VCM Impact on Aerosol Retrievals: Feedback from Aerosol cal/val Team

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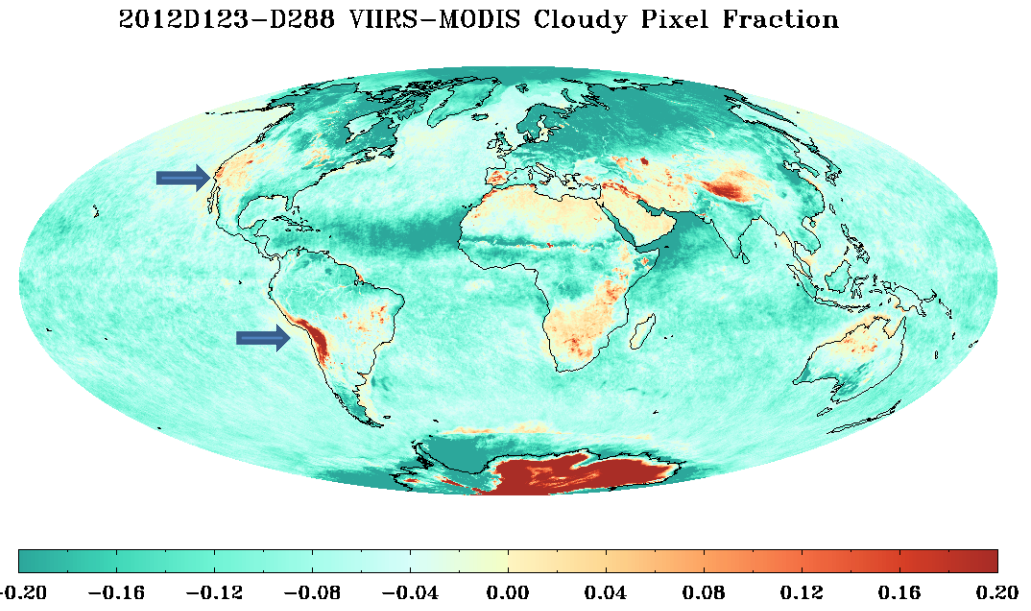
VCM EDR Provisional Review

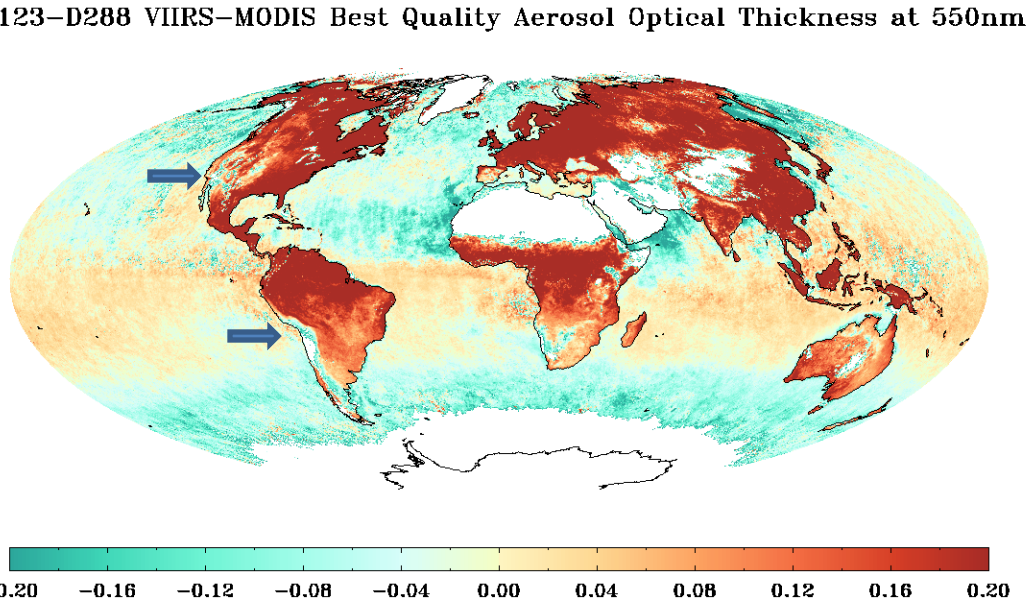
VCM Flags Used by Aerosol Algorithm

Flag description Key	Impact On Aerosol Retrieval	
Cloud Detection Result & Confidence Indicator	No retrieval if probably or confidently cloudy	Major Impact
Snow/Ice	No retrieval if snow/ice detected	
Sunglint	No retrieval over ocean if sunglint detected	
Fire detection	No retrieval if fire detected	
Heavy aerosol	Cloud mask is reset to confidently clear if heavy aerosol is detected and aerosol retrieval attempted	
Land/Water Background	Selecting retrieval path (land or ocean algorithm)	
Shadow detected	Retrieval quality degraded if shadow detected	Marginal Impact
Volcanic ash	Retrieval quality degraded if ash detected; set suspended matter type as ash	
Thin cirrus	Retrieval quality degraded if cirrus detected	

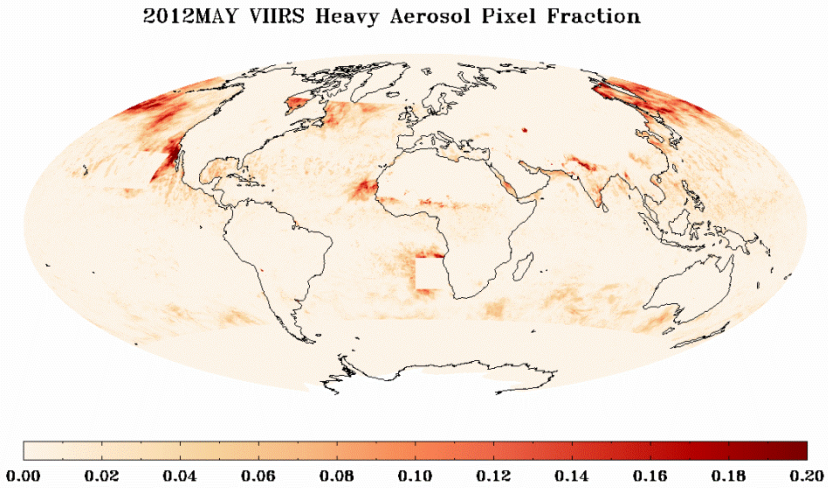
Cloud Fraction (VIIRS – MODIS)

