

Validation of GOSAT Products in the Southern Hemisphere: Southeast Asian & Australian TCCON Operations-Readying for Ibuki 2-validation (SATORI)

Phase A: Alice Springs, Australia



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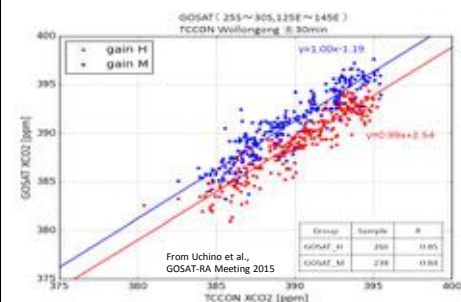
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The Mission

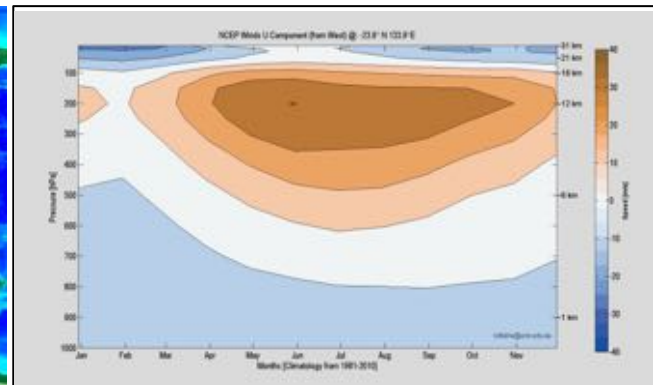
- Design, build and automate an EM27 fairing, ready for deployment and automated operations in harsh environments
- Perform measurements in Alice Springs, coincident with Air Core samples
- compare GOSAT M-Gain measurements over Alice Springs.
- Perform measurements in the tropics



◀ GOSAT M-gain retrievals over Australia are not validated up to now. Other desert regions of the world may be inaccessible to a TCCON instrument.



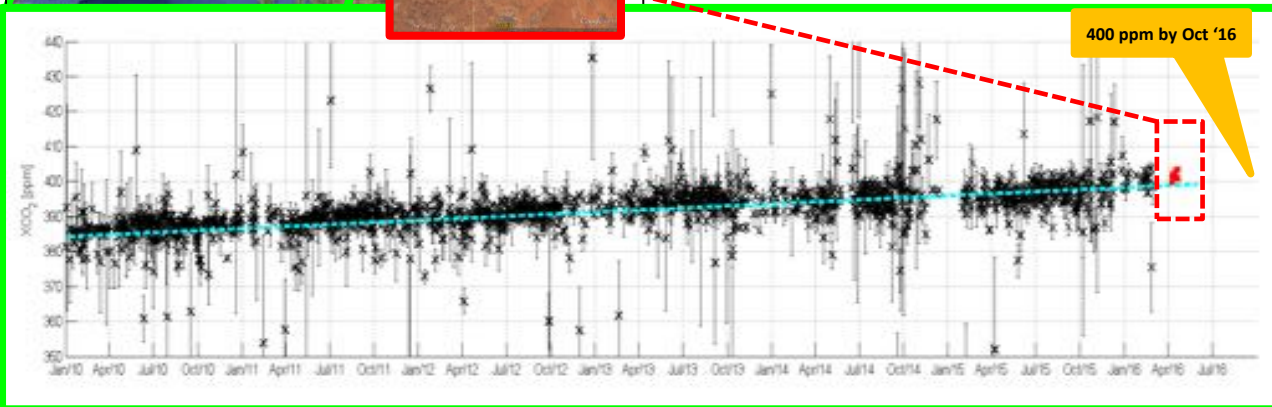
◀ EM-27 and tracker housed in a weather-proof, automated fairing. Design and manufacture was done at the University of Wollongong. Inset: preliminary operations coincident with Wollongong TCCON FTS.



▲ NCEP U wind vectors. There is a slow down of winds around February, however, the high surface temperatures (>40°C) around that month will pose a challenge.

▼ GOSAT Observation Requests over Alice Springs (courtesy of M. Ajiro) have been performed since April 2016. This will help us determine the extent of the XCO₂ variability in the region and verify our data selection criteria. So far, the results confirm that the scatter of XCO₂ around Alice Springs is small and that these XCO₂ measurements can be used as baseline.

▶ The plot on the right shows GOSAT satellite XCO₂ retrievals around the BOM site. As expected, the XCO₂ signal is very "clean", but currently, no ground-based instrument can validate this record. We expect to measure and validate the same record. GOSAT target requests were provided by M. Ajiro (red 'x')



SATORI Phase B: Philippines (see also poster by Isamu Morino)



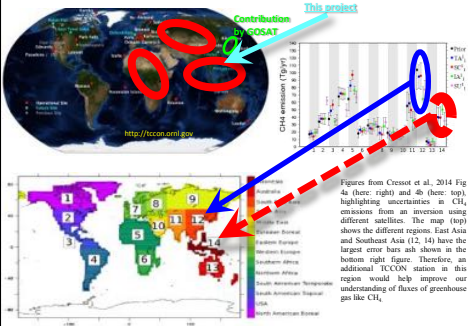
Introduction: significance of the region



Motivation:
 • Many countries in the east Asian region are ranked high when it comes to vulnerability to climate change.
 • There is a high uncertainty in carbon sources/sinks in the region.
 • What will be the effects of a changing climate to the region and what are the time-scales?

