Application of aggregated non-spherical ice-phase particle modeling to assimilation of GPM radiance observations in meso-scale NWP

*Sara Q Zhang[1], Philippe Chambon [2], William Olson [1]

1. NASA Goddard Space Flight Center, Greenbelt, MD, USA, 2. Meteo France, Toulouse, France

Variations in the distributions of ice-phase cloud and precipitation particles are important indicators of dynamical and physical processes in atmosphere, but at the same time, the representation of these particle types and the underlying processes in numerical weather prediction model forecasts are often subject to substantial errors. Since ice-phase cloud/precipitation can have a significant impact on upwelling microwave radiances at the higher microwave frequencies (85 –183 GHz) through the scattering process, assimilation of satellite microwave observations into model-supported analyses has the potential to correct for model errors. Crucial to the assimilation of these observations are forward radiative models that can be used to simulate higher-frequency microwave radiances based on forecast earth/atmosphere states. In this work we present the development and improvements in forward modeling of using aggregated non-spherical ice-phase particles to calculate microwave single-scattering properties with particle size distribution descriptions based of field campaign studies. Experiments are carried out using NASA Unified Weather Research Forecast ensemble data assimilation system. All-sky radiance observations from NASA/JAXA Global Precipitation Measurement (GPM) mission Microwave Imager (GMI) are assimilated into high-resolution model forecasts. The impact of both the input data and the forward modeling on first-guess radiance departures and analyzed/forecast fields are investigated in case studies of mid-latitude snowstorm and warm season convective storm overland.

Keywords: satellite observations, precipitation, data assimilation

