

Name of research institute or organization:

Max Planck Institut für Biogeochemie, Jena

Title of project:

Flask comparison on Jungfrauoch

Project leader and team:

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Project description:

The European project IMECC (Infrastructure for Measurements of the European Carbon Cycle) has introduced an activity called Transnational Access (TA). It is designed to enable high-precision measurements to be made across EU wide research institutions and, thus, to broaden and improve access to European Carbon Cycle measurement facilities. One of these facilities is the Research Station at Jungfrauoch.

MPI-BGC Jena has submitted a proposal to get access to this research station which was approved in 2008. The goal behind this TA activity is to compare CO₂ and O₂ concentrations of air samples taken simultaneously at Jungfrauoch station via combined flask filling. The Jena MPI has supplied the research station at Jungfrauoch with a flask sampling unit of the standard MPI-BGC design. This is run in conjunction with the Groningen (project Rolf Neubert, Groningen) as well as UBern (project Markus Leuenberger, Bern) flask sampling programmes.

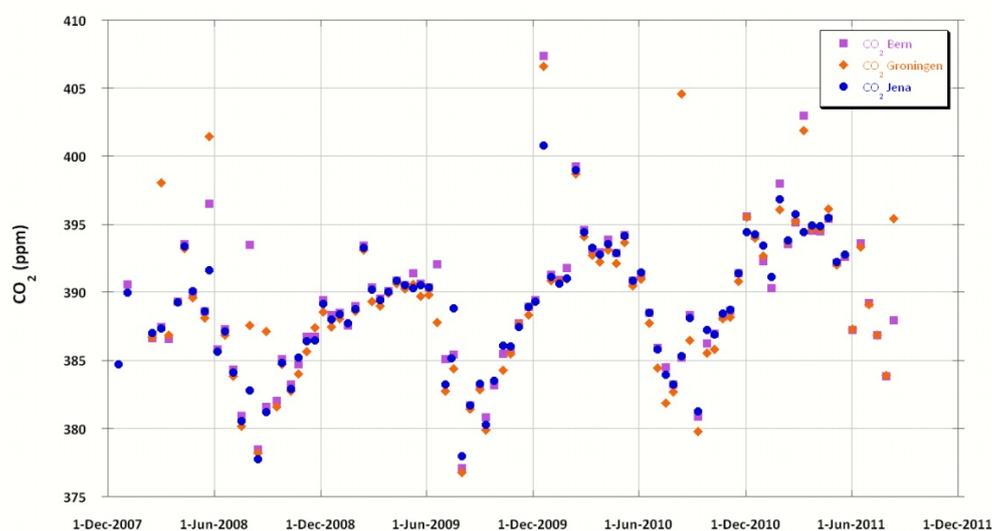


Figure 1. Comparison of CO₂ concentration measured by MPI-BGC Jena, CEP UBern and CIO Groningen.

Figure 1 presents results from more than 3.5 years of operation. The three laboratories capture the seasonal cycle as well as the absolute values consistently, confirming that the CO₂ scales maintained in each lab are well adjusted and have not drifted significantly during the comparison period. However, considering the WMO target of ± 0.1 ppm for the CO₂ mixing ratio compatibility between different laboratories there

are still some remaining issues (Figure 2); the scatter of the data did not decrease as would be expected when improvements are triggered by the ongoing intercomparison. A more frequent update of data appears necessary in order to provide a timely feedback on the sampling procedure.

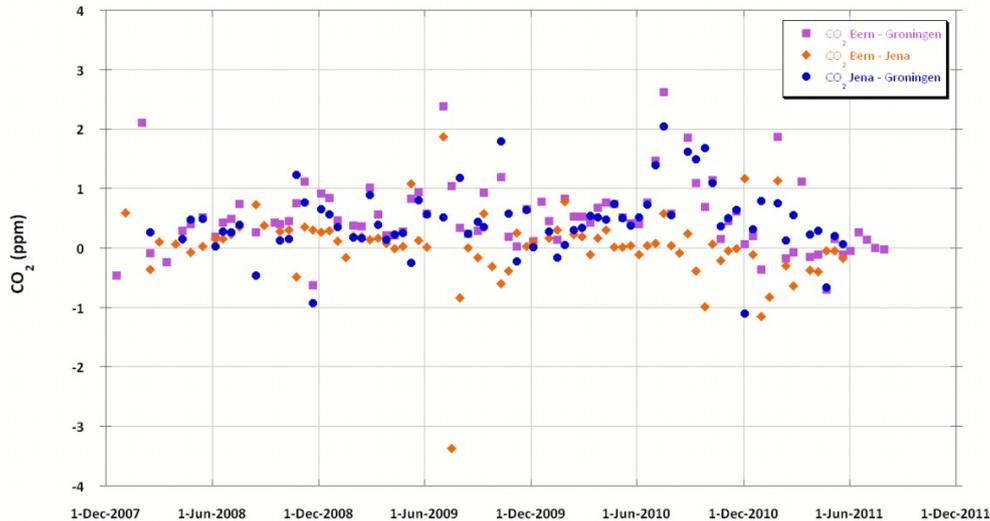


Figure 2. CO_2 concentration differences calculated from MPI-BGC Jena, CEP UBern and CIO Groningen measurements.

