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JAXA's project status update ~ GOSAT ~

Makiko Mukai/ JAXA

Atmospheric Composition Constellation (ACC) Workshop on Air Quality

Overview of “Ibuki”, GOSAT

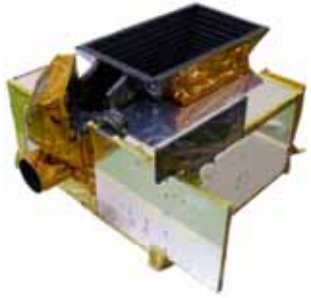
- **The Greenhouse gases Observing SATellite.**
- A satellite to monitor global distribution of Greenhouse Gases (GHG);
  - Carbon dioxide and Methane
  - at 100-1000km spatial scale
  - with relative accuracy of 0.3-1% (1-4ppm) for CO2 and 0.6-2% (10-34ppb) for CH4
- A joint project of
  - JAXA (Japan Aerospace Exploration Agency),
  - MOE (Ministry of the Environment) and
  - NIES (National Institute for Environmental Studies).
- Launched by Japan’s H-IIA launch vehicle on 23rd January 2009

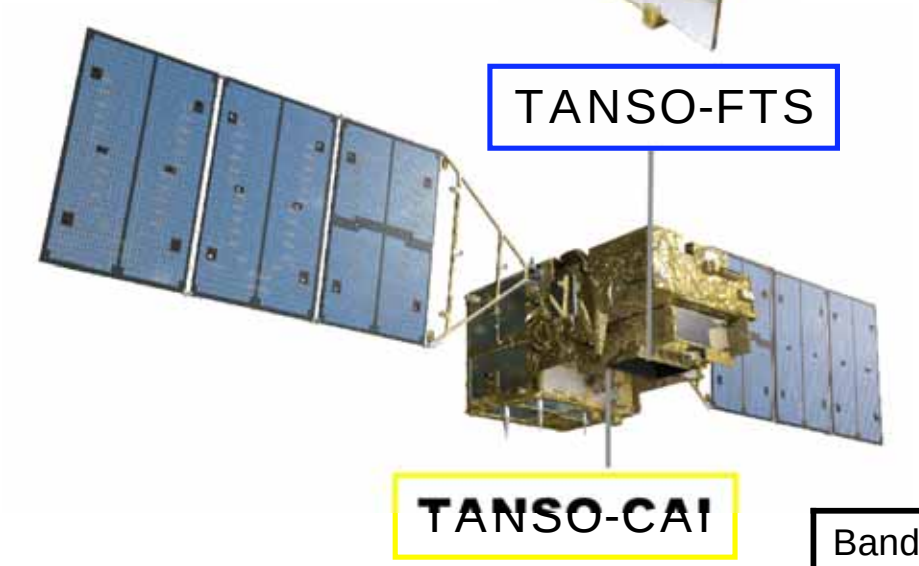
GOSAT flight model

The Launch of the GOS

GOSAT Satellite and Sensors

The measurements of CO_2 and CH_4 is taken with FTS.





TANSO-FTS:
Fourier Transform Spectrometer

Spectral ch	1P, 1S	2P, 2S	3P, 3S	
Obs. band (micron)	0.75-0.78	1.56-1.72	1.92-2.08	5.5-

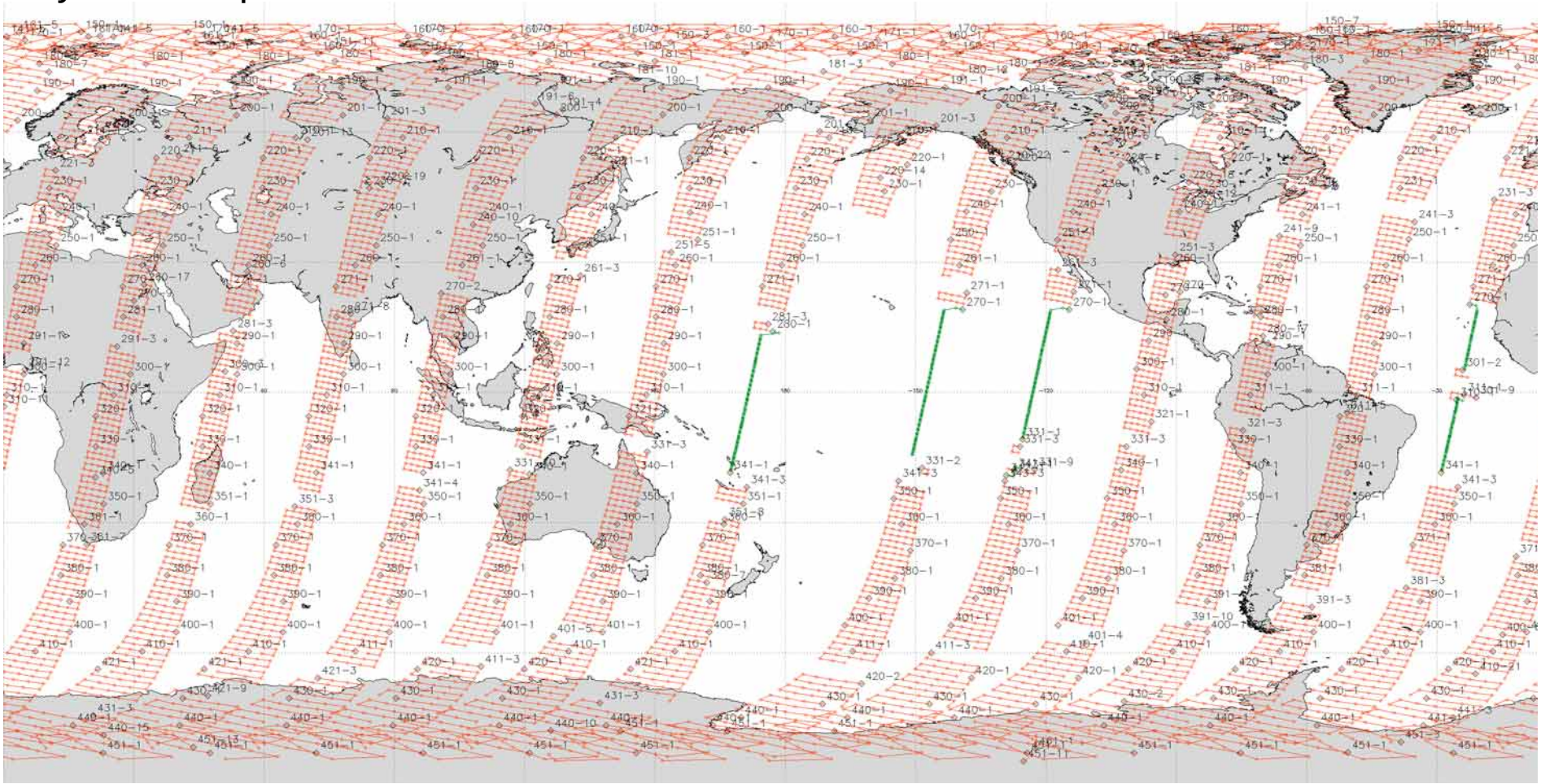
TANSO-CAI:
Cloud and Aerosol Imager

CAI observes clouds and aerosols that would interfere the greenhouse gas measurement.

