guedes Soares, Carlos
Guzman, Emanuel
Haas, Kevin
Haluska, James
Hanlon, Lynda Michelle
Hansen, Jens Morten
Hart, Deirdre
Hatcher, Bruce
Hegde, Venkatraman S.
Hosier, Paul E.
Hsu, Yulun
Huang, Zhenhua H.
Hwang, Jin H.
Jewell, Kim
Kana, Timothy
Karimpour, Arash
Kearney, Michael S.
Kelly, Sean
Kerans, Andrew
Kolahdoozan, Morteza
Kong, Jun
La Peyre, Megan
Laakkonen, Katie
Lane, Hillary
Latif, Shahid
Legare, Bryan
Lees, Dennis
Linder, B. Lee
Little, David
Liu, James
Long, Joshua
Lucas, Kelly L.
Lynk, Kenneth
Mann, Thomas
McCants, Carson
Miyazaki, Yusuke
Mooneyhan, David
Moreno-Casasola, Patricia
Nadal-Caraballo, Norberto
Naess, Arvid
Nagdee, Mohammed Rafik
Narine, Patrick
Nguyen, Anh
Oakley, Adrienne
Oellermann, Lawrence Keith
Ofo Numbere, Aroloye
Paine, Jeffrey G.
Pucino, Nicolas
Purandare, Jemma
Ramos, Carmela Cristhy
Restrepo, Juan C.
Rogers, Kerrylee
Rua, Alex F.
Ruangchuay, Rapeeporn Karaipoom
Ruiz-Martinez, Gabriel
Shah, Dharmendra
Sharples, Chris
Slattery, Michael Patrick
Song, Zhiyao
Stiros, Stathis C.
Swanson, Robert Lawrence
Tajul Baharuddin, Mohamad Faizal Bin
Tebbens, Sarah F.
Twomey, Niall
van Keulen, Mike
Walker, Ian J.
Waters, Jeffrey P.
Webb, Bret Maxwell
Widmer, Walter
Wright, Ian
Xharde, Regis
Xie, Zhenglei
Xu, Chunyang
Yu, Guo
Zhang, Wei
Zhang, Xueqing
Zhao, Zhongwei

CERF MEMBERS

Abi-Ghanem, Carine
Abogado, María Teresa
Aboobacker Mamun, Basil
Adams, Peter
Adegbie, Adesina
Adomat, Friederike
Ahmed, Mostafa
Ahrendt, Kai
Aiello, Antonello
Akgul, Mehmet
Alcantara-Carrio, Javier
Allan, Jonathan
Almar, Rafael
Alves, Bruna
Amarjouf, Najat
Amini, Farshad
Amos, Carl
Anderson, Agnes
Anderson, Tiffany
Anfuso, Giorgio
Angnuureng, Donatus
Anselme, Brice
Anthony, Edward
Antunes Do Carmo, Jose
Aragones, Luis
Aramuge, Aderito
Aranguena, Edorta A.
Araújo, Maria Amélia
Arechiga, Jorge
Arena, Felice
Arens, Bas
Armbruster, Charles
Armono, Haryo
Arntsen, Oivind
Atkins, Rowland
Aucoin, Francis
Augustinus, Pieter
Azuz-adeath, Isaac Andres
Baas, Andreas
Bae, Jae Seok
Baeteman, Cecile
Baganha Baptista, Paulo
Balouin, Yann
Banks, Ken
Bao, Kunshan
Baptista Baganha
Barbaro, Giuseppe
Barboza, Eduardo
Barnard, Patrick
Barnett, Joel
Barnhardt, Walter
Barreiros, Joao
Barreto, Maritza
Barut, Ipek
Batayneh, Awni
Battiau, Yvonne
Baye, Peter
Bayram, Bulent
Beal, Irina
Beck, Tanya M.
Belknap, Daniel
Benavente, Javier
Benedet Filho, Lindino
Bernasconi, Maria
Berry, Ashton
Betard, Francois
Bethel, Matthew
Biljili, Ata
Billy, Julie
Birch, Gavin
Bittencourt, Abilio
Bologna, Paul
Bonetti, Jarbas
Boon, John
Boothroyd, Jon
Bouchette, Frédéric
Brander, Rob
Brill, Dominik M.
Brook, Adam
Brooke, Brendan
Brown, Alyson
Bruno, Maria Francesca
Brutsche, Katherine
Buenfil-lopez, Luis
Bugajny, Natalia
Bui, Trong Vinh
Burningham, Helene
Bush, David
Buynevich, Ilya
Byrne, Mary-Louise
Byrnes, Mark
Cahoon, Lawrence B.
Calado, Helena
Campbell, Foster Josef
Campbell, Thomas J.
Cannizzaro, Jennifer
Carbajal, Noel
Carle, Melissa
Carobene, Luigi
Carrasco, Ana Rita
Carter, Gregory A.
Carvalho da Silva, André L.
Casares-Salazar, Rafael
Castelle, Bruno
Cattani, Pamela
Caudle, Tiffany
Caufield, Brian Andrew
Cearreta, Alejandro
Celso, Felix
Certain, Raphael
Chandramohan, P.
Chao, Min
Chapalain, Georges
Charlier, Roger H.
Chaumillion, Eric
Chen, Guan-yu
Chen, Jianfang
Chen, Jianyu
Cheng, Jun
Cheng, Yan
Chevalier, Cristele
Childs, Jayson
Cho, Yong-Sik
Choi, Byung Ho
Chrystal, Clinton
Chua, Vivien
Chun, Hwusub
Chun, Insik

Continued on Next Page

Cienfuegos, Rodrigo
Clara, Moira
Claudino-Sales, Vanda
Cline, Marie
Coch, Nicholas K.
Cohn, Nicholas
Concejo, Ana Vila
Conley, Daniel C.
Cooper, J. Andrew
Cornejo Ortega, Jose Luis
Cornwell, Jeffrey
Crowell, Mark
Cuadrado, Diana G.
Cuc, Nguyen
Currin, Carolyn
D'Sa, Eurico
da Silva Dias, Francisco
da Silva, Anderson
da Silva, Andre
Dahm, Jim
Dai, Heng Non
Dai, Peng
Dai, Zhijun
Dally, William
Davidson-Arnott, R.
Davis, Richard Albert
Day, John
de Andrade, Luciana
de Assis Machado, Raquel
De Falco, Giovanni
de Jager, Alfred
de Lacerda, Luiz Drude
de Lange, W.P.
De Muro, Sandro
de Oliveira, Anabela P.
de Sousa Felix, Rosigleyse C.
Defeo, Omar
Delgado-Fernandez, Irene
Delpesh, Charmaine O'brien
Dentale, Fabio
Deo, M.C.
Dethier, Megan
Dias, Gilberto
Dias, João Miguel
Diaz-Sanchez, Roberto
Dickson, Stephen
Diez, J. Javier
Dionne, Jean-Claude
Do, Duc Minh
Donnangelo, Alejandro
Donoghue, Joseph
Dornbusch, Uwe
Douglass, Scott
Doyle, Alister
Doyle, Thomas
Duce, Stephanie
Duclos, Pierre-Arnud
Dudzinska-Nowak, Joanna
Dusek, Gregory
Dzwonkowski, Brian
Eakins, Barry
Echeverria, Carlos
Ehrlich, Üllas
El-Asmar, Hesham
Eliot, Ian
Ellis, Jean T.
Elwany, Hany
Ennis, Brad
Ericksen, Marc
Escobar, Carlos
Esteban, M. Dolores
Esteves, Luciana
Etienne, Samuel
Evans, Graham
Everts, Craig
Ewing, Lesley
Ezer, Tal
Fang, Kezhao
Farrell, Stewart
Feagin, Rusty
Ferentinou, Maria
Ferina, Nicholas
Fernandes, Marcus
Ferreira, Maria Adelaide
Ferreira, Oscar Manuel
Finkl, Charles W.
Fitchen, William M.
FitzGerald, Duncan
Fitzgerald, Tom
Flampouris, Stylianos
Fletcher, Charles
Flores Montes, Manuel
Fortunato, André
Frederickson, Erlend
Freedman, Janet
Freeman, Angelina
Friedrichs, Carl
Froede, Carl
Fuentenebro, Maria
Funderburk, William
Furmanczyk, Kazimierz
Gale, Emma
Gallego-Fernandez, Juan B.
Gao, Shu
Geiman, Joseph
Gelinas, Morgan
Georgiou, Ioannis
Ghandour, Ibrahim
Giese, Graham
Glick, Patty
Goble, Bronwyn
Godinez-Orta, Lucio
Gomez, Rocio Carrero
Gong, Zheng
Gontz, Allen M.
Gonzalez Leija, Mariana Berenice
Gonzalez-Alvarez, Sergio
Gonzalez-Zamorano, Patricia
Gonzalo, Malvarez Garcia
Goodman, Patricia
Goodwin, Ian David
Gopaul, Nazeer
Gornitz, Vivien
Gorokhovich, Yuri
Granja, Helena Maria
Green, Andrew
Griggs, Gary
Grover, Robert
Guastella, Lisa
Guedes Soares, Carlos
Gundlach, Erich
Guy, Donald
Guzman, Emanuel
Ha, Taemin
Haas, Kevin
Hale, Rachel