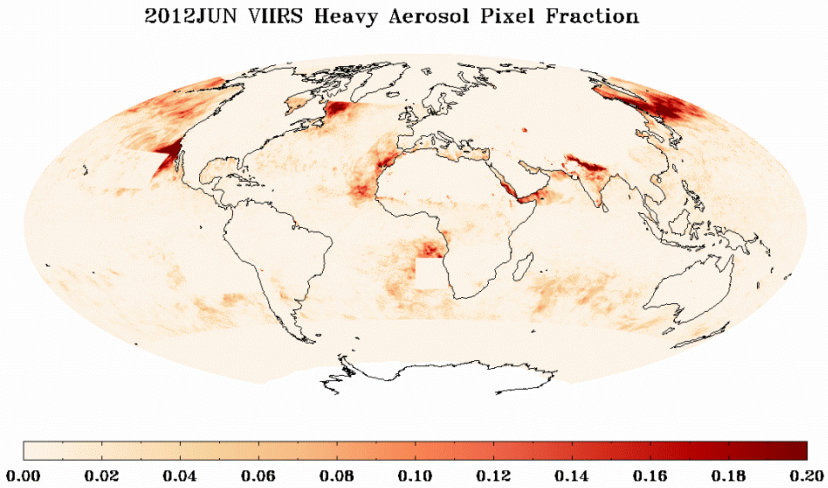
- 0.25-degree gridded monthly **cloud fraction** (*ratio of sum of probably and confidently cloudy pixels to total number of pixels*) for the time period 05/02 – 10/14, 2012.
- VIIRS Cloud Mask (IICMO)
- Aqua MODIS Level 2 Cloud Mask (MYD35_L2.006) (1km) – MCM
- Un-collocated data
- Overall patterns in VCM and MCM are very similar, but VCMs
  - cloud fraction over high latitude on Northern Hemisphere and dust outflow regions is smaller;
  - cloud fraction over some bright surface (high altitude) areas is larger. The VIIRS AOT bias compared to MODIS and AERONET over land will be investigated further from cloud mask and surface reflectance perspective;
  - MCM is not “truth”!

