DLR Falcon UMAQS N2O and CO Measurements

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1.0 Data Set Overview

The data set contains in-situ measurements of the atmospheric trace gases N_2O and CO by the DLR FALCON aircraft during the Deep-Propagating Gravity Wave Experiment (DEEPWAVE) 2014 in New Zealand. The data set includes 13 files for every DLR FALCON research flight between the 29th of June and 20th of July 2014 with take-off and landing in Christchurch/New Zealand. The measurement area was located from 20°S – 60°S, and 130°E – 150°E, respectively. For additional information on DEEPWAVE check the project webpage under: https://www.eol.ucar.edu/field_projects/deepwave.

2.0 Instrument Description

The in-situ measurements were performed with the University of Mainz Airborne Quantum Cascade Laser-spectrometer (UMAQS), which is based on the Aerodyne Quantum Cascade Laser Mini Monitor (Aerodyne Research Inc., MA, USA) with a 76m astigmatic multipass absorption cell [1,2]. The instrument applies direct absorption spectroscopy using a continuous-wave quantum cascade laser with a sweep rate of 2 kHz. To account for potential drifts, an in-flight calibration unit with compressed ambient air, which has been calibrated before and after the flights against a laboratory standard, is used. Further information on the instrument can be found in [3].

	Time resolution	Precision (2 σ) [ppbv]	Accuracy relative to working standard [ppbv]
CO	1Hz	0.7 ppbv	1.3 ppbv
N_2O	1Hz	0.2 ppbv	0.4 ppbv

The accuracy values can be regarded as conservative estimates and are dominated by drifts during ascent and descent, with significant higher stability during horizontal flight sections.

3 Hz data are available on request.

3.0 Data Collection and Processing

The data set contains 13 files, one for each research flight of the DLR Falcon:

Flight	Date (UTC)	File
RF-F-01	2014-06-29	DEEPWAVE_RF_F_01_20140629_20150529_UMAQS_N2O_CO.ames
RF-F-02	2014-06-30	DEEPWAVE_RF_F_02_20140630_20150529_UMAQS_N2O_CO.ames
RF-F-03	2014-07-02	DEEPWAVE_RF_F_03_20140702_20150529_UMAQS_N2O_CO.ames
RF-F-04	2014-07-04	DEEPWAVE_RF_F_04_20140704_20150529_UMAQS_N2O_CO.ames
RF-F-05	2014-07-04	DEEPWAVE_RF_F_05_20140704_20150529_UMAQS_N2O_CO.ames
RF-F-06	2014-07-10	DEEPWAVE_RF_F_06_20140710_20150529_UMAQS_N2O_CO.ames
RF-F-07	2014-07-11	DEEPWAVE_RF_F_07_20140711_20150529_UMAQS_N2O_CO.ames
RF-F-08	2014-07-11	DEEPWAVE_RF_F_08_20140711_20150529_UMAQS_N2O_CO.ames
RF-F-09	2014-07-12	DEEPWAVE_RF_F_09_20140712_20150529_UMAQS_N2O_CO.ames
RF-F-10	2014-07-12	DEEPWAVE_RF_F_10_20140712_20150529_UMAQS_N2O_CO.ames
RF-F-11	2014-07-14	DEEPWAVE_RF_F_11_20140714_20150529_UMAQS_N2O_CO.ames
RF-F-12	2014-07-16	DEEPWAVE_RF_F_12_20140716_20150529_UMAQS_N2O_CO.ames
RF-F-13	2014-07-20	DEEPWAVE_RF_F_13_20140720_20150529_UMAQS_N2O_CO.ames