Continued on Next Page

Halsey, Susan D.
Haluska, James
Hanamgond, Pramod
Haney, Rebecca
Hanlon, Lynda Michelle
Hansen, Jens Morten
Hanslow, David
Hanson, Hans
Hardaway, C. Scott
Harman, Ben
Harris, Michael
Hart, Deirdre
Hartwell, S. Ian
Haslett, Simon
Hatcher, Bruce
Hegde, A. Vittal
Hegde, Venkatraman S.
Hegge, Bruce John
Heilman, Daniel
Henderson, Gina
Hennecke, Werner
Henry, Kelly
Hester, Mark
Hill, Douglas
Hilton, Mike
Ho, Chung-Ru
Hoagland, Porter
Hobbs III, Carl H.
Hoekstra, Piet
Holgate, Simon
Hoonhout, Bas
Horn, Diane
Horsburgh, Kevin
Hosier, Paul E.
Houston, James R.
Hsu, Tai-Wen
Hsu, Yulun
Hu, Jiauyu
Huang, Wenrui
Huang, Zhenhua H.
Huff, Robert
Hughes, Michael
Huisman, Bastiaan
Hunt, Trent
Hwang, Jin H.
Hwang, Sun-Wan
Ibba, Angelo
Iida, Tatsuki
Isla, Federico
Jackson, Nancy L.
Jarmalavicius, Darius
Jena, Basanta
Jeng, Dong-Sheng
Jensen, Jesper
Jenson, John
Jewell, Kim
Jewell, Laura
Jian, Shuguang
Johnson, David
Johnson, Markes
Johnsson, Mark
Jolicoeur, Serge
Jones, Christopher
Jones, Rebekah
Jordan, Elizabeth Jean
Judd, Frank
Jugwanth, Samista
Kabiling, Mike
Kabuth, Alina
Kaempf, Jochen
Kaiser, Mona
Kaminsky, George
Kana, Timothy
Kang, Jeongwon
Karimpour, Arash
Kaszubowski, Leszek
Kearney, Michael S.
Keen, Timothy
Kelletat, Dieter
Kelley, Joseph
Kelly, Christopher
Kelly, Sean
Kench, Paul
Kennedy, David
Kenov, Isabella
Kerans, Andrew James
Keyers, Jessica
Kidder, George
Kim, Chang S.
Kim, Choong-Ki
Kim, Dongseon
Kim, Kyeong Ok
Kim, Kyuhan
Kindinger, Jack L.
Kjerfve, Bjorn
Kizhisseri, Abdulla Sharief
Klemas, Victor
Knight, Jasper
Kobayashi, N.
Kocum, Esra
Koftis, Theoharris
Kokot, Roberto Roque
Kolahdoozan, Morteza
Kolerski, Tomasz
Komar, Paul D.
Kong, Jun
Kont, Are
Kosmynin, Vladimir
Kovacs, John
Kowalski, Joseph Lawrence
Krestenitis, Yannis N.
Kriebel, David L.
Kuang, Cuiping
Kumar, P.K.
Kure, Shuichi
Kusdua, Tetsuya
Kwarteng, Andy Yaw
La Peyre, Megan
Laakkonen, Katie
Laboyrie, Kurt
Labuz, Tomasz
Lace, Michael
Laibi, Raoul
Lakhan, V. Chris
Lally, John
Lam, Nina
Lane, Hillary
Lapine, Chris
Larnier, Stanislas
Lathrop, Richard
Latif, Shahid
Lau, Anthony
Leadon, Mark
Leatherman, Stephen
Lee, Hee
Lee, Jun-Whan

Continued on Next Page

Lee, Tae-Won
Lees, Dennis
Lefebvre, Jean-Pierre
Legare, Bryan
Lemckert, Charles
Lencart e Silva, João
Levoy, Franck
Lewis, Matt
Lewis, Roy
Li, Jin
Li, Linjuan
Liang, Bingchen
Liang, Shin-Jye
Liang, Shuxiu
Lim, Hak-Soo
Lin, Haijiang
Lin, Tsung-Yi
Linder, B. Lee
Linhoss, Anna
Lisimenka, Aliaksandr
Lisle, Lorance Dix
List, Jeffrey
Little, David Irving
Little, Mimely
Liu, James
Liu, Kam-biu
Liu, Sen
Liu, Yue
Lonard, Robert
Long, Jordan
Long, Joshua
Lonyszyn, Przemyslaw
Lopes Alves, Fátima
Lopes, Carina
López Gutiérrez, Jose S.
López, Gloria
Losada Rodriguez, Miguel
Louda, J. William
Loureiro, Carlos
Loveson, Victor
Lucas, Kelly L.
Lucrezi, Serena
Luijendijk, Arjen
Lychagin, Mikhail
Lynk, Kenneth
Magarotto, Mateus
Mahgoub, Mohamed
Mahiques, Michel
Maio, Christopher
Makowski, Christopher
Malan, Niel
Malvarez Garcia, Gonzalo
Mann, Thomas
Mano, Akira
Marchese, Christian
Marcomini, Silvia
Markull, Katrin
Marques, Joana
Marrack, Lisa
Martinez Diaz de Leon, Asdrubal
Martinez Flores, Guillermo
Martinez, Maria
Martins, Ana
Martivs, Maria
Mason, Owen
Mateo, Zenon
Matias, Ana
Mattheus, Robin
Mawdsley, Robert
Mazaheri, Said
McBride, Randolph Alexander
McCants, Carson
McCorquodale, Alex
McDowell Peek, Katie
McKenna, Kimberly K.
McLaren, Patrick
Medellin, Gabriela
Medina-Gomez, Israel
Medina, Raul
Mehta, Ashish
Mendelssohn, Irving
Mendoza-Gonzalez, Gaby
Messaros, Roy
Meyer-Arendt, Klaus
Miles, Jon
Miller, Deborah
Miller, Eric
Miller, Ian
Mimura, Nobuo
Min, Jee-Eun
Miossec, Alain
Miyazaki, Yusuke
Monge, Jackie
Montefalcone, Monica
Monteiro, Marcos
Mooneyhan, David
Moore, Gregg
Moran, Kelli
Moreland, Kimber
Moreno-Casasola, Patricia Barcelo
Moskalski, Susanne
Mozley, Edward
Mull, Jeremy
Munoz-Perez, Juan
Murakoshi, Naomi
Murdukhayeva, Angelica
Murillo, Elizabeth Marie
Murray, A. Brad
Murren, Courtney
Nadal-Caraballo, Norberto
Naess, Arvid
Nagdee, Mohammed Rafik
Naidu, V.S.
Naquin, James
Narine, Patrick
Nava-Sanchez, Enrique
Navas Concha, Fatima
Neal, William J.
Needelman, Brian
Negro, Vicente
Nettles, N.S.
Neumeier, Urs
Neves, Claudio F.
Nguyen, Anh
Nicholls, Robert J.
Nicolas, Robin
Nordstrom, Karl
November, Eben
Numanoglu, Genc Asli
Nunes Barboza, Conceicao
Nunes da Rocha, Saulo M.
O'brien Delpesh, Charmaine
O'Shea, Michael
Oakley, Adrienne Jean
Oakley, Brian
Oakley, Bryan

