Infusing JPSS PMW Retrievals to Improve CMORPH Global Precipitation Estimates: Preliminary Results

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2013.03.20.

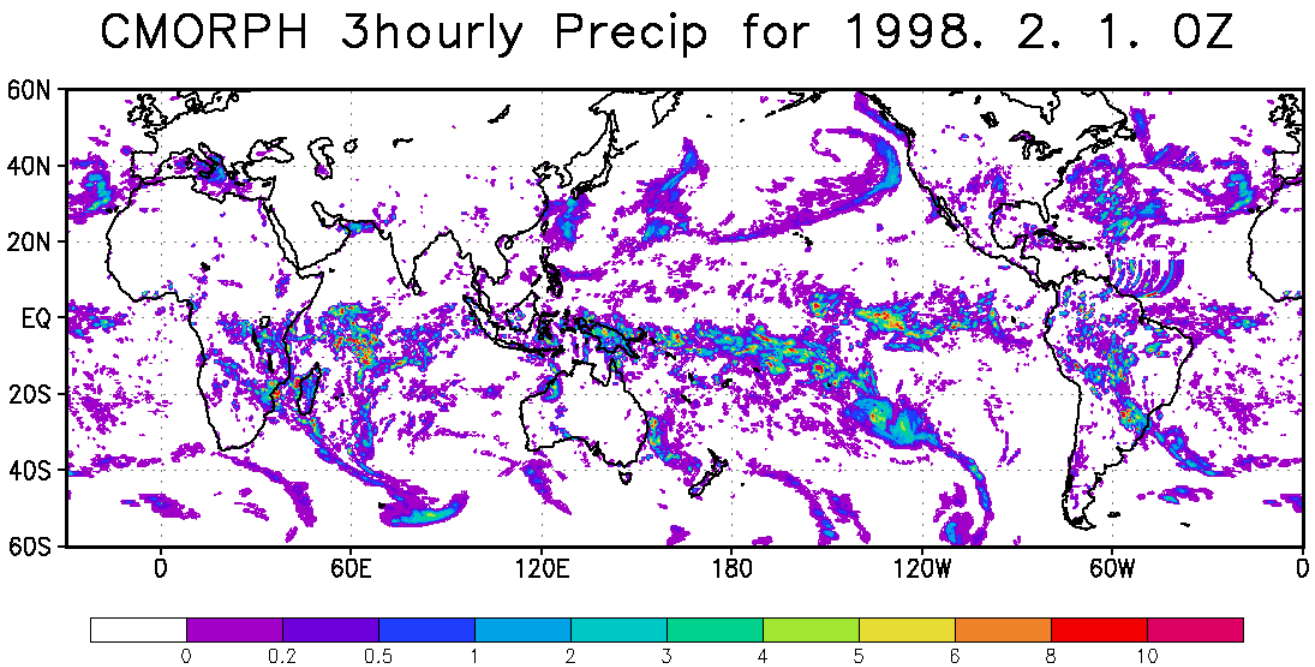
Our Newly Funded JPSS Project

- Funded for FY2012-2015
- Objectives:
  - To improve the representation of snowfall in the CMORPH using retrievals from NPP/JPSS and other satellites;
  - To shorten the latency of the real-time CMORPH through the use of more frequent PMW observations from NPP and other satellites;
  - To reduce the temporal inhomogeneity in the CMORPH time series; and
  - To perform impact tests of the NPP/JPSS infusion to the improvements of the CMORPH precipitation analysis quality

