

# COCCON observations of XCH4 variability in Antarctica

## EM27/SUN deployment to Antarctica, summer 2019/20

### INTRO

The use of the Total Carbon Column Observing Network (TCCON), and more recently the Collaborative Carbon Column Observing Network (COCCON) for the validation of satellite observations of column averaged dry-air mole fractions of greenhouse gases has been well demonstrated. However, significant geographic gaps in the coverage of these networks exist e.g., the southernmost TCCON site is at 45° S.

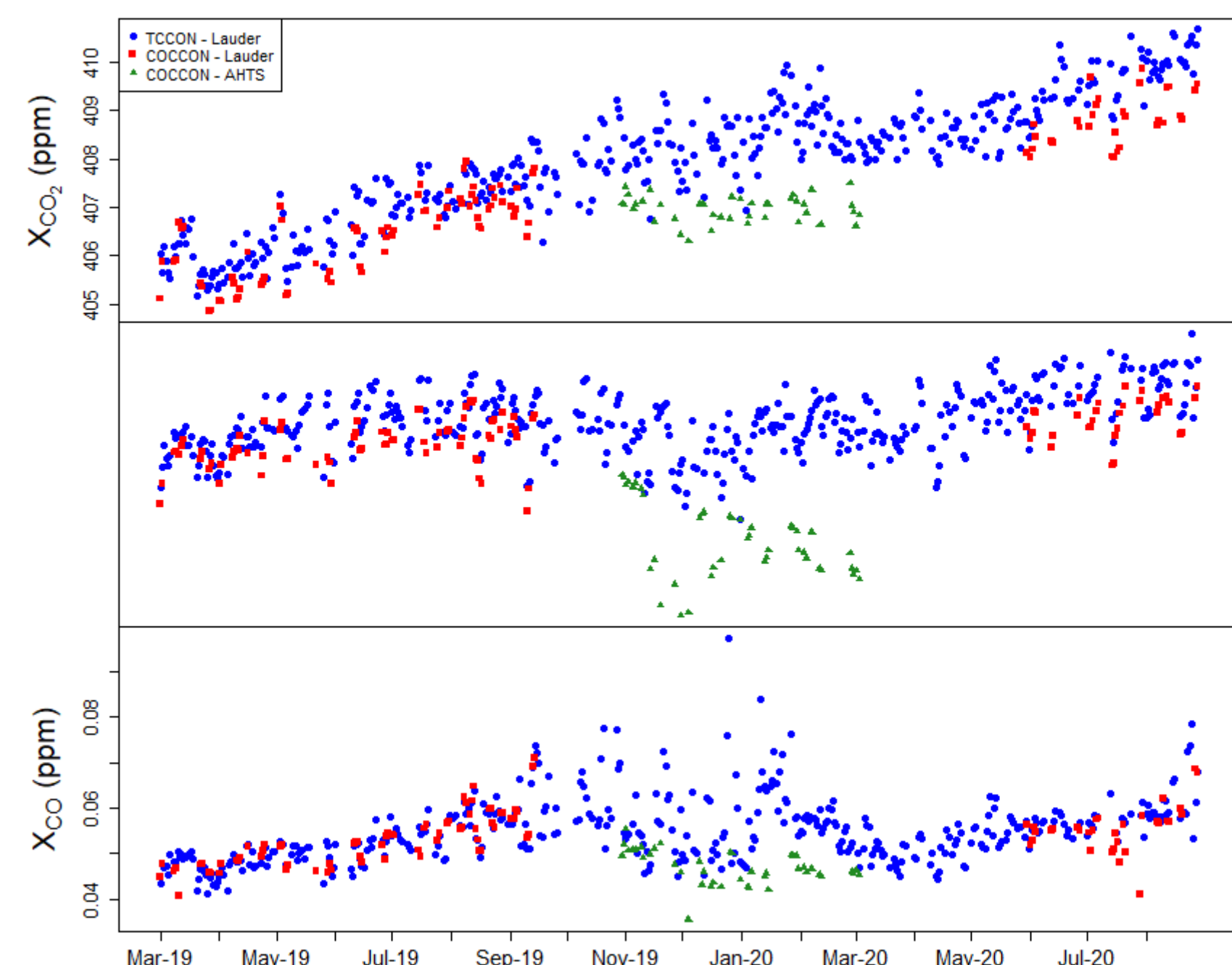
Over the Austral summer of 2019/20 we took an EM27/SUN to the Arrival Heights laboratory on Ross Island, Antarctica (77.83° S, 166.66° E, 205m AMSL) to demonstrate the utility of COCCON to provide coverage in this region.

