

CALVAL in JAXA



Akihiko KUZE (JAXA EORC)

March, 2016
Canberra

IBUKI Launch Date 12:54, January 23, 2009 (JST)

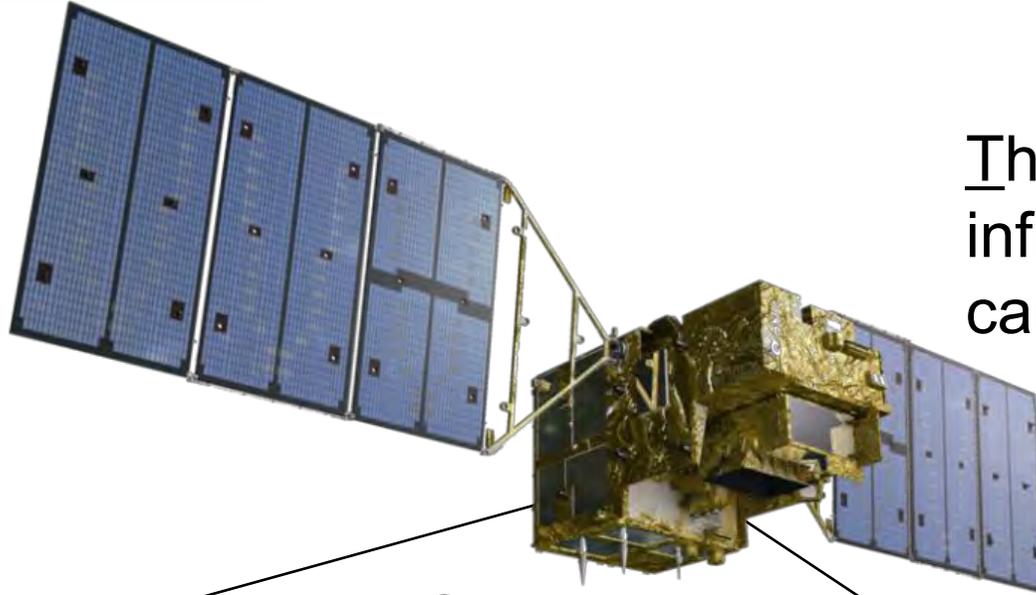




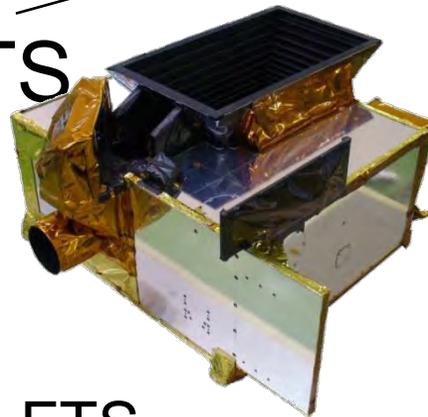
TANSO-on GOSAT (2009-)



Thermal And Near
infrared Sensor for
carbon Observation

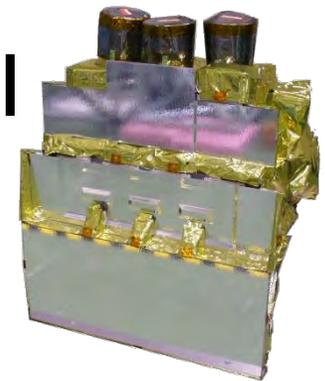


TANSO-FTS



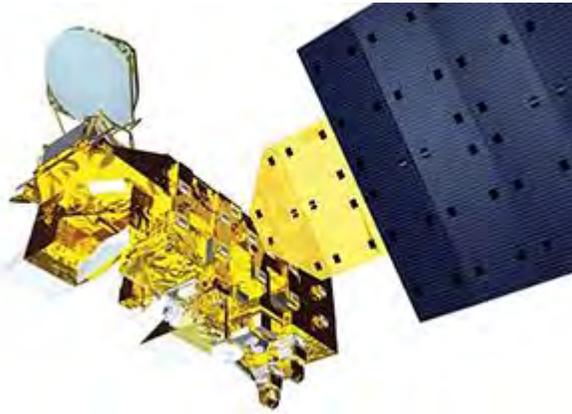
SWIR/TIR FTS

TANSO-CAI

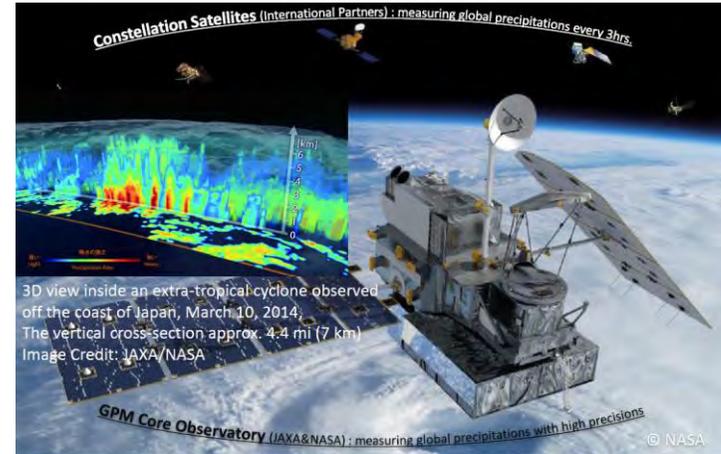


UV, Visible, SWIR Imager

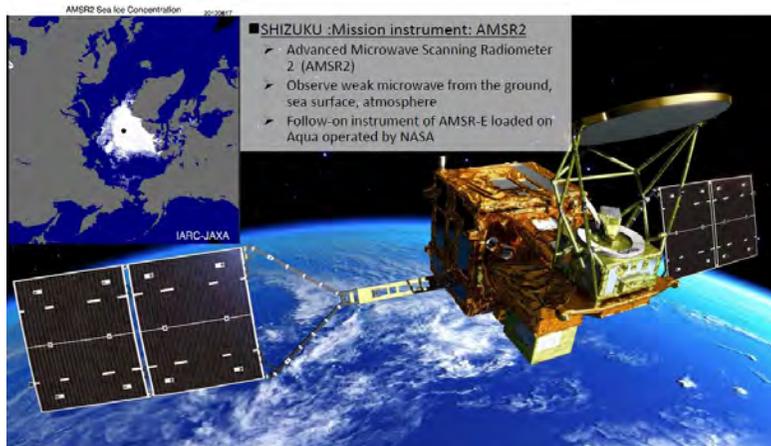
JAXA's earth observing instruments from space (non-optical)



