Evolution of Low-level Flow Patterns in Littoral Regions when Extratropical Marine Cyclones Encounter Coastal Mountains

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LONG-TERM GOALS

The long term goal of this project is to understand the interaction of slightly different large scale flows interaction with complex coastal topography to produce both regions of enhanced and diminished near surface winds.

OBJECTIVES

The objectives of this study are to utilize mesoscale and enhanced synoptic scale observations from the California Land-falling Jets Experiment (CALJET) to define the mesoscale wind fields in complex coastal topography. These mesoscale wind fields will be related to critical parameters in the incident flow to determine when sheltering and enhancement of local winds occurs. The ability of mesoscale models to capture this interaction will also be examined.

APPROACH

The basic approach used in this study is to utilize local mesoscale observations to define the local wind response near coastal mountains and to relate these responses to incident flow characteristics and to the accuracy of mesoscale model forecasts. This will be done for cases that occurred during the CALJET experiment in order to provide a range of synoptically similar but slightly different incident flow situations.

WORK COMPLETED

To examine the prediction of flow interaction with coastal topography under varying synoptic situations, cases from the CALJET experiment have been examined. To define the mesoscale flow the local mesoscale observations for the Monterey Bay region have been assembled together and have been used to produce mesoscale analyses for the central California region. Analyses for the Feb. 5

1999 have been completed and are being used to examine the conditions where flow blocking and coastal accelerations occur. These analyses also provide ground truth for mesoscale model forecasts for this event. Other events have been identified and are being processed to produce similar ground truth analyses.

RESULTS

The results from this study are limited to a single case, Feb. 5, and do show substantial modification of the flow by the mesoscale coastal topography. The nature of the interaction is time dependent as the incident flow speed and stratification evolve. This interaction is consistent with theoretical models of flow interaction with topography although further investigation is underway to more completely quantifiy the relevant flow parameters. An examination of the operational model forecasts for this event, show that these models tended to over predict the surface winds near topography which may be an artifact of inaccurate stratifications. Additional tests on this and other cases are presently being done.

IMPACT/APPLICATION

The impact of these studies will be in furthering our basic understanding of flow interaction with coastal mountains and will aid Navy forecasters in assessing the accuracy of mesoscale model forecasts of coastal winds.

TRANSITIONS

These results have been used as classroom examples at the Naval Postgraduate School.

RELATED PROJECTS

The ONR-sponsored project by the same investigators, entitled “Dependence of mesoscale coastal predictability on sampling and data assimilation” is closely related and utilizes some of the same cases for fundamental predictability studies.