

# Interaction of Fronts with Topography

by

Melinda S. Peng and R. T. Williams

Naval Postgraduate School

Naval Postgraduate School, Monterey, CA

## Abstract

The hydrostatic Boussinesq equations are used in studying the interactions of fronts with topography in a barotropic, stratified 2-D framework. The frontal solutions are generated by a cyclic deformation field imposed on the perturbation fields. To understand the influence of the mountain on passing fronts, mountain solutions which correspond to uniform flows are studied first. It is realized that semi-geostrophic solution can not represent the true mountain solution before the semi-geostrophic assumption breaks down (a critical mountain height  $h = h_c$  where the static stability and wind speed becomes infinite at mountain crest). For experiments where the height is of the order of  $h_c$ , a hydraulic jump develops near the base of the mountain on the lee side.

The major mechanism of the mountain acting on the passing fronts are the mountain forced divergence flow on the upwind side which generates frontolysis and the convergence flow on the lee side of the mountain which generates frontogenesis. For a wide mountain where generation of lee-side gravity wave is small, the net effect on the frontal intensity is small for symmetric mountain. When the mountain is narrow, the front actually breaks down with a hydraulic jump on the lee side. Blocking of the progression of fronts are observed. The frontal scale as a passive scalar moving over the mountain is also compared with full interacting fronts with the mountain.