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Satellites Observations and Climate Vulnerability, Assessment, Mitigation and Adaptation

Analysis of the Evolution of the Nabro Eruption aerosol using CALIPSO and a HYSPLIT Trajectory Model

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The Nabro volcano in Eritrea, Ethiopia, Africa (13.37°N, 41.70°E) erupted on June 13, 2011 ejecting significant levels of SO2 into the stratosphere. The stratospheric aerosol produced remained in the atmosphere for several months with layers observed between 11 and 15 km. It was clearly observable globally by multiple ground-based monitoring stations and Earth-orbiting satellites including CALIPSO (Sawamura et al., 2012). We have studied the temporal evolution of Nabro's aerosol and its transport globally between 13 June and 31 July 2011 using CALIPSO observations and a HYSPLIT trajectory model. Hampton University's lidar team observed a stratospheric layer believed to be produced by the Nabro eruption on July 20, 2011. The back trajectories starting at Hampton confirm that a short time after the eruption (3-10 days) the aerosol was transported over Europe, over Asia, and about 20-days later the stratospheric aerosol arrived over the United States. This paper will describe the measurements made by CALIPSO and HU's ground-based lidar over this period and compare those data and the results of the HYSPLIT predicted layer locations.

References

P Sawamura, J P Vernier, 2012, "Stratospheric AOD after the 2011 eruption of Nabro volcano measured by lidars over the Northern Hemisphere". *Environ. Res. Lett. 7, Number 3*

Cloud and Moisture Conditions in Cold Air Outbreaks along the Northeastern Seaboard

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Cold air outbreaks over the northeastern seaboard of the United States can create hazardous wind and temperature conditions. These events also generate massive fluxes of heat and moisture from the Atlantic Ocean that have an important role in weather and climate along the coast. In this study, we identify cold air outbreaks using reanalysis data for 2001-2009 and then examine wind, temperature, moisture, and cloud properties during the events. Composites of temperature and winds generated using reanalysis data confirm that the events are most often part of an extratropical cyclone transiting the region. Composites of daily water vapor fields from the NASA Water Vapor Project- MEaSUREs (NVAP-M) and cloud fraction from the International Satellite Cloud Climatology Project (ISCCP) as well as the Moderate Resolution Imaging Spectroradiometer (MODIS) show a somewhat surprising result: during the cold air outbreaks there is anomalously high cloud fraction and anomalously low water vapor over the ocean off the coast. The reason for this is explored using cloud top pressure, cloud top height and cloud optical depth retrievals from MODIS, and our analysis shows that the contradictory cloud/water vapor relationship is partially an artifact of the definition of cloud cover and partially resulting from the physical mechanism through which low cloud cover is generated.

Using Lidar to Examine Extinction Coefficients and Raman Scattering

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The problem of producing extinction profiles for specific atmospheric characteristics using Raman scattering is examined. This was done using the Klett stable analytical inversion solution for processing lidar returns and Raman scattering, while using data received from Hampton University's lidar. Klett extinction profiles are examined from July 20, 2011, and Raman extinction profiles for Nitrogen, are compared to Klett method profiles from March 7, 2012. It was found that extinction profiles can be retrieved from Raman scattering data, but the data used did not have a high enough signal to noise ratio to produce a good result, even with a significant amount of averaging. This was caused by many factors, including having a weak return signal, assuming a constant lidar ratio, and background noise. This poster will describe these efforts.

Utility of a GPS Radio Occultation and Hyperspectral Infrared Sounder Matchup Dataset: Temperature Profile Comparisons

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Satellite products have been increasingly used to push forward research boundaries in the field of atmospheric and oceanic sciences with the recent advancements of space remote sensing technology. Minimizing errors in these satellite products broadens the possible extent of their use and has beneficial implications for climate, weather, and modeling studies. This work demonstrates a methodology for identifying error characteristics of infrared sounder and GPS radio occultation (RO) temperature products through their inter-comparison.

GPS RO, due to its stability and measurement principle that is fundamentally different from that of radiometric instruments, offers an independent dataset for comparison against infrared retrievals. Unlike the radiosonde network, which has been traditionally used for sounder validation purposes, GPS RO is unbiased to have more samples over land or ocean, has a more continuous temporal and spatial range, and provides more samples in the upper troposphere and lower stratosphere.

By spatiotemporally matching individual GPS RO and infrared profiles while taking into account the GPS RO profile geometry and horizontal resolution, spatial and temporal mismatch errors in the bias and root-mean-square matchup statistics are minimized.

Additionally, vertical resolution differences of the profiles are addressed. Temperature profile comparison statistics involving NASA AIRS version 5 and 6, IDPS CrIMSS,
NOAA IASI, CDAAC COSMIC, and CDAAC GRAS data for a global and 5 latitude zones have been made and some example case studies are high-lighted.

Climate Change Detection in the Intra-Americas Region and Local Implications to Sensitive Eco-systems

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The Intra-Americas Region (IAR), defined as the geographical region that includes the Caribbean, Mexico, Central America and parts of North and South America, is a distinctive region of dynamic climatological phenomena that is particularly sensitive to global climate changes. A 30-year analysis of high resolution SST data revealed a warming trend for the IAR during the 1982 – 2012 period. Using an optimum interpolated sea surface temperature (OISST) product with spatial resolution of 0.25 degrees, the 30-year climatological analysis was generated to observe annual, monthly, and seasonal trends. Results show that on a regional scale SSTs are increasing annually and during the two distinct Caribbean rainy seasons – the Early Rainfall Season (ERS), at an estimated 0.0161°C/year, and the Late Rainfall Season (LRS), at an estimated 0.0209°C/year, both with high statistical significance. Sub-regional analysis revealed that warming has occurred particularly in the Gulf of Mexico and North of South America during the ERS and LRS, also with high statistical significance. These regional changes in SST are believed to have a great impact on local sensitive ecosystems located within the IAR; one such case is the rapid expansion of Lake Enriquillo and Lake Azuéi located on the Dominican Republic-Haiti border. Surface area of these lakes have rapidly expanded over the past decade. Lake Enriquillo has doubled in size since 2004. The socio-economic implications of these sudden environmental changes are evident, as large portions of flooded land have misplaced entire communities, destroyed roads and farms, and affected trade near the border crossing.

Identifying 3D Radiative Cloud Effects via Derived Distributions of Liquid Water Path that Conserve MODIS Visible Reflectance Measurements

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Cloud feedback processes are one of the dominant causes for variability among general circulation models. The poor simulation of in-cloud microphysical properties causes much of this variability due to treating these properties as homogenous. Studies have shown that shortwave albedo of clouds is sensitive to variability of in-cloud liquid water.[1]
A method developed by Foster et al., 2011 derives distributions of cloud liquid water path over partially cloudy scenes while conserving the total-scene reflectance.[2] Potential uses of this include generating model validation datasets and facilitating satellite record intercomparison studies. This study explores another use: identifying and quantifying cloud 3D effects. This methodology has been applied to MODIS AQUA and TERRA satellites for the duration of their records over a selection of ocean regions. Initial findings include, seasonal and geographical patterns in the efficiency of the methods in the North Pacific, South Pacific, and South Atlantic. This study investigates whether areas where the method works best correspond with significant 3D cloud effects. Sensitivity to spatial and temporal variables such as geography, seasonality, cloudiness, viewing geometry, and distributions of cloud microphysical properties is also studied. Future results will include simulations of 3D radiative transfer from the I3RC model.

