Use of the Reprocessed GMS/MTSAT Data in JRA-55

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Long-term observations from operational meteorological satellites now play an increased role in climate monitoring. These are important data sources for reanalyses as well, providing global observations since the 1980's when the full-blown satellite observing system became operational. However, as is often the case with real-time data for operational numerical weather prediction (NWP), long-term homogeneity of these data is often insufficient for climate-related applications due to reasons such as inter-satellite biases, inevitable quality changes caused by continuous improvement of processing algorithms and so on. To overcome these problems and produce high-quality, homogeneous satellite products, reprocessing of past satellite observations with the latest processing algorithms is recently being conducted at major meteorological satellite centers.

Currently, the Japan Meteorological Agency (JMA) is conducting the Japanese 55-year Reanalysis (JRA-55) project. It aims at providing a comprehensive atmospheric dataset that is suitable for studies of climate change or multi-decadal variability, by producing a more time-consistent data for a longer period than JRA-25. The data assimilation system used in JRA-55 is based on a low-resolution version (TL319L60) of the JMA operational NWP system as of December 2009, into which many improvements have been implemented since the time of the JRA-25 production. The observational dataset used in JRA-55 has also improved upon those used in previous reanalyses, which includes newly available data such as reprocessed satellite observations. The Meteorological Satellite Center (MSC) of JMA has reprocessed past observations from the Geostationary Meteorological Satellite (GMS) and the Multi-functional Transport Satellite (MTSAT) series with the latest processing algorithms for use in reanalyses. MSC has provided Atmospheric Motion Vectors (AMVs) from GMS for the year 1979 and from GMS-3 through -5, Geostationary Operational Environmental Satellite (GOES)-9 and MTSAT-1R for the period since 1987, and Clear Sky Radiances (CSRs) from GMS-5, GOES-9 and MTSAT-1R for use in JRA-55.

The reprocessed AMVs have been improved upon real-time operational AMVs in the following aspects; 1) improvement of the height assignment scheme, 2) the optimally resized image segment for tracking clouds and water vapor patterns, 3) expansion of the derivation area from 50S-50N to 60S-60N and 4) addition of the Quality Indicator (QI). Preliminary experiments using the reprocessed AMVs in the JRA-55 data assimilation system show that scores of 500hPa geopotential height forecasts are substantially improved in the extra tropical Southern Hemisphere. The impact of the operational AMVs, however, is almost neutral in the current data assimilation system in terms of forecast scores.

The reprocessed CSRs have been produced not only for the period during which the operational CSRs were produced but also for the period from the year 1995, extending by 11 years from the time when the production of CSR became operational at MSC. The CSR provides area average radiances and brightness temperatures for cloud-free pixels. The spatial resolutions of the reprocessed CSRs are 80 x 80 km^2 for GMS-5 and 60 x 60 km^2 for MTSAT-1R, respectively. The reprocessed CSRs have been produced every hour and this high temporal resolution can be utilized effectively with advanced data assimilation schemes such as the four-dimensional variational assimilation system used in JRA-55. We are assimilating the CSRs reprocessed from the water vapor channel in JRA-55. Preliminary experiments show that the reprocessed CSRs improve the upper tropospheric water vapor field over the GMS/MTSAT viewing area.

These results demonstrate that the newly reprocessed GMS/MTSAT data have high quality, and these data are expected to improve quality of the JRA-55 product. These results also illustrate the importance of reprocessing past satellite observations in general, and its continuation is required for further improvement of

reanalysis products.

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