The EM27SUN was in a lab where solar radiation could be directed into the instrument from an existing solar tracker. Measurements were performed on clear days when the lab was attended by a technician. Retrievals were made using the PROFFAST suite of software.

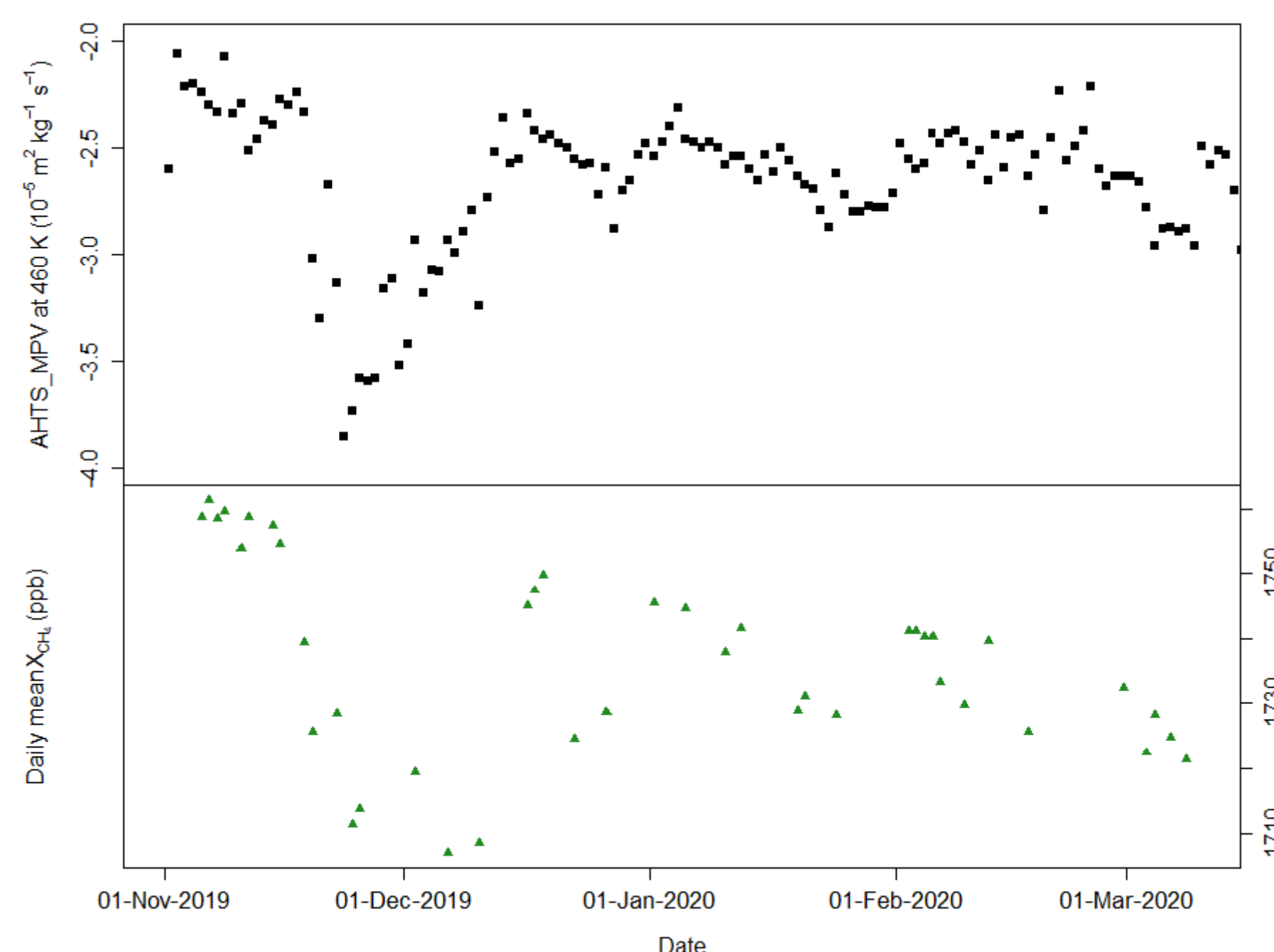
To ensure the stability of the EM27/SUN, measurements were made alongside the Lauder TCCON site (45.04° S, 169.68° E, 370m AMSL) before and after shipping to Antarctica and the ILS was determined at KIT before and after shipping to New Zealand.

