# ISETCSC DAY ABSTRACTS

## INVITED PRESENTATIONS

**Louisa Koch**, *Director of Education, NOAA, US Department of Commerce*. "NOAA Priorities"


ABSTRACT

The National Oceanic and Atmospheric Administration's (NOAA) envisions an informed society that uses a comprehensive understanding of the role of oceans, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions. In 2007, Congress passed the America COMPETES Act that provides broad education authority for NOAA. In response, NOAA created an Education Strategic Plan's (2009-2029) to bring together education capabilities across the agency, from the National Weather Service to the National Marine Sanctuaries. NOAA has two education goals: 1) To foster an environmentally literate public; and 2) To build a future workforce that reflects the diversity of the Nation, skilled in science, technology, engineering, mathematics (STEM), and other disciplines critical to NOAA's mission. NOAA's Educational Partnership Program (EPP) is NOAA's largest education program and is dedicated to building a diverse future workforce skilled in oceanic and atmospheric sciences. Established in 2001, the Educational Partnership Program (EPP) has formed effective partnerships with Minority Serving Institutions (MSIs) resulting in 2,052 trained students and 971 graduated students in STEM fields. EPP has established five Cooperative Science Centers to increase research collaboration with MSIs. The Interdisciplinary Scientific Environmental Technology Cooperative Science Center (ISETCSC) at North Carolina A&T State University is the newest of the five centers. To date, the Cooperative Science Centers have graduated 720 students and 541 are in the pipeline. In its short three-year tenure, ISETCSC has graduated 51 students and created a pipeline of 131 students of undergraduate and graduate students who have benefited directly from educational and research experiences.


**Louis W. Uccellini** *Director, National Centers of Environmental Prediction (NCEP)*
"Advancing the Prediction of Extreme Events"


ABSTRACT

In this presentation, a historical perspective on the ongoing improvements in weather forecasting is presented to illustrate how the prediction of extreme events has been advanced over the past 50 to 60 years. The advances in numerical prediction and access to the modern global observing system dominated by a myriad of satellite observations and the skill set of forecasters who work with the information inherent in these models are given as key reasons for the overall improvement in forecasting and the recent successes in extending the prediction of severe weather, winter storms and other weather related events days to even a week in advance. A review of today's numerical model suite run at NCEP is then discussed, with the ongoing second revolution in operational model forecasts (i.e., the increasing use of multi model ensemble prediction systems) emphasized. Finally the performance of the models and related forecast challenges related to the recent winter storms affecting the southern United States will be discussed.

**William H. Brune** *Professor and Chair, Department of Meteorology, Pennsylvania State University* "Figuring out Air Pollution"

ABSTRACT

Air pollution affects us all. It hurts our health, damages our environment, and changes our climate. While we generally know which human activities cause air pollution, we cannot simply stop doing them without completely changing our lives. Instead, we need to figure out the details of air pollution so that we can make smart changes. The most common approach is to put everything we think we know into large computer models and then compare the calculated pollution with the measured pollution. Once we have confidence in the models, we can use them to predict what the pollution will be if we make changes. These predictions can then help us make smart changes. While the models and measurements are good, are they good enough? Not quite, but we can do something about that.

**Judith Curry**, *Professor and Chair, School of Earth and Atmospheric Sciences, Georgia Institute of Technology* "African Easterly Waves and Atlantic Hurricanes"

ABSTRACT

Sub seasonal hurricane forecasts (1-4 weeks) would be useful to support decision makers in the energy, retail, and reinsurance sectors. The prospect for such extended range hurricane forecasts lies in the potential predictability of the genesis and development of African Easterly Waves (AEWs). AEWs provide the seed for more than 60% of all North Atlantic tropical cyclones, and 85% of major hurricanes. However, determining the likelihood of AEW intensification remains a difficult task. We have developed a Bayesian diagnostic methodology to understand genesis of North Atlantic tropical cyclones (TCs) spawned by AEWs through the examination of the characteristics of the AEW itself together with the large-scale environment, resulting in a probabilistic discrimination between large-scale environments associated with intensifying and decaying AEWs. For the prediction of genesis from an AEW, the most useful variables are the initial amplitude of the AEW, column integrated heating, vertical velocity, specific humidity, and SST. To assess whether forecast skill exists on intraseasonal timescales, we use the ECMWF Monthly Forecasting System. This modeling framework features an ensemble of 51 coupled ocean—atmosphere integrations out to 32 days, that are produced weekly. A tropical cyclone genesis and tracking scheme is applied to the ECMWF forecast products for the 2007-2009 Atlantic hurricane seasons. The forecasting scheme provides the greatest skill for hurricanes produced by AEWs. The skill of the monthly forecasts of TC activity are shown to vary in accordance with the phase and intensity of the Madden-Julian Oscillation at the time of model initialization.

