

DLR Falcon WARAN (Water vapor measurements)

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1.0 Data Set Overview

The data set contains in-situ measurements of total water and calculated ice water content by the DLR Falcon research aircraft during the DEEPWAVE experiment. The data cover a time period between 29 June and 20 July 2014. In this time 13 research flights of the DLR Falcon took place. The aircraft was stationed at the airport in Christchurch, New Zealand. The measurements were located between 20°-60°S and 130°-150°E.

For more information on the DEEPWAVE project please visit:
https://www.eol.ucar.edu/field_projects/deepwave

2.0 Instrument Description

The measurements were performed by an Atmospheric Water Vapor Sensing System (WVSS-II, SpectraSensors Inc.) called WARAN (Water Vapor Analyzer). The measurement principle is based on a tunable diode laser technique. Atmospheric air is lead through a closed measuring cell, where the laser beam is set to 1.37 μm on an absorption line of water vapor. To determine the water vapor mixing ratio the 2f method is used. The calibration of the signal is done by SpectraSensors, Inc.

Further information on the instrument can be found in the data sheet and technical publications (<http://www.spectrasensors.com/wvss/#1>).

Time resolution	Accuracy (SpectraSensors, Inc.)	Measurement range (SpectraSensors, Inc.)
~0.4 Hz	$\pm 5\%$ or ± 50 ppmv, whichever is greater	50-40000 ppmv

3.0 Data Collection and Processing

Data were collected with a heated forward-facing inlet on the aircraft fuselage. According to the forward-facing direction we measure total water (gas phase water and evaporated particles). The inlet characteristic leads to an enhancement of particles, which has to be corrected. We suppose a maximum enhancement factor determined by the ratio of the aircraft speed to the velocity of the airstream in the inlet line. The corrected total water measurements are used to calculate the ice water content (IWC). The IWC is derived by subtracting the saturation mixing ratio from the total water mixing ratio.

Additionally, we corrected all data with a pressure dependent calibration, which was done before the campaign. Total water mixing ratios below 40 ppmv were deleted due to imprecise measurements in this range.

The data files just contain the calculated ice water content to give information about clouds. For gas phase water vapor measurements please refer to the DLR Falcon CR-2 data.

The data set contains 13 files of each DLR Falcon research flight.

RF#	Date	File	Version
RF_F01	2014-06-29	DEEPWAVE_RF_F01_WARAN_140629a	V4
RF_F02	2014-06-30	DEEPWAVE_RF_F02_WARAN_140630a	V4
RF_F03	2014-07-02	DEEPWAVE_RF_F03_WARAN_140702a	V4
RF_F04	2014-07-04	DEEPWAVE_RF_F04_WARAN_140704a	V4
RF_F05	2014-07-04	DEEPWAVE_RF_F05_WARAN_140704b	V4
RF_F06	2014-07-10	DEEPWAVE_RF_F06_WARAN_140710a	V4
RF_F07	2014-07-11	DEEPWAVE_RF_F07_WARAN_140711a	V4
RF_F08	2014-07-11	DEEPWAVE_RF_F08_WARAN_140711b	V4
RF_F09	2014-07-12	DEEPWAVE_RF_F09_WARAN_140712a	V4
RF_F10	2014-07-12	DEEPWAVE_RF_F10_WARAN_140712b	V4
RF_F11	2014-07-14	DEEPWAVE_RF_F11_WARAN_140714a	V4
RF_F12	2014-07-16	DEEPWAVE_RF_F12_WARAN_140716a	V4
RF_F13	2014-07-20	DEEPWAVE_RF_F13_WARAN_140720a	V4

Version V4: 2016-01-29

4.0 Data Format

The data set is provided in the NASA Ames Format.

The header lines of each data file contain metadata according to the guidelines.

Example of the header:

```
31      1001
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(Christiane.Voigt@dlr.de)
Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Institut fuer Physik der
Atmosphaere
1|Falcon|WARAN
DEEPWAVE (June/July 2014)
1      1
2014 06 29      2016 01 29
0.0
UTC in sec after midnight (Falcon data system time)
1
1
-9999.99
Ice water Content [g/m3]
15
-----
FINAL DATA
PLEASE CONTACT THE DATA OWNER CHRISTIANE VOIGT BEFORE USING THE DATA.
-----
The data are shifted to a regular time grid with 1 s grid spacing.
The measured parameter is the total water mixing ratio, sampled with a
forward-facing inlet and a time resolution of about 0.4 Hz.
We calculated the ice water content (IWC) from the total water mixing ratio.
Saturation mixing ratio has been applied for calculation - data will differ
slightly by use of gas phase water vapor.
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Particle enhancement: correction due to unisokinetic sampling in clouds by using
the maximum enhancement factor (ratio of true air speed to inlet velocity)
Mixed phase clouds: during ascent, descent and high pressure flight legs the
data should be classified as total water content
Some data are deleted at very low total water mixing ratios (detection limit of
WARAN) and at moments of too much moisture in the inlet line.
Accuracy of measured total water mixing ratio: +/-5% or +/-50 ppmv, whichever is
greater (SpectraSensors, Inc.)
Accuracy of calculated enhancement factor: +/-5%
We have no corrections for the position of the TGI inlet and for particle
trajectories influenced by the geometry of the Falcon fuselage.
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1
UTC      IWC
81592    -9999.99
81593    -9999.99
81594    -9999.99
81595    -9999.99
81596    -9999.99
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Description of authors
and campaign

Date of collection and last processing

Missing value
Parameters and units

Comment lines

Start of data reading

5.0 Data Remarks

A pressure dependent offset on the water vapor mixing ratios is corrected by a calibration. The calculated ice water content is given in g/m^3 . We have no corrections for the position of the TGI inlet and for particle trajectories influenced by the geometry of the Falcon fuselage.