AMSR-E on EOS Aqua (Completed in 2015)



DPR on GPM (2014-)



AMSR2 on GCOM-W (2012-)



ALOS-2 (2014-)

GOSAT





Launch and Orbit

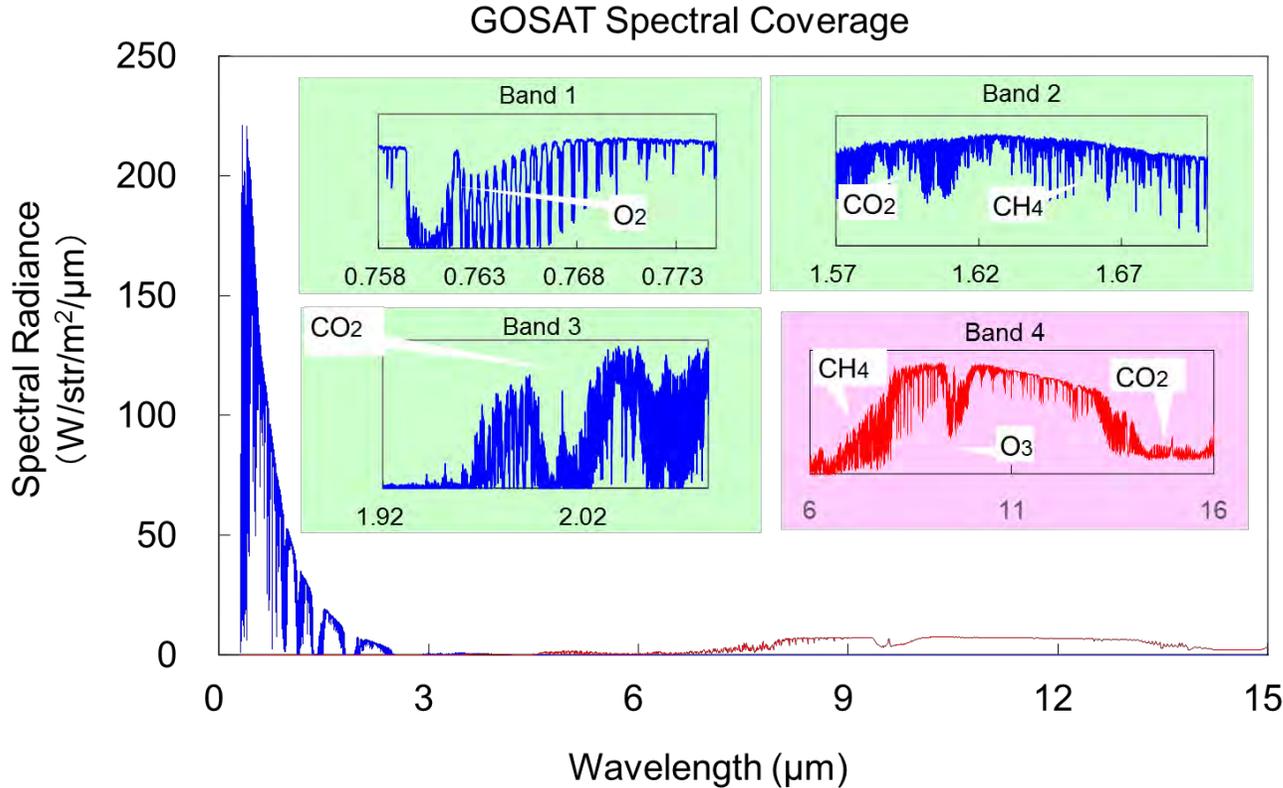


Size	Main body	3.7m(H) x1.8m(W) x 2.0m(D) (Except attachment)
	Wing Span	13.7 m
Mass	Total	1,750 kg
Power	Total	3.8KW(EOL)
Life Span	5 years	
Orbit	Sun Synchronous Orbit	
	Local time	13:00+/-0:15 (12:47 March 2009)
	Altitude	666 km
	Inclination	98 deg
	Re-visit	3 days
Launch	Vehicle	H-IIA
	Date	Jan. 23, 2009





Wide Spectral Coverage



- 3 narrow bands
 - 0.76 μm
 - 1.6 μm
 - 2.0 μm
- A wide band
 - 5.5 – 14.3 μm
- With 0.2cm^{-1} spectral resolution (interval)

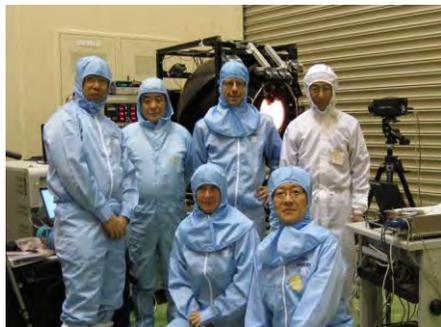
- Column averaged density of CO₂ is mainly retrieved by using the absorption lines between 1.6 μm region.
 - The intensities of these lines are less temperature dependent and not interfered by other molecules.
- O₂ A band absorption at 0.76 μm : Dry air column



- Radiometric Calibration
- Prelaunch and in-orbit



Prelaunch Radiometric Calibration X calibration with OCO in 2008

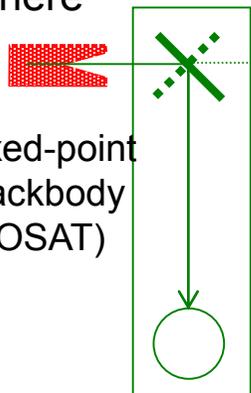


AIST/NMIJ
Standard

NIST Lamp
Standard



GOSAT Inner-Illuminated Integrating Sphere



Portable standard radiometers
3 spectral bands (GOSAT)

0.76 micron	ABO2
1.6 micron	WCO2
2.0 micron	SCO2
3 Detectors (OCO)	

OCO Inner-Illuminated Integrating Sphere

FieldSpec Spectroradiometer

Double Grating Monochromator

Dec, 2008@TKSC
Difference 1.59%, 1.1%, 1.4%

April 2008@JPL Difference
1.5%±0.6%, 2.7%±1.1%, 0.2%±4.1%



Calibration and Validation at RRV, Nevada



Path 37 from West



33.0deg



Horizontal
CO₂ CH₄

Vertical
CO₂ CH₄ O₃



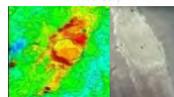
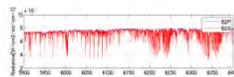
Aerosol Optical
Depth

