



JPSS DPA Program Planning Meeting VCM (Cloud) EDR Team

Dr. Andrew Heidinger
Cloud EDR Lead
September 17-18, 2012





Overview of Data Products



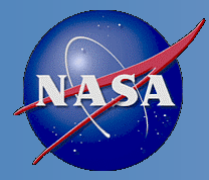
- The VIIRS Cloud Mask (VCM) is comprised of a series of Quality Flags (QF) that describe cloud cover condition as well as various flags that serve multiple purposes. These include:
 - Cloud confidence (4 cases)
 - Day/Night
 - Water/Land/Desert/Snow/Coast
 - Sun glint
 - Cloud shadow
 - Cloud phase
 - Presence of heavy aerosols



Overview of Data Products



- The VIIRS Cloud Products (beyond VCM) include:
 - Cloud Top Temperature / Height / Pressure
 - Cloud Base Height
 - Cloud Optical Depth (Day)
 - Cloud Particle Size (Day)
 - Cloud Optical Depth (Night)
 - Cloud Particle Size (Night)
 - Cloud Cover Layers

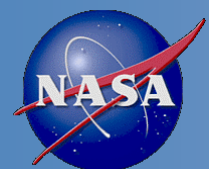


VCM Team Members' Roles & Respon.



EDR	Name	Organization	Funding Agency	Task
Lead	Andrew Heidinger	NOAA/NESDIS/STAR	NJO	Product Lead

EDR	Name	Organization	Funding Agency	Task
Co-Lead	Thomas Kopp	The Aerospace Corporation	NASA	Validation Lead
	Richard Frey	UW/CIMSS		Match-ups, tuning
	D. Botambekov	UW/CIMSS		Large scale analysis
Phase	Mike Pavolonis	NOAA/NESDIS/STAR	NJO	Phase Alg.
	Keith Hutchison	NGAS		Golden Granules
	Barbara Lisager	NGAS		VCM Code
	Bill Thomas			JAM
	Kurt Brueske	Raytheon		COAST member
Liaison	Eric Vermote	UM		Liaison /Land
Liaison	Heather Cronk	NOAA		Liaison/Aerosols
Liaison	Doug May	NAVO		Liaison/SST



Cloud Team Members' Roles & Respon



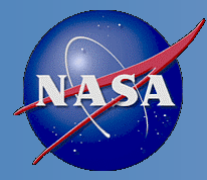
EDR	Name	Organization	Funding Agency	Task
Lead	Andrew Heidinger	NOAA/NESDIS/STAR	NJO	Lead Cloud EDR Team
Validation co-Lead	Robert Holz	UW/SSEC	JPSS and NPP PEATE	PEATE collab and Val Manag.
All	Janna Feely	DPA		JAM
All	Eric Wong	NGAS		Alg Support
All	Kurt Brueske	Raytheon		
VCM	Christine Molling			Surface Val.
Cloud Phase	Bryan Baum	UW/SSEC		Phase Validation with MODIS
All	Jay Mace	Uni Utah	JPSS	ARM Val.
COP	Andi Walther	UW/CIMSS	JPSS	COP Val and Alg.
CTP	Min Min Oo	UW/CIMSS	JPSS	CTP Val and Alg.
CBH	Steve Miller	CSU/CIRA	JPSS	CloudSat Comp.
CBH	Dan Lindsey	NOAA/NESDIS/STAR	NJO	CBH Val and Alg.



VCM FY-12 Accomplishments



- Completed 30 day spin-up of all tuning thresholds less than 90 days after activation of the IR bands
 - Three years of planning and coordination pulled off ahead of original schedule
 - Novel approach to early ICV proved successful
- Corrected major sources of leakage
 - Snow/cloud discrimination errors over water eliminated in all non-polar regions
- Revealed critical errors in background snow and NDVI fields



VCM FY-12 Accomplishments



- Successfully accomplished all activities, despite changing standards, for 5 S/W changes in 6 months
- Created and analyzed 9 Golden Granules
- Proved value of using “liaisons” on coordinating with other Cal/Val teams
- Performance, except for leakage, within 1% of current MODIS Cloud Mask only 6 months after start of ICV
- Beta status declared May 2012



Cloud FY-12 Accomplishments



- Evaluated CTP performance against CALIPSO for one entire month.
- Evaluated COP globally relative to MODIS Collection 5. Determined issues with distributions that led to a major bug discovery (below)
- Identified major bug in COP lookup table formats and corrected for Mx6.3
- Identified a CTP algorithm issue causing absence of low-level clouds over ocean. NOAA/NASA solution proposed, tested and implemented. Did not make it into Mx6.3.
- Identified CTP issue with clouds being retrieved (falsely) at the Tropopause height.