[1] Calahan,R.F., W.Ridgway, W.J. Wiscombe, T.L. Bell, and J.B. Snider, 1994. "The albedo of fractal stratocumulus Clouds." J. Atmos. Sci., 51, 2434---2455
Pincus, R., and S.A. Klein, 2000. "Unresolved spatial variability and microphysical process rates in large---scale models." J. Geophys. Res., 105, 27059---27065
Barker, H.W., and P. Raisanen, 2005. "Radiative sensitivities for cloud structural properties that are unresolved by convential GCMs." Quart. J. Roy. Meteor. Soc., 131, 3103---3122
[2] Foster, M.J., R. Bennartz, A. Heidinger, 2011. "Estimation of liquid cloud properties that conserve total---scene reflectance using satellite measurements," J. Appl. Meteor. Climatol., 50, 96---109

Wintertime Cloud Cover as a Contributor towards Inter-Annual Sea Ice Variability

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The role of cloud forcing on Arctic sea ice is fundamental but also complex, serving as an accelerant or antagonist to ice growth on a hemispheric scale. Though sea ice decline in recent decades is largely attributed to arctic amplification, plunges in ice extent and restorative winter refreezes occurring on a year-to-year basis cannot be adequately explained by this general trend. Improved understanding and prediction of inter-annual fluctuations in sea ice requires cloud effects on surface energy budgets to be seen as an important factor for ice growth and melt. For example, the significant rebound of arctic sea ice from the September 2012 record minimum was aided by the effects of anomalously negative winter cloud cover (fewer clouds), as per a recent study using satellite and reanalysis data.[1]

This study uses ERA-Interim reanalysis to quantify the contribution of surface radiative forcing by wintertime cloud cover on sea ice during years with anomalous total ice areas over a 32-year record, though future results seek to use MODIS-derived cloud forcing. Comparisons between reanalyzed winter cloud forcing and passive microwave-derived ice concentrations in September demonstrate a significant inverse correlation between cloud forcing during winter and the ice extent at the end of a melt season. Cloud re-emission of longwave radiation in winter months curbs the process by which polar seas radiatively cool to space and freeze, so that less winter cloud forcing generally results in thicker sea ice. Findings stand to improve climate model projections and assign some cause to year-to-year ice variability.

[1] *Y. Liu, J. Key, 2014. "Less winter cloud aids summer 2013 Arctic sea ice return from 2012 minimum". Environ. Res. Lett.,* 9, 9pp.

Evaluation of Trends in Chlorophyll-a Concentration in Response to Climatic Variability in the Eastern Bering Sea from MODIS

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The Bering Sea is one of the most productive ecosystems in the world and supports major commercial and subsistence fisheries. Recent reports indicate that climatic variability is affecting the abundance of phytoplankton, zooplankton, and fish in the Bering Sea. Only a few studies have been reported utilizing satellite data to assess the Bering Sea ecosystem response to recent climatic variability. The performance of current ocean color satellite algorithms to estimate chlorophyll-a—a measure of phytoplankton biomass, has been found to be unsatisfactory. Here we propose a new algorithm for estimating chlorophyll-a from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the satellite Aqua. MODIS-Aqua ocean color products are derived using the NOAA Multi-Sensor Level-1 to Level-2 (MSL12) ocean color data processing system. Results show that chlorophyll-a estimates using the new algorithm are improved for the eastern Bering Sea. To elucidate the relationship between chlorophyll-a and recent climatic variability in the eastern Bering Sea; annual, seasonal, and monthly composite chlorophyll-a images were produced for the period of 2003–2013. For the decade of study period, chlorophyll-a exhibited strong seasonal and inter-annual variability. However, we have not observed long-term trend in phytoplankton biomass associated with variability in the physical environment in the Bering Sea.

Near−surface air temperatures and snow skin temperature comparison from CREST-SAFE station data with MODIS land surface temperature data

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Land Surface Temperature (LST) is an important factor that helps drive the energy balance and water exchange between the Earth's surface and its atmosphere. Hence, validation is always required for the proper use of any analytical model in which LST is a crucial parameter. LST satellite readings have been validated using ground-based estimates. The objective of this research is to assess the correlation between MODerate resolution Imaging Spectroradiometer (MODIS) land surface temperature data and observed temperature readings obtained from a ground-based microwave radiometers (37GHz and 89GHz) installed in the National Weather Service (NWS) CREST-SAFE station at Caribou, Maine for the winters of 2012 and 2013. The CREST-Snow Analysis and Field Experiment (CREST-SAFE), a ground-based station that conducts dual polarized microwave observations continuously from the time of snow onset to snow melt off, has been carried out since January 2011. Additionally, detailed synchronous observations of snowpack physical properties are executed.

Keywords: Land surface temperature, snow skin temperature, microwave radiometers.

Extratropical Cyclone Clouds: Impact on Cyclone Strength and Climate

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Clouds of extratropical cyclones (ECs) lie at the intersection of well-developed theory of dry baroclinic waves and nonlinear feedback on these dynamics due to the effects of moisture and radiation. Of all cloud regimes, EC clouds are the most effective at blocking short-wave radiation, while trapping heat within the troposphere via long-wave blocking. The net modulation of moist processes on the transient wave and the resulting climatological effects due to modified energy and water transports remain unclear. A novel cyclone tracking algorithm (NASA's MCMS) is used to identify ECs in the ERA-I reanalysis data and collect properties of each disturbance. A classification scheme based on cyclone radius and pressure depth is developed and compared to various strength metrics. Properties of resulting classes are analyzed, and composites of radiation (ISCCP FD) and precipitation (TRMM TMPA) are assembled for each class. At this stage of research each detected cyclonic disturbance is treated independently of its prior/future realizations or phase of development. Lifetime and temporal evolution will be considered in subsequent investigations. The depth--radius classes defined here meaningfully discriminate between over 10^6 extratropical disturbances and correspond with distinguishable regimes of precipitation and radiation. Seasonal variability of cyclone types and their diabatic heating are described as well as interesting interannual trends.

Retrieving Snowpack Properties From Land Surface Microwave Emissivities Based on Artificial Neural Network Techniques

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The objective of this research is to better isolate the snow signature in microwave signals and to use this signature to retrieve the snowpack properties. The retrieval of snowpack properties is performed by inverting microwave emissivities using artificial neural network ANN-based technique. The microwave emissivities used in this study are derived from SSM/I passive microwave observations by removing the contributions of the cloud and atmosphere and then separating out the surface temperature variations using ancillary atmospheric, cloud and surface data. A time-anomaly of differences between effective emissivity at 19V and 85V enabled the constant effects of land surface vegetation properties to be removed to isolate the snow signature. An emission model (Microwave Emission Model of Layerd Snowpack, MEMLS) was used to produce the train dataset to the neural network. To retrieve the neural network the 7 channels of microwave emissivities (The pixels that were identified as snow), the IR skin temperature, and the ground emissivity (emissivity of snow-free of each pixel) were used as the inputs and the neural network retrieves snow depth, snow density, snow grain size, and volumetric water percentage in the snow. The resulting depth and SWE (depth * density) were compared with CMC snow depth and Chang algorithm. It was observed that the results obtained through ANN-based technique are lower by 8% than those obtained through other approaches. These comparisons have been more explored with different vegetation type, topography, and snow percentage coverage of each pixel.

Establishing Consistent Radiometric Calibration between NOAA AVHRR and Suomi NPP VIIRS to Improve Satellite Data Quality for Weather and Climate Applications

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Multi-decadal Earth observation from multiple satellites are required to study long term global change. Satellite data archive should be very well calibrated to fulfill stringent requirements of critical weather and climate quality data records. AVHRR is a heritage instrument on NOAA's polar orbiting satellites with more than three decades of global earth observation. Due to absence of onboard calibrator for the visible and near-infrared channels, AVHRR sensors rely on desert sites for relative calibration with uncertainties primarily due to lack of rigorous site characterization and atmospheric effects. AVHRR data archive needs to be radiometrically consistent with Suomi NPP VIIRS which is a follow on mission to AVHRR and MODIS. This allows AVHRR data to put into same scale of radiometric accuracy with current VIIRS and future J1 instrument. The study is basically a two-step process. At first, it shows how the radiometric stability and accuracy (within 2%) of VIIRS is estimated using intercalibration with MODIS. Second, the study shows use of well calibrated VIIRS data to perform inter-comparison with NOAA-19 AVHRR to evaluate its radiometric consistency. Then the well calibrated NOAA-19 AVHRR can be cross-calibrated in future with other AVHRR instruments back in time to connect multi-decadal data into same radiometric scale. The study uses extended low latitude SNOs over African desert for inter-comparison. Additionally, the inter-comparison is performed using SNOs over high latitude polar region. The results are validated using vicarious calibration sites including Antarctica Dome C. The impacts of spectral differences are quantified using EO-1 Hyperion and MODTRAN.

References

1. Uprety, Sirish, Changyong Cao, Xiaoxiong Xiong, Slawomir Blonski, Aisheng Wu, Xi Shao 2013. "Radiometric Inter-comparison between Suomi NPP VIIRS and Aqua MODIS Reflective Solar Bands using Simultaneous Nadir Overpass in the Low Latitudes". Journal of Atmospheric and Oceanic Technology, 30, pp:2720–2736.

2. Cao Changyong, Frank DeLuccia, Xiaoxiong Xiong, Robert Wolfe, Fuzhong Weng (2013). "Early On-orbit Performance of the Visible Infrared 1 Imaging Radiometer Suite (VIIRS) onboard the Suomi National Polar-orbiting Partnership (S3 NPP) Satellite", IEEE Transaction on Geoscience and Remote Sensing, Volume: 52, Issue: 2, pp: 1142 - 1156.

