Author(s): Ahmed El-habashi and Sam Ahmed

Title: **A new technique for satellite retrievals of *Karenia brevis* harmful algal blooms in the west Florida Shelf using neural networks**

Type of Presentation: ______ Poster

__√__ Oral

Short Abstract:

We apply Neural Networks (NN) to the detection and tracking, of *Karenia brevis* Harmful Algal Blooms (*KB* HABs) that plague the coasts of the West Florida Shelf (WFS) using Visible Infrared Imaging Radiometer Suite (VIIRS) satellite observations. Previous approaches primarily used observations from the Moderate Resolution Imaging Spectroradiometer Aqua (MODIS-A) satellite. They depended on the remote sensing reflectance signal at the 678 nm chlorophyll fluorescence band (*Rrs*678) needed for the normalized fluorescence height (nFLH) algorithms which proved effective for *KB* HABS retrievals. VIIRS which has replaced MODIS-A, unfortunately does not have a 678 nm fluorescence channel. To overcome that hurdle, we customized our NN approach to retrieve phytoplankton absorption at 443 nm (a_{ph443}) using only *Rrs* measurements from existing VIIRS channels at 486, 551 and 671 nm. The a_{ph443} values in these retrieved VIIRS images, can in turn be correlated to chlorophyll-*a* concentrations [*Chla*] and *KB* cell counts. To retrieve *KB* values, the VIIRS NN retrieved a_{ph443} images are filtered by applying limiting constraints, defined by (i) low backscatter at *Rrs* 551 nm and (ii) a minimum a_{ph443} value known to be associated with *KB* HABs in the WFS. The resulting filtered residual VIIRS images are shown to very effectively delineate and quantify existing *KB* HABs in the WFS. Comparison with historical in-situ measurements and MODIS-A satellite retrievals over the 2011-15 period confirm the viability and efficacy of the NN approach.

Conference Title: 2016 CoRP Symposium

Authors: Elius Etienne, Naresh Devineni, Reza Khanbilvardi

Title: Quantifying demand sensitive drought risk and capturing the potential impacts across the United States.

Type of presentation: Oral

Abstract
Droughts have cascading effects on the environment, economy, and society. Seasonal water deficits resulting from natural variability in rainfall, coupled with increased demands have severe implications for the adequacy of water storage in both surface and groundwater stores. Historically, municipal water supply planning has focused on developing new resources as demands increased. Today, limitations on acceptable new reservoir sites, restrictions on groundwater sources, rising development costs, and growing concern for environmental impacts limit the ability to develop new resources. Furthermore, seasonal to multi-year water deficits resulting from natural variability in climate and changes in near to long-term demands also determine the reliability and resilience of water systems. Water managers need better tools to assist in water operations and decision-making. While global and national drought indicators exist, none directly connects existing or projected water demand to the potential deficit during the drought. They are essentially supply based. However, the temporal patterns of both demand and supply ultimately determine the stress or impact and provide essential elements of droughts that can be used for risk assessment, planning, and operations. Consequently, assessment of risk for various sectoral operations could be much better informed if appropriate stress indices were developed for drought conditions relative to current and projected demands, and their likelihood assessed through historical and future climate scenarios. This talk will present the development of demand sensitive droughts metrics for the conterminous United States (at the county scale) to emphasize the dimensions and spatial extents of the potential water scarcity relative to the historical and current water consumption patterns. The varying distribution of water supply and demand across the United States involves complex patterns and policies in space and time that directly influence water systems.

Conference Title: 2016 CoRP Symposium

Author(s): Ali Hamidi; Naresh Devineni; Reza Khanbilvardi

Title: **Flood Risk Analysis in New York City Applying Nonparametric Simulation on Radar Rainfall Data**

Type of Presentation: Oral

Short Abstract:

Flood response in an urban area is the product of interactions of spatially and temporally varying rainfall and infrastructures. Scenarios that properly represent likely storm tracks through the city and the associated space-time patterns of rainfall can help improve the operation of urban hydrologic systems. The goal of this study is to apply simulation based approach to reproduce spatially dependent storm data and use it to quantify the risk of extremes in New York City (NYC) and to compare with the current design criteria. In this regard, radar data stage IV from 2002-2015 is employed to determine extreme rainfall events and examine the spatial consistency between them in NYC. A nonparametric copula-based simulation approach is applied to the spatial fields with arbitrary dependence structures and marginal densities. The nonparametric simulator uses log-spline density estimation in the univariate setting, together with a sampling strategy to reproduce dependence across variables through a nonparametric numerical approximation of the underlying copula function. Results indicate current design criteria of NYC underestimates the extreme rainfall in boroughs of Manhattan and Staten Island while overestimates the events over Brooklyn and Queens area. Therefore, instead of stationary design criteria, we propose a spatially dynamic design criteria for NYC to meet the extremes.

