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Daytime Cloud Optical Microphysical Parameters (DCOMP) for GOES-ABI and VIIRS

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Background

☞ Daytime microphysical parameters Cloud Optical Depth, (COD) Effective Radius (REF) are key cloud parameters. They are also used to derive cloud water content.

☞ DCOMP is the standard NOAA Algorithm Working Group (AWG) retrieval for GOES-ABI. It is part of the cloud retrieval system together with cloud mask (ACM) and cloud height retrieval (ACHA).

☞ **DCOMP** runs on SEVIRI, AVHRR, NPP VIIRS, MTSAT, GOES I-M, GOES-ABI (future), and MODIS

☞ DCOMP products are part of NOAA/NESDIS climate data set PATMOS-x (AVHRR + GOES).

Method

• **Nakajima & King approach** of simultaneous retrieval of COD and REF by measurement in a non-absorbing channel (visible) at 0.6µm and in an absorbing channel (infrared) at 1.6µm (DCOMP mode 1), 2.2µm (mode 2) or 3.75µm (mode 3).

• DCOMP for all sensors consists on one common FORTRAN90 code and look-up-table design. It differs only in respect to the exact channel settings of reflectance measurement in visible and near-infrared.

• ***Atmospheric correction*** for ozone, water vapor and Rayleigh extinction. Data basis is GFS/NPW reanalysis data. This is done in a two-level scheme for above and below the cloud.

• ***Forward model*** is a doubling-adding radiative transfer model, which is capable to simulate cloud reflectance, transmission and spherical albedo. It uses Mie calculations and Baum and Yang ice scattering functions.

• ***Inversion*** is a 1DVAR Optimal estimation method.

• DCOMP provides physically-based **uncertainty estimates**.

Capability of DCOMP to current sensors

Sensor / channel (µm)	0.6	0.8	1.6	2.25	3.75	Coverage/comments
SEVIRI	✔	✔	✔			Africa, Europe/ 15 minutes
AVHRR/METOP -A (PATMOS-X)	✔	✔			✔	Global view/ 4 times per day, longest consistent time series (30 yrs)
VIIRS M-band	✔	✔	✔	✔	✔	750m resolution
VIIRS I-band	✔	✔	✔		✔	375m resolution
GOES I-M	✔				✔	South and North America
GOES-ABI (-R)	✔	✔	✔	✔	✔	The Americans, up to 5 minutes and 0.5 km ; prospected launch in 2015
MODIS	✔	✔	✔	✔ 2.1µm	✔	Global View, AQUA is part of A-Train
AATSR	✔	✔	✔		✔	on ENVISAT

DCOMP on VIIRS

☞ **DCOMP on NPP VIIRS** offers new options:
- Higher spatial resolution (750m for M bands, and 375 for I bands at nadir)
- 2.2 micron channel
- Better above-snow retrievals

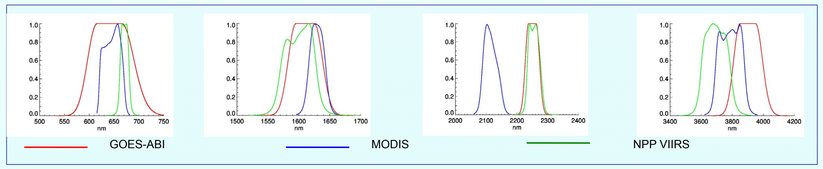


Fig.: Response functions of GOES-ABI, NPP VIIRS M-bands and MODIS for the visible channel and the IR channels used for DCOMP mode 1,2 and 3.

☞ **NPP VIIRS** gives the first opportunity to test the official GOES-ABI 0.6/2.25 micron channel retrieval with real satellite data
☞ Full day **processing time** is less than 2 hours for a full cloud data set including cloud height, type and mask products.

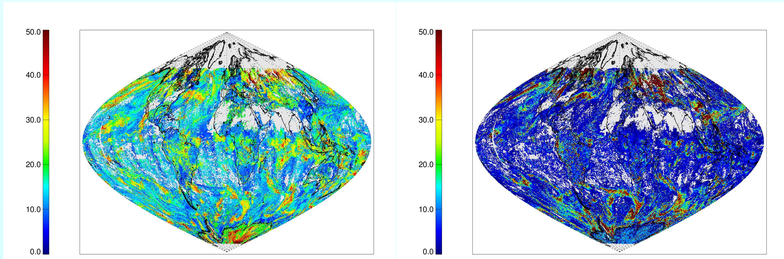


Fig.: DCOMP results for a full day of VIIRS observations from 20 February 2012: Effective Radius (left) and Cloud Optical Thickness (right) for DCOMP Mode 2.

