Review by Ezio Todini of:

"Estimation of predictive hydrological uncertainty using quantile regression: examples from the national flood forecasting system (England and Wales)" by A. H. Weerts, H. C. Winsemius, and J. S. Verkade

As clearly indicated by the title, the paper describes the application of a methodology, known as the "Quantile Regression" (QR) to estimate predictive bounds for a number of cases relevant to the National Forecasting System of England and Wales.

The paper is well written and interesting, but has one major limitation due to the fact that it looks more a technical report rather than a scientific paper. I will try to clarify this aspect in the sequel.

The main purpose of a technical report is to describe the application of a chosen approach, the work done and the quality of results. Fair enough and this paper fully responds to these lines. Nonetheless, it is quite different from the scope of a scientific paper where one illustrates the proposed approach in the light of what has already been done, possibly by quoting the past experiences and comparing the results. In addition a scientific paper must be written with a critical view on pros and cons of the proposed approach and most of all stating its limitations (the ones mentioned in the conclusions apply to all the methods aimed at estimating predictive uncertainty).

But in the present paper:

1) There is no mention of several recent papers on the predictive uncertainty subject (Raftery, 1993; Raftery et al. 2003; 2005; Vrugt and Robinson 2007) and in particular (Todini, 2008) where several of these methods were compared and an alternative approach, the MCP, was introduced.
Therefore the authors must add these quotations in page 5549 line 16 in addition to (Reggiani and Weerts, 2008; Reggiani et al., 2009; Seo et al.,2006; Wood and Schaake, 2008; Krzysztofowicz and Maranzano, 2004). Moreover they should quote (Todini, 2008) in page 5553 line 6 after Krzysztofowicz and Maranzano (2004) and by Montanari and Brath (2004)

2) There is no comparison of the results that can be obtained with the proposed approach as an alternative to other approaches such as HUP (Krzysztofowicz and Kelly, 2000), BMA (Raftery, 1993; Raftery et al. 2003; 2005) and MCP (Todini, 2008). The authors are invited to show such comparisons or to discuss why they have not done it or do not intend to do it.

3) It is not stated why they have decided to base the QR on the residuals (observed minus computed) instead of directly regressing the observed values over the computed (in the Normal or in the non transformed space) as described by its originators (Koenker and Basset, 1978; Koenker, 2005). The use of residuals has two types of drawbacks. The first one is that one can generate negative bounds (which does not occur in the original QR approach) and the second one is that the approach cannot be extended to multi-models approaches, which is only possible if using the original QR formulation. The authors are invited to discuss this aspect.

4) The authors did not clearly set into evidence that the proposed method does not describe the full density. It only provides upper and lower quantiles and that for each couple of quantiles (say 0.05 and 0.95), one must estimate at least 4 parameters (two per quantile as in Eq. 7). Other approaches, such as for instance the MCP, only require the estimation of 1 parameter (in the same case shown in the paper of a single model) in order to determine the full density of the predictive uncertainty. The authors are invited to discuss this issue which can be a limitation.

5) In order to apply QR, homoscedasticity of residuals is a requirement (as mentioned in page 5551, lines 23-25). This is not the case of some of the examples shown in the paper (Fig. 2) where the variance of residuals tends to increase with the value of prediction. Moreover, as shown in a recent paper by Todini and Coccia (2010) from which the following Figures 1 and 2 have been copied, QR should not be applied (Figure 1 right) when there are changes in the residual patterns (such as for instance reduction of variance or change in the regression slope) while a truncated Normal approach using MCP can provide reasonable estimates (Figure 2).

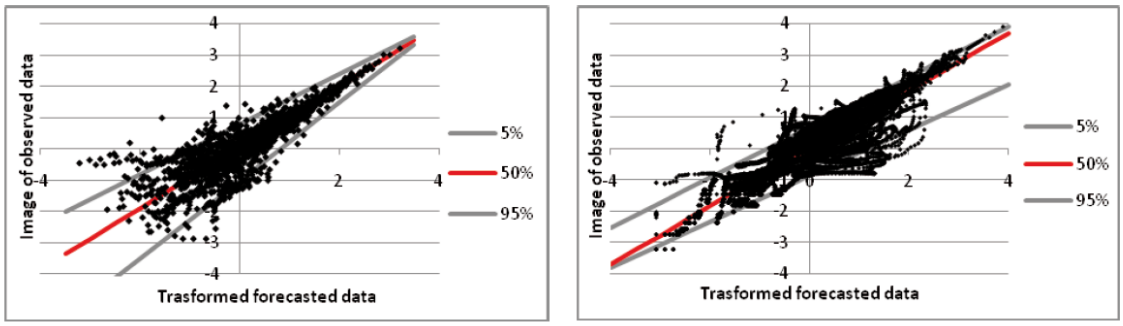

Figure 1 *An optimal situation for using the QR is shown on the left (a), while poor results are obtained using QR in the situation represented on the right (b), which, by the way, is quite common in hydrological applications.*

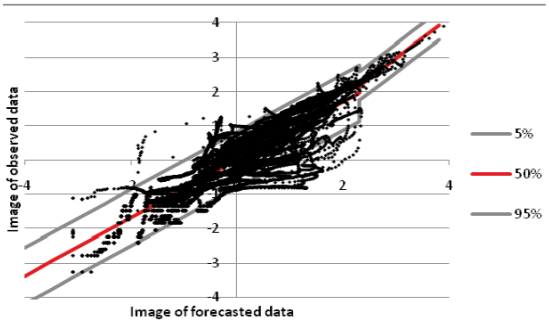

Figure 2 *Truncated Normal Joint Distributions. The division of the Joint Distribution in the Normal Space into two Bivariate Truncated Normal Distributions. The red line represents the modal value, while the grey lines represent the 5% and the 95% quantiles.*

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