Conference Title: 2016 CoRP Symposium

Author(s): Kristofer lasko, Colin Miller

Title: A bottom-up approach to characterizing crop residue burning practices and estimating resultant emissions variations in Hanoi, Vietnam

Type of Presentation: _____ Poster

___x__ Oral

Short Abstract: The systematic burning of crop residues contributes to approximately one-third of global biomass burning emissions with impacts on air quality, public health, and greenhouse gas emissions. Though significant research has characterized emissions from crop residue burning, to date studies typically assume one level of emissions without accounting for emissions variation due to differential burning practices. In this project, we employ a case study approach in Hanoi, Vietnam to map dominant crop rotations and quantify crop residue burning practices in the field and with smallholder input. We then inform case study findings by emulating a multitude of crop residue burning scenarios in the lab and estimating associated emissions levels. This bottom-up approach to characterizing and quantifying residue burning practices and emissions contributes not only to improved emissions calculations, but also to better understandings of how burning practices influence emissions totals in agricultural regions. This study additionally has the potential to guide incentives and policies that may encourage farmers to follow improved practices that reduce residue burning emissions and thereby improve local and global environments and public health while still maintaining economic viability and preserving livelihoods.

Authors: David M. Loveless, Timothy J. Wagner, Christopher M. Rozoff, David D. Turner[1], Wayne F. Feltz, and Steven A. Ackerman

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Title: Near-Continuous Profiling of the Boundary Layer during Bore Passages by Mobile Profiling Systems during PECAN

Conference: NOAA/NESDIS CoRP Symposium

Type of Presentation: Oral

Abstract:

Atmospheric bores are a type of gravity wave that form when a density current interacts with a stable boundary layer. Bores are thought to aid in nocturnal convective initiation by changing boundary layer stability via turbulent mixing and by mechanically lifting air parcels from the stable boundary layer up to the level of free convection. Because of their importance to nocturnal convective initiation, it is important to understand the thermodynamic and dynamic effects that bore passages may have on the stable boundary layer.

The Plains Elevated Convection At Night (PECAN) campaign took place from 1 June to 15 July 2015 in the Central Plains of the United States with the goal of improving the understanding and forecast accuracy of nocturnal convection. Using a network of fixed profiling sites and deploying a network of mobile vehicles, the campaign focused observations on nocturnal convective initiation, boundary layer waves, low-level jets, and mesoscale convective systems. Mobile profiling systems were used to profile the boundary layer for time periods of several hours in locations of interest. The University of Wisconsin Space Science and Engineering Center (SSEC) Portable Atmospheric Research Center (SPARC) and National Severe Storms Laboratory/University of Oklahoma's Collaborative Lower Atmosphere Mobile Profiling System (CLAMPS) were two of the four mobile profiling systems featured during PECAN. Both vehicles retrieve thermodynamic and kinematic profiles of the boundary layer using an Atmospheric Emitted Radiance Interferometer (AERI) and a Doppler Lidar. The Doppler Lidar uses a 1.5 microns laser to measure three-dimensional wind vectors in the boundary layer. AERI measures downwelling infrared radiation from 520 to 3000 cm^{-1} at a spectral resolution of about 1 cm^{-1}, from which high-temporal resolution temperature and moisture profiles can be retrieved. In addition to the remote sensing observations, radiosondes were also launched to validate the instruments and offer in situ observations of the boundary layer.

Data collected by CLAMPS and SPARC is used to identify the evolution of the boundary layer during each vehicle's observed bore passages. Characteristic changes of boundary-

layer stability in the pre- and post-bore environment are determined from the vertical observations. This analysis helps characterize changes to the boundary layer induced by bore passages and provide insight into the role of bores in the convective initiation process.

