Near UV Aerosol Group Report

Omar Torres
NASA GSFC 614

GSFC Aerocenter Update
May 31, 2013

People

Research Group:

-Omar Torres (NASA – 614)
-Changwoo Ahn (SSAI)
-Hiren Jethva (GESTAR-USRA)
-Pawan Gupta (GESTAR-USRA)
-Santiago Gasso (GESTAR- Morgan State University)
-Peter Leonard (ADNET)

Collaborations:

-PK Bhartia
-Nick Krotkov
-Mian Chin
-Rich McPeters
-Peter Colarco, Valentina Aquila (JHU)
-E.S. Yang (SSAI)
-Sasha Marshak, Jay Herman (UMBC)
-Kelly Chance (SAO)
-Lorraine Remer (UMBC)
-Robert Loughman (HU)

Projects

OMI near UV aerosol algorithm and products
-Algorithm Upgrades (Ahn, Jethva, Gupta, Torres)
-Product Assessment (Ahn, Jethva, Gasso, Torres)
-OMI-MODIS Synergy (Gasso, Torres)
-Near UV High Spatial resolution (CAI, GLI) Analysis (Gasso, Torres)

Detecting Aerosol Above Clouds (Jethva, Ahn, Torres, Bhartia, Remer)
-OMI
-MODIS Application
-Inter-comparison to other techniques (POLDER, CALIOP)

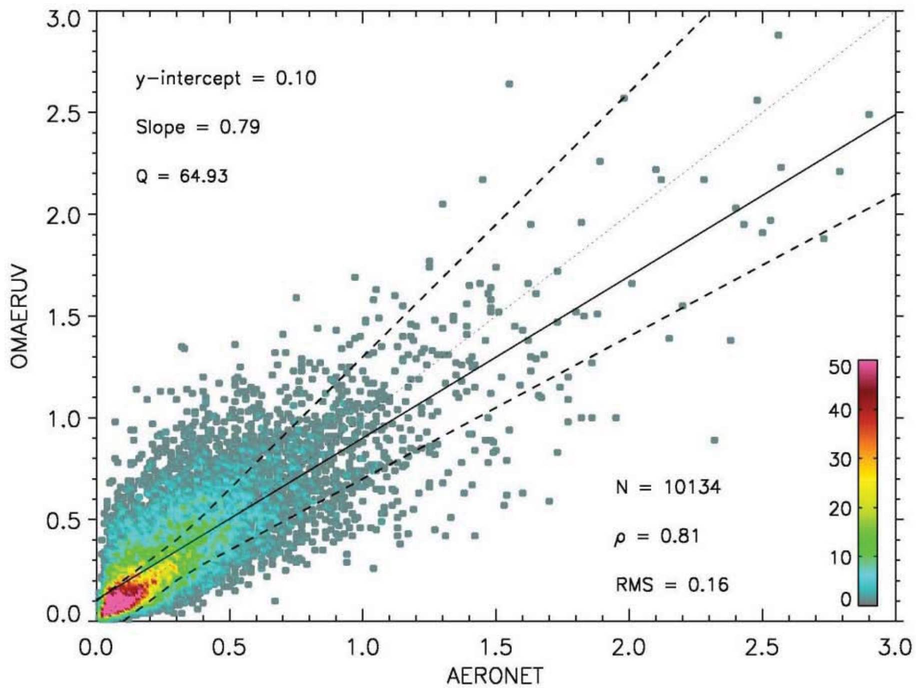
Ground based observations of aerosols (Krotkov, Mok, Jethva, Loughman, Torres, Labow)
-Combined use of Cimel and UV and VIS MFRS sensors to measure aerosol absorption

Real and spurious effects of stratospheric aerosols on Satellite-measured total ozone
(Aquila, Yang, Torres, Bhartia, McPeters, Colarco)

