Advanced radiative transfer modeling system (ARMS) – a new generation of fast and accurate RT models in China

Fuzhong Weng[a,*], Yihong Duan[a], Jun Yang[b] , Peng Zhang [b], Shouguo Ding[a], Chuanwen Wei[a] , and Lei Bi[c]

[a] *State Key Laboratory of Severe Weather, No 46 Zhongguancun S. Ave., 100081, Beijing, China*
[b] *National Satellite Meteorological Center, No 46 Zhongguancun S. Ave., 100081, Beijing, China*
[c] *Zhejiang University, Zhejiang, China*

[*] *Presenting author (fweng58@gmail.com)*

Many satellite instruments measure the radiation emitted by or reflected from the Earth at different spectral wavelengths. These observations – generally referred to as radiances – contain information about the Earth's surface and atmosphere. Satellite radiances are not components of the atmospheric state vectors predicted by NWP models. In order for these radiances to be assimilated by the NWP models, a relationship between the model state vectors and the observed radiances is required. This relationship is derived from the forward radiative transfer model simulations (simply forward models) with the state vectors as input. In addition, the Jacobian vectors (or the derivative of radiance relative to the state vectors) are also needed in satellite data assimilation systems. For each satellite mission, a fast and accurate radiative transfer model is deemed necessary for the overall mission success. In the past two decades, the United States, Europe, and many other countries have already invested in the development of fast radiative transfer models through their space programs. These models have resulted in huge successes in uses of satellite data in operations.

In this presentation we review the current capabilities of fast radiative transfer models developed in the numerical weather prediction community, summarize the full requirements on fast radiative transfer models for current and future satellite data assimilation, and propose new techniques for superfast computations of atmospheric and surface radiative transfer processes.

Mode of presentation: Invited