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Regional frequency analysis of extreme suspended sediment concentrations : Comparison of methods in North America

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The number of stations monitoring daily suspended sediment concentrations (SSC) has been decreasing since the 1980s in North America while suspended sediment is more and more considered as a key variable for water quality. Only a few rivers in the world are monitored daily for SSC, this lack of measurements makes it difficult to predict and quantify extreme events. The purpose of this study is to compare different regionalisation methods for the estimation of extreme SSC in ungauged basins. Regional frequency analysis is used for the estimation of extreme hydrological events at sites where little or no data is available. Annual maximum of SSC for 72 non-regulated rivers in Canada and USA were modelled with probability distributions in order to estimate quantiles corresponding to different return periods. Several regionalisation techniques were tested using the climatic, topographic, land cover and soils attributes of the watersheds. The approaches tested include methods for delimitating fixed regions, such as the clustering on physiographic characteristics or seasonality measures and delimitation of hydrological neighbourhoods with Canonical Correlation Analysis (CCA). Multiple regression models between SSC quantiles and watershed characteristics were built in each region or neighbourhood. Estimated SSC quantiles were compared with the local values. Results show that regional estimation of extreme SSC is more efficient than a global regression model including all sites. Regions delimitated by the clustering on physiographic characteristics and the clustering on monthly frequencies of occurrence of annual maximum SSC give the best estimation results. Once removing 7 stations with extreme SSC values, CCA gives the best results for estimation of SSC for long return periods. All approaches are very sensitive to the

size of regions or neighbourhoods considered due to the limited number of stations.