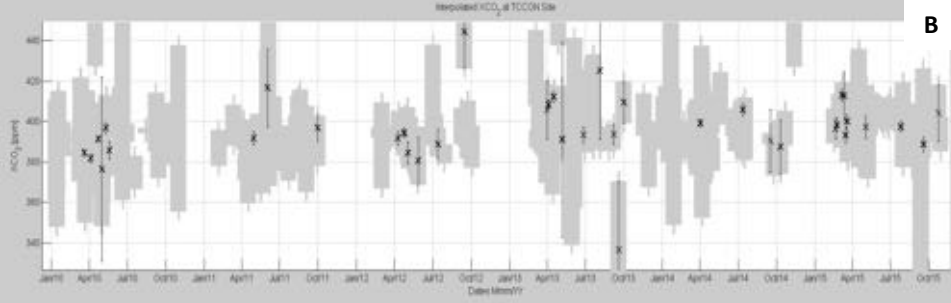
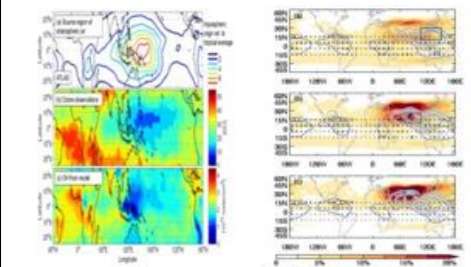
Expansion of TCCON for validating space-based GHG data and reducing uncertainties in carbon cycle studies

• Established in 1994 and the measurements at Park Falls, Lauder, and Ny Alesund have started.
 • Now more than 20 sites! Operating by individual sites.
 • The lack (red ellipses) of reliable validation data for the satellite-based greenhouse gas observing missions in the tropical regions is a common limitation in global carbon-cycle studies that have a tropical component.



OH hole and the giant elevator

• SE Asia is the preeminent source of tropospheric air entering the tropical stratosphere (right: Fig. 7 from Wright et al., 2011)
 • It is at the edge of the OH hole and at the foot of the "giant elevator" that transports trace gases into the stratosphere (Rex et al., 2014).
 • The lack of data in the tropical regions is also a common limitation in global carbon-cycle modeling studies that have a tropical component (Gurney et al., 2002).



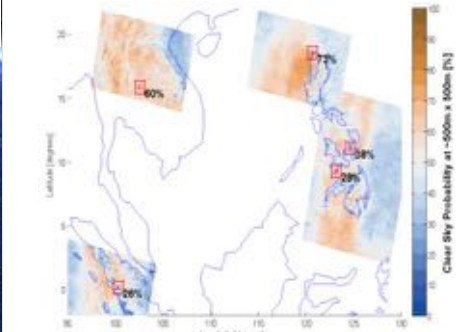
Panel A shows GOSAT soundings (green circles) selected within a 400-km radius (white circle). Panel B shows the time series of XCO₂ values interpolated within this radius. The values were derived by weighting the GOSAT soundings according to their associated errors and their distance from the Burgos site. The gray shaded areas represent the 1-sigma scatter of the interpolated GOSAT XCO₂ values over a radius of 1000 EM-27 Deployment Second Phase:

After benchmark measurements in Alice Springs, we propose to deploy the system to the Philippines to assess future TCCON operations at the site in Burgos. Other sites in the Philippines, with local support, are also possible

- Objectives (tentative)
- Initial side-by-side comparisons with TCCON
 - Possible re-deployment within tropical region

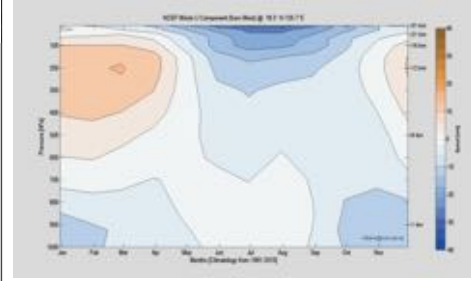
Acknowledgements
 We would like to thank the GOSAT RA Project Office for the continued support within this RA project. GOSAT data used here were accessed via the GUIG. We thank NIES, Japan-MOE and JAXA for the data.

A



Clear sky probabilities calculated from each pixel measured by the GOSAT Cloud and Aerosol Imager (CAI). The pixel sizes are approximately 500 m x 500 m. The numbers in % over the assessed sites (including two other sites in Thailand and Indonesia) indicate the probability that the closest pixel has a value of "1" (clear) out of 120 overpasses for 2014.

B



▲ NCEP U wind vectors. In the tropics, there are two distinct seasons: rainy and dry. These usually correspond with the position of the jet stream around 300 mb.
 ▼ NCEP V wind vectors show the passing of the ITCZ over the Philippines: in January and in July.

