Exceedance Probabilities of Envelope-Curves: the R-package "pREC"

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Envelope curves of flood flows are classical hydrological tools that graphically summarize the current bound on our experience of extreme floods in a region. Probabilistic Regional Envelope Curves (PRECs) have been recently introduced in the literature, as well as an empirical estimator of the return period, RP, associated with the curves. PRECs can be used to estimate the RP-year flood (design-flood) for any basin in a given region as a function of the catchment area alone. We present a collection of R-functions that can be used for (1) constructing the empirical envelope curve of flood flows for a given hydrological region and (2) estimating the curve's RP on the basis of a mathematical representation of the cross-correlation structure of observed flood sequences. The R-functions, which we tested on synthetic regional datasets of annual sequences characterized by different degrees of cross-correlation generated through Monte Carlo resampling, provide the user with straightforward means for predicting the exceedance probability $1/RP$ associated with a regional envelope curve, and therefore the RP-year flood in any ungauged basin in the region for large and very large RP values (e.g. hundreds of years). Furthermore, the R-tools can be easily coupled with other regional flood frequency analysis procedures to effectively improve the accuracy of flood quantile estimates at high RP values, or extended to rainfall extremes for predicting extreme point-rainfall depths associated with a given duration and recurrence interval in any ungauged site within a region. A beta-version of the R-package, which collects tools and test data, is available on GitHub and can be installed by invoking these R commands:

```
>install.packages("devtools")
>library(devtools)
>install_github(repo="pREC", user="alessio-pugliese")
>library(pREC)
```