Climate Change and Extreme Surface Flooding in Northern Italy

Markus Stowasser (1), Ivo Bánovský (2), Erasmo Buonomo (3), Carlo Buontempo (3), Thomas Duveau (4), Cressida Ford (5), Jane Toothill (5), and Silvio Tschudi (1)

(1) Allianz Re, Germany, (2) Intermap Technologies, Germany, (3) UK Meteorological Office, UK, (4) World Wide Fund for Nature, Germany, (5) JBA consulting, UK

In a joint effort of Allianz, the UK Meteorological Office, JBA consulting, Intermap Technologies and the World Wide Fund for Nature, the influence of climate change on extreme precipitation and related flooding events in Northern Italy is investigated. A region surrounding Venice was chosen for this study since a recent flooding event in September 2007 caused significant losses in the area. Aim of the project is to create maps for surface water flooding resulting from extreme rainfall events for present and future climate. Focus of the study is also to identify any changes of return periods of extreme precipitation events in the warmer climate scenario runs. In this study Intermap's 5m NEXTMap Digital Terrain Model and climate and extreme event modeling from the UK Met Office are used as inputs to JBA's "JFLOW+" 2D hydraulic modeling technology.

An ensemble of the Met Office Hadley Center HadCM3 GCMs run with different parameterization schemes of sub-grid processes and a resolution of 300 km were used to drive the Regional Climate Model HadRM3 with 25 km horizontal resolution, enabling an 11-member ensemble of transient RCMs to be derived. A significant effort has been put in developing a bias correction algorithm able to correct not only the mean but also the higher moments of rainfall distribution in the modeled precipitation data.

The HadRM3 model data was further downscaled to a 5km grid using an empirical statistical relationship derived from the scaling properties of observed precipitation; the 5km downscaled data were then used as input for the detailed hydraulic modeling with JFLOW+. The frequency of extremes was derived by Generalized Extreme Value distribution fitting. The method was applied to two periods in the present climate and two periods in the future (2030-2050 and 2080-2100).

The resulting flood plain maps will provide a detailed case study of the potential impacts of climate change on flood risk in this region and present a showcase as to how climate and flood modeling can be combined to generate outputs that are of practical use to the insurance community. The information derived in this project help to determine the future loss potential of extreme flooding events in this region and their implications for the insurance industry.