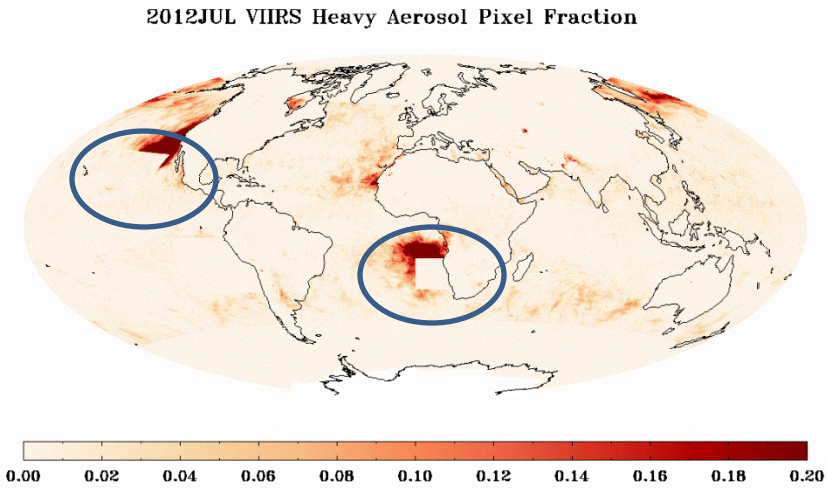


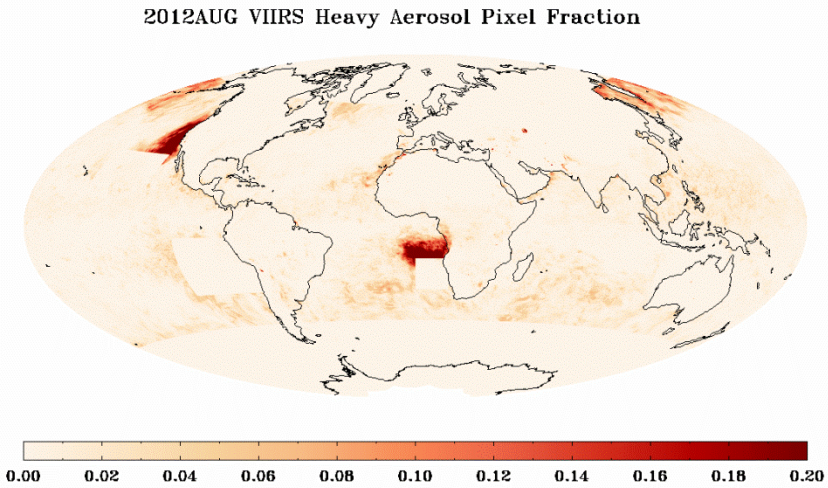


VIIRS Heavy Aerosol



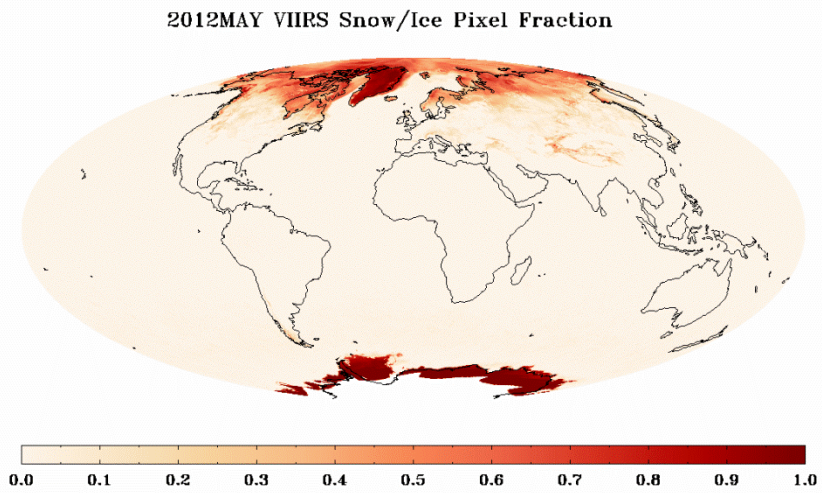


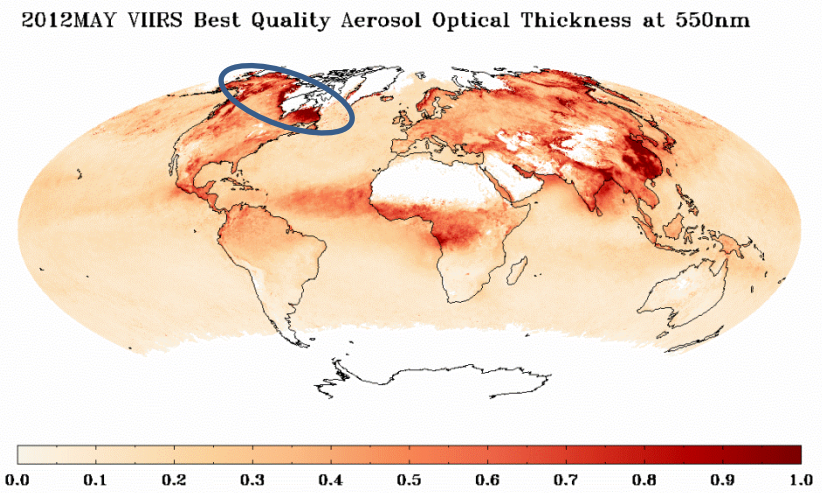


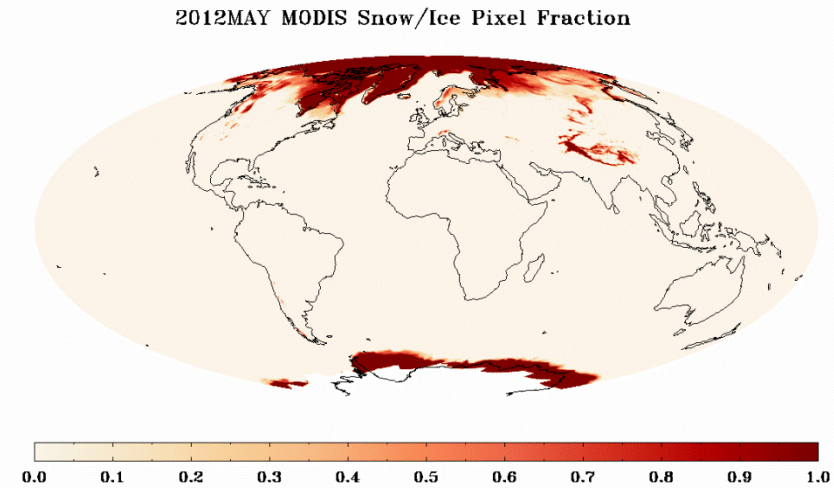


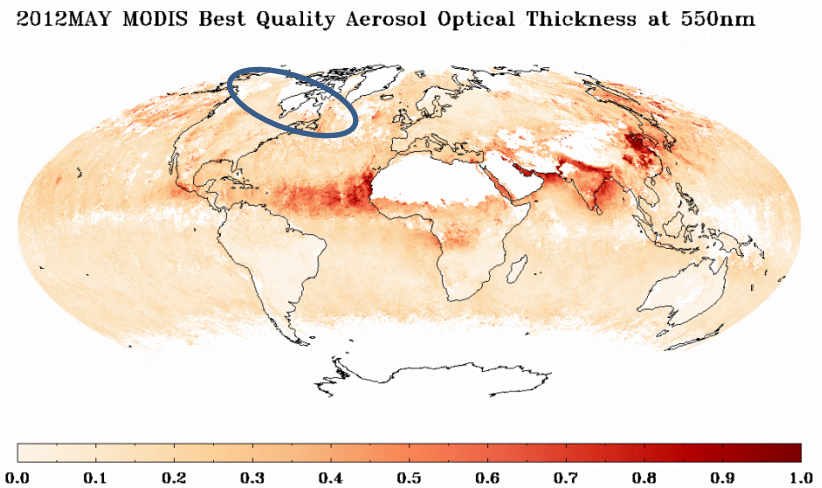
- Strange patterns and higher fraction of heavy aerosol mostly over the ocean

VIIRS Snow/Ice









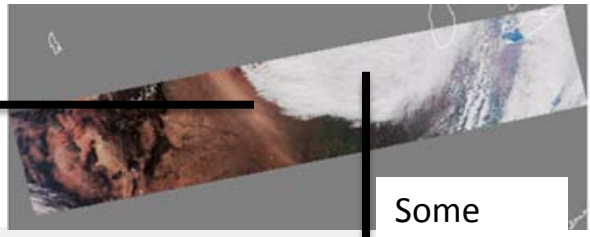
Lower snow/ice fraction in VIIRS compared to MODIS. In general, there are more VIIRS aerosol retrievals than MODIS even after accounting for sampling differences.

Collocated MODIS-VIIRS Cloud Mask

