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Developing the Second Generation CMORPH: A Prototype

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A prototype system of the second generation CMORPH is being developed at NOAA Climate Prediction Center (CPC) to produce global analyses of 30-min precipitation on a 0.05deg lat/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, estimates derived from infrared (IR) observations of geostationary (GEO) as well as LEO platforms, and precipitation simulations from numerical global models.

First, precipitation estimation / retrievals from various sources are mapped onto a global grid of 0.05deg lat/lon and calibrated against a common reference field to ensure consistency in their precipitation rate PDF structures. The motion vectors for the precipitating cloud systems are then defined using information from both satellite IR observations and precipitation fields generated by the NCEP Climate Forecast System Reanalysis (CFSR). To this end, motion vectors are first computed from CFSR hourly precipitation fields through cross-correlation analysis of consecutive hourly precipitation fields on the global T382 ($\sim$35 km) grid. In a similar manner, separate processing is also performed on satellite IR-based precipitation estimates to derive motion vectors from observations. A blended analysis of precipitating cloud motion vectors is then constructed through the combination of CFSR and satellite-derived vectors with an objective analysis technique. Fine resolution mapped PMW precipitation retrievals are then separately propagated along the motion vectors from their respective observation times to the target analysis time from both forward and backward directions. The CMORPH high resolution precipitation analyses are finally constructed through the combination of propagated PMW retrievals with the IR based estimates for the target analysis time. This Kalman Filter based CMORPH processing is performed for rainfall and snowfall fields separately with the same motion vectors.

Experiments have been conducted for two periods of two months each, July – August 2009, and January – February 2010, to explore the development of an optimal algorithm that generates global precipitation for summer and winter situations. Preliminary results demonstrated technical feasibility to construct global rainfall and snowfall analyses through the integration of information from multiple sources. More work is underway to refine various technical components of the system for operational applications of the system. Detailed results will be reported at the EGU meeting.