Band No.	1	2	3	4
Observation Band (nm)	372-387	667-680	866-877	1560-
Center Wavelength (nm)	380	678	870	162

Operation Status
Observation pattern in dayside

Dayside on April 6, 2009

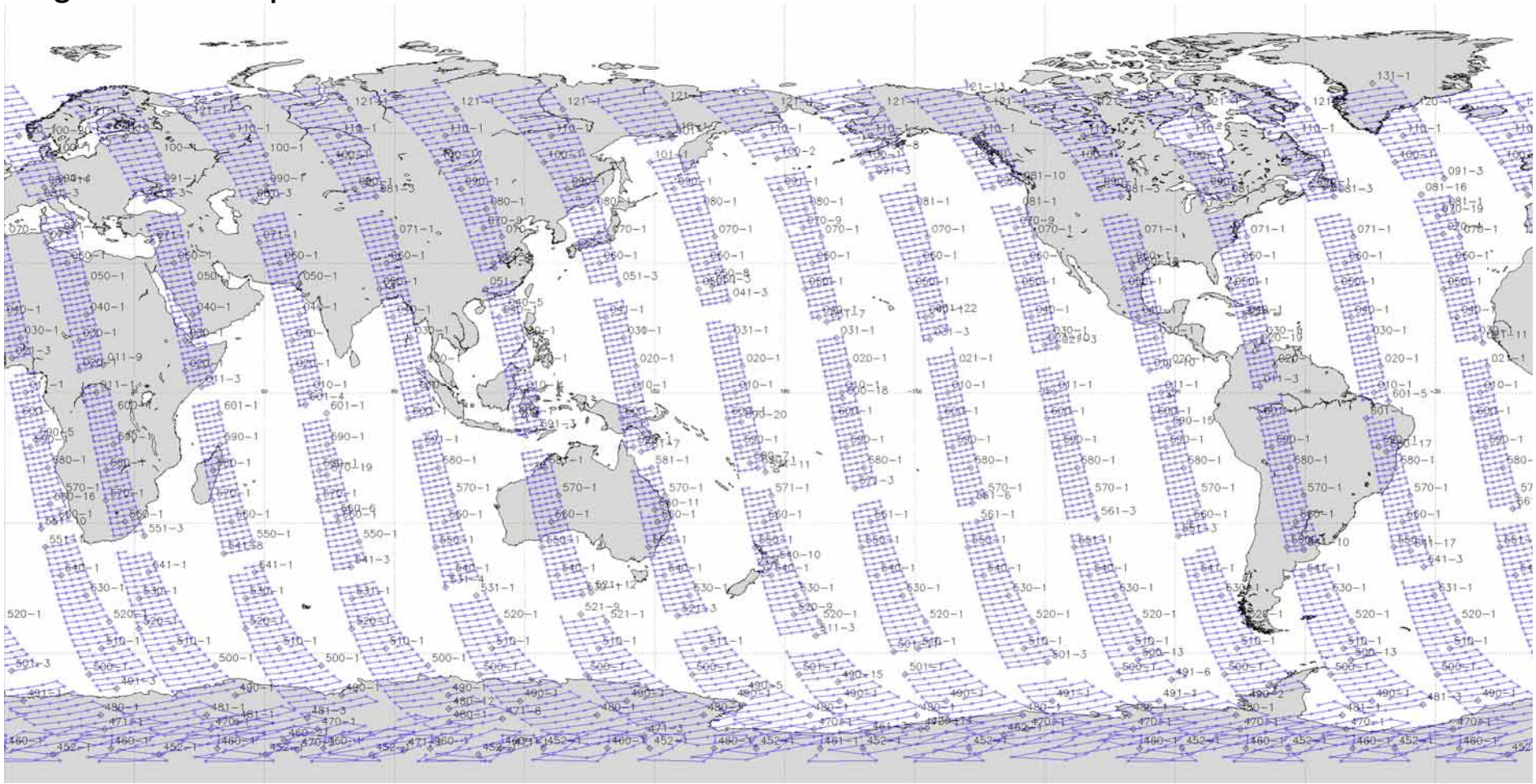


Day observation mode product

Special observation mode product (Sun glint)

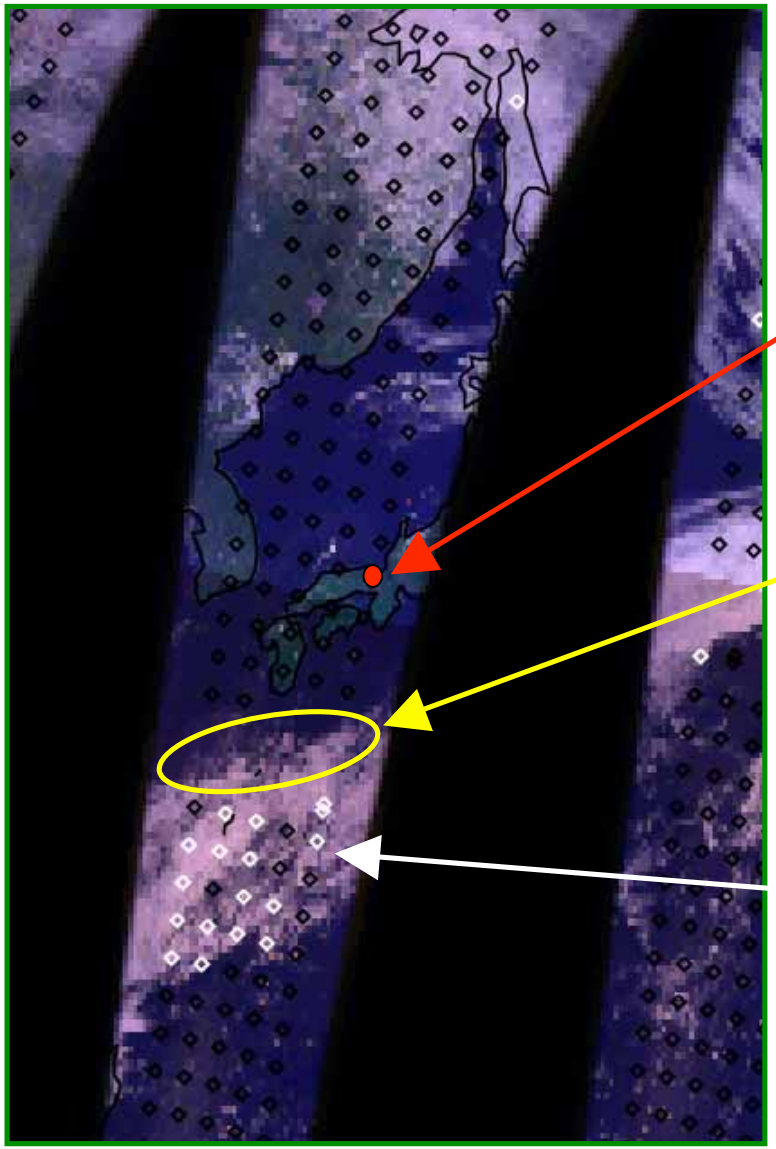
Operation Status
Observation pattern in nightside