## STUDENT PRESENTATIONS

**James Spinks**; *ISETCSC/Mathematics Graduate Student, Faculty Advisors:* **Dr. G. Tang and Dr. Yuh_Lang Lin;** "The Generation, Maintenance and Propagation of the Pre-Helene African Easterly Waves and Mesoscale Convective Systems over Africa: A Numerical study and Analysis of the Environment"


ABSTRACT

Based on the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) infrared (IR) satellite imagery and controlled simulations using the Weather Research and Forecasting (WRF) model, the pre-Hurricane Helene (2006) African Easterly Wave and mesoscale convective system (AEW-MCS) were found to be initially formed over eastern North Africa. Specifically, the Ethiopian Highlands (EH) play an essential role in the formation of the AEW which, in turn, was able to merge with the convective clouds over EH, Darfur Mountains (DF) and Cameroon Mountains (CM) organized into an AEW-MCS system, which is similar to that found in a previous study on Tropical Storm Alberto (2000), but differs in taking a longer merging process due to weaker pre-Helene AEW and MCS.

Based on WRF analysis of the pre-Helene AEW-MCS system, this study found that vertical moisture flux played a major role in the generation of AEW-MCS and maintenance of the convective cycles associated with the pre-Helene AEW-MCS system as it traveled westward across Northern Africa. The simulated propagation speed of the pre-Helene AEW-MCS is 8.3 $ms^{-1}$, which is consistent with the observed speed. Initially, orographic forcing induced vortex leading to AEW on the lee of EH and MCSs over EH, DF, and CM. The AEW helped these MCSs organized into the pre-Helene AEW-MCS system. As the pre-Helene AEW-MCS system travels westward across the continent, the moisture flux fluctuated in reflection of the local environment. This study also identified several convective genesis periods and three lysis periods of the mesoscale convective system.

In addition to the supply of upward vertical flux from the environment, AEW also played an important role in keeping the MCS coherent. It was also found that the pre-Helene AEW-MCS is slightly modulated by orography downstream from the EH and DF regions.


**Darkus Jenkins,** *ISETCSC/EES/Chemistry- PhD Student;* ***Faculty advisor:*** **Dr. Zerihun Assefa**
"Search for materials capable of detecting Volatile Organic Compounds in the Atmosphere: Synthesis and spectroscopic studies of gold (I) phosphine complexes"


ABSTRACT

Due to environmental and health concerns of Volatile Organic Compounds (VOCs), they have become of interest in many research areas. The mode and extent of deployment of various VOCs is of current interest. One such VOC is acetonitrile. In this presentation the synthesis, structural characterization, and luminescence properties of gold (I) phosphine complexes are described with their usefulness as potential VOC detectors. Material synthesis involves a number of modified imidazole-based phosphine ligands including 1-methyl imidazole phosphine, benziimidazole phosphine, and 1-methylbenziimidazole phosphine. Details of the current status of our synthetic work, where the imidazole-based phosphine ligands are targeted for potential application in VOC detection will be described.



**Structural data collection and analysis by Dr. Richard Sykora, University of South Alabama is kindly acknowledged.*

**William Wright***; ISETCSC/EES/Computer Science -PhD Student; Faculty Advisor:* **Dr. Albert Esterline** "Thrust Area III and Sensor-Web Research"

ABSTRACT

The research of Thrust Area III focuses on data mining, fusion and collection for analysis and modeling. This area concentrates on the challenge of data collection, analysis, and interpretation of large volumes of climate data. Data mining and data fusion techniques are particularly challenged by the complex relationships of the large volumes of data. Multiagent systems, web services, and grids are some of the state-of-the-art techniques used for addressing solutions to these challenges. Multiagent systems, Web services, and grids present distributed architectures that help bind our software components for data fusion and data mining techniques with our hardware components of sensor networks and sensor webs, which are spatially distributed collections of sensors. The tasks of Thrust Area III address efficient data collection methods through sensor webs, the integration of physical models and statistical learning for data fusion, efficient data mining of large volumes of data using multiagent systems and grid computing, and the incorporation of geospatial data models for modeling and visualization.