Summary of the Final Report of Research Results

1) Title of the proposed research

Atmospheric Composition and Chemistry-Climate interactions with GOSAT

2) Principal Investigator (PI) and Co-Investigators (Co-Is)

PI:

Dr. Pierre-François Coheur

Co-I:

Dr. Lieven Clarisse

Dr. Daniel Hurtmans

Dr. Cathy Clerbaux

3) PI's affiliation

Université Libre de Bruxelles

4) Summary of the Final Report of Research Results

Radiance comparisons with IASI:

A relatively good agreement was found in the cross-comparison between the IASI and the TANSO-FTS co-located absolute thermal infrared radiance spectra for ocean surfaces, within the geographical region between 115°W-135° W longitude and 20°S and 5°S latitude. A better agreement between nighttime measurements is seen. Removing the cloudy scenes from the TANSO-FTS dataset confirms this tendency (Figure 1): a good linear relation is found, but with a remaining 2 K high bias for TANSO-FTS as compared to IASI, for the day-time data and a 0.7 K low bias for night-time.

Trace gas retrievals from TANSO-FTS:

TANSO-FTS spectra have shown sufficient quality to provide useful information on reactive trace gases. Using a simple radiance indexing method based on brightness temperature differences (Clarisse et al., 2009), TANSO-FTS is likely more sensitive than IASI to detect ammonia in the boundary layer: the brightness temperature difference calculated from TANSO-FTS is significantly higher (up to 2.5 K) than the values calculated from IASI (mostly around 0.3 K). This suggests a better detection capability of TANSO-FTS for ammonia, complementing the less sensitivity but much higher sampling of IASI.

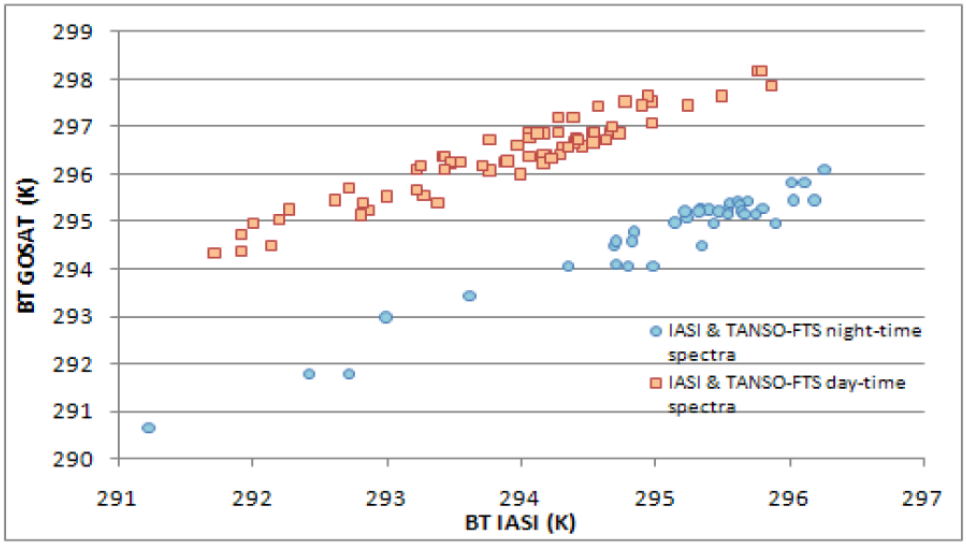

Figure 1: Brightness temperature comparison between co-located (within 2° in latitude and longitude and 3 h maximum time difference) and cloud-frees IASI and TANSO-FTS spectra above oceans. The orange squares are for daytime, the blue circles to nighttime.

Analyses of TANSO-FTS spectra for extreme events:

The analysis of TANSO-FTS spectra during severe events, corresponding to large fires and volcanic plumes, showed its capability to detect reactive trace species. HCOOH was detected during the Russian wildfires, its spectral signature shows up in the residual in addition to that of NH_3 (Figure 2), and SO_2 was detected in the plume of the Merapi volcanic eruption. Note that it is the first observation of SO_2 and HCOOH by TANSO-FTS. Overall the concentrations retrieved for these species are in agreement with those of IASI.

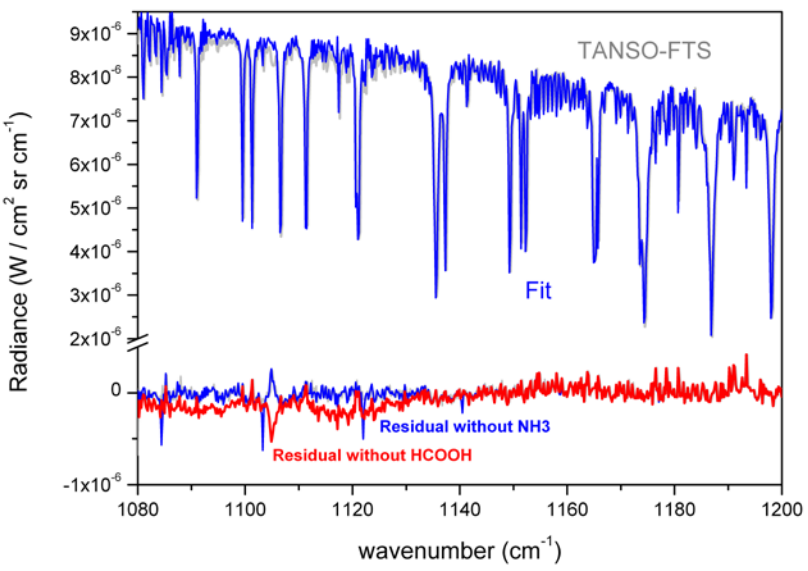

Figure2: Spectral fit (blue line) of a TANSO-FTS spectrum (grey line), measured in a fire plume, in Central Russia. The bottom panel shows the best spectral residuals (grey) compared to the residuals when NH3 (blue) and HCOOH (red) are excluded.

Clarisse, L., C. Clerbaux, F. Dentener, D. Hurtmans, P.-F. Coheur, Global ammonia distribution derived from infrared satellite observations, 2009, Nature Geoscience, 2, 479-483.

5) List of publications relating to the proposed research

Master thesis

Santos, Barbara: A first analysis of the atmospheric measurements from TANSO/GOSAT, Master thesis in Physics, ULB, 2010.

Abstracts and conference presentations

Conference abstract and presentations

Payan, S., Bureau, J., Camy-Peyret, C., Clerbaux, C., Coheur, P.-F., Hurtmans, D., Hadji-Lazaro, J., & Bauduin, S. (2012). On the joint use of IASI and GOSAT retrievals in the thermal infrared. Presented at the AGU Fall Meeting 2012, San Francisco, USA.