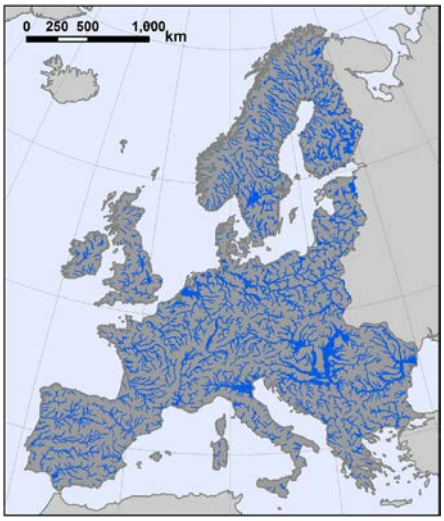
Current and future European flood risk

Supervisors:
Prof Paul Bates (School of Geographical Sciences, University of Bristol) – Main supervisor
Dr Jeff Neal (School of Geographical Sciences, University of Bristol)
Professor David Stephenson (Department of Mathematics, University of Exeter)
Peter Salamon (EU Joint Research Centre, Ispra, Italy)
Host Institution: University of Bristol

Project description: Flood risk maps at national and trans-national scale would be hugely useful for applications ranging from climate change studies, reinsurance pricing, aid to emergency operations for major flood crisis and determing and prioritizing the appropriate strategic investment in flood protection by national governments. However, at such scales few data sets are available, and those that do exist tend to be of poor quality. Until recently the key constraint to understanding flood risk across Europe has been the lack of a consistent method to map flood *hazard* at this scale. Alfieri *et al*. (in press) have recently solved this problem by combining Europe-wide models of catchment hydrology and floodplain inundation at 100m resolution, with the latter being based on the LISFLOOD-FP model developed at University of Bristol. Alfieri *et al*. demonstrated that such an approach is now computationally feasible and can produce results of acceptable accuracy (see Figure below).



European flood hazard map for the 100-year return period

At present this approach maps the 1% annual probability flood hazard along every major European river, however the return period of real floods varies markedly in space along river networks as a function of local hydrology and meteorology. For example, a 100 year flood on the River Severn is very unlikely to occur simultaneously with a 100 year flood on the Danube. The next step for such research is therefore to move from the simulation of *hazard* to a simulation of *risk*. This PhD will address this issue by implementing the above scheme in a risk modelling framework. This require new research into the characterictics of extreme European storms that generate floods, the development of statistical weather generators to allow simulation of realistic storm events and their rassociated probability, and analysis of the impact of uncertainty in extreme storm data on the simulated flood risk. The work will not only address the major applied questions noted above, but will also yield important scientific insights into how flood probability scales across networks in a way that has never before been possible.

Bates, P.D., Horritt, M.S. and Fewtrell, T.J. (2010). A simple inertial formulation of the shallow water equations for efficient two dimensional flood inundation modelling. *Journal of Hydrology*, **387**, 33-45. (10.1016/j.jhydrol.2010.03.027).
Alfieri, L., Salamon, P., Bianchi, A., Neal, J., Bates, P. and Feyen, L. (in press). Advances in pan European flood hazard mapping. *Hydrological Processes*. (10.1002/hyp.9947).