Researchers monitor conditions in Delaware Bay aboard Cape May-Lewes Ferry

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UD researchers monitor air and water conditions in the Delaware Bay using sampling equipment aboard the Cape May-Lewes Ferry.

As families make their way down to the beach each summer day, a pleasant breeze moves up the sand to greet them. Known as the sea

breeze, this gentle air current originates over the open water and is driven toward land by changes in surface heat and pressure between water and land.

According to Dana Veron, associate professor of geography in the University of Delaware's College of Earth, Ocean, and Environment, the sea breeze serves a greater function than just cooling a lifeguard's brow. When the sea breeze blows, it cools the coast and often drives insects away from the beaches. It also alters wind speed and direction, affecting conditions crucial for generation of electricity via wind power.

Veron is investigating what atmospheric and marine factors influence sea breeze, and how researchers can predict when sea breeze will occur.

"Ultimately, the ability to predict sea breeze presence could help us forecast how and when wind turbines, clean sources of renewable energy, will produce the most and the least energy," said Veron.

Wind turbines carry great potential for generating clean energy. The UD wind turbine in Lewes, for example, generates enough energy annually to power the entire Hugh R. Sharp Campus, including laboratories, offices and academic buildings, with surplus energy left over at certain times of the year. In the first two years of the turbine's operation, the University sold 2.3 million kilowatt-hours (kWh) of surplus electricity to the Lewes Board of Public Works.

Veron is researching factors tied to sea breeze and wind energy through the Cape May-Lewes Ferry monitoring project, a research initiative designed and implemented by CEOE professor emeritus Jonathan Sharp in partnership with the Delaware River and Bay Authority, through funding from Delaware Sea Grant (DESG).

The ferry serves a dual purpose: as it carries commuters and tourists

across the bay, it measures water quality parameters like temperature, salinity, dissolved oxygen and chlorophyll, as well as atmospheric properties like pressure, temperature, humidity and wind speed.

"It's called a 'ship of opportunity,'" said Veron, a co-principal investigator on the project. "It's a vessel that can record data in areas and at times that traditional research vessels might not take regular measurements."

According to Veron, the frequency with which the ferry monitoring system collects data makes the project stand out from other marine data collection projects. A vessel used exclusively for research may take occasional trips to a location, or monitor an area for a specific period of time, but the ferry provides data streams each time it crosses the bay, several times a day, year-round.

A custom-designed valve set in the bow of the boat samples water as the ferry runs, while a meteorology station on the bridge of the ferry collects atmospheric data. Cables connect the measuring equipment to a computer onboard the ferry, allowing the recorded data to be transmitted back to a station on land when the vessel is in port.

The system provides high-resolution data streams that help researchers understand the conditions and health of the bay, which affect not only wind energy potential but everything from recreation and tourism to the fishing industry.

"The conditions monitored by the ferry affect the ecology of the entire Delaware Bay," Sharp said. "This means that anyone who sails, swims, fishes or otherwise interacts with the bay is affected by its health."

The ferry monitoring project has been gathering and compiling data since 2011 with continuous DESG funding, helping scientists better

understand and evaluate the movement of water masses in the lower Delaware Bay, where the bay meets the ocean.

When the Brandywine Shoals Light, a monitoring station owned and maintained by the National Oceanic and Atmospheric Administration's National Ocean Service, was damaged during Superstorm Sandy in 2012, the ferry was the only method of data collection for monitoring the conditions in the middle of the bay. The station has resumed function, and the ferry system continues to provide data complementing that collected at Brandywine.

In January 2015, Sharp turned the project over to Veron and Wei-Jun Cai, CEOE professor of oceanography and co-principal investigator. Cai is an expert on estuarine pH and carbon dioxide concentration and flux. Through DESG, Veron and Cai are continuing and expanding the project.

The sampling equipment has been updated to measure carbon dioxide and pH, which can be used to observe conditions affected by climate change, like ocean acidification.

Coastal water acidification jeopardizes fish populations that anglers rely on to support the seafood industry and can be detrimental to the overall ecosystem. Cai is using the updated ferry monitoring equipment to record data on these changes.

According to Veron and Cai, the ferry data is useful in analyzing bay ecology after major storms and meteorological events. Storms can cause sudden influxes of water into the bay, disrupting conditions and possibly influencing the exchange of carbon dioxide between water and air. Understanding this exchange is important to understanding the global carbon cycle, and therefore climate change.

Veron and Cai are working with the Delaware Environmental Observation System to make Delaware Bay data accessible to partners and the general public through a computer program that uploads livestream data into a public database.

The database will allow CEOE researchers to connect with and communicate data to partners like the Delaware River and Bay Authority, the National Weather Service and the Delaware Department of Natural Resources and Environmental Control, enhancing collaboration on storm preparedness, coastal monitoring and other programs.

From bidding on wind power to understanding climate change, researchers can utilize the ferry monitoring data in many significant ways.

"Complicated conditions affect the health of the bay," said Veron. "It's a critical time to make sure we're checking its pulse."

Provided by University of Delaware

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