Atmos. Chem. Phys. Discuss., 10, C5744–C5746, 2010
www.atmos-chem-phys-discuss.net/10/C5744/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Extreme events in total ozone over Arosa – Part 1: Application of extreme value theory" *by* H. E. Rieder et al.

H. E. Rieder et al.

harald.rieder@env.ethz.ch

Received and published: 27 July 2010

Reply to the minor comments of Referee 2 (called "R2" below) by H.E. Rieder on behalf of the authors.

R2:" On page 12769 numbers like 9.83 x 10ËĘ-6 seem to suggest a precision which does not exist. Reducing the number of significant digits would help."

We will reduce the number of significant digits.

R2: "On page 12770 I would omit equation (1) since it is misleading (mathematically wrong). The message of the paragraph before is rather simple, can be even shortend in text, and doesn't need the equation."

We apologize for the missing minus in Eq.1. The equation will be corrected in the revised version of the paper. We will keep Eq.1 as it outlines that the same approach is also valid for values below a certain threshold value u.

R2: "Page 12771, line 23: Term (3) isn't an equation. (Same for page 12772, line 4.)"

We will embed the mathematical expression in the text.

R2: "Page 12771, line 25: What does the brackets around index i mean ?"

The brackets are not needed, we will remove them in the updated version of the manuscript.

R2: "Page 12776, lines 6-8; Table 1: The standard errors of the shape parameter u (too low)are lower than those for u."

This is addressed on P12776 of our article: The methodology used was: (i) to update the GPD parameters from Eq. (6) with a threshold equal to 445DU (443 DU); (ii) to compare the model uncertainties by standard errors (see Table 1). As expected the standard errors for the models using too high threshold values are much larger than for the optimum models. Although many more observations were used when using a lower threshold, the standard errors from the optimum models might be smaller. This statement combined with the QQ-plots indicates that the optimum model corresponds to the best trade-off between bias and variance.

To clarify we will add a point iii) "assess goodness of fit from QQ-plots and density plots" to the section above.

Anyway we state of P12771: "An essential preliminary step is to determine an appropriate threshold u for which the asymptotic GPD approximation holds. This requires consideration of the trade-off between bias and variance: too high a threshold will reduce the number of exceedances and thus increase the estimation variance (see Fig. 6, discussed later), whereas too low a threshold will induce a bias because the GPD will fit the exceedances poorly (see Fig. 7, discussed later)".

From a mathematical point of view one assumes that the standard errors for models using too high threshold values are much larger than those for optimum models. This is clearly visible in Table 1. Concerning too low threshold values one has to consider the trade-off between bias and variance. Most often, though not invariabily, standard errors from the optimum models can be smaller but must not as those from the models using too low threshold values. A final limit choice is based on comparison of QQ-plots and density plots. The comparison of Fig. 7 and Fig. 5 shows clearly that the GPD with lower thresholds fits the data less. A lower limit is derived from Fig. 4 where points are plotted following Eq. 4 and Eq. 5, deriving the smallest threshold u above which the graph is roughly constant.

R2: "Page 12778, lines 14-18: One would be interested to know, whether the predicted mini-holes coincide with the observations or the number of mini-holes can be predicted only."

Within this study we addressed only the frequency of ozone mini-holes and not their temporal evolution. To address this problem another (updated and more complex) statistical model would be needed, which is beyond the scope of the presented study. The aim of this paragraph is only to show that from the frequency distribution of ELOs the frequency of mini-holes can be estimated highly accurate.

R2: "Figures: Enlarging many labels (numbers and letterings) would enhance easy readability."

We will enlarge the labels of the figures in the updated version to enhance readability.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 12765, 2010.