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Use of earth observing satellite data at Japan Meteorological Agency

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Earth observing satellites have been used for diverse operations and researches at Japan Meteorological Agency (JMA): They include numerical weather prediction (NWP), environmental and disaster monitoring, and verification of models and products.

Operational geostationary satellites such as MTSAT are inevitable because of their capability of frequent, long-term measurements and real-time data dissemination. However, due to their measurement limitation to visible (VIS) and infrared (IR) band, we face the difficulty to obtain information below thick clouds or vertical information about the temperature, humidity, cloud and precipitation. In contrast, they are provided by low earth orbiting (LEO) satellites carrying microwave (MW) sensors, IR multi-channel sounders, and cloud- and precipitation-radars. Thus, it is essential to take comprehensive advantage of both operational geostationary and LEO satellites.

For example, MW imagers have been used for analysis of sea surface temperature, sea-ice and snow depth, NWP and reanalysis even in cloudy regions. In the typhoon analysis, while IR/VIS cloud imagery of MTSAT is usually used to estimate the central position and pressure, MW imagers can help to identify the center, and the development of deriving maximum wind speed in typhoon region with TRMM/TMI is underway.

For NWP, satellite data are essential to data assimilation that creates initial state analysis, providing model boundary dataset, and verification of model and analysis. Increasing accuracy and variety of satellite data and advancement in data assimilation system have significantly improved the NWP accuracy for the past 20 years. For example, cloud and precipitation vertical information from TRMM/PR and Cloudsat/CPR contributes to model verification. Assimilation of radiances of MW sounders and imagers and hyperspectral IR sounders, radio propagation refractive data from the global navigation satellite system (GNSS) occultation, sea surface winds of MW scatterometers generates accurate analysis of the information of temperature, humidity and wind. In the current assimilation system, however, the accuracy of analysis related to cloud and precipitation is not sufficient. The important challenge is the effective assimilation of cloud- and precipitation-affected radiances and cloud- and precipitation-radars.

Keywords: satellite, typhoon analysis, data assimilation, JMA