3. Cao, Changyong, J. Xiong, S Blonski, Q Liu, S Uprety, X Shao, Y Bai, F Weng, 2013. "Suomi NPP VIIRS sensor data record verification, validation, and long-term performance monitoring". Journal of Geophysical Research: Atmospheres, 118 (20), 11,664-11,678.

4. Cao, Changyong, Sirish Uprety, Jack Xiong, Aisheng Wu, Ping Jing, David Smith, Gyanesh Chander, Nigel Fox, and Stephen Ungar, 2010. "Establishing the Antarctic Dome C Community Reference Standard Site towards consistent Measurements from Earth Observation Satellites". Canadian Journal of Remote Sensing, 36:(5) , pp: 498-513.

5. Uprety, Sirish, and Changyong Cao, 2012. "Radiometric and spectral characterization and comparison of the Antarctic Dome C and Sonoran Desert sites for the calibration and validation of visible and near-infrared radiometers". J. Appl. Remote Sens. 6(1), 063541.

6. Sirish Uprety, Changyong Cao, Slawomir Blonski, Xi Shao, 2013. "Evaluating radiometric consistency between Suomi NPP VIIRS and NOAA-19 AVHRR using extended simultaneous nadir overpass in the low latitudes". Proc. of SPIE Vol. 8866.

7. Cao, C., M. Weinreb, and H. Xu, 2004. "Predicting Simultaneous Nadir Overpasses among Polar-Orbiting Meteorological Satellites for the Intersatellite Calibration of Radiometers". J. Atmos. Oceanic Technol., 21, 537–542.

Synoptic Patterns Associated with Northeast and Southeast Ice Storms

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Wintertime storms that produce precipitation events such as snow, freezing rain, and ice pellets cause significant damage to utility services and disrupt travel. These synoptic systems involve deep isothermal regions where warm, moist air over-runs surface sub-freezing air. However, little else is known about the synoptic evolution of the storms. Therefore this study analyzes the dynamic and thermodynamic conditions of ice events along the east coast.

The National Climatic Data Center (NCDC) Storm Events Database is used to pull the dates of ice events from the Northeast and Southeast climate regions for 1996-2013. We find that Southeast ice storms often cover a large geographical region, while Northeast ice storms tend to be much smaller but more frequent. We utilize Geographic Information Systems (GIS) to relate the spatial coverage of our ice events to population density in order to compare the impacts of the events in the two regions.

Next, we analyze the synoptic control of ice storms from both regions in an effort to explain what causes the size differences. For the ice storms gathered from the Storm Events Database, composites are generated for sea level pressure from reanalysis data. A comparison of the composites for the Southeast and Northeast storms suggests that the size differences relate in part to the thermal structure produced by cold air damming.

Role of Satellites in Building Resilient Urban Ecosystems and Coastal Communities

Radiometric Calibration of Current and Future Ocean Color Satellite Sensors

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More than half of the world's population centers exist in coastal regions, where there is a direct mutual influence between the human population and the coastal ecosystem. Therefore, monitoring the health of coastal waters using Ocean Color (OC) satellite sensors provides tangible socioeconomic advantages. We propose (and demonstrate for visible bands) a new concept for radiometric vicarious calibration of OC satellite sensors through radiative transfer (RT) simulations carried out for the full sunlight path of the coupled ocean–atmosphere system. The approach is based on the aerosol and water-leaving radiance data obtained from AERONET-OC sites. Quantitative evaluation of the potential of the proposed approach for achieving radiometric accuracies of has been made through direct comparisons between simulated and satellite measured Top of Atmosphere (TOA) radiances. Very high correlations ($R \geq 0.96$ for all visible channels) are achieved for the Visible Infrared Imaging Radiometer Suite (VIIRS) sensor when this approach is applied with the data from the LISCO and WaveCIS AERONET-OC sites. High cross-site consistency is observed in vicarious calibration gain factors derived with the proposed approach exhibiting uncertainty levels below 0.5% in the blue and green parts of the spectrum, while the temporal uncertainties are also within 0.28% – 1.23% permitting the approach to be used at this stage for verification of sensor calibration performance.

References

1. NASA, "Pre-Aerosol, Clouds, and ocean Ecosystem (PACE) Mission Science Definition Team Report," (2012).
2. IOCCG, "Mission Requirements for Future Ocean-Colour Sensors," Report # 13, (IOCCG, 2012).
3. World Meteorological Organization, "Systematic Observation Requirements for Satellite-Based Data Products for Climate," Supplemental details to the satellite-based component of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2010 Update), (World Meteorological Organization, 2011).
4. IOCCG, "In-flight Calibration of Satellite Ocean-Colour Sensors," Report # 14, (IOCCG, 2013).
5. H. R. Gordon, "In-orbit calibration strategy for ocean color sensors," Remote Sens. Environ. 63, 265-278 (1998).
6. M. Wang and H. R. Gordon, "Calibration of ocean color scanners: how much error is acceptable in the near infrared?," Remote Sens. Environ. 82, 497-504 (2002).
7. B. A. Franz, S. W. Bailey, P. J. Werdell, and C. R. McClain, "Sensor-independent approach to the vicarious calibration of satellite oceancolor radiometry," Appl. Opt. 46, 5068-5082 (2007).
8. D. Clark, H. Gordon, K. Voss, Y. Ge, W. Broenkow, and C. Trees, "Validation of atmospheric correction over the oceans," J. Geophys. Res. 102, 17209-17217 (1997).

9. P. J. Werdell, S. W. Bailey, B. A. Franz, A. Morel, and C. R. McClain, "On-orbit vicarious calibration of ocean color sensors using an ocean surface reflectance model," Appl. Opt. 46, 5649-5666 (2007).
10. R. E. Eplee, K. R. Turpie, G. F. Fireman, G. Meister, T. C. Stone, F. S. Patt, B. A. Franz, S. W. Bailey, W. D. Robinson, and C. R. McClain,"VIIRS on-orbit calibration for ocean color data processing," Proc. SPIE, 8510, 85101G (2012)

Evaluating the Effects of Temperature Stress on Coral's Fluorescence and Reflectance Signatures using Point-Specific Hyperspectral Remote Sensing

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Approximately 60% of coral reefs are currently threatened from various natural and anthropogenic impacts (Hughes *et. al* 2003). Around the world, climate change, pollution and disease are recognized as principal threats to these ecosystems. Recently, scientists Roth and Deheyn evaluated the effect of heat stress on coral fluorescence. Building off their work, we evaluated how heat temperature stress affected three Caribbean species of coral (Acropora cervicornis, Orbicella annularis, and Porites furcata) using point-specific hyperspectral remote sensing measurements in a laboratory setting to observe the response of coral fluorescence and reflectance signatures. The PARISS (Prism and Reflector Imaging Spectroscopy System, LightForm, Inc) hyperspectral imaging system provided the spectral signatures related to the fluorescence of the corals'. A Walz PAM Fluorometer was used to assess the efficiency of the corals' photosystems, and graphs were produced in Excel displaying relative fluorescence vs. wavelength (nm) for the fluorescent and reflectance measurements. Fluorescent images were taken using an Olympus MVX-10 fluorescent macroscope, under constant settings of light intensity, focal zoom level, and blue light filter exposure time for 'green channel' average intensity measurements. Data is still in the process of being analyzed, but currently there appears to be a correlation between declining coral health and coral fluorescence and reflectance signatures. The heat-treated corals experienced a decrease in relative fluorescence, while an increase in reflectance. By modeling the relationship between temperature shifts and change in hyperspectral signatures, this research provides the foundation for large-scale and efficient assessment of coral health through aircraft and satellite monitoring.

Hughes, T. P., Baird, A. H., Bellwood, D. R., Card, M., Connolly, S. R., Folke, C., & Roughgarden, J., 2003. "Climate change, human impacts, and the resilience of coral reefs". *Science*, *301*(5635), 929-933.

Roth, M. S., & Deheyn, D. D., 2013. "Effects of cold stress and heat stress on coral fluorescence in reef-building corals". *Scientific reports*, *3*.

