Center for Ocean-Atmospheric Prediction Studies

Newsletter
Summer 2009

About COAPS

The Florida State University Center for Ocean-Atmospheric Prediction Studies performs interdisciplinary research in ocean-atmosphere-land-ice interaction to increase our understanding of the physical, social, and economic consequences of climate variability.

COAPS is located in Tallahassee's Innovation Park and has a staff of approximately 50, including teaching faculty, research scientists, and students from the fields of meteorology, physical oceanography, statistics, and the computer and information sciences.

COAPS is a NOAA Applied Research Center and is home to the Florida Climate Center (Office of the State Climatologist) and the Research Vessel Data Center. Sponsors include NASA, NOAA, NRL, NSF, ONR, the State of Florida, USDA, and the U.S. DOE.

Hurricane Katrina's eyewall as seen from a NOAA P-3 hurricane hunter aircraft. Photograph by Lieutenant Mike Silah/courtesy NOAA.

The 2009 Hurricane Season Is Here

by Mark Powell, NOAA Scientist stationed at COAPS

June 1 brings the official start of the hurricane season and COAPS scientists will be priming for action! Hurricane season runs from June 1 through 30 November, with the climatological peak found in the second week of September. You may have heard or seen some of the forecasts for the season already from other organizations. These forecasts are based on statistical methods that look for correlations between various factors (such as rainfall over Africa, and the phase of the ENSO) and the number of hurricanes and tropical storms in a given season.

Issuing a seasonal forecast is a sure way to get some media attention but are those forecasts any good? It turns out that forecasts issued before hurricane season starts have little to no skill and only show some skill when updated in August, at which time the season is a third over. But let's say the forecast is good... does it mean you are "off the hook" if an inactive season is called for? That was not the case in 1992. The forecast was for an inactive year and the forecast was pretty good. The first storm of the year formed in late August. Unfortunately that storm was Hurricane Andrew and it left over 200,000 people homeless after striking South Florida.

A new way to conduct seasonal forecasts, discussed on the following page, has been developed by COAPS scientists Tim LaRow, Young-Kwon Lim, Dong-Wook Shin, Eric Chassignet and Steven Cocke. This ensemble approach was recently published in the *Journal of Climate* and is the basis for a new type of seasonal activity forecast that shows great promise.

Now what else is going on hurricane-wise at COAPS? As part of my job as a NOAA Hurricane Research Division (HRD) scientist, I'll be working with colleagues at COAPS and in Miami to conduct real-time analyses of tropical cyclone wind fields using H*Wind, an analysis system that includes JAVA graphical interface to a hurricane database. I'll be joined in this effort by COAPS colleagues Henry Winterbottom, a PhD candidate who is investigating new methods to initialize hurricanes in coupled numerical models, and Steven DiNapoli, a new graduate student who is working with Dr. Mark Bourassa and I to look into methods to quantify uncertainty in hurricane wind analysis. When a tropical cyclone is west of about 60 degrees longitude, it's within reconnaissance aircraft range and a schedule is set up for wind analyses every 6 hours or, when a hurricane warning is issued near the U. S., every 3 hours. These analyses are archived on the web where they become available as research guidance for forecasts and warnings, as initial fields for the modeling community, or for remote sensing validation efforts. This season new metrics for tropical cyclone destructive potential will be issued along with the wind field analysis products. These include new scales for wind and storm surge/wave damage that are a big improvement over the outdated Saffir-Simpson scale.

Tropical Cyclone Activity in the Northern Hemisphere

COAPS Ph.D. student **Ryan Maue**, with support from COAPS Associate Professor **Mark Bourassa**, recently conducted research on tropical cyclone activity in the northern hemisphere.

Tropical cyclones are low pressure storm systems over warm tropical or sub-tropical waters with intense thunderstorm activity and destructive surface wind circulation. Classifications include hurricanes, typhoons, tropical storms, and tropical depressions.

In his research, Maue examined variations in accumulated cyclone energy (a measurement of intensity, frequency, and duration) over the past 3 decades and found that, while energy levels in the northern hemisphere have varied widely during this time period, there has been no overall trend in tropical cyclone activity.