The Current Operational CMORPH

1) Brief Description

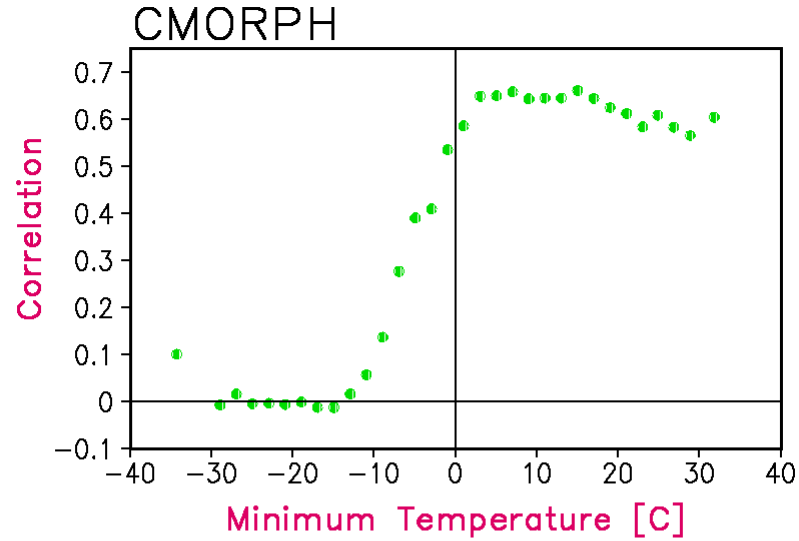
- GEO IR data used to derive cloud motion vectors
- L2 PMW precip retrievals propagated from their observation times to the target analysis time
- Products
  - 8kmx8km over the globe (60ºS-60ºN)
  - From Jan.1, 1998 to the present
  - Updated on a real-time basis

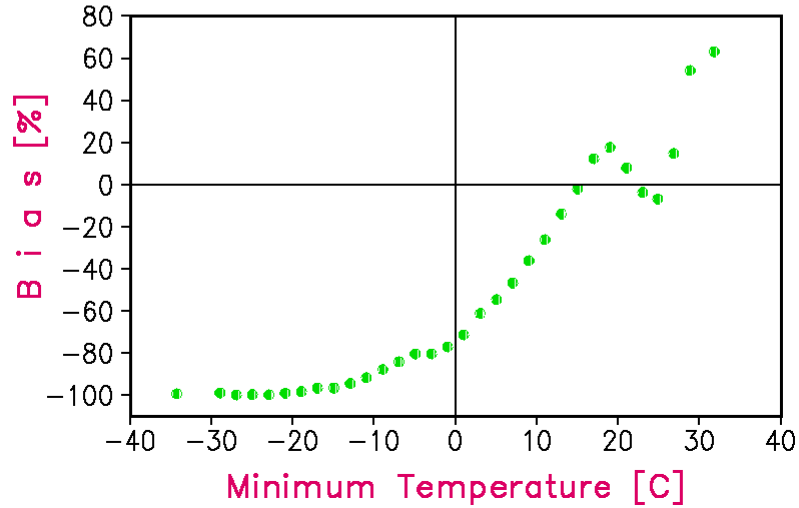


The Operational CMORPH

2) Restrictions and Shortcomings

- Poor quality over mid-latitudes and during cold seasons
  - *CMORPH performance as a function of surface air temperature*
- Covers only 60ºS-60ºN
  - *Use of GEO/IR to derive motion vectors*
  - *Coverage of PMW retrievals over high latitudes*