Retrieval of river ice parameters for ice jam prediction with MODIS on the lower Susquehanna

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In winter rivers may transition from fully open water to partially or fully frozen. During these transitional periods, ice floes may accumulate and cause a jam in the river. Jams are problematic since their timing and severity is difficult to predict, especially in light that they may cause flooding both due to backwater effects and surge-like waves which form as more severe jams break up. Generally, ice-jams have been examined with a particular focus on hydrometric stations only, but recent studies (1,2) indicate that valuable information may be gleaned by incorporating data from larger regions in the analysis, such as data obtained up- or downstream. This work shows how more detailed information may be retrieved and over a larger area, via remote sensing. The Moderate Resolution Imaging Spectroradiometer (MODIS) carried by both AQUA and TERRA is used to look at a larger stretch of the Susquehanna River for the presence of river ice during the 2014 winter. The study area consists of a 100 km stretch on the Susquehanna River, which includes Harrisburg, PA. Resulting satellite images can corroborate in-situ observation of freeze-up and break-up of ice and river-ice for the 2014 winter. Furthermore, they show that river ice can be detected from mid-December 2013 to mid-March 2014. A time series analysis of river ice indicates that warnings issued with regards to ice jam flooding coincide with dates where both large amounts of river ice is detected, and above freezing temperatures occur.

1. Wang Tao, Yang Kailin and Guo Yongxin, 2008. “Application of Artificial Neural Networks to Forecasting Ice Conditions of the Yellow River in the Inner Mongolia Reach”. J. Hydrol. Eng., 13(9), 811-816
2. J. Wang, J. Sui et al., 2010. “Forecast of water level and ice jam thickness using the back propagation neural network and support vector machine methods”. Int. J. Environ. Sci. Tech. 7, 215-224.

Urban Heat Island Studies: Los Angeles' Changing Climate

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The Los Angeles urban heat island (UHI) is a complex changing entity. This study aims to analyze the UHI as it exists throughout the greater Los Angeles metropolitan area. Major influences on the UHI include population, land use, Pacific Ocean variability, weather, and climate. Downtown average temperatures have increased over the last century with minimum values increasing faster than maximum values, similar to other UHI cities. However the LA UHI is uniquely affected by California's diverse topography and microclimates. The city also lacks well defined rural areas that are characteristic of UHI. Our study looks at urban thermal patterns and the state of the UHI in recent years. Diurnal temperature data was collected from weather stations located throughout the study area. Gradient temperature maps drawn every 6 hours for the summer and winter, 2012-13, reveal large variations in the locations of most intense UHIs. Warming trends are compared with population increases using census data and land use changes, using Landsat data. Calculating the areas that experience the most intense UHI effects reveals the locations in which mitigation efforts can be focused.

Exposure, Socio-Economic Vulnerability, and Infrastructure at Risk to Current and Projected Coastal Flooding in New York City

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Sea-level rise throughout the 21st century will result in increased flood exposure as current flood levels are achieved more frequently and new flood levels result in more widespread inundation. To increase the resiliency of coastal communities and allow populations to respond and recover to these hazards, it is important to develop a place-based understanding of how storm surge exposure, impacts, and community vulnerability will change over time. This work uses a GIS-based methodology to develop and map a composite exposure and infrastructure vulnerability index for New York City populations within existing and predicted flood zones to assess overall flood risk at the intersection of exposure and vulnerability.

Both the physical and socio-economic impacts of flooding events are often unevenly distributed, with socially vulnerable groups most likely to experience a disproportionate share of the detrimental effects. When both physical and socio-economic vulnerability are present in combination, the risk to populations is exacerbated. The combination of social vulnerability, critical infrastructure at risk, and exposure to hazard provides a metric to rank neighborhood risk to flood hazards through an overall vulnerability index that characterizes site-specific levels of risk to flood hazard. Preliminary results show that future sea-level rise will increase the risk of the 100- and 500-year floods, particularly under scenarios of potential population growth and distribution in the coastal and near-coastal zones.

KEY WORDS: social vulnerability index, coastal vulnerability, GIS, sea level rise, New York City.

Urban Livability Index (ULI): Identifying At-Risk Populations and the Interconnected Factors of the Urban Heat Island Effect

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The Urban Livability Index (ULI) is a geospatial model that measures the impact of the urban heat island effect on New York City from an engineering and socioeconomic perspective. The ULI is a function of the intensity of the urban heat island effect, peak electricity load connected to the air emissions and the identification of at-risk populations using a weighted framework. The contribution of this work is to operationalize interconnected factors that are not typically addressed in the literature. Remote sensing and Geographic Information Systems (GIS) will be utilized to process the temperature and socioeconomic data that will comprise the spatial index. A series of statistical techniques will be deployed to identify the at-risk populations within the city. At the same time, the outcome of the model will be used to provide the quantitative perspective to develop planning solutions such as the implementation of green infrastructure in the city. Therefore, the primary objective of this research is to examine the effects of UHI from an interconnected perspective providing better insights into the challenges and developing planning solutions for mitigation.

PACE Ocean Color Mission applications and Societal Benefits

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The PACE (Pre- Aerosol, Clouds and ocean Ecosystems) mission is a strategic Climate Continuity mission, included in NASA's 2010 plan: "Responding to the Challenge of Climate and Environmental Change: NASA's Plan for a Climate-Centric Architecture for Earth Observations and Applications from Space". On a polar orbit, PACE will make climate-quality global measurements that are essential for understanding ocean biology, biogeochemistry and ecology, and determining how the ocean's role in global biogeochemical cycling and ocean ecology both affects and is affected by climate change.

With advanced global remote sensing capabilities that include high spectral-resolution imaging, extended spectral coverage to the UV and SWIR, improved spatial resolution in inland, estuarine and coastal waters, enhanced atmospheric correction and higher signal-to-noise, PACE is expected to provide high quality observations that, over the long-term, will contribute to an extended time series of records on inland, coastal, and ocean ecosystems—all of which have substantial value beyond basic science and research. The combination of climate-quality, global atmospheric and oceanic observations provided by the PACE mission will provide a unique capability to help understand changes that affect our ecosystem services, implement science-based management strategies of coastal, marine and inland aquatic resources, and support assessments, policy analyses, and design approaches to plan adaptation and responses to impacts of climate change. Here we discuss the PACE applications program, the new capabilities afforded by this future satellite mission, and how they could potentially advance applications related to assessing impacts of current and future pressures in highly vulnerable coastal environments.

Analyzing changes in the intensity and frequency of Flash Floods in the municipality of Fajardo

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Flash Floods are short term events, occurring within six hours of the causative event and often within two hours of the start of high intensity rainfall. These events can also occur even if no rain has fallen after a sudden release of water. Flash Floods are among the most frequent and costly natural disasters in the United States including P.R. For instance the Interstate PR # 3 and the Jose Celso Barbosa Highways, both located in the municipality of Fajardo, has experience a series of severe flash floods events in the last decade which have caused disasters and an economic impact. The Interstate PR # 3 constitutes the main entrance to this municipality thus any event preventing the access or traffic through this highway represents monetary losses to the municipality as well as a reduction in productivity due to employees that cannot reach their destinations. These events are related to climate change. The two key elements that determine the risk or probability of flash floods are: rainfall intensity and duration. This study shows that there is a positive trend in the frequency of rainfall events that generated between one and two inches in a period of six or less hours for the early rainfall season. This can help explain an increase in the intensity and frequency of flash flood events during the early rainfall season. The same cannot be said about events higher than two inches. There is also a decrease in the frequency of events between one and two inches for the late rainfall season. Completely the opposite of what it is posed in this study. This suggests there are other factors involved at least during the late rainfall season. No trends were observed during the dry season. A closer evaluation to the impacts of the events registered in April 17-18 of 2003 in this municipality highlights the necessity for the local authorities to take action.

Satellites and Environmental Assessment and Forecasting

Assessment North Polar Sea Ice Melt/Freeze and Landscape Freeze/Thaw Using Satellite Scatterometers and Model Data

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The effect of climate change on Earth's high latitudes has become apparent. This circumpolar region, from 60°N to 90°N, is being increasingly influenced by warming temperatures, with noticeable consequences on Arctic sea ice cover and boreal/Arctic terrestrial biomes. With warming temperatures occurring and the subsequent melting of the sea ice and increasing non-frozen seasons over the terrestrial biomes, it is important to understand past, present, and future condition of this region and associate feedbacks to global climate. There are a few ways that this is studied, and that is through data collection using a variety of methods, such as satellites and computer modeling. We apply time series microwave scatterometer data to examine seasonal transitions across this domain. We compare with model output from the Arctic Cap Nowcast/Forecast System (ACNFS) to examine commonalities in modeled fields and remote sensing observations of the sea ice, examining modeled air temperatures and the freeze/melt potential. Backscatter data utilized in this effort include multi-year observations from the Advanced Scatterometer (ASCAT) and the SeaWinds-on-QuikSCAT. These two datasets help elucidate the land-sea ice interaction that may contribute to systematic feedbacks, with implications to coupling with the global climate system.

