Quality Assessment and Forecast Sensitivity of Global Remote Sensing Observations

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Abstract: The satellite-derived wind from cloud and moisture features of geostationary satellites is an important data source for numerical weather prediction (NWP) models. These datasets and global positioning system radio occultation (GPSRO) satellite radiances are assimilated in the four-dimensional variational atmospheric data assimilation system of the UKMO Unified Model in India. This study focuses on the importance of these data in the NWP system and their impact on short-term 24-h forecasts. The quality of the wind observations is compared to the short-range forecast from the model background. The observation increments (observation minus background) are computed as the satellite-derived wind minus the model forecast with a 6-h lead time. The results show the model background has a large easterly wind component compared to satellite observations. The importance of each observation in the analysis is studied using an adjoint-based forecast sensitivity to observation method. The results show that at least around 50% of all types of satellite observations are beneficial. In terms of individual contribution, METEOSAT-7 shows a higher percentage of impact (nearly 50%), as compared to GEOS, MTSAT-2 and METEOSAT-10, all of which have a less than 25% impact. In addition, the impact of GPSRO, infrared atmospheric sounding interferometer (IASI) and atmospheric infrared sounder (AIRS) data is calculated. The GPSRO observations have beneficial impacts up to 50 km. Over the Southern Hemisphere, the high spectral radiances from IASI and AIRS show a greater impact than over the Northern Hemisphere. The results in this study can be used for further improvements in the use of new and existing satellite observations.