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Quantifying alteration of river flow regime by large reservoirs in France

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Reservoirs may highly modify river flow regime. Knowing the alterations is of importance to better understand the biological and physical patterns along the river network. However data are not necessary available to carry out an analysis of modifications at a national scale, e.g. due to industrial interests or to lack of measurements. The objective of this study is to quantify the changes in a set of hydrological indices due to large reservoirs in France combining different data sources.

The analysis is based on a comparison between influenced discharges (observed discharges) and natural discharges available from: (i) gauging stations available upstream the dam, (ii) regionalization procedures (Sauquet et al., 2008; Sauquet et Catalogne, 2011; Cipriani et al., 2012), or (iii) historical data free from human influence close to the dam location.

The impact of large reservoirs is assessed considering different facets of the river flow regime, including flood quantiles, low flow characteristics, quantiles from the flow duration curve and the twelve mean monthly discharges. The departures from the indice representative of natural conditions quantify the effect of the reservoir management on the river flow regime.

The analysis is based on 62 study cases. Results show large spread in terms of impact depending on the purposes of the reservoirs and the season of interest. Results also point out inconsistencies in data (water balance between outflow and inflow, downstream of the dam is not warranted) due to uncertainties in mean monthly discharges and to the imperfect knowledge of inflows and outflows. Lastly, we suggest a typology of hydrological alterations based on the purposes of the reservoirs.

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