Continued on Next Page

Obeysekera, Jayantha
Obiefuna, Jerry
Oellermann, Lawrence Keith
Ofo Numbere, Aroloye
Oh, Sang-Ho
Olea, Richardo
Ollerhead, Jeff
Olsen, Erik
Oltman-Shay, Joan
Orford, Julian
Ortiz, Juan
Osborne, Philip
Oseji, Ozuem
Ozturk, Derya
Paine, Jeffrey G.
Palalane, Jaime
Paquier, Anne-Eleonore
Park, Heung-Sik
Park, Kyeong
Parker, Hugh
Parks, David
Parnell, Kevin
Pattiaratchi, C.B.
Paulsen, Manfred
Pavlidou, Alexandra
Pechsiri, Joseph
Pelinovsky, Efim
Pereira da Silva, Carlos
Pereira, Luci
Perez, Carlos
Peterson, Curt D.
Phillips, Mike
Pierce, Aaron
Pilkey, Orrin
Pinet, Paul R.
Pintado, Emilia
Pinto, Josep
Pirazzoli, Paolo
Pivovaroff, Alex
Plecha, Sandra
Poate, Timothy
Pokavanich, Tanuspong
Pons, Frank
Pousa, Jorge
Pranzini, Enzo
Psuty, Norbert
Pucino, Nicolas
Pupienis, Donatus
Purandare, Jemma
Pye, Kenneth
Quan, Steven
Quigg, Antonietta
Radermacher, Max
Radtke, Ulrich
Rahman, Saeed
Rahn, Jennifer
Ramos, Carmela Cristhy
Ramsay, P.J.
Ramsey III, Elijah
Randazzo, Giovanni
Rangger, Helmut
Reid, Sergey
Ren, Hai
Renato, Paulo
Resio, Don
Restrepo, Juan C.
Richards, Russell
Riksen, Michel
Ritphring, Sompratana
Ritter, Erich
Ro, Young Jae
Roberts, H.H.
Robertson, John
Robertson, William
Rogers, Kerrylee
Romeu, Marco
Rosen, Peter
Rossi-Santos, Marcos
Rua, Alex F.
Ruangchuay, Rapeeporn Karaipoom
Rusenko, Kirt
Russell, Barbara
Ryan, Emma Jean
Saito, Yoshiki
Saitoh, Takehisa
Salmon, Michael
Salzmann, Leslee
Sander, Lasse
Sanders, Brett
Sas, Marc
Savoya, Veronica
Scheffers, Anja Maria
Schembri, Patrick
Schiller, Rafael
Schmid, Keil
Schwab, William
Schwartz, Maurice
Schwarzer, Klaus
Scott, Timothy
Sealey, Kathleen
Seidle, Peter
Sembiring, Leo
Semeniuk, Vic
Senechal, Nadia
Serra-Raventos, Jordi
Sexton, Walter J.
Shaffer, Anne
Shah, Dharmendra
Shahrizal, Ab Razak Mohd
Sharples, Chris
Shaw, Charles
Sherman, Douglas
Sherman, Heidi
Shih, Ruey-Syan
Shim, Jae-Seol
Shin, Sungwon
Shipman, Hugh
Short, Andrew
Shrestha, Pravi
Silva Gomes, Raimunda K.
Silva, Juliana
Silva, Rodolfo
Simeone, Simone
Simpson, David
Sinclair, Alex
Slattery, Michael Patrick
Slaymaker, David
Slim, Pieter
Slinger, Jill
Smith, Alan
Smith, Ernest
Solari, Sebastian
Sommerfield, Christopher
Song, Zhiyao
Souza Filho, Jose R.
Souza, Alejandro

Continued on Next Page

Spencer, Tom
Spetter, Carla
Sposato, Patricia
Staiger, Jon C.
Stanley, Jean-Daniel
Steichen, Jamie
Stewart, William
Stiros, Stathis C.
Stive, Marcel
Stokes, Christopher
Stotz, Wolfgang
Styles, Richard
Suastika, Ketut
Suh, Kyung-duck
Suh, SeungWon
Sundar, Vallam
Sutherland, Michael
Suursaar, Ülo
Swanson, Larry
Swanson, Robert Lawrence
Switzer, Adam
Szefler, Kazimierz
Szeglin, Arthur
Tajul Baharuddin, Mohamad Faizal Bin
Talke, Stefan
Tanski, J.
Tatui, Florin
Taylor, Eleonor
Tebbens, Sarah F.
Terchunian, Aram
Terefenko, Pawel
Thibault, Charles Henry
Thieler, Robert E.
Thorner, Jaqueline
Thorpe, Antony
Tomás, Luís Miguel
Tomlinson, Rodger
Tong, Chuan
Tõnisson, Hannes
Torio, Dante
Trembanis, Arthur
Tseng, Yung
Tsujimoto, Gozo
Tuan, Do Anh
Tuominen, Jyrki
Turner, Eugene R.
Turpie, Kevin
Twomey, Niall
Underwood, Steve
Vacchi, Matteo
van der Meulen, Frank
van der Valk, L.
van Dijk, Deanna
van Dongeren, Albertus
van Heteren, Sytze
van Keulen, Mike
van Wellen, Erik
Varnell, Lyle
Vaz, Nuno
Vella, Godfrey
Venekey, Virag
Verville, Jean-François
Vespremeanu-Stroe, Alfred
Vicinanza, Diego
Villagran, Mauricio
Vilumaa, Kadri
Vollmer, Heather
Walker, Cameron
Walker, Ian J.
Walker, Simon
Wallace, Davin
Walter, Scott
Walther, Michael
Wang, Fu
Wang, Jian-hua
Wang, Jieyong
Wang, Ke
Wang, Ping
Wang, Ya Ping
Wang, Ying
Wang, Zongming
Ward, Larry
Warren, Richard E.
Waters, Jeffrey P.
Watson, Phil
Webb, Bret Maxwell
Weir, Adam
Weishar, Lee
Wells, John
Wetzelhuetter, Chris
Weymer, Bradley
White, John
Widmer, Walter
Williams, Allan Thomas
Williams, Harry
Windom, Herb
Wolters, Michel
Woodroffe, C.D.
Woodworth, Philip
Woolard, Liza
Wootton, Louise
Wright, Eric
Wright, Ian
Wu, Jia-Ping
Wu, Weiming
Wynja, Valerie
Xharde, Regis
Xie, Zhenglei
Xu, Chunyang
Xu, Yan
Yang, Qingxuan
Yao, Yu
Ye, Ming
Yokoyama, Katsuhide
Yoshida, Jun
Young, Donald
Young, Robert S.
Yu, Guo
Yu, Tai-Yi
Zahid, Ahmed
Zalewski, Tomasz
Zavala-Hidalgo, Jorge
Zhan, Jie-min
Zhang, Keqi
Zhang, Peidong
Zhang, Wei
Zhang, Xueqing
Zhang, Zhihong
Zhao, Zhongwei
Zhu, Jianrong