Surface
CO₂ CH₄ O₃

25deg



19deg



High altitude

19.9deg



Path 36 from East

TOA Spectral radiance



Surface Thermal
radiation



Surface Spectral
Reflectance

BRDF



Variability

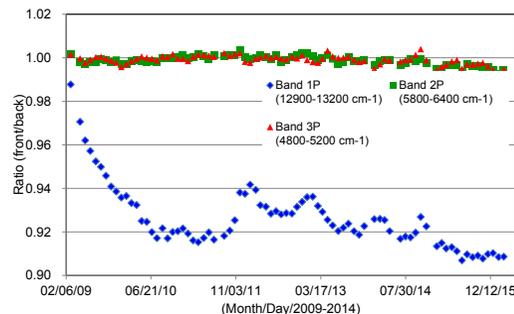
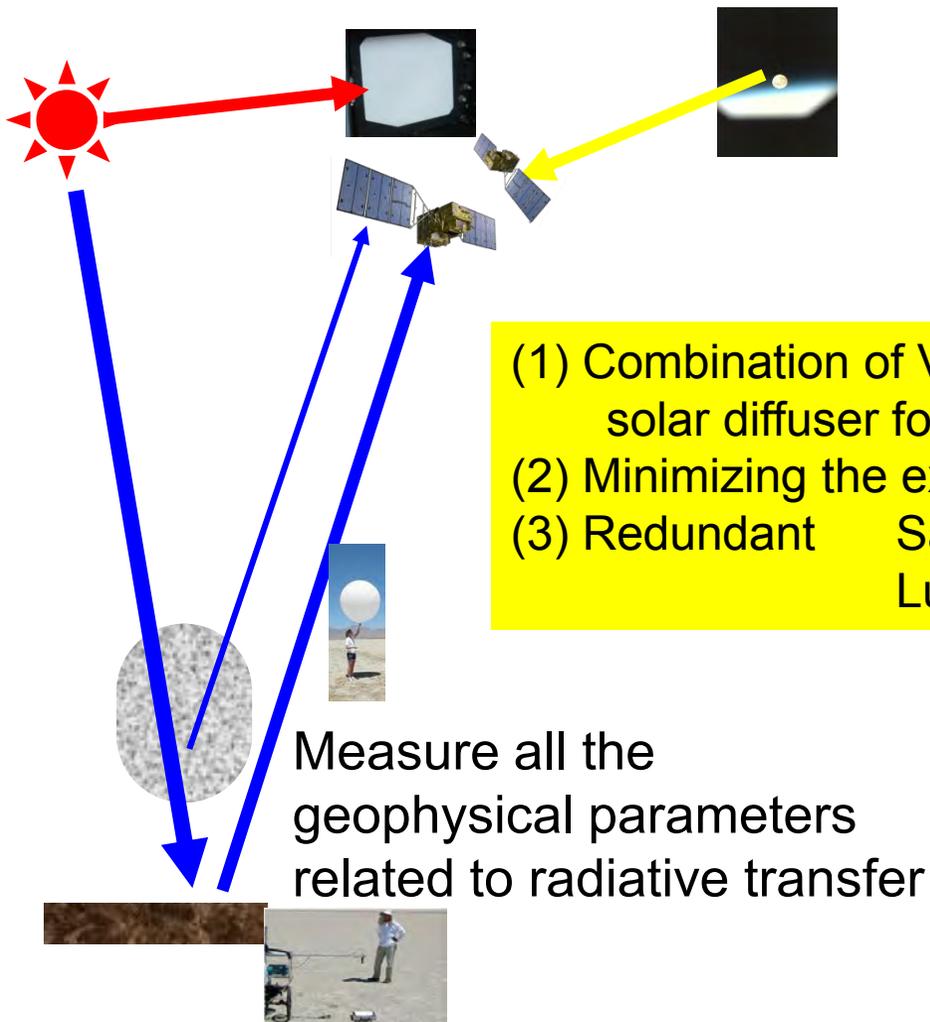