Increases in cyclone energy in the northern Atlantic have been counterbalanced by decreases in the northern Pacific, and, in the last several years, cyclone activity in the northern hemisphere has been relatively inactive.

Related article in *Geophysical Research Letters*: http://dx.doi.org/10.1029/2008GL035946.

Seasonal Predictions of Tropical Cyclone Activity using the FSU/COAPS Global Spectral Model

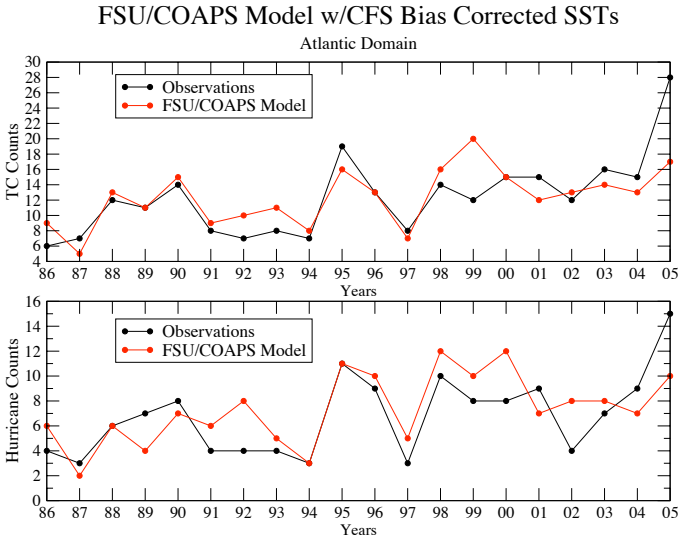
by Tim LaRow, Associate Scholar Scientist, and Lydia Stefanova and Dong-Wook Shin, Assistant Scholar Scientists

At COAPS, we have recently begun to study the seasonal predictability of tropical cyclone activity using the FSU/COAPS global spectral model.

For our initial research, we analyzed the relationships between observed sea surface temperatures (SSTs), the number of model-generated tropical cyclones (TC), and accumulated cyclone energy from the 1986-2005 hurricane seasons. For the interannual variability of TC numbers and accumulated cyclone energy, the correlation with the observations was very high: 0.78 for TC numbers and 0.85 for the accumulated cyclone energy. In order to get a probabilistic measure of skill, we conducted multiple experiments, varying the initial atmospheric conditions centered on June 1st for each year. This research, published last year in the Journal of Climate, yielded the highest interannual correlation of TC numbers for the Atlantic basin of any published work thus far.

Given the success of the study with observed SSTs, we wanted to test how well the atmospheric model could perform using forecasted SSTs. So we repeated the same 20-year study but replaced the observed SSTs with forecasted SSTs from the National Centers for Environmental Prediction's Climate Forecast System (CFS) model. We used the daily forecasted SSTs from the June 1st CFS forecasts and applied a simple bias correction to the SSTs to remove any systematic errors in the SSTs.

The FSU/COAPS model performed surprisingly well for the entire 20 years using the forecasted CFS SSTs. The agreement between the interannual variability of total storms (tropical storms + hurricanes) and for just hurricane counts is very high, as can be see in the figure.



Based on the above results, we conducted a forecast for this hurricane season using the latest forecasted CFS SSTs from May 30, 2009, and applied these to our model to dynamically predict the 2009 hurricane season. Our model predicts a mean of 8 tropical systems and 4 hurricanes for the 2009 Atlantic hurricane season, which is below the model's 20-year average of 13 tropical systems and 8 hurricanes. Contributing to the low activity this year is the possible re-emergence of El Niño-like conditions in the tropical east Pacific and relatively cool tropical Atlantic Ocean temperatures.

