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DataSetdescription:

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Instrument: MIAWARA-C (MIddle Atmospheric WAter vapour RAdiometer for Campaigns)
Site: Ny-Alesund
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

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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

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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

Shi, G., Krochin, W., Sauvageat, E., & Stober, G. (2023). Ozone and water vapor variability in the polar middle atmosphere observed with ground-based microwave radiometers. Atmospheric Chemistry and Physics, 23, 9137–9159. https://doi.org/10.5194/acp-23-9137-2023. (Uses MIAWARA-C H_2O together with GROMOS-C O_3 at Ny-Ålesund.)

Shi, G., Liu, H., Tsutsumi, M., Gulbrandsen, N., Kozlovsky, A., Stober, G., Kero, J., Nozawa, S., Lester, M., Baumgarten, K., Belova, E., & Mitchell, N. (2025). New insights into the polar ozone and water vapor, radiative effects, and their connection to the tides in the mesosphere–lower thermosphere during major sudden stratospheric warming events. Atmospheric Chemistry and Physics, 25(16), 9403–9430. https://doi.org/10.5194/acp-25-9403-2025. (Includes MIAWARA-C water vapour from Ny-Ålesund.)

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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 is an uncooled heterodyne receiver with a system temperature of 150 K. In the back end the signal is spectrally analysed with an FFT spectrometer with 400MHz 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 Pyarts software (, Buehler et al, 2025) which makes use of ARTS 2.6 (Eriksson et al., 2005), 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 for levels above 10hPa, whilst below 100hPa the ECMWF analysis is

used, and the two sources are combined and smoothed for pressure levels between 100hPa and 10hPa. 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:
Located at Ny-Alesund since September 2015