- MODIS(MYD35) and VIIRS(IP) cloud mask collocated within 1 minute
- Collocated VIIRS data are filtered with High Cloud Mask quality (i.e., >80% of collocated VIIRS must be High Cloud Mask quality)
- 6 days with approximately 2 hours per day collocation and total 354 VIIRS granules result in this collocation period – days 38,41,43,45,48 and 51 of 2012

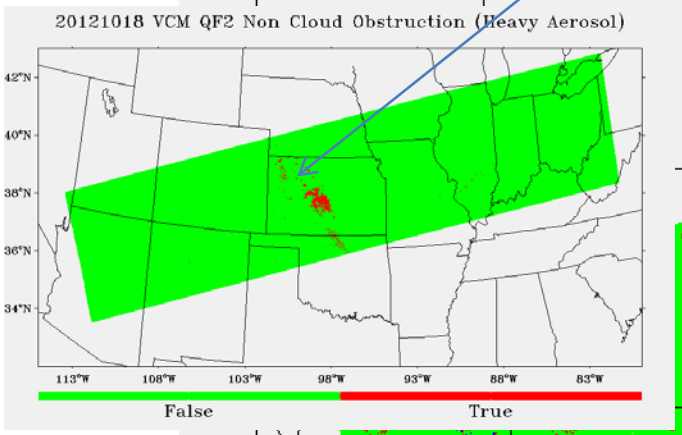
	MODIS (Confidently or Probably) Cloudy	MODIS (Confidently or Probably) Clear
VIIRS (Confidently or Probably) Cloudy	84.23 %	14.49 %
VIIRS (Confidently or Probably) Clear	15.77 %	85.51 %
Total number of Collocation	272,326,966 ~ 272 million	93,245,598 ~ 93 million

