Nat. Hazards Earth Syst. Sci. Discuss.,
doi:10.5194/nhess-2016-229-AC2, 2016
© Author(s) 2016. CC-BY 3.0 License.

Natural Hazards and Earth System Sciences
Open Access
Discussions

Interactive comment on "Simple and approximate upper-limit estimation of future precipitation return-values" *by* Rasmus E. Benestad et al.

Rasmus E. Benestad et al.

rasmus.benestad@met.no

Received and published: 17 October 2016

1. We are grateful for the comments made by Reik Donner, who rightly points to the issue of biases connected with the GCMs in CMIP5. We made use of area averaged temperatures, and it's a good idea to add some evaluations of the mean bias as well as biases in the spread of interannual variability and past trends. An account on this aspect will be included in a revised version.

2. The concern about whether the statement that "heavy precipitation will become more severe in already wet areas in the future" holds globally in all such regions is indeed valid. We do not have the analysis for the entire globe here, but we can refer to previous studies (e.g. Benestad, R.E (2006) Can we expect more extreme precipitation on the monthly time scale? J.Clim Vol. 19, No. 4, pages 630-637) as well as the IPCC

Printer-friendly version

Discussion paper

CC BY

AR5.

3. There may be other processes that cause a mean seasonal variations in μ, especially if they are correlated with the mean seasonal cycle. Hence, the use of an upper limit. On the other hand, there is physics which explains the connection between temperature and air moisture (Clausius-Clapeyron). We will add some more text on these caveats.

4. It is possible that some other process that also varies with the means seasonal cycle also affects μ in a way that is indistinguishable from the mean seasonal cycle in the temperature over the North Atlantic. This is one of the main caveat of this strategy. We are not aware about possibilities to rule out positive interferences from physical principles.

5. It is correct that the gamma distribution is more commonly used for 24-hr precipitation, however, it is more difficult to fit and it is less constrained with two parameters. Furthermore, past analysis suggests that the exponential distribution (which is a special case of the gamma distribution) gives an approximate representation of the frequencies for when only wet-days (more than 1 mm/day) are considered. We use the exponential distribution because is gives an approximate fit to the data (Benestad, R.E., D. Nychka and L.O. Mearns, 'Specification of wet-day daily rainfall quantiles from the mean value', Tellus A, 64, 14981, DOI: 10.3402/tellusa.v64i0.14981; Benestad, R.E., D. Nychka and L.O. Mearns Spatially and temporally consistent prediction of heavy precipitation from mean values, Nature climate Change, doi:10.1038/nclimate1497) and the single parameter distribution makes it easier to infer changes in the tail as a consequence of a change in the bulk shape of the pdf. This will be more carefully explained in the revised version.

6. We chose a region according to our understanding of the physics and expectations about it being a source region for moisture. We could probably find a more optimal area, but it would involve a kind of "cherry picking" and we would need to account for multiple

CC BY

tests through field significance. We also think that different geographical conditions influence the presence of different phenomena all which affect μ. In the interior regions, it is primarily summertime convective events that give high amounts, whereas for the mountain range along the west coast of Norway, it seems to be cyclones and orographic precipitation.

7. The noise term may for all intents and purposes be considered to be white as there is little autocorrelation from year to year.

8. We used PCA to compress the information in the data and to simplify the analysis, as well as to identify canonical shapes in the seasonal cycle. The weights (PCs) were used in the latter to identify locations with similar means seasonal cycle characteristics.

9. Thanks for pointing this out.

10. Thanks for the technical comments - they will be taken into consideration in a revision.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2016-229, 2016.