Surface and Profile
of Pressure,
Temperature, Humidity

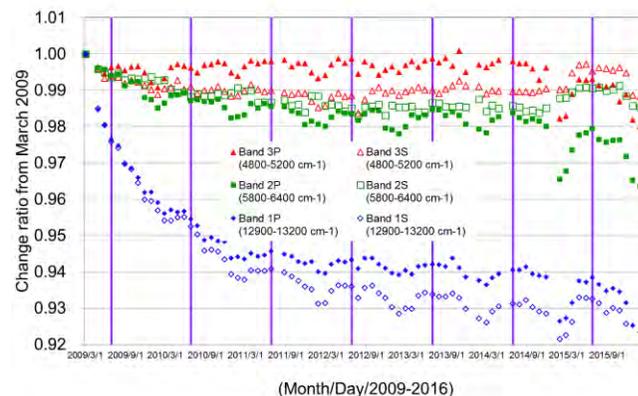
March, 2016, Canberra



GOSAT Calibration: long term stability

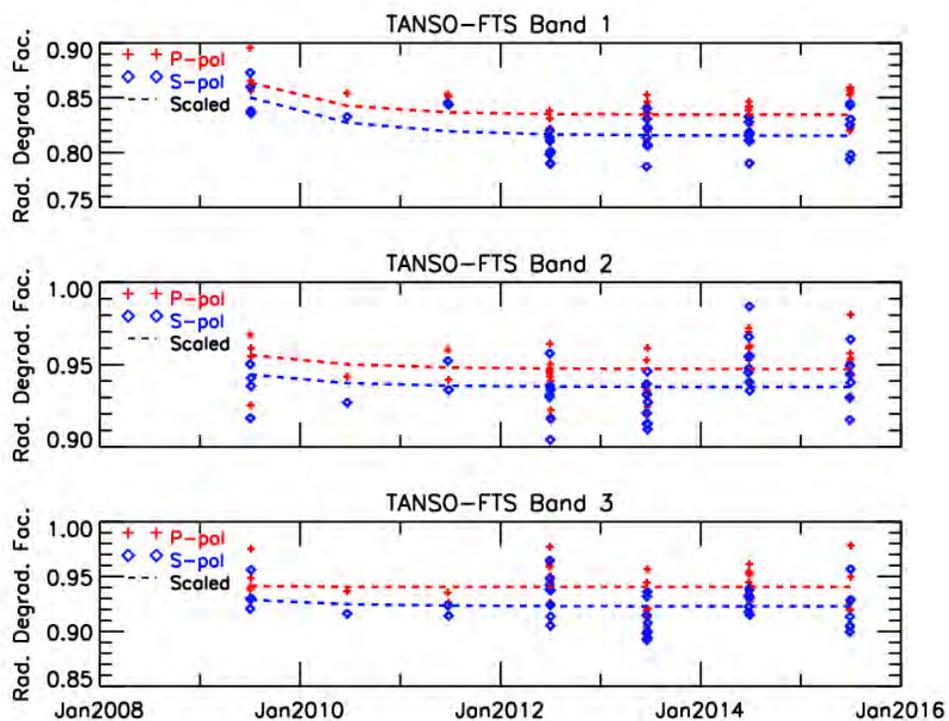


- (1) Combination of Vicarious calibration for absolute and **backside** solar diffuser for relative
- (2) Minimizing the exposure time of the calibration sources.
- (3) Redundant Sahara: unknown AOT
Lunar: Strong BRDF

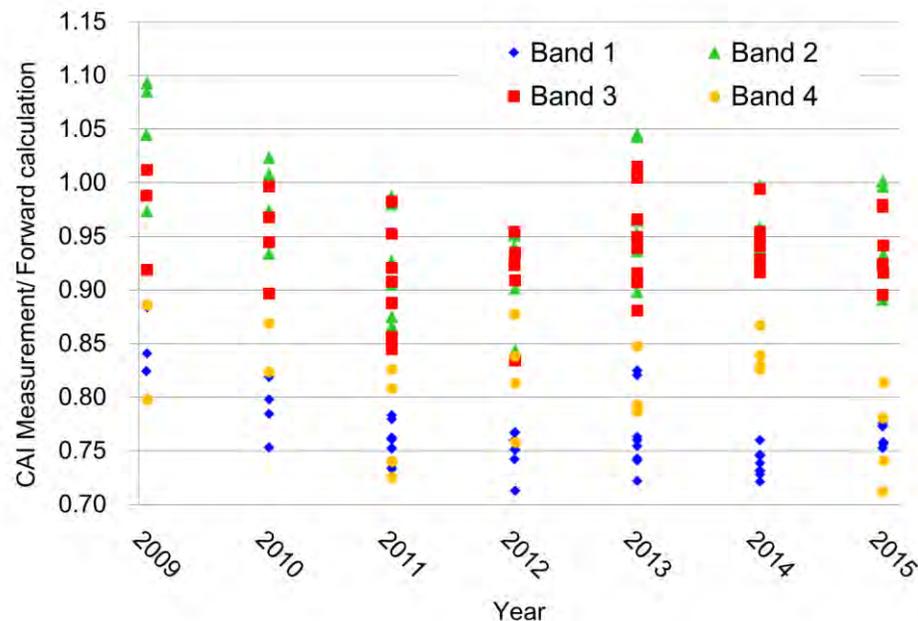




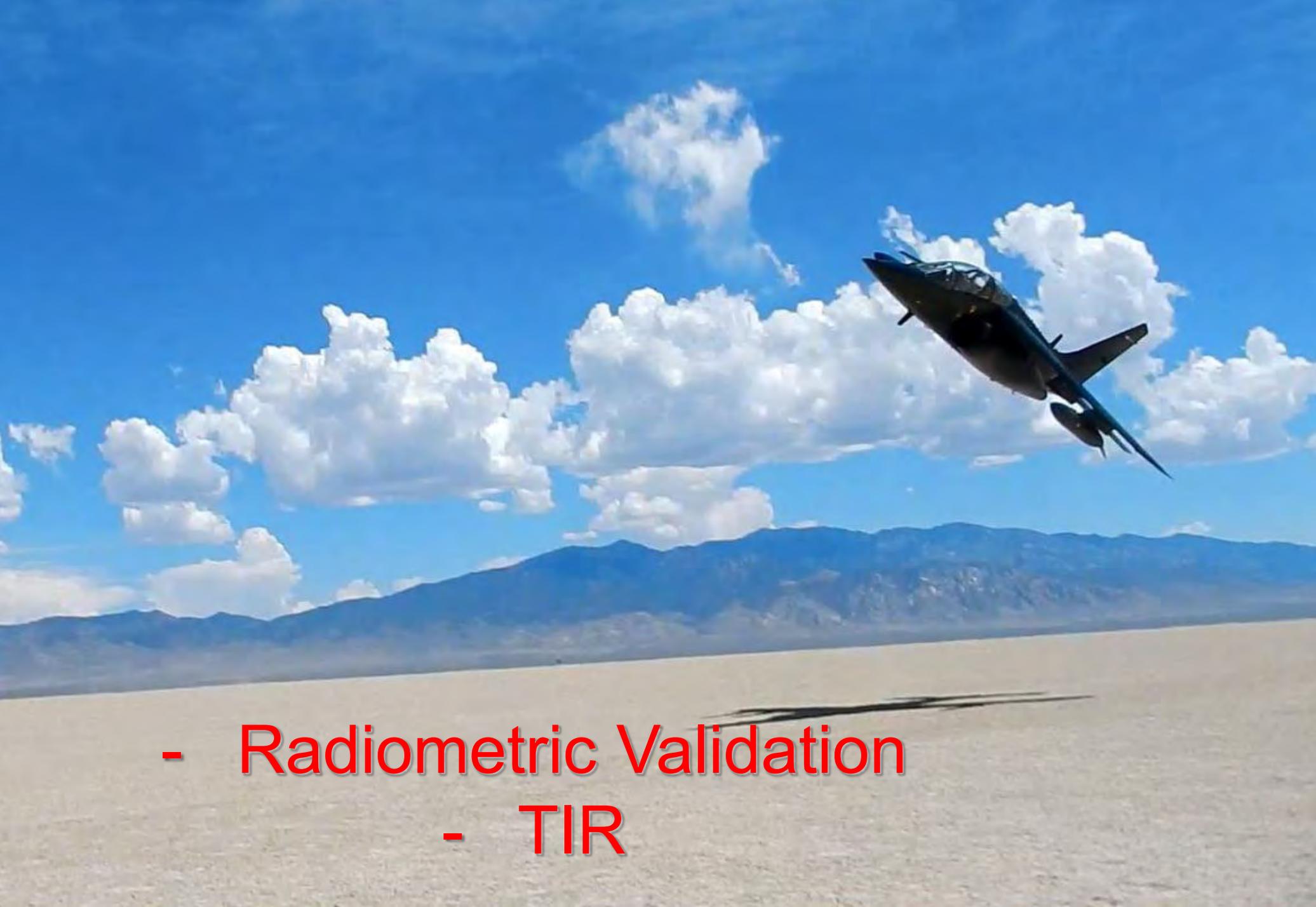
TANSO: Radiometric Degradation Factors using RRV (Nevada) campaign data