FY12 Accomplishments: DRs



DR number	Short Description
4403	Updating of nighttime thresholds before activation of IR bands - implemented
4576	30 day spin up of VCM thresholds - implemented
4577	Cloud/Snow discrimination issue – completed over water
4639	Correction of sign error in “snow_night” routine – implemented
4xxx	Declaration of VCM as beta - completed
4734	Additional volcanic ash correction – in work
4793	M1/M7 scattering correction – M7 in build 6.3
4851	M1 scattering correction – scheduled for AERB in October
4852	M7 coefficient update – scheduled as part of next threshold update
4858	COP IP contains negative EPS values in Mx6-based products
4766	Errors in Mx6 VIIRS COP LUTs
4740	Overestimation of cloud height for low-level clouds



VCM Scientific Advancements



- First ever 30 day spin up for validation of cloud mask accomplished
 - All gross errors eliminated, majority of granules meeting spec as of April 2012
 - Results sufficient to allow other EDRs to begin their Cal/Val efforts without undue negative impacts from the VCM
- Spatial tests using I-bands proved value of reducing impacts from small sub-pixel clouds
- Value shown in adding shadows and aerosol detection to cloud mask output



Cloud Scientific Advancements



- Demonstrated value of using active sensors to characterize issues in passive retrievals from a new sensor quickly.
- Demonstrated other algorithms work consistently on VIIRS data. This allowed for demonstration of radiometric consistency between VIIRS and MODIS in the channels used for cloud remote sensing.



VCM Issues, Challenges, Setbacks



- Continued use of “fixed” field for snow and NDVI limits ability to validate and tune affected areas
 - Problem was identified back in March, still exists
 - Proposed monthly fix mitigates the problem and would allow further validation, but does not appear sufficient to attain provisional status
 - Operational cloud masks for both DoC and DoD use daily updates for snow
- Leakage (missed cloud) has been a persistent challenge
 - While we are hearing complaints, especially from the SST team, few specific granules with leakage issues have been identified
 - We cannot resolve a problem without specific granules to work with
- Time ticking on use of CloudSat/CALIPSO
 - Primary source of match-up data not likely to exist for JPSS-1



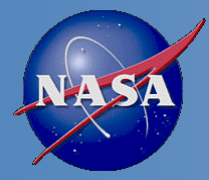
Cloud Issues, Challenges, Setbacks



- Access to VIIRS Edrs and their evaluation is no problem (thanks in large part to UW/SSEC NPP Atmos Peate)
- Beyond the VCM, team struggles with running algorithms in ADL.
 - CSPP will provide the ability to run ADL on arbitrary granules but to date it is not ready for the Cloud Team
 - Limited granules processed through ADL through have been provided by Raytheon.
- Big algorithm issues remain (relative to other products).



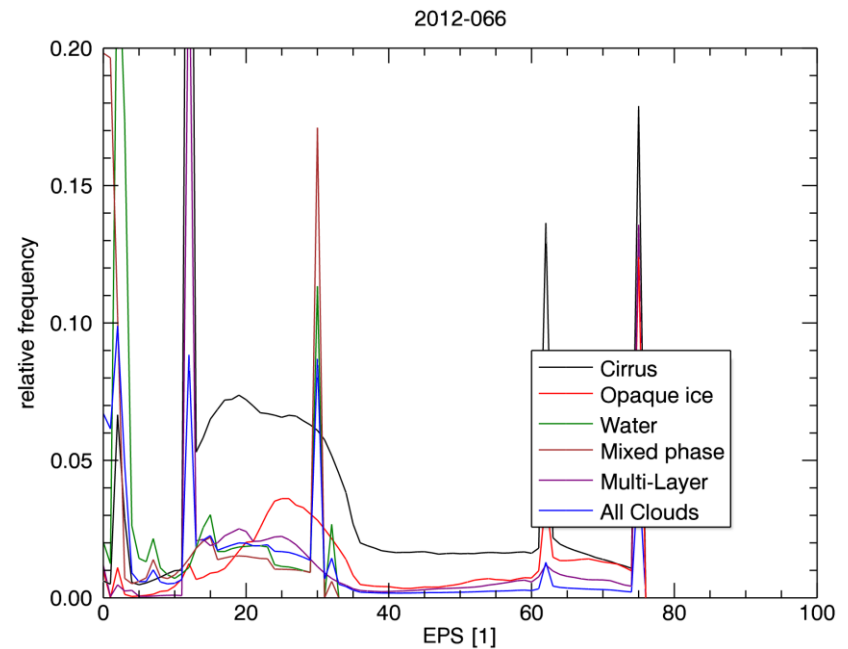
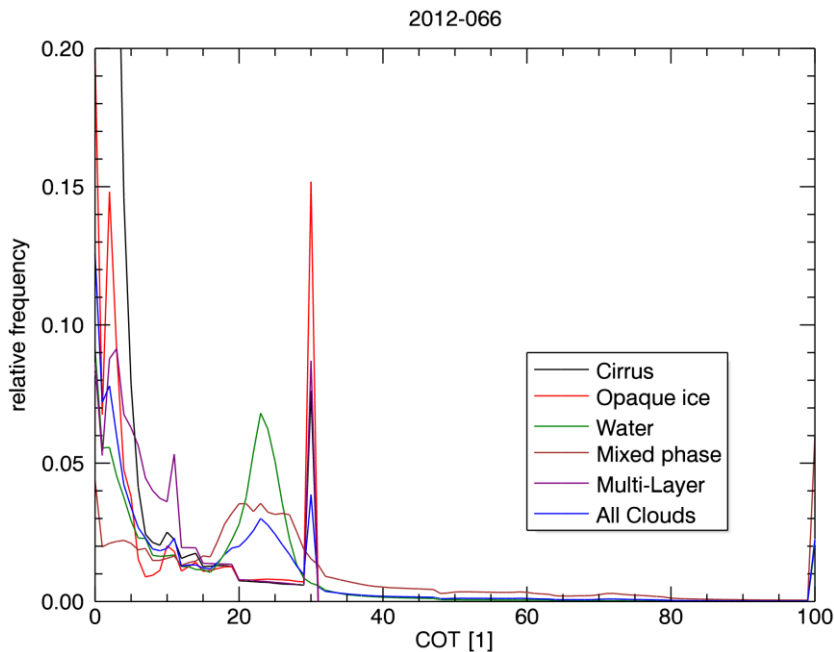
Examples of Cloud Product Performance



COD/EPS Distribution Mx6.2



Same analysis for a second full day to double check the results (6 March 2012:):



First conclusions:

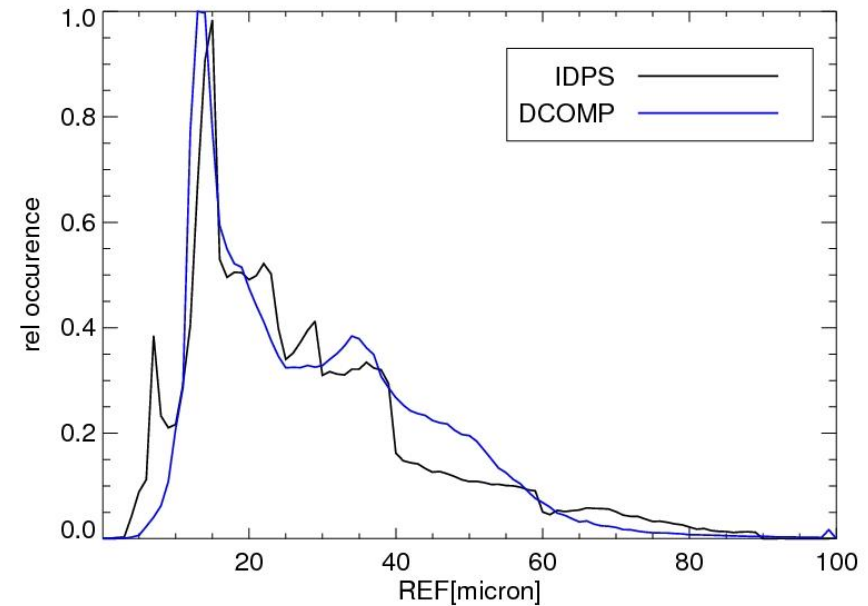
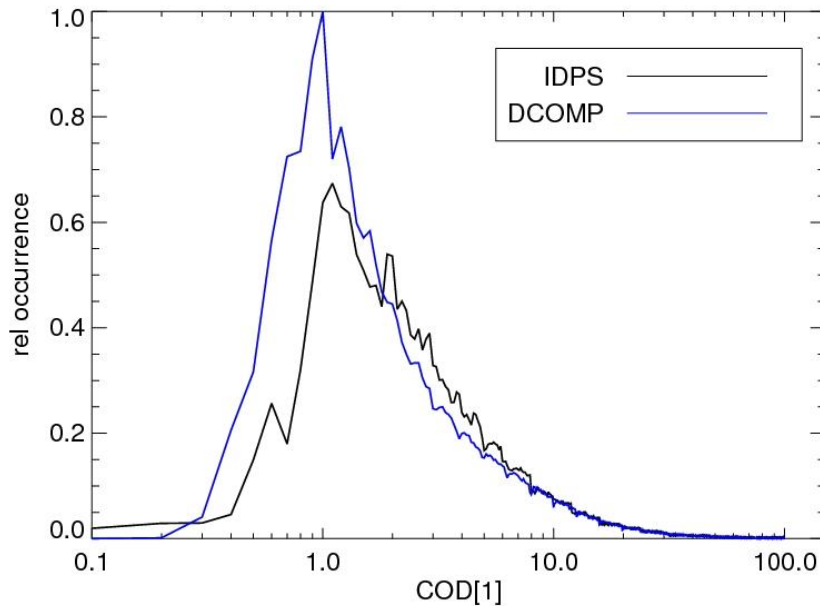
- IDPS retrieval shows noticeable and assumingly non-realistic peaks in histograms of COD and EPS.
- They seem to be related to cloud phase.