In comparison, NOAA's 2009 seasonal hurricane outlook, which is based on current and forecasted large-scale atmospheric and oceanic conditions, calls for a 50% chance of a near-normal season. Based on these scenarios, NOAA estimates a 70% probability for each of the following seasonal ranges:

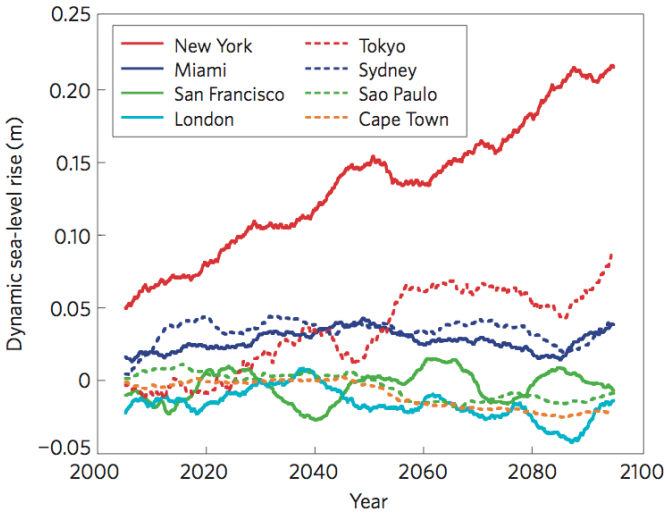
- 9-14 named storms;
- 4-7 hurricanes;
- and 1-3 major hurricanes.

Model Projections of Sea Level Rise

COAPS scientist **Jianjun Yin** recently led a study published in *Nature Geoscience* showing that regional sea levels along the northeast coast of the U.S., particularly near New York, are expected to rise almost twice as fast as global sea levels during the twenty-first century.

For the study, Yin and colleagues Michael Schlesinger of the University of Illinois at Urbana-Champaign and Ronald Stouffer of the Geophysical Fluid Dynamics Laboratory at Princeton University analyzed climate projections from a set of state-of-the-art global climate models under a variety of greenhouse-gas emission scenarios.

Under all of the models and scenarios the researches used, they found that warming temperatures are projected to slow down the Atlantic meridional overturning circulation (AMOC), which moves warm waters in the upper ocean northward, and pushes cold water at depth southward. As this ocean conveyor belt slows down, the model projections show significant rises in regional sea levels along the northeast U.S.

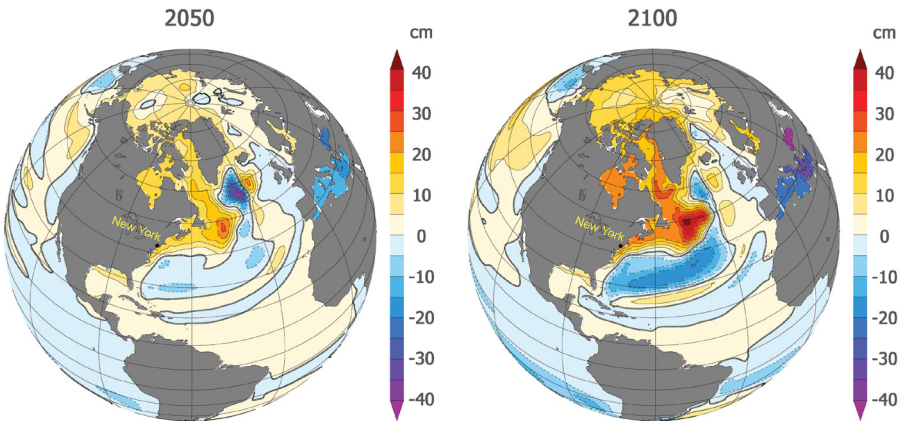


Dynamic sea level rise projections for coastal cities worldwide under a medium greenhouse-gas emission scenario.

According to the medium greenhouse-gas emission scenario used in the study, the regional rise in the northeast due to changes in circulation is estimated to be 8.3 inches by the year 2100. This regional rise is in addition to the estimated 10.2 inch mean global sea level rise that is expected to occur due to thermal expansion.

This work suggests that the northeast coast of the U.S. is among the regions most vulnerable to future changes in sea level through variations in ocean circulation, and is at greater risk for floods, storm surge, beach erosion, and infrastructure damage.

