Blending satellite-derived precipitation data sets from multiple sources at short time scales

by

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In order to properly utilize meteorological satellite-derived precipitation estimates in numerical weather prediction (NWP) applications, knowledge of the observation error statistics are needed as well as information on how they are correlated in space and time. However, very few raingauge networks operate with the necessary spatial density and time resolution required for validation of a satellite-based precipitation analysis generated at short space and fine time scales (e.g., 0.25-degree or less and sub-six-hourly). Raingauge data from operationally supported national networks in Australia and Korea were used for validation and performance analysis of an operationally developed blended-satellite precipitation analysis over different seasons and rainfall regimes. The blended satellite analysis is based upon area-dependent statistical relationships derived from a precise, near realtime ensemble of colocated passive microwave (PMW) and infrared (IR) pixels from all low Earth-orbiting (LEO) and geostationary satellites respectively, as their individual orbits and sensor scan patterns continuously intersect in space and observation time. Using the dense, nearly homogeneous, one-minute reporting network operated by the Korean Meteorological Agency (KMA), the space-time root mean square (RMS) error, mean bias, and correlation matrices were computed using various time windows for the gauge averaging centered about the satellite observation time during June-August 2000. Below approximately 24-hours and 1-degree time and space scales, respectively, a similar decay of the error statistics were obtained by trading off either spatial or time resolution; beyond these scales the blended estimates were nearly unbiased and with a rapid reduction in the RMS error. Using the daily, 0.25-degree Australian Bureau of Meteorology (BOM) continental raingauge analysis, the blended technique was analyzed for one year beginning in April 2001. The blended technique performed the best in the tropical wet season and with larger RMS errors in the mid-latitudes. The overall error characteristics of the blended satellite technique appear to be limited by the worst-case revisit time of the underlying LEO constellation. Also, the results suggest that the performance of the blended satellite technique may be more sensitive to inter-satellite biases between the PMW sensor types than by gaps in the overall time sampling pattern of the underlying LEO constellation. Implications for the proposed Global Precipitation Mission (GPM) will be discussed.