COD/EPS Distribution Mx6.3



Analysis of all water cloud for one granule on September 12, 2012 (Mx6.3 with correct vis. cal). Note our ability evaluate began in September – so definitive Mx6.3 results are not yet available.



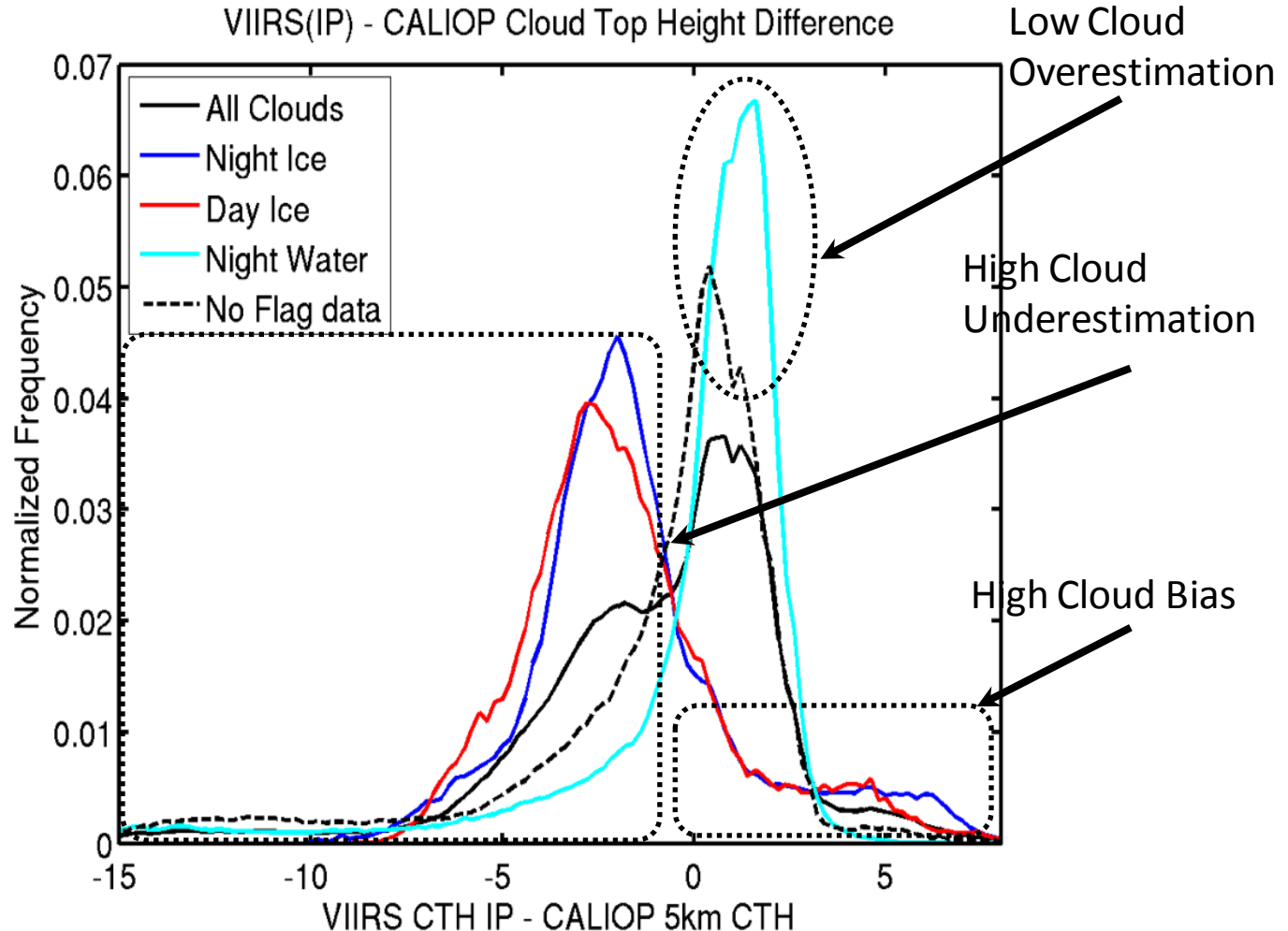
- Erroneous IDPS peaks in Mx6.2 are gone.
- Mean distributions between NOAA (DCOMP) and IDPS are similar
- Also, number of pixels with successful results much higher.
- Differences between DCOMP and IDPS are larger than DCOMP and MODIS.
- Still major issues with Nighttime IDPS COP products.



Cloud Top Height Differences



- Low Cloud Overestimation issue identified, resolved in Mx7
- High Cloud bias being studied but solution not identified.
- High cloud underestimation will be addressed later.



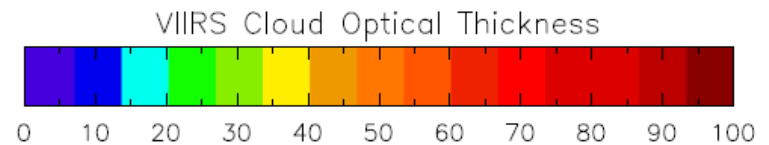
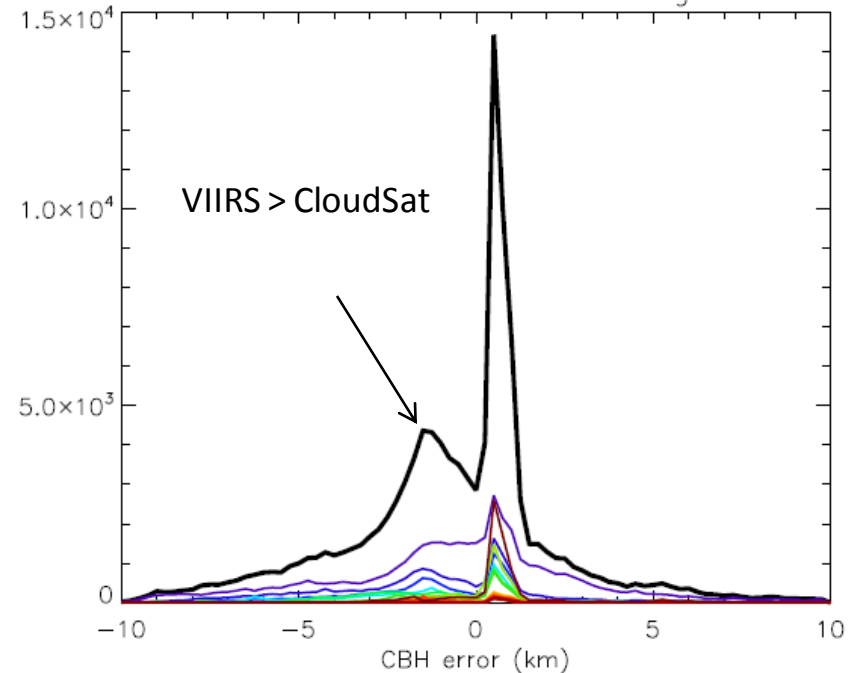


Summary of Cloud Base Height Validation



- Histogram shows a bimodal error distribution when VIIRS Cloud Base Height (CBH) is compared to CloudSat CBH, $R^2 = 0.001$, i.e., almost no skill
- We believe there are multiple reasons for these errors, with the Cloud Top Height (CTH) retrieval errors being the most important
- We recommend the development of VIIRS Cloud Base Height retrievals within the NOAA-AWG CTP approach (PATMOS-x).
- NOAA-AWG CTP already runs on VIIRS and has been validated wrt CALIPSO.
- At a minimum, this will help us diagnose IDPS CBH issues.