Storm Tracks and their Influence on North American Precipitation in the Boreal Winter

Storm tracks can have a profound impact on the climate by influencing the variability in cyclonic activity in the mid-latitudes. This study uses 6-hourly Climate Forecast System Reanalysis (CFSR) data to investigate the behavior of Northern Hemisphere (NH) winter storm tracks and their relation to surface precipitation in North America. Storm tracks are described by isentropic potential vorticity (IPV) within a Lagrangian framework. The two most prominent storm tracks in the NH, the Pacific and North American-Atlantic (NAA) storm tracks, are analyzed to discern their impacts on North American weather and climate. First, the main properties of the storm tracks are discussed, including their mean intensities, or average strengths, and small-scale regions of cyclogenesis and cyclolysis. The majority of storms identified from IPV are likely those where deep convection dominates because the isentropic level used here resides in the mid- to upper troposphere and potentially misses low-level shallow convection.

Much of the reanalysis precipitation produced by storms occurs in regions where the storm tracks are strongest, indicating that storm tracks identified from IPV values leave a strong footprint in surface precipitation, especially over the oceans. Even the weaker portions of the storm tracks over land are shown to leave a signal in precipitation. An analysis was also performed using daily precipitation accumulations from the Global Precipitation Climatology Project (GPCP). The results show that the observed precipitation associated with IPV storm tracks occurs in nearby regions as the storm precipitation from the reanalysis. The magnitudes of both observed and reanalysis patterns over the Pacific Ocean are similar; however, the reanalysis appears to overestimate precipitation over the western coast of North America and in the western North Atlantic Ocean.

Conference Title: 2016 CoRP Symposium

Author(s): Patrick Meyers[1], Scott Rudlosky[1, 2], Ralph Ferraro[1, 2], Michael Folmer[1], Nai-Yu Wang[1], Mike Pavolonis[2,3], John Cintineo[3]
[1]CICS-MD; [2]NOAA/NESDIS/STAR; [3]CIMSS

Title: Developing an Interactive Probabilistic Forecasting Tool for Maritime Weather Hazards

Type of Presentation: _____ Poster

__X__ Oral

Short Abstract:

Forecast offices responsible for monitoring weather conditions over open water rely on antiquated forecasting tools. Geostationary imagery and numerical weather prediction (NWP) analyses are the primary information sources for forecasters when outside of radar range. There is a lack of products specifically developed and designed for offshore operational forecasting of mesoscale and synoptic scale meteorological events. This project is designed to create an interactive tool for forecasters at the Ocean Prediction Center to identify developing and sustained weather systems that have the potential to produce navigational hazards.

This project is analogous to the ProbSevere model, developed by CIMSS, which calculates the likelihood that a radar-identified precipitation cell will produce severe weather (wind speed > 50 knots or hail > 1 inch) in the next 60 minutes. ProbSevere collocates precipitating cells with the glaciation rate and growth rate from GOES infrared imagery, the maximum expected size of hail from radar, and the effective bulk shear and convective available potential energy from NWP. A Bayesian model compares the observed conditions to previous storms and severe storm reports to calculate the probability of the storm becoming severe, which is visualized in interactive forecasting software. ProbSevere has received terrific reviews from National Weather Service forecasters, however, the model is incapable of monitoring regions outside of radar coverage. New predictors are being tested for use in the maritime environment, where storm lifecycles are dramatically different than typical mesoscale systems over land. For instance, NWP will be critical to establish ambient environmental conditions, recent precipitation estimates from low earth orbit sensors will serve as a proxy for radar, and lightning flash data can identify intense convective regions. This project is in support of the GOES-R Risk Reduction Program.

