EVALUATION OF VIIRS CLOUD AND AEROSOL PRODUCTS FOR THE NPOESS PREPARATORY PROJECT

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1. INTRODUCTION

The NPOESS Preparatory Project (NPP) mission is currently scheduled to launch in 2011. It will provide a first look at a new generation of science products from U.S. operational polar orbiting Earth observing satellites. The primary focus will be on the production of Sensor Data Record (SDR) and Environmental Data Record (EDR) science products in the Interface Data Processing Segment (IDPS) of the NPOESS Ground System. The NASA NPP Science Team has been tasked with evaluation of the anticipated operational products from the IDPS within a facility known as the Science Data Segment (SDS) [1]. Within the SDS, NASA has established five Product Evaluation and Algorithm Test Elements (PEATEs). The purpose of each PEATE is to enable its associated NPP Science Team to evaluate the operational SDRs and EDRs (both pre-launch and post-launch) from NPP efficiently. The PEATEs are organized into categories including Atmosphere, Land, Ocean, Ozone and Sounder. The Atmosphere PEATE has been established within the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison.

The Atmosphere PEATE assists the NPP Science Team in evaluating the suitability of the NPP Atmosphere EDRs for continuing the NASA climate record and assessing the performance of the NPP Atmosphere EDRs through comparison with other ground-based and satellite-based measurements. This is a moving target as the current NASA teams working with various sensors in the Earth Observing System are continually evaluating and improving the science products. The Atmosphere PEATE team would like to incorporate new research advances as they become mature, and test each algorithm using global data over days, weeks, months, and even years. The Atmosphere PEATE allows the NPP Science Team to rapidly assess the climate quality of the NPP atmosphere algorithms in the pre-launch period using proxy data including MODIS, AIRS, and IASI, and validation data from ground based, aircraft, and satellite sources including CALIPSO and CloudSat.

The Atmosphere team strategy is to use Aqua MODIS and AIRS proxy data for VIIRS and CrIS, respectively, as years of global data and heritage products currently exist. Assessment of the performance of the NPP cloud/aerosol algorithms will be gained through comparison of global cloud and aerosol products to those obtained from CALIPSO and CloudSat data as well as data from ground-based systems such as AERONET. The NPP cloud and aerosol EDRs will be generated using the latest available versions of the operational (OPS) codes provided by the NPP instrument contractors.

2. ATMOSPHERE PEATE DEVELOPMENT SYSTEM - LEOCAT

To facilitate the completion of the product evaluation tasks assigned to the Atmosphere PEATE, a development platform is required with which the MODIS and VIIRS cloud and aerosol algorithms can be compared and evaluated. This requirement is met through the use of LEOCAT (Low Earth Orbit Cloud Algorithm Testbed). To evaluate the algorithms, LEOCAT implements

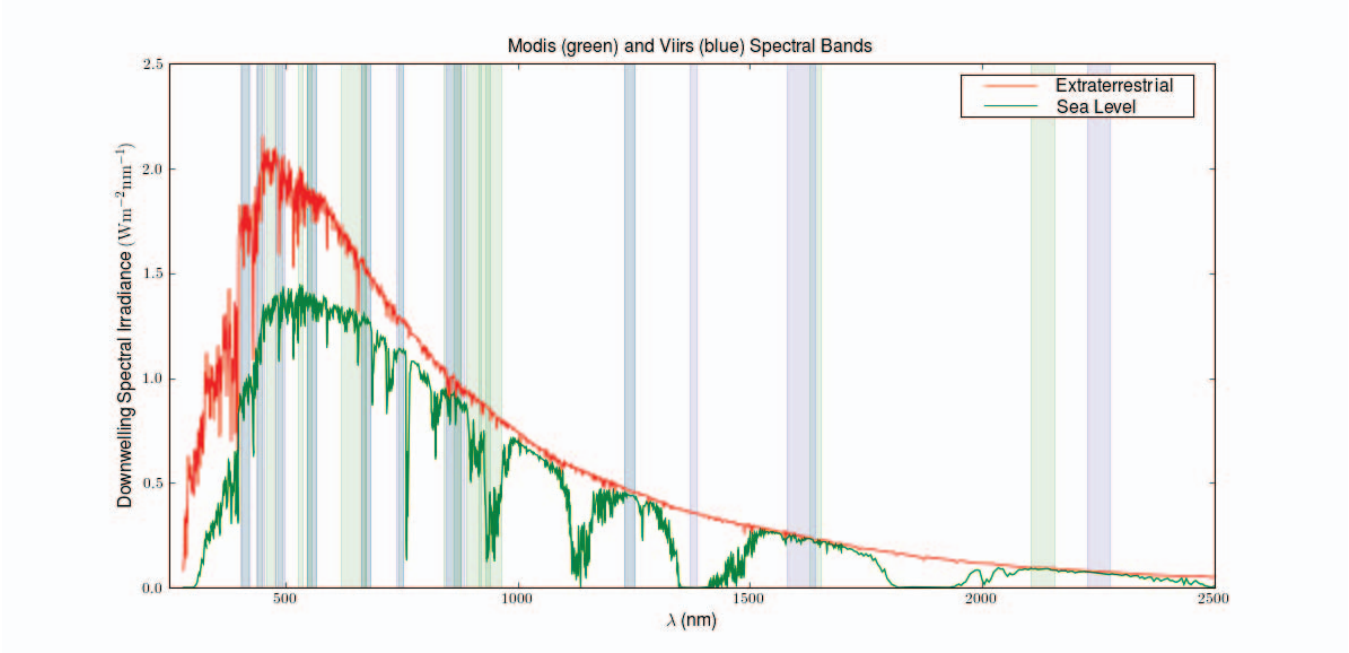


Fig. 1. Shown in this figure are the extraterrestrial and sea-level downwelling irradiances, overlaid with the VIIRS (blue) and MODIS (green) reflective bands.

a data ingest capability at the SDR level, providing a standardized interface through which the algorithm modules can access the required SDRs. In this way, multiple versions of a particular module can be tested in a common environment, providing confidence that the generated EDRs differ only to the extent to which there are differences between the algorithms being compared. Perhaps more importantly, LEOCAT thus also provides a means of running both MODIS and VIIRS algorithm modules in a common environment, attempting to come as close as is practical to objectively comparing the science embodied in the respective algorithms.

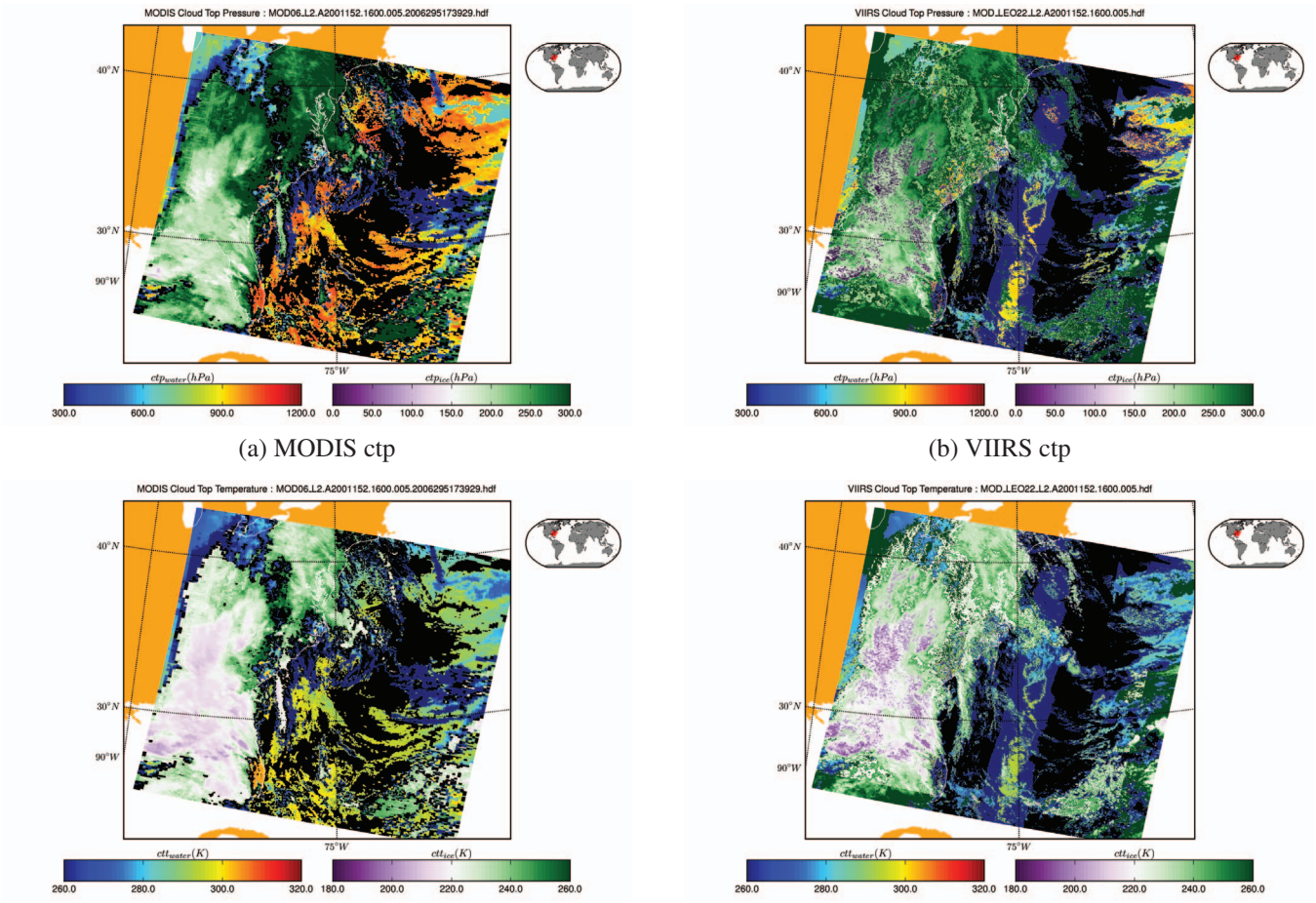
3. MODIS AND VIIRS SENSORS

The VIIRS sensor has some significant differences from the MODIS imager. The various VIIRS and MODIS bands are shown in Figure 1.

The choice of spectral bands for VIIRS results in some products, which are available from MODIS, to be degraded (fire product) or not available (water vapor winds over poles, total water vapor). On the other hand, VIIRS will have better spatial resolution for off-nadir pixels.

4. COMPARISON OF MODIS AND VIIRS CLOUD PRODUCTS

The MODIS Atmospheres Team provides cloud and aerosol products, with cloud parameters including cloud fraction, cloud top pressure/temperature, cloud thermodynamic phase (ice, water, or a combination of both), cloud optical thickness, and effective particle size. Shown in Figure 2 are some of the MODIS cloud products, and the corresponding VIIRS products derived from MODIS proxy data using the LEOCAT environment.



(a) MODIS ctp

(b) VIIRS ctp

(c) MODIS ctt

(d) VIIRS ctt

Fig. 2. The MODIS (a) and VIIRS (b) cloud top pressures, and the MODIS (c) and VIIRS (d) cloud top temperatures using Terra MODIS proxy data (Day 152, 2001, 1600 UTC).

5. REFERENCES

[1] R.J. Schweiss, M. Hunter, and S. Samadi, "The NPOESS Preparatory Project Science Data Segment: The Final As Built Description," in *IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, 2008.