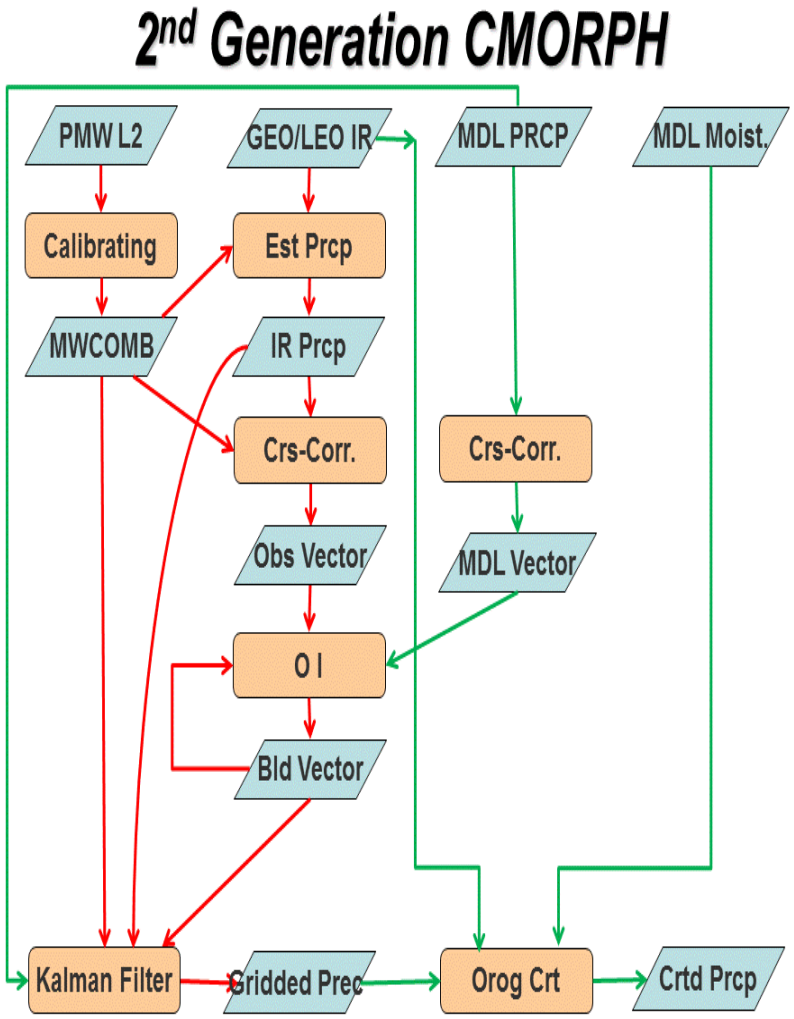




The New Global CMORPH

1) Overall Strategy and Flowchart

- **Features**
  - 0.05ºlat/lon over the entire globe
  - Explicit representation of snowfall
- **Input Precip**
  - PMW L2
  - GEO/LEO IR-based estimates
  - (optional) CFSR
- **Cloud motion vectors**
  - Cross-correlation from GEO/LEO IR based precip
  - Cross-correlation from CFSR (optional)
  - Blended analysis through OI
- **Integration Framework**
  - Kalman Fielter based algorithm
- **Other components**
  - Orographic effects..



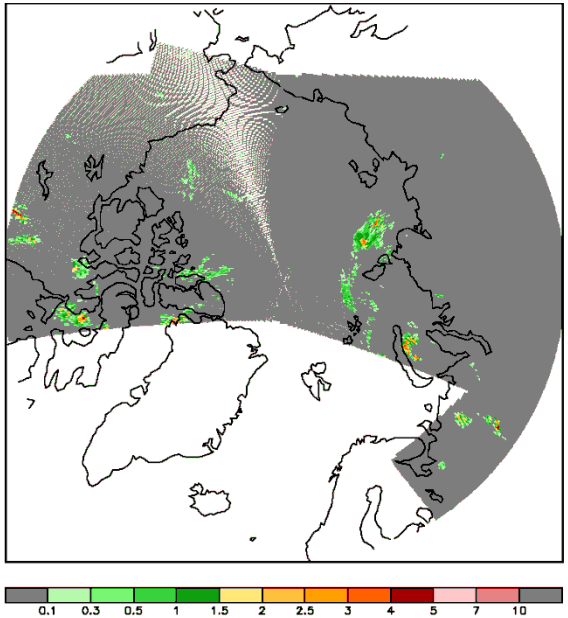
Required Developments

1) Current Status

- Examining potential inputs
  - *Done*
- Developing techniques to estimate precip from GEO/LEO IR
  - *Prototype algorithm developed*
  - *Estimates generated for test periods (two months each for summer and winter)*
- Developing algorithms to construct blended cloud motion vector over the globe
  - *New methods tested to derive motion vectors from both geostationary and low orbiter satellites / CFSR precip fields*
  - *OI-based blending technique under investigation*
- Integration Framework
  - *Developed and published*
- Including snowfall info
  - *New NESDIS PMW-based snowfall retrievals examined*
  - *Reanalysis (model) based cold-season precip fields examined*
  - *Gridded analyses of ground observed snowfall and snow depth being constructed for future evaluation*

