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Hydrology and Earth System Sciences Discussions

Interactive comment on "Technical Note: The Normal Quantile Transformation and its application in a flood forecasting system" *by* K. Bogner et al.

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First of all we would like to thank Prof. Todini (RC1) and Dr. Montanari for reviewing and for giving valuable comments for improvements of the manuscript.

RC1: The authors, present a technical note on the problem of how one can estimate the probability in the tail of a distribution when using the Normal Quantile Transform. The problem is rather well known and, although several approaches have been proposed and used (see for instance the recent Coccia and Todini, 2011) it still deserves more attention and deeper insight. The paper is well written, but, although it discusses a

couple of alternatives, I am not sure that it can really meet the scope of clarifying the actual points.

AC1: We agree that we could not clarify all theoretical problems of the NQT, but we believe that this would be beyond the scope of a technical note. Anyhow we will include some more explanations of the actual points and references (like Coccia and Todini, 2011). Our prime concern however is the indication of some of the problems of the NQT and to give practical solutions.

RC1: First of all I would suggest to the authors to eliminate the R terminology and the R examples since I cannot find a reason for its inclusion since it does not add information while it reduces readability.

AC1: We would like to keep the R commands, since we believe it is quite valuable for a steadily increasing number of researchers using this freely available and most powerful computing environment (see also comment of referee 2). We agree that the R commands may not add information, but it gives useful hints and detailed insights, and we believe that it is worth mentioning in a technical note. For better readability the commands however will be given in an appendix.

RC1: The second point is that lines 3 to 10 in page 9279 do not clarify what the authors do to estimate predictive uncertainty. What is the role of the "minimization of the error between the recent past observed and simulated discharge values". Is this minimization done prior to enter into the HUP processor and the NQT transformation? Or is it applied after the HUP processor? In the first case, the minimization should be run over all the past observations in order to make the HUP consistent with future values, while in the latter case the minimization would modify in the predictive uncertainty properties estimated using the HUP.

AC1: We will include the following explanation that the minimization of the error between the simulation and the observation is done prior to the HUP. This error correction is done by applying the Vector AutoRegressive model with eXogenous input

(VARX) to the transformed time series of wavelet coefficients (i.e. fitting the VARX to the wavelet transformed series of the observations and simulations simultaneously covering a range of scales). The HUP is applied to the corrected series, i.e. after minimizing the error between the simulations and the observations.

RC1: The third point (lines 4-9 page 9280) is that the recent work of Krzysztofowicz is definitely oriented to the fitting of probability distributions to overcome the tails problems. In any case the authors should recognize that all the available uncertainty processors (HUP, BMA, QR and MCP) imply stationarity in time, otherwise they could not be used.

AC1: We would like to thank the reviewer for this comment and we have added more recent references. We would like to mention that we are aware of the stationarity assumption for the HUP based on daily time series as well as for the Extreme Value distributions fitted to series of annual maxima.

RC1: The fourth point is that the figures are unclear and moreover it is not clearly explained how the authors can claim that the uncertainty band is (or is not) too wide. I would also expect that the author show if the predicted uncertainty probability density matches the residuals (observed – expected value of prediction conditional to the model). On this point see for instance figures 19 and 20 of Coccia and Todini, 2011.

AC1: We have evaluated the matches of the predictive uncertainty for several stations in our WRR paper (Bogner and Pappenberger, 2011) using predictive QQ plots, which are similar to the method of Coccia and Todini, 2011. We will refer to these 2 papers for further details however we would like to avoid the inclusion of additional figures for brevity reasons. We will explain the figures in more detail and will stress the subjectivity of the evaluation method (see review 2 also).

RC1: Few additional minor issues are: Quoting the NQT means to refer to its inventor, who is not Krzysztofowicz, who correctly quoted Van der Waerden. The correct references are: Van der Waerden (1952, 1953a, 1953b). Line 26-27 Page 9276. The

reference Todini, 2008 is wrong sing MCP does not make use of HUP. This reference should be shifted at the end of the second line in page 9277 after Seo et al. (2006).

AC1: Will be corrected according to this comment! Thank you very much!

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 9275, 2011.