European Commission

Science for Environment Policy

22 January 2015
Issue 400

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Source: Ward, P. J., Jongman, B., Kummu, M., *et al*. (2014). Strong influence of El Niño Southern Oscillation on flood risk around the world. *Proceedings of the National Academy of Sciences*, 111, 15659-15664. doi:10.1073/pnas.1409822111

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

El Niño Southern Oscillation can be used to predict global flood risk anomalies

Unusually warm or cool Pacific sea surface temperatures, known as El Niño and La Niña, can be used to reliably predict anomalies in flood risk for river basins that cover 44% of the Earth's land surface, a new study has shown. The researchers also quantified overall flood damage by combining information on flood risk with estimates of damage to economies and numbers of people at risk. This could help improve flood disaster planning, they say.

Flooding causes huge amounts of economic and social damage, destroying homes, infrastructure, businesses and taking lives. The 2013 floods in Europe, between May and June, were estimated to have caused €12 billion worth of damage and resulted in 25 deaths.

There are many different factors which affect flood risk across the globe. Greater understanding of these can improve flood prediction accuracy, and help to identify how best to plan flood protection measures. These can include built defences, but natural water retention measures, such as river re-meandering, are also important, especially as they provide other environmental, social and economic benefits.

On a global scale, the El Niño Southern Oscillation (ENSO) is a very important factor in modulating flood risk. ENSO refers to periods of unusually warm or cool sea surface temperature in the tropical eastern Pacific Ocean and variations in air pressure in the tropical Pacific. Together, these have a strong effect on temperatures and rainfall levels across large parts of the globe. ENSO is also known to influence the severity of other natural hazards, such as cyclones and hurricanes.

In this study, researchers used historical climate data (1958-2000) to model the influence of ENSO events on flood risk across the globe. These data were combined with a global socioeconomic impact model, allowing them to estimate the damage to economies and number of people at risk, expressed as a percentage change in 'flood damage' from the average across all years.

The results show that there is a reliable pattern of anomalies in flood risk during El Niño or La Niña years, or both, in river basins that cover 44% of the Earth's land surface.

Parts of southern Africa may expect flood damage increases of between 25-50% above average in La Niña years and decreases in flood damage of between 25-50% in El Niño years. Eastern Australia may expect little change from average during El Niño years, but increases of 25-50% during La Niña years.

Within Europe, during El Niño years, Spain and Portugal both see increases of between 10 and 20% higher than average flood damage, while Italy may expect flood damage to be reduced by between 25 and 50% in these years. During La Niña years, annual expected flood damage was reduced throughout Portugal, Spain and France. However, Denmark, Austria and Slovenia may expect average flood damage increases of between 25 and 50% compared to normal.

While the factors which influence ENSO events are poorly understood, there are indications that extreme El Niño events may become stronger or more frequent under a warmer global climate. As such, predicting the impacts of ENSO on global flood risk could become increasingly important in the future.

The probability of an ENSO event occurring can typically be predicted a few months in advance by monitoring sea surface temperatures. By combining this with the findings of this study, better forecasting of flood risks on both national and regional scales becomes possible, allowing improved disaster planning.