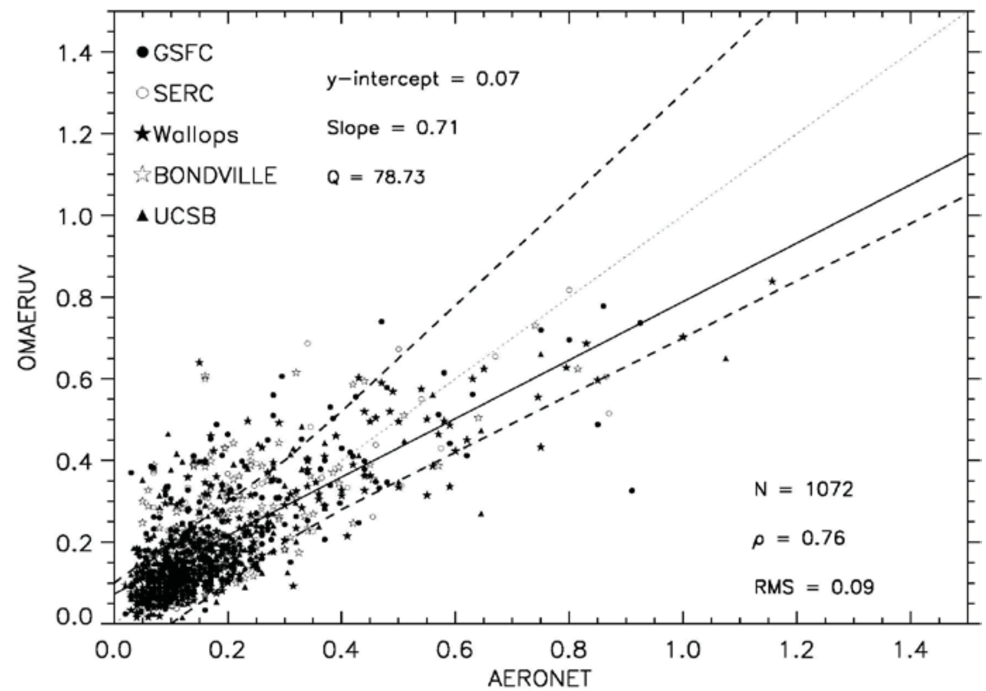
MEASURES Near UV Aerosol Project (Torres, Bhartia)

OMAERUV AOD Validation

Comparisons at 44 AERONET sites over for years (2005-2008)



