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Abstract: **VIIRS Radiance Cluster Analysis under CrIS Field of Views**

Likun Wang , University of Maryland, College Park, MD;
and Y. Chen, D. Tremblay, and Y. Han

The Suomi National Polar-orbiting Partnership (Suomi NPP) satellite, successfully launched in October 2011, is a weather satellite to serve as a gap-filler between NOAA's heritage Polar Operational Environmental Satellites (POES) and the new generation Joint Polar Satellite Systems (JPSS). Five key instruments are carried on Suomi NPP. Among them, the Visible Infrared Imaging Radiometer Suite is a whiskbroom scanning imaging radiometer, collecting visible and infrared imagery of the Earth through 22 spectral bands between 0.412 μm and 12.01 μm with a resolution of 375 m or 750 m at nadir. The Cross-track Infrared Sounder is a Michelson interferometer with 1305 spectral channels over three wavelength ranges: long-wave infrared (LWIR) (9.14–15.38 μm), middle-wave IR (MWIR) (5.71–8.26 μm), and short-wave IR (SWIR) (3.92–4.64 μm). In contrast to a state-of-the-art high-spatial-resolution imager instrument of VIIRS, the sounder instrument CrIS provides information on the vertical profiles of temperature, water vapor, and critical trace gases of the atmosphere, albeit with coarse spatial resolution (14.0 km at nadir).
The combination of high spatial resolution measurements from an imager and high spectral resolution measurements from an infrared (IR) sounder can take advantage of both spectral and spatial capabilities; hence, it can further improve atmospheric and surface geophysical parameter retrievals and data utilization for numerical weather prediction models.

In this study, we propose implementation of VIIRS radiance spatial distribution into the CrIS Field of Views (FOVs) in term of radiance clusters. The processing of the imager pixels mapped inside the sounder FOV is an efficient way to detect small amount of clouds because of its high spatial resolution, to determine the number of cloud layers and the complexity of the situation. Specifically, the VIIRS radiances from all infrared channels will be collocated within CrIS FOVs using the newly-developed fast and accurate collocation algorithm based on line-of-sight (LOS) vectors (Wang et al. 2016). The collocated VIIRS pixels are then separated into several classes based on cluster analysis; for each class, the fraction of CrIS FOV coverage,

mean radiance value, standard deviation mean will be analyzed and put into CrIS FOVs. In our previous efforts, the CrIS geolocation parameters have been adjusted to make CrIS perfectly align with VIIRS to minimize the spatial co-registration uncertainties (Wang et al. 2016, the manuscript for JGR). The implementation of VIIRS radiances under CrIS FOVs will facilitate the following applications, including 1) accurate determination of heterogeneous degree of the CrIS FOVs, 2) fast selection of clear situation, 3) cloud-clearing for partly-cloudy situations using cluster cover, and 4) allowing CO_2-slicing on CrIS channels for homogeneous semi-transparent transparent situation.

These applications will be discussed in this presentation.