### RESULTS

Timeseries of daily mean Xgas (column averaged dry-air mole fraction) before, during and after deployment, for COCCON and TCCON



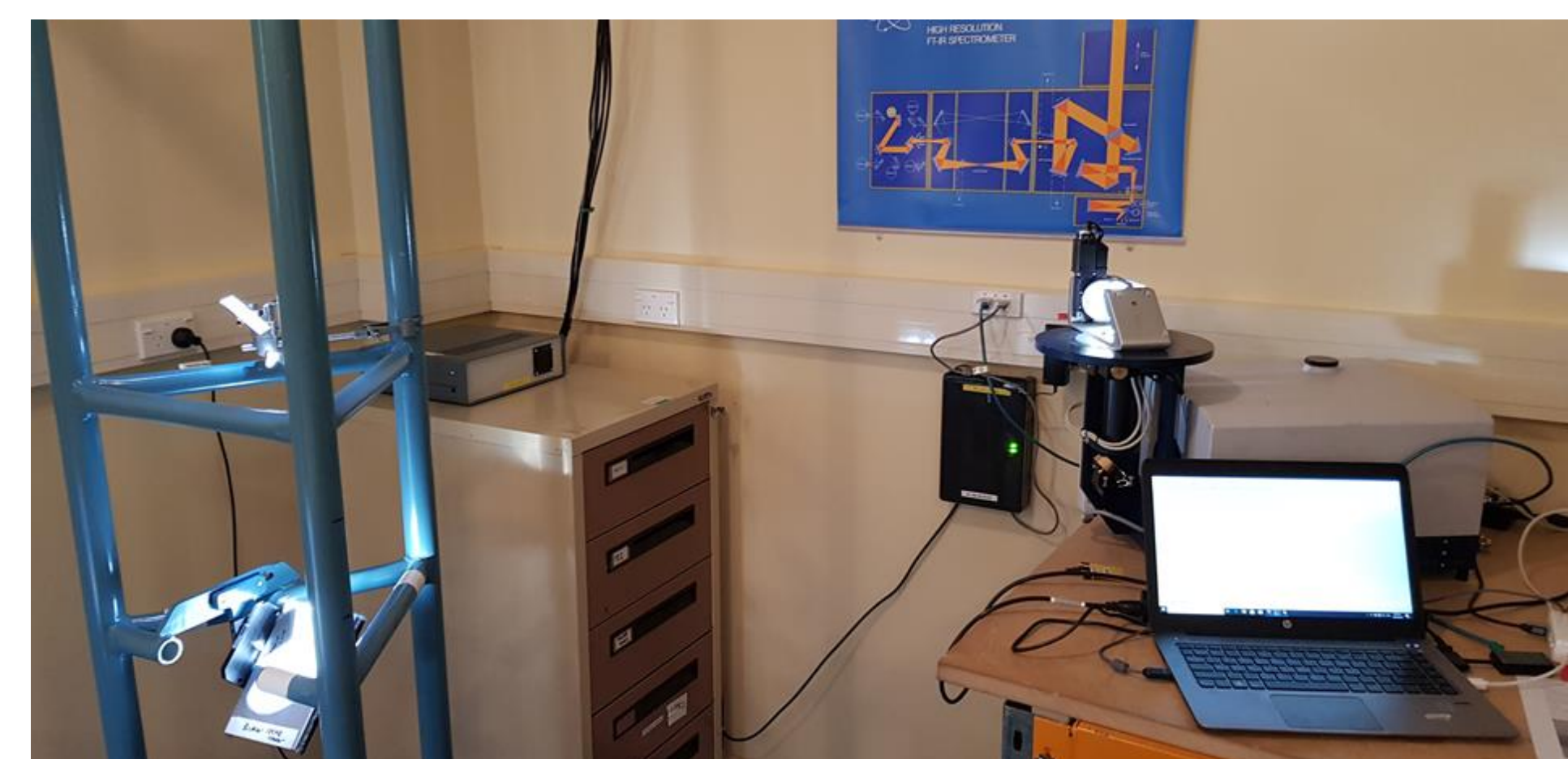
Results for XCO2 and XCO were as expected, with lower values and variability than at Lauder. XCH4 values observed at Arrival Heights were more variable. To investigate this structure further we examined the isentropic modified potential vorticity (MPV) over Arrival Heights derived from the Modern Era Retrospective-Analysis for Research and Applications reanalysis product (MERRA2) to give an indication of the proximity of the polar vortex