All sites

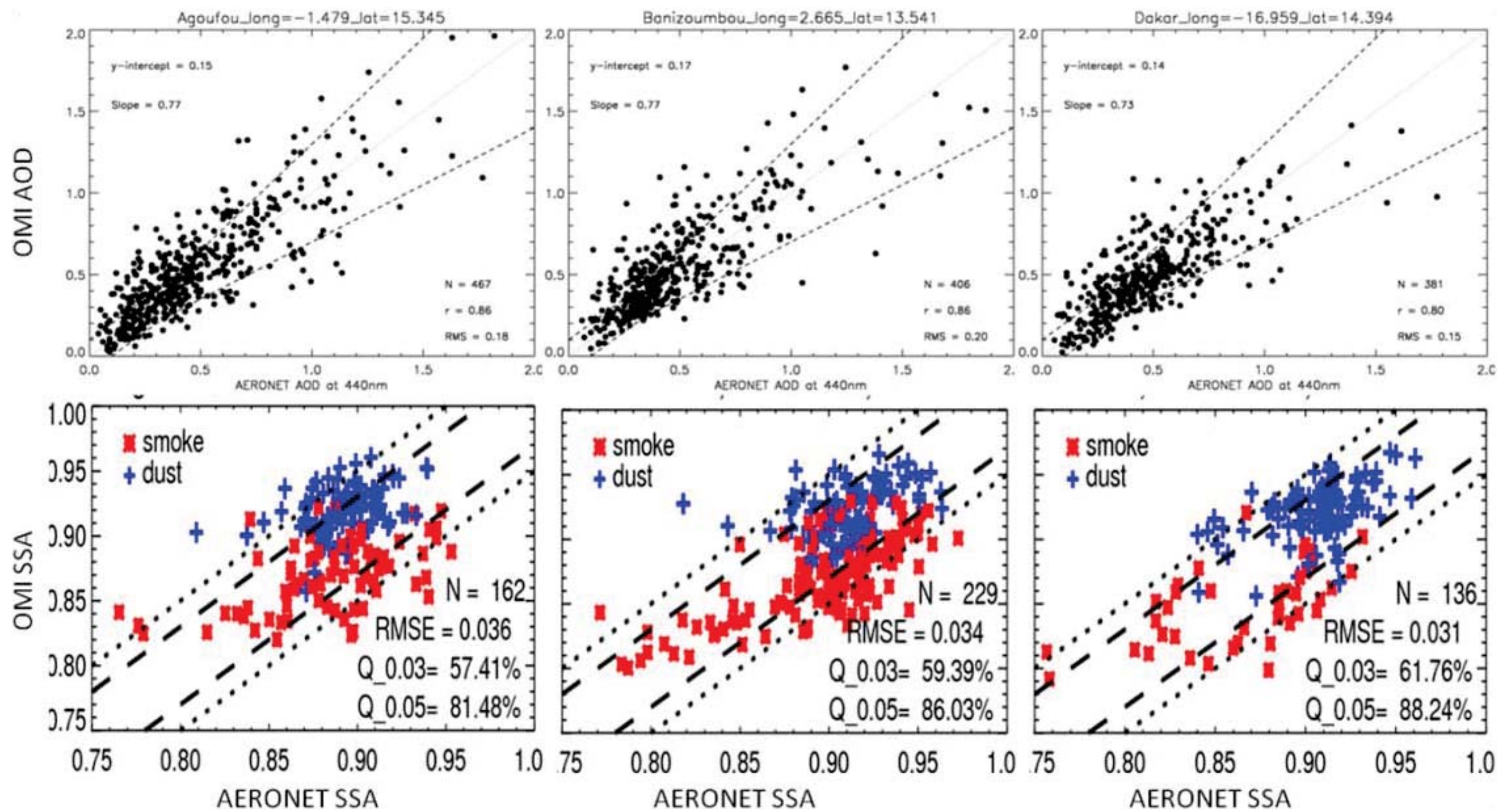


Non-absorbing aerosol sites

Ahn et al., JGR 2013 (submitted); Torres et al., AMT 2013, (submitted)

Single Scattering Albedo Evaluation

Comparison to AERONET SSA (440 nm) retrievals



Most OMAERUV SSA retrievals agree with AERONET's within 0.03 in South America, Northern India, NE China, Eastern Saharan Desert, and the Sahel region.

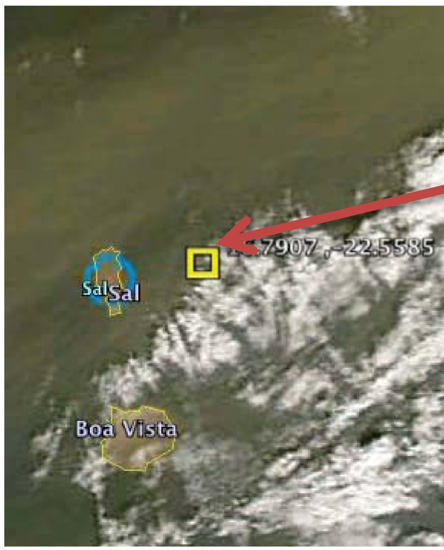
Larger differences are observed in Central Saharan, Southern Africa and Southeast Asia.

Jethva et al., JGR, 2013 submitted

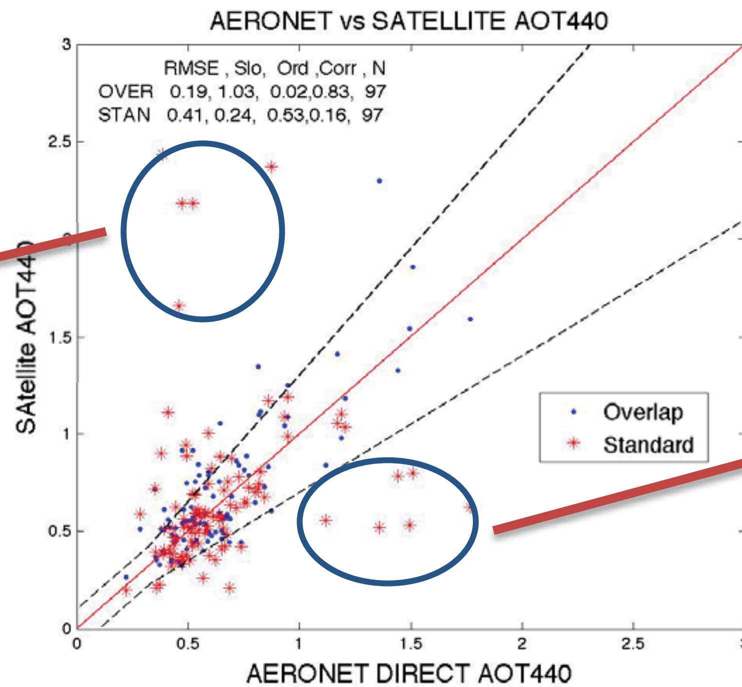
OMI-MODIS AOD analysis
Identification of OMI algorithm and scene specific issues

(Santiago Gassó)

Cloud Contamination



Overestimation of AOD in partly cloud conditions



Algorithm Related issues

Underestimation of AOD in very dense dust storms (assumed size distribution, aerosol height)