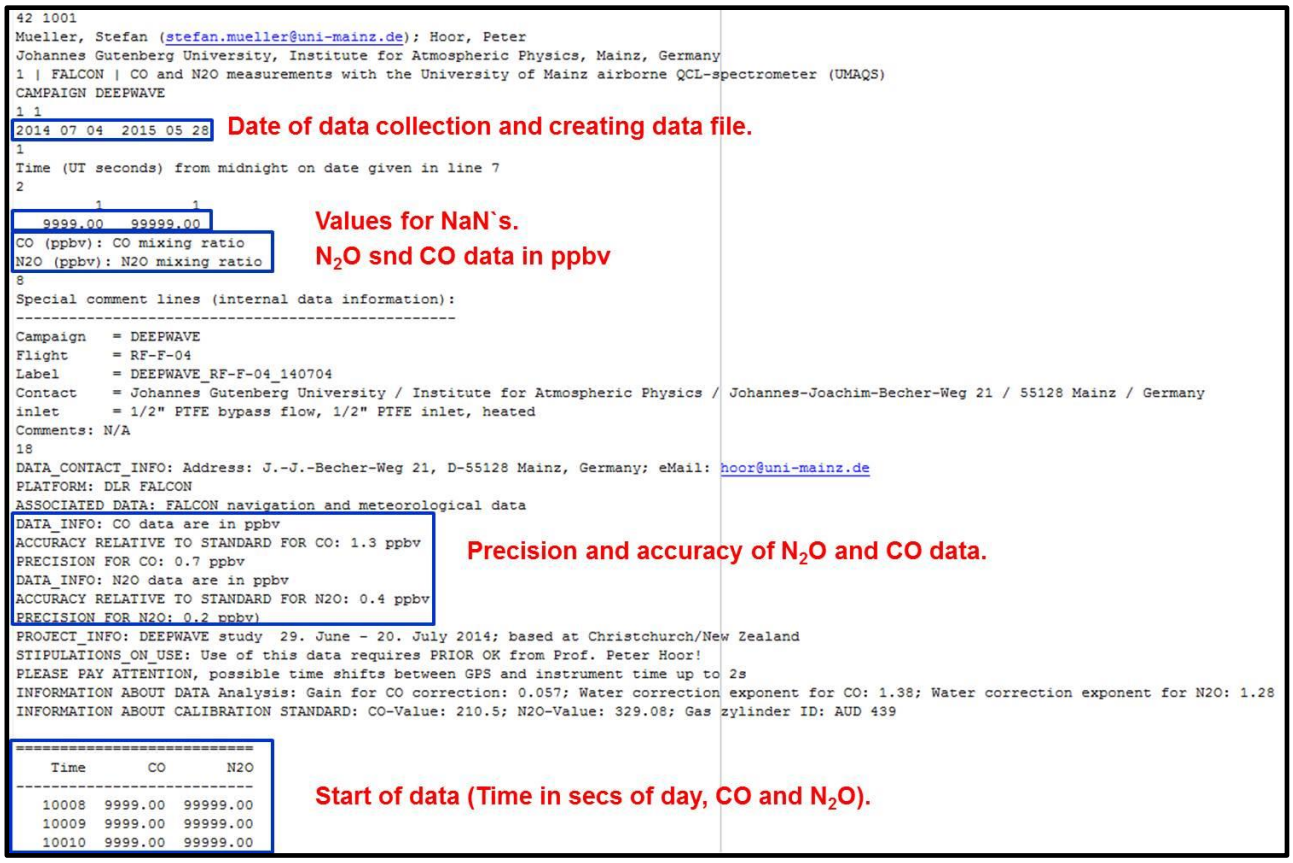
The N_2O and CO data is corrected for potential instrumental drifts based on in-flight calibrations against compressed air, which is traceable against NOAA laboratory standards.

4.0 Data Format

The data set is provided in the NASA Ames Format for Data Exchange (https://badc.nerc.ac.uk/help/formats/NASA-Ames/).

The header lines contain metadata according to the NASA Ames Format guidelines (see: **Fehler! Verweisquelle konnte nicht gefunden werden.**).

Figure 1: Header of data files with description of important sections.



5.0 Data remarks

Almost full data coverage for all research flights during DEEPWAVE 2014. NaN`s in the data time series are mostly due to in-flight calibrations. According meteorological and GPS data of the DLR Falcon is necessary for scientific interpretation.

6.0 References

(1) McManus, J. B., D. D. Nelson, and M. S. Zahniser (2010), Long-term continuous sampling of 12CO2, 13CO2 and 12C18O16O in ambient air with a quantum cascade laser spectrometer, *Isot. Environ. Health Stud.*, *46*(1), 49–63, doi:10.1080/10256011003661326.

(2) McManus, J. B., M. S. Zahniser, and D. D. Nelson (2011), Dual quantum cascade laser trace gas instrument with astigmatic Herriott cell at high pass number, *Appl. Opt.*, *50*(4), A74–A85, doi:10.1364/AO.50.000A74.

(3) Müller, S., P. Hoor, F. Berkes, H. Bozem, M. Klingebiel, P. Reutter, H. G. J. Smit, M. Wendisch, P. Spichtinger, and S. Borrmann (2015), In situ detection of stratosphere-troposphere exchange of cirrus particles in the midlatitudes, *Geophys. Res. Lett.*, *42*, doi:10.1002/2014GL062556.