

Improved GOES Water Vapor Products over CONUS – Planning for GOES-R

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Introduction: The investigation of the Geostationary Operational Environmental Satellite (GOES) 12 total precipitable water (TPW) product data and the coinciding Global Positioning System (GPS) TPW record for the past year and a half has revealed that the moist bias in GOES 12 sounder derived products remains similar to that from other GOES satellites and is consistent over time. The compelling question for us at Earth System Research Laboratory (ESRL) is just how can we best use the GPS synoptic data to improve the satellite operational products? If we improve the current GOES product data will we be better able to produce a GOES R product? The result is work summarized by this paper – establish a means to characterize the current GOES error based on past data and apply the correction in real time to new product data; furthermore, to examine the characteristics of proxy GOES R advanced baseline imager (ABI) data derived from current moderate resolution imaging spectroradiometer (MODIS) polar orbiter data and assess its performance.

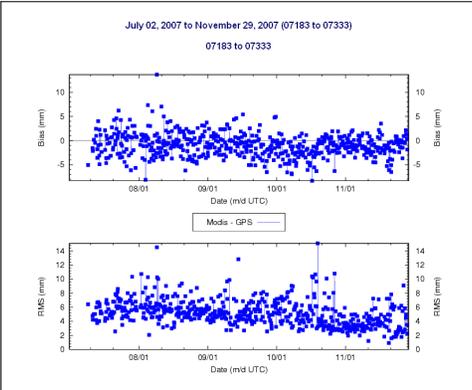
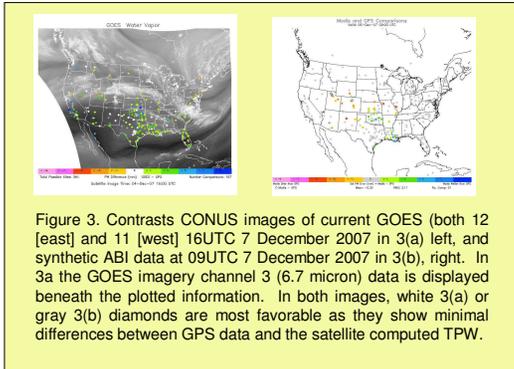
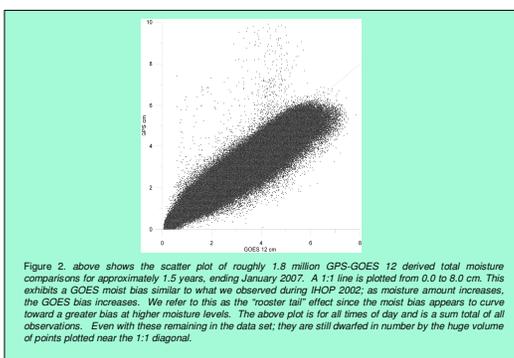
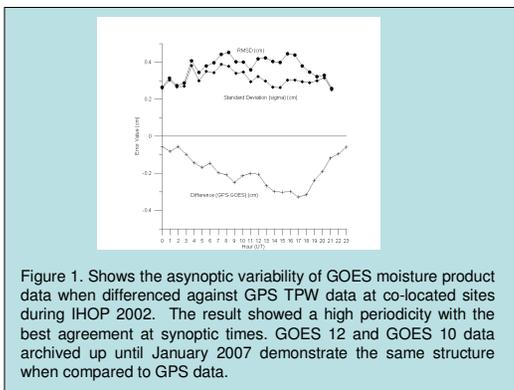


Figure 4. 3 Plots bias (ABI-GPS) mm above and root mean square (RMS) of the difference data below. What is labeled as "MODIS" is in fact proxy ABI data. The trend seen in the ABI data was **initially near zero bias** but as we have moved into a drier season, the ABI product appears to be becoming **dry biased**. Overall **RMS statistics have decreased** as the season has moved to the dry time of year. No removal of outliers was performed in on these plots. The handful of high RMS values (greater than 10 mm) can likely be ignored.

