

# IASI AND GOSAT RETRIEVALS IN THE THERMAL INFRARED : CASE STUDY FOR SURFACE TEMPERATURE COMPARISONS

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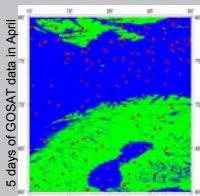
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## I – Motivation for retrieval of GOSAT data in B4 band

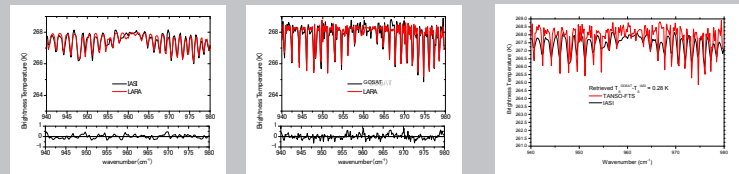
- Periods of no-observation (sun too low, clouds) hamper the estimation of the annual carbon budget from GOSAT alone
- TIR spectra of TANSO-FTS have not yet been used extensively as compared to SWIR spectra
- Potential of TIR has to be explored, especially in view of the TIR/SWIR synergy
- Diurnal variation (day/night) of XCO<sub>2</sub> and XCH<sub>4</sub> could be sampled with TIR retrievals
- But the actual data quality and retrieval accuracy of measurements from TIR have to be further investigated  
→ Compare IASI and GOSAT results in coincidence

## II – Method and Strategy

- Both IASI and TANSO-FTS perform measurements in the TIR:
  - B4 [700 – 1800 cm<sup>-1</sup>] band of GOSAT (*de facto* only to 1400 cm<sup>-1</sup>)
  - B1 [645 – 1210 cm<sup>-1</sup>] and B2 [1210 – 2000 cm<sup>-1</sup>] bands of IASI
- Not SNO (simultaneous nadir observations) as for IASI/AIRS
- Good coincidences (space and time) near the poles (orbit crossing)
- IASI is considered as a reference for radiometric calibration of other instruments. The radiometric calibration of TANSO-FTS is still to be assessed
- But IASI and TANSO-FTS have different instrumental noise and spectral resolution  
→ direct comparison of radiances not directly feasible
- Solution : retrieve surface temperature from coincident IASI and GOSAT for comparison
- Window chosen for this study : [940;980] cm<sup>-1</sup> window for CO<sub>2</sub> (laser band), [1240;1320] cm<sup>-1</sup> for CH<sub>4</sub>, [1140;1200] cm<sup>-1</sup> for N<sub>2</sub>O, and [980;1100] cm<sup>-1</sup> for O<sub>3</sub>  
→ obtain CO<sub>2</sub>, O<sub>3</sub>, N<sub>2</sub>O and CH<sub>4</sub> as a by-product
- 3 Periods/scenarios chosen:
  - April 2010 during a CNES balloon campaign from ESRANGE/KIRUNA (Sweden) i.e. in **cold conditions** and **low sun** in Northern Scandinavia (for TANSO-FTS SWIR/NIR)
  - July and August 2010 with **“warmer”** ground conditions than for April
  - TANSO-FTS and IASI spectra in coincidence with TCCON sites during year 2010 (768 couples of coincident spectra)



Example of coincidence / fit  
 •IASI : 13:57 UT – 75.351°N – 21.591°E  
 •GOSAT : 14:00 UT – 75.385°N – 21.609°E  
 •Date : 2010/04/25  
 •Distance between IFOV centers : 3.92 km



IASI and GOSAT retrieval using LARA (“home made” radiative transfer and retrieval algorithm for research studies).  
 P and T profiles from ECMWF, emissivity fixed.  
 Retrieved parameters : surface temperature, spectral shift, CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, O<sub>3</sub> and/or H<sub>2</sub>O slant column density.

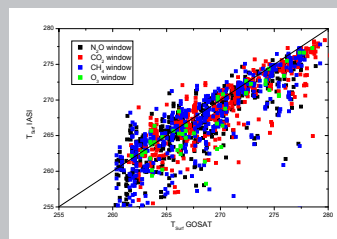
## Acknowledgments

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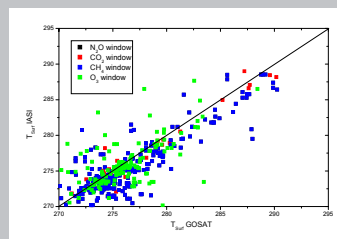
## III – Results

- Retrieved T<sub>surf</sub> from coincident IASI and GOSAT spectra are well correlated  
→ **good for confirming GOSAT B4 radiometry**
- Weak dependence of correlation with the distance or time difference criteria  
→ **reasonable statistics achievable**

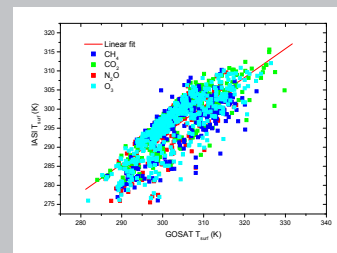
Arctic - April 2010 :  
 Δt = 30 min  
 ΔD = 20 km  
 121 coincidences  
 91.2% correlation  
 [262-280 K] range



July-August 2010  
 Δt = 30 min  
 ΔD = 5 km  
 310 coincidences  
 84.1% correlation  
 [270-290 K] range

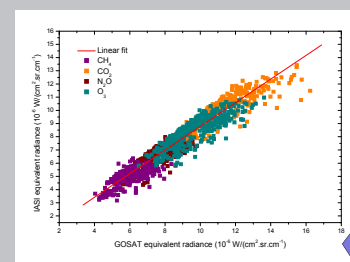
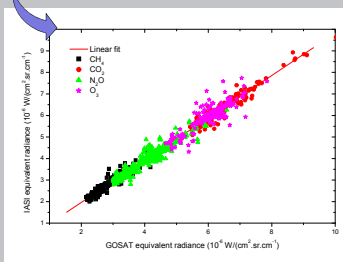


TCCON Sites coincidences 2010  
 Δt = 6 hr  
 ΔD = 100 km  
 768 coincidences  
 80.6% correlation  
 [285-320 K] range



### Conversion of all retrieved surface temperature into radiances :

Arctic (good space and time coincidences but low surface temperatures).  
 Correlation = 98.67 %  
 Slope = 0.990 ± 0.005



Coincidences over TCCON Sites (bad time coincidences, but higher surface temperature compare to Arctic)  
 Correlation = 80.60 %  
 GOSAT equivalent radiances > IASI = in agreement with orbits of both instrument (GOSAT measurements after IASI and then latter in the day)

## IV - Outlook

- Comparisons of IASI and GOSAT xCO<sub>2</sub>, xCH<sub>4</sub> and xN<sub>2</sub>O retrievals.
- Cloud filtering still to be refined (snow, ice conditions) / better filtering of cloudy, icy or snowy spectra
- Improve statistics by considering coincidences all over the globe during several months.