Authors: James Reagan (UMD/ESSIC/CICS-MD & NOAA/NCEI) and Tim Boyer (NOAA/NCEI)

Title: The World Ocean Database: Connecting Ocean Observing Systems since 1998

Type of Presentation: Oral

Short Abstract: The World Ocean Database (WOD) is the world's largest in situ ocean profiling database that is available without restriction. The WOD contains over 14.5 million quality controlled, uniformly formatted profiles that date back to Captain Cook's second voyage in 1772. The WOD merges data from many different observing systems and instruments. There are three general steps that each dataset received for inclusion in WOD goes through: the dataset is converted into a common format, automatic and manual quality control checks are applied, and any incoming data that is already in WOD is removed before merging (i.e., duplicate checking). The direct uses of WOD data are plentiful, ranging from oceanographic and climate research to serving as environmental variables in biological studies. The WOD also serves as the foundational dataset in calculating the World Ocean Atlas, a globally gridded climatology of multiple oceanographic variables. Furthermore, WOD is also used to calculate ocean heat and salt content products. While the WOD itself connects multiple ocean observing systems, the data and products derived from WOD can also serve as validation datasets for various satellite missions, ultimately connecting in situ observations to remotely sensed observations. The WOD and its utility in both the in situ and remote sensing fields will be discussed.

Authors: Kathryn Sauter, Tristan L'Ecuyer

Title: The Impact of Convection on the Transport and Redistribution of Dust Aerosols

Type of Presentation: Oral

Short Abstract:

The distribution of mineral dust aerosols that originate from the Saharan Desert and sweep across the tropical Atlantic Ocean can significantly impact climate processes in the region. The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission was launched in April 2006 as a part of the A-Train constellation in order to gain a better understanding of the role that aerosols and clouds play in the complex climate system [*Winker et al.*, 2006, 2007]. The ability to assess the vertical and spatial transportation of dust across the Atlantic Ocean using CALIPSO aerosol retrievals provides valuable insight into the effects of dust aerosols on the Earth's climate system. This study couples in-situ observations of dust storm events with aerosol optical depth from the polar orbiting CALIPSO ground track and the GOES East Pathfinder Atmospheres Extended (PATMOS-x) geostationary cloud dataset to constrain the processing, transport and redistribution of dust aerosols over the tropical Atlantic Ocean before and after the passage of convection. Cloud top temperature, cloud optical thickness, and cloud top size are further used to quantify the sensitivity of wet deposition to the intensity of tropical convection. Identifying the removal impacts from convection on the dust aerosols will allow for the interpretation and understanding of processes that transport and redistribute the dust. It is conjecture that when there are more convective clouds present, more dust will be removed from the atmosphere. Preliminary results provide evidence that convection both reduces downstream dust optical depths and occasionally transports dust to higher altitudes than the main Saharan dust layer. These redistribution and scavenging effects have implications for direct and indirect impacts of dust on radiation balance both locally and downstream of the convection. Further analysis of these complementary datasets may offer new revelations into aerosol-cloud climate interactions.

Classifying Vertical Wind Speed Profiles for Offshore Wind Resource and Power Assessment

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To justify the economic viability of a potential offshore wind energy project, an accurate assessment of the site-specific wind resource, thus expected energy yield, is required prior to wind farm construction. Unfortunately, uncertainties during this assessment exist, due in-part to limited offshore wind measurements throughout a turbine's rotor-layer (~40-200m) and related uncertainties predicting a turbine's available power. To better understand these uncertainties in the Mid-Atlantic USA, Doppler wind lidar and other met-ocean measurements were collected offshore within Maryland's Wind Energy Area from July-August 2013. Given the diversity of vertical wind speed profile (VWP) observations, VWPs are classified based on the goodness-of-fit to several mathematical expressions. Results demonstrate VWP classification is dependent on the temporal and spatial resolution of analysis, however for 10-min VWP types (40-220m), low-level wind maximum are the most frequent (~37%), while only ~17% resemble industry-standard logarithmic-like, power law wind profiles. In addition, VWP variability is related to prevailing wind direction (i.e. offshore fetch), as more unexpected VWPs are found during wind regimes flowing from land to sea, while power-law profiles persist during northeasterly flow. In terms of potential impact on a wind turbine's available power, unexpected VWP types are associated with greater variability in superimposed meteorological features demonstrated to impact turbine performance, therefore the importance of predicting such variability cannot be understated. Finally, the sensitivity of VWP type on several techniques used to estimate a turbine's available power are demonstrated, elucidating how both an overestimate and underestimate of traditional hub-height available power may occur given distinct VWP type and power assessment technique employed; therefore, a possible concern for the offshore wind energy industry in the Mid-Atlantic USA.