TANSO-FTS
(0.76, 1.6, 2.0 μm)



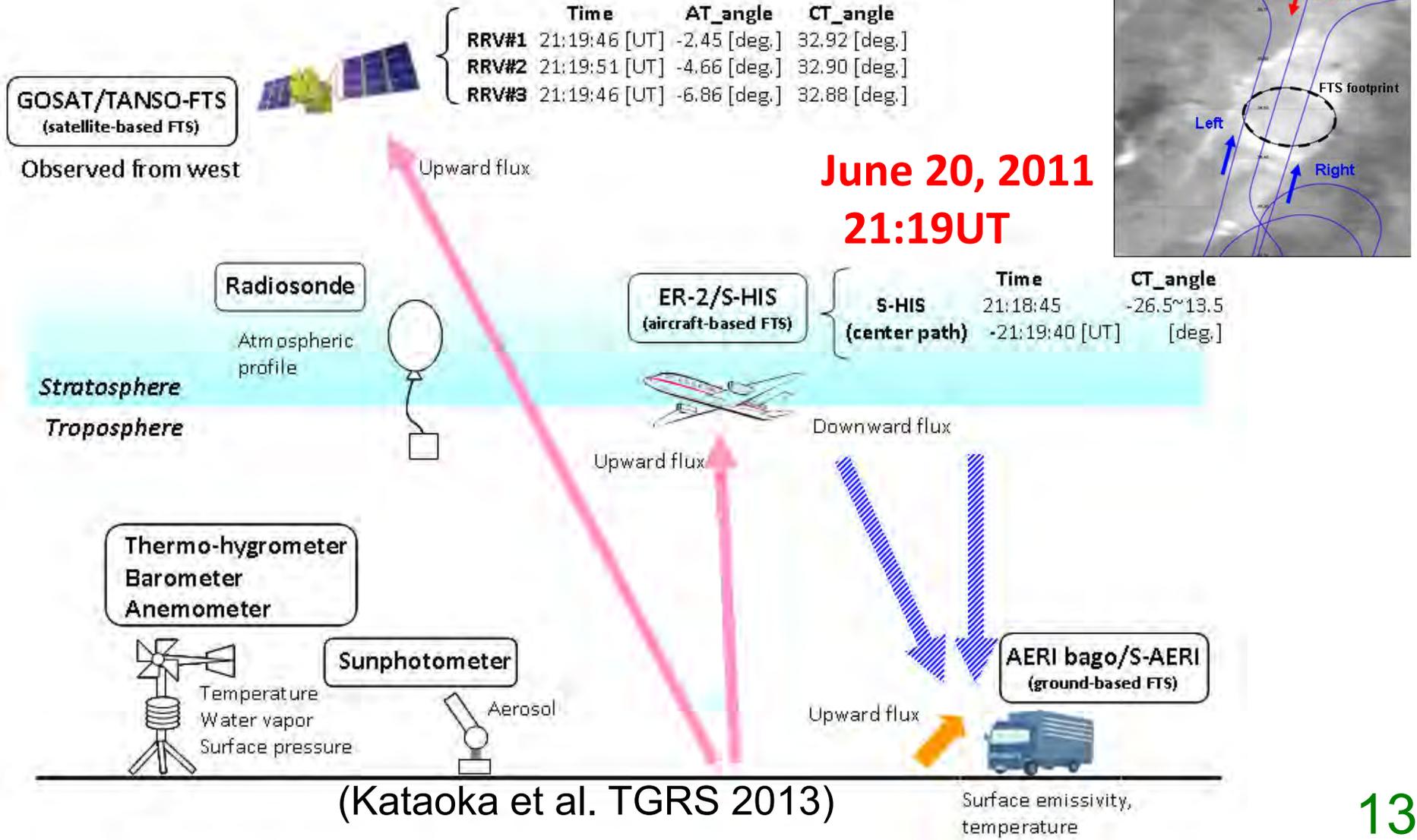
TANSO-CAI
(0.38, 0.67, 0.87, 1.6 μm)



