A Bayesian analysis of trends in ozone sounding data series from 9 Nordic stations

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Ozone soundings from 9 Nordic stations have been homogenized and interpolated to standard pressure levels. The different stations have very different data coverage; the longest period with data is from the end of the 1980ies to 2013.

We apply a model which includes both low-frequency variability in form of a polynomial, an annual cycle with harmonics, the possibility for low-frequency variability in the annual amplitude and phasing, and either white noise or AR1 noise. The fitting of the parameters is performed with a Bayesian approach not only giving the posterior mean values but also credible intervals.

We find that all stations agree on an well-defined annual cycle in the free troposphere with a relatively confined maximum in the early summer. Regarding the low-frequency variability we find that Scoresbysund, Ny Aalesund, and Sodankyla show similar structures with a maximum near 2005 followed by a decrease. However, these results are only weakly significant. A significant change in the amplitude of the annual cycle was only found for Ny Aalesund. Here the peak-to-peak amplitude changes from 0.9 to 0.8 mhPa between 1995-2000 and 2007-2012.

The results are shown to be robust to the different settings of the model parameters (order of the polynomial, number of harmonics in the annual cycle, type of noise, etc). The results are also shown to be characteristic for all pressure levels in the free troposphere.