Abstract
This poster presents the evaluation of the Suomi NPP TPW Level-2 and 3 products with TPW data from ground-based and satellite-based measurements. The goal of the Suomi NPP VIIRS Moisture Project is to provide total column water vapor (TPW) properties from merged VIIRS infrared measurements and CrIS plus ATMS water vapor soundings to continue the depiction of global moisture at high spatial resolution started with MODIS. While MODIS has two water vapor channels within the 6.5 µm H2O absorption band and four channels within the 15 µm CO2 absorption band, VIIRS has no channels in either IR absorption band. The VIIRS + ATMS TPW algorithm being developed at CCMSC is similar to the MODIS synthetic regression algorithm. It uses the three VIIRS longwave IR window bands in a regression relation and adds the NUCAPS (CrIS + ATMS) water vapor product to compensate for the absence of VIIRS water vapor channels. Level-3 global 0.5° daily and monthly mean data products were developed by using a gridding software (called Yori) developed at UW/Madison SSEC. The development of Yori is funded by NASA VIIRS Atmospheric SIPS. The Level-3 products have been processed from May 2012 to December 2016.

Comparison to MWR and GPS measurements
The Suomi-NPP VIIRS Total Precipitable Water Product
Eva Borbas, Zhenglong Li, Paul Menzel, Matyas Rada and Laura Dobor
Space Science and Engineering Center, University of Wisconsin – Madison, WI, USA

Level-3 Global daily and monthly 0.5 degree gridding

Zonal monthly mean cross-comparisons of different TPW products
Comparing to MODIS/Aqua (MYD07 day/night)

Conclusions and Future Plans
• The Level-2 6-minutes and 750 m spatial resolution VIIRS TPW product file includes the collocated NUCAPS background TPW; the VIIRS-only TPW, and VIIRS-HUCAPS TPW with a quality flag.
• The Level-3 VIIRS TPW products are daily and monthly means aggregated to 0.5 degree spatial resolution separated by day and night.
• The Level-3 products have been processed for data between May 2012 and December 2016.
• The Level-2 and Level-3 comparison with Aqua MODIS showed that VIIRS/NUCAPS TPW quality is better than VIIRS or NUCAPS alone. Values missing in the NUCAPS alone due to surface emissivity issues are filled by using VIIRS alone values. Values missing in VIIRS and MODIS alone due to interference from non-radiating clouds are filled by using smoothed NUCAPS values.
• The VIIRS-NUCAPS combined TPW algorithm is producing near-MODIS quality TPW in the comparison between 2012-2016 with 0.5 values greater than 0.50 over land and ocean both day and night.

In the future, we are planning to
• Improve the VIIRS TPW by radiance fusion from CrIS or product fusion (Wissel et al., 2017) and
• Make some refinements like updating the forward model from CRTM to RETT0V, increasing viewing angle categories, and investigate the retrieval noise occurring over land at cloudy edges, and update the IR emissivity data base (from UW/IFreis to CAMEL.)

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Table 1: Comparison of the characteristics of the Aqua MODIS (MYD07) and the VIIRS NUCAPS data products

Figure 3: Daytime Daily (Oct 15, 2014, top panels) and monthly (Oct 2014, bottom panels) mean 0.5 degree gridded VIRS/NUCAPS (left) and AQUA/MODIS MYD07 (right) TPW products.

Figure 2: Processing a VIIRS TPW granule to a gridded granule (15 October 2014 at 08:50 UTC).

Figure 1: TPW comparison on 15 October 2014 at 08:50 UTC (top left) Aqua MODIS MYD07, (top middle) VIRS only (top right) VIIRS plus NUCAPS retrievals, (bottom left) NUCAPS only (bottom left), CrIS + ATMS analyzas, (bottom middle) NUCAPS v1.1 TPW, (bottom right) quality flag.

Note: the better coverage and improved quality for VIIRS plus NUCAPS with holes filled compared with VIIRS alone, NUCAPS alone, and even MODIS.

Figure 7 (right): The latitude/longitude data and the latitude/longitude zones used for comparison. The land/water mask was used at a first selection, the TPW data was derived from the SSW data.

The scatter plots show the day-night ocean and land expected relationships between the Level-3 MYD07 (v007) and the Level 3 NUCAPS. VIIRS-only and VIIRS NUCAPS data products.

The correlation table shows the relationship between the Aqua MODIS and VIIRS-only (left), NUCAPS (middle) and VIIRS NUCAPS (right) monthly mean Level-3 data products, separated by day, night, ocean and land.

Table 2: Final statistics of the VIIRS algorithm

Table 3: TPW Products used for the zonal cross-comparison

Figure 8: The scatter plots show the day-night ocean and land expected relationship between the Level-3 MYD07 (v007) and the Level 3 NUCAPS, VIIRS-only and VIIRS NUCAPS data products.