Nightside on April 6, 2009



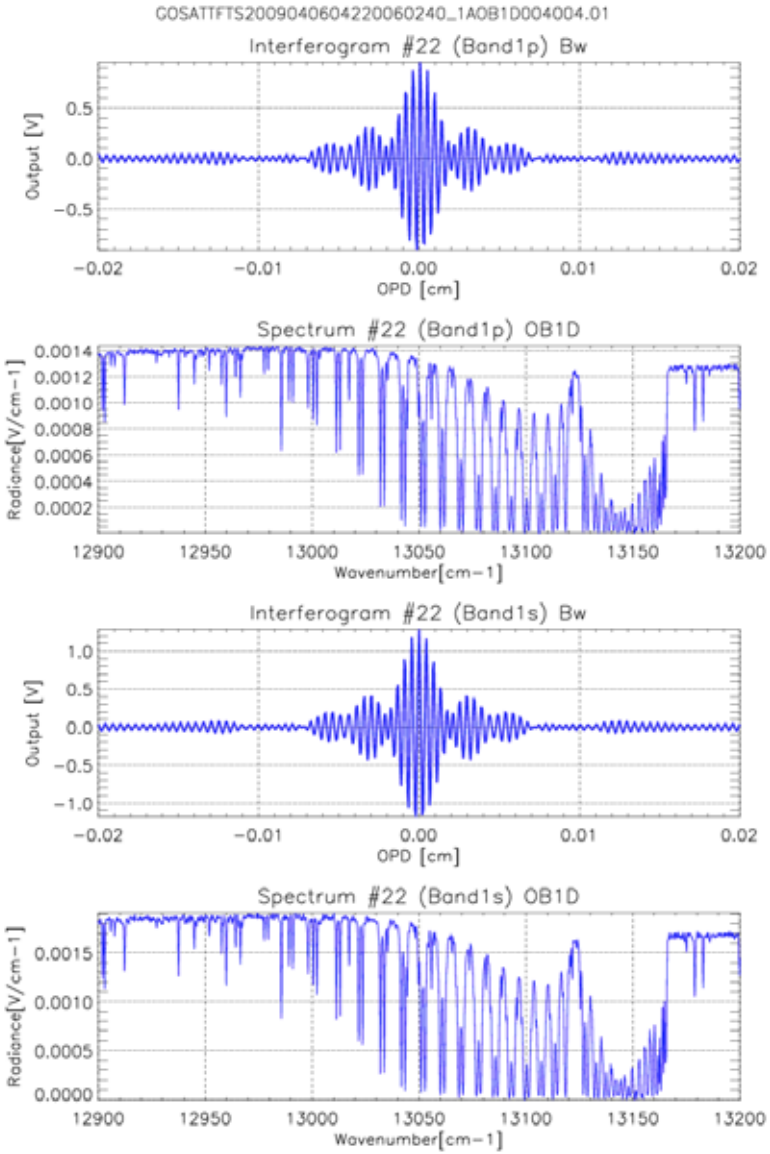
Night observation mode product

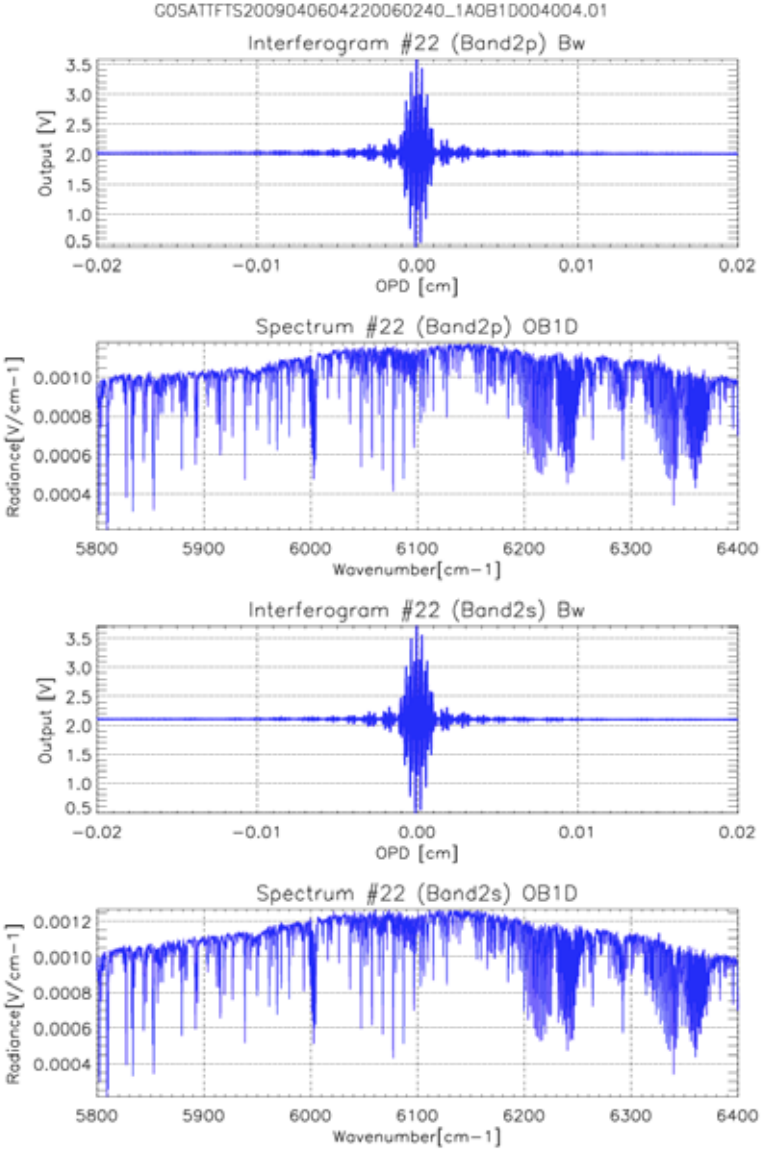
Operation Status
Observation data (1/3)



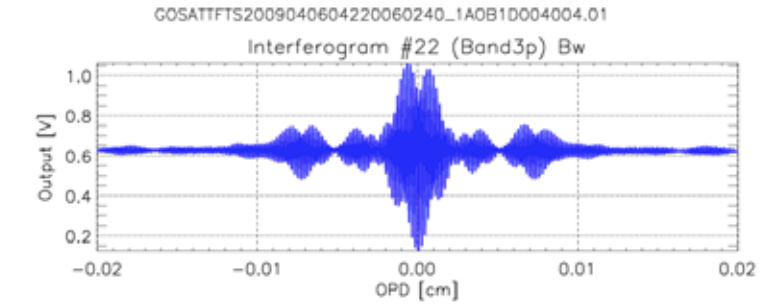
- FTS observation points over CAI imag
  - Simultaneous observation of FTS and CAI
  - Around Japan in Path 6 on April 6, 2009
- Sample IGM / SPC (red circle->*next pa*
  - Land observation over Japan
  - Cloud free
- Calibration (blank)
  - Blackbody and deep space are acquired 4 times respectively.
  - It is acquired 8 sets in 1 orbit.
- Saturation (white circle)
  - Only B2P/S H gain data is saturated at clo observation with high reflectivity over 0.3 c albedo.