Average error: -0.4 km r^2 value: 0.001
Standard deviation of error: 3.1 km
Median error value: 0.0 km
RMSE: 3.1 km
Percentage of pixels with CBH within 250 m of CloudSat: 1.6%





VCM Changes in Strategy (due to funding constraints)



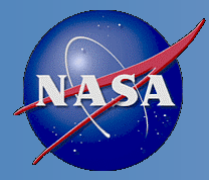
- The VCM core team has been, and continues to be, a three-legged pedestal
 - STAR and UW/CIMMS produce large scale quantitative results and match-ups
 - NGAS created golden granules and formally makes and tests all software changes
 - Aerospace leads and verified threshold changes (tuning)
- Liaisons mitigate direct funding issues by providing feedback of VCM consequences



Cloud Team Changes in Strategy (due to funding constraints)



- The pace of algorithm modification is slow due our inability to run ADL ourselves on arbitrary granules to track specific issues and test algorithm changes.
- Given the interest in try other algorithms in ADL (the workshop this week), we would like to include that work in our plan.
- We plan to rely on Walter Wolf's NESDIS AIT for algorithm implementation support. We look to the AIT for guidance on cost and schedule of this work.
- Our team as staffed, can not accomplish this alone.
- At a minimum, this will speed up our ADL learning.



FY-13 VCM Schedule and Milestones



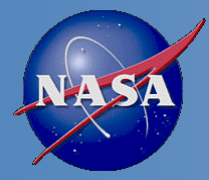
- Schedule has VCM meeting provisional in Mar 2013
 - Likely dependent on snow/NDVI situation at that time
- Validation stage one planned for Sept 2013
 - Transition from provisional to validation stage 1 will depend on feedback from liaisons
- Various software changes in the queue for 2013
 - Heavy aerosol/volcanic ash detection
 - Thin cirrus detection over elevated or cold locations
 - Specialized code for terminator region/Antarctica
- Tuning improvements made as needed



FY-13 Cloud Schedule and Milestones



- Our initial assessment of going Beta with post-VCM cloud properties was too optimistic. Original plan was to achieve Beta status 4 months after the cloud mask.
- We intend to verify expect day COP changes in Mx6.3 in early in Fy2013 (first useable data from September 5, 2012).
- We will transition the CTP low-level cloud issue in Nx7.0.
- We will study the need for COP Lookup table update to match upcoming MODIS Collection 6.
- We will also develop tool to fully test IDPS COP Luts including the NGAS modifications to the NOAA Luts used as input.
- We will continue to push forward on the issues we have identified so far (CTP high cloud issues).
- Begin analysis of Nighttime COP results.
- If given approval, we will ready our NOAA algorithms for ADL implementation in coordination with the AIT schedule.



Path Forward (FY-13 thru FY-17)

(assume “FYxx” runs from April 1, 20xx to March 31, 20xx+1)



	Suomi NPP	JPSS J1
FY13	Achieve provisional/validated stage 1	
FY14	Achieve validated stage 2	Begin preparations/draft Cal/Val plan
FY15	Achieve validated stage 3	Finalize Cal/Val plan/additional tools as needed
FY16		Implement any changes necessary to support ICV for JPSS I
FY17		Begin ICV



VCM Summary



- VCM made significant progress in 2012
 - Completed ambitious 30 day spin up
 - Already implemented or delivered multiple software corrections/improvements
 - VCM at beta stage, moving towards provisional
- Cal/Val team has well established roles for 2013
 - Additional software work underway
 - Consistent communication in place with liaisons
- Plan for JPSS 1 can follow that for SNPP, but must adjust for expected loss of CloudSat/CALIPSO



Cloud Summary



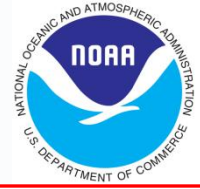
- Cloud Team Validation Tools have been applied to months of global VIIRS data.
- Cloud Team has had definite impact on some obvious EDR issues.
 - Day COP Lookup Table
 - CTP low-level cloud issue
- Cloud team struggles with testing modifications independently which slows our pace our pace of progress.
- Cloud team welcomes chance to implement NOAA algorithms (as warranted) into ADL if NESDIS AIT is able to support it.



