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First continuous time series of tropical, mid-latitudinal and polar middle-atmospheric wind profile measurements with a ground-based microwave Doppler-spectro-radiometer

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Wind is one of the key parameters for the characterisation of the atmosphere and the understanding of its dynamics. Despite this, no continuously operating instrument for wind measurements in the upper stratosphere and lower mesosphere existed so far.

Aiming to contribute to the closing of this data gap by exploiting the potential of microwave radiometry the Institute of Applied Physics of the University of Bern built a ground-based 142 GHz Doppler-spectro-radiometer with the acronym WIRA (WInd RAdiometer). WIRA is specifically designed for the measurement of middle-atmospheric horizontal wind and is sensitive to the altitude range between 35 and 70 km. The architecture of the radiometer is fairly compact what makes it transportable and suitable for campaign use. WIRA is conceived in a way that it can be operated remotely and does hardly require any maintenance.

The operational use of WIRA started in September 2010. Since a technical upgrade in autumn 2012 which drastically increased the signal to noise ratio of the instrument, the meridional component is permanently measured along with the zonal wind to get a full picture of the horizontal wind field.

During the last year the wind retrieval algorithm has been entirely rebuilt and tested. It is now based on the optimal estimation technique (OEM) and uses an upgraded version of the ARTS/QPACK radiative transfer and inversion model.

Time series of middle-atmospheric wind from measurement campaigns of 7 to 11 months duration at mid and high latitude sites (Bern, 46°57′ N, 7°26′ E; Sodankylä, 67°22′ N, 26°38′ E; Observatoire de Haute-Provence, 43°56′ N, 5°43′ E) have been obtained. In September 2013 WIRA was moved to Observatoire du Maïdo (21°04′ S, 55°23′ E) to study the dynamics of the tropical middle atmosphere. The measurements have been compared to the data from the ECMWF model. Generally good agreement has been found in the stratosphere, however systematic discrepancies exist in the mesosphere.

At the conference, the main results from the measurement campaigns and the comparison of the ECMWF model data with these measurements will be presented after a short introduction to the measurement technique.