Enhancing CMORPH2 Through Infusing Retrievals from Direct Broadcast and Small Satellites

Pingping Xie, Shaorong Wu, and Yaping Li
NOAA Climate Prediction Center

Abstract

Second generation CMORPH (CMORPH2) is a technique to construct high-quality, high resolution (0.05^{o}lat/lon, 30-minutes) global precipitation analysis through combining information from multiple sources including satellite observations, ground measurements, and numerical model simulations. Level 2 precipitation (rain rate and snowfall rate) retrievals from multiple (~10) low earth orbit (LEO) platforms are first inter-calibrated and combined to form composite LEO precipitation retrieval fields. Geostationary precipitation estimates (GPE) are then derived through calibrating the IR TBB from geostationary (GEO) satellites against the LEO precipitation composites. Motion vectors are computed from the consecutive GPE over GEO coverage and from numerical model hourly precipitation beyond the 60^{o} parallels. Purely satellite-based raw CMORPH2 precipitation estimates are then defined by propagating the LEO precipitation retrievals from their respective measurement times to the target analysis time along the motion vectors following the Kalman filter framework. Finally bias in the raw CMORPH2 is removed through comparison against the CPC daily gauge analysis over land and through adjustment to the GPCP monthly analysis V3.2 over ocean. In addition to the total precipitation intensity, fraction of solid precipitation is also estimated from surface air temperature. The processing systems for both the retrospective and real-time analyses have been re-engineered to ensure stable, efficient productions and easy maintenance. The real-time production of bias corrected CMORPH2 is now available at a very short latency of less than one hour to satisfy requirements from NWS field offices.

Quality of the above-mentioned CMORPH2 routine production is compromised when (e.g. at short latency) / where (e.g. over the tropics) coverage of the L2 retrievals is limited. In this presentation, we report our work to improve the CMORPH2 through infusing direct broadcast (DB) of MiRS precipitation retrievals over CONUS, Alaska and adjacent oceans and the MiRS retrievals of PMW measurements from small satellites (SS). To this end, MiRS retrievals from the DB and SS are first calibrated against the combined LEO precipitation retrievals generated in the routine production. The calibration is carried out through PDF matching tables constructed for each satellite, for each 0.5^{o}lat/lon grid box and updated daily. The calibrated DB and SS retrievals are then injected into the CMORPH2 production to fill in the gaps in the LEO combined precipitation retrievals. Preliminary studies showed substantial improvements in the CMORPH2 especially in the short-latency real-time production. Work is underway to optimize

the algorithms for real-time implementation. Evaluation results will be reported at the workshop.