

The Total Carbon Column Observing Network (TCCON) – cal/val reference for all GHG satellite missions

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Remote sensing: column-averaged GHG observations



http://oco.jpl.nasa.gov/



GOSAT/Japan: since 2009



OCO-2/USA: since 2014

- Covers full atmospheric column from ground to ~100 km
- Measure total column of CO2/CH4 and use total column of O2 as proxy for airmass (assuming constant mole fraction of 0.2095)
- Observed parameter is colum-averaged dry-air mole fraction => XCO2/XCH4
- Division of columns minimizes broad-band spectral biases (e.g. from aerosols)



Total Carbon Column Observing Network (TCCON)

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Total Carbon Column Observing Network (TCCON) 2018

- Network of ground based FTIR stations
- Different groups, common standards
- High-precision column observations of CO2, CH4, CO, N2O.
- Crucial reference for satelllite GHG measurements

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Column-averaged XCO2 and in-situ CO2 are hard to compare



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TCCON global coverage



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TCCON European coverage



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TCCON XCO2 is calibrated to WMO CO2 in-situ scale

- TCCON stations are calibrated vs aircraft insitu profiles
- Calibration provides network-wide scaling factor from spectroscopic scale to WMO in-situ scale
- Very consistent over many years and different continents
- TCCON provides link between in-situ networks and satellites





TCCON funding sources

- No central funding source for TCCON. Very diverse situations for individual stations.
- Substantial support from NASA and JAXA in the past: complete stations + operation over years.
- TCCON stations in Europe rely mostly on institutional and national (competitive) funding for the largest part of their operations. Some stations supported by ESA & DLR in 2017-20.
- TCCON Europe would need a new business model to provide long-term operational service.



TCCON site cost structure



Estimated cost breakdown for operating Ascension Island TCCON station for 10 years



TCCON & ICOS

- TCCON is currently not associated with ICOS.
- Discussions to include (some) European TCCON stations in ICOS have been going on for some time. Official negotiations starting in Oct 2018.
- Station operation in ICOS would have to be funded nationally. Issue: 8 out of 11 European TCCON stations are run by German groups.



Conclusions

- TCCON is the cal/val reference for all current satellite GHG missions.
- This reference cannot be provided by groundbased in situ observations readily.
- Important regions like Africa and South America are currently not covered.
- Very few TCCON stations have stable long-term funding.
- All future satellite GHG missions at least plan to use TCCON data.