

Reviewer 2 Anonymous

We like to thank Reviewer 2 for the helpful comments. Below, we answer to each point brought forward.

- In the first comment, the reviewer argues that the NQT step is perhaps not necessary if we would choose to perform a non-linear conditional flow estimation functions. The main benefit of the NQT is indeed to enable the derivation of linear error quantiles. This prevents subjective choices about the shape of the chosen error quantile functions and results in a parsimonious approach (i.e. only two parameters are needed, the slope and offset of the error quantile relations in NQT space). Following the recommendations of the reviewer, we will highlight this issue in the paper. Reviewer #3, Prof. Ezio Todini has also commented on this issue which we will incorporate in the discussion. Please refer to our reply to his comments for more information.
- The reviewer suggests that it would be useful to see a comparison with other error regression approaches. The main goal of the paper is to present and validate the QR approach for hydrological forecasting purposes. Intercomparison with other methods such as the meta-gaussian approach presented by Montanari and Brath (2004), the Hydrologic Uncertainty Processor (Krzysztofowicz and Maranzano, 2004) and the Model Conditional Processor (MCP), is indeed an interesting and useful further step but would in our opinion distract the reader from the main message: that QR forecast – error relations can be validly used applying the method presented in our paper, and are in particular useful in forecast environments because relatively few data (that are in fact always available in forecasting context) are required to estimate the error quantiles. Currently, we are working on intercomparison of predictive uncertainty methods for both single value and ensemble forecasts and we hope to report on this work soon both in scientific journals and in future HEPEX and other meetings (i.e. the general assembly of the European Geosciences Union);
- The reviewer mentions a number of benchmark papers on quantile regression applications. We would like to thank reviewer 2 for the careful consideration of additional references. We will look into the references suggested and include these in a comprehensive discussion on other applications of QR;
- The reviewer raises the issue of the crossing of quantile relations in the lower domain of the forecast error relationship. The approach to prevent the QR quantile lines to cross is explained in the answer to the review provided by Roger Koenker and will be included in the revised version of the manuscript; We agree that the abrupt change in the NQT domain is relatively smooth in the flow space.
- Finally, the reviewer discusses the validation of the method. The authors have tried to outline the validity of the results in Section 3.2 of the paper. In fact, we have shown that the QR approach results in reliable results for almost all forecast locations and all quantiles considered. We have presented this in Table 2. To clarify the validity of the results, we suggest to replace Table 2 by Figure X given below. The figure shows Quantile-Quantile (QQ) plots for all locations.

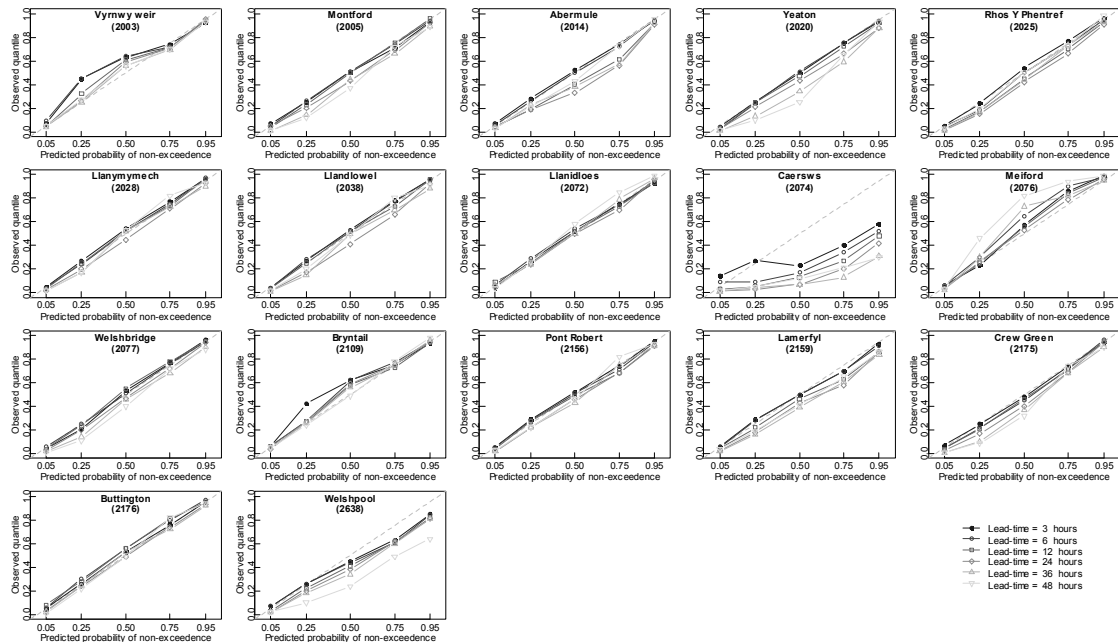


Figure X. Reliability plots (predicted non-exceedence probabilities vs the fraction of observations that are less than the corresponding estimated value indicated by “observed quantiles”) for all locations (bracketed numbers are unique station identifiers) and for all lead times considered for the validation period 2008&2009.

Only for one location (2074 Caersws) in Table 2 the results are unreliable, for all other locations tested the results are good/reliable. We hope that the reviewer is convinced by the QQ plots of the Midlands case study which can replace Table 2. The figure provides a more clear presentation of the results. The useful suggestion to switch the validation and calibration period for the one location (2074 Caersws) with unreliable results will be investigated for the Midlands case study and included in the manuscript.

#### Specific/Style comments

- “extremely simple”: we will replace extremely simple by relatively simple. We think we showed the QR approach is robust as tested on these 3 case studies (20 odd locations).
- “Agency should shift”: In fact, the word ‘will’ is accurate because we are not recommending this, but this is recommended by the Pitt review.
- Note on deterministic forecasting: We agree with the reviewer and will rephrase this sentence using the suggestion of the reviewer;
- QR is a form of the second option described: we agree and will refer to the “second option” mentioned in the paragraph before;
- Other applications of QR: We will add the discussion on other QR applications in geoscience after line 5550 22;

- Why to use the NQT: We will include a discussion on why we apply the NQT at/after p5551 ln 25 (see first bullet point of our reply);
- Point of gaussianity of error residuals. In fact, we do not assume this in our approach, we describe after this sentence that some applications assume this by minimizing the sum of squared residuals. As from p. 5554, l. 4, we describe how we deal with this issue. Here we mention that we do not assume gaussianity of the residuals.
- Why the NQT transform?: see previously mentioned point;
- length of the training period: we have tried to demonstrate the adequacy of the training period by extensive validation (Section 3.2 in our manuscript). We will refer forward to this section to clarify.
- Elaborate more on the effect of the NQT: We will add an explanation on the NQT-1 transformation and its effect on the resulting quantiles;
- figure quality (4-7): We will improve the figures along the suggestions of the reviewer (see also reply to Reviewer 1 Koenker)
- Evaluation of the results: We will include the QQ plots to replace table 2.
- We will rephrase the wording as it was not fully accurate. Wide bands (e.g. for 90 % confidence intervals) are not necessarily wrong, as long as in 90 percent of the forecasted values, the observed value remains within the bands (over many events).
- We will ask a native speaker to review the English language;