

Himawari-8/9 follow-on satellite program and NWP impacts assessment of hyperspectral IR sounder

Presented to CGMS-49 Plenary, Thematic Session: NWP Impact Assessment of Satellite Data

Introduction / Executive Summary

- Future GEO program follow-on to Himawari-8/-9
 - ✓ To be **launched by FY2028**, and operation will be started in FY2029 (Basic Plan on Space Policy, Japan)
 - ✓ HSIR: one of the potential payloads, recommended in Vision for WIGOS in 2040
- Assessment of potential impacts of GEO HSIR (GeoHSS) on JMA NWP systems by reanalysis-based OSSE (RA-OSSE)
 - ✓ Two-year (FY 2018-2019) project at JMA, but the investigation continues with new cases
 - ✓ **Positive impacts on JMA's Global/Regional (Meso-scale) NWP systems**
 - Reported at CGMS-48 Plenary session

JMA's NWP Strategic Plan Toward 2030 und Updates since CGMS-48

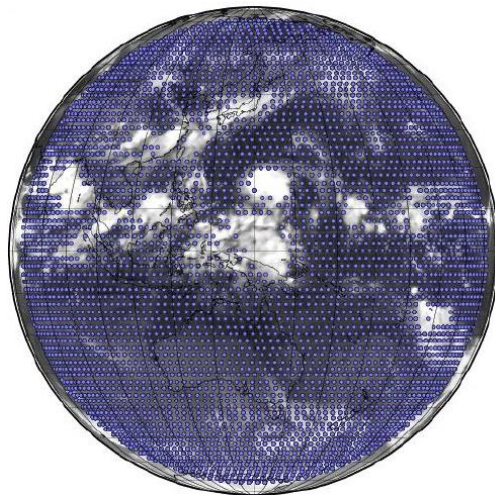
- **Meteorological Operation Focusing on Science and Technology Toward 2030**
 - ✓ Intended to help prevent and mitigate natural disasters and improve socioeconomic productivity
- **GeoHSS is expected to play an important role to meet the goals in the strategy**
 - ✓ Improve the accuracy of 3-day typhoon forecast up to the same level with the current position error of 1-day forecast (100 km)
 - ✓ Provide information on the risk of disasters associated with the heavy rainfall from half a day before
- Confirmed results of OSSE from the viewpoint of **how much they may be realized by GeoHSS**

Experimental Settings – Global / Regional Data Assimilations

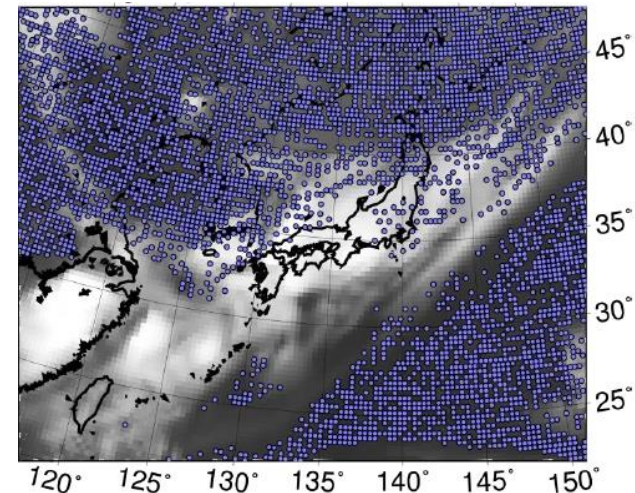
- **Global DA:** assimilation of **clear-sky radiance** simulated by RTTOV-12.2
 - ✓ **36 Temperature / 25 WV channels**, spatial thinning of 200 km
 - ✓ Obs error: similar to the operational IASI setting
- **Regional DA:** assimilation of **T/RH vertical profiles in clear-sky scenes**
 - ✓ HSS not yet introduced in the operational regional DA system
 - ✓ Spatial thinning of 45 km and 13 (7) layers btw 1000 and 50 (300) for T (RH)
 - ✓ Obs error: 1.5 times the operational RAOB obs error

Hypothetical GeoHSS obs. after quality control and thinning

Global DA
Ch. 3
(14.260 μm)