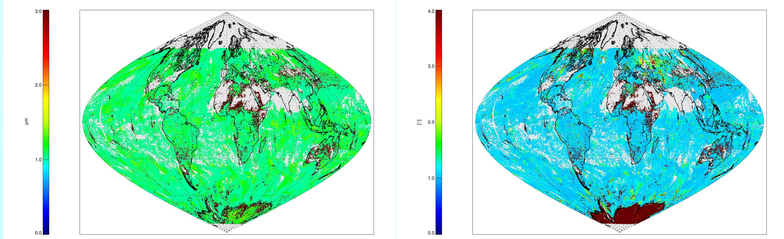
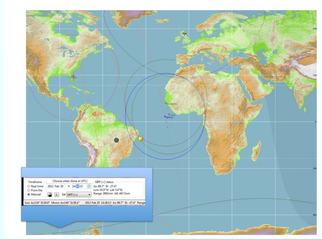


Fig.: DCOMP results for a full day of VIIRS observations from 20 February 2012: Uncertainty of Effective Radius and Cloud Optical Thickness for DCOMP Mode 2.

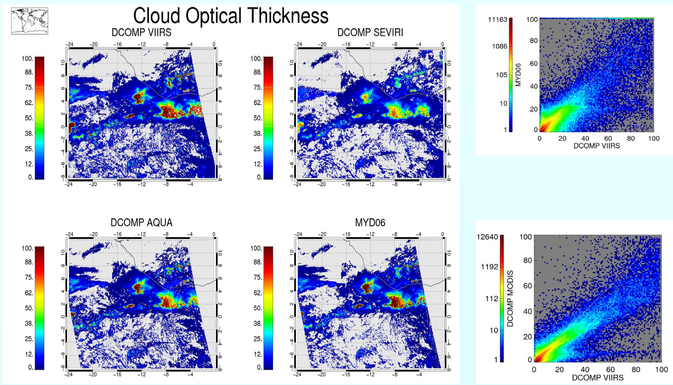
Conclusions and Outlook

- DCOMP is running on NPP VIIRS M-band data for all channel combinations in real-time from UW/SSEC Direct Broadcast system.
- DCOMP results are consistent between the current sensors in space.
- The use of VIIRS data as the new proxy for the standard GOES-ABI DCOMP channel combination is successful.
- Future DCOMP development work: (I) improve snow/sea-ice surface retrieval, (II) improved ice cloud scattering functions (III) multilayer forward operator, (IV) considering higher uncertainty for rainbow and similar observation geometries
- Future extension: Running DCOMP on NPP VIIRS I-band data.
- Algorithm reference: Walther, A. and A. Heidinger, 2011: Implementation of the Daytime Cloud Optical and Microphysical Properties Algorithm (DCOMP) in PATMOS-x. JAMC, in press doi:10.1175/JAMC-D-11-0108.1

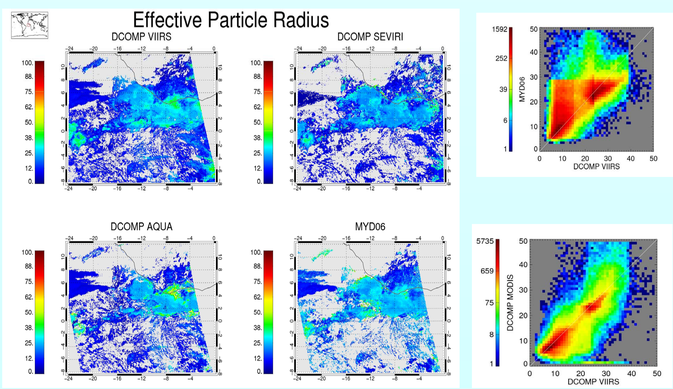
Evaluation of DCOMP VIIRS



• Scene on 20 February 2012 shows a good matchup between AQUA and NPP
• All data are re-sampled to 1/30. degree regular lon /lat grid.
• Matching criteria: Time shift less than 2 minutes
• Compared data sets are DCOMP on VIIRS, DCOMP on MODIS, DCOMP on SEVIRI and MAST (MYD06 AQUA coll.5)



• COD is in general in a good agreement between DCOMP on different sensors and the MAST/MYD06 product.



• REF is the more challenging product due to higher sensitivity to uncertainty in phase function, especially for ice clouds.
• MODIS and VIIRS DCOMP Mode-2 results are not completely comparable, since IR channel is not at the same spectral location.