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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Trends and annual cycles in soundings of Arctic tropospheric ozone" *by* Bo Christiansen et al.

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We want to thank the reviewer for the very thoughtful and constructive comments.

Comment 1:

The data from Eureka, Ny Aalesund, and Lerwick are homogenized by the institutions of the 3 persons mentioned in the acknowledgements. The other stations are homogenized by the institutions of the authors of the paper. In the revised paper we will include this and some more details about the homogenization procedure. We will also describe which data that are available from the websites.

Unfortunately, changes in ozonesonde types and (vertical) resolutions are not clear-cut. There are often transition periods lasting several years where a combination of

different sondes and resolutions are used. In the revised version we will include the main changes in Table 1 or indicate them in Fig. 1.

Comment 2:

Probably the biggest differences between Bayesian and sequential methods are that in the Bayesian approach the parameters of the model can be seen as random variables and that the Bayesian approach can systematically include prior information (not used in the present study). The Bayesian method is also often seen as more philosophically appealing.

However, the main practical advantage of the Bayesian method (and the reason we use it here) is that we obtain a characteristic ensemble of solutions which systematically provides uncertainties. These uncertainties are not only obtained for all parameters but also for all derived quantities such as trends, annual cycles, differences in annual cycles etc. Another advantage of the model based Bayesian method is that we can use all data directly without first doing, e.g., monthly averaging. As the model is non-linear it is not easy to fit directly, but the Monte-Carlo methods used in Bayesian statistics do this. The fitting could also be done by using a fitting routine that deals with nonlinear models. However, such methods does not allow for directly obtaining the uncertainties.

In the revised version of the paper we will include a somewhat more detailed description of the Bayesian method and the Monte-Carlo procedure used for sampling.

Residuals calculated as the difference between the mean model (cyan in the original Fig. 1) and the original data (black dots in the original Fig. 1) are shown in the attached figures for Ny Aalesund and Lerwick at 500 hPa. In general the residuals are stationary with little low-frequency structure. The distributions are close to symmetric and not far from Gaussian but with some outliers. There is no or only a weak seasonal cycle in the residuals. These results are characteristic for levels below 300 hPa at all stations.

Above 300 hPa an annual cycle is seen in the residuals with largest deviations in the

winter; most probably related to the strong stratospheric variability in this season. In particular at 300 the residuals are positively skewed, probably because this level moves in and out of the stratosphere. In the stratosphere the residuals are again almost Gaussian.

In the revised version we will include the discussion of the residuals (perhaps in a supplement).

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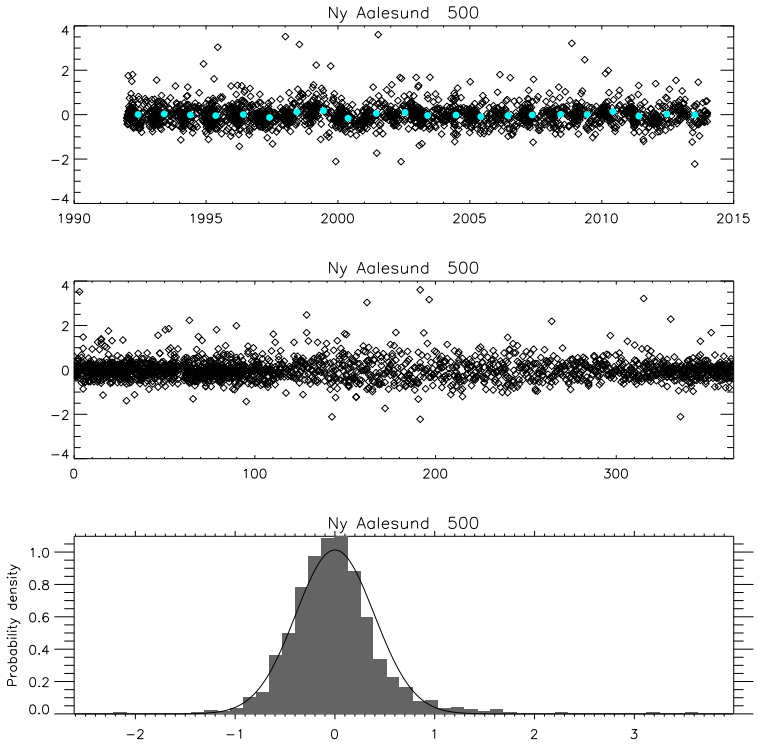

Fig. 1. Residuals at 500 hPa. Ny Aalesund. Upper panel: residuals as function of time. Cyan circles are annual means. Middle panel: residuals as function of the day of year. Lower panel: histogram of resid.

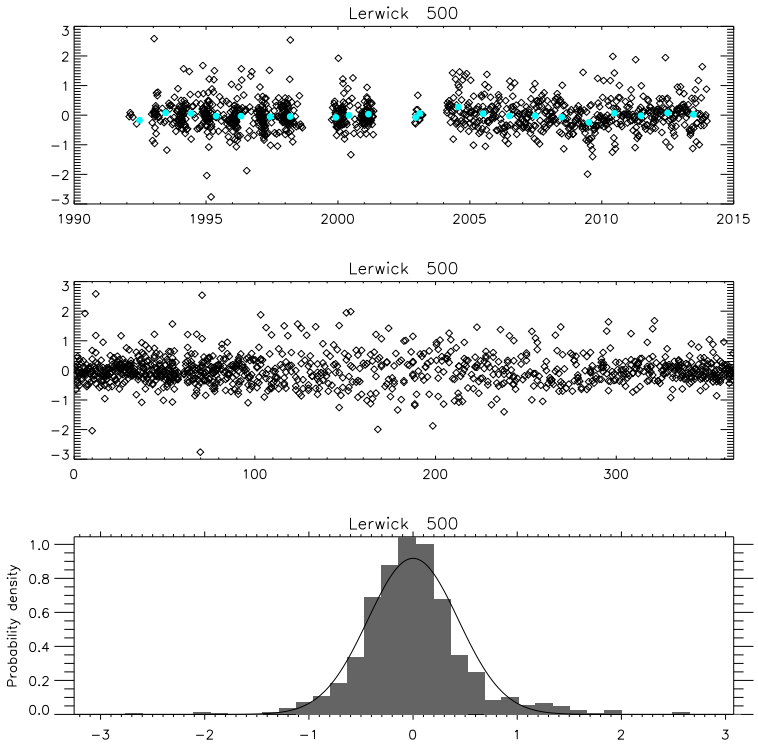

Fig. 2. As Fig. 1 but for Lerwick.