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A global-scale vulnerability assessment of human displacement for floods and tropical cyclones

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Floods and tropical cyclones displaced more than 275 million people between 2008 and 2020, with the two hazards together being responsible for 86% of all displacements. It is important to understand the socio-economic drivers of displacement vulnerability to quantify future changes in risk, for instance, due to climate change, economic development, or social inequities. Here, we investigate globally and event-by-event the displacement vulnerability due to flooding and tropical cyclones (TCs), using remote sensing-derived hazard data. We create a database of displacement events associated with spatially explicit flood or TC hazard, by matching displacement data from the Internal Displacement Monitoring Center (IDMC) spatially and temporally with satellite imagery from the recently published Global Flood Database and a collection of tropical cyclone data. The resulting hazard footprints are overlaid with gridded population data to derive the number of affected people for each event, which is compared with estimated displacement to determine the event-specific vulnerability. Between and within continental regions, displacement vulnerability varies by several orders of magnitude. We generally find a negative trend between displacement vulnerability and increasing (socio-)economic prosperity indicators, such as GDP per capita or the Human Development Index (HDI). Indicator binning reveals further insights, for instance, a higher proportion of urbanization or female population tends to indicate a lower susceptibility towards TC impacts. We analyze the uncertainty associated with different population datasets and methods to compute the number of affected people. Our analysis provides new insights into patterns and potential drivers of displacement vulnerability across space and between socio-economic groups. To our knowledge, the usage of the extensive set of observational satellite imagery is an unprecedented approach for global flood vulnerability analysis, posing remote sensing as a suitable alternative for global models for future studies.