Related article in *Nature Geoscience*: http://dx.doi.org/10.1038/ngeo462.



Dynamic sea level rise projections for 2050 and 2100.

CoCoRaHS Update

by Melissa Griffin, Assist. State Climatologist & Florida CoCoRaHS Co-Coordinator

The Community Collaborative Rain, Hail, & Snow network (CoCoRaHS) is alive and well in Florida! CoCoRaHS is a national organization of volunteers who take daily precipitation measurements from their own backyards for a variety of natural resource, education, and research applications.

CoCoRaHS currently has 475 active observers in Florida, and many played an important role in capturing data from the heavy rains that fell along the east coast this May. One station in Ormond Beach recorded 24.41" in three days!

Other parts of the state, unfortunately, haven't received nearly as much precipitation. An observer in Lehigh Acres has only had 2.10" since the first of May, while an observer in Monticello has only reported 3.35".

If you are interested in becoming a CoCoRaHS volunteer, please email mgriffin@coaps.fsu.edu, call 850.644.0719, or visit http://www.cocorahs.org.

Family Activity: Stratification/Internal Wave Demonstration

You will need: a clear container with a wide brim, such as an aquarium or a large glass bowl; an additional container, such as a pitcher; a ladle or similar utensil; salt; food coloring; hot and cold water; and a spatula.

Step 1: Fill 1/3 of the clear container with cold water and add 1/8 cup salt for every 1 cup of cold water.

Step 2: In the other container, mix hot water and food coloring.

Step 3: Use the ladle to *very slowly* add the hot water mix to the surface of the cold water. Because the hot water is less dense than the cold salt water, the hot water should stay on top.

Step 4: *Very slowly* dip the spatula into the water mixture and move it back and forth, creating internal waves between the two layers. Internal waves are found in both the ocean and the atmosphere, in between layers of different densities.

Student Spotlight: *Austin Todd* (Ph.D. Student, Oceanography)

I am a second-year PhD student in physical oceanography.

I began working at COAPS in May 2006 as an undergraduate student in Meteorology, where I studied the relationship between fire occurrences in Florida and a commonly used drought index.

For my PhD dissertation, I am currently using ocean models to simulate the coastal ocean circulation in the Florida Big Bend region. By understanding the physics behind how the coastal ocean circulates in this northeastern corner of the Gulf of Mexico, I hope to enhance knowledge of the early stages of the gag grouper life cycle. This work will aid in fisheries management practices and provide marine ecologists with insight into some bio-physical connections in the Gulf of Mexico.

The interdisciplinary nature of this research is one of the things that I love most about my work, allowing me to interact with not only other physical oceanographers, but also with biologists, ecologists, fishers, and the marine science field at large. The vibrant, collaborative environment at COAPS makes my work even more enjoyable.

Upon graduation, I hope to stay in the research field and to pursue a career as a faculty member at a major oceanographic institution.

Alumnus Spotlight: *Matt Sittel* (M.S. Meteorology, 1994)

I am working for the Air Force Weather Agency (AFWA) at Offutt AFB, Nebraska. I am currently employed by the University Corporation for Atmospheric Research (UCAR) as a Visiting Scientist.

For the last 10 years, my job has been verification of meteorological forecast models. I work on all aspects of verification, including observation database retrieval and quality control, software maintenance, statistical and graphical summarization, and web page design. AFWA runs many global and regional scale models, and in the past year has begun running ensembles. I especially enjoy being part of this exciting new field, and designing new methods to depict model performance tailored to military personnel stationed around the world.

I have been married since 1998 to Karen, who is also a meteorologist. We have one son, Nathan, who will turn 6 years old in June. We love to travel, and in my spare time, I can often be found watching and photographing birds and other wildlife. My personal web page details this and my other interests: http://www.mcsittel.com/.

I've only been back to Tallahassee 3 times in the 15 years since I graduated. I miss Florida during our long, cold winters in the upper Midwest!

If you are an alumnus interested in sharing your experiences, please contact Meredith Field (mfield@coaps.fsu.edu).

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