GOSAT
(Greenhouse gases Observing SATellite)
(IBUKI: breath in Japanese)

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(A) GOSAT ; present stage
(a) Pointing mechanism : target mode operation
(b) Spectral analysis ; 2D-CH₄ distribution
(c) Some examples ; India and China
(B) Three Steps for Monitoring of CH₄
(a) GOSAT data
(b) Remote sensing observation from Aircraft
(c) Ground measurement
GOSAT was launched from Tanegashima (Launch Site) by H2-A rocket on 23rd January 2009.
GOSAT observes the column amount of CO$_2$ and Methane. Column amount = total amount of gas from surface to space. Not the concentration itself.
April 23, 2009
Japan area

Clear sky

Cloud
Cloud coverage in July, 2002

Nine days clear sky data points in April, 2009
Observed and Simulated Spectrum of CH$_4$
Nine days composite of CH$_4$ column concentration in April, 2009
The conversion of monsoon wind climbing along Himalaya makes the column amount high collecting the emitted GHG along the course.
How to apply GOSAT data to the pipeline / gas-mining sites?
Foot prints in normal observation mode

cross track patters
(normally 5 points)
4 seconds/spectrum

160 km

Satellite Direction
(along track)

GOSAT

Pointing Mechanism

GPS receiver

GPS

Star Tracker

Cross track
Operational 5-points mode to Target mode
### Three Steps Monitoring of CH$_4$

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- **GOSAT**
- **Sky-ship**
- **Inside Station**
- **Satellite**
- **Sky-ship+ Thermal viewer (or Lidar)**
- **Thermal viewer**
- **Continuous Monitoring**
- **On demand.**
- **Planning of Rehabilitation**
- **10~1.000km**
- **10~100 m**
- **Pin Point**

\[ F_{\text{total}} = \int C(h,x) v(h,x) \, dx \, dh \]
Leak rate from a composite source

\[ F_{\text{total}} = \int C(h,x) \, v(h,x) \, dx \, dh \]

\( C \) : Methane concentration at \((h,x)\)

\( v \) : Wind velocity at \((h,x)\)
**Lidar observation from Aircraft**

- Column CH$_4$ Conc.
- Horizontal distance across the plume
**Possible performance**

- **Target:** CO₂ (at 400 ppm)
- **Distance between LIDAR and Target:** 1 km
- **Averaging period:** 32 sec
- **Precision:** 4 ppm (1% of background concentration)

*Example of field observation*

*Photo of CO₂ system*

*Variation of CO₂ concentration observed by our DIAL system*

*Night-time accumulation*

*Photosynthesis*
Possible usage of GOSAT data

• The data is stored in a memory system, and down-linked at Norway and Japan only.

• FTS L1A data is processed together with the housekeeping data, and converted to L1B data (spectra) in a day by JAXA, which are transferred to NIES, and distributed to users.

• NIES convert them to L2 data (concentrations) in a week, using aerosol and cloud data from GOSAT TANSO-CAI and aerosol model, and concentration from model as the initial guess.

• We can obtain the concentration pattern rather than the concentration by a quick-view analysis.
Data Policy

1. Data is fully open and free of charge in R&D.

2. In order to access to the data in early stage, it is recommended to apply to the Research Announcement (RA).

3. Special Targeting Operation can be requested by the RA users only.

4. Above items are applied as long as it is the R/D stage. Profitable application is requested to compensate the cost necessary to handle the data set.
The detectable leak rate is about 10 tCH₄/day. (assuming averaged 5 m/hr winds)
The spatial resolution is 10 km or more.
One observation per three days if clear days continue.

Local Observation
Summary

• GOSAT was launched successfully.
• The quality of SWIR(NIR) bands spectra are excellent.
• The retrieved concentration patterns are reasonable for clear sky data.
• We hope GOSAT data would widely contribute to reduce the GHG emission.