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Occurrence of Polar Stratospheric Clouds using ground-based DOAS observations

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Polar Stratospheric Clouds (PSCs) favour heterogeneous reactions and thus are an important component of ozone depletion processes in polar regions. Although satellite observations already yield high spatial coverage, the sampling frequency of a specific air volume depends on the measurement method. Here, continuous ground-based measurements with high temporal resolution can be a valuable complement.

Since 1999, a MAX-DOAS (Multi AXis-Differential Optical Absorption Spectroscopy) instrument has been operating at the German research station Neumayer (70° S, 8° W), Antarctica. Primarily, slant column densities of trace gases such as NO₂, BrO and OClO are retrieved. However, in this study the so-called colour index (CI), i.e. the colour of the zenith sky, is investigated. Defined as the ratio between the observed intensities of scattered sun light at two wavelengths, it enables to monitor the occurrence of polar stratospheric clouds during twilight even in the presence of tropospheric clouds.

Using the radiative transfer model McArtim, the CI changes in the presence of polar stratospheric clouds can be analysed. Especially the height of the PSC layer affects the retrieved signal, but also the choice of the wavelengths has a strong impact. Here, it is advantageous that measurements are available in the UV and visible spectral range which allows a more extensive comparison of different CI choices. In order to assess the application of the colour index method, meteorological data are used to identify PSC cases in the data set.

The aim is to improve and evaluate the potential of this method. It is then used to infer the occurrence of PSCs throughout the measurement time series of more than 20 years.