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Wavelet Analysis of Stratospheric SCIAMACHY Ozone - The Quest for the 27-day Cycle!

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The high-frequency influence of solar radiation has already been investigated by Hood (1986) in the 80s of last century during solar maximum 21 (1979-1981). It was done with the help of SBUV (Solar Backscattered UltraViolet) ozone measurements onboard Nimbus 7. Further investigations followed. Hood and Zhou (1998), Ruzmaikin et al. (2007) and Gruzdev et al. (2008) are only a few studies to mention from the following years, whereas the last study was based upon the output of a three-dimensional Chemistry-Climate-Model (CCM) and the other studies on satellite measurements.

Besides different means of the descriptive statistics and their associated investigation of the statistical significance use of the within the last two decades in popularity grown wavelet analysis has been made. The advantage to standard techniques is a higher temporal resolution with a combined adjustment between the time and frequency resolution depending on the choice of wavelet and its order. Within a given time series the connection between ozone and solar radiation is sometimes not well-defined and should be able to be investigated in more detail.

On the one side ozone profiles from SCIAMACHY (SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY) limb measurements retrieved with the knowledge about ozone absorption in the Hartley, Huggins and Chapuis bands are used in this study. On the other side we apply the wavelet analysis to the SCIAGOME Mg II index (Skupin et al., 2005) which serves as solar proxy. The modulation of the Mg II index goes along with the rotation of the sun (27-day cycle).

Note: 27 days in not the only period for the solar rotational cycle. Depending on the solar latitude at which active regions and sunspots are located on the sun the periods vary from 25 days to 30 days. The differential rotation of the sun lets regions with an intensified radiative output appear and disappear within the field of view of the earth. It is simply convenient to call it the 27-day cycle.

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