

**Gao, X. 1993. Modeling of rainfall distribution, hydrologic processes and examination of model sensitivity in the context of atmosphere-land surface interactions. Ph.D. dissertation. University of Arizona. Tucson, Arizona. 111 pp.**

In order to improve current climate models, two issues have been recognized to be significant: (1) properly representing the precipitation distribution within a GCM grid square, (2) evaluating and improving the existing land surface hydrologic schemes. This dissertation is devoted to these issues.

Precipitation affects the climate system in a variety of ways and occurs over areas that are usually smaller than the GCM grid square. This complicates the modeling of land surface processes. There are, however, stable seasonal statistical patterns underlying the observed data for a GCM grid square. A stochastic scheme was therefore proposed for the assimilation of the statistical patterns (extracted from historical data) into the land surface scheme to enhance the simulation. The required high resolution precipitation data may be obtained from satellite imagery for global application.

Systematic sensitivity analyses for the Biosphere-Atmosphere Transfer Scheme (BATS) was described in this dissertation. Two types of experiments were conducted to examine the BATS performance. The first type consisted of varying 'perturbation variables' and exploring corresponding variations in energy/water states and fluxes. The employed method stressed (1) long term and multiple measures of model behavior, (2) the dominant processes under certain conditions and the proper ranges for model parameters estimates. The second type experiments applied BATS to a GCM grid covering the Lower Colorado River Basin and examined the effect of intragrid variability on land surface hydrology. The results from different spatial resolutions are compared. BATS sensitivity to initialization, atmospheric forcings, land surface properties and the computational grid size are discussed.