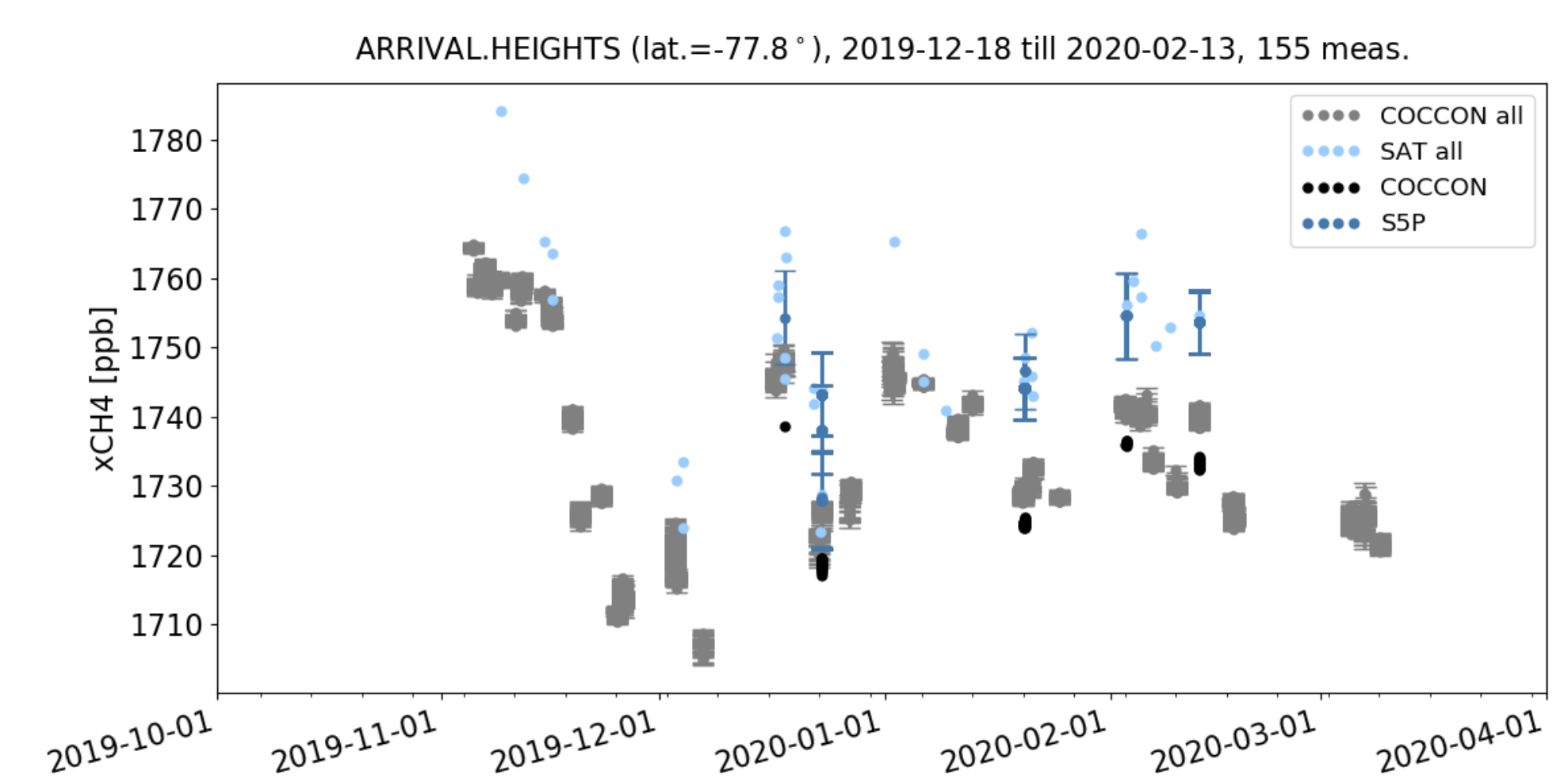
XCH4 and MPV are well correlated ( $r=0.82$ , 95% CI: 0.68-0.90) indicating that the variability is due to the polar vortex generating a weak barrier effect

### OTHER FIGURES

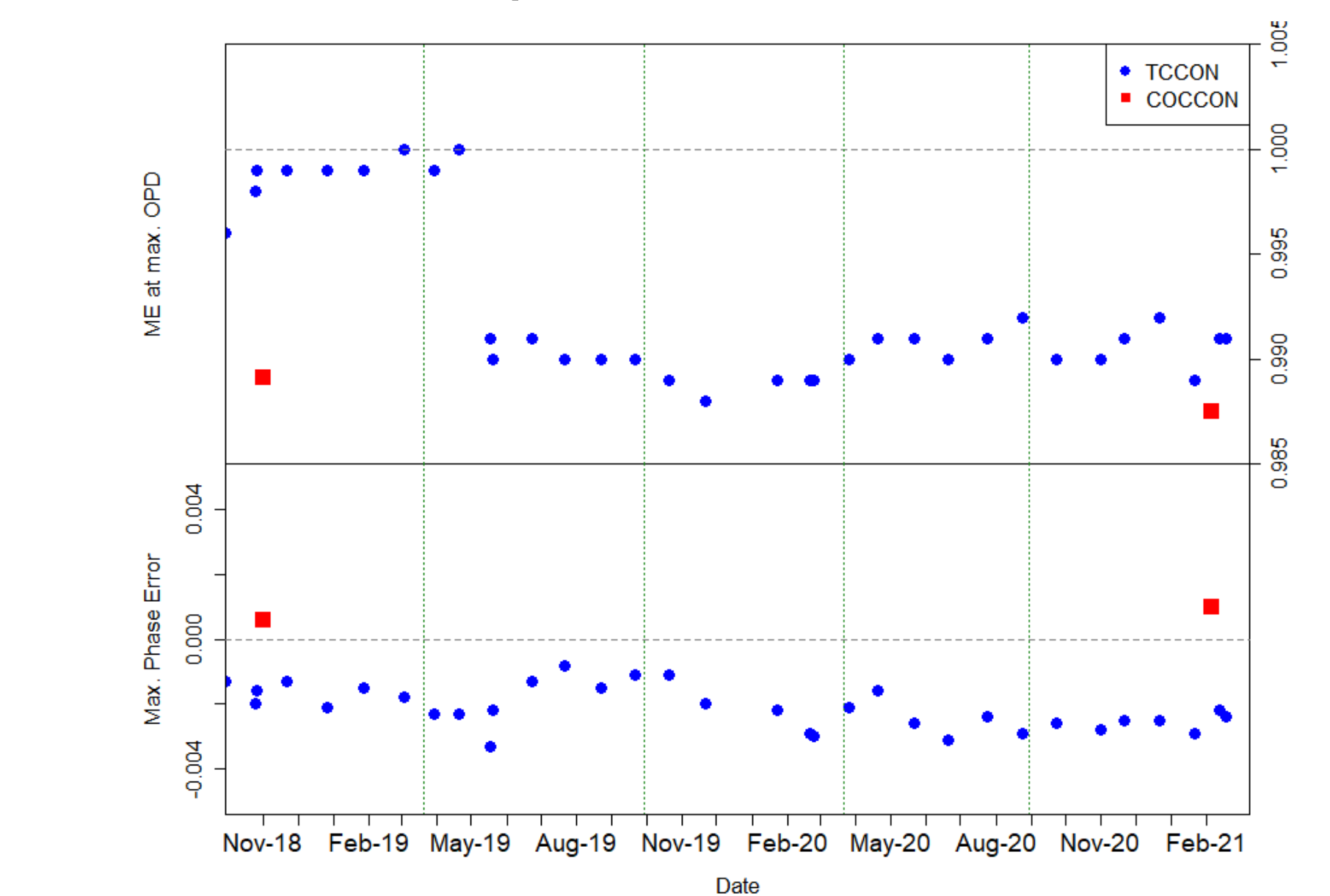
EM27/SUN configuration using and existing solar tracker.



XCH4 variability is also evident in coincident S5P retrievals:



ILS retrievals when the EM27/SUN was shipped from and to Karlsruhe, and for the Lauder TCCON instrument, show that both instruments were stable throughout the measurement period.



With thanks to:



(1)



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