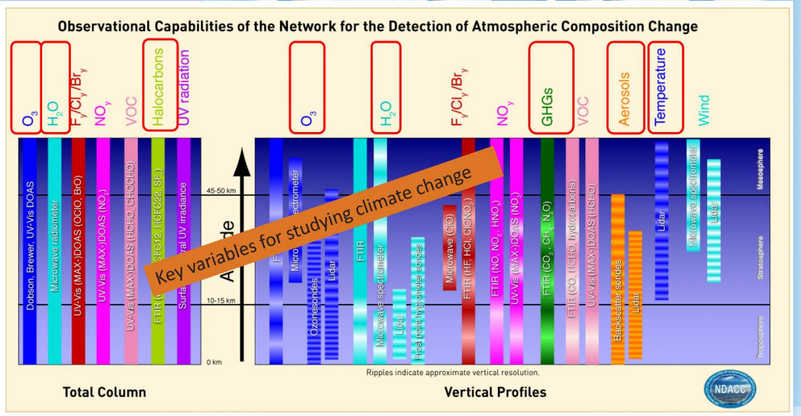
How the Network for the Detection of Atmospheric Composition Change (NDACC) contributes to the provision of reference data for climate monitoring.

M. De Mazière[1], I. Petropavloskikh[2,3], J. Wild[4,5], J. W. Hannigan[6], E. Mahieu[7], J. Notholt[8], A. Dehn[9], and the IRWG[10] and FRM4GHG[11] teams

NDACC current status (ndacc.org)

- About 95 stations worldwide, of which 73 active
- 151 active instruments
- Observational capabilities



TCCON – TCCON.Caltech.edu	NDACC Infrared Working Group
Bruker IFS 125HR	Bruker IFS 120HR/125HR
Resolution 0.02cm^{-1}	Resolution 0.0036cm^{-1}
Spectral range: SWIR	SWIR, MIR and thermal IR
CO2, CH4, N2O, CO, H2O/HDO...	(CO2), CH4, N2O, CO, H2O/HDO...+ CFC, HCFC, SF6, tropospheric O3, ...
Total column only retrievals	Profile retrievals
Clear-sky daytime only; global coverage	Clear-sky daytime only; global coverage
Data back to 2004 → https://tccondata.org/	Data back to <1991 → NDACC DHF
Strict QA/QC protocols	QA/QC protocols

Uncertainties	(X)CO* (%)	(X)CH4* (%)	(X)N2O* (%)
TCCON - random	< 3,5 (~2, 0)	0,5	1,0
TCCON - systematic	0 (?)	0 (?)	0 (?)
NDACC - random	1,0	1,5	1,5
NDACC - systematic	2,5	3,0	2,0

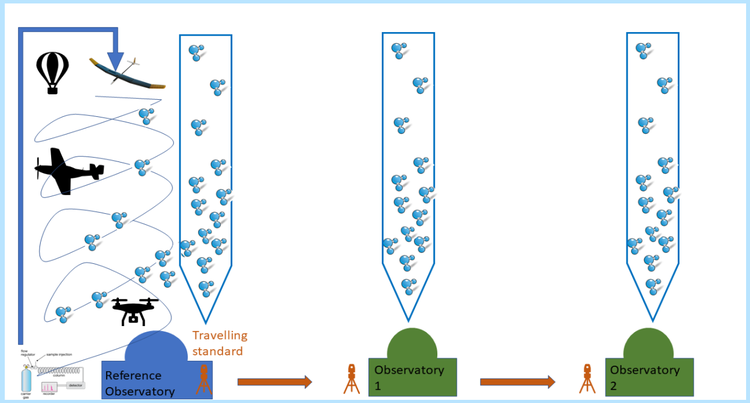
** XCO for TCCON and NDACC; XCH4 for TCCON and CH4 column for NDACC*

DOF	(X)CO	(X)CH4	(X)N2O
TCCON	1	1	1
NDACC	≥ 2	2,5	~3,5

Systematic uncertainties ?
Main sources are spectroscopy ad T-profile
⇒ *Removed in TCCON by dedicated calibration*
Smoothing error ?
Due to low /no vertical resolution and a priori profiles
⇒ Worse for TCCON than NDACC

Improve calibration of remote sensing data towards agreed standard?

Concept of travelling standard



See also F. Hase et al., poster T2-D12, and FRM4GHG project

Take home messages as to FTIR measurements of GHG

- The global monitoring networks NDACC FTIR and TCCON provide long-term climate data records of GHG data, since 1991 and 2004, resp. – with high accuracy and precision. Both networks are well on their way towards providing the data according to the FAIR data principles.
  - TCCON focuses on CO2, CH4, CO and (less so) on N2O total columns;
  - NDACC-FTIR provides CH4, CO, N2O plus additional short- and long-lived climate pollutants like CFC, HCFC, HFC, SF6, …total and partial columns.
- The smoothing error must be accounted for in the total uncertainty budget to have the full picture.
- Documentation on applied calibration factors and procedures must be included with the data.
- To improve site-to-site consistency and calibration towards agreed standards for consistency between remote sensing and in-situ data, we need progress on
  - traceability of spectroscopic data
  - traveling standard instruments and in-situ measurements from airborne platforms not only for target GHG gases but also for ancillary data and other species interfering in the GHG retrievals.
- The FRM4GHG project has demonstrated the adequateness of some compact mobile FTIR instruments to be developed as travelling standards for GHG measurements, in th NIR as well as the MIR spectral domains – and possible extension to additional species like HCHO

[1]Royal Belgian Institute for Space Aeronomy (BIRA-IASB), Brussels, Belgium; [2]CIRES, University of Colorado, Boulder, CO, USA; [3]NOAA, Global Monitoring Lab, Boulder, CO, USA; [4]CISESS, University of Maryland, College Park, MD, USA; [5]NOAA/NESDIS/STAR, College Park, MD, USA; [6]NCAR, Boulder, CO, USA; [7] ULiège, Liège, Belgium; [8] Institute of Environmental Physics, University of Bremen, Bremen, Germany, [9] ESA, ESRIN, Frascati, Italy; [10] www.ndacc.org, [11] frm4ghg.aeronomie.be

martine.demaziere@aeronomie.be; ndacc.org; frm4ghg.aeronomie.be