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 slowly add the hot water to 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 in the water.

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

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

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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).

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

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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 wind 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.

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 seen 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.

COAPS scientist Jianguo 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 researchers used, they found that warming temperatures are projected to slow down the Atlantic tropical ocean 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.

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.
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

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Model Projections of Sea Level Rise

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CoCoRaHS Update

by Melissa Griffin, Co-Coordinators

The Community Collaborative Rain, Hail, & Snow network (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.

The CoCoRaHS network has 475 active observers in Florida, and many play an important role in capturing data from the heavy rains that fall 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 Leland, North Carolina, 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 mgiffin@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 mixture to the face 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.

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**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 our knowledge of the early stages of the gulf 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 pursue a career as a faculty member at a major oceanographic institution.

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**The 2009 Hurricane Season Is Here**

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 October 31. 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 LaRowe, Young-Kwon Lim, Dong-Wook Shin, Eric Crossgrett, and Steven C Rick. 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 will be working with colleagues at COAPS and in Miami to conduct real-time analyses of tropical cyclone wind fields. These analyses are archived on the web where they become available near the U.S., every 3 hours. These analyses are developed 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 pursue a career as a faculty member at a major oceanographic institution.

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**Center for Ocean-Atmospheric Prediction Studies**

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