Geophysical Research Abstracts,
Vol. 11, EGU2009-8586, 2009
EGU General Assembly 2009

Use of Projected Mean Discharge Values for Estimating Future Flood Risk

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To determine how flood risk changes under various possible future climate scenarios, extreme value analysis is used to determine an extreme discharge based on a timeseries of peak discharges. However, output from large-scale hydrologic models for future scenarios is often only available in the form of monthly mean discharges, which, if used in extreme value analysis, will greatly underestimate extreme discharges. The purpose of the presented work was to carry out a technique to determine the exceedance probability of peak discharge on the basis of the monthly mean discharge. To determine this relationship, historical daily discharge data was analyzed at 144 stream gauging stations throughout Europe. At each station location, the resulting relationship was then applied to convert monthly mean discharge output from the WaterGAP hydrologic model for various future climate scenarios into monthly peak discharge exceedance probabilities. These exceedance probabilities were then used to perform a Monte-carlo analysis to determine multiple possible peak discharge timeseries for future scenarios. Each of these timeseries was analyzed using extreme value analysis to produce multiple possible extreme discharges (1/100 year frequency), from which a best estimate and an uncertainty could be derived.