Portions of this work were performed at the Jet Propulsion Laboratory, California Institute of Technology, under contract to the National Aeronautics and Space Administration.

Imaging of underwater targets with polarimetric camera

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Underwater imaging has always been challenging because of the significant attenuation of light due to absorption by water and suspended/dissolved matter and scattering by water and suspended particulates. These effects, both absorption and scattering, result in image degradation and rapid blurring. Additional information obtained when using polarization properties of the light propagating through the water can provide a better understanding of light propagation and methods for improving image quality. Some living and manmade objects in water have partially polarized surfaces, whose properties can be advantageous in the context of target camouflage or, conversely, for easier detection. Such is the case for underwater images taken to assess the health of marine life and coral reefs which are of significant scientific and technical interest. The main challenge faced by these images is that of improving (increasing) the visibility for ecosystems near and beyond the mesophotic depth zone.

The results shown in this presentation correspond to measurements acquired on a target with well-known polarization characteristics in both Open Ocean (clear) and coastal (more turbid) waters during our last field campaign in the Atlantic Ocean and East Coast, as well as previous trips. Data, in the form of images and videos, was then acquired using a green-band full-Stokes polarimetric video camera and measurements of each Stokes vector components were collected as a function of the Sun's azimuth angles. These measurements were then compared with the modeled image of the target using radiative transfer code for the atmosphere-ocean system combined with the simple imaging model.

A regression model with radar and satellite data for rainfall nowcasting

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A nowcasting algorithm with radar and satellite data for predicting the spatial and temporal distribution of rainfall rate is introduced in this work. The algorithm predicts first the most likely rainy areas and then predicts the expected intensity of rainfall rate in each rain pixel. A discriminant analysis was adopted to identify contiguous rain pixels. A new algorithm is introduced to track rain cells; this algorithm maximizes persistent pixels taking into account the size of rain cells. Tracking results are used to estimate the cloud motion vector and provide the basis for predicting the most likely rainfall areas, which are divided into smaller regions to best represent the nonstationary behavior of rainfall processes. An exponential regression model in time and spatial domain is developed for each region to predict the growth and decay of rainfall intensity. It is assumed that the potential predictors are the two previous observations of reflectivity (radar) and brightness temperature (satellite) located in a neighborhood region with center on a predicted pixel. An iterative forward selection algorithm is proposed to eliminate irrelevant pixels and determine the best predictors for each region; and finally, the intensity of rainfall rate is predicted at pixel level. Five tropical storms that occurred in Puerto Rico during 2003-2013 were used to validate the proposed algorithm. The nowcasting results show the proposed algorithm is a potential tool to predict rainfall rate for short lead times.

Data fusion of Satellite AOD and WRF meteorology for improved PM25 estimation for northeast USA Satellites and Environmental Assessment and Forecasting

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The current approach to ingesting satellite data (IDEA- Infusing satellite Data into Environmental air quality Applications Product) into surface PM2.5 retrievals uses a combination of spatial interpolation and a global geo-chemical model (GEOS-CHEM) to define appropriate mass to AOD factor maps that can be used with satellite AOD retreivals. This information is then statistically blended with current AIRNow measurements creating a refined retrieval product. In this paper, we propose to use the same approach except that we replace the GEOS-CHEM component with an alternative high resolution meteorological model scheme. In particular, we illustrate that the GEOS-CHEM factors can be strongly biased and explore methods that incorporate a combination of satellite AOD retrievals with WRF meteorological forecasts on a regional scale. We find that although PBL height should be a significant factor, the WRF model uncertainties for PBL height in comparison to Calipso make this factor less reliable. More directly we find that the covarying PBL averaged temperature (together with wind direction) are the most important factors. Direct statistical comparisons are made against the IDEA product showing the utility of this approach over regional scales. In addition, we explore the importance of a number of factors including season and time averaging showing that the satellite approach improves significantly as the time averaging window decreases illustrating the potential impact that GOES-R will have on PM25 estimation.

Particle Size Profile Distribution (PSPD) determination and its ingestion into RAMS model Solar Radiation validation: GOES-VS-Pyranometer

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Aerosol particle size distribution (PSD) has been shown to influence total accumulated precipitation, rain rates, and spatial rain distribution. Currently, there are column integrated PSDs available via the NASA maintained Aerosol Robotic Network (AERONET). To build on this vertically homogenous PSD, the present research includes the use of LIDAR and molecular extinction calculated from radiosonde data to determine the vertical profile of PSD in the planetary boundary layer. An algorithm was written to facilitate determination of the varying vertical structure of aerosol. The method is based on the Fredholm equation and Twomey regularization method applied to LIDAR profile data. Average PSD obtained by the particle size profile distribution (PSPD) algorithm has been compared with AERONET PSD for three different days. The radii at which maximum aerosol influence in the distributions are in agreement for the two plots. Also explored in this work is solar radiation validation between the 1km resolution GOES satellite product and a local pyranometer installed at the University of Puerto Rico at Mayaguez (UPRM) for summer 2014. Results show that differences between the two data sets compare well at an R2 of 82%.

Development of a Demand Sensitive Drought Index and its Forecasting for Climate Adaptation and Water Management over the continental United States

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Drought has cascading effects on the environment, economy and society. Managers need better estimates of potential shortfalls in supply due to droughts of varying severity and duration. While global and national drought indicators exist, none directly connect 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. Consequently, assessment of risk for various sectorial 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 for future climate scenarios.
The present research addresses this methodological gap by (1) developing new drought indices that consider both water supply and current or projected sectorial demands, (2) developing insights into the large-scale climatic drivers for forecasting drought onset, duration and severity up to one season ahead for climate informed adaptive risk assessment and long-term planning, and (3) seeking connections to other satellite derived indices such as the NDVI.
We present an application at a county level for the conterminous United States considering more than 60 years of rainfall data as the renewable supply, and water demand patterns for 3 sectors (agricultural, industrial, and domestic use). The resulted index is useful for indicating whether small or large surface storage will suffice, or whether the extent of groundwater storage or external transfers, or changes in demand are needed to achieve a sustainable solution.

Quantification of the Environmental Impacts of Anthropogenic Heat Fluxes in Highly Developed Urban Environments

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New formulations to account for latent and sensible heat production in urban environments from evaporation in impervious surfaces and buildings were incorporated in the Building Energy Parameterization (BEP) of the Weather Research and Forecasting (WRF) to improve surface energy balance estimations. Building information from the New York City Department of City Planning was assimilated and the LCLU classification was modified to better represent the city. A seasonal evaluation for the summer of 2010 over New York City showed an improvement in temperature and humidity estimation mainly during rainy days when evaporation from impervious surfaces plays an important role in the energy balance. Anthropogenic heat from air conditioning systems is a major contributor of sensible and latent heat during the summer particularly in commercial sites where the introduction of cooling towers increase the amount of latent heat affecting surface temperature and humidity. The seasonal assessment for summer 2010 includes a heat wave event and results show significant improvements in the maximum temperature forecast when incorporating modifications to the BEP over conventional approaches.

Mapping Palm Swamp Wetland in Peru using UAVSAR data

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Palm swamp wetland ecosystems form where seasonal flooding is moderate but surface inundation remains constant. The combination of permanently saturated soils, warm temperature year-round, and low oxygen in the palm swamp soils can lead to a large carbon release to the atmosphere, particularly as methane whose warming potential as a greenhouse gas is 23 times higher than that of CO2. Little is known however, on the contribution of carbon from palm swamps and scarce information exists about the location of these ecosystems. **Here we propose a methodology to map palm swamps of the Pacaya-Samiria National Reserve in Peru using UAVSAR data.** The Van Zyl Decomposition algorithm was applied to the data in order to identify the scattering properties of the surface. **The land cover classification was developed by applying the Maximum Likelihood method along with decision trees, yielding results representative of the land cover.**

References

[1] Francis Kahn, 1991, "Palms as key swamp forest resources in Amazonia", Forest EcologyandManagement pp. 133-142.
[2] Lalitha Dabbiru, James V. Aanstoos and Nicolas H. Younan, 2010, "Classification of Levees using Polarimetric Synthetic Aperture Radar (SAR) Imagery", IEEE.
[3] Stein E. Sakshaug, 2013, "Evaluation of Polarimetric SAR Decomposition methods for tropical forest analysis", Library from the University of Troms.

