

Intercomparison of total column GHGs measurement from low-cost portable spectrometers at Sodankylä

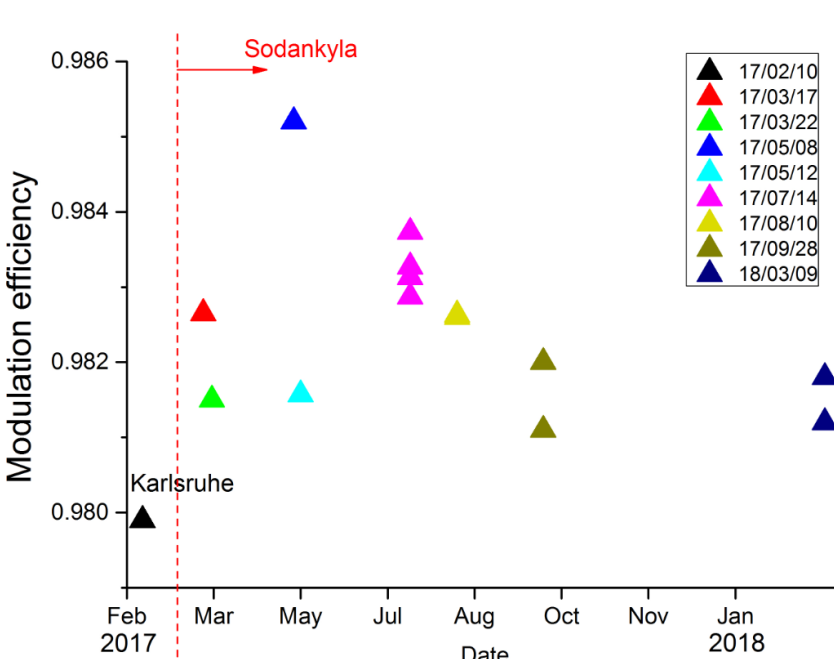
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FRM4GHG: Fiducial Reference Measurements for Ground-Based Infrared Greenhouse Gas Observations

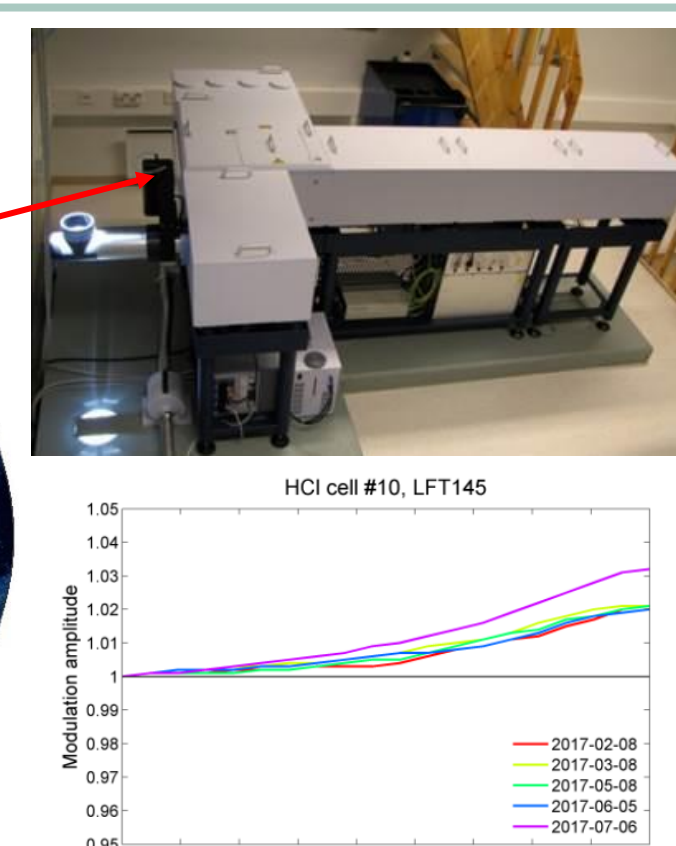
Implement: Simultaneous measurements of CO₂, CH₄, CO using several portal and low-cost spectrometers w.r.t TCCON under different atmospheric conditions



