

File Revision Date:

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Data Set description:

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Instrument: WInd RAdiometer for Campaigns WIRA-C
Measurement Quantities: Horizontal wind speed profiles

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Reference Articles:

Hagen, J.; Murk, A.; Rüfenacht, R.; Khaykin, S.; Hauchecorne, A.; Kämpfer, N. WIRA-C: A Compact 142-GHz-Radiometer for Continuous Middle-Atmospheric Wind Measurements. Atmospheric Measurement Techniques Discussions 2018, 1-30.
doi 10.5194/amt-2018-69

Hagen J., K. Hocke, G. Stober, S. Pfreundschuh, A. Murk, N. Kämpfer, First measurements of tides in the stratosphere and lower mesosphere by ground-based Doppler microwave wind radiometry, Atmospheric Chemistry and Physics, 20/4, 2020
doi: 10.5194/acp-20-2367-2020

Hagen, Jonas; Luder, Andres; Murk, Axel; Kämpfer, Niklaus (2020). Frequency-Agile FFT Spectrometer for Microwave Remote Sensing Applications. Atmosphere, 11(5), p. 490. MDPI 10.3390/atmos11050490

Instrument description:

The WInd-RAdiometer for Campaigns (WIRA-C) is a microwave radiometer developed at the University of Bern which observes the pressure-broadened emission line of ozone at 142.2 GHz. It is a compact campaign instrument, which needs only a power and internet connection for its automated and remote controlled operation. The instrument has an uncooled heterodyne receiver with a SSB noise temperature of 550 K. The spectral analysis of the signal is performed with a FFT spectrometer based on an Universal Software Radio Peripheral (USRP X310) receiver. It has two independently tuneable input channels with 2x120 MHz instantaneous bandwidth and 12.2 kHz resolution. One of these channels remains tuned to the center of the Ozone line, while the second observes the line wing for the tropospheric correction. The instrument's field-of-view is switched alternating between the four cardinal directions (N, E, S, W) at 22° elevation, and it is calibrated using an internal hot load and tipping curves.

Retrieval algorithm:

The Doppler shift of the pressure broadened ozone lines is used to retrieve vertical profiles of the zonal and meridional wind speeds at altitudes between 35 to 70 km. The retrieval is based on the radiative transfer program ARTS2 (Eriksson et al., 2011) using an optimal estimation method (Rodgers, 1976). The standard retrieval uses an a-priori wind speed of 0 m/s and an a-priori Ozone profile based on WACCAM simulations. The retrieval has a vertical resolution in the order of 10 km and a time resolution of 12 h.

Accuracy:

The uncertainty of the retrieved wind profiles is in the order of 15 - 25 m/s.

The results have been validated by comparisons with Doppler wind lidar and ECMWF data.

Instrument History:

Maido, La Reunion: 11/2016 - 01/2018

Bern, Switzerland: 03/2018 - 05/2018

Andoya, Norway: 06/2018 - 03/2020