



Analysis of climate anomalies during past disasters

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Climate-related disasters largely affect society and with climate change, many extreme weather and climate events are expected to become both more severe and more frequent. Whether a climate event is classified as a disaster is often defined based on observed impacts such as affected people or economic damage. The International Disaster Database (EM-DAT) records events where at least one of the following criteria is fulfilled: i) 10 or more people reported killed, ii) 100 or more people reported affected, iii) declaration of a state of emergