Transition of Cloud Products from MODIS to VIIRS

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Overview

The activities of the Atmosphere PEATE are discussed with respect to the evaluation of MODIS and VIIRS cloud products within the LEOCAT development framework. Various VIIRS cloud products, generated within the LEOCAT environment using MODIS Aqua proxy data, are compared with MYD06 cloud products for the same data. A comparison of the VIIRS Cloud Mask products from the mini-IDPS and LEOCAT are compared.

Introduction

- **NPP:** 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.
- **NPP PEATEs:** 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). Within the SDS, NASA has established five Product Evaluation and Algorithm Test Elements (PEATEs). The PEATEs are organized into categories including Atmosphere, Land, Ocean, Ozone and Sounder.
- **Atmosphere PEATE:** 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 Atmosphere PEATE has been established within the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison.

LEOCAT

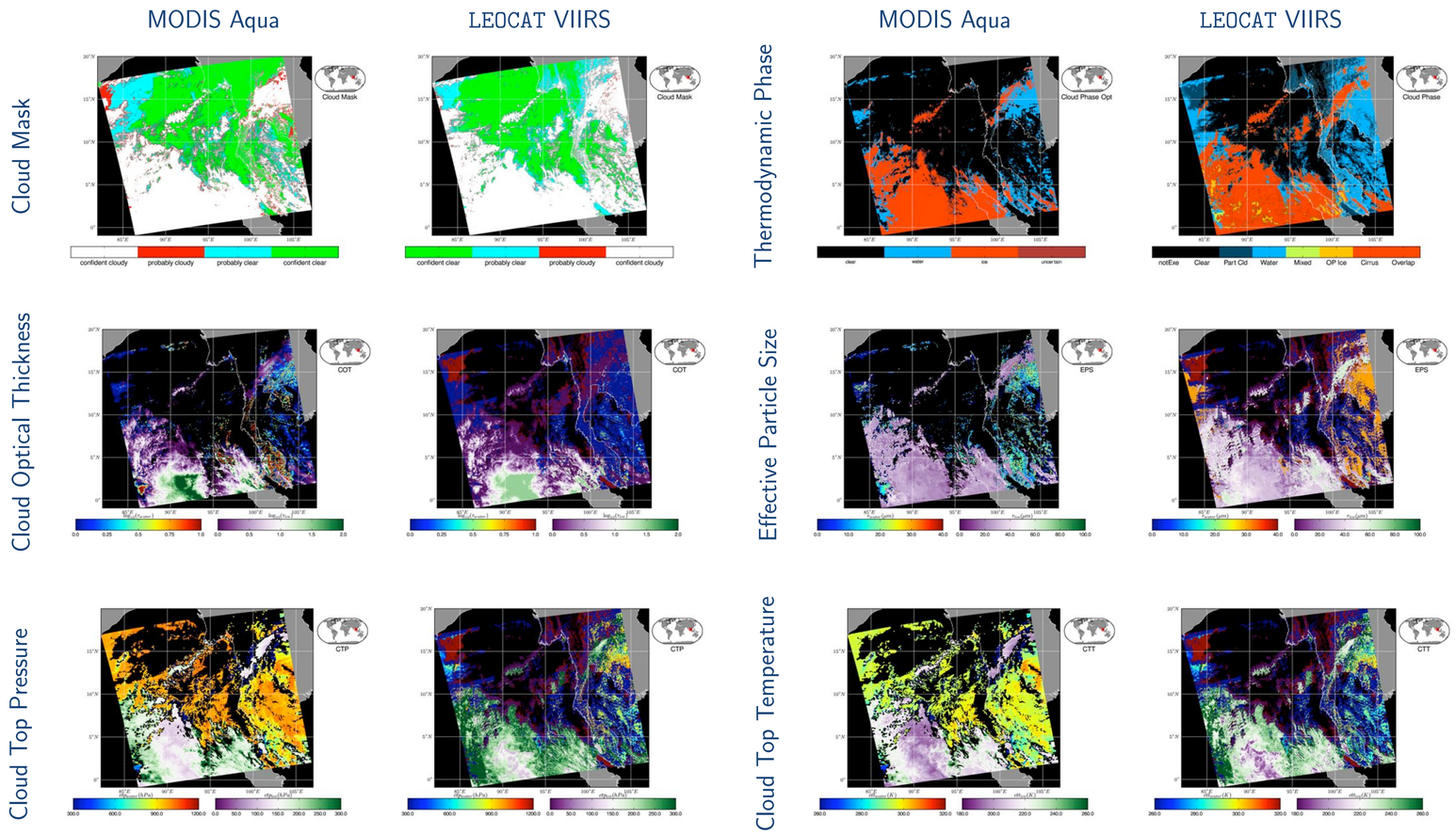
- **Low Earth Orbit Cloud Algorithm Testbed**: Application written in C at SSEC by Mike Pavlonis.
- Provides a platform agnostic framework for testing cloud algorithms for multiple sensors (MODIS, VIIRS etc...)
- Task of importing ancillary data is handled by the core of LEOCAT, which then provides a common interface through which the various cloud algorithms can access this data.
- A small amount of "glue" code must be written for each algorithm, to copy data provided by LEOCAT to the appropriate algorithm data structures.
- At completion, each algorithm passes its output data through the provided interface to LEOCAT, which then handles writing the output to well-formed and documented HDF4 files.

The Atmosphere PEATE

- As part of fulfilling our objective at the Atmosphere PEATE, we have undertaken to use LEOCAT to evaluate the VIIRS v1.5 cloud algorithms, the source code for which was developed and provided by Northrop-Grumman.
- For each VIIRS Cloud Intermediate Product (IP), we extracted the relevent "science code" and wrote for it a wrapper routine, which provided the interface between the science code and LEOCAT. This has been done for the VIIRS Cloud Mask (VCM-IP), Cloud Optical Properties (COP-IP) and Cloud Top Parameters (CTp-IP).
- Using MODIS proxy data, we ran each of the VIIRS Cloud IP algorithms in LEOCAT. The results of these retrievals, along with the corresponding MODIS collection 5 retrievals, are shown at right (VIIRS Cloud Products from LEOCAT).

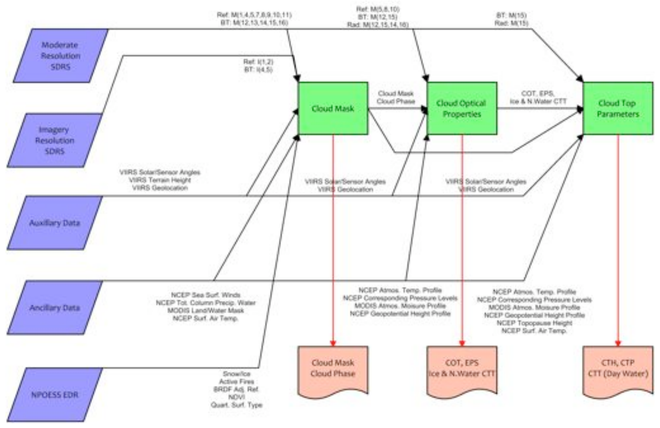
VIIRS Cloud Products from LEOCAT

Shown below are the MODIS MYD35 and MYD06 cloud products (first and third columns), and the corresponding VIIRS cloud products (second and fourth columns) generated by our implementation of the VIIRS v1.5.0.18 cloud algorithms in LEOCAT, using MODIS proxy data.



VIIRS Cloud Product Interdependency

- **VIIRS Cloud Algorithms** The VIIRS cloud algorithms, namely the Cloud Mask (VCM), Cloud Optical Properties (COP) and the Cloud Top Parameters (CTp), depend on the VIIRS SDRs, auxillary data and ancillary data.
- **VIIRS Cloud Mask** The VCM depends on several NPOESS Intermediate Products (IP), which are generated at an earlier point in the IDPS processing chain. The VCM serves as input the COP algorithm, which in turn serves as input to the CTp algorithm.
- **Ancillary Data** The QSTLSM-IP, which provides the surface ecosystem type and land-sea mask, is present only ephemerally in the IDPS, and is discarded once the VCM is generated. As a result, we generate our own QSTLSM-IP using the same input as the IDPS, using our own granulation method. Ideally, the LSM would be available in the VIIRS gelocation files, as is the case with MODIS.



HDF5 Support in LEOCAT

NPOESS uses the latest version of the Hierarchical Data Format (HDF) for the RDR, SDR, EDR and IP products. Support for HDF5 has been included in LEOCAT for both input and output, using the C API. It has generally been the case that the reading and writing of product attributes and datasets has been much easier using the HDF5 standard, as opposed to HDF4.

Shown below are the VIIRS cloud mask and cloud phase (left column) as generated by the mini-IDPS. In the right column are the cloud mask and cloud phase generated in LEOCAT. Both the mini-IDPS and LEOCAT cloud products used mini-IDPS SDRs as input, which were generated by re-gridding MODIS granules ($1\mathrm{km}^2$ pixels at NADIR) to the VIIRS moderate and imagery resolution granulation ($(750\mathrm{m})^2$ and $(375\mathrm{m})^2$ pixels at NADIR).