- Radiometric Validation
- TIR

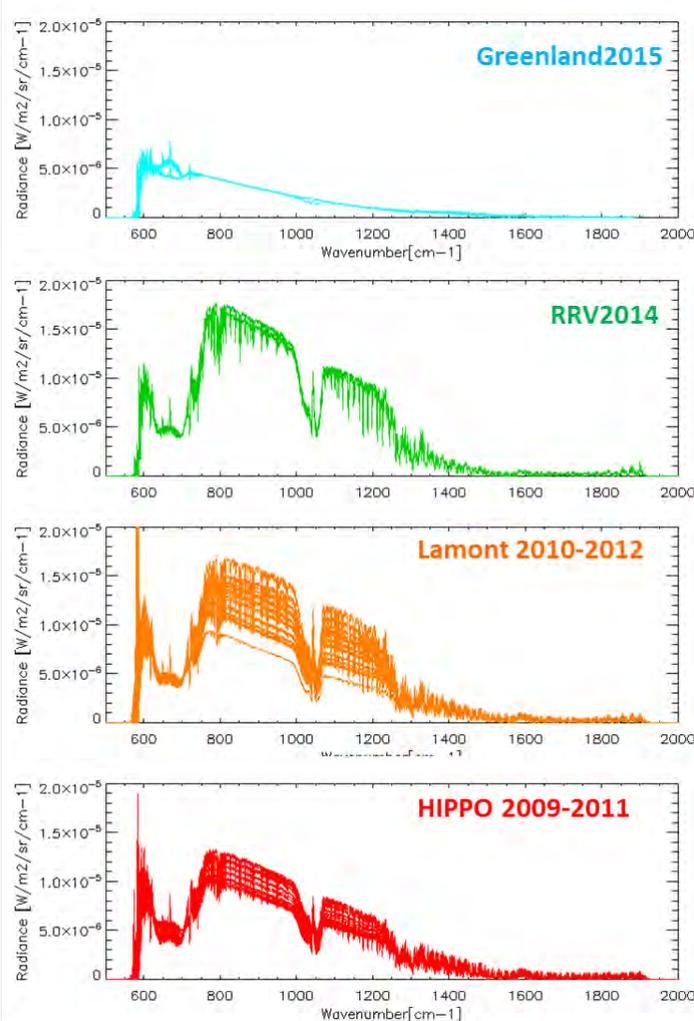
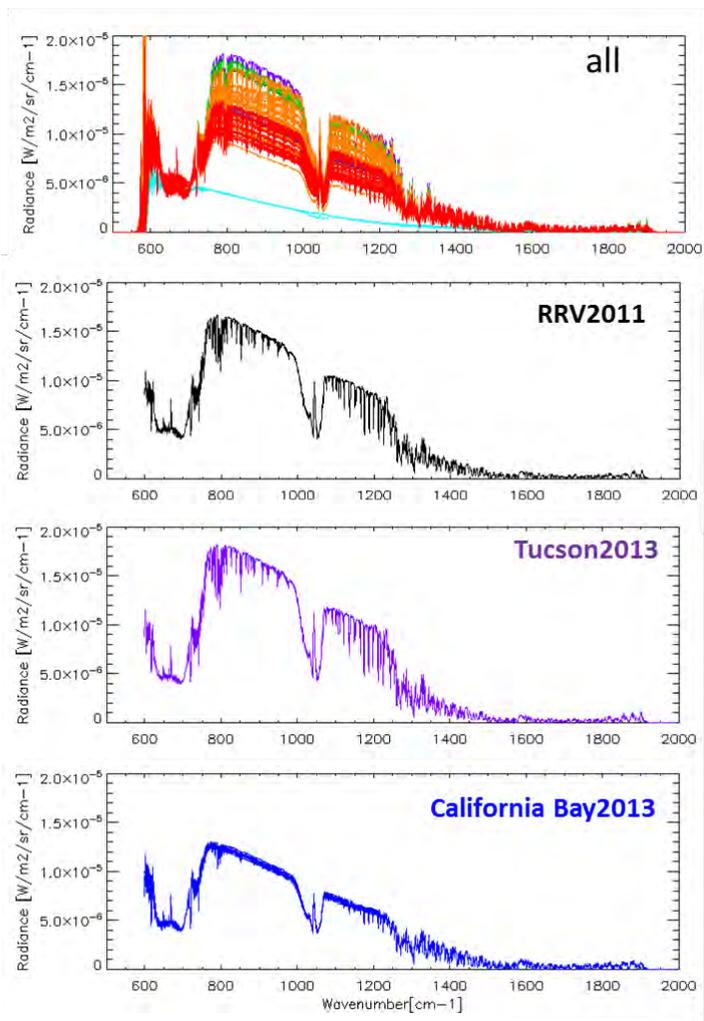


Various Calibration (TIR) Hot Land target over the land (high temperature)

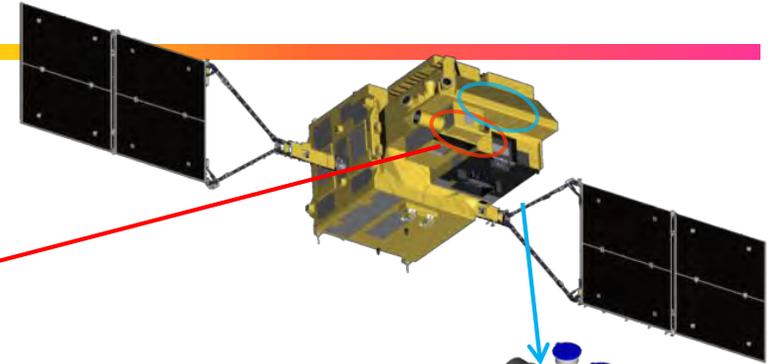




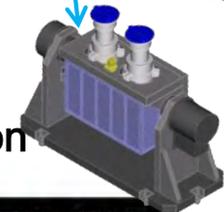
GOSAT data that are compared to Simulation with HIPPO and S-HIS data



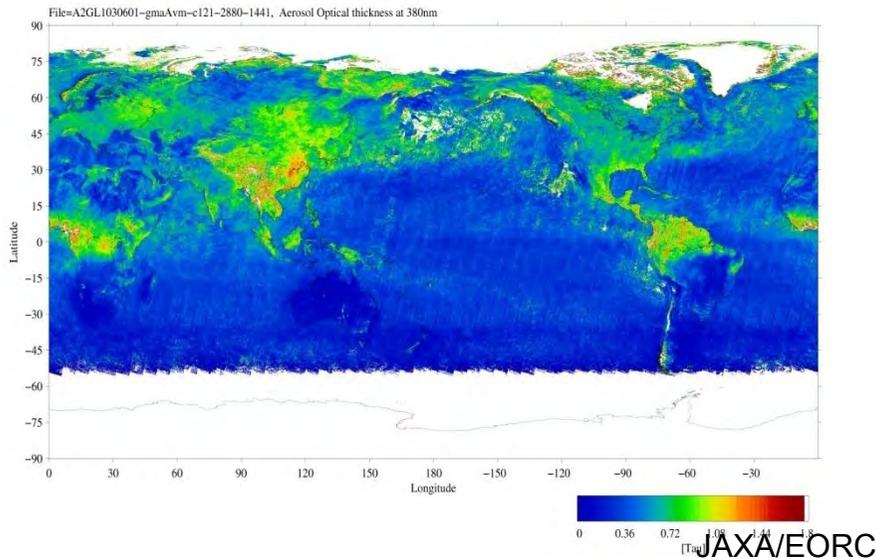
SGLI VNR non-POL telescopes:
380, 412, 443, 490, 530,
565, 673, 763, 868nm



SGLI VNR Polarization telescopes:
673 (pol: IQU), 868nm (IQU)



