Wind speeds in southern New England declining inland, remaining steady on coast

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Oceanographers at the University of Rhode Island have analyzed long-term data from several anemometers in southern New England and found that average wind speeds have declined by about 15 percent at inland sites while speeds have remained steady at an offshore site.

Kelly Knorr, a graduate student at the URI Graduate School of Oceanography, and Professor John Merrill reported the results of their research today at the fall meeting of the American Geophysical Union in San Francisco.

The researchers found that average wind speeds at T.F. Green Airport in Warwick, R.I., declined from about 9 knots to 7.7 knots from 1975 to 2011 and from about 8.2 knots to 7 knots at New Bedford Regional Airport in Massachusetts from 1973 to 2011. A 25-year record of wind speeds at a buoy at the mouth of Buzzards Bay, Mass., shows that wind speeds there remained steady at about 15 knots during the period.

Knorr and Merrill suggest several reasons for the decline in wind speeds at inland locations, including changing weather patterns and urbanization.

"If the anemometer height is at about the same level but everything else is growing up around it, like buildings and forests, that would create surface roughness or drag that could decrease wind speeds," said Knorr, an ensign in the U.S. Navy assigned to URI to earn a graduate degree.

The scientists say that climate change may also be a factor. "Southern New England has typically had a long period of frequent winter storms, but with climate change, that pattern of winter weather is shifting to the north, meaning we may be in that pattern less often," said Merrill. "If those mid-latitude storms aren't here as often, average wind speeds will decrease."

Knorr and Merrill say that data from other sites should be analyzed to confirm the trend they found.

"The Department of Energy wants the U.S. to have 20 percent of its electricity generated from wind power by 2030, but if this trend of declining wind speeds is widespread across the country, then that could have a significant effect on the future of wind energy here," said Knorr.

In addition to analyzing the long-term data, the URI oceanographers examined wind profile data from towers at five sites in Rhode Island to determine how wind speeds change at varying heights above the surface. They collected data over 20 months at heights ranging from 30 to 60 meters.

The scientists found that wind speeds increased with height at a much greater rate at inland sites compared to sites along the ocean-facing coast.

"Wind speeds at inland sites are much lower near the ground because of the greater drag at the surface, but there is much less drag the higher you go, so speeds can really pick up," Knorr said. "Over the ocean, wind speeds start out stronger at the surface because there's less drag, and it doesn't increase as quickly the higher you go."

They also found greater variation in wind speeds from daytime to nighttime at inland sites, due to the land-breeze/sea-breeze cycle, which

is a phenomenon known by sailors.

"When land heats up in the daytime, the warm air rises and the wind blows in from the ocean to the land," said Knorr. "In the evening it reverses. But at coastal locations, there is less land to warm up, so there is a weaker cycle."

Knorr and Merrill recently installed a permanent tower at the URI Narragansett Bay Campus to begin long-term data collection of wind speeds for further analysis. They also plan to analyze data from a number of other sites where long-term data on wind speeds have been recorded and compare it to the data from their initial sites.

Provided by University of Rhode Island