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More than ten years of monitoring the solar spectrum from 280 to 850 nm in the north of Munich: climatology and trends.

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Since 1996, measurements of the downwelling solar spectral irradiance from 280 to 850 nm are performed at the Helmholtz Zentrum München (former GSF National Reasearch Center for Environment and Health), 11.6 E, 48.22 N, 490 m above sea level. The spectral resolution (FWHM) is 1 nm in the UV range and 2 nm in the visible and near infrared range. The records are made in a 15-minute interval with a TDM300 double monochromator system of Bentham (Reading, UK) temperature stabilized at 20 +/- 1 °C. The entrance optics consists of a quartz cosine diffuser in combination with a 4 m quartz fibre. Calibration of the system is done on a weekly basis using a 100 W tungsten lamp whose spectral emission is traceable to a primary standard of the Physikalisch Technische Bundesanstalt (PTB, Braunschweig, Germany).

From these measurements, trends in spectral and broadband irradiance and their uncertainties were calculated. The most important influencing factors like natural variability, systematic and random errors of the measurements, and uncertainties caused by gaps in the time series are taken into account. For our trend analysis, the natural variability is characterized by the following effects (parameters): clouds (fraction, type, base altitude), aerosols (horizontal visibility), ground surface (albedo including effects of snow cover and snow depth) and ozone (total ozone column). These parameters are obtained by observation and measurement performed by the German Weather Service (DWD) nearby our measurement site at Munich Airport (distance to our site approx. 20 km) and Oberschleißheim (approx. 4 km).