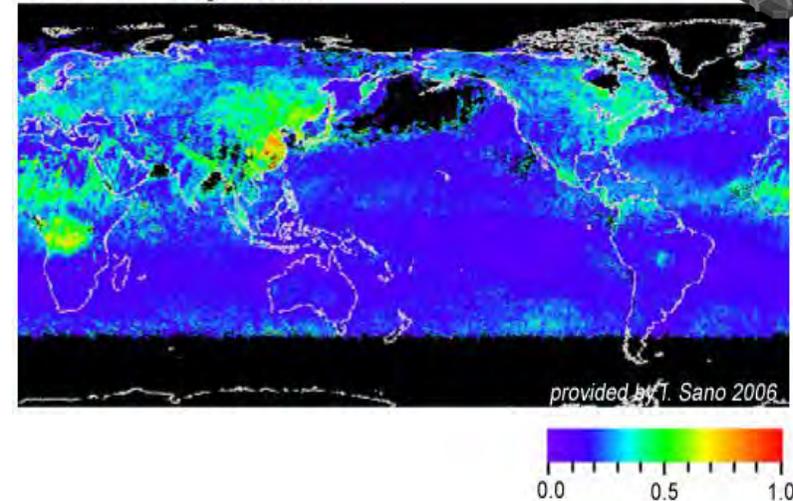
Aerosol estimated by Near-UV



Global aerosol optical thickness in June 2003 using the GLI Near-UV (380nm) channel (NIR is used for the ocean area)

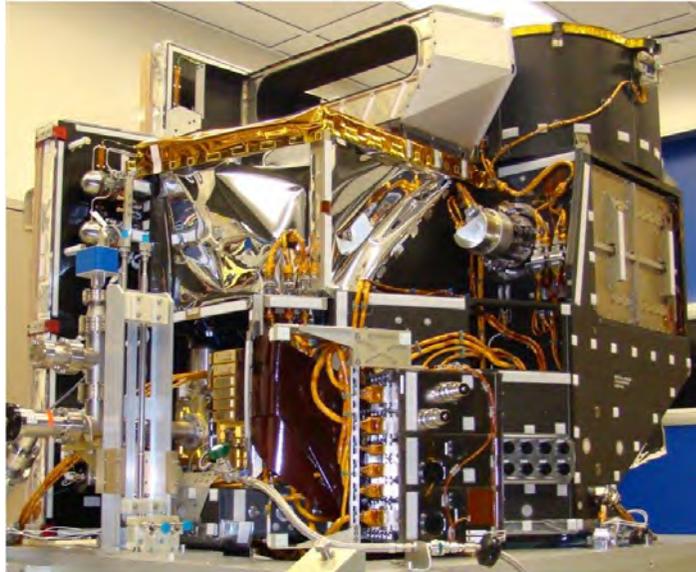
Aerosol estimated by polarization

AOT June 2003 using POLDER-2



Global aerosol optical thickness in June 2003 using POLDER-2 polarization reflectance (provided by T. Sano, Kinki Univ.)

- Geostationary Weather Satellite
 - Himawari 8 and 9

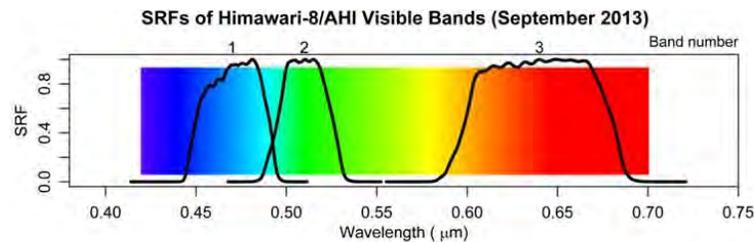


JAM

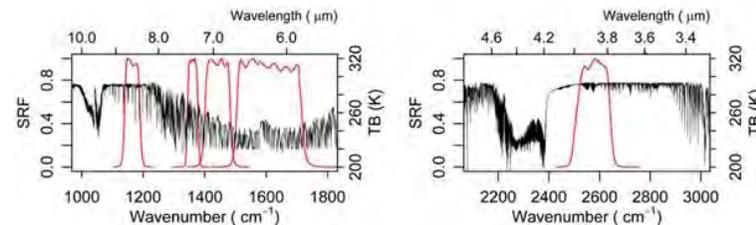
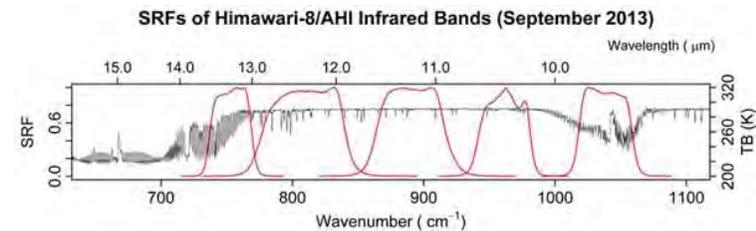
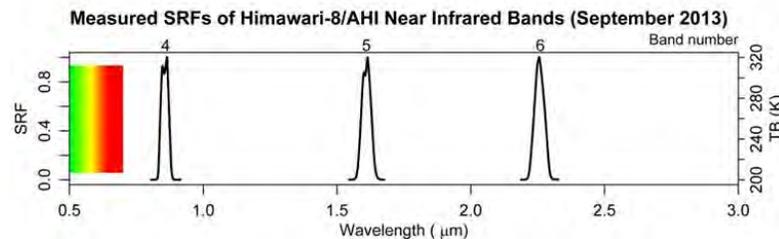
[JMA homepage](#)

Asia Air quality monitor

area	Band number (see Table 1)	Spatial resolution at SSP (sub satellite point)[km]	Numbers of pixels	
			East-west direction	North-south direction
Full Disk	3	0.5	22,000	22,000
	1,2,4	1	11,000	11,000
	5-16	2	5,500	5,500



RGB VALUES FOR VISIBLE WAVELENGTHS by Dan Bruton (<http://www.physics.sfasu.edu/astro/color/spectra.html>)





Asia Air quality monitor

High resolution (~2km) and frequent data for mega cities in Asia can be provided.
Aerosol thickness and size index.



