

Remote sensing of the atmospheric composition in the infrared spectral region within the Network for the Detection of Atmospheric Composition Change (NDACC) and the Total Carbon Column Observing Network (TCCON)

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ABSTRACT:

Remote sensing has been established as a powerful tool in atmospheric research. Throughout the last decades satellite and ground-based remote sensing instruments and methods have been developed to sample the atmosphere. The international ground based networks NDACC-IR and TCCON are based on solar absorption spectrometry in the infrared. Both networks consist of more than 30 observations sites around the globe, from the high Arctic through mid-latitudes and the tropics to the southern hemisphere and Antarctica. NDACC concentrates on stratospheric observations in relation to ozone chemistry, in many instances, information on the vertical distribution of the target species is determined. Measured trace gases include O₃, HCl, HF, HNO₃, ClONO₂ and many others. In addition, the tropospheric composition is studied by measuring anthropogenic and biogenic species including HCN, OCS, H₂O, CO, CH₂O, C₂H₆, and C₂H₂. The aim of TCCON is to acquire accurate and precise column-averaged abundances of CO₂, CH₄, N₂O, i.e. atmospheric trace gases which have a very small natural variability. TCCON measurements are linked to WMO calibration scales by comparisons with co-incident in situ profiles measured from aircraft or balloon.

Results from both networks have been used in many studies in relation to stratospheric ozone chemistry, air-pollution, and with regard to the carbon-cycle. Long-term series are necessary for trend analysis, gaining insight into annual and longer term variability and placing into context shorter term process studies. Due to the similar observation geometry, the ground-based observations are optimally suitable for satellite and model validation and form an essential part of many satellite projects. They also play an important role in the validation of the Copernicus Atmospheric Monitoring Service.

In our contribution we will give an overview on the current status of both networks, ongoing efforts to improve network coverage, precision and accuracy, and several examples of scientific highlights.