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Flood durations and their response to ENSO at the global scale

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The economic losses associated with flooding are huge. In 2012 alone, economic losses from flooding exceeded $19 billion, and these losses are rising rapidly. Hence, in recent years several methods have been developed to assess the influence of climate change, climate variability, and socioeconomic change, on flood hazard and flood loss. To date, most of the studies employ methods that simulate flood hazards based on some measure of instantaneous peak discharge (e.g. peak annual discharge), which is used as a proxy for the severity of an event. However, recent large flood disasters, for example those experienced in Thailand, Pakistan, and Queensland, have shown that for the most disastrous floods, the duration of flooding is also very important. To date, few studies have specifically assessed the impacts of climate change and/or variability on flood durations. In this contribution, we examine relationships between flood durations at the global scale and the El Niño Southern Oscillation (ENSO).

At the globally aggregated scale, we found no statistical difference between the number of floods during El Niño and La Niña years, compared to the number of floods during neutral years. However, we found that the durations of floods during both El Niño and La Niña are longer than during neutral years. At the regional scale, we found that ENSO exerts a very large influence on both the number of flood events and the duration of those floods. Statistically significant differences in the average duration of floods between neutral years and El Niño and/or La Niña years were found in Australia and Oceania, Eastern Asia, Eastern Europe and Central Asia, Middle and South Africa, North Africa, and Western Europe. We present maps showing the geographical patterns of these influences at the basin scale. We also provide composite analyses of atmospheric conditions during long duration floods for several case study regions (e.g. Queensland, Chao Phraya). Finally, we discuss how such information could be use to improve flood disaster planning and risk management.

The research was carried out using the global hydrological model PCR-GLOBWB, and its extension for dynamic routing, DynRout. Using these models, we developed a time-series of daily flood events, and examined relationships between the duration of those flood events and different phases of ENSO.