A NUMERICAL SIMULATION OF THE SACRAMENTO VALLEY FLOOD OF 1986

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ABSTRACT

The existence of the mountain ranges over California can generate up slope lifting, causing the formation and enhancement of clouds and precipitation. At the same time, the mountains may block or deflect the airflow and produce strong local circularions. During the winter months, the interaction of large-scale weather systems with the complex mountain ranges over California can produce localized heavy precipitation, causing floods and flash floods, mud slides and even loss of lives. One recent example is the flood over the Sacramento Valley in February 1986, which caused hundreds of millions of dollars in property damage. This paper will present the results from a numerical simulation of this flood event and a comparison with the observational data. Of special emphasis is the effect of the complex topographyin in producing heavy and localized precipitation.

The special feature of the model used in this paper is the explicit prediction of the contents of cloud water, rain water, ice, snow, and graupel while retaining the cumulus parameterization scheme. It is quite complicated but it is still the simplest way to account for all the major microphusical interactions in the atmosphere. The detailed microphysical process in a mesoscale model gives at least two advantages: (1) it provides cloud cover, which affects the amount of radiation reaching the ground and, therefore, the soil surface temperature; and (2) it lets the precipitation particles drift in the air and fall in an area not necessarily the area of formation.

A one-way nested domain is used to cover both the large-scale weather system fostering the storms and the mesoscale wind pattern and precipitation generated by the topography. The inner domain covers the entire Sacramento Valley and the surrounding mountainous region with a 20 km grid interval. The outer domain covers most of the westem United States with a 60 km grid interval. The initial condition consists of the NMC analysis data at 0000 UCT, February 16, 1986. A 48 hour simulation is made.

The results indicate that both the Coastal Ranges and the Sierra Mountains have a profound effect on the amount and location of precipitation.

The model is currently been modified to include a complete radiation and biosphere-atmosphere interaction package for regional climate simulation. The feasibility of using this model to study the impact of greenhouse effect on regional scale climate will also be discussed.