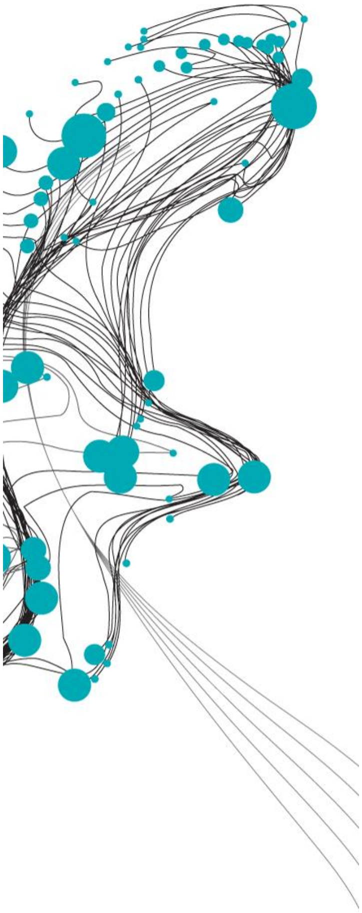
USING ENSEMBLE STREAMFLOW PREDICTIONS FOR EXTREME DISCHARGE PURPOSES IN THE RIVER RHINE



In order to estimate design discharges in the river Rhine at Lobith, annual maximum observed discharges are used for a period of 110 years and extrapolated to return periods up to 1250 year. Uncertainties can be large, since a relative low number of annual maxima is used. Longer discharge series are required in order to reduce this uncertainty.

In this research two numerical weather products, EraClim and GLOFAS are used in order to construct long independent weather series. EraClim is a re-analysis of observed weather between 1901 and 2010. The initial conditions of the deterministic re-analysis are 10 times perturbed resulting in 10 so called ensemble members of 109 years each with equal probabilities to occur. GLOFAS provides for the period 2003 to 2015 every day a 15-day weather forecast. Initial conditions of the deterministic GLOFAS forecast are also perturbed, leading to 51 ensemble members. The first 5 days of each of the 51 ensemble members cannot be used because all ensemble members are too much influenced by the initial conditions. The last 5 days cannot be used too, because all members tend to move to a climatological average. The remaining part is called a segment.

Ensembles members of both EraClim and GLOFAS are tested for mutual correlation between each ensemble member with all other ensemble members. Both turned out to be independent. For EraClim a 1090 year long weather series can be constructed by just putting each of the 10 ensembles in a subsequent order. The segments of the GLOFAS weather ensembles are used to construct a 1090 year long weather series too.

Figure 1 shows the extreme discharge distributions for different datasets at Lobith. Ten day extreme precipitation prior to the peak discharge is lower than observed for GLOFAS. This lead to a lower extreme discharge distribution than observed at Lobith. For EraClim the 10-day pre-peak precipitation is more similar to the observations, resulting in a better corresponding extreme discharge distribution. However, both GLOFAS and EraClim show much more peak discharges at Lobith in summer than observed. This is because of more frost in the Alpine regions, leading to higher snow storages. This volume is added to the river system during May and June and contributing to more summer peaks at Lobith. Furthermore, discharge patterns in more upstream sub-basins are difficult to explain. For these reasons the use of EraClim or GLOFAS cannot be recommended. However when having only a very few number of annual maxima, the use of EraClim or GLOFAS is an option. Important hereby is the perception of making large over- or underestimations of extreme discharge distributions.

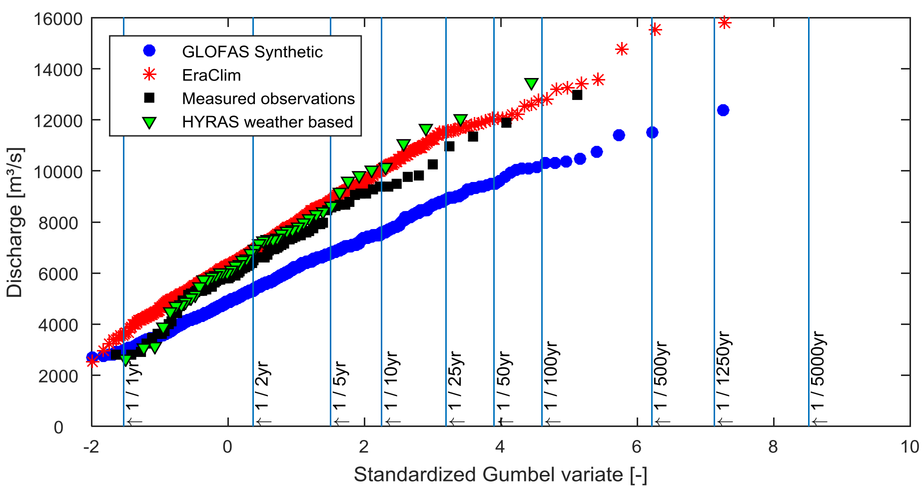


Figure 1: Extreme discharge distribution at Lobith; synthetic GLOFAS (n = 1090), EraClim (n = 1090), observations (n = 110) and simulated HYRAS discharges (n = 55).

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3 November 2016

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