The Effect of Sea Surface Temperature on Sea Breeze Dynamics Along the Coast of New Jersey

by

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ABSTRACT OF THE THESIS

The Effect of Sea Surface Temperature on Sea Breeze Dynamics Along the Coast of New Jersey

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The New Jersey sea breeze phenomenon is an important mesoscale feature during the warmer months of the year that can dramatically impact sensible weather in the coastal region of the state. Inaccurate meteorological forecasts of the sea breeze can have important ramifications for the public, marine, aviation, and public utility sectors in the heavily tourist laden coastal zone. This can lead to significant losses in terms of tourist dollars, as well as a lack of availability of energy during periods of peak demand, leading to brownouts on hot summer afternoons. Additionally, recirculation of air within the sea breeze circulation can lead to increases in pollution and any accidental or intentional release of toxic chemicals in the coastal zone.

The sea breeze is the result of the differential heating rates of the land and sea. The local temperature gradient near the immediate shoreline determines the behavior of the sea breeze; i.e. wind speed, temperature decrease, inland penetration, and sea breeze frontal shape. The behavior of the sea breeze is observed using visible imagery from satellites and radar reflectivity returns from National Weather Service Doppler radar, and the characteristics of the sea breeze can be monitored through the use of surface observations of wind, temperature, and relative humidity. Local variations in ocean

temperature due to coastal upwelling can impact the behavior of the sea breeze by increasing locally the magnitude of the land – sea temperature gradient in the coastal zone.

A mesoscale model was used to simulate two sea breeze case studies utilizing different ocean temperatures to study the sensitivity of sea breeze behavior to coastal upwelling. The results of these case studies convincingly show the effect of coastal upwelling on the sea breeze, and the importance of the inclusion of high-resolution sea surface temperature data in model simulations of the sea breeze phenomenon.

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