Dust/Cloud Discrimination

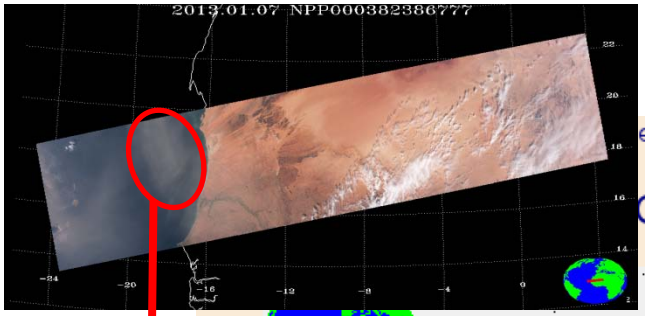


Dust plume flagged as confidently cloudy. Only some pixels in this region flagged for "heavy aerosol"

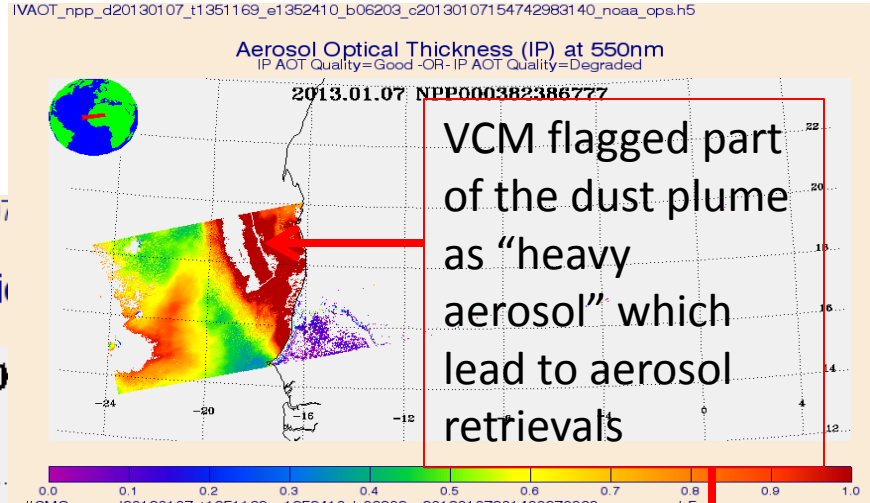
Some cloudy pixels are flagged as clear because of snow/ice flag



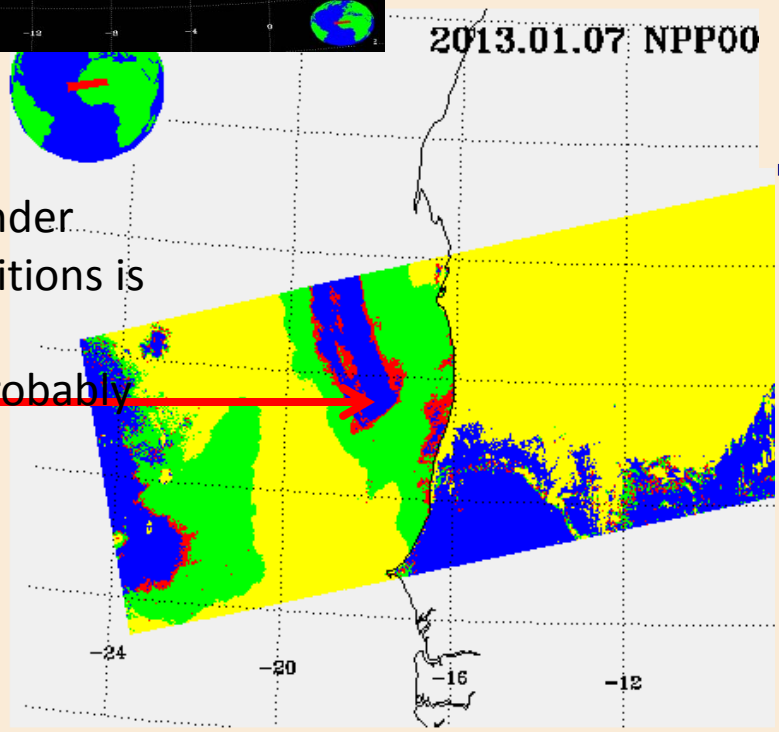
Dust/Cloud Discrimination over Atlantic Ocean

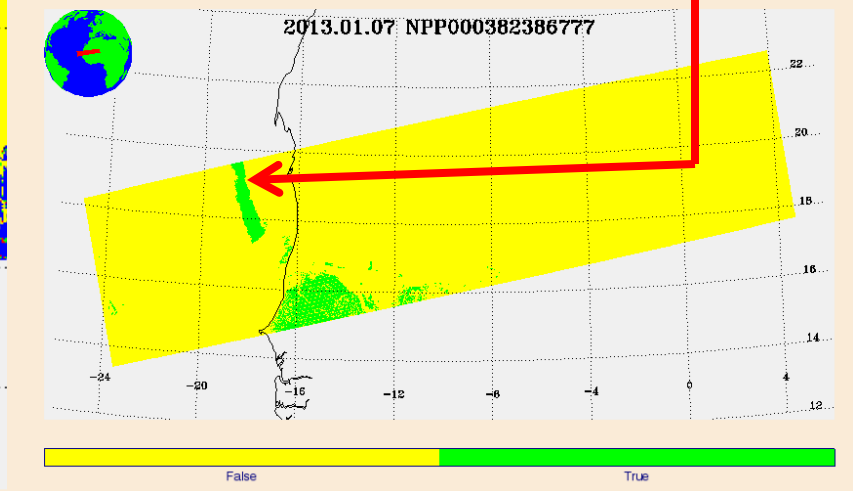


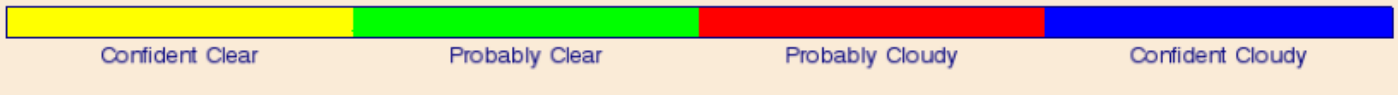
Dust plume under clear sky conditions is identified as confidently/probably cloudy



