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Recent Progress on the Second Generation CMORPH: LEO-IR Based Precipitation Estimates and Cloud Motion Vector

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As reported at the EGU General Assembly of 2014, a prototype system was developed for the second generation CMORPH to produce global analyses of 30-min precipitation on a 0.05olat/lon grid over the entire globe from pole to pole through integration of information from satellite observations as well as numerical model simulations. The second generation CMORPH is built upon the Kalman Filter based CMORPH algorithm of Joyce and Xie (2011). Inputs to the system include rainfall and snowfall rate retrievals from passive microwave (PMW) measurements aboard all available low earth orbit (LEO) satellites, precipitation estimates derived from infrared (IR) observations of geostationary (GEO) as well as LEO platforms, and precipitation simulations from numerical global models. Key to the success of the 2nd generation CMORPH, among a couple of other elements, are the development of a LEO-IR based precipitation estimation to fill in the polar gaps and objectively analyzed cloud motion vectors to capture the cloud movements of various spatial scales over the entire globe. In this presentation, we report our recent work on the refinement for these two important algorithm components.

The prototype algorithm for the LEO IR precipitation estimation is refined to achieve improved quantitative accuracy and consistency with PMW retrievals. AVHRR IR TBB data from all LEO satellites are first remapped to a 0.05olat/lon grid over the entire globe and in a 30-min interval. Temporally and spatially co-located data pairs of the LEO TBB and inter-calibrated combined satellite PMW retrievals (MWCOMB) are then collected to construct tables. Precipitation at a grid box is derived from the TBB through matching the PDF tables for the TBB and the MWCOMB. This procedure is implemented for different season, latitude band and underlying surface types to account for the variations in the cloud – precipitation relationship.

At the meantime, a sub-system is developed to construct analyzed fields of cloud motion vectors from the GEO/LEO IR based precipitation estimates and the CFS Reanalysis (CFSR) precipitation fields. Motion vectors are first derived separately from the satellite IR based precipitation estimates and the CFSR precipitation fields. These individually derived motion vectors are then combined through a 2D-VAR technique to form an analyzed field of cloud motion vectors over the entire globe. Error function is experimented to best reflect the performance of the satellite IR based estimates and the CFSR in capturing the movements of precipitating cloud systems over different regions and for different seasons.

Quantitative experiments are conducted to optimize the LEO IR based precipitation estimation technique and the 2D-VAR based motion vector analysis system. Detailed results will be reported at the EGU.