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Investigation of aerosol and water vapor effects on shortwave and longwave downward irradiance using different ground-based measurements during clear sky conditions

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The present study investigates the influence of water vapor and aerosols on short- and longwave downward irradiance in Vienna during a period of one and half year.
Aerosol optical depth has been measured continuously since May 2016 using a CIMEL sunphotometer installed on the measurement platform of University of Natural Resources and Life Sciences (BOKU). Water vapor was obtained from CIMEL measurements, from radiosonde data and was also retrieved using spectral irradiance measurements performed on the measurement platform of Austrian Institute of Technology (AIT). In addition MAX-DOAS observations of water vapor are performed on the University of Veterinary Medicine (VetMed) measurement platform.
Global, diffuse and direct radiation data were taken from measurements performed at BOKU and at Austrian Weather Office (ZAMG). The ZAMG station belongs to the Austrian Radiation Monitoring Network which follows BSRN quality standards.
First, we selected clear sky days looking first at the diurnal course of global radiation and in addition for the selected days at fish eye camera monitoring of cloudiness.
We secondly analyzed the correlation of meteorological data and aerosol optical depth (AOD). Higher AOD values were measured during weather conditions with low wind speed and eastern wind flows. AOD was also clearly anticorrelated with direct and global radiation.
Third, the influence of water vapor on short and longwave radiation was evaluated. We first analyzed the difference between water vapor obtained from CIMEL, from radiosonde data, by retrieval using the spectral radiation measurements, and from MAX-DOAS data. The fluctuations of short and longwave radiation as a function of atmospheric water vapor concentrations were then analyzed. For a more detailed analysis of atmospheric water vapor content on downward longwave radiation the atmospheric vertical profile of temperature and radiative transfer simulations had to be used.