Long-term dynamics of OH* temperatures over central Europe: trends and solar correlations

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We present the analysis of annual average OH* temperatures in the mesopause region derived from measurements of the GRound based Infrared P-branch Spectrometer (GRIPS) at Wuppertal (51° N, 7° E) in the time interval 1988 to 2015. The temperature time series shows a clear correlation with the solar radio flux F10.7cm (11-year cycle of solar activity) with a sensitivity of about 3 - 5 K/(100 SFU) . Beside this correlation we find a trend break in the temperature time series in 2008.

This apparent trend break can be caused by a long periodic oscillation. Thus, we describe the OH* temperature time series by using the solar radio flux and an oscillation. A least square fit leads to a sensitivity to the solar activity of (4.1 ± 0.8) K/(100 SFU), a period $P = (24.8 \pm 3.3)$ years, and an amplitude $C_{sin} = (1.95 \pm 0.44)$ K of the oscillation. The most important finding here is that using this description an additional linear trend is no longer needed.

It furthermore turns out that a trend derivation is principally difficult if a long period oscillation exists in the atmosphere and the sampling interval is shorter than the period. As a consequence, completely different linear trends with respect to magnitude and sign can be observed depending on the analysed time interval.