Assimilating merged remote sensing and ground-based snowpack Information for hydrological simulation and forecasting

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Stream flow estimation and flood prediction influenced by snow melting processes have been studied for the past couple of decades because of their destruction potential, money losses and demises. It has been observed that snow, that was very stationary during its seasons, now is variable in shorter time-scales (daily and hourly) and rapid snowmelt can contribute or been the cause of floods. Therefore, good estimates of snowpack properties on ground are necessary in order to have an accurate prediction of these destructive events. The snow thermal model (SNTHERM) is a 1-dimensional model that analyzes the snowpack properties given the climatological conditions of a particular area. Gridded data from both, in-situ meteorological observations and remote sensing data will be produced using interpolation methods; thus, snow water equivalent (SWE) and snowmelt estimations can be obtained. The soil and water assessment tool (SWAT) is a hydrological model capable of predicting runoff quantity and quality of a watershed given its main physical and hydrological properties. The results from SNTHERM will be used as an input for SWAT in order to have simulated runoff under snowmelt conditions. This project attempts to improve the river discharge estimation considering both, excess rainfall runoff and the snow melting process. Obtaining a better estimation of the snowpack properties and evolution is expected. A coupled use of SNTHERM and SWAT based on meteorological in situ and remote sensed data will improve the temporal and spatial resolution of the snowpack characterization and river discharge estimations, and thus flood prediction.

Keywords: Stream flow, Flood prediction, Snow melting, SWAT, SNTHERM.

Characterizing Environmental Factors and Thermal Variations in the Context of Urban Heat Islands and Climate Change, New York City

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All year around heat island forms in Manhattan, New York due to land surface modification, radiative trapping and lack of evapotranspiration. This phenomenon is known as Urban Heat Island (UHI). UHI refers to an increase in air and surface temperatures in urban centers as compared to surrounding suburban and rural areas. Many studies have focused on the UHI effect between rural and urban areas and not many studies are focused on air and surface temperature changes within a city itself. Manhattan is one of United States' most high densely populated city with 27,000 person per Km2 and due to its different elevations and water bodies, the temperature is not uniformly distributed and some areas may heat up more than other. The urban heat island of a city can be subdivided into physically defined neighborhoods that can respond differently to large scale environmental forcing. The urban classification would account for the roughness parameters and surface fluxes and reflect large scale influences with proximity to large body of water or vegetation.

To find the biases at the street level in Manhattan, field campaigns of temperature and relative measurements have been formed for the summer of 2012 and 2013.Two types of field campaigns have been done to complete temperature measurements. One is the suite of mobile sensors to measure temperature and relative humidity. The sensors are deployed by foot simultaneously for measuring street level environmental conditions. This measurement is high spatial resolution and it contains data from the hottest part of the day. Another field campaign measurement is done by 10 fixed sensors which were deployed to measure temperature, relative humidity and sunlight. These sensors were installed at selected locations throughout Manhattan for high temporal resolution. The spatial and temporal variability sampled by these two campaigns provide complementary information that can help in predicting environmental variability throughout Manhattan.

This project will be the first and most high resolution street level neighborhood study on a metropolitan city. To understand the impact of UHI on Manhattan's land cover, this research will create high resolution neighborhood-scale data sets using three basic approaches; employing fixed stations, walking campaign data, and Landsat satellite data. The main goal of the project is to develop a neighborhood based temperature predictions using large scale measurements with down-scaling techniques for both near term and climate projections, and to anticipate climate adaption and mitigation at the neighborhood scale, preparing the health community for climate induced increases in heat wave frequency/intensity.

Land, Climate and Socioeconomics from NOAA Operational Satellites

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The new Global Vegetation Health (GVH) data set has been developed from AVHRR data for operational and scientific purposes. The GVH has advantages before other long-term global data sets, being the longest (34 years), having the highest spatial resolution (4-km), containing, in addition to NDVI, products from infrared channels, originally observed reflectance/emission values, no-noise indices, biophysical climatology and what is the most important, products, characterizing moisture, thermal and vegetation health conditions. The GVH was validated comprehensively around the world and is used widely for monitoring large-scale weather disasters, such as drought, land cover change, climate, ecosystems' diversity and socioeconomic activities. The GVH data and products are designed in the application-ready (without additional processing) indices and products for monitoring, assessments and predictions in agriculture, forestry, climate and lands cover, human health, invasive species, deceases, ecosystem, climate forcing impacts and related topics. The applications are addressing such important topics as food security, land cover degradation, climate dynamics, environmental security and others. Since the NOAA/AVHRR-based technology is gradually coming to the end of its operation, it will be replaced with the most advanced SNPP/VIIRS (transitioning to JPSS/VIIRS) operational system continuing applications and global data records. This presentation will cover most of these issues.

CREST-Snow Analysis and Field Experiment (CREST-SAFE): Continuous In Situ Observations of Snow Physical Properties and Microwave Emission

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The storage of water in snowpack affects runoff and soil moisture, and is therefore important at the regional scale for various hydrologic applications as flood prediction and water resource management. To understand the complex influence of different snow characteristics (grain size, density, snow temperature) on the microwave emission, The CREST-Snow Analysis and Field Experiment (CREST-SAFE) has been carried out since January 2011 at the research site in the backyard of the National Weather Service office, Caribou, ME, USA. In this ground experiment, 37 and 89 GHz dual polarized microwave (10.65 and 19 GHz planned) observations are conducted continuously from the time of snow onset to snow melt off along with detailed synchronous observations of snowpack physical properties.

In this presentation, the overview of the field experiment and of routinely automatic and manually measured data sets including: microwave observations, meteorological observations (air temperature, snow skin-temperature, humidity, wind speed and direction, cloud cover, precipitation, incoming and outgoing radiations), and snow physical parameters at different depth (snow depth, grain size, shape, hardness, and density) will be presented. The analysis of radiometric microwave observations along with observations and modeling of the snowpack properties suggested significant impact of snow wetness on radiometric observations. Therefore, this presentation will also focus on the development of a new method to estimate snow wetness (liquid water content) based on snow grain size and temperature; with the objective of assimilate the wetness on microwave emission models. New instrumentation developed and tested for accurate estimation of snow wetness through the winter season will be discussed.

Keywords: Snow Wetness, Grain size, Microwave Radiometers.

IR LIDAR for Aerosol Detection

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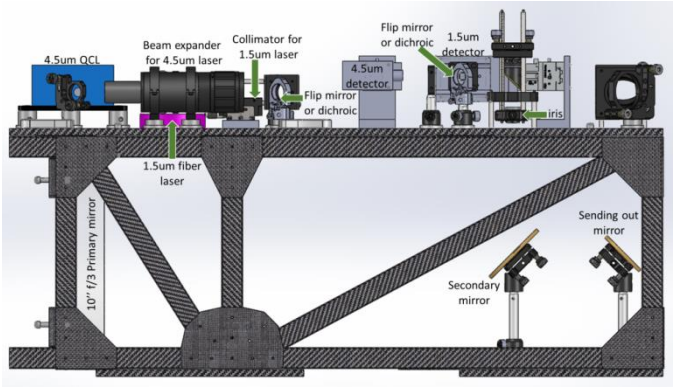
Identifying and quantifying ambient aerosols are important for air-quality applications. Characterization of aerosols size distribution requires significant spectral coverage from the ultra-violet (UV) to mid-infrared because of the broad and highly overlapped aerosol mode spectral signature. Also, modelling local and global climate requires detailed understanding of the aerosol radiative properties, their cloud nucleating properties, and their impact on precipitation. This project explores the possibility of including an optimized backscatter dual channel LiDAR at 4.5µm and 1.5µm to improve cloud and aerosol property retrieval when combined with existing VIS (visible), UV (ultraviolet), and NIR (near infrared) measurements from our LiDAR Facility at CCNY. The present IR LiDAR work is focused on developing an instrument which will provide aerosol and cloud base observations as well as improve the separation of coarse and fine mode particulates.



Assessment of Upper atmospheric plume models using Calipso

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The ability to identify and quantify plumes is critical for better interpreting passive satellite observations of aerosol optical depth (AOD). A number of numerical models which combine meteorological transport and satellite observations has been developed which attempt to quantify plume vertical height and extent including the Navy's NAAPS model and NOAA's GOES ASDTA product. In this presentation, we explore the performance of these models in plume forecasts based on statistical comparisons of Calipso data at different horizontal resolutions. In addition, we also explore the potential of using assimilating satellite total AOD to improve plume forecasts and show that the 12 hour forecasts of plume height and extend can benefit from MODIS AOD. Finally, we illustrate with examples how these plumes can interact with the PBL and effect local air quality.