JCR Outside Reviewers 2015

The outside reviewers of the *Journal of Coastal Research* (JCR) have generously donated their time to conduct the review process, which includes the thorough evaluation of manuscripts by providing comments and recommendations to the Editor-in-Chief concerning the ultimate disposition of submitted material. Because we frequently receive reviews from specialists outside of our own Editorial Board, we acknowledge with thanks the following reviewers who have vetted papers submitted to the JCR. Their interest and cooperation are much appreciated.

Acosta-Velázquez, Joanna, CONABIO, Mexico Akter, Jakia, UNESCO-IHE, Netherlands
Alagan Chella, Mayilvahanan, Norwegian University of Science and Technology, Norway
Albrecht, Frauke, Universidad de Concepcion, Chile
Alcantara-Carrio, Javier, Universidad Catolica de Valencia, Spain
Alfredini, Paolo, Universidade de Sao Paulo, Brazil
Alkire, Abby Lynn, University of South Carolina, United States
Almeida, Diana Neves de, Institute of Geopraphy and Spatial Planning, Portugal
Alonso, Guadalupe, Servicio de Hidrografía Naval, Argentina
Alvarez, Reviewer, IMPA, Brazil
Alves Martins, Maria Virginia, Universidade de Aveiro, Portugal
Anderas, Lars, University of Massachusetts–Boston, United States
Anfuso, Giorgio, University of Cadiz, Spain
Antunes do Carmo, José Simão, IMAR–University of Coimbra, Portugal
Aquino da Silva, Andre Giskard, Christian Albrechts Universität zu Kiel, Germany
Aragone´s, Luis, University of Alicante, Spain
Araújo, Maria Assunção, Univ. Oporto, Portugal
Arena, Felice, Mediterranea University, Italy
Ashraf, P Muhamed, Central Institute of Fisheries Technology, India
Bagheri, Milad, Universiti Putra Malaysia (UPM), Malaysia
Baker, Robert G.V., University of New England, Australia
Balzano, Andrea, University of Cagliari, Italy
Banks, Kenneth, Broward Environmental Protection and Growth Management Dept., United States
Barbirato, Juliano, Universidade Vila Velha, Brazil
Barboza, Conceiçáo Denise Nunes, Universidade Federal Fluminense, Brazil
Barkovskii, Andrei L., Georgia College and State University, United States
Barman, Nilay Kanti, Hijli College (Vidyasagar University), India
Bassi, Davide, Universita degli Studi di Ferrara, Italy
Beaugrand, Hawley, University of Victoria, Canada
Benedet, Lindino, Coastal Planning & Engineering, United States
Bernasconi, Maria Pia, University of Calabria, Italy
Berry, Ashton James, University of the Sunshine Coast, Australia
Bi, Xiaoli, Yantai Institute of Coastal Zone Research, China
Bokuniewicz, Henry J., Stony Brook University, United States
Bologna, Paul, Montclair State University, United States
Boon, John, Virginia Institute of Marine Science, United States
Borrelli, Mark, Provincetown Center for Coastal Studies, United States
Bozzeda, Fabio, Universita del Salento, Italy
Broussard, Whitney, University of Louisiana at Lafayette, United States
Browne, Nicola, James Cook University, Australia
Bruno, Daniel, Centro Austral de Investigaciones Científicas (CADIC- CONICET), Argentina
Bruno, Regina Lucia Machado, Universidade Federal do Rio Grande do Sul, Brazil
Buenfil-Lopez, Luis Antonio, Instituto Politecnico Nacional, Mexico
Burley, David M., Southeastern Louisiana University, United States
Cajueiro Carneiro Pereira, Luci, Universidade Federal do Pará–Brasil, Brazil
Cala, Yuself, ECOSUR, Mexico
CAO, Yuguang, China University of Petroleum Huadong, China
Cao, Haijin, Hohai University, China
Cappietti, Lorenzo, University of Florence, Italy
Carbajal, Noel, Instituto Potosino de Investigacio´n Científica y Tecnologica, Mexico
Carelli Fontes, Roberto Fioravanti, Universidade Estadual Paulista, Brazil
Carneiro, Juliane, Federal University of Paraná, Brazil
Carson, Mike, Australian National University, Australia
Castedo Ruiz, Ricardo, School of Mines (UPM), Spain
Castelle, Bruno, Universite´ Bordeaux I, France
Castillo, Jesus, University of Seville, Spain
Cavalcante, Geórgenes Hilário, Federal University of Alagoas, Brazil
Chen, Qingqiang, East China Normal University, China
Chen, Jianyu, Second Institute of Oceanography, State Oceanic Administration, China
Chen, Jian-fang, Second Institute of Oceanography, State Oceanic Administration, China
Chen, Guang Cheng, Third Institute of Oceanography, State Oceanic Administration, China
Chen, Luzhen, Xiamen University, China Cheng, Hong, Beijing Normal University, China
Cheng, Yongcun, Center for Coastal Physical Oceanography, United States
Cheng, Jun, University of South Florida, United States
Cheung, Zhenwei, Island Research Center, S.O.A., China
Cho, Yong-Sik, Hanynag University, Republic of Korea
Choi, Byung Ho, Sungkyunkwan Univeristy, Republic of Korea
Chun, Hwusub, Samsung Electronics, Republic of Korea
Ciesliński, Roman, University of Gdańsk, Poland
Coleman, Richard, University of Tasmania, Australia
Coles, Neil, University of Western Australia, Australia

