Geophysical Research Abstracts
Vol. 15, EGU2013-5762, 2013
EGU General Assembly 2013

First middle-atmospheric zonal wind profile measurements with a new ground-based microwave Doppler-spectro-radiometer

Rolf Rüfenacht, Niklaus Kämpfer, and Axel Murk
University of Bern, Switzerland (rolf.ruefenacht@iap.unibe.ch)

Today, the wind data for the upper stratosphere and lower mesosphere are commonly extrapolated using models or calculated from measurements of the temperature field, but are not measured directly. Still, such measurements would allow direct observations of dynamic processes and thus provide a better understanding of the circulation in this altitude region where the zonal wind speed reaches a maximum. Observations of middle-atmospheric winds are also expected to provide deeper insight in the coupling between the upper and the lower atmosphere, especially in the case of sudden stratospheric warming events. Furthermore, as the local chemical composition of the middle atmosphere can be measured with high accuracy, wind data could be beneficial for the interpretation of the associated transport processes. In future, middle-atmospheric wind measurements could help to improve atmospheric circulation models.

Aiming to contribute to the closing of this data gap the Institute of Applied Physics of the University of Bern built a new ground-based 142 GHz Doppler-spectro-radiometer with the acronym WIRA (WInd RAdiometer) specifically designed for the measurement of middle-atmospheric wind. Until now wind speeds in five levels between 30 and 79 km can be retrieved what made WIRA the first instrument continuously measuring profiles of horizontal wind in this altitude range. On the altitude levels where our measurement can be compared to ECMWF very good agreement has been found in the long-term statistics, with WIRA = $(0.98\pm0.02) \times$ ECMWF + (0.44 ± 0.91) m/s on average, as well as in short time structures with a duration of a few days.

WIRA uses a passive heterodyne receiver together with a digital Fourier transform spectrometer for the data acquisition. A big advantage of the radiometric approach is that such instruments can also operate under adverse weather conditions and thus provide a continuous time series for the given location. The optics enables the instrument to scan a wide range of azimuth angles including the directions east, west, north, and south for zonal and meridional wind measurements. The design of the radiometer is fairly compact and its calibration does not rely on liquid nitrogen 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.

A first time series of 11 months of zonal wind data was obtained for Bern (46°57' N, 7°26' E) before the instrument was moved to Sodankylä (67°22' N, 26°38' E) in September 2011 to measure at polar latitudes during a period of 10 months. After a substantial technical upgrade (integration of a pre-amplifier and sideband filter) increasing the instruments signal to noise ratio by a factor of 2.4 the measurement campaign of the ARISE project at the site of the Observatoire de Haute-Provence was joined where among others data intercomparison with a newly operational Rayleigh-Mie Doppler wind lidar is planned.

At the conference, the main results from these campaigns will be presented along with the measurement technique and the instrument properties.