Geophysical Research Abstracts, Vol. 9, 08684, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08684

Solar Activity observed by means of OH*-Temperature Fluctuations utilising the Differential Rotation of the Sun

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Measurements of the hydroxyl rotational temperatures (OH*) at 87 km altitude above Wuppertal (51.3°N, 7.2°E) are analysed. The time series covers the time interval from 1987 until 2005 and consists of more than 4000 night mean temperature data. Seasonal and longer term trends are removed from the data set and OH* temperature fluctuations on temporal scales of about 3 to 40 days are derived. Various spectral analysis techniques (harmonic analysis, maximum entropy method and the wavelet transform) are applied.

Due to the Sun's rotation the irregular pattern of sunspots on the solar disc leads to OH*-temperature fluctuations. Pronounced spectral components in the OH*-temperature fluctuations around the periods from 27 to 31 days are frequently observed. We tentatively attribute these signatures to the differential rotation of the Sun: Sun's equatorial regions rotate faster (taking only about 27 days) than the polar regions (about 40 days). Sunspots occur at heliographic latitudes between +40° and -40°, which correspond to a rotation rate of about 27 to about 31 days. The OH*-temperature fluctuations within this period range show a long-term modulation of 11 years. Thus, tracking the spectral intensity of the 27-31 day component allows the direct monitoring of the solar sunspot cycle.