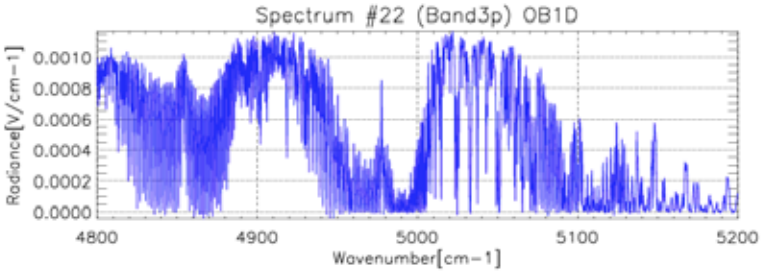
Operation Status
Observation data (2/3)

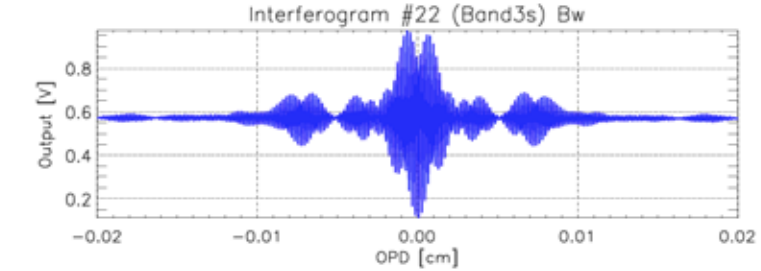


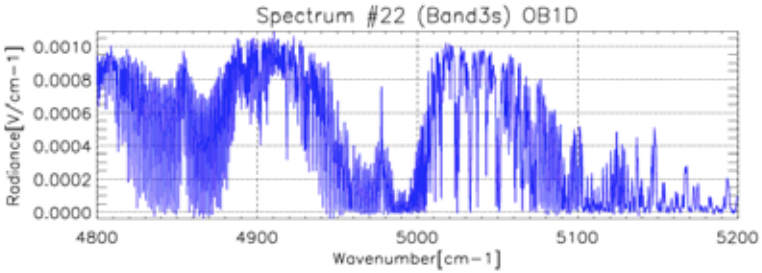


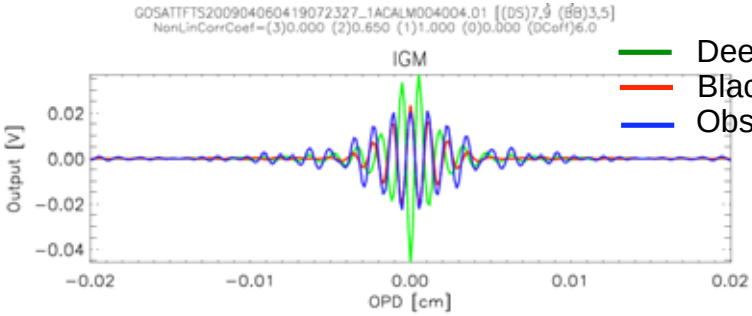
Operation Status
Observation data (3/3)

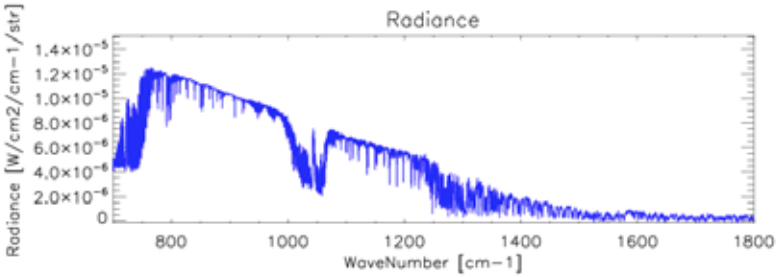


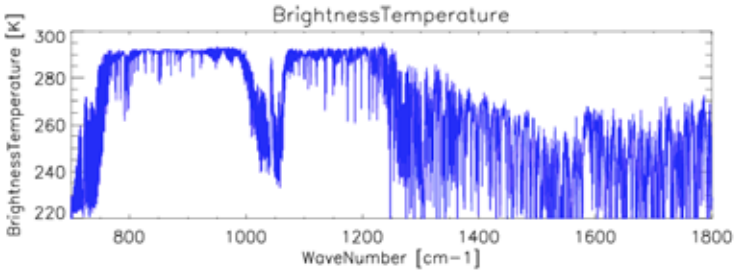












- GOSAT was launched on January 23, 2009.
- First lights were acquired successfully on February 7 for FTS SWIR bands and CAI, and on March 11 for FTS TIR band.
- Initial functional verification was completed on April 10.
- Initial calibration and validation phase has been started and continues in 3 months.

- GOSAT Level 1 ground system is processed the TANSO-FTS and CAI Level 1 products in operation.
  - Initial check-out phase is completed on April 10 in 3 months after the launch.
  - The preliminary checked un-calibrated data is provided to NIES L2 processing system and GOSAT PIs for limited calibration / validation / algorithm use from April 27.

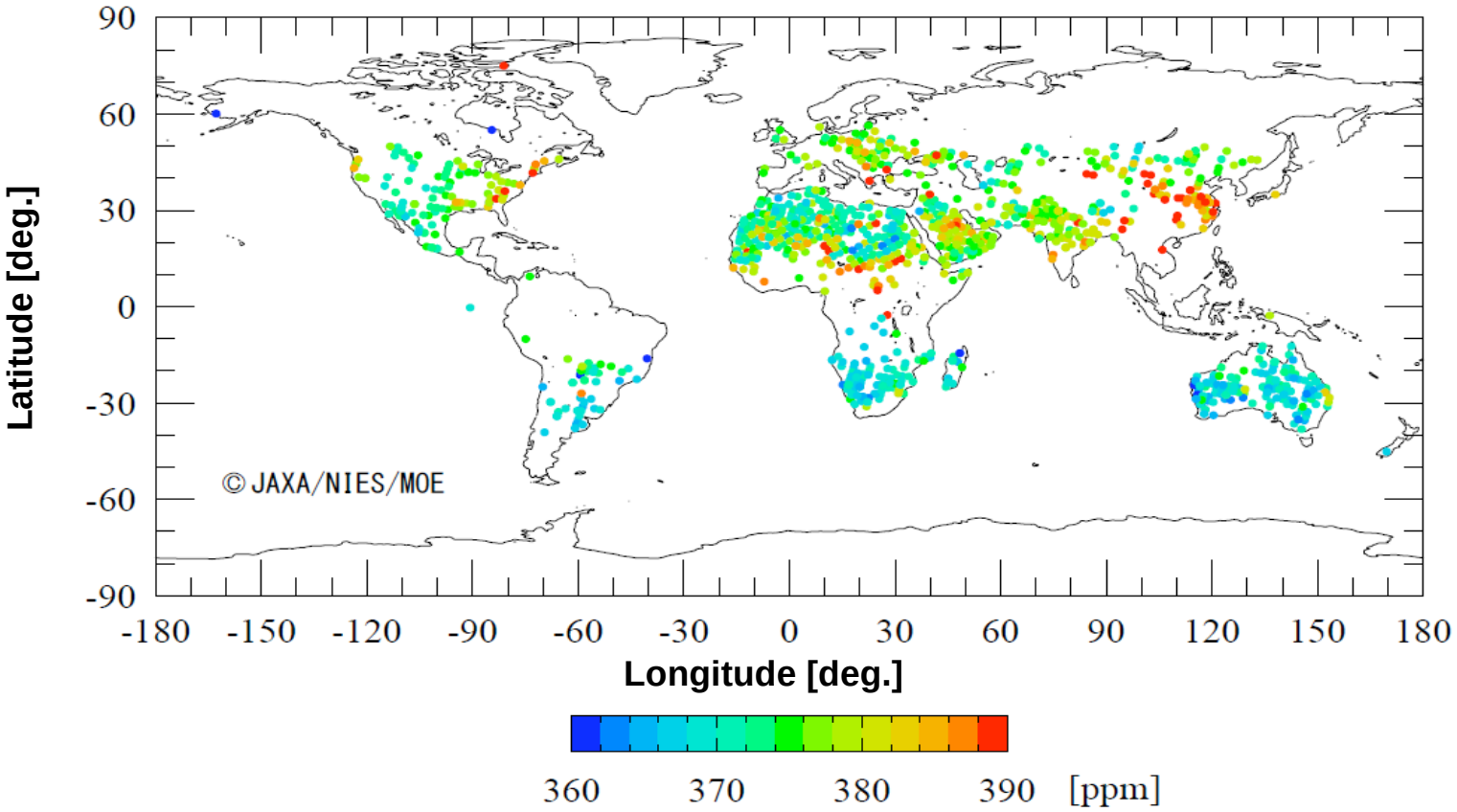
- GOSAT Level 1 products will be improved after the initial calibration and validation phase (till July 23).
  - The checked calibrated data will be provided to NIES and PIs.
  - Radiometric, geometric, and spectral accuracies will be evaluated after the initial calibration results.