JAXA Himawari Monitor

P-Tree System

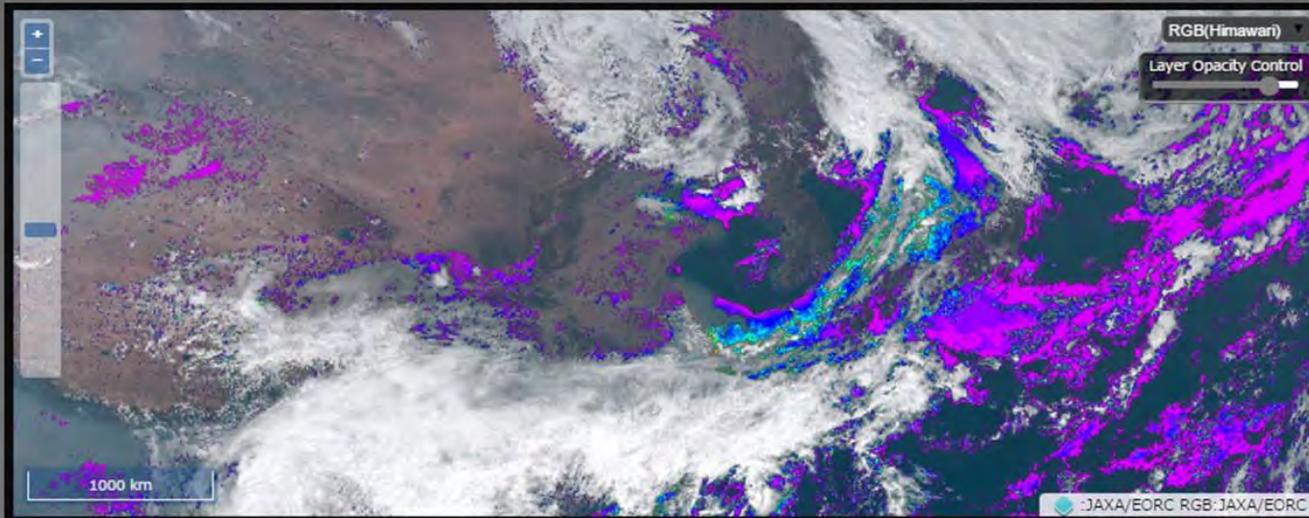
日本語 Last Update: 07 Nov 2015 15:02:02 UTC

Date: 2015 / 10 / 9 4 : 10-19 UTC Search

Prev Latest Image Next

10 min

1 Hour Ave./Integ.



AOT0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

Overlay : Coastline Lat/Lon Major River

Sea Surface Temperature

Aerosol Optical Thickness

Aerosol Angstrom Exponent

Short Wave Radiation

<http://www.eorc.jaxa.jp/ptree/index.html>

Operation and weather forecast: Japan Meteorological Agency

Advanced data analysis (aerosol): JAXA Earth Observation Research Center

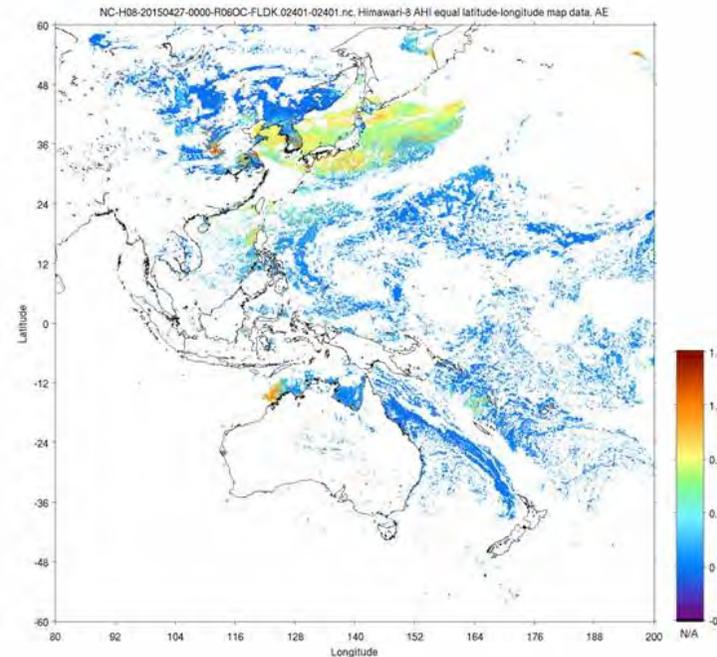
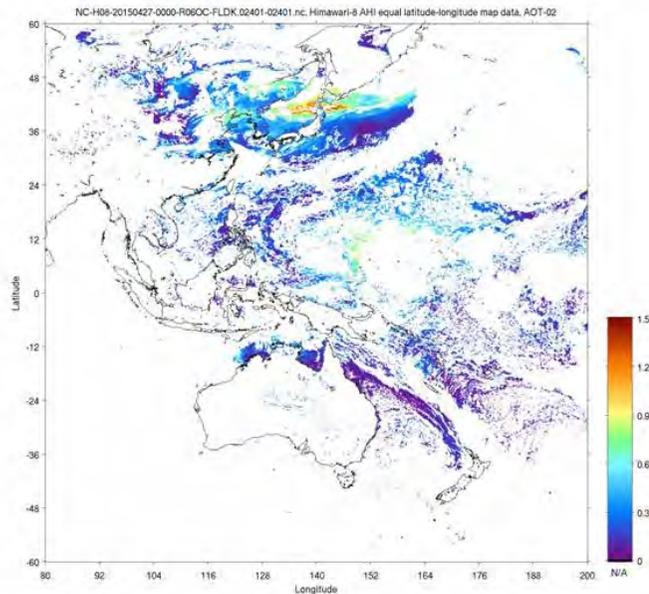


AHI Advance Himawari Imager
 More frequent, more bands (5>16)
 Much higher spatial resolution (1km)



Aerosol optical thickness

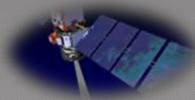
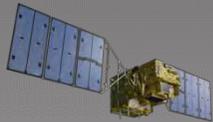
Himawari-8 Aerosols Aerosol angstrom exponent



An example on 27 April 2015

Courtesy of Dr. Murakami

- Every 10 minutes, full disk
- Data available in a day



NEXT CEOS WGCV meeting

EOS WGCV-41 (Sep 7-9) Working Group on Calibration & Validation

CEOS SAR (Sep 5-7) SAR Calibration & Validation sub-group Workshop



The 100th Anniversary Hall at Senju Campus
Tokyo Denki Univ.

5 Senjyu-Asahicho, Adachi-ku, Tokyo 120-8551, Japan