

Observation system simulation experiments for a hyperspectral infrared sounder onboard geostationary satellite

*Hiromi OWADA¹, Kozo OKAMOTO², Masahiro Kazumori¹, NAOTAKA UEKIYO², Hiroshi Ishimoto², Masahiro Hayashi²

1. Japan Meteorological Agency, 2. Meteorological Research Institute

JMA started discussing the next geostationary satellite program. A hyperspectral infrared sounder (HSS) is one of the candidates for instruments considered to be on board the next satellite; by using this, the precision of weather forecast is expected to increase dramatically. Hence JMA has been performing Observing System Simulation Experiment (OSSE) since last year to assess its impact on Numerical Weather Prediction (NWP).

The pseudo-radiances of HSS are produced on an assumption that the IRS which is scheduled on board the MTG Satellite in Europe is to be on the next Himawari. The simulation is performed by the radiative transfer model RTTOV12.2 with ECMWF reanalysis (ERA5) as the input. As clear-sky radiances of HSS is assimilated, cloud detection is crucial. At first, the existing quality control process of HSS on the polar orbit satellite was applied for the cloud area discrimination in the preprocessing, and the resultant the all-sky radiances in the clear sky area were assimilated. However, the cloud area judgement process for the real observation may not be appropriately used in this OSSE, due to a high dependency of the simulation of all-sky radiances on the cloud information (cloud cover, cloud water content, and cloud ice content) of ERA5. Clear sky channel is determined by the difference between the clear-sky radiance and the all-sky radiance (the difference less than 1 K). The instrumental error is determined by multiplying random numbers (assuming normal distribution with mean 0 and standard deviation 1) to the NEdT value given in the IRS specification; the error is then added to the clear-sky radiance of RTTOV output before assimilation.

The experiment was performed for the one month period of August 2018 using the global data assimilation system utilized in operation of JMA. Assimilating hourly fulldisk pseudo-radiances revealed clear improvements in analyses and forecasts verified against radiosonde observations. An improvement was also shown by the application of the pseudo-radiances in the typhoon track prediction errors in the period.

To this date, the differences on impacts to NWP were evaluated by various observation patterns with assimilation of full-disk observation 3-hourly, assimilation of the southern hemisphere only 3-hourly (hourly for the northern hemisphere) and so on. We are summarizing the results and will present and discuss them at this meeting, and utilize them in the evaluation of the effectiveness of HSS.

Keywords: Himawari, Hyperspectral infrared sounder, OSSE