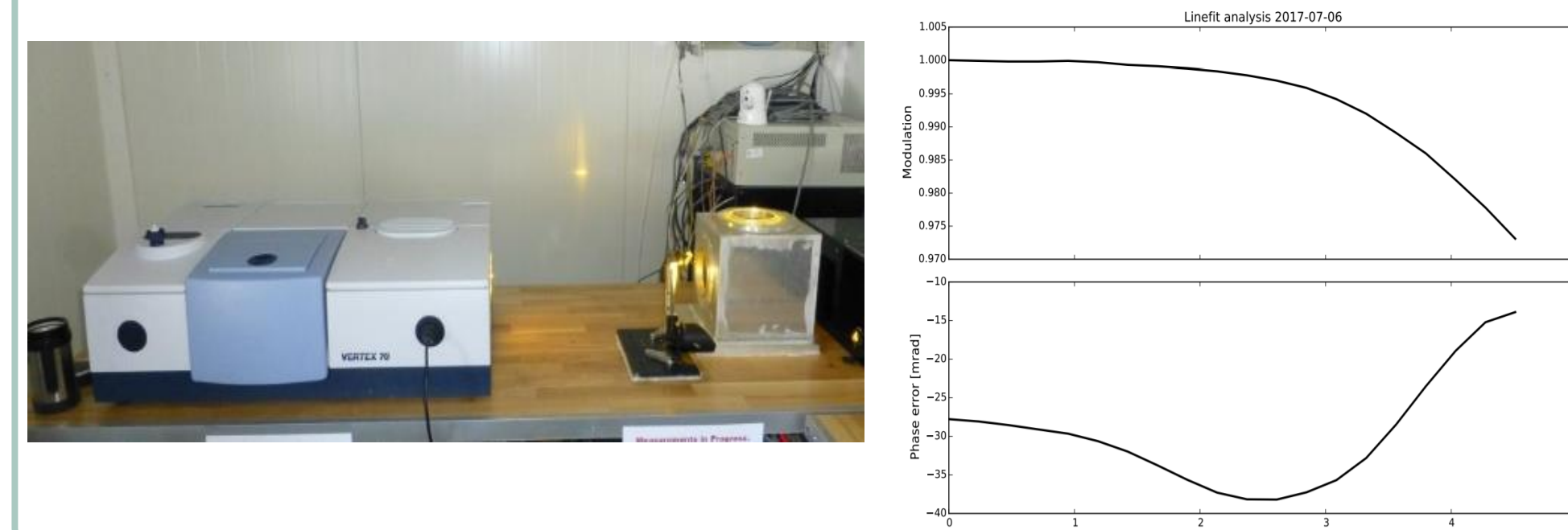
EM27/SUN - KIT



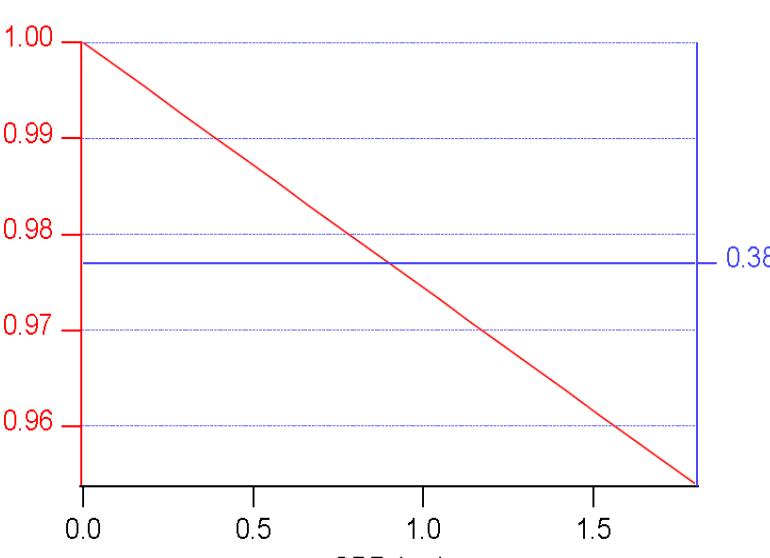
TCCON 125HR - FMI



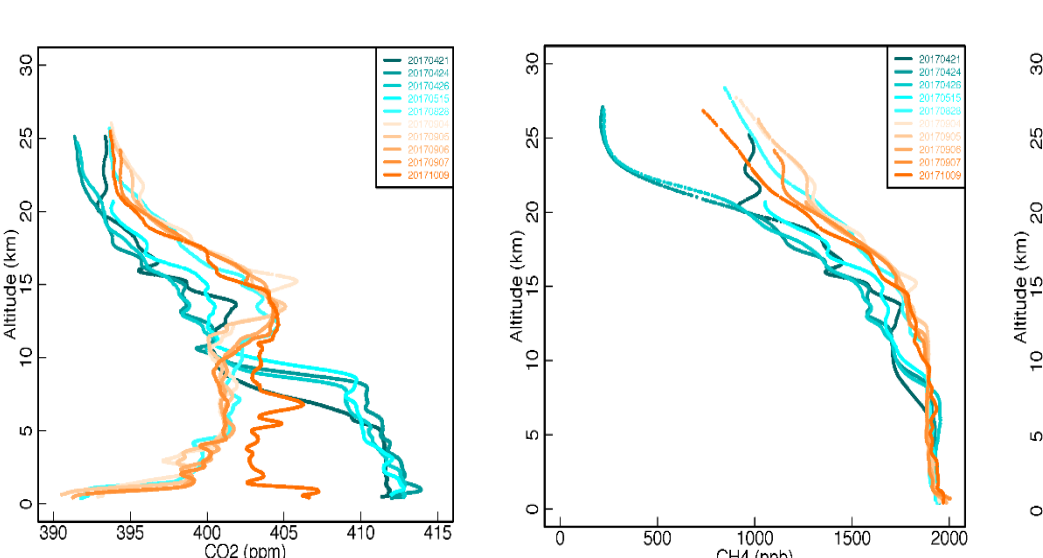
Vertex 70 – UoB&BIRA



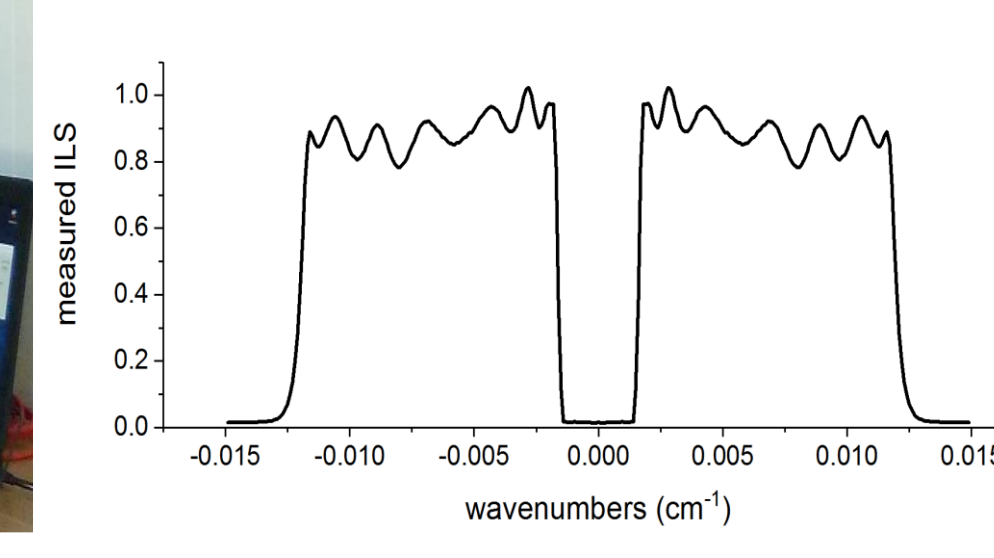
IRCube - UoW



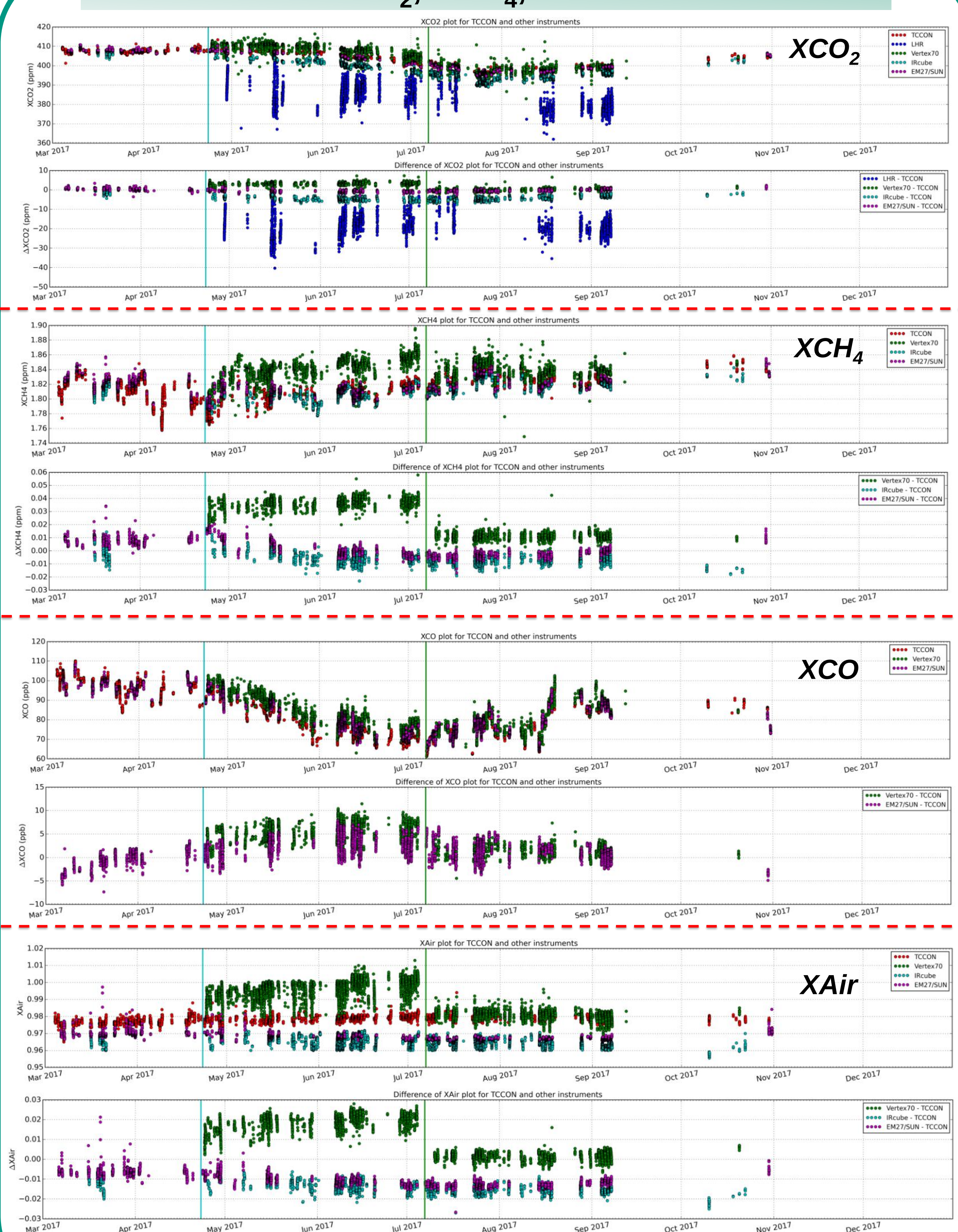
AirCore – UoG&FMI



LHR - RAL

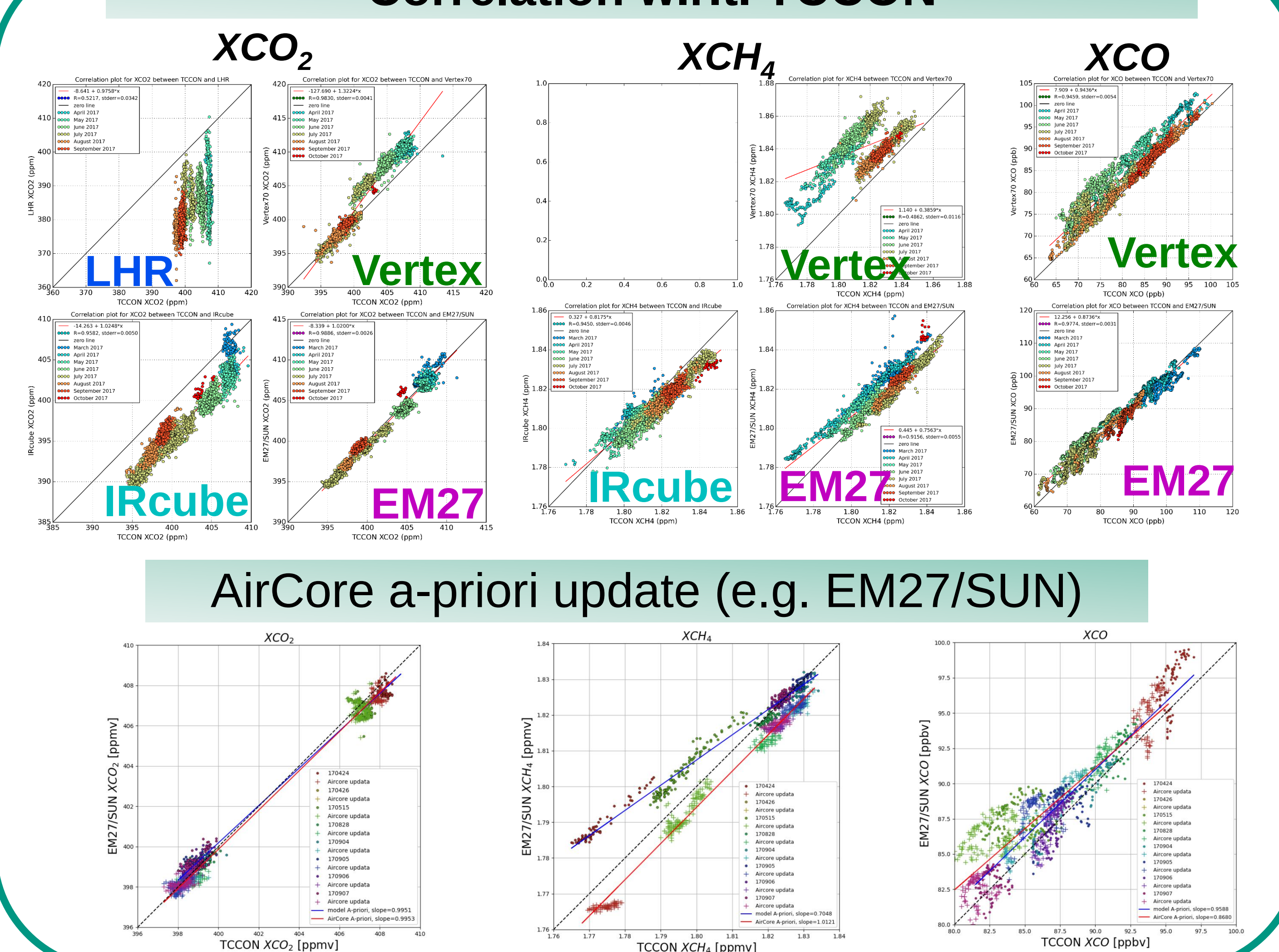


Time series of XCO₂, XCH₄, XCO and XAir in 2017



* Optical fiber cable replacement for IRCube at the end of April (cyan vertical bar); Instrument modification for Vertex 70 in July (green vertical bar)

Correlation w.r.t. TCCON



Conclusions:

- Most instruments have demonstrated stability and good consistency with TCCON reference during the whole year;
- EM27/SUN: showed very small bias relative to TCCON and was operated outside under ambient conditions, covering a temperature of -25°C to 25°C. Small seasonal variability of bias existed;
- Vertex 70: better correlation after instrument modification but a bit higher bias of XAir than other instruments;
- IRCube: best correlation in XCH₄ of all instruments;
- LHR: self-developed instrument. A new retrieval algorithm is under development;
- ILS and XAir are important characteristics in assessing instrument performance;
- AirCore profiles displayed certain impact on retrievals, especially for XCH₄ in early year. Better a-priori profiles have improved the results.

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- Thanks to all the colleagues for their contribution in this campaign.



<http://frm4ghg.aeronomie.be>

Outlook:

- Providing an essential ground-based validation dataset for GHGs-measuring satellite validation, e.g. Sentinel-5 Precursor;
- Improving the availability of high-quality ground-based observations of GHGs and for supplementing the TCCON core stations with lightweight instruments.