Required Developments

2) Performance of LEO/IR Based Precip Estimates



Correlation with Finland Radar 30-min Precip

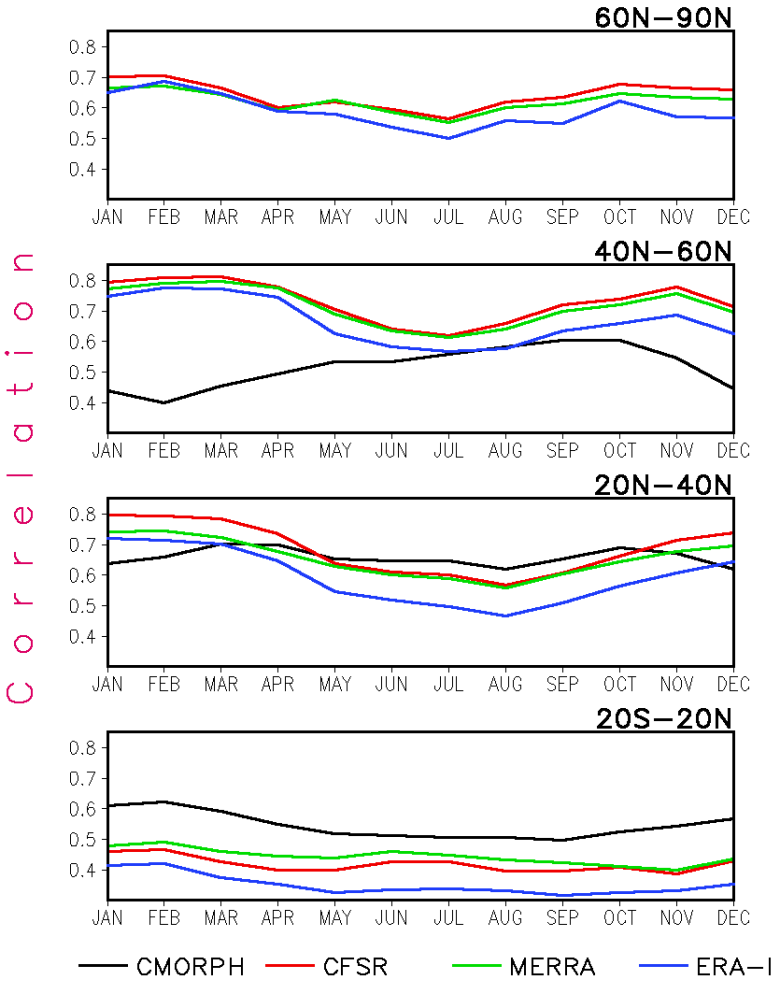
Satellite Estimates	Land	Ocean
PMW retrievals from NOAA 18	0.380	0.353
IR-based estimates from NOAA18	0.227	0.318

- Precipitation estimates derived from LEO IR perform reasonably well over high latitudes at least during warm seasons
- **IR-based precipitation estimates provide useful information over high-latitude**

Required Developments

2) Performance of New generation Reanalyses

- Three sets of global reanalyses at high-resolution
  - **CFSR**
  - **MERRA**
  - **ERA-I**
- Compared against daily gauge analysis for a 12-year period from 1998 to 2009
- CMORPH outperforms the reanalyses in capturing precipitation over tropics and during warm seasons over sub-tropics
- Reanalyses precipitation fields perform very well over mid- and hi-latitudes and over cold seasons over sub-tropics



