Geophysical Research Abstracts
Vol. 21, EGU2019-12907, 2019
EGU General Assembly 2019

Quality control supporting climate policy and research: Assessing two decades of GAW audit results for N2O and CO

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Human impact on climate through increasing greenhouse gas amount fractions in the atmosphere is well accepted. For interpretation of data obtained by different laboratories, measurement results have to fulfil Data Quality Objectives (DQOs) set by the World Meteorological Organization (WMO) [1]. This is addressed by the WMO Global Atmosphere Watch Programme (GAW), where Central Calibration Laboratories (CCLs) maintain calibration scales to ensure consistency of measurements within the network. Furthermore, GAW laboratories are supported by World Calibration Centres (WCCs) performing audits and organizing round-robin comparisons. Empa operates the World Calibration Centre for Carbon Monoxide (CO), Methane (CH4), Carbon Dioxide (CO_2) and Surface Ozone (WCC-Empa) since 1996 as a Swiss contribution to GAW, and has conducted over 90 audits over the past two decades.
Recently, significant advances in measurement techniques have been made, and an assessment showed improved capabilities of spectroscopic techniques for methane and carbon dioxide compared to traditional methods [2]. However, WMO/GAW network compatibility goals are still regularly missed, as shown by comparisons of field samples, parallel measurements, and round-robin experiments.
Here, we will give a comprehensive overview of comparison activities made during on-site audits and round robins with a focus on CO and N2O. Audit results of these two parameters show that the DQOs are often not met, and further improvements with regard to analytical techniques and calibration standards are needed to solve this issue.

[1] WMO: 19th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases and Related Tracers Measurement Techniques (GGMT-2017), Dübendorf, Switzerland, 27-31 August 2017, GAW Report No. 242, World Meteorological Organization, Geneva, Switzerland, 2018.
[2] Zellweger, C., et al.: Assessment of recent advances in measurement techniques for atmospheric carbon dioxide and methane observations, Atmos. Meas. Tech., 9, 4737-4757, 2016.