Center for Ocean-Atmospheric Prediction Studies

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.

The Power of Wind: New Investigations into the Viability of Harnessing Offshore Wind Energy for Florida

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Wind Power Overview

- Wind power is the fastest growing form of renewable energy, with potential worldwide production doubling every 3 years[1].
- Wind energy is collected using tower-mounted wind turbines.
- 50-100 turbines are typically combined to make a wind farm.
- A 1-megawatt wind turbine can power 250 homes (indefinitely, assuming a constant rate of production and consumption).
- In Europe, 2- and 3-megawatt turbines are in operation, and 5-megawatt turbines are being deployed.
- Offshore turbines are typically built in shallow water (less than 100 feet), but deepwater installations are under development in Europe.

Why Should We Consider Offshore Wind Power for Florida?

- Average household electricity costs for Florida are expected to increase by 4.7% ($7.50/month) each year over the next decade[2].
- Offshore winds are typically stronger and more stable than winds over land.
- Larger, more efficient turbines are more viable offshore.
- Florida has 1197 statute miles of coastline.
- Offshore wind turbines are a proven technology in harsh environments like the North Sea.

Construction of a turbine off the coast of England.

Successful Examples

- Offshore wind farms are currently operating in Denmark, the United Kingdom, Germany, Ireland, Sweden, Finland, Norway, Japan, Belgium, and the Netherlands, and are under construction in China and Italy.
- In the U.S., over half a dozen offshore wind farms are in the proposal and planning stages.
- In May 2010, the Cape Wind Project obtained major federal approvals for construction off the coast of Cape Cod.

Florida Wind Energy Industry

- General Electric builds offshore wind turbines in Pensacola.
- Siemens Wind Power North America is based in Orlando.
- NextEra Energy Resources, an FPL Group Inc. company, is the largest wind developer in the U.S.

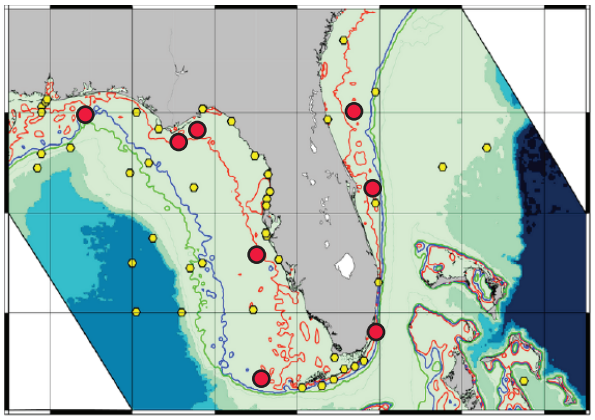
A wind farm near Copenhagen.

1 World Wind Energy Association, 2010: World Wind Energy Report 2009. http://www.wwindea.org/.
2 Florida Public Service Commission, 10-Year Site Plan, 2009.

COAPS Research and Results

- Coarse spatial resolution (using stations hundreds of miles apart) offshore wind resource maps reveal potential for wind power in Florida's offshore waters.
- The COAPS-Institute for Energy Systems, Economics, and Sustainability (IESES) pilot study investigated wind resource at select towers and buoys in Florida's waters.
  - The local resource was evaluated by examining average wind speeds and capacity factors at a typical turbine hub height of 279 feet.
  - Capacity factor = percentage of wind energy a single turbine can generate based on the observed wind conditions compared to the turbine's maximum output under optimal wind conditions.
- Capacity factors near 30% are economically viable for land-based wind farms.
- The economics of the capacity factors off Florida's extensive coastline must be assessed, taking into account
  - the cost of deployment within our unique marine environment, and
  - the ability of new wind turbines to produce more energy at lower wind speeds.

K tower in the Gulf of Mexico.



Station locations around Florida (red dots mark stations in table). Water depth marked at 65 feet (red) and 328 feet (blue).

Preliminary results from COAPS-IESES analysis. (Annual averages at 279 feet)

Location	Average Wind Speed (mph)	Capacity Factor (%)
Pensacola (buoy 42012)	15.2	27
Apalachicola (C tower)	15.9	33
St. Teresa (K tower)	14.7	29
Sarasota (buoy 42013)	14.8	28
Dry Tortugas (tower)	14.6	27
Miami (tower)	15.0	27
Cape Canaveral (buoy 41009)	15.5	29
St. Augustine (buoy 41012)	15.8	30

Requests from Industry Sector

- Florida wind industry expressed need for
  - high-resolution (at 5-mile intervals) wind resource maps for the coastal waters extending to 25 miles inland,
  - peak wind climatologies to assess risk to infrastructure from hurricanes, and
  - seasonal and interannual wind variability studies.

Capabilities of FSU and Partner Organizations

- COAPS specializes in atmospheric modeling, seasonal and longer-term climate studies, hurricane risk assessment, and marine weather observation (satellite and surface).
- IESES provides expertise in engineering, economics, and energy policy.
- NOAA Northern Gulf of Mexico Cooperative Institute deploys and maintains weather observing systems on northern Gulf towers (e.g., K-tower).

Future Research Objectives

- Create products to meet industry needs using all available surface and satellite wind data.
- Develop wind resource maps using state-of-the-art atmospheric models and observations.
- Deploy additional dedicated offshore weather towers to support verification of wind resource maps.
- Assess hurricane risk in the coastal regions.

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