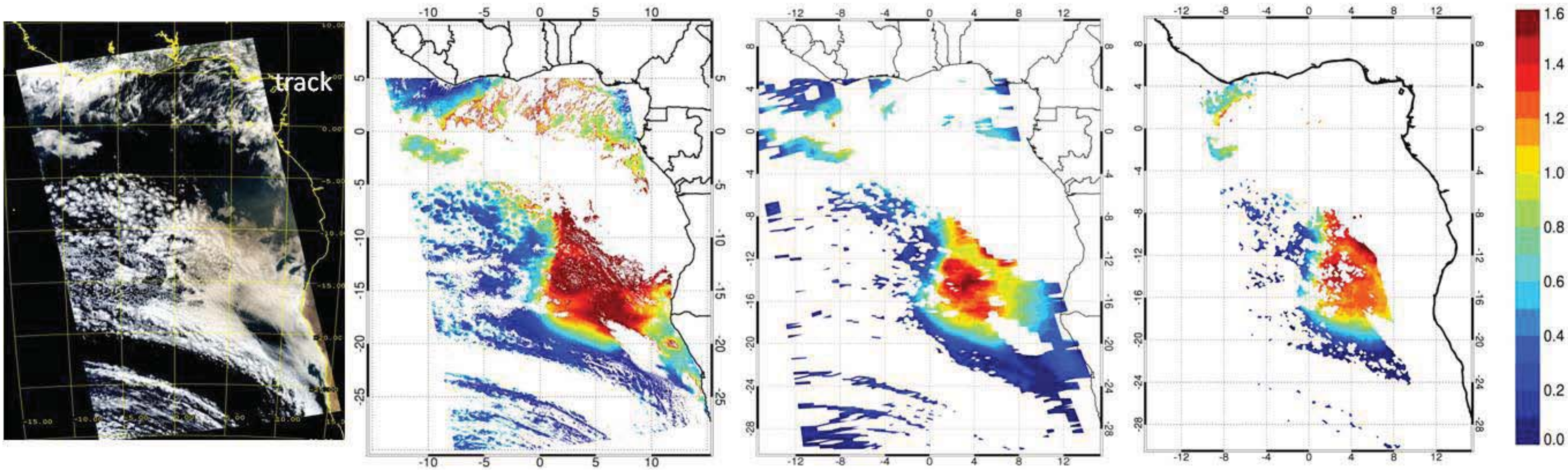
About the graphs:
Collocated OMI+MODIS+Aeronet pixel (years 04-11)

Overlap : OMI AOD corrected by the MODIS AOD
Standard : OMAERUV AOD

Gasso and Torres (in preparation)

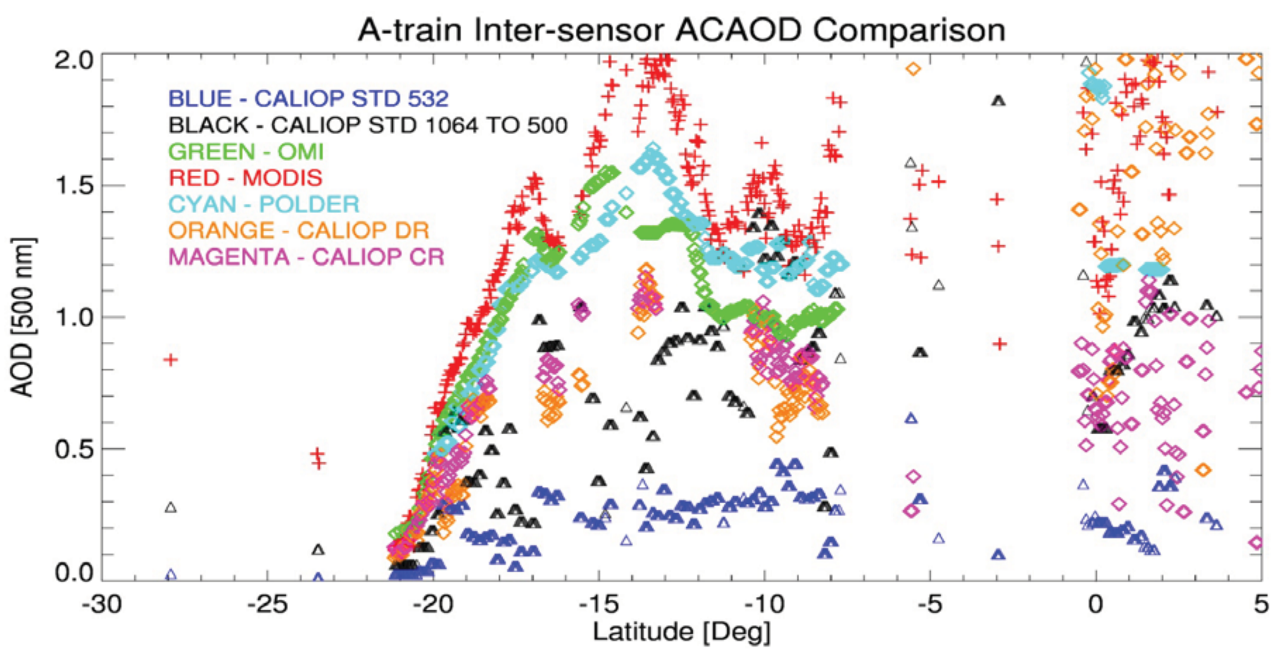
Aerosols Above Clouds: Sensor Inter-comparison