VCM flagged part of the dust plume as “heavy aerosol” which lead to aerosol retrievals



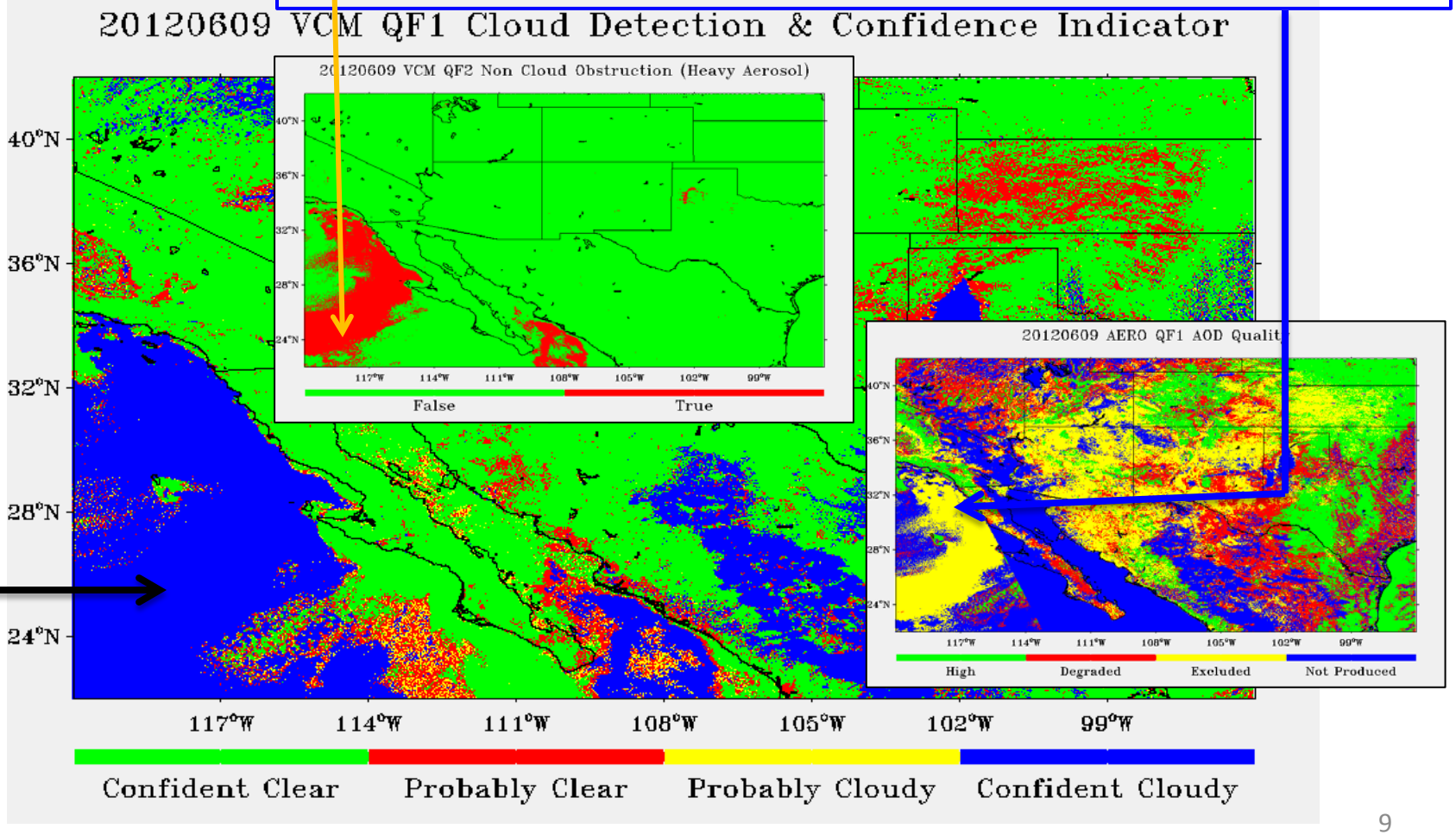




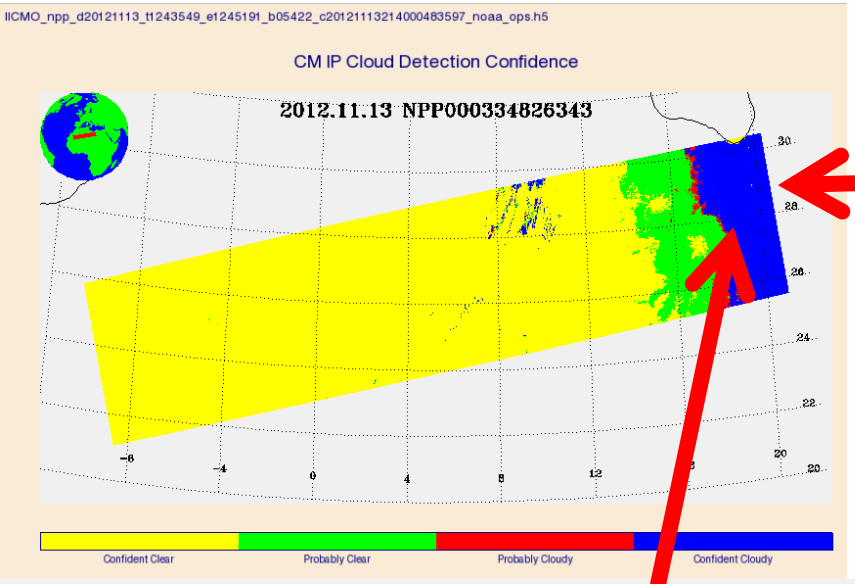
Heavy Aerosol Flag

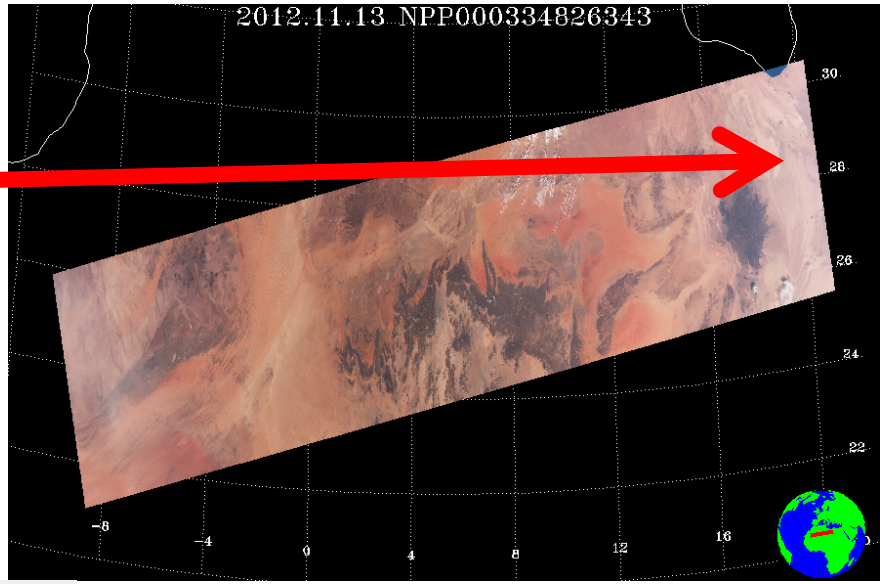
VCM indicates heavy aerosol in this region, due to which cloud mask flag is reset to clear in the aerosol code and aerosol retrieval is attempted for this cloud region.

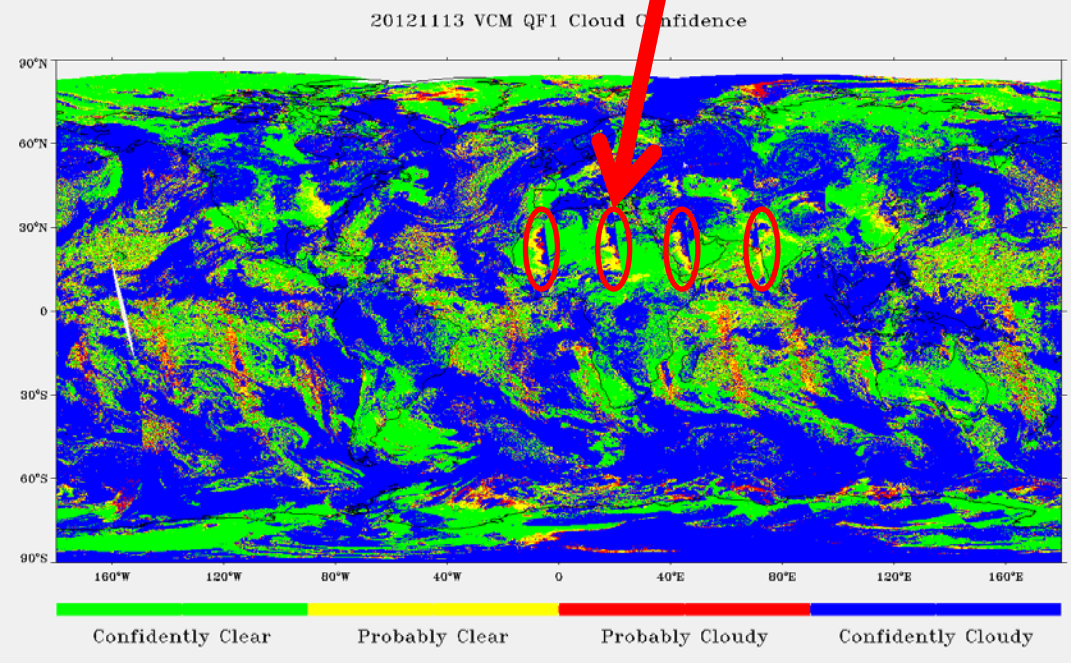
AOT, however, is excluded because of “AOT out of range “ flag. If aerosol LUT is expanded from AOT “0 to 2” to “0 to 5”, these pixels will become available to the user.