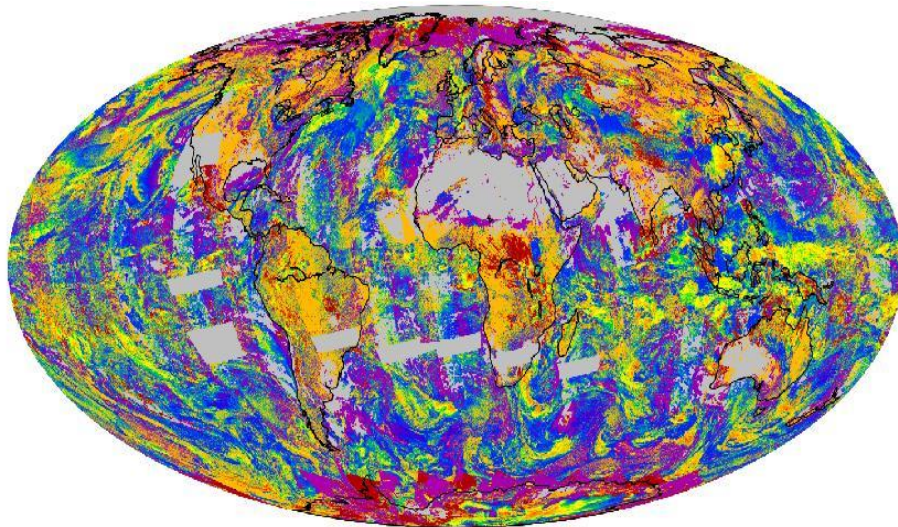
Extra Material



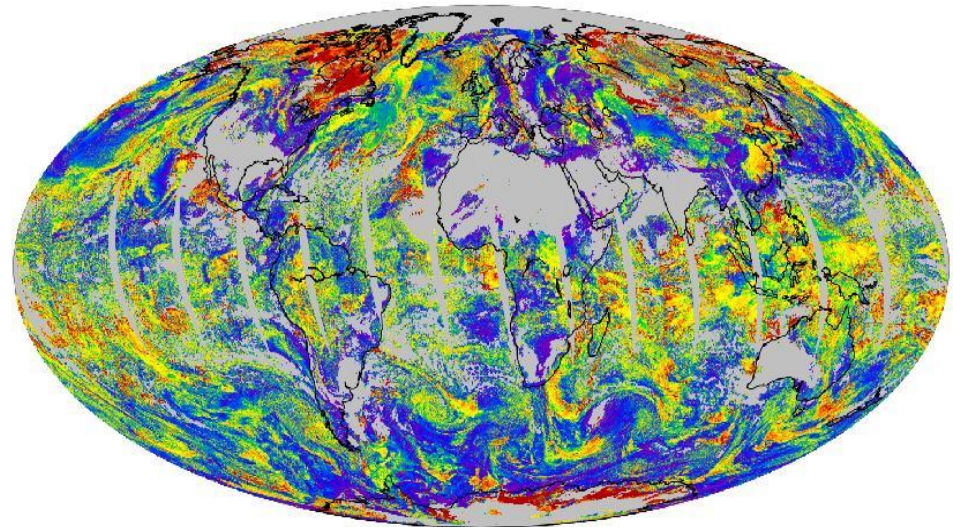
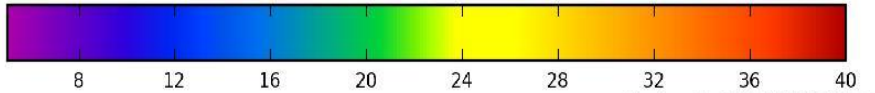
Cloud Effective Particle Size (CEPS)



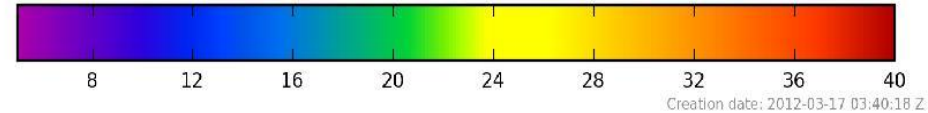
Global Composite from UW/SSEC Atmospheric PEATE for March 4, 2012 (Mx6.2)



