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## The importance of long-term reactive trace gas remote sensing measurements for ACTRIS science and services

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The Network for the Detection of Atmospheric Composition Change ([NDACC](#), De Mazière et al, 2018) became operational in 1991 under the auspices of national and international scientific agencies, including the World Meteorological Organization (WMO). Since then, NDACC has contributed to the Global Atmosphere Watch (GAW) programme. Today NDACC comprises about 80 active affiliated stations distributed world-wide among which many in Europe or operated by European partners. Its primary purpose of NDACC is to provide mutually consistent high-quality reference data on the variability, distribution, and long-term trends of more than 30 atmospheric variables at the global scale, from the troposphere to the mesosphere, with an emphasis on ozone, and species affecting climate change and air quality.

Building on this long heritage of coordinated observations, data quality control and fair data dissemination, the past, present and future reactive trace gas remote sensing observations that are included in the ACTRIS RI will provide an essential contribution to ACTRIS research. In ACTRIS the target variables for now are ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), formaldehyde (HCHO), ethane (C<sub>2</sub>H<sub>6</sub>) and ammonia (NH<sub>3</sub>) columns and vertical profiles, measured by Fourier-transform Infrared (FTIR) spectrometry, UV-Visible (MAX)DOAS type spectrometers and/or O<sub>3</sub> DIAL lidars, complemented with PANDORA measurements belonging to the Pandonia Global Network ([PGN](#)). The Topical Centre for Reactive Trace Gas Remote Sensing (CREGARS) will ensure a sustainable service for ensuring data quality and consistency, in compliance with the ACTRIS requirements and aligned with the NDACC and PGN data protocols whenever there is overlap.

In this presentation, the focus will be on the scientific impact of high-quality long-term data records

from the various trace gas remote sensing observations contributing to ACTRIS. In addition, the importance of continuous monitoring for enabling the identification of unexpected atmospheric processes, for the detection of anomalies, and for watching the compliance with environmental regulations will be showcased with recent examples.

Remote sensing observations are the most useful reference for satellite and global or regional model validation, as will be demonstrated with examples from the ESA Atmospheric Mission Performance Validation and Data Analysis Facility (ATM-MPC VDAF) and the Copernicus Atmospheric Monitoring Service (CAMS) Evaluation and Quality assurance (EQA) activities.

In addition we will discuss the scientific rationale behind the collaboration with PGN and future challenges and evolution of the observational and data analysis techniques calling for fundamental science and technological advances.

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