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Data Set description:

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Instrument:	MIAWARA-C (MIddle Atmospheric WAter vapour RAdiometer for Campaigns)
Site:	Multiple – see history below
Measurement Quantities:	Water vapour profiles

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Reference Articles:

Straub, C., Murk, A., & Kämpfer, N. (2010). MIAWARA-C, a new ground based water vapour radiometer for measurement campaigns. Atmospheric Measurement Techniques, 3(1), 1–20. http://doi.org/10.5194/amt-3-1-2010

Straub, C., Murk, A., Kämpfer, N., Golchert, S. H. W., Hochschild, G., Hallgren, K., & Hartogh, P. (2011). ARIS-Campaign: Intercomparison of three ground based 22 GHz radiometers for middle atmospheric water vapor at the Zugspitze in winter 2009. Atmospheric Measurement Techniques, 4(9), 1979–1994. http://doi.org/10.5194/amt-4-1979-2011

Straub, C., Tschanz, B., Hocke, K., Kämpfer, N., & Smith, A. K. (2012). Transport of mesospheric H2O during and after the stratospheric sudden warming of January 2010: Observation and simulation. Atmospheric Chemistry and Physics, 12(12), 5413–5427. http://doi.org/10.5194/acp-12-5413-2012

Scheiben, D., Straub, C., Hocke, K., Forkman, P., & Kämpfer, N. (2012). Observations of middle atmospheric H2O and O3 during the 2010 major sudden stratospheric warming by a network of microwave radiometers. Atmospheric Chemistry and Physics, 12, 7753–7765. http://doi.org/10.5194/acp-12-7753-2012

Tschanz, B., Straub, C., Scheiben, D., Walker, K. A., Stiller, G. P., & Kämpfer, N. (2013). Validation of middle-atmospheric campaign-based water vapour measured by the ground-based microwave radiometer MIAWARA-C, 6, 1725–1745. http://doi.org/10.5194/amt-6-1725-2013

Scheiben, D., Schanz, A., Tschanz, B., & Kämpfer, N. (2013). Diurnal variations in middle-atmospheric water vapor by ground-based microwave radiometry. Atmospheric Chemistry and Physics, 13, 6877–6886. http://doi.org/10.5194/acp-13-6877-2013

Scheiben, D., Tschanz, B., Hocke, K., Kämpfer, N., Ka, S., & Oh, J. J. (2014). The quasi 16-day wave in mesospheric water vapor during boreal winter 2011/2012. Atmospheric Chemistry and Physics, 14, 6511–6522. http://doi.org/10.5194/acp-14-6511-2014

Tschanz, B., & Kämpfer, N. (2015). Signatures of the 2-day wave and sudden stratospheric warmings in Arctic water vapour observed by ground-based microwave radiometry. Atmospheric Chemistry and Physics, 15, 5099–5108. http://doi.org/10.5194/acp-15-5099-2015

Schranz, F., Tschanz, B., Rüfenacht, R., Hocke, K., Palm, M., & Kämpfer, N. (2019). Investigation of Arctic middle-atmospheric dynamics using 3 years of H2O and O3 measurements from microwave radiometers at Ny-Ålesund. Atmospheric Chemistry and Physics, 19, 9927–9947. http://doi.org/10.5194/acp-19-9927-2019.

Instrument description:

MIAWARA-C, the MIddle Atmospheric WAter vapour RAdiometer for Campaigns, is a ground-based microwave radiometer built at the University of Bern and specially designed for campaigns. It is therefore a very compact instrument which only needs a power connection and an Internet connection and which is operated remotely. The instrument front-end consists of two uncooled heterodyne receivers observing simultaneously in two orthogonal polarization with a system temperature of 150 K. In the back-end the signal is spectrally analysed with a FFT spectrometer with 2x500MHz bandwidth and 30.5 kHz spectral resolution. The instrument measures the pressure-broadened emission line of water vapour at 22 GHz.

Retrieval algorithm:

The retrieval of the water vapour profiles from the spectra is performed with QPACK (Eriksson et al., 2005) and ARTS2 (Eriksson et al., 2011), using an optimal estimation method (Rodgers, 1976). An a priori water vapour profile is required for the optimal estimation method and is taken from an MLS climatology of the years 2004–2008. The retrieved water vapour profiles have an altitude range of 37–75km with a vertical resolution of 12–19 km. The time resolution is 24 hours.

Accuracy:

MIAWARA-C water vapour profiles from Ny-Alesund were intercompared with satellite measurements and model data for a 3 year period starting in September 2015 (Schranz et al. 2019). On average SD-WACCM and ACE-FTS are within ±5% of the MIAWARA-C water vapour measurements up to 0.1 hPa (about 60 km). The EOS-MLS measurements have however a constant offset to MIAWARA-C over the 3 years, which is on average 10%–15% depending on altitude. In the mesosphere this offset was already seen when MIAWARA-C was located at Bern and Sodankylä for 2012– 2013 (Tschanz et al., 2013)

Instrument History:

Zugspitze, Germany:	01/2009 - 04/2009
Table Mountain, USA:	09/2009 - 10/2009
Sodankylä, Finland:	01/2010 - 06/2010

Zimmerwald, CH:	07/2010 - 09/2011
Sodankylä, Finland:	06/2011 - 03/2013
Maido,La Reunion:	08/2013 - 02/2015
Ny Alesund, Svalbard:	09/2015 - current