Using ensemble reforecasts to generate flood thresholds for improved global flood forecasting

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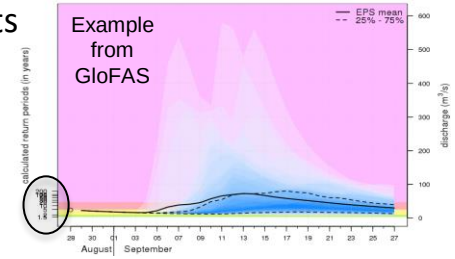
Rationale

- Very high return period forecasts in the Global Flood Awareness System (GloFAS). Are these real or just artifact of the non-representative thresholds?



Research questions

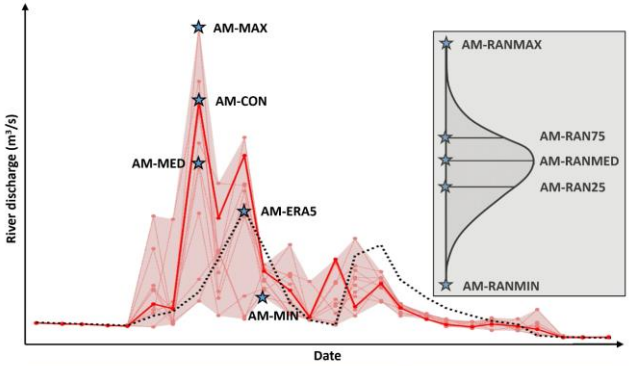
- How adequate it is to use a reanalysis dataset to define flood thresholds and apply them for all forecast lead times?
- How best to use reforecast ensemble information in the flood threshold generation to improve flood forecast performance?

Conclusions

- The variability of threshold magnitudes, when estimated from the different annual maxima samples, can be extremely large, as can the subsequent impact on forecast skill
- Reanalysis-based thresholds should only be used for the first few days, after which ensemble-reforecast-based thresholds, that vary with forecast lead time and can account for the forecast bias trends, provide more reliable and skilful flood forecasts
- We recommend that forecast system developers should carefully evaluate these potential inconsistencies and explore the biases, if available, with a reforecast data set

Analysis method

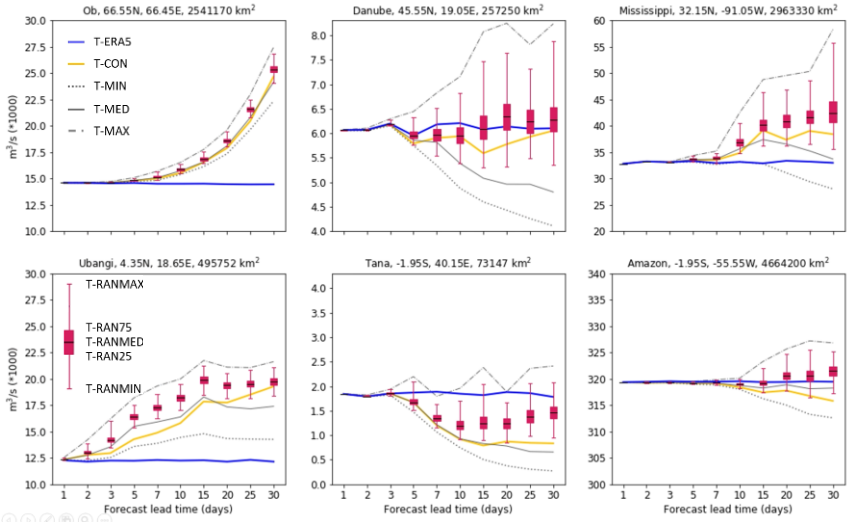
- Analysed in the context of GloFAS (30-day) with over 5,000 catchments globally on the period of 1997-2016
- Different sampling strategies for extracting annual maxima samples to conduct flood frequency analysis
- Single threshold set from reanalysis
- Various lead-time-specific thresholds from ensemble reforecasts
- Threshold magnitude, forecast reliability and skill analysed for days 1-30 and 2- to 20-year return periods



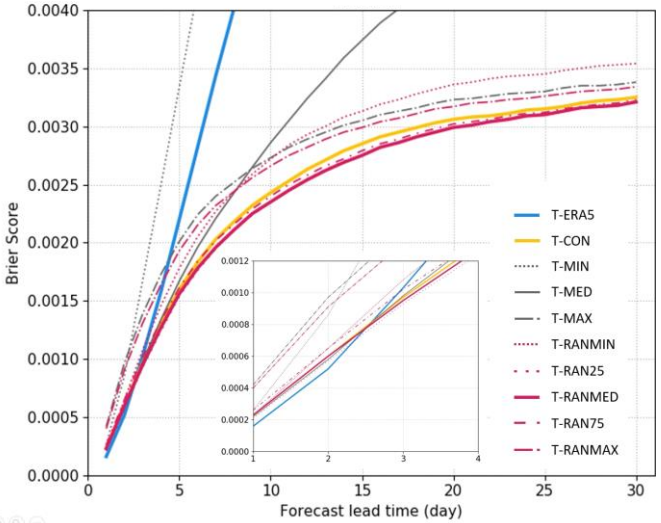
Version	Time series set	Version	Time series set
T-ERA5	Benchmark set	T-RANMIN	Minimum extended reforecast set
T-CON	Control member reforecast set	T-RAN25	25th percentile extended reforecast set
T-MIN	Minimum member reforecast set	T-RANMED	Median extended reforecast set
T-MED	Median member reforecast set	T-RAN75	75th percentile extended reforecast set
T-MAX	Maximum member reforecast set	T-RANMAX	Maximum extended reforecast set

Results

Thresholds for 10% AEP (six contrasting catchments)



Brier score for 10% AEP



Further reading:
Zsoter,E., Prudhomme,C., Stephens,E., Pappenberger,F. and Cloke,H.: Using ensemble reforecasts to generate flood thresholds for improved global flood forecasting, J. Flood Risk Manag., doi:10.1111/jfr3.12658, 2020.