Continued on Next Page

JCR Outside Reviewers 2015

Cosentino, Claudia, Universitádegli Studi di Palermo, Italy
Czitrom, Steven Peter, Universidad Nacional Auto´noma de México, Mexico
Dai, Zhijun, East China Normal University, China
dai, heng, Florida State University, United States
Daneshgar, Pedram Patrick, Monmouth University, United States
de Jager, Alfred, Joint Research Centre of the European Commission, Italy
de Jesus Flores, Manuel, Federal University of Pernambuco, Brazil
De La Vega-Leinert, Anne Cristina, Ernst-Moritz-Arndt University Greifswald, Germany
de Moura MONTEIRO, SURY, Universidade Federal do Para, Brazil
de Oliveira Torquato, Felipe, Universidade Federal do Rio Grande, Brazil
de Sá Guerreiro, Juliana, Universidade Federal do Pará , Brazil
De Serio, Francesca, Technical University of Bari, Italy Defeo, Omar, Facultad de Ciencias, Uruguay
Dellapenna, Timothy Michael, Texas A&M University at Galveston, United States
den Bieman, Joost, Deltares, Netherlands
Dengen, Nataniel, Mulawarman University, Indonesia
Dentale, Fabio, MEDUS–Maritime Engineering Division University of Salerno, Italy
Di Martino, Vincenzo, Consiglio Nazionale delle Ricerche / National Research Counsil, Italy
Dias Loureiro, Daniel, Universidade Federal Fluminense, Brazil
Díez-Minguito, Manuel, University of Granada, Spain
Dong, Sheng, College of Engineering, Ocean University of China, China
Donoghue, Joseph F., University of Central Florida, United States
Dvarioniene, Jolanta, Kaunas University of technology, Lithuania
Echeverría, Carlos Alejandro, Universidade Federal do Rio de Janeiro, Brazil
Elwany, Hany, Scripps Institution of Oceanography, United States
Emerich Souza, Priscila, Universidade Federal do Rio Grande, Brazil
Ergul, Halim Aytekin, Kocaeli University, Turkey
Esteban, M Dolores, UPM, Spain
Esteves, Luciana, London Metropolitan University, United Kingdom
Eulie, Devon, University of North Carolina at Wilmington, United States
Ezell, John, University of Florida, United States
Ezer, Tal, Old Dominion University, United States
Farris, Monica T., University of New Orleans, United States
Farris, Emmanuele, University of Sassari, Italy
Feng, Xingru, Chinese academy of sciences, China
Ferreira, Oscar, Universidade do Algarve, Portugal
Filippo, Alessandro, Universidade do Estado do Rio de Janeiro, Brazil
FitzGerald, Duncan M., Boston University, United States
Flampouris, Stylianos, University of Southern Mississippi, United States
Foley, Mary, National Park Service, United States
Franca, Marlon, Federal Institute of Para, Brazil
Funderburk, William Richard, University of Southern Mississippi, United States
Furmanczyk, Kazimierz Konrad, University of Szczecin, Institute of Marine and Coastal Sciences, Poland
Furukawa, Yoko, Naval Research Laboratory, United States
Gandara Martins, Ana Luiza, Universidade Federal do Paraná, Brazil
Gao, Shu, Nanjing University, China
Gao, Li, Gannett Fleming, Inc., United States
Gevaña, Dixon, College of Forestry and Natural Resources, Philippines
GHIONIS, GEORGE, University of Athens, Greece
Gomes, Moab, Universidade Federal do Rio Grande do Norte, Brazil
Gong, Zheng, Hohai University, China
Gontz, Allen M., University of Massachusetts–Boston, United States
Gorokhovich, Yuri, Lehman College, CUNY, United States
GOUDA, Krushna Chandra, CSIR C-MMACS, India
Gracia, Francisco Javier, University of Cadiz, Spain
Green, David Richard, University of Aberdeen, United Kingdom
Gúnes, Aslı, Egean University Bayındır Vocational Training School, Turkey
Guerra-Santos, Jesús, Universidad Autónoma del Carmen, Mexico
Guillou, Nicolas, CETMEF, France
Guimarães, Pedro, Federal University of Rio Grande do Sul, Brazil
Guimarães Barboza, Eduardo, Universidade Federal do Rio Grande do Sul, Brazil
Guo, Jie, Yantai Institute of Coastal Zone Research, Chinese Academy of Sciences, China
Gurdek, Rodrigo, Institute of Ecology and Environmental Sciences, Uruguay
Hagy, James, U.S. EPA, United States
Hampson, Robert, Moffatt and Nichol, United States
Hapke, Cheryl, U.S. Geological Survey, United States
Hardaway, Caswell Scott, Virginia Institute of Marine Science, United States
Harff, Jan, Baltic Sea Research Institute, Germany
Harith, Hadzley, Fisheries Research Institute, Malaysia
Hatcher, Scott Vincent, Memorial University, Canada
Heller, Valentin, The University of Nottingham, United Kingdom
Hernández Cordero, Antonio Ignacio, Universidad de Las Palmas de GC, Spain
Hernández-Walls, Rafael, UABC, Mexico
Hesp, Patrick Allan, Flinders University, Australia
Hill, David, Oregon State University, United States
Hoang, Tin Cong, Curtin University, Australia
Houston, James R., Engineer Research and Development Center, United States
Hsu, Yulun, Fo Guang University, Taiwan
Hu, Xiaozhou, Central South University, China
Hu, Kelin, Louisiana State University, United States Hua, JIANG, Shaoguan University, China
Huang, Wenrui, FAMU-FSU College of Engineering, United States
Huang, Wei Po, National Taiwan Ocean Univ., Taiwan
Huang, Xiao, University of California Irvine, United States
Huang, Zhenhua, University of Hawaii at Manoa, United States
Hubbard, Dennis, Oberlin College, United States
Huiru, Ren, Institute of Geographic Sciences and Natural Resources Research, China
Hunt, Melody, South Carolina Sea Grant Consortium, United States
Ismail, Zubaidah, University of Malaya, Malaysia
Jeng, Dong-Sheng, Griffith University, Australia
Jeong, Kwang Young, Korea Hydrogarphic and Oceanographic Administration, Republic of Korea
Jingtao, Liu, Binzhou University, China
Jose da Silva Dias, Francisco, Universidade Federal do Ceará , Brazil
Judd, Frank Wayne, University of Texas-Pan American, United States
K R, Renjith, Cochin University of Science and Technology, India
Kamath, Arun, Norges Teknisk-Naturvitenskapelige Universitet, Norway
Kandasamy, Kathiresan, Annamalai University, India
Katz, Rachel, University of Massachusetts Amherst, United States