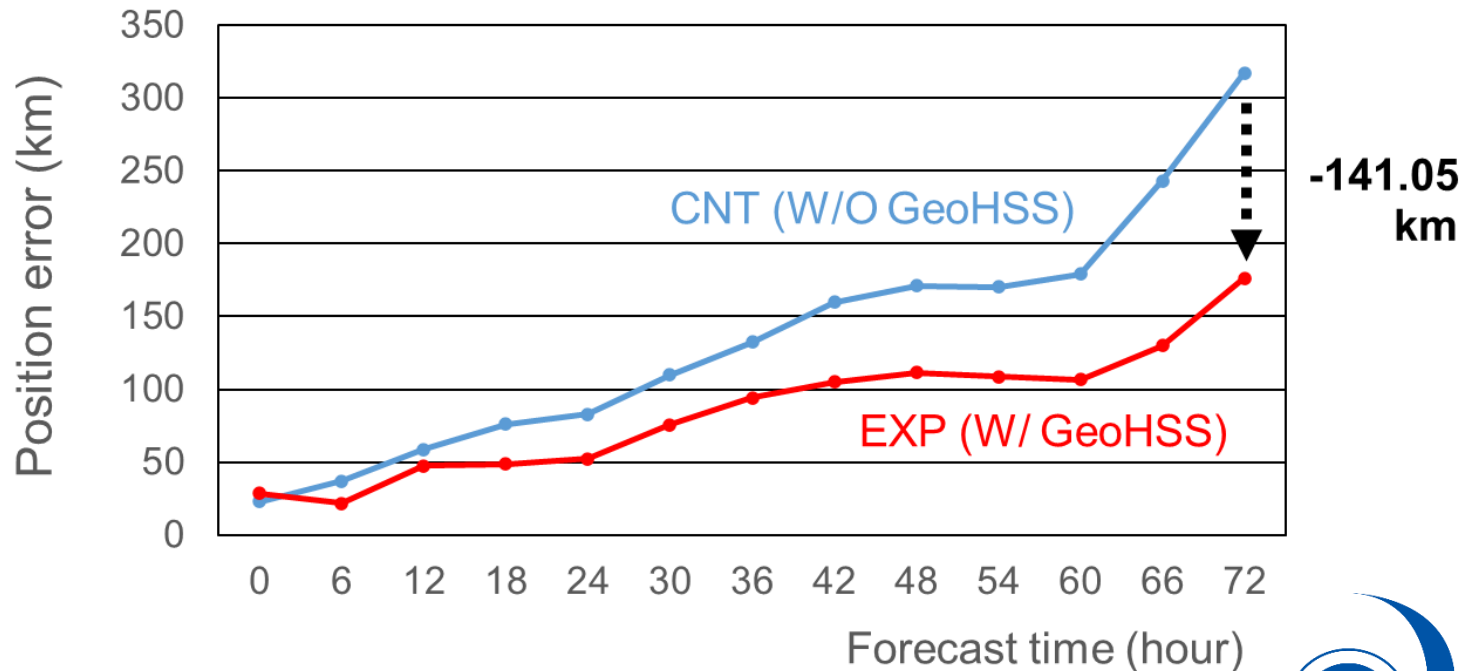


Regional DA
Temperature
150 – 250 hPa



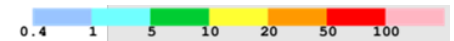
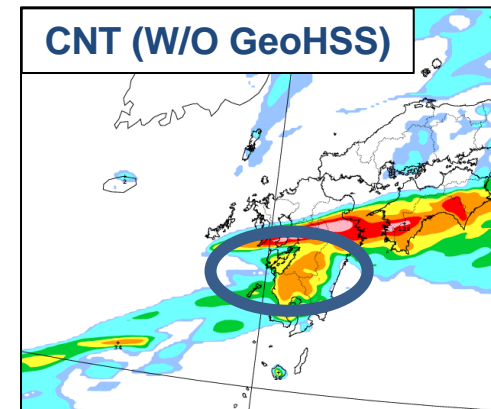
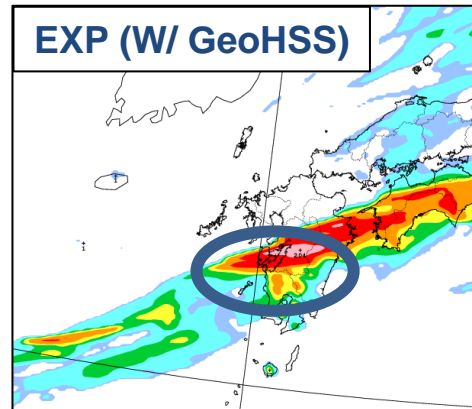
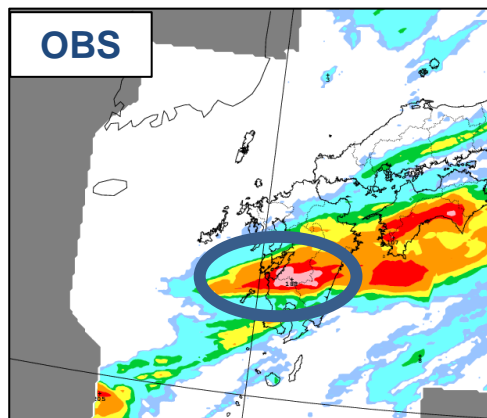
Global Data Assimilation Experiment – Results

- Averaged errors of track forecasts for four typhoons making landfall in Japan, 2018. One forecast whose initial time was 3 days (72 hours) before landing in Japan were chosen for each typhoon
 - **Halve the position error at the time of 3 days before landing**



Regional (Meso-Scale) Data Assimilation Experiment – Results

- 3-hour accumulated rainfall forecast at 12 h initialized at 2100 UTC on 3 July 2020. CNT failed to predict the location of the heaviest rain area that caused devastating flood. Meanwhile, EXP better predicted the location
 - **To realize “evacuation from half a day before” by improving prediction accuracy**



Three-hour accumulated rainfall (mm) valid at 0900 UTC 04 July 2020

Key issues of relevance to CGMS/for consideration:

- Impacts of GeoHSS were assessed using a reanalysis-based OSSE to discuss Himawari-8/-9 follow-on program
 - Assimilation experiments clearly demonstrate value of GeoHSS for the prediction of heavy rainfall event and large-scale system such as typhoon
- GeoHSS data with high frequency over wide area improved both synoptic and meso scale atmospheric state, and this leads to significant improvements of typhoon track and heavy rainfall location forecasts with a long lead time