Initial Analysis of Observation Data

An Initial analysis of carbon dioxide and methane concentrations wa
recently obtained for clear-sky scenes over land.

Carbon dioxide initial analysis

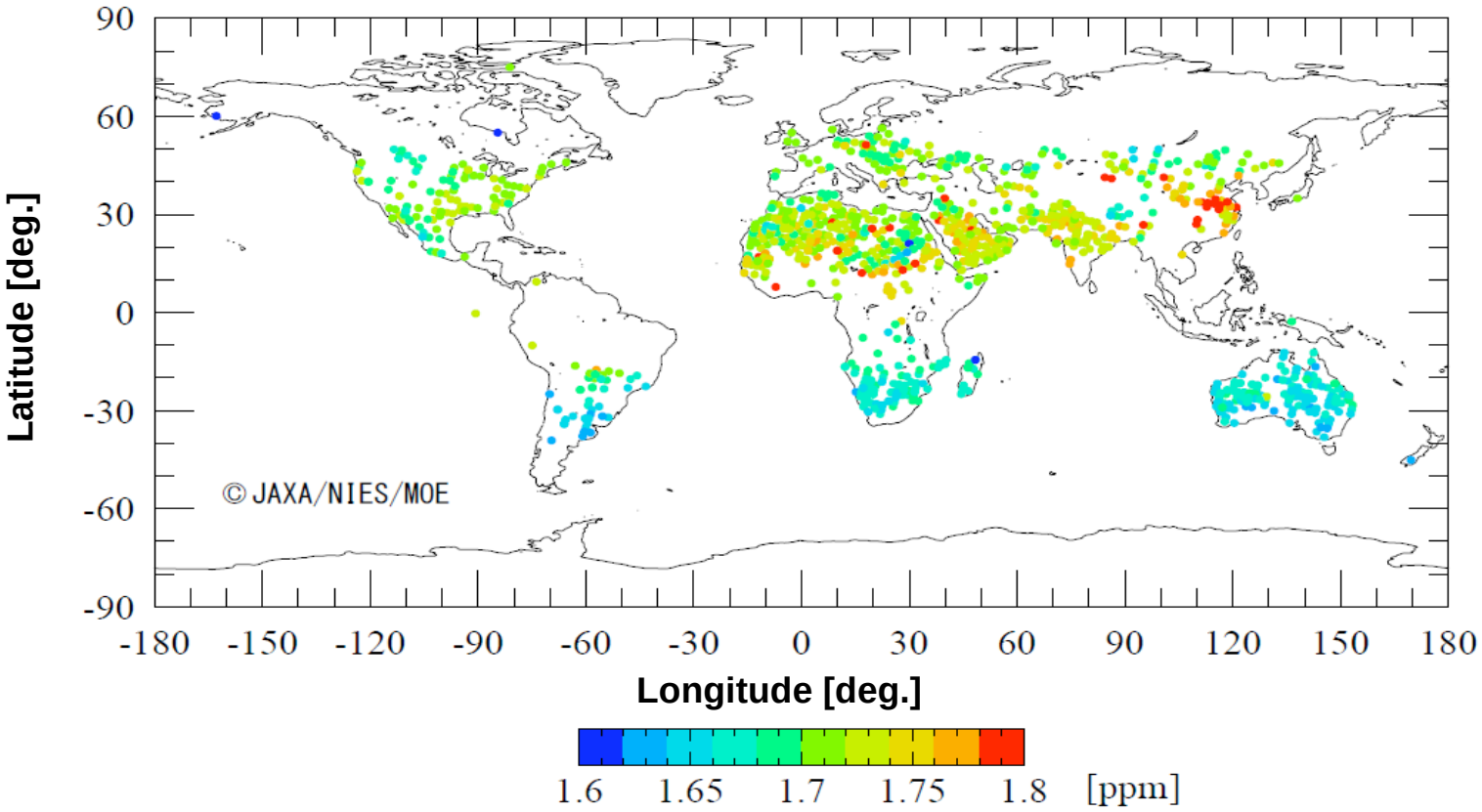
from GOSAT data (April 20-28 observation data)



XCO_2 (Column averaged dry air mole fraction) (uncalibrated data)

Methane initial analysis

from GOSAT data (April 20-28 observation data)



XCH_4 (Column averaged dry air mole fraction) (uncalibrated data)

- Data shows a hemispheric gradient, with larger values over the Northern Hemisphere, consistent with other measurements.
- Derived values are generally lower than model predictions.
  - Due to the analysis involving un-calibrated radiance spectrum data.
  - Due to the parameter adjustment for the analysis method not being finalized.

- In the future, after further calibration and validation of the data, observation data and corresponding analyzed products will be made available to registered users from the general public.

GOSAT Standard Products

Level	Sensor	Product name	Contents	Unit	Format
L1B	FTS	FTS L1B data	FTS spectral radiance	FTS scene	HDF5
L1B	CAI	CAI L1B data	CAI radiance	CAI frame	HDF5
L1B+	CAI	CAI L1B+ data	CAI radiance	CAI frame	HDF5
L2	FTS SWIR	L2 CO2 column amount(SWIR)	CO2 column amount	Any(on-demand)	HDF5
L2	FTS SWIR	L2 CH4 column amount(SWIR)	CH4 column amount	Any(on-demand)	HDF5
L2	FTS TIR	L2 CO2 pofile(TIR)	CO2 vertical concentration profile	Any(on-demand)	HDF5
L2	FTS TIR	L2 CH4 profile(TIR)	CH4 vertical concentration profile	Any(on-demand)	HDF5
L2	CAI	L2 cloud flag	Clear sky reliability	CAI frame	HDF5
L3	FTS SWIR	L3 global CO2 column amount(SWIR)	Average CO2 column amount	Global	HDF5
L3	FTS SWIR	L3 global CH4 column amount(SWIR)	Average CH4 column amount	Global	HDF5
L3	FTS TIR	L3 global CO2 distribution(TIR)	Altitude-average CO2 concentration	Global	HDF5
L3	FTS TIR	L3 global CH4 distribution(TIR)	Altitude-average CH4 concentration	Global	HDF5
L3	CAI	L3 global radiance (all pixels)	CAI radiance of 3-day average (all pixels)	Global	HDF5
L3	CAI	L3 global radiance (clear sky)	CAI radiance of 3-day average (clear sky)	Global	HDF5
L3	CAI	L3 global NDVI	Vegetation index	Global	HDF5
L4A	FTS	L4 global CO2 flux	Area CO2 source and sink (annually)	64 locations	text
L4A	FTS			Area information	
L4B	FTS	L4 global CO2 distribution	CO2 concentration (monthly)	Global 2.5deg mesh	NetCDF

