

## ASSESSMENT OF BASIN RAINFALL GRADEX OVER 1 TO 7 DAYS FROM POINT DAILY GRADEX IN 67 RHONE SUB-CATCHMENTS

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Within the context of a global hydrological and open-channel hydraulics study directed by the Rhône-Saône Institute (IRS) and aiming to reduce flood risks over the Rhône Valley (France), the University of Nice Sophia Antipolis was in charge to provide hydrological parameters necessary for studying peak discharges of the Rhône tributaries. These parameters are the basin gradex over 1 to 7 days during the high risk season and related to the 67 main and secondary sub-basins of the Rhône River (catchment area about 96500km<sup>2</sup>). Two types of datasets are available: daily rainfall time series at 243 stations over the 11 main sub-catchments and daily seasonal gradex at 325 raingauges and recording raingauges over the whole Rhône catchment estimated by Djerboua (2001). The purpose of the study is to identify a relation between the gradex assessments of the 11 main basins over the 7 durations and the daily seasonal point gradex, in order to provide accurate estimates of the seasonal gradex over 1 to 7 days in the 67 sub-basins.

The spreading of the 243 raingauges providing daily rainfall time series is not homogeneous over the 11 main sub-catchments, which are characterized by mountainous areas under temperate and Mediterranean climates. Consequently, the mean areal rainfall over a basin is assessed by solving a kriging system. Within this context, Lebel and Laborde (1988) underlined the relevance of analysing the spatial variability of rainfall. The spatial structure of extreme daily rainfall is analysed with a correlogram which enables to determine their average range within the neighborhood of a gauge. Extreme events which are taking into account are those exceeding a threshold on average three times a year. Thus, interpolation of daily rainfall over a basin is performed from weighted raingauges depending both on extreme daily rainfall spatial structure and on distances between locations. Daily basin rainfall over the 11 main Rhône sub-catchments are assessed during a period of about 40 years and cumulative rainfall over 1 to 7 days are calculated.

The basin gradex over the 7 durations are determined by fitting the Gumbel distribution to monthly areal rainfall maxima during the high risk season. This season, excluding non significant events occurring during the rest of the year, is defined both by considering the period of major flood events and by analysing gradex values of monthly basin rainfall maxima, as demonstrated by Bontron and al. (1999). Regarding monthly basin gradex values over 1 to 7 days in the 11 main sub-catchments, the high risk season is supposed to be in autumn from September to November. This statistical approach, which assumes that the probability law remains stationary during the 3 months of the high risk season, allows to produce more robust estimates by multiplying the samples by 3. Basin gradex thus estimated point out the areal reduction factor applied to point gradex, the relative

differences ranging from 8 to 36% concerning daily rainfall.

Daily rainfall time series being not available at a sufficient number of raingauges for evaluating gradex values over 1 to 7 days in the 67 Rhône sub-catchments, a relation between the gradex of the 11 main sub-basins estimated over the 7 durations and the daily seasonal point gradex available for all sub-basins is carried out. Basin gradex can be explained by an empirical formula depending on the weighted mean of point daily seasonal gradex and the basin area according to the rainfall duration. The validation of the model is performed with a test sample composed of 3 sub-catchments. Fig. 1 shows that the less accurate estimated values are included within a  $\pm 20\%$  interval with regard to 'true' gradex and concern sub-catchments characterized by heavy Mediterranean rainfall. These deviations are due to the hypothesis (induced by the formula) that gradex values increase with rainfall duration according to the Montana law. The comparison between the weighted mean of daily point gradex and daily basin gradex for the 67 sub-catchments underlines the effect of areal reduction factor becoming more significant with high values.

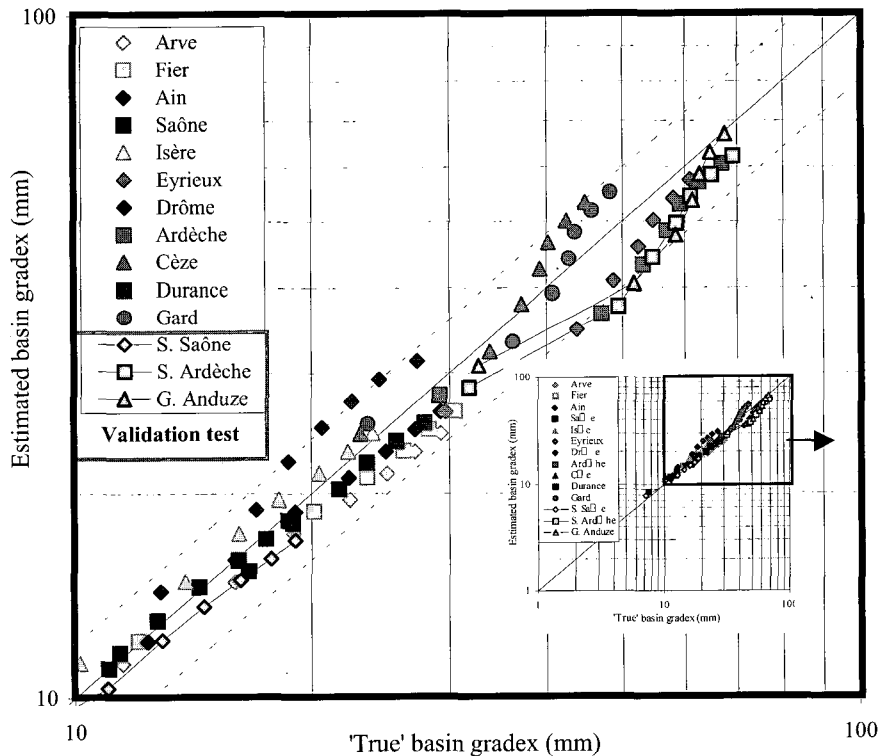


Fig. 1 Comparison between 'true' basin gradex and estimated basin gradex over the 7 durations in the 11 main sub-catchments – sub-basins located both on the same bank of the Rhône River and in the same part (Northern/Southern) are plotted with the same colour – and Validation test

#### REFERENCES

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