



An orographically adjusted GPM precipitation retrieval for NOAA's QPE over mountainous terrain

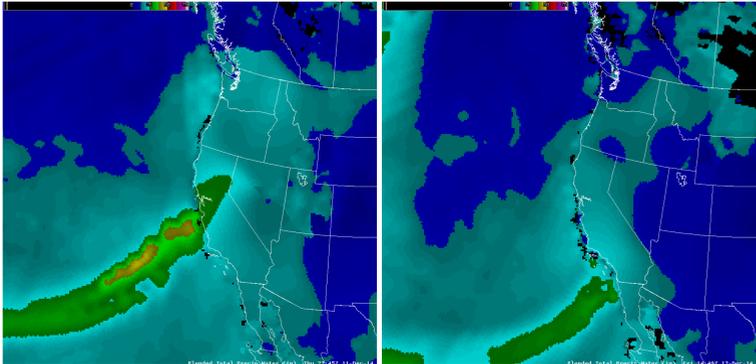
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12 December 2014 case:

CIRA Blended TPW (bTPW)



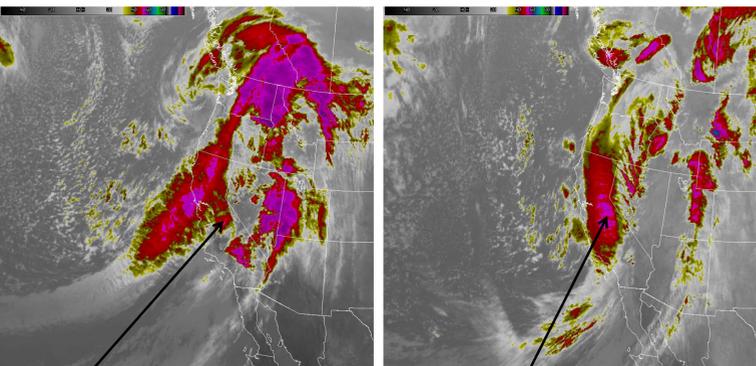
2245 UTC 11 Dec 2014

1449 UTC 12 Dec 2014

- CIRA bTPW product depicts significant Atmospheric River event.
- Widespread (5"+) rainfall coastal / inland California.

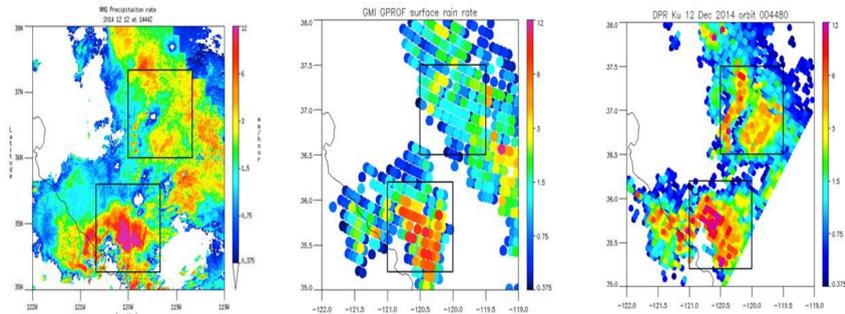
GOES IR at 2230 UTC 11 Dec 2014

GOES IR at 1445 UTC 12 Dec 2014



Cloud cover likely associated with orographic precipitation ahead of warm conveyor belt / frontal band.

Region of GPM pass obscured by warm conveyor belt cloud cover.



- Northern sector (foothills of Sierra Nevadas in the northeast corner)
 - Land based radar (NMQ) does not capture the full extent of the higher precipitation rates in proximity to the ascending topography compared to DPR.
 - GMI has even lesser precipitation rates, indicating the potential for ORI to identify (and enhance) this region of orographic precipitation.
- Southern sector (coastal mountain ranges)
 - Area of convective rainfall.
 - GMI in better agreement with DPR / NMQ

Abstract:

The core satellite of the Global Precipitation Mission (GPM) was successfully launched on February 28, 2014. Designed as a baseline for the inter-calibration of various passive microwave sensors comprising the GPM constellation (including SSMI/S, AMSR-E, and MHS), this core satellite carries a dual frequency precipitation radar [DPR; Ku band (13.6 GHz) and Ka band (35.5 GHz)] and state-of-the-art GPM microwave imager [GMI; multiple bands in the 10 – 183 GHz spectrum]. The full complement of the GPM constellation enables a global precipitation product having roughly 10 km spatial resolution on 3-hourly intervals that approaches the scales needed for hydrologic applications. One of the limitations of the GPM precipitation products is an underestimation of precipitation rate over orography due to mechanical lifting of water vapor that leads to substantial precipitation without a commensurate increase in the ice phase.

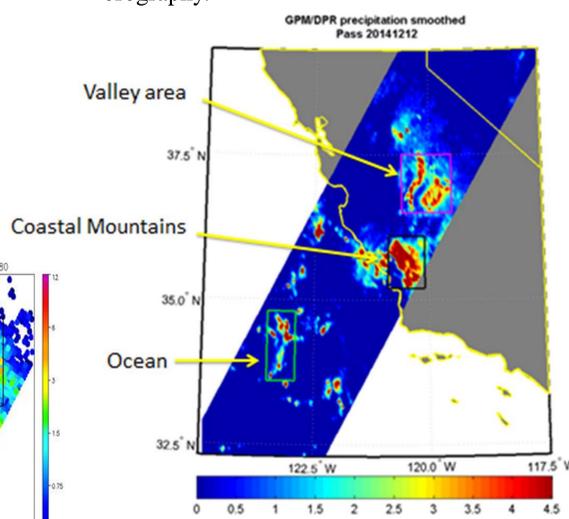
To address this underestimation, the Orographic Rain Index (ORI) product is investigated to determine if ORI can enhance GMI precipitation estimates over orography.

