Atmosphe
Chemis
and Physi
Discussio

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

R. Lund (Referee)

lund@clemson.edu

Received and published: 21 June 2010

[11pt]letter

Referee comments on Extreme events in total ozone over Arosa — Part 1: Applicati of extreme value theory by Reider, Staehelin, Maeder, Peter, Ribatet, Davison, Stu Weihs, and Holawe.

Overall Comments: This paper uses peaks over threshold extreme value methods quantifying stratospheric ozone holes and ozone highs at Arosa, Switzerland, wh is the world's longest ozone record. It is well written and easy to follow. In gene the methodology chosen seems appropriate. While I might have handled some issu differently in places, I think most of the methods chosen are appropriate and defer ble. In other words, I do not think that my comments below will appreciably char conclusions.

Specific Comments:

1. It is not clear whether autocorrelation is accounted for in the analysis. Is any decl tering of threshold exceedence runs done? Certainly, one expects daily ozones to heavily correlated in time.

2. While daily ozones have seasonal means and variances, it is not evident to me tha seasonally varying threshold is physically appropriate here. I thought the health haz involved ozone lows. This would seem to suggest a constant threshold — and then analysis of a periodic process crossing this time-homogeneous threshold, irrespect of season of threshold exceedence. This said, I don't object to the seasonal thresh as the authors seem more interested in trends.

3. For purposes of extremes, I think the authors would have been better to convir me that the tails of the detrended and deseasonalized data are non-Gaussian rat than the entire distribution. This could have been accomplished with a kernel dens estimate comparison overlayed with a normal density fit. I don't think the quoted values are appropriate for correlated data anyway.

4. The methods used in developing the seasonal (daily) thresholds came across somewhat ad hoc. Given the near sinusoidal shapes in Figure 8, why not fit a seaso GPD model of form

$$F_\nu(x) = 1 - \left[1 + \xi\left(\frac{x - u_\nu}{\sigma_\nu}\right)\right]_+^{-1/\xi}$$

where ν represents the season and satisfies $1 \le \nu \le 365 = T$ (ignore leap year da and the seasonal parameters have the sinusoidal form

1. Equation (1) should be $\min(X_i) = -\max(-X_i)$.

2. The reference to Lund and Reeves (2002) should be deleted. The reference to Lu
et al. (1995) should not be for extreme value theory, but rather for the fact that they
not find a significant trend in the monthly data up to 1980.

3. It might be best to employ notation that emphasizes that Equation (2) is for
amounts over the threshold.

4. Page 8, line 20, "From this two" to "From these two".

5. Page 13 line 18, "on annual scale" to "on an annual scale".

6. Multipaneled graphics. I tend to read across the page first rather than down. T
Chinese may do otherwise. :)

Robert B. Lund, June 21, 2010.