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Ozone trends in the stratosphere determined by Dynamic Linear Model

Professor Erkki Kyrölä
(Finnish Meteorological Institute)

Abstract

The possibility of strong decline of middle atmospheric ozone became evident when large loss of ozone was detected over Antarctica in mid 1980s. The international Montreal protocol in 1988 and its later amendments have restricted and forbidden man-made chemicals that were found to be responsible for the ozone loss. This has led to the reduction of ozone depleting chemicals and hopes for ozone recovery are realistic. Several recent studies have found that weak signs of recovery are present in various satellite data sets.

The most straightforward modeling for ozone loss and its predicted recovery is a piecewise linear model where initial ozone loss is followed by ozone recovery. This modeling captures the behavior near the time when the trend changes, but it may be too restrictive to describe complicated middle atmosphere ozone processes. In this work we apply the so-called dynamic linear model (DLM) for the time evolution of the middle atmosphere ozone. The method allows ozone trend to vary smoothly and continuously as a function of time.

The main target of our study is to determine ozone trends in the stratosphere (between 20-50 km) using satellite data. The data set for this altitude region is SAGE-CCI-OMPS time series covering 1984-2018. We will compare our new results to our earlier results retrieved from the combination of GOMOS and SAGE II occultation measurements covering 1984-2011. We will also compare results to the recent report Scientific Assessment of Ozone Depletion: 2018.