(Jethva, Torres, Waquet, Chand)



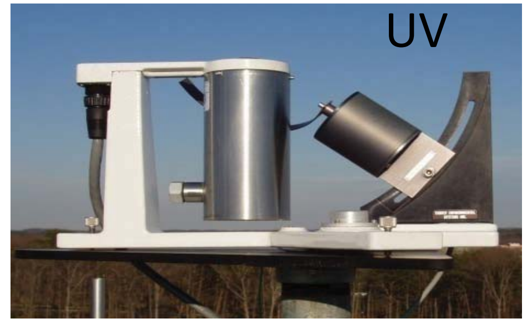
Aqua-MODIS **OMI** **POLDER**

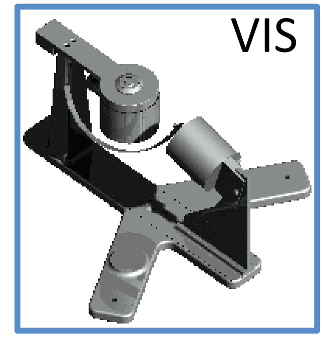
Aug 13, 2006



Combined use of CIMEL and Modified UV and VIS MFSR Measurements

(Krotkov, Torres, Mok, Labow, Jethva, Loughman)





Inter-calibration:

$$\tau_{440}^{Cimel} = \tau_{440}^{MFSR}$$

Replace three original UV filters with CIMEL's 340, 380 and 440 nm filters.

Add a 440 nm CIMEL filter to VIS MFSR sensor

Measure 1 min F_{diff} and F_{tot} (3% error)