VIIRS EPS IP Day 2012-03-04



Aqua EPS Day 2012-03-04



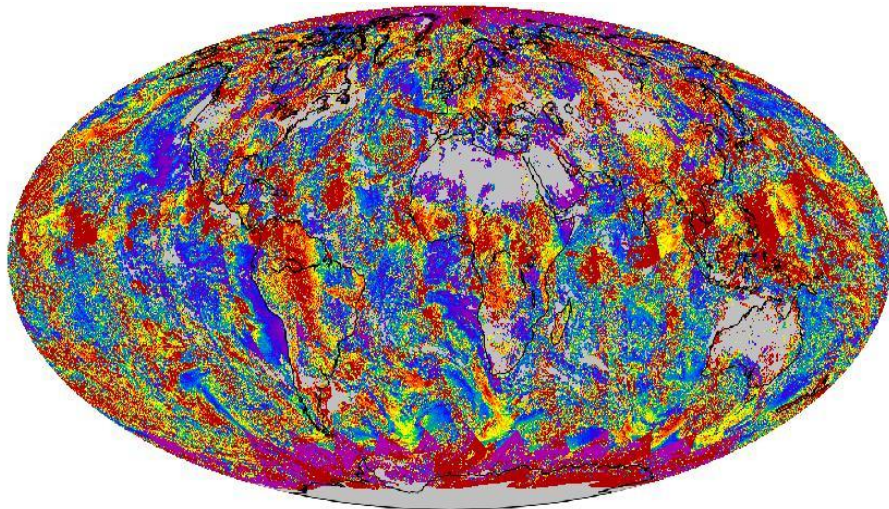
Visually, the CEPS global composites show unrealistic scan-angle and land/ocean differences



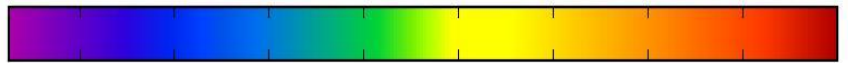
Cloud Effective Particle Size (CEPS)



Global Composite from UW/SSEC Atmospheric PEATE for September 12, 2012 (Mx6.3)

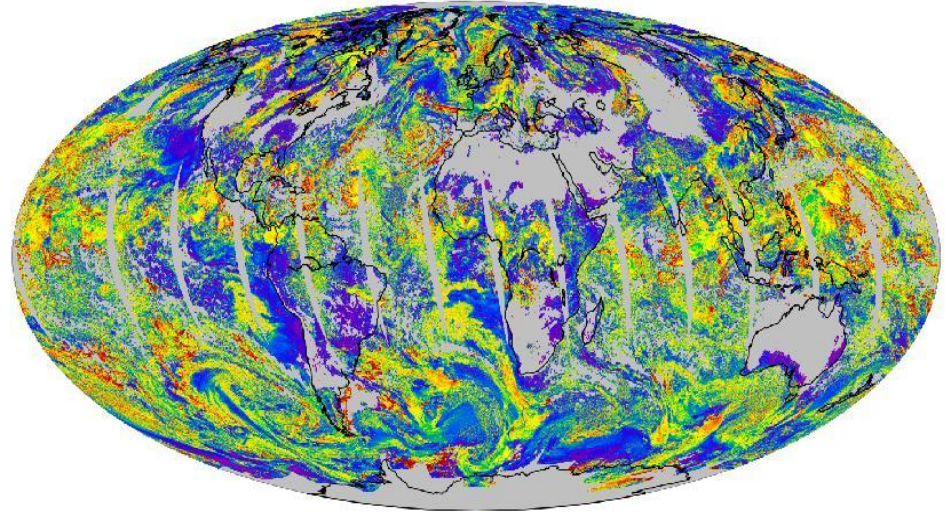


VIIRS EPS EDR Day 2012-09-12

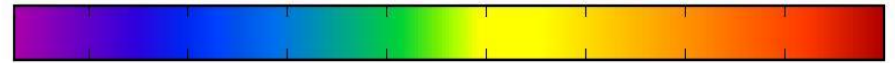


8 12 16 20 24 28 32 36 40

Creation date: 2012-09-13 12:05:01 Z



Aqua EPS Day 2012-09-12



8 12 16 20 24 28 32 36 40

Creation date: 2012-09-14 00:12:50 Z

Visually, the CEPS global composites show differences with MODIS but unrealistic scan-angle and land/ocean differences are less than with Mx6.2