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Flood risk assessment at the global scale – the role of climate variability

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Globally, flooding is one of the worst natural hazards in terms of economic damage. For example, Munich Re estimates the losses in 2011 alone to be in excess of $60 billion. Whilst major advances have been made in assessing these damages at the local to river basin scale, there are still few assessment methods at the continental to global scale. However, the demand from stakeholders for information on natural hazard risks at the global scale has grown explosively in recent years, with global risk playing a prominent role in several major reports (e.g. Global Assessment Reports (GAR) on Disaster Risk Reduction and IPCC SREX report). Moreover, whilst many studies at the local to regional scale have tried to assess the impacts of long term climate change on risk, the relationships with interannual climate variability have been largely neglected.

In response, we have developed a novel global risk assessment model, and used it to assess the impacts of interannual climate variability (namely El Niño Southern Oscillation (ENSO)) on flood risk. The model calculates flood risk at a resolution of 1km x 1km, which can then be aggregated to the target scale of a stakeholder's needs (e.g. province, country, continent). We carried out this assessment through the following steps: (1) used gridded daily temperature and precipitation from the EU-WATCH project (0.5º x 0.5º) to; (2) simulate daily flood volumes for the period 1958-2000 using PCRGLOB-WB (0.5º x 0.5º); (3) estimated flood volumes per grid-cell for flood return periods (RP) from 1 to 100 years using extreme value statistics (0.5º x 0.5º); (4) simulated inundation extent and depth for different RPs using dynRout (1km x 1km); and (5) combined these inundation maps with socioeconomic data (e.g. population, asset values) to calculate global flood risks. The results show that ENSO has a clear and strong influence on flood risk in many parts of the world, with anomalies in annual expected flood damages in excess of 50% during El Niño and/or La Niña phases (compared to non-El Niño and non-La Niña phases) in several regions.

We demonstrate the use of this information for several stakeholders: NGOs for short to medium term disaster contingency planning; International Financing Institutes and development agencies for assessing which investments in natural disaster risk reduction are most promising to invest in; intra-national institutes for monitoring progress in risk reduction activities; (re-)insurers who need to plan their insurance coverage; and large companies to assess and prepare for risks to their regional investments.