



# Cloud-Resolving Modeling of Convective Processes

*Shouting Gao, Xiaofan Li*

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Clouds and cloud systems and their interactions with larger scales of motion, radiation, and the Earth's surface are extremely important parts of weather and climate systems. Their treatment in weather forecast and climate models is a significant source of errors and uncertainty. As computer power increases, it is beginning to be possible to explicitly resolve cloud and precipitation processes in these models, presenting opportunities for improving precipitation forecasts and larger-scale phenomena such as tropical cyclones which depend critically on cloud and precipitation physics.

This book by Professor Shouting Gao of the Institute of Atmospheric Physics in Beijing and Xiaofan Li of NOAA's National Environmental Satellite Data and Information Services (NESDIS) presents an update and review of results of high-resolution, mostly two-dimensional models of clouds and precipitation and their interactions with larger scales of motion and the Earth's surface. It provides a thorough description of cloud and precipitation physics, including basic governing equations and related physics, such as phase changes of water, radiation and mixing. Model results are compared with observations from the 1992-93 Tropical Ocean Global Atmosphere Coupled Ocean Atmosphere Response Experiment (TOGA COARE) experiment. The importance of the ocean to tropical convective systems is clearly shown here in the numerical results of simulations with their air-sea coupled modeling system. While the focus is on tropical convection, the methodology and applicability can be extended to cloud and precipitation processes elsewhere.

The results described in this well-written book form a solid foundation for future high-resolution model weather forecasts and climate simulations that resolve clouds explicitly in three dimensions—a future that has great promise for the understanding and prediction of weather and climate for the great benefit of society.

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