Calculate F_{dir}

Derive τ_{uv-vis}^{MFSR}

Direct Sun measurements: AOD

Sky-radiance measurements

Particle Size Distribution

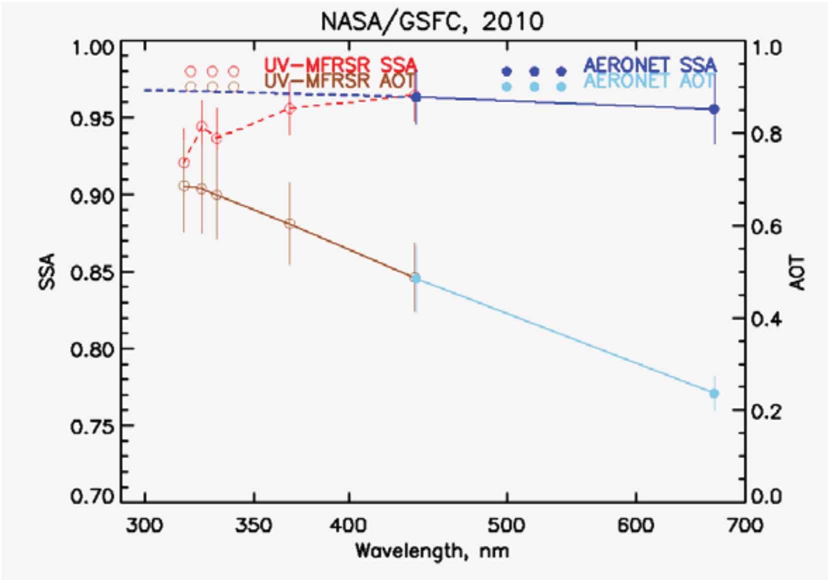
Real Refractive Index

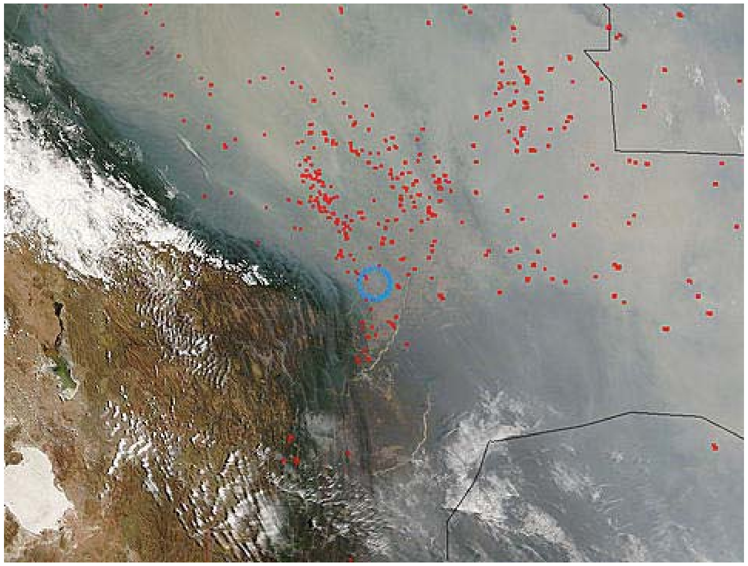
τ_{uv-vis}^{MFSR}

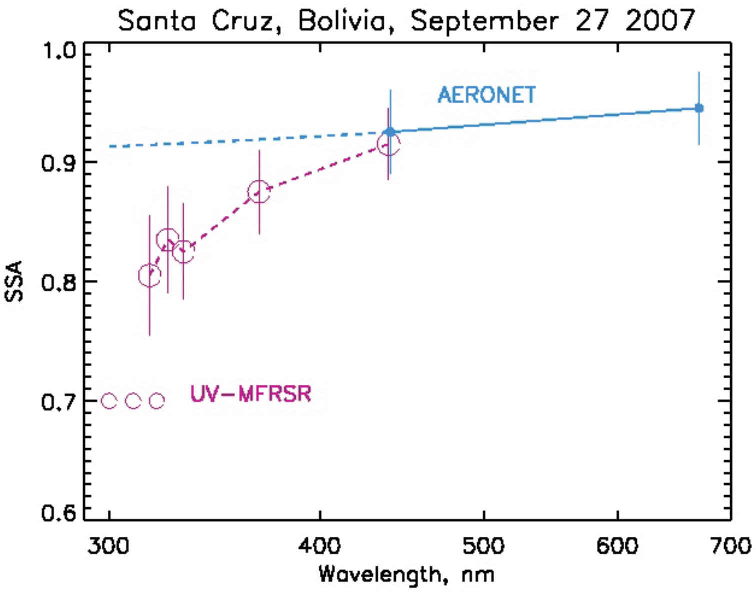
Mie plus RT Calculations

