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Solar induced inter-annual variability of ozone

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Measurements by the Michelson Interferometer for Passive Atmospheric Sounding instrument on board the ENVIromental SATellite from 2005 – 2011 are used to investigate the impact of solar and geomagnetic activity on O_3 in the stratosphere and mesosphere inside the Antarctic polar vortex. It is known from observations that energetic particles, mainly originating from the sun, precipitate in the Earth atmosphere and produce odd nitrogen NO_x (N + NO + NO_2) in the upper mesosphere and lower thermosphere, which is transported downwards into the stratosphere during polar winter. Results from global chemistry-transport models suggest that this leads to a depletion of O_3 down to $\sim$30 km at high latitudes during winter. Therefore it appears promising to search for a link between high energetic particles and O_3 in actual data sets. Thus in this study, correlation analysis between a 26 days average centred around 1 Apr, 1 May and 1 Jun of several solar/geomagnetic indices (Ap index, F10.7 cm solar radio flux, Lyman-alpha, 2 MeV electrons flux) and 26 day running means from 1 Apr - 1 Nov of O_3 in the altitude range from 20 - 70 km were performed. The results reveal negative correlation coefficients propagating downwards throughout the polar winter, at least for the Ap index and the 2 MeV electrons flux. Comparisons with TIMED/SABER and Odin/SMR O_3 data are in moderate agreement, also showing a descending negative signal in either indices, but only for the correlation with 1 Apr.