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Trends in extremely high water temperatures in France for power plants cooling

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After summer 2003 heatwave, Electricité de France created a global plan called "heatwave-dryness". In this context, the study presented here tries to estimate high river temperatures for the next decades, taking climatic evolutions into account. These temperatures will be used to define heatwave conditions for which special operation procedures are designed. The river temperatures studied consist of 27-year mean daily temperature measured near the power plants (between 1977 and 2003), with four series for the Rhône river, four for the Loire river and some others on other French rivers. For each series, we have applied statistical extreme value modeling. Because of thermal inertia, Generalized Extreme Values (GEV) statistics was preferred. Classical GEV laws are corrected by the medium cluster length $1/\Theta$ which represents thermal inertia of water during extreme hot events. The μ and σ parameters of the GEV laws are taken as polynomial or continuous piecewise linear functions of time. The optimal functions of μ and σ parameters are chosen using physical criteria and likelihood tests. Finally results for return levels are compared to an ordinary linear regression of hot water temperature. For all series, the trend is positive both with GEV statistics and linear regression. Therefore we can say that there is a positive trend for hot water temperature during the last twenty seven years. Even if the two techniques are not rigorously comparable, they provide similar results for the ten, twenty and thirty future years. This enhances our confidence in quantitative return levels which could then be validated by physical models for example. The sample is too short to provide reliable estimation further in the future beyond thirty years.