K_{uv-vis}, SSA_{uv-vis} that explains measured F_{diff}/F_{tot} ratios

CIMEL and Modified UV and VIS MFSR observations: Results





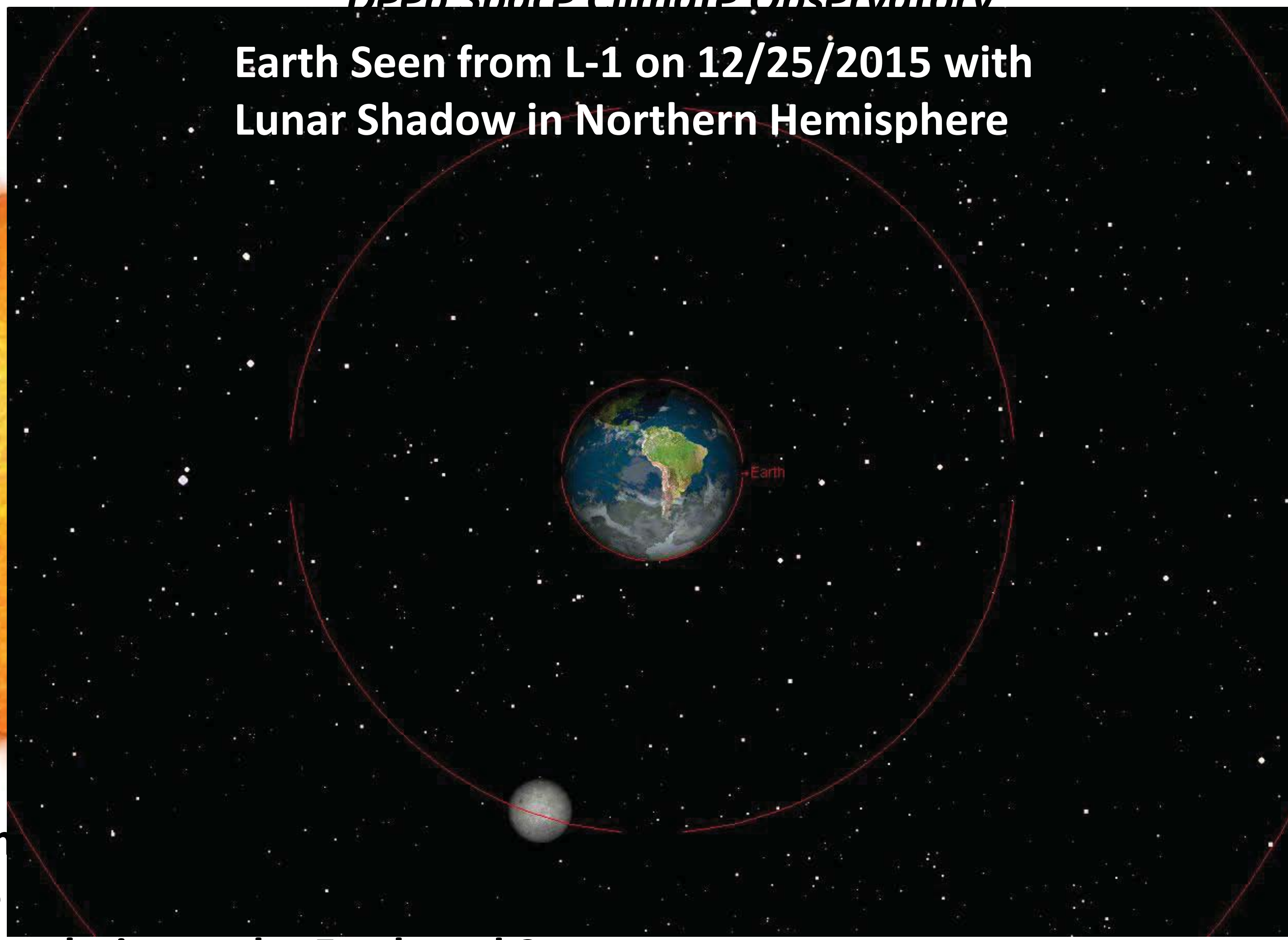


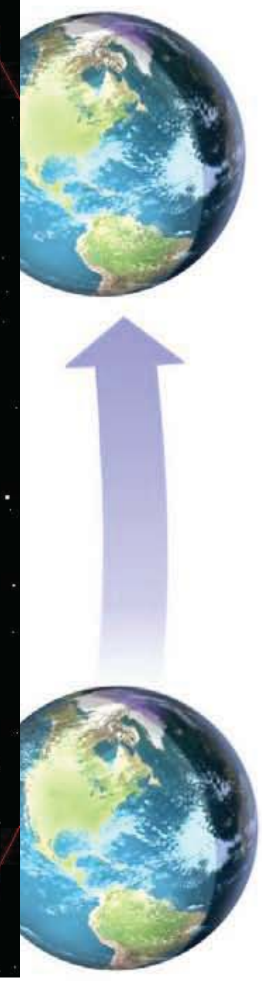
Plan to return to Bolivia in 2013 using three-instrument suite

Future Perspective:

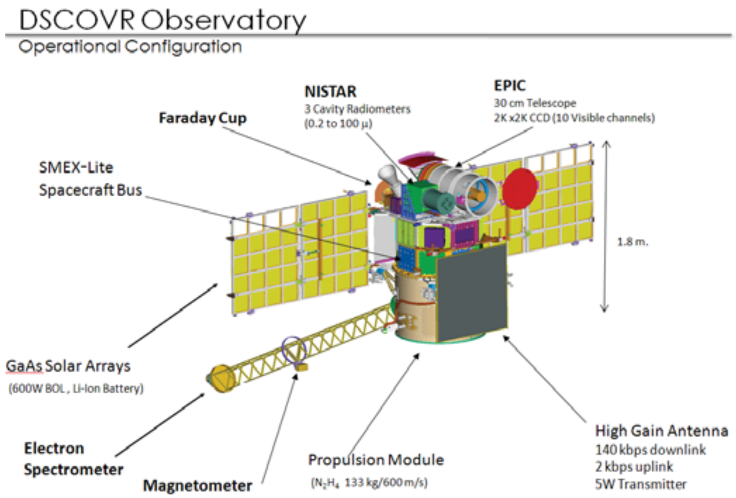
DSCOVR At Lagrange-1

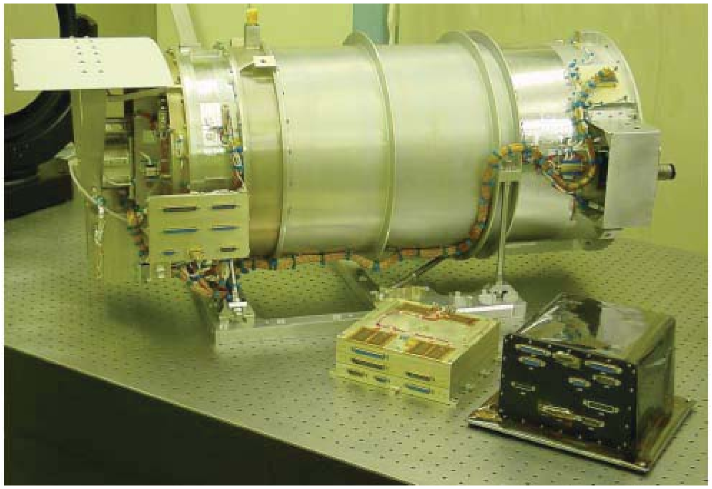
Deep Space Climate Observatory





At L1, th
and the
position relative to the Earth and Sun





Earth Polychromatic Imaging Camera

Channels and Applications

Channel (nm)	FWHM (nm)	Purpose	Spatial Resolution (km)	SNR	Exp. Time (seconds)
317.5 ± 0.1	*1 ±0.2*	*Ozone, SO_2, UV*	*10**	265	1.3
325 ± 0.1	*1 ±0.2*	*Ozone, UV*	*10*	265	0.84
340 ± 0.3	*3 ± 0.6*	*Ozone, Aerosols, UV, and Volcanic Ash*	*10*	265	0.13
388 ± 0.3	*3 ± 0.6*	*Aerosols, Clouds, UV and Volcanic Ash*	*10*	266	0.087
443 ± 1	*3 ± 0.6*	*Blue, Aerosols, Vegetation*	*10*	265	0.052
551 ± 1	*3 ± 0.6*	*Green, Aerosols, Vegetation*	*10*	265	0.030
680 ± 0.2	*2 ± 0.4*	*Red, Aerosol, Veg., O_2 B-Band, Clouds*	*10*	266	0.037
687.75 ± 0.2	*0.8 ± 0.2*	*O_2 B-Band Cloud Height*	*10*	266	0.060
764.0 ± 0.2	*1 ± 0.2*	*A-Band Cloud Height*	*10*	265	0.061
779.5 ± 0.3	*2 ± 0.4*	*A-Band Reference, Vegetation*	*10*	265	0.036

Official launch date: November 2014

Science Team to be selected via ROSES call

Future Perspective (2):

Tropospheric Emissions: Monitoring of Pollution (TEMPO)

PI: Kelly Chance (Smithsonian Astrophysical Observatory)

-First GEO NASA Science Mission
-Commercial Satellite Hosted Payload
-GEOCAPE Precursor
-To be launched in 2019

GEOGRAPHICAL COVERAGE

KEY INSTRUMENT CHARACTERISTICS

Requirements		Comment
Field of Regard	GNA	Mexico City to Canada tar sands & Atlantic to Pacific
Imaging Time	1 hr	1250 scan positions with 2.8 sec integration
Footprint N/S	2.0 km	Native pixel achieved by 44 cm telescope effective focal length
Footprint E/W	4.5 km	
Spectral Range	290-690 nm	1,024 spectral channels matched to 2k focal plane
Spectral Resolution	0.6 nm	Achieved by spectrometer design
Spectral Sampling	0.2 nm	

PLANED PRODUCTS

Species	λ Band nm	SNR Reqs	SNR Predict	EOL Margin
SO_2	305-345	1297	1820	40%
H_2CO	327-354	487	2094	330%
NO_2	423-451	1233	1910	55%
$C_2H_2O_2$	433-457	1350	2331	73%
O_3 (UV)	303-345	1122	1635	46%
O_3 (Vis)	546-648	958	1254	31%
AOD	354, 388	1000	1596	60%

SCIENCE TEAM

Kelly Chance, (PI)	**SAO**	Xiong Liu, (DPI)	**SAO**
James Carr	**Carr Astro**	Ronald Cohen	**UC Berkeley**
David Edwards	**NCAR**	Jack Fishman	**St. Louis U.**
David Flittner	**LaRC**	Jay Herman	**UMBC**
Daniel Jacob	**Harvard**	Scott Janz	**GSFC**
Joanna Joiner	**GSFC**	Nickolay Krotkov	**GSFC**
James Leitch	**Ball**	Randall Martin	**SAO**
Doreen Neil	**LaRC**	Michael Newchurch	**UAH**
R. Bradley Pierce	**NOAA**	Robert Spurr	**RT Solutions**
Raid Suleiman	**SAO**	James Szykman	**EPA**
Omar Torres	**GSFC**	Jun Wang	**U. Nebraska**