Objectives:

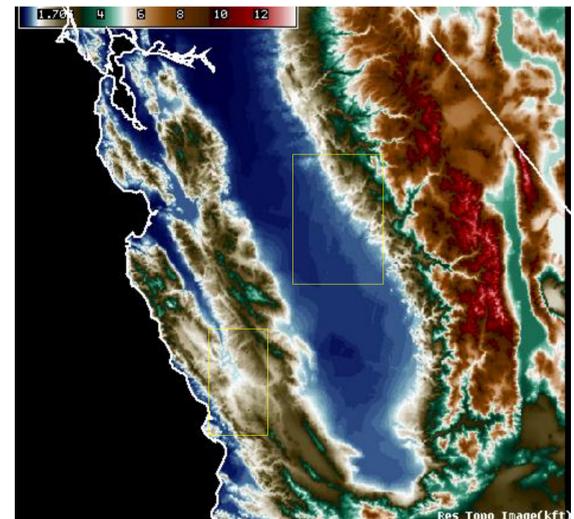
- Compare the GMI to the DPR estimates of precipitation rates (with the DPR serving as “ground truth”).
 - This highlights where GMI retrievals have limitations (presumed to be over orography)
- Compare the distribution of ORI to GMI, both subjectively and quantitatively through a comparison at similar points.

Hypothesis:

- ORI should be able to use GMI estimates to result in a more accurate precipitation estimate over orography.

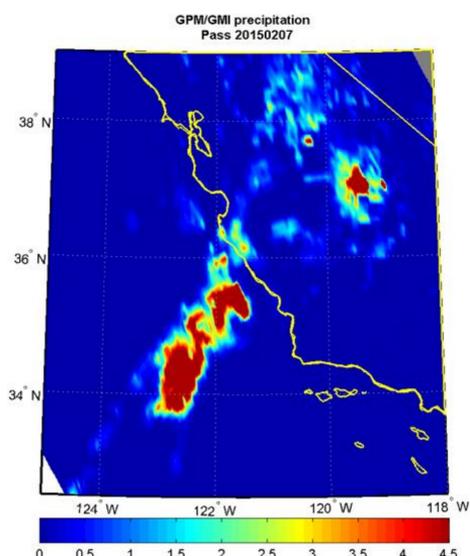


GPM/DPR pass at 15Z 12 December 2014. Sectors over land on left.

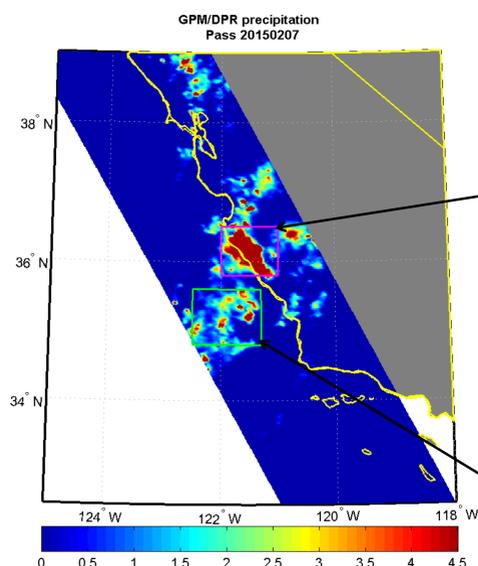


Topographic map with boxes as shown on left

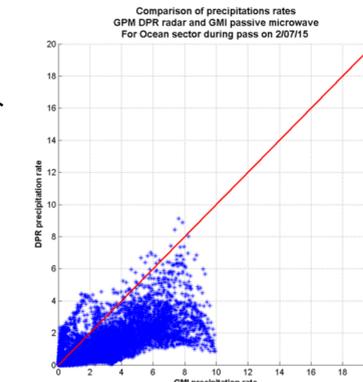
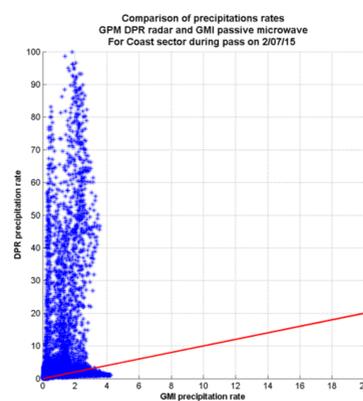
7 February 2015 case:



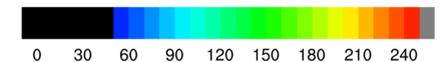
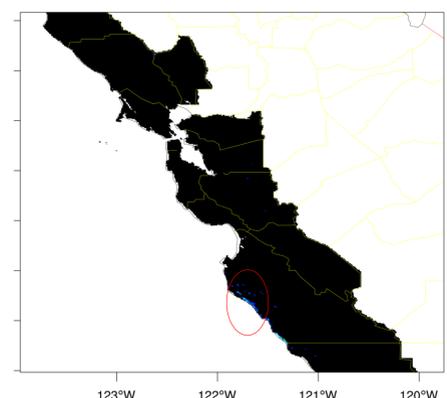
GPM/GMI pass at 15Z 7 February 2015.



GPM/DPR pass at 15Z 7 February 2015. Boxes correspond to scatter plots on right.



ORI valid 1500 UTC 02/07/2015



ORI at 15Z 7 February 2015. Red oval highlights higher ORI values in the coastal mountain range in the northernmost box to the left.