Continued on Next Page

Kazmer, Miklos, Eotvos University, Hungary
Kearney, Michael S., University of Maryland, United States
Kelletat, Dieter Hanns, University of Duisburg–Essen, Germany
Kelpsaite, Loreta, Klaipeda University, Lithuania
Kempema, Edward, University of Wyoming, United States
Kidd, Ian, University of Tasmania, Australia
Kim, Kyeong Ok, Korea Institute of Ocean Science & Technology, Republic of Korea
Koftis, Theoharris, Aristotle University of Thessaloniki, Greece
Kolerski, Tomasz, Gdansk University of Technology, Poland
Kolker, Alexander Samuel, Louisiana Universities Marine Consortium, United States
Kon, Koetsu, University of Tsukuba, Japan
Kong, Jun, Hohai University, China
Kopa-Ovdienko, Nikita, Zubov's State Oceanographic Institute, Russian Federation
Koutandos, Evangelos, Hellenic Center for Marine Research, Greece
LaBarbiera, Carolyn Marie, Duke University, United States
Landi, Marco, University of Siena, Italy
Larroude, Philippe, University Joseph Fourier of Grenoble, France
Lee, Woo-Dong, Gyeongsang National University, Republic of Korea
Lee, Guan-Hong, Inha University, Democratic People's Republic of Korea
Lees, Dennis Cody, Littoral Ecological & Environmental Services, United States
Lewis, Matt, Bangor University, United Kingdom
Li, Yi, Marine Infrastructure Dynamics Corp., Canada Li, Jianguo, Nanjing University, China
Liang, Bingchen, Ocean University of China, China
liang, shuxiu, State Key Lab. of Coastal and Offshore Eng., China
Liang, Shin-Jye, The National Taiwan Ocean University, Taiwan
Lim, Hwee-San, Universiti Sains Malaysia, Malaysia
Little, David Irving, David. I. Little (MA, PhD) Limited, United Kingdom
Liu, Jian, Chinese Academy of Sciences, China
Liu, Rongjie, First Institute of Oceanography, SOA, China Liu, Yongxue, Nanjing University, China
Liu, Wen-Cheng, National United University, Taiwan, Province Of China
Liu, Feng, Sun Yat-Sen University, China
Liu, Changgen, Tianjin University, China
Liu, Mingxiao, North China University, China
Lobo, Francisco Jose´, CSIC, Spain
Lonard, Robert, University of Texas Rio Grande Valley, United States
Longhitano, Sergio Giuseppe, Basilicata University, Italy
Lopes Paiva, Mariele, Universidade Federal do Rio Grande, Brazil
Losada Rodr´ıguez, Miguel Angel, Universidad de Granada, Spain
Lu, Qingshui, CAS, China
Lu, Yu, Harbin Engineering University, China
Lucas, Kelly, Mississippi Department of Marine Resources, United States
Lucrezi, Serena, North-West University, South Africa
Luiz Mattos Laut, Lazaro, Universidade Federal do Estado do Rio de Janeiro– UNIRIO, Brazil
Makarynskyy, Oleg, URS Australia, Australia
Makowski, Chris, Coastal Education & Research Foundation, United States
Malvarez, Gonzalo C., Universidad de Sevilla, UPO, Spain
Mann, Thomas, Leibniz Center for Tropical Marine Ecology (ZMT) GmbH, Germany
Mariotti, Giulio, Louisiana State University, United States Marrack, Lisa, UC Berkeley, United States
Marshburn, Ernest Guy, East Carolina University, United States
Marteleira, Rita, Instituto Superior Técnico–Universidade de Lisboa, Portugal
Masciadri, Silvana, Universidade Federal Rio Grande Do Norte, Brazil
Maskell, John, National Oceanography Centre, United Kingdom
Mastronuzzi, Giuseppe, Universita degli Studi di Bari Aldo Moro, Italy
Mathara Arachchi, Samanmali, University of Colombo, Sri Lanka
McIlvenny, Jason, University of the Highlands and Islands; North highland College, United Kingdom
McLaren, Patrick, SedTrend Analysis Limited, Canada
Medina-Gómez, Israel, Cinvestav-IPN, Mexico
Mehta, Ashish J., Nutech Consultants, Inc., United States
Mendes Silveira, Tanya, Faculty of Sciences of the University of Lisbon, Portugal
Mendoza, Gabriela, Instituto de Ecología, Mexico
Mirlean, Nicolai, Federal University of Rio Grande, Brazil
Mo, Wenyuan, Center for Coastal Ocean Science and Technology, China
Montes Arechiga, Jorge Manuel, Centro de Investigación Cientíífica y de Educación Superior de Ensenada, BC, Mexico
Moore, Gregg Emery, University of New Hampshire, United States
Morang, Andrew, Engineer Research and Development Center, United States
Moskalski, Susanne, Stockton University, United States
Muñoz Vallés, Sara, Universidad de Sevilla, Spain
Munoz-Perez, Juan Jose, University of Cadiz, Spain
Murren, Courtney, College of Charleston, United States
Nadal-Caraballo, Norberto C., U.S. Army Corps of Engineers, United States
Nakaza, Eizo, Ryukyus University, Japan
Narayana, A. C, University of Hyderabad, India
Neumann, Barbara, Kiel University, Germany
Nguyen, Phong Tan, James Cook University, Australia
Niu, Lixia, Delft University of Technology, Netherlands
Nordstrom, Karl, Rutgers University, United States
Nunnally, Clifton Charles, University of Hawaii at Manoa, United States
Nurlu, Engin, Ege University Faculty of Agriculture, Turkey
Oakley, Bryan Andrew, Eastern Connecticut State University, United States
Ocaná Borrego, Frank Alberto, El Colegio de la Frontera Sur, Mexico
Ojeda, Elena, Universidad Nacional Autonoma de Mexico Instituto de Ingenieria, Mexico
Olin, Jill A., Stony Brook University, United States
Olmedo-Cobo, Jose´ Antonio, Universidad de Granada, Spain
Orford, Julian David, Queen's University Belfast, United Kingdom
Ortiz, Juan Carlos, Universidad del Norte, Colombia
Ortiz-Burgos, Selene, Facultad de Estudios Superiores Zaragoza, Universidad Nacional, Mexico
Oseji, Ozuem Frederick, University of Maryland Eastern Shore, United States
O'Shea, Michael, University College Cork, Ireland
Oyedotun, Temitope Dare Timothy, Adekunle Ajasin University, Nigeria
Ozgur Kirca, V.S., Istanbul Teknik Universitesi, Turkey
Palinkas, Cindy, University of Maryland Center for Environmental Science, United States
Pan, Yi, Hohai University, China
Pan, Jero´nimo, National University at Mar del Plata, Argentina
Park, Jae Hyun, Gyeongsang National University, Republic of Korea
Park, Young Hyun, Korea Institute of Ocean Science and Technology, Republic of Korea