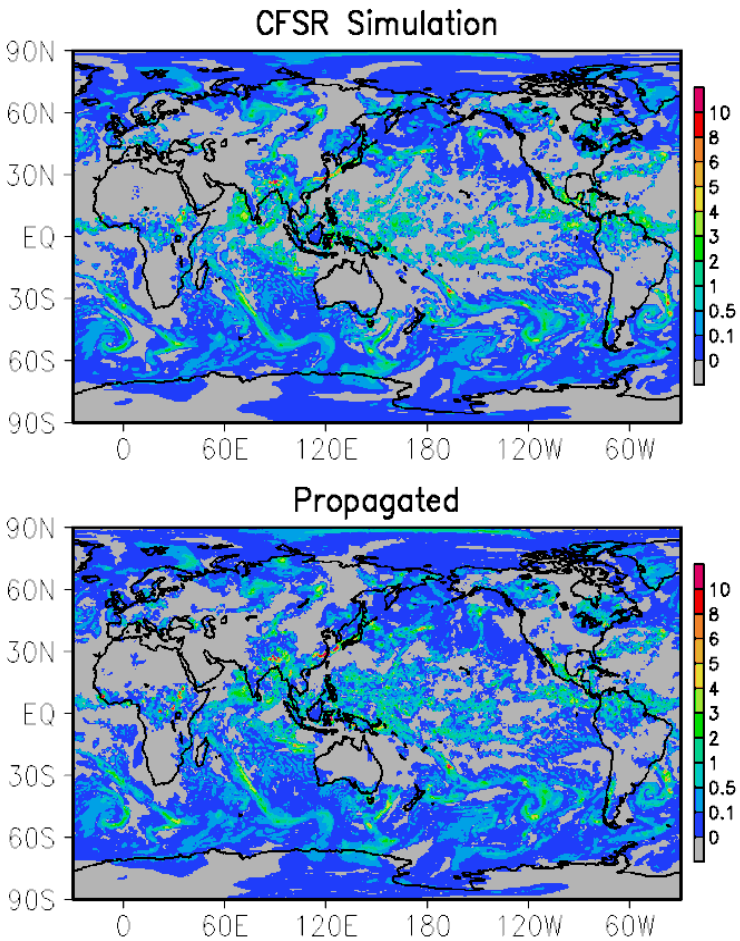
Required Developments

3) Motion Vectors derived from CFSR Precip Fields

- Defining motion vectors through computing cross-correlation between precipitation fields at two close time steps

- Motion vectors can be derived from satellite PMW / IR based precipitation fields, however spatially limited to grid boxes with consecutive coverage;

- Cloud motion vectors derived from CFSR hourly precipitation fields present reasonable quality