Modeling New York City Impacts on Long Island Weather

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Extreme heat events have severe consequences on human health and the energy infrastructure. These effects are enhanced within urban centers such as New York City, where buildings and concrete structures in the urban canopy can increase temperatures. Previous studies have also shown that cities can have impacts on weather in surrounding areas by initiating storms through increased convective activity or splitting incoming systems. This study explores the effects that New York City may have on weather in Long Island during an extreme heat event using the state of the art Weather and Research Forecast (WRF) model with a Building Energy Parameterization and Building Energy Model (BEP and BEM, respectively) to simulate a heat wave in July 2010. These impacts are explored through a sensitivity study of the weather over Long Island to the presence of the urban land cover in New York City. The sensitivity study consists of a control case using current MODIS 20 class land cover as input to WRF with no urban parameterizations, a forest case where the urban grid points over New York City are changed to deciduous broadleaf with an increase in soil moisture, and a urbanized WRF run with current land cover. Results show that temperatures decrease when the city is substituted by deciduous broadleaf forest, with nighttime temperatures being up to 2 ^{o}C cooler than the other two cases.

Using Remove Sensing to Identify and Characterize Groundwater-Reliant Ecosystems

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Groundwater Dependent Ecosystems (GDEs) are plants, animals, and other organisms that depend on groundwater to maintain their structure, composition, and function. GDEs are of crucial importance for a variety of ecological resources such as plants, wildlife, sensitive fish, and other organisms which are highly vulnerable to changes in groundwater. Increasing pressure exerted on these ecosystems and the source of water that supports them both in terms of quality and quantity, has made it critical to identify the location and extent of GDEs. This study focuses in the formulation, analysis, and testing of an algorithm for mapping GDEs at 1 km resolution. This is achieved by evaluation of three criteria in which variables are obtained from remote sensing satellite products. The first criterion identifies areas where evapotranspiration (ET) remains constant through a prolonged dry period, pointing to a groundwater contribution to the ecosystem water supply. The second criterion consists in mapping areas with persistent green vegetation during extended dry periods using Normalized Difference Vegetation Index. The third criterion uses Normalized Difference Water Index as an estimate of plant water content to identify vegetation that exhibits lower water stress than the nearby vegetation during a drought. Delineation of groundwater dependence is complemented with equilibrium water table depth maps as well as microwave inundated area products. It is hypothesized that GDEs will be more vulnerable to long-term drought or chronic water diversion than precipitation-dependent ecosystems, which can be both assessed at a coarse spatial resolution using GRACE-measured water storage.

Multivariate Forecasting System: An Integrated Approach for Mitigating Agricultural Risks

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From a risk management context, prognostic information of a single variable such as total precipitation or average temperature will be of less utility especially for specific operational purposes. An integrated regional climate-weather forecast system covering precipitation, temperature and humidity etc. over the year will benefit the farmers in the context of a specific decision time table for irrigation scheduling as well as for pre-season crop choices. Hence, contrary to the existing forecasting methods that develop multi time scale information of a single variable at a time, in this paper, we introduce an integrated regional multivariate climate-weather forecasting system that directly relates to agricultural decision making and risk mitigation. These multi-scale risk attributes include mutually dependent, spatially disaggregated statistics such as total rainfall, average temperature, growing degree days, relative humidity, total number of rainfall days/dry spell length, and cumulative water deficits that inform the potential irrigation water requirements for crops etc. Given that these attributes exhibit mutual dependence across space and time, we propose to explore common ocean-atmospheric conditions from the observations and the state of the art Global Circulation Models (GCMs) that can be utilized as the predictor variables for the forecasting system. Non parametric bootstrap resampling methods and Hierarchical Bayesian methods that can easily handle the high dimensionality of such problems will be used to develop the integrated forecast system. The developed multivariate forecasts will be adapted and disseminated as decision tools for the farmers under the contract in Florida.

Using satellite data on Science On a Sphere® at museums to inform society through ClimateBits: short, engaging videos on essential Earth Science concepts

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Satellite missions are funded by US taxpayers, yet too often the valuable science that results from them is never clearly communicated to the public. ClimateBits is a resource currently being developed at CICS-MD to fill that gap. Using global satellite data, we simplify Earth Science concepts to minute-long videos played on Science On a Sphere (SOS) museums around the world, with an estimated 35M visitors per year, and visible to anyone on the website: http://climatebits.umd.edu . Working closely with the Maryland Science Center, we realized the need for museum staff and the general public to get quick explanations of climate science topics and their relevance to society. Our goal is to provide insight into these terms rather than just a simple definition. Museums can use ClimateBits within an SOS show or anybody can use them online for background information (e.g. K-12 teachers with smartboards, policymakers). Initial proof-of-concept videos on solar radiation, ozone layer, and air quality have been favorably received by test populations of museums docents, K-12 educators and scientists (at NOAA, NASA, Smithsonian, university and public school venues). These introductory videos are being developed at CICS-MD/UMD in collaboration with NASA GSFC. We are in the process of creating additional ClimateBits on a variety of key concepts (e.g. seasons, ozone hole, UV index, acid rain, carbon cycle, precipitation) using satellites from multiple missions and platforms to increase its visibility with the general public and to help communicate the importance of the science derived from satellite data.

On the Validation of Airborne Data and Atmospheric Modeling on Summer Temperature Gradients in Southern California

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Understanding changes in sea breeze temporal and spatial dynamics including inland penetration is a relevant subject in many coastal climates. The case of the California coastal summer climate is of particular importance due to the strong influence of the sea-breeze in the regional climate. Further, recent studies by the authors found that summer average-maximum air temperature in the populated California coastal areas of San Francisco Bay Area and the South Coast Air Basin (SoCAB) showed cooling trends at low elevation coastal areas open to marine air penetration and warming trends at inland and high elevation coastal areas (Lebassi *et al.* 2009). The authors hypothesized that this coastal cooling was the consequence of an increase of sea-breeze activity during the period, reflected by the increase in sea-land pressure gradients in the region calculated, as from ECMWF ERA-40 data from 1979-2002. These results require further analysis of the summer sea-breeze spatial and temporal extent in the Los Angeles area through numerical modeling.

The present study takes advantage on observations of maximum sea-breeze and associated regional thermal response for the South Coast Air Basin in support of the above hypotheses. A field study was configured to observe the sea-breeze intensity and penetration via 18 surface ground stations and 5 wind profilers along the projected transect of the sea-breeze during September 24th 2013, one of the days of the HyspIRI flight campaign over the SoCAB Box.
Broadband albedo and land surface temperature derived from the Level 2 products from this campaign were ingested into the Weather Research Forecast (WRF) model in order to update surface and land characteristics. The model ouputs are then compared with observations of 2-m air temperatures and surface winds during the same period of the flight campaign. Results show a much better improvement of model outputs using the higher resolution HyspIRI derived products into the model against the default model characteristics.

The surface, vertical and airborne data acquired during this campaign will provide the framework for numerical model validation of temperature and wind in the Los Angeles area. These modeling studies will assess which are the most influential factors on changes in temperature and wind patterns over the last four decades. These factors include: Global Warming, Pacific Decadal Oscillation (PDO) and changes in Land Cover-Land Use.

Hyper-spectral Retrievals From the NOAA Aerosol and Ocean Science Expeditions (AEROSE)

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The tropical Atlantic Ocean is a region of significant meteorological and oceanographic interest in terms of atmospheric chemistry and mesoscale-to-synoptic scale dynamic and thermodynamic phenomena. Passive and active remote sensing instruments onboard geostationary and polar orbiting satellites are providing global data, but the unique dynamic and thermodynamic nature of advected Saharan and sub-Saharan air masses over maritime environments provide a unique challenge for the interpretation of these remote sensed profile data. As a consequence, oceanic research missions are necessary for validation of satellite remote sensors using in-situ measurements. In this poster, a series of trans-Atlantic research campaigns, the Aerosol and Ocean Science Expeditions (AEROSE), will be discussed. A principal component retrieval technique will be reviewed and retrievals from the Infrared Atmospheric Sounding Interferometer (IASI) in the presence of Saharan and sub-Saharan dust aerosols will be presented.

Importance of Satellites in building Weather Ready Communities

Calibration of the Runoff Component of the GOES-PRWEB algorithm in Puerto Rico

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Accurate estimates of the surface water budget are necessary for management of water resources in Puerto Rico. Using Satellite and radar data, the GOES-PRWEB algorithm estimates the components of the water budget on a daily basis at 1-km spatial resolution over Puerto Rico. The goal of this study is to calibrate the runoff and aquifer recharge components of GOES-PRWEB.