Continued on Next Page

Perez, Carlos Daniel, Universidade Federal de Pernambuco–CAV, Brazil
Pérez-Castañeda, Roberto, Universidad Autonoma de Tamaulipas, Mexico
Perner, Kerstin, Leibniz Institute for Baltic Sea Research, Germany
Phillips, Michael Robert, Swansea Metropolitan University, United Kingdom
Piazza Meireles, Ricardo, Universidade Federal de Santa Catarina, Brazil
Pierce, Aaron, Nicholls State University, United States
Pierro, Thomas, Coastal Planning & Engineering, Inc., United States
Pilkey, Orrin H., Duke University, United States
Pinho, Jose´, Universidade do Minho, Portugal
Pomeroy, Andrew, The University of Western Australia, Australia
Postacchini, Matteo, Universitã` Politecnica delle Marche, Italy
Purba, Noir, Padjadjaran University, Indonesia
Quan, Steven, California State University, Monterey Bay, United States
Ramasamy, Manivanan, Central Water and Power Research Station, India
Ramsey, III, Elijah, U.S. Geological Survey, United States
Reale, Ferdinando, University of Salerno, Italy
Reis Gutierres, Francisco, Institute of Geography and Spatial Planning, Universidade de Lisboa, Portugal
Reis-Santos, Patrick, MARE–Marine and Environmental Sciences Centre, Portugal
Reo, Bianca Marie, University of Pennsylvania, United States
Reyes-Mendoza, Oscar, Centro de Investigacion y de Estudios Avanzados del Instituto Politecnico Nacional, Mexico
Ribeiro, Rannyele, Universidade Federal do Rio de Janeiro, Brazil
Ricklefs, Klaus, University of Kiel, Germany
Rincón, Jesú s, Consejo Superior de Investigaciones Cientificas, Spain
Ro, Young Jae, Chungnam National University, Republic of Korea
Roberts Briggs, Tiffany, Florida Atlantic University, United States
Robertson Parham, Peter, Universiti Malaysia Terengganu, Malaysia
Romine, Bradley, University of Hawaii Sea Grant College Program, United States
Rossi-Santos, Marcos, Tauassu Ambiental, Brazil
Rúa, Alex, Universidad de Antioquia, Colombia
Ruiz, Gabriel, Centro de Investigacion y de Estudios Avanzados, Mexico
Safak, Ilgar, United States Geological Survey, United States
Samaras, Achilleas, University of Bologna, Italy
Sanay, Rosario, Universidad Veracruzana, Mexico
Santhi Pechsiri, Joseph, Royal Institute of Technology (KTH), Sweden
Santoro, Pablo Esteban, Facultad de Ingeniería–Universidad de la República, Uruguay
Santos, Thuareag, Universidade Federal do Para, Brazil
Satkunas, Jonas, Lithuanian Geological Survey, Lithuania
Scanu, Sergio, Tuscia University, Italy
Schupp, Courtney, National Park Service, United States
Seelam, Jaya Kumar, National Institute of Oceanography, India
Shand, Tom, Tonkin & Taylor Ltd., New Zealand
Shaw, Charles, Centro Ecologico Akumal, Mexico
Shih, Ruey Syan, Tungnan University, Taiwan
Sílc, Urban, ZRC SAZU, Slovenia
Smith, Grant Alexander, Bureau of Meteorology, Australia
Smith, Stephen Michael, National Park Service, United States
Smith, Jordan, Utah State University, United States
Soares Santos-Filho, Francisco, Universidade Estadual do Piaui, Brazil
Solari, Luca, Universita degli Studi di Firenze, Italy
Sommerfield, Christopher, University of Delaware, United
States Song, Dehai, Ocean University of China, China
Soomere, Tarmo, Institute of Cybernetics at Tallinn University of Technology, Estonia
Souza, Sirius Oliveira, Universidade Estadual de Campinas, Brazil
Storlazzi, Curt, U.S. Geological Survey, United States
Sullivan Sealey, Kathleen, University of Miami, United States
Sun, Zhaochen, Dalian University of Technology, China
Taborda, Rui, Univ. Lisbon, Portugal
Tang, Yougang, Tianjin University, China Taramelli, Andrea, ISPRA, Italy
Tebbens, Sarah, Wright State University, United States
Teodoro, Ana Cláudia, Faculty of Science University of Porto, Portugal
Thieler, E. Robert, Coastal and Marine Geology Program, United States
Tong, Chuan, Fujian Normal University, China
Tónisson, Hannes, Institute of Ecology at Tallinn University, Estonia
Tudor, David, Pelagos Consulting, United Kingdom
Turner, R. Eugene, Louisiana State University, United States
Ullmann, Albin, Centre de Recherches de Climatologie, France
Uzaki, Ken-ichi, Port and Airport Research Institute, Japan
Vale, Claudia, Universidade Federal do Espírito Santo, Brazil
Vernon Carle, Melissa, NOAA, Marine Fisheries, United States
Vieira Pinheiro, Liliana, National Laboratory for Civil Engineering, Portugal
Vieira da Silva, Guilherme, Universidade Federal do Rio Grande do Sul, Brazil
Wadey, Matthew, University of Southampton, United Kingdom
Walker, Brian, Nova Southeastern University, United States
Wang, Wei, Chinese Academy of Sciences, China
Wang, Siyuan, Chinese Academy of Sciences, China
Wang, Hu, Ocean University of China, China
Wang, Xing, Ocean University of China, China
Wang, Ke, Remote Sensing and Information System Application, China
Wang, Changyou, School of Marine Sciences, China
Wang, Yan, State Key Laboratory of Coastal and Offshore Engineering, China
Wang, Hongqing, U.S. Geological Survey, United States
Warrick, Jonathan, U.S. Geological Survey, United States
Watson, Elizabeth Burke, CICESE, Mexico
Weaver, Robert, Florida Institute of Technology, United States
Webb, Bret, University of South Alabama, United States
Wheeler, Peter, Monash University, Australia
Williams, Amy, Texas A&M University, United States
Windom, Herbert, University of Georgia, United States
Wootton, Louise, Georgian Court University, United States
Wright, Ian, Christchurch City Council, New Zealand
Wright, L. Donelson, Southeastern Universities Research Association, United States
Wu, Meilin, Chinese Academy of Sciences, China
Wu, Wei, The University of Southern Mississippi, United States
Xia, Meng, University of Maryland Eastern Shore, United States
Xie, Lingling, Guangdong Ocean University, China
Xie, Mingxiao, Tianjin Research Institute for Water Transport Engineering, China

Continued on Next Page

Xu, Qing, Hohai University, China
Yang, Shi Lun, East China Normal University, China
Yao, Yu, Changsha University of Science & Technology, China
Yaukey, Peter, University of New Orleans, United States
Yi, Liang, First Institute of Oceanography, State Oceanic Administration, China
Yu, Guoliang, Shanghai Jiao Tong University, China
Yuan, Saiyu, Hohai University, China
Zhan, Jie-min, Sun Yat Sen University, China
Zhang, Yi, Altair Engineering, Inc., United States
Zhang, Wenyan, Institute of Physics, Germany
Zhang, Huaguo, Second Institute of Oceanography, China
Zheng, Jinhai, Hohai University, China
Zheng, chong wei, People's Liberation Army University of Science and Technology, China
Zhu, Jianrong, East China Normal University, China

The following list includes JCR outside reviewers that did not enter an affiliation into our peer review database. We strongly encourage all JCR outside reviewers to log into their account and fill in all professional affiliation information.

Amon, Rainer, United States
Andersen, Thorbjrn J., Denmark
Andó, Sergio, Italy
Andrade, Francisco, Portugal
Añonsen, Kjetil Bergh, Norway
Arias Gonzá lez, Jesús Ernesto, Mexico
Armynot du Châtelet, Eric, France
Ãvila, Sérgio, Portugal
Baecher, Greg, United States
Bagdanavićiuté, Ingrida, Lithuania
Bai, Junhong, China
Bao, Hongyan, China
Barbara, M., United Kingdom
Barnes, Brian, United States
Baustian, Joseph J., United States
Bendoni, Michele, Italy
Bennett, Abigail, United States
Bertin, Xavier, France
Blanco, Ramon, Spain
Bolinger, Rebecca, United States
Bonneton, Philippe, France
Borsje, Bas, Netherlands
Bowen, Robert, United States
Brander, Robert, Australia
Briggs, Roger, New Zealand
Browder, Al, United States
Burchell, Michael R., United States
Callies, Ulrich, Germany
Campos, Carlos J.A., United Kingdom
Capuzzo, Elisa, United Kingdom
Carrillo, Laura E., Mexico
Castro, Alberte, Spain
Catto, Norm, Canada
Cavalcante, Geórgenes H., Brazil
Cazenave, Anny, France
Chan, I-Chi, United Kingdom
Chau, K.W., Hong Kong
Chen, Jim, United States
Chen, Hao, China
Chu-Agor, Maria L., United States
Church, John, Australia
Clements, Kendal, New Zealand
Coelho, Carlos, Portugal
Collins, Tripp, United States
Convertino, Matteo, United States
Cordell, Jeff, United States
Cornell, Sean, United States
Correa, Ivan, Colombia
Costa-Mendes, Thiago, Brazil
Costas, Susana, Portugal
Cui, Baoshan, China
Dabees, Mohamed, United States
Danovaro, Roberto, Italy
Delaplaine, Mark, United States
Deligiorgi, Despina, Greece
Deng, Zhiqun, United States
Di Domenico, Maikon, Brazil
Dudzińska-Nowak, Joanna, Poland
Duque, Carlos, Norway
Ebersole, Bruce A., United States
Eliot, Ian, Australia
Emeis, Kay, Germany
Enloe, Steven, United States
Ernoul, Lisa, France
Evans, Suzanna, United Kingdom
Ferrara, Allyse, United States
Ferreira, J.G., Portugal
Filigheddu, Rossella, Italy
Fischer, Andrew M., United States
Florea, Lee, United States
Fontan Bouzas, Angela, Portugal
Fortes, C.J., Portugal
Fourniotis, N., Greece
França, Susana, Portugal
Freedman, Janet, United States
Fry, Brian, Australia
Fugate, David, United States
Gittman, Rachel K., United States
Glibert, Pat, United States
Gonc¸alves Lima, Juliana Schober, Brazil
Gray, Sarah, United States
Grossmann, Mary M., Japan
Grottoli, Edoardo, Italy
Guntenspergen, Glenn, United States
Guo, Xinyu, Japan
Halls, Joanne N., United States
Harrison, Adrianne, United States
Harter, Till, Canada
Harvey, Adele, Australia
Herrington, Thomas, United States
Herrmann, Maria, United States
Hladik, Christine, United States
Holleman, R.C., United States
Hughes, Zoe, United States
Hwang, Paul A., United States
Jia, Peihong, China
Jung, Tae Hwa, Republic of Korea
Kennedy, Andrew, United States
Kincaid, Todd, United States
Kirshen, Paul, United States
Klinck, John M., United States
Kosmynin, Vladimir, United States
Kosters, Elisabeth, Canada
Kunz, Hans, Germany
Lace, Michael J., United States
Lane, Chad S., United States
Laska, Shirley B., United States
Le Cozannet, Gone´ri, France
Lehrter, John, United States
Li, Lin, United States
Li, Xing, China
Li, Hailong, China
Linkov, Igor, United States
Liu, Run, China
Livingston, Robert J., United States
Lu, Chunhui, China
Lubin, Pierre, France
Marshall, Heather, United States
McCarthy, Matthew J., United States
McKee, Brent, United States
McKenna, Kim, United States
McMahon, Kathryn, Australia
McManus, John, United States
McPhee, Miles, United States
Meyer, Michelle, United States
Mied, Richard P., United States
Mitchell, Molly, United States
Mongelli, Giovanni, Italy