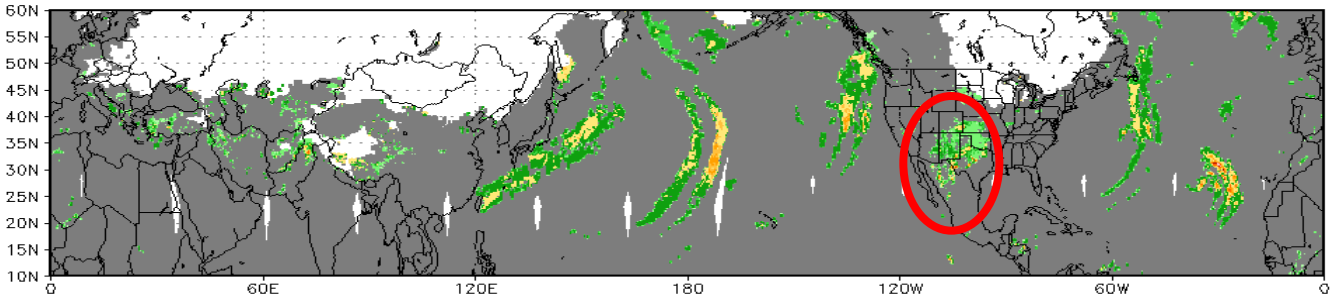


Required Developments

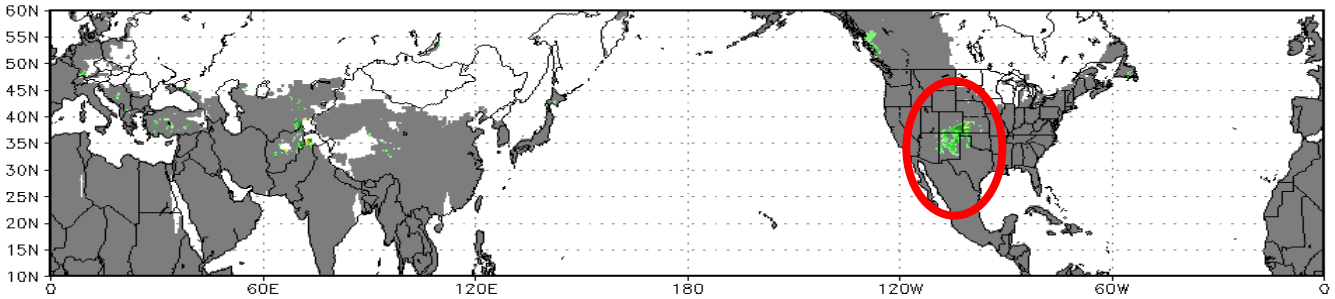
4) PMW Snowfall Retrievals Bring in Important Information

Jan.28,2010

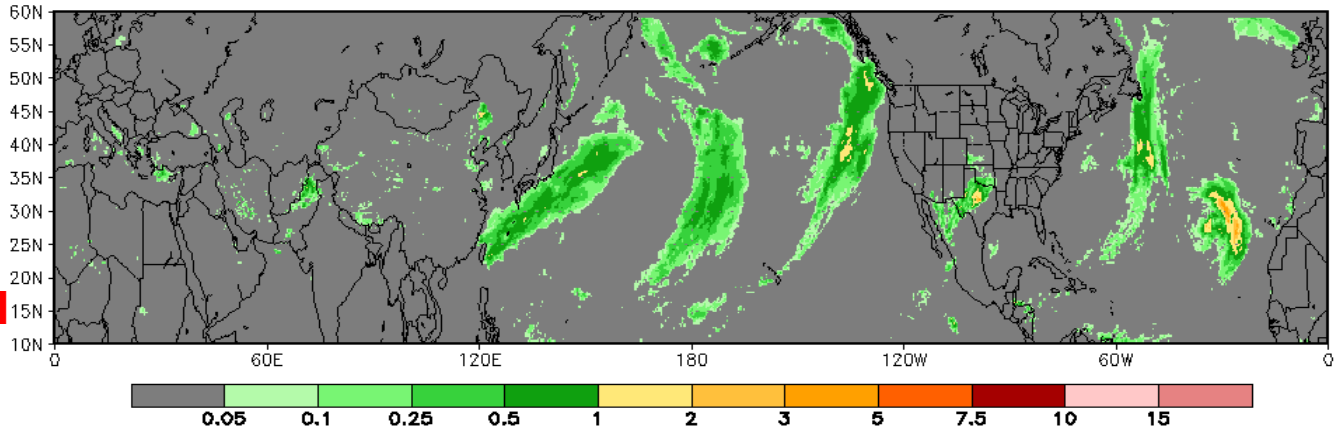
N18 MHS Rain



N18 MHS Snow



Current CMORPH



Summary

- Strategy designed for the new CMORPH covering the entire globe from pole to pole on a refined resolution (0.05^{o}lat/lon – 30-min) and with improved representation of cold season rainfall and snowfall
- Key component techniques being developed
- Construction of prototype global analyses (for summer first) to be completed before summer for further improvements
- We appreciate it very much the project supports from JPSS!