The approach uses historical US Geological Survey (USGS) stream flow data from all gauged watersheds in the island. As part of the calibration process, the runoff curve number (CN) is adjusted until the modeled and measured stream flows come into approximate agreement. As a preliminary exercise we have analyzed the Guanajibo watershed in southwest Puerto Rico.

Preliminary results indicate that the model is overestimating surface runoff and stream base flow in some cases. We hypothesize that the errors that remain, after adjustment of the CN values, is a result of errors in the NEXRAD radar rainfall volume. A further step in the calibration process will use daily near-real-time stream flow volume data to back calculate a bias correction factor for the watershed radar rainfall. The process will be automated and corrections to the NEXRAD radar rainfall will be performed each day and made available on a website where they will be available to the public.

The Microwave Integrated Retrieval System (MiRS): Algorithm Status and Science Updates

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The Microwave Integrated Retrieval System (MiRS) is a NOAA operational algorithm responsible for generating various environmental products from multiple satellite platforms carrying passive microwave radiometers with different instrumental configurations. Thanks to the algorithm's 1DVAR architecture, the retrieval is applicable to both cross-track sounders and conical imagers in the same algorithmic framework, ensuring consistent retrievals across different satellite platforms. Currently, MiRS is applied operationally to the AMSU-A and MHS instruments on board of NOAA and EUMETSAT polar orbiting satellites, SSMIS on DMSP polar satellites, and ATMS on Suomi-NPP satellite. The algorithm is also being adapted to accommodate SAPHIR onboard Megha-Tropiques, TMI on TRMM, AMSR-E on Aqua, AMSR-2 on GCOM-W1, and GMI on the GPM core satellite.

Mathematically, MiRS solves an inversion problem via optimal estimation to find a set of geophysical parameters that are consistent with the satellite brightness temperatures observed. The inversion problem is solved by minimizing a two-term cost function- (1) the departure of the simulated radiances from the actual measurements and (2) the departure of the retrieved parameters from their respective *a priori* information. The geophysical parameters in the state vector include temperature and moisture profiles, vertical profiles of cloud, ice, and rain water contents, skin temperature, and surface emissivity spectra. Additional products are derived from the retrieved geophysical products, which include- total precipitable water, snow cover, snow water equivalent, sea ice concentration, cloud liquid water path, ice water path, rain water path, and rainfall rate.

Soon, a newer version of the MiRS system (v11), will be released operationally, applicable to all operational satellite platforms. In this new release, significant changes have been made that have led to improved retrievals for certain geophysical products. In this presentation, the new capabilities and science improvements that are added to the MiRS v11 release will be highlighted. Using independent validation, the improved geophysical products associated with the science improvements will be demonstrated. Notable updates in the MiRS v11 release include- 1) updated forward modeling capability from pCRTM version to CRTM v2.1.1, 2)

updated microwave sea surface emissivity model (FASTEM-5), 3) implementation of a dynamic (spatially and temporally varying) *a priori* database, and 4) improved retrieval of hydrometeor quantities with a modified physically-based surface rain rate relationship.

Furthermore, given the flexibility of the MiRS system, it can be used as Quality Control (QC) and pre-processing tool in the GSI data assimilation system.

Investigating Correlations of Horizontally Oriented Ice and Precipitation in North and South Pacific Maritime Clouds Using Collocated CloudSat, CALIOP, and MODIS Observations

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In late 2007, the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) aboard the A-train changed its nadir-viewing angle. The original viewing angle of 0.3° (changed to 3° in 2007) allowed the polarization capabilities of the Lidar to determine the orientation of ice crystals. This is because viewing ice clouds at a nadir angle closer to 0° will yield specular reflection due to horizontally oriented ice. Similarly to how a mirror will reflect a laser that is pointed perpendicular to the plane of the mirror, oriented ice crystals return a strong integrated attenuated backscatter while also returning low depolarization values. This results in a distinguished depolarization and attenuated backscatter signature for horizontally oriented ice crystals as opposed to ice crystals that have no pattern in orientation (i.e. randomly oriented ice). In a preliminary search, it is found that up to 20% of warm (250 - 270 K) mid- latitude middle level clouds contain horizontally oriented ice. By taking advantage of the nearly synchronous orbits of the A-train constellation, an opportune dataset from 2006 and 2007 is compiled. This dataset includes collocated products from the CloudSat Cloud Profiling Radar (CPR), CALIOP, and the Aqua Moderate-resolution Imaging Spectroradiometer (MODIS). The Lidar capabilities of CALIOP in conjunction with the microwave sensitivity to precipitation provided by the CloudSat CPR give a unique point of view to explore the connection between these two physical phenomena. Similarly, the spatial imaging from MODIS yields insights into the phase of cloud layer tops and particles' effective radii. MODIS aerosol optical depths may also shed light upon the cloud ice nucleation mechanisms that also may play a large role in the precipitation process. Preliminary results suggest that not all marine regions have the same occurrences of HOIC; the Northern Hemisphere demonstrates a strong seasonal dependence with a maximum in the winter months while the Southern Hemisphere is mostly seasonally independent. Using collocated CloudSat retrievals of precipitation we find a strong correlation between the occurrences of HOIC and precipitation, which will be explored in the presentation.

1. Hu, Y. et al. (2009), CALIPSO/CALIOP Cloud Phase Discrimination Algorithm, *J. Atmos. Ocean. Technol., 26*(11), 2293–2309.

A New Differential Absorption Lidar to Measure Sub-hourly Fluctuation of Tropospheric Ozone Profiles in the Baltimore - Washington D.C. Region

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Tropospheric ozone profiles have been retrieved from the new ground based National Aeronautics and Space Administration (NASA) Goddard Space Flight Center TROPospheric OZone DIfferential Absorption Lidar (GSFC TROPOZ DIAL) in Greenbelt, MD from 400 m to 12 km AGL. Current atmospheric satellite instruments cannot peer through the optically thick stratospheric ozone layer to remotely sense boundary layer tropospheric ozone. In order to monitor this lower ozone more effectively, the Tropospheric Ozone Lidar Network (TOLNet) has been developed, which currently consists of five stations across the US. The GSFC TROPOZ DIAL is based on the Differential Absorption Lidar (DIAL) technique, which currently detects two wavelengths, 289 and 299 nm, with multiple receivers. The transmitted wavelengths are generated by focusing the output of a quadrupled Nd:YAG laser beam (266 nm) into a pair of Raman cells, filled with high pressure hydrogen and deuterium, using helium as buffer gas. With the knowledge of the ozone absorption coefficient at these two wavelengths, the range resolved number density can be derived. An interesting atmospheric case study involving the Stratospheric-Tropospheric Exchange (STE) of ozone is shown to emphasize the regional importance of this instrument as well as assessing the validation and calibration of data. There was a low amount of aerosol aloft and an iterative aerosol correction has been performed on the retrieved data which resulted in less than a 3 ppb correction. The retrieval yields an uncertainty of 16-19% from 0-1.5 km, 10 - 18% from 1.5 -3 km, and 11 - 25% from 3 km to 12 km according to the relevant aerosol concentration aloft. There are currently surface ozone measurements hourly and ozonesonde launches occasionally, but this system will be the first to make routine tropospheric ozone profile measurements in the Baltimore-Washington D.C. area.

Developing and Validating Satellite Land Surface Temperature Product for JPSS Missions

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Information on land surface temperature (LST) is important for understanding climate change, modeling the hydrological and biogeochemical cycles, and is a prime candidate parameter for Numerical Weather Prediction assimilation models. Satellite remote sensing is the only resource for providing regular regional and global LST measurements. The satellite LST production has been conducted over 30 years, through a variety of sensors onboard geostationary- and polar-orbiting satellites; a number of different algorithms have been applied for LST derivation from the sensor data. Currently, NOAA is conducting a new LST product generation through the Joint Partnership Satellite System (JPSS) program which has had the first satellite launched in October 2011. Several issues have been found and investigated in the JPSS LST product development and validation. For instance,, it is well-known that quality of LST production is significantly lower comparing to the satellite production for sea surface temperature (SST) using the same sensor data. Applications of the satellite LST product have been significantly restricted due to such low-quality status. This is particularly true in promoting the LST data usage in numerical weather predicting model, which is a critical application domain of the satellite products at National Oceanic and Atmospheric Administration (NOAA). Understanding issues in LST development and validation is vital in our efforts to improve the satellite LST production.