Continued on Next Page

JCR Outside Reviewers 2015

Mueller, H., Germany
Nenadovic, Mateja, United States
Nichols, C. Reid, United States
Nielsen, Alexander, Australia
O'Donncha, Fearghal, Ireland
Ortinez, Jose´ Abraham, Mexico
Pan, Shunqi, United Kingdom
Pardo, Francisco, Spain
Park, Joseph, United States
Parnell, Kevin, Australia
Passeri, Davina, United States
Peek, Michael, United States
Pe'eri, Shachak, United States
Peng, Zhong, United Kingdom
Pezzoli, Alessandro, Italy
Phillips, Jonathan, United States
Piccolo, Cintia, Argentina
Plodinec, John, United States
Pollack, Jennifer, United States
Quirk, Tracy, United States
Ramos, Carlos, United States
Rapinel, Sébastien, France
Resio, Donald T., United States
Rheault, Bob, United States
Rissik, David, Australia
Roelfsema, C., Australia
Roman, Charles, United States
Romic, M., Croatia
Rong, Zengrui, China
Roskin, Joel, Israel
Rutherfurd, Ian, Australia
Sanderson, Brian, Canada
Saraceno, John Franco, United States
Sato, S., Japan
Schuerch, Mark, Germany
Seckus, Jonas, Italy
Seingier, Georges, Mexico
Sekiguchi, Hideo, Japan
Sherman, Clark, United States
Siokou-Frangou, Joanna, Greece
Song, Dehai, China
Spieler, Richard, United States
Spinoni, Jonathan, Italy
Stevenson, Duane E., United States
Stremme, Donald, United States
Sui, Jueyi, Canada
Suman, Daniel O., United States
Sun, Jian, China
Suzuki, Tomohiro, Belgium
Switzer, Adam, Singapore
Szekielda, Karl, United States
Thoe, W., United States
Thomson, Jim, United States
Underwood, Graham J.C., United Kingdom
Velo-Suárez, L., Spain
Venugopal, V., United Kingdom
Vicinanza, Diego, Italy
Vollmer, Heather, United States
Walker, Tony, Canada
Wang, David, United States
WANG, Yunwei, China
Wang, Shaohui, China
Ware, Carolyn, United States
Warrick, Richard, New Zealand
Wdowinski, Shimon, United States
Wei, Zhangping, United States
Wernand, Marcel, Netherlands
Wernette, Phil, United States
Weston, Mike, Australia
Whadams, Peter, United Kingdom
Whitehead, Jessica, United States
Wilber, Pace, United States
Wright, Grant, United Kingdom
Xiu, Peng, China
Xu, Dewei, China
Yagci, Oral, Turkey
Yang, Haiyan, China
Yilmaz, Tuluhan, Turkey
Yin, Jianjun, United States
Yin, Kedong, China
Young, Donald, United States
Zhai, Weidong, China
Zhang, Yunlin, China
Zhang, Y. Joseph, United States
Zhao, Zhongxiang, United States
Zhou, Jun, China

Current Issue Volume 32, Issue 5 (September 2016)

COVER PHOTOGRAPH: Man O'War Bay along the Jurassic Coast of Dorsett, southern England

Man O'War Bay along the Jurassic Coast of Dorsett, southern England. The Jurassic Coast is a designated World Heritage Site along the English Channel coast of southern England. Stretching a distance of nearly 155 km, this segment of coastline provides over 180 million years of coastal geologic history through the presence of Triassic, Jurassic, and Cretaceous cliffs. The coast is also unique in that stretches of both concordant and discordant shorelines can be found, along with a plethora of coastal landforms. For example, in Man O'War Bay, as shown above, the limestone has been tilted up so forcefully by regional folding and faulting that a nearly vertical orientation now exists at this location. Of particular interest is that this resistant bed of limestone results in forming an offshore barrier, partially protecting the Bay from wave attack and erosion. (Photograph taken 30 September 2015 by Gary Griggs, University of California, Santa Cruz [UCSC], Santa Cruz, California, U.S.A.)

The Coastal Education & Research Foundation *[CERF]* graciously thanks you for your membership and involvement in our international society. We hope that you have enjoyed this latest edition of *Just CERFing*, our society's official newsletter. As mentioned previously, we encourage the worldwide communication of our members through the *Just CERFing* newsletter. If you have any news or announcements that you would like to promote, please send your request or questions directly to Dr. Charles W. Finkl at cfinkl@cerf-jcr.com CERF continues to provide our members with the most up-to-date, professional features of the society. We encourage you to please visit our Foundation's website at http://www.cerf-jcr.org to see all the new content that has been added.

Next Issue of *Just CERFing* coming October 2016.

IN THIS ISSUE

CERF Regional Vice Presidents

Acceleration in U.S. Mean Sea Level? A New Insight using Improved Tools

Sea Surface Temperature Trends in Venice Lagoon and the Adjacent Waters

Beach Renourishment: Book Review

The Block Island Bluff Image Project: Using Google Earth™, Spreadsheet Mapper, and Google Drivee to Build a Database of Spatially Located Field Images of Coastal Bluffs

Geoscience Research Resource Work Award

Encyclopedia of Marine Geosciences

Lakes of the World (CRL)

Coastal Research Library (CRL)

Hypsometry of Cape Cod Salt Marshes (Massachusetts, USA) and Predictions of Marsh Vegetation Responses to Sea-Level Rise

4th International Rip Current Symposium

Forecasting the Potential Effects of Climatic and Land-Use Changes on Shoreline Variation in Relation to Watershed Sediment Supply and Transport

JCR Special Issue #75

Spatial Variability of Hydrodynamic Timescales in a Broad and Shallow Estuary: Mobile Bay, Alabama

The Influence of Morphology on Sinkhole Sedimentation at Little Salt Spring, Florida

Membership Options

CERF Website

Publish Your Photos

CERF Board of Directors

JCR Editorial Board

CERF Lifetime Members

CERF Patron Members

New CERF Members

Current CERF Members

JCR Outside Reviewers 2015

JCR Current Issue, Cover Photo