The following simple correction algorithm was devised to match the conventions GOES product TPW to GPS TPW.

$$G_c = aG^b$$

The coefficients (a and b) in the above equation were derived by minimizing the functional below that differences all GPS and GOES data.

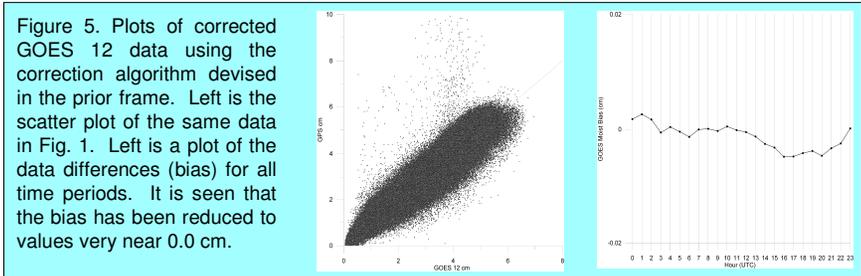
$$J = \sum_{i=1}^N (G_{ci} - GPS_i)^2$$


Figure 5. Plots of corrected GOES 12 data using the correction algorithm devised in the prior frame. Left is the scatter plot of the same data in Fig. 1. Left is a plot of the data differences (bias) for all time periods. It is seen that the bias has been reduced to values very near 0.0 cm.

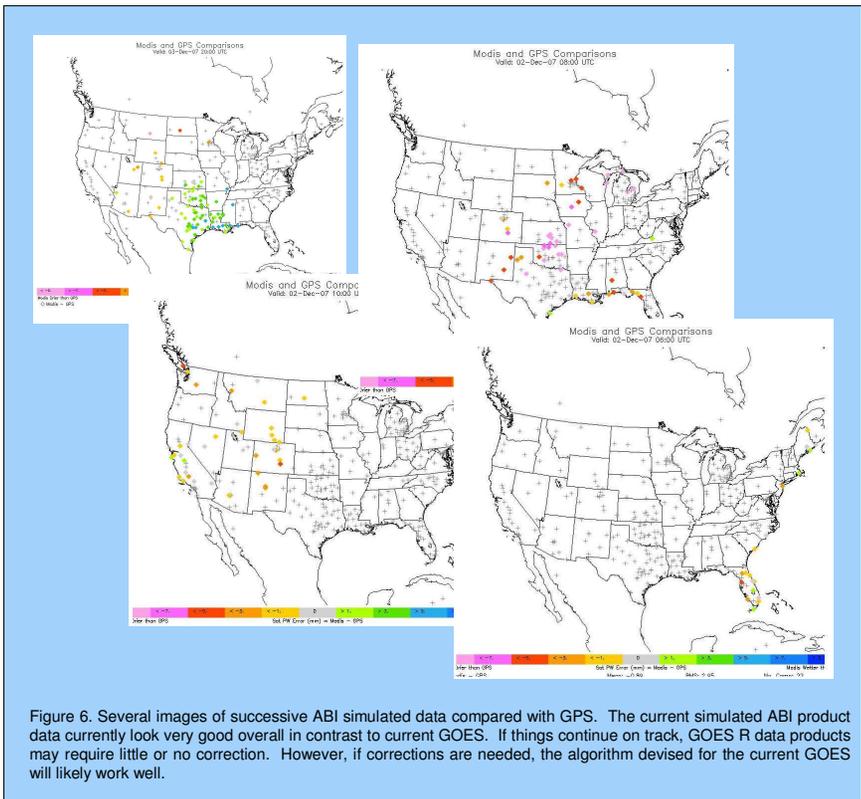


Figure 6. Several images of successive ABI simulated data compared with GPS. The current simulated ABI product data currently look very good overall in contrast to current GOES. If things continue on track, GOES R data products may require little or no correction. However, if corrections are needed, the algorithm devised for the current GOES will likely work well.