False Cloud Detection at Granule Edges

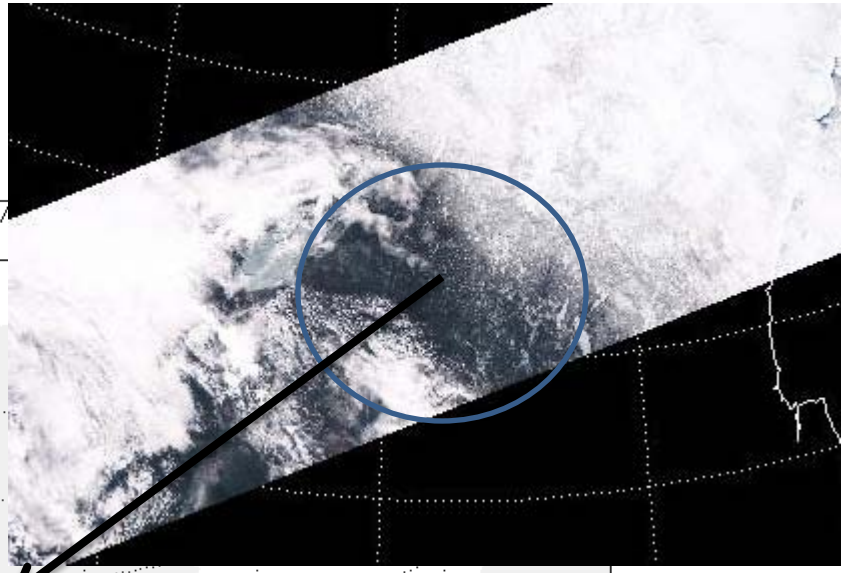


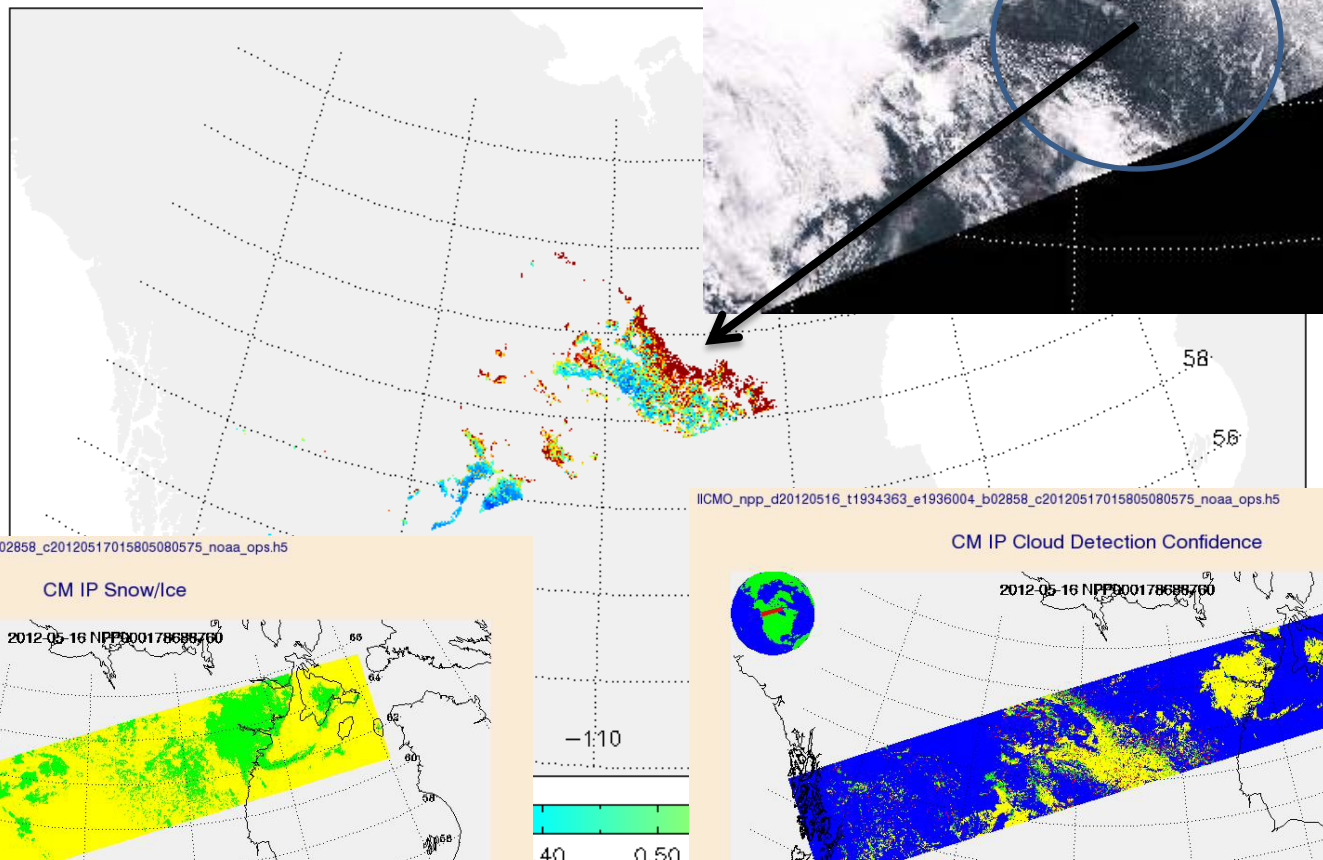


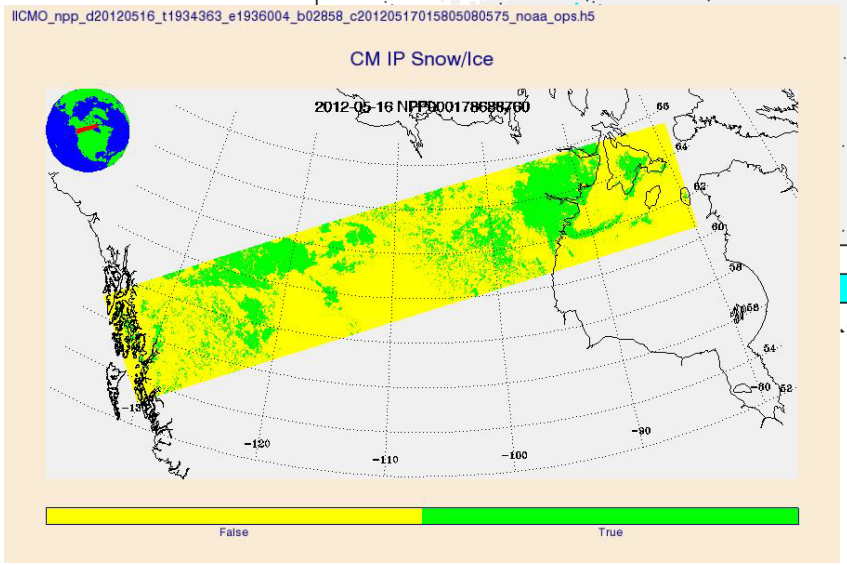


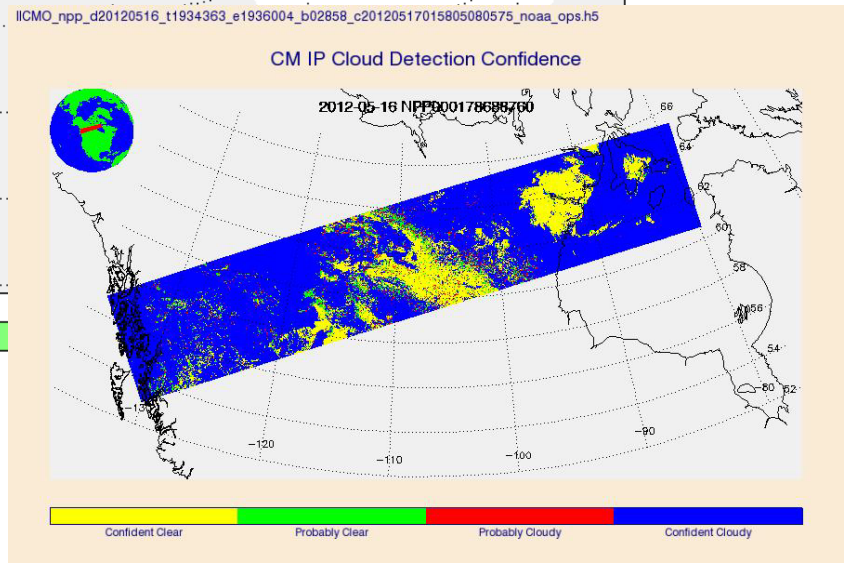
For some granules over bright surfaces, along the right-hand-side edge of the granules, there is a false identification of surface/dust as cloud. In these situations, often heavy aerosol flag is also not set leading to “no aerosol retrieval”. However, current aerosol retrieval is not attempted over bright surface for which this is a non issue.

