Reply

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The comment by de Haan (2007) offers a welcomed opportunity to outline further the significance of the issue of plotting positions in the analysis of extreme events. As noted by de Haan, the purpose of the extreme value analysis is to estimate the return periods of hazardous events, or vice versa, to estimate the magnitude of such phenomena that have a probability of "exceedance" that is acceptable as a risk level. The issues raised and numbered by de Haan are discussed below:

1) The generally used term "plotting position" dates from the days when the graphical analysis was the only available method. This term is, perhaps, misleading today. "Probability position" would be more appropriate, because it associates a probability with the order-ranked data in a fundamental way and because, contrary to what is implied by de Haan, the issue of plotting positions is by no means limited to the graphical presentation. The probability estimates must always be determined before any kind of analysis of the order-ranked extremes can be made (see, e.g., Coles 2001, p. 36). For example, estimating the parameters of a measured distribution by the maximum likelihood method is done by order-ranked extremes, which requires first determining the plotting positions (Jones 1997; Rasmussen and Gautam 2003; Jordaan 2005).
2) It was mentioned in Makkonen (2006) that in modern analysis a generalized extreme value distribution, that is, a family of classical extreme value distributions, is also used. This was to outline that the error made in using a wrong plotting formula affects the analysis whatever the chosen statistical model is. The Gumbel model was used as an example only. The point by de Haan that an appropriate statistical model must be chosen is certainly important (see also Harris 2001, 2004; Cook and Harris 2004), but, before any model is fitted, the data should be correct. Model selection and the fitting methods are unrelated to determining first the correct model-free plotting positions and were outside the scope of Makkonen (2006).
3) The purpose of the analysis for extrapolation was explained in the legend of Fig. 1 of Makkonen (2006). The peak-over-threshold method was also mentioned, pointing out that errors in the plotting positions affect the analysis in that method also.

De Haan offers the view that some other statistical methods have overruled the extreme value analysis based on probability plotting of order-ranked data. This is not so in the fields of meteorology, hydrology, and civil engineering. The classical Gumbel analysis is still the most commonly used method in wind analysis (see the review by Palutikof et al. 1999), and the modern variations of it, such as the use of the general extreme value function and the peak-over-threshold method, are widely applied to order-ranked data that require determining the plotting positions.

A clear indication of the relevance of the classical extreme value analysis and the plotting positions is that they are widely discussed and utilized in the modern literature. Recent references include in meteorology: Brabson and Palutikof (2000), Folland and Anderson (2002), and Kharin and Zwiers (2005); in hydrology: Hosking and Wallis (1995), Jones (1997), Yu and Huang (2001), Rasmussen and Gautam (2003), and Kidson and Richards (2005); and in civil engineering: Galambos and Macri (1999), Harris (1996, 1999, 2000, 2001, 2004), Cook (1998), Simiu et al. (2001), Cook et al. (2003), Cook and Harris (2004), Whalen et al. (2004), and McRobie (2005). Many recent textbooks include extensive discussion on the classical extreme value analysis and the plotting positions, as well (e.g., Jordaan 2005).

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The final comment by de Haan that the issue of plotting positions is irrelevant to modern extreme value statistics is unfounded in regard to civil engineering practices in evaluating return periods of natural hazards for structural design. Virtually all international and national building codes and regulations are based on return-period data obtained by the methods that involve determining the plotting positions. Thus, it is not overstating to note that the structural design of our entire modern built environment is based on them. As a consequence, when Makkonen (2006) showed that these data are largely erroneous, the issue of correcting them is highly relevant to public safety worldwide. A reanalysis of these historical data is required to validate present engineering practices even if more prudent methods were to be used in the future.

As a final note regarding the relevance of the findings by Makkonen (2006) in today's civil engineering work, Hazen's formula is the default plotting position in the MATLAB proprietary software, Jenkinson's formula is recommended in the National Institute of Standards and Technology handbook of statistical methods (NIST/SEMATECH 2006), Gringorten's formula is preferred in the review on methods of calculating extreme wind speeds by Palutikof et al. (1999), Hazen's and Cunnane's formulas are recommended in a recent textbook by Jordaan (2005), and the numerical method by Harris (1996) is still being promoted in scientific literature. As shown by Makkonen (2006), all of these methods result in underestimating the risk of hazardous weather events and other extreme phenomena.

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