Evaluation of the VIIRS TPW algorithm with ground based measurements

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ABSTRACT

The goal of the Soumi 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/MODIS TPW algorithm being developed at CERES is similar to the MOD07 synthetic regression algorithm. It uses the three VIIRS longwave IR window bands in a regression relation and adds the CrIS/ATMS water vapor product to compensate for the absence of VIIRS water vapor channels.

This paper presents a initial evaluation of the S-APP TPW products with TPW data from the ground-based Global Positioning System (GPS) over the SUOMI network and from the Microwave Water Vapor Radiometer (MWR), RAOB and GPS over the Atmospheric Radiation Measurement (ARM) Cloud and Radiation Testbed (CART) sites at three different climate regions (Tropical Western Pacific, North Slope of Alaska, and Southern Great Plains).

DATA and SITES

Ground based measurements:
- Microwave Water Vapor Radiometer (MWR) TPW
- GPS TPW measurements
  Time period: Jan 2012 – July 2015

Airborne measurements:
- MODIS/MOD07 L2
- AIRS, AIRS+AMSU L2
- NUCAPS (CrIS+ATMS)
- VIIRS

RESULTS

The closest MWR value in time was compared to the GPS measurements over the SGP CART site when both ground based TPW measurements were available.

METHODS

Collocations in space:
- MODIS, VIIRS, 25km around the site, if 50% clear
- AIRS, AIRS+AMSU, NUCAPS: closest pixel to the site

Collocation in time:
- MODIS, AIRS, AIRS+AMSU. VIIRS: closest pixel timing
- MWR: 5mm average around the satellite data timing (~12 values)
- GPS: 50mm average around the satellite data timing (~2 values)

The main aim is to develop a VIIRS TPW algorithm for the continuation of the MOD07 product. MODIS: 5km resolution, has two water vapor channels, VIIRS: high spatial resolution (10 km) has no IR absorption channels. It has IR windows at 6.6, 10.8 and 12 μm (low level moisture information)

DATA and SITES

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Comparison to MWR measurements

SGP CART site

Comparison to GPS measurements

GPS and MWR measurements

SGP CART site

The closest MWR value in time was compared to the GPS measurement over the SGP CART site when both ground based TPW measurements were available.

Comparison to MWR measurements

Total Precipitable Water [mm]

Comparison to GPS measurements

VIIRS-like MODIS
- VIIRS simulation based on MODIS data
- Using the CrIS/ATMS algorithm as VIIRS has 5 km resolution

Future Plans:
- Finalize the VIIRS+NUCAPS combined algorithm
- Apply the Space Time Grid software (Smith et al, 2014) to build global daily/monthly VIIRS/NUCAPS TPW L3 global products
- Compare VIIRS/NUCAPS TPW L3 global products to MOD07 L3, AIRS L3 and SSMI TPW products

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