Snow/Ice Flag

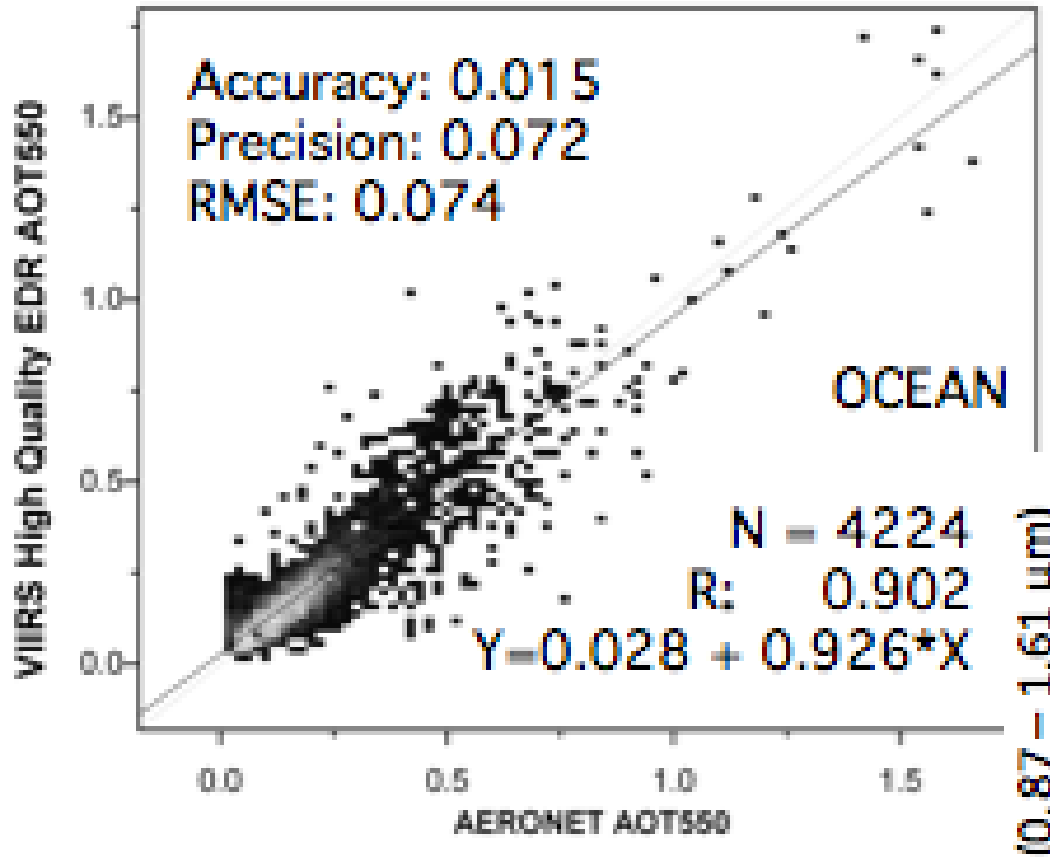






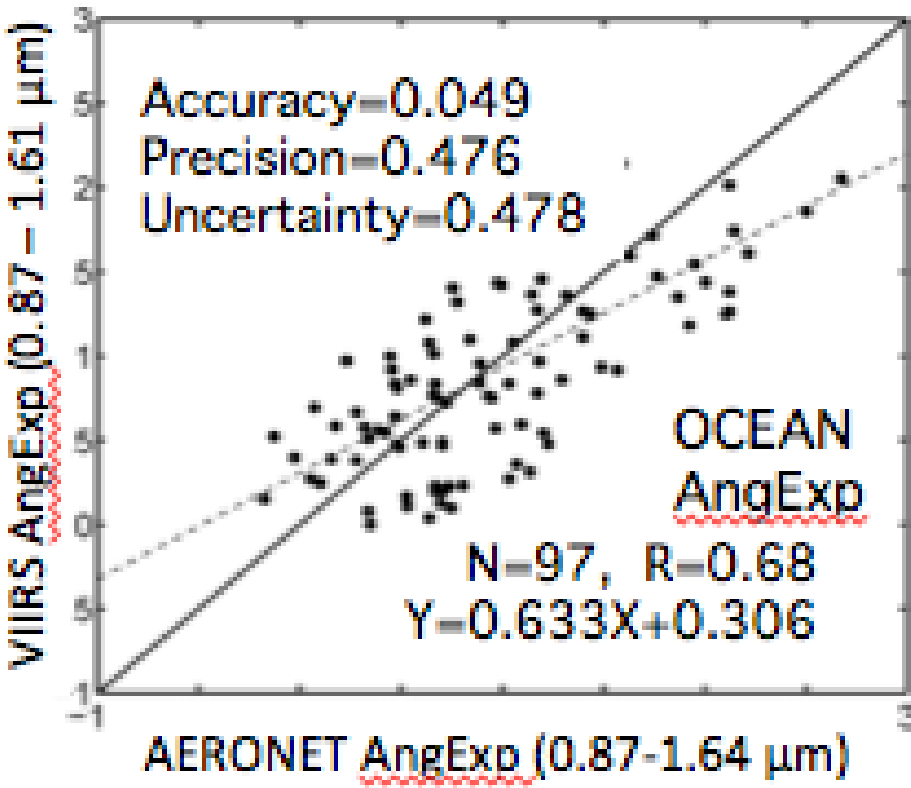


Validation of VIIRS AOT and Angstrom Exponent over Ocean



AOT

Angstrom Exponent



Summary and Issues

- Aerosol cal/val team statement
  - No major problems with VCM that would prevent the product from becoming provisional
  - Despite best efforts, experience with MODIS indicates that some level of cloud contamination likely to be present in aerosol products.
- Issues
  - Heavy aerosol flag: aerosol/cloud discrimination
    - aerosol identified as cloud or cloud identified as aerosol
  - Snow/ice flag:
    - Snow identified as cloud or cloud identified as snow
      - No aerosol retrieval in either situation
  - Snow detected when no snow or snow not detected when there is snow
  - Ephemeral water flag:
    - Threshold for the test is very different in VCM compared to the one in aerosol code (internal test) or in MODIS. VCM ephemeral water flag has no bearing on aerosol retrieval as aerosol algorithm does not use the flag.
- Solutions for some issues identified here are under development by the VCM team
- STAR has developed an independent heavy aerosol flag (dust and smoke) that will soon be tested.