GOSAT Research Products

Level	Sensor	Product name	Contents	Unit	Format
L2	FTS SWIR	L2 H2O column amount(SWIR)	H2O column amount	Any(on-demand)	HDF5
	FTS TIR	L2 CO2 column amount(TIR)	CO2 column amount	Any(on-demand)	HDF5
	FTS TIR	L2 CH4 column amount(TIR)	CH4 column amount	Any(on-demand)	HDF5
	FTS TIR	L2 H2O column amount(TIR)	H2O column amount	Any(on-demand)	HDF5
	FTS TIR	L2 H2O profile(TIR)	H2O vertical concentration profile	Any(on-demand)	HDF5
	FTS TIR	L2 Temperature profile(TIR)	Vertical temparatureprofile	Any(on-demand)	HDF5
	CAI	L2 aerosol property	Aerosol optical thickness	CAI farame	HDF5
	CAI	L2 cloud property	Cloud optical thickness	CAI farame	HDF5
L3	CAI	L3 global aerosol property	Global aerosol optical thickness(avegrage)	Global	HDF5
	CAI	L3 global cloud property	Global cloud optical thickness(avegrage)	Global	HDF5
L4A	FTS	L4 global CH4 flux	Area CH4 source and sink (annually)	64 locations	text
	FTS			Area information	
L4B	FTS	L4 global CH4 distribution	CH4 concentration (monthly)	Global 2.5deg mesh	NetCDF

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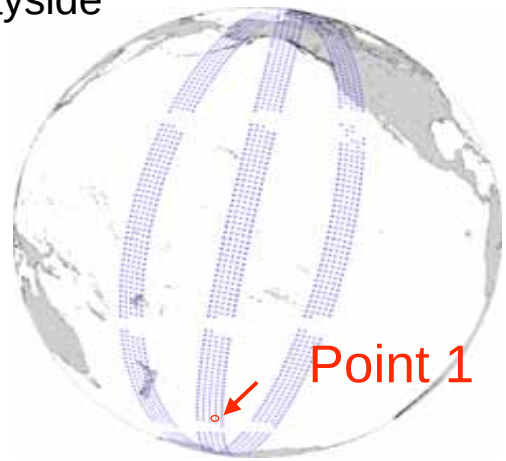
Retrieval of Ozone from GOSAT/TANSO-FTS TIR band

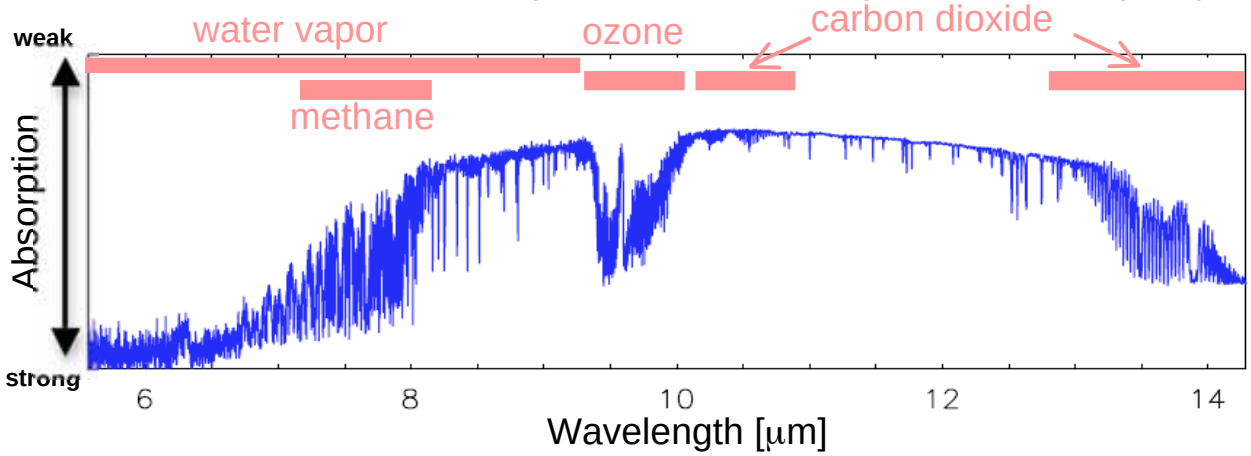
Spectra from TANSO-FTS TIR Observation Data

both Dayside and Nightside on March 12, 2009

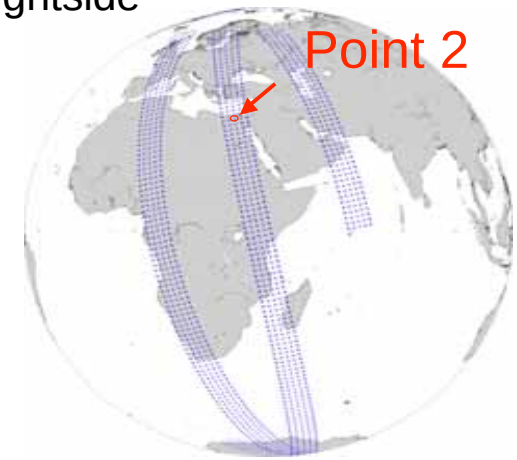
Dayside



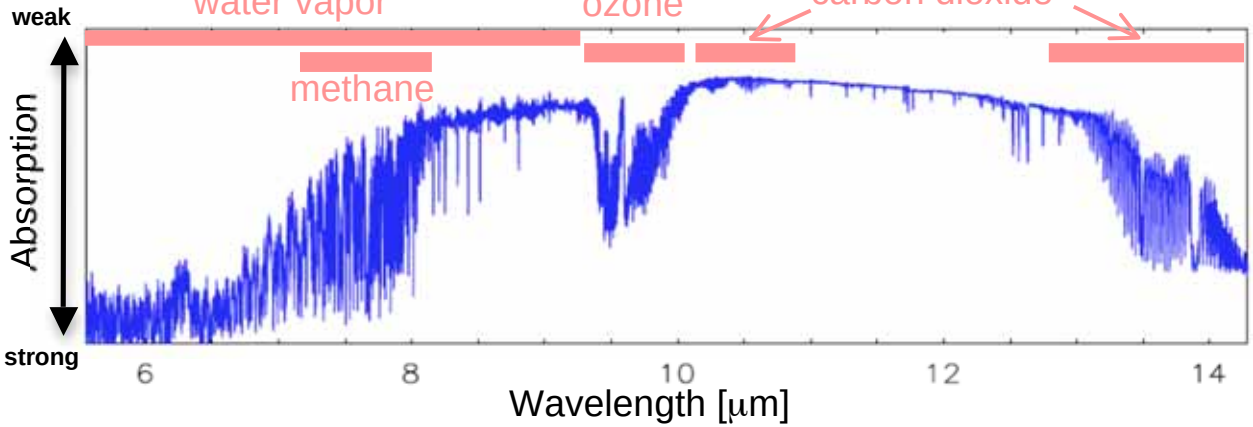
Point 1: Pacific Ocean (S57.45 , W168.47) at 8:23 a.m. (JST)



Nightside

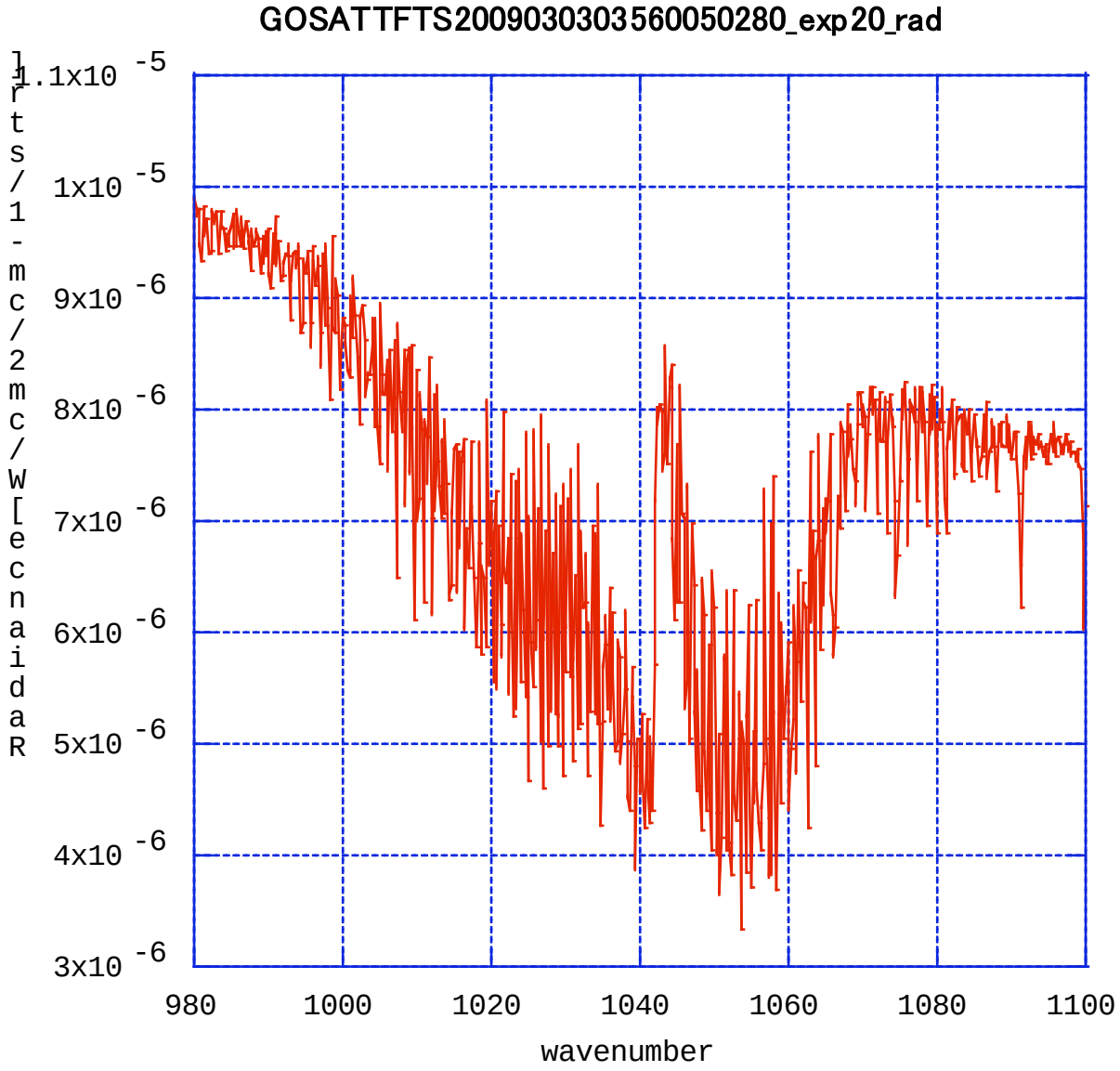


Point 2: Egypt (N29.97 , E30.94) at 7:26 a.m. (JST)



* Red bar shows gas absorption bands.

TANSO-FTS (TIR)
Ozone at 9.6um



Ozone column from GOSAT/TANSO-FTS TIR band

- Pre-Research product (Ozone)
  - Column of Tropospheric ozone
    - Waveband: 9.6micron
    - Spatial resolution: (L2) 158kmx158km (TDB)
    - Vertical resolution: 2 or 3 layers in the troposphere
    - Accuracy: 20%
- Algorithm
  - MAP (Maximum A posteriori) method
    - Atmospheric profile: ECMWF- ERA40
    - Surface coverage: MODIS
    - Surface emissivity: ASTER spectral library
- The first version will be released to limited users nine months from the launch.

GOSAT Data Researches

- 1st Research Announcement
  - 5 categories:
    - Calibration, Validation, Algorithm -> RA* users
    - Model, Data application -> RA+ users
  - 52 research proposals were selected.
  - GOSAT L1 preliminary checked products, such as FTS L1B, CAI L1B and L1B+, have been started to provide to RA* users on April 23.
  - GOSAT L2 preliminary checked products will be provided from 4 months after the launch.
- 2nd Research Announcement
  - Release of RA: April 7, 2009
  - Due date for proposal submission:
    - RA* users: June 8, 2009
    - RA+ users: June 23, 2009

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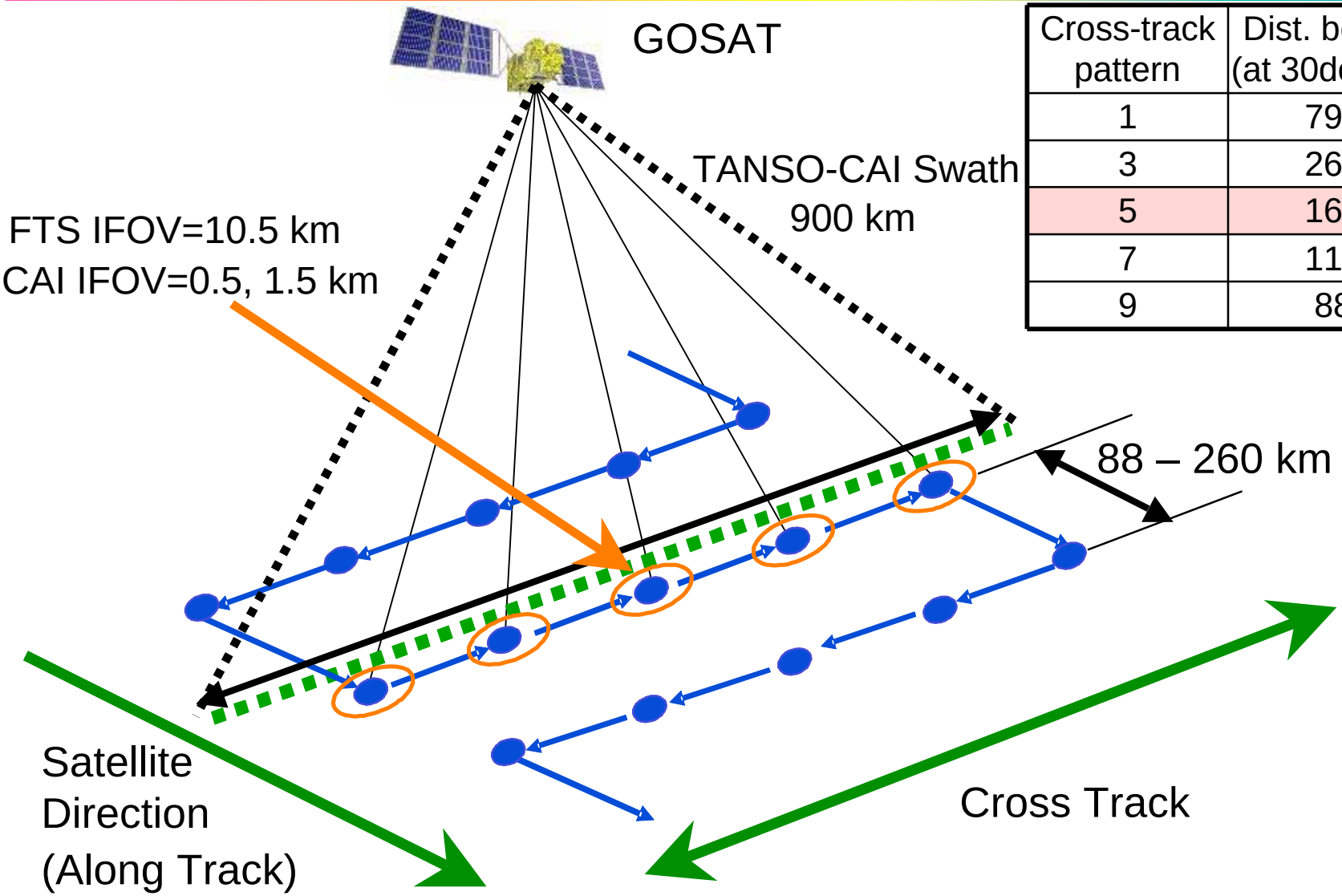
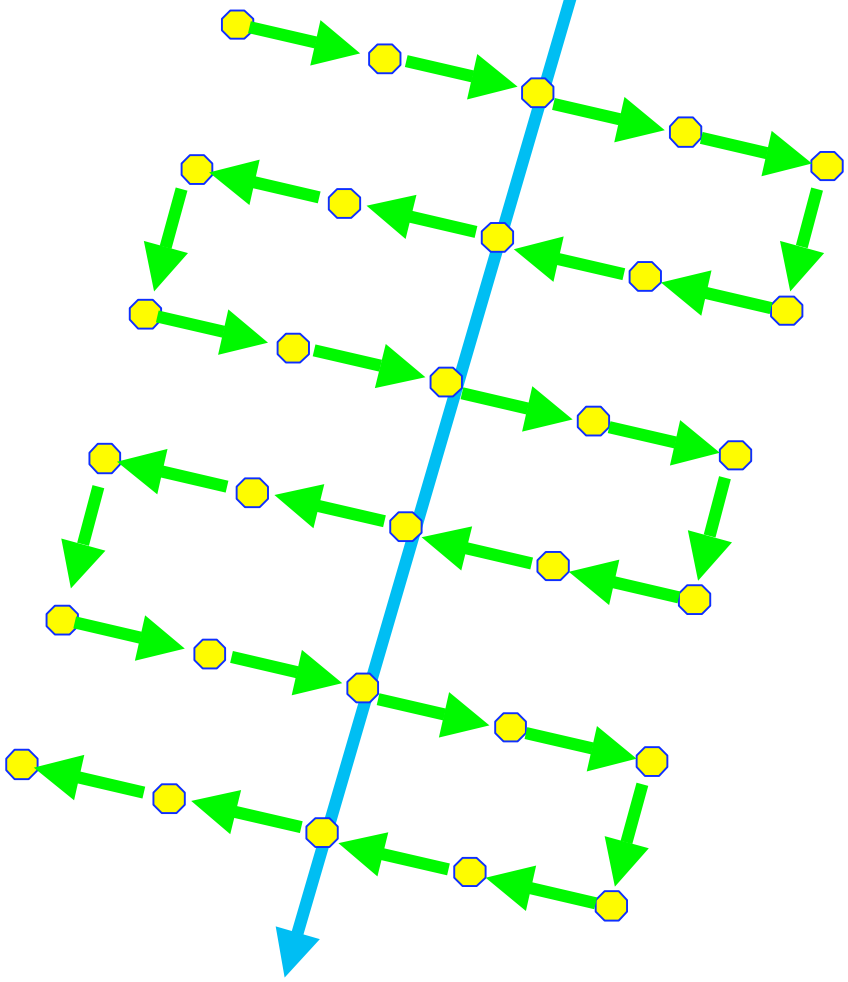
TASNO Operation
Pointing and footprints

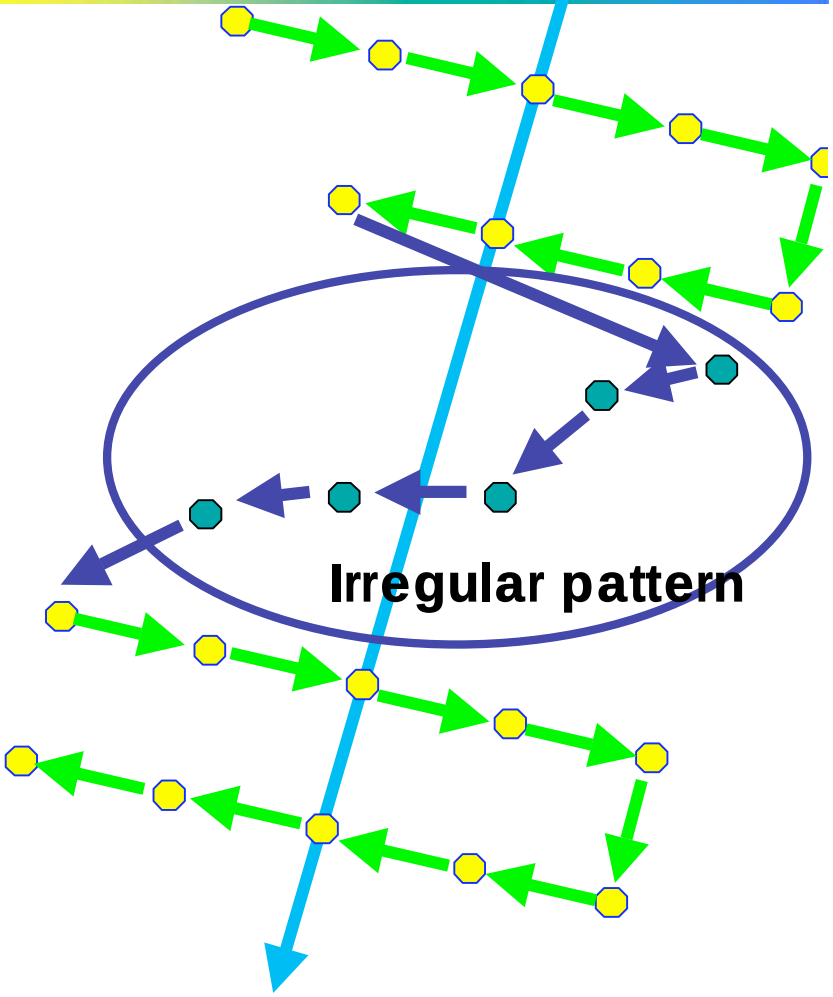


Cross-track pattern	Dist. bet. points (at 30deg in lat)	Ex (s
1	790 km	4
3	260 km	4
5	160 km	
7	110 km	
9	88 km	

Observation Pattern



Regular Observation Pattern
(5 points in the cross-track direction)



Specific Points
Observation Pattern