The Integrated Observation and Data Fusion Application of FY-3G Precipitation Satellite and China's Weather Radar Network

ZHANG Peng[1,2,3] Chen Yubao[1,2,3] SHANG Jian[4,5,6] WU Lei[1,2,3]

CHEN Lin[4,5,6] BU Zhichao[1,2,3] LI Lu[1,2,3] LI Jun[4,5,6]

1 State Key Laboratory of Environment Characteristics and Effects for Near-space, Beijing 100081

2 CMA Meteorological Observation Centre, Beijing 100081

3 CMA Engineering Technology Research Center for Meteorological Observation, Beijing, China

4 National Satellite Meteorological Center/National Center for Space Weathel, Beijing 100081

5 Innovation Center for Fengyun Meteorological Satellite, Beijing 100081

6 Key Laboratory of Radiometric Calibration and Validation for Environmental Satellites, Beijing 100081

Abstract: China has established the world's largest ground-based multi-band weather radar network and successfully launched its first active radar precipitation measurement satellite, the third of its kind globally, achieving world-class overall technical capabilities. Weather radars and precipitation satellites are crucial components of the integrated space-ground precipitation observation network, providing key technical support for accurately capturing precipitation dynamics and comprehensively analyzing precipitation characteristics. While weather radars offer high spatiotemporal resolution, their coverage is geographically constrained, limiting continuous global observation. Spaceborne precipitation radars provide three-dimensional precipitation structure information over global mid-to-low latitudes, particularly over regions difficult to cover by ground-based equipment, such as oceans and plateaus. The fusion application of space-ground systems achieves an organic combination of continuous large-scale precipitation monitoring and refined detection of local precipitation features. This provides more precise and comprehensive data support and decision-making basis for meteorological forecasting, disaster warning, and water resource management. This paper details the technical characteristics, operational quality, data products, collaborative observation of the multi-band weather radar network and the FY-3G precipitation satellite in China. It also presents the preliminary results of the data fusion application on the radar reflectivity factor as the fundamental data in three aspects: (1) the cross-validation and data fusion of satellite-ground radar reflectivity factor; (2) the simulation of ground-based radar signals using geostationary satellite data; and (3) the fusion of active/passive microwave and geostationary satellite infrared precipitation data.

Key Words: Multi-band Weather Radar; Spaceborne Precipitation-Measuring Radar; Space-Ground Integrated System; Fusion Application