For O_2/N_2 ratio measurements, the precision requirements are severely enhanced (< 5 per meg). Unfortunately, the data of the inter-laboratory comparison miss that target by far. The seasonal cycle as well as the longer term O_2 decline are captured by all participants; at the same time, all laboratories suffer from significant occasional deviations from atmospheric background levels (Figure 3). Most of these outliers can be explained by improper sampling, e.g. problems with reaching the sampling pressure, low gas flow, wrong manipulation during sampling, etc. The sampling procedure varies for the different flasks, hence it is not a common problem, which can be equally attributed to all laboratories. The MPI-BGC Jena flasks for instance request a sampling pressure of about 1600 mbar whereas the Groningen and UBern flask are filled to about 960 mbar. Therefore, the Jena flasks are filled separately while the Groningen and UBern flasks are filled together. The time of sampling remains the same for all flasks with a biweekly rhythm. Most of the larger outliers are towards the positive side, indicating that small post-sampling leaks might have contributed. A contamination with polluted laboratory air would cause a shift to the opposite side. Restriction of the O_2/N_2 record to values, for which the lab-differences are within ± 50 permeg - still very high - improves it significantly. However, even when focussing on periods of acceptable record coherence no deeper insight into the more detailed causes of the laboratory differences or scale drifting can be inferred owing to the remaining high scatter of the data.

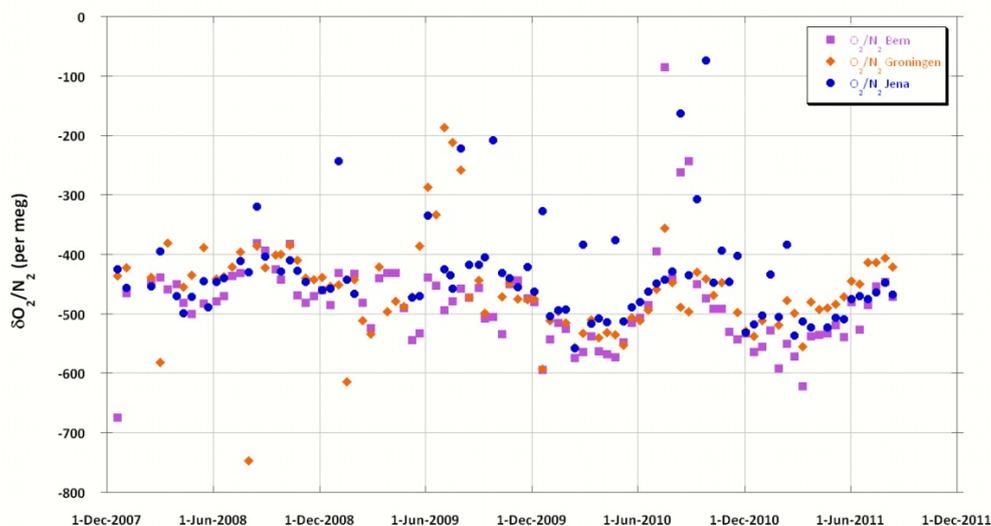


Figure 3. Comparison of O_2/N_2 ratio measured by MPI-BGC Jena, CEP UBern and CIO Groningen.

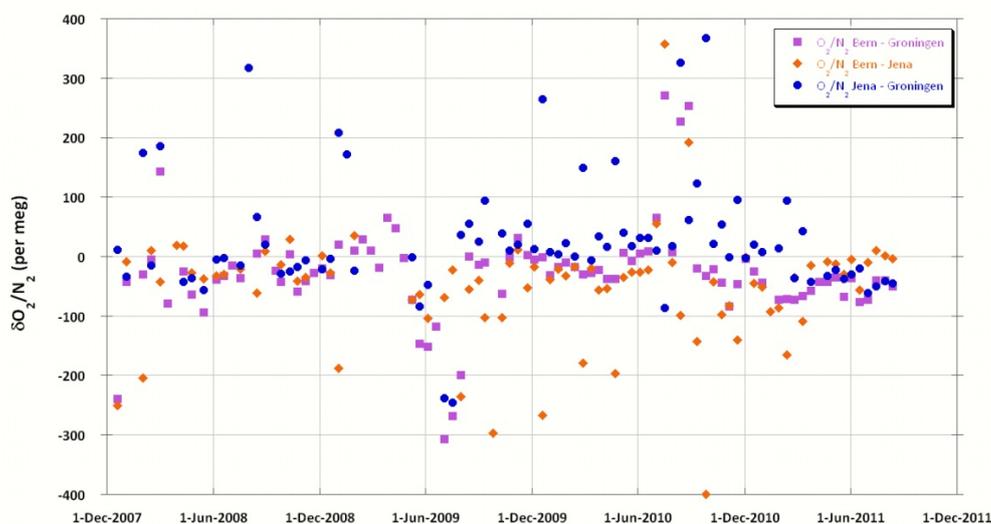


Figure 4. O_2/N_2 ratio differences calculated from MPI-BGC Jena, CEP UBern and CIO Groningen measurements.

Key words:

Flask measurements, inter-comparison, oxygen and carbon dioxide measurements, Greenhouse gas

Collaborating partners/networks:

IMECC partners

Scientific publications and public outreach 2011:

Conference papers

I.T. van der Laan-Luijkx, S. van der Laan, C. Uglietti, M.F. Schibig and M. Leuenberger, Overview of 10 years of CO₂ and O₂ observations at Jungfraujoch, Switzerland, The 16th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse

Gases, and Related Measurement Techniques (GGMT) 2011, 26 October 2011,
Wellington, New Zealand, Abstract book.

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