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Effect of Lake Characteristics on Mesoscale Boundary Layer Structure

Final Report

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The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

12a. DISTRIBUTION / AVAILABILITY STATEMENT

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13. ABSTRACT (Maximum 200 words)

A three-dimensional mesoscale planetary boundary layer model was used to perform a series of model sensitivity studies to examine the effects of lake-land temperature difference, ambient wind magnitude and direction, lake size, surface roughness, the Coriolis force and baroclinic ambient wind conditions on mesoscale lake circulations. Results indicate lake size, speed and direction of ambient wind and the baroclinicity of the flow to be important factors influencing mesoscale convergence.

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1. PROBLEM STUDIED

Sudden change in roughness and heating induce changes in momentum and heat fluxes causing local accelerations and convergence zones. A large body of water such as a reservoir presents a sudden change in surface characteristics. Extent and degree of air mass modification and the associated wind structure would depend very much on the size and shape of the lake, surface heat flux gradient, ambient wind speed and wind shear to name a few. The main objective of this research will be to systematically investigate the effect of some of these parameters on mesoscale convergence and circulation over the lake and the surrounding land using a three-dimensional mesoscale numerical model.

2. SUMMARY OF MOST IMPORTANT RESULTS

(a) Divergent flow of the lake-breezes causes a well defined lake-breeze convergence zone around the lake.
(b) Spatial and temporal variations of this convergence zone and hence the convective activities are controlled to a large extent by the speed and direction of the ambient wind.
(c) Lake size has an important effect in intensifying convection.
(d) Surface roughness values over land influence the location and the magnitude of convection.
(e) Initial baroclinic flow modifies mesoscale lake breeze circulation patterns.

3. PUBLICATIONS

Boybeyi, Z. and S. Raman, 1991; A Three-dimensional Sensitivity Study of Mesoscale Circulations Induced by Circular Lakes, Submitted to Meteorology and Atmospheric Physics.

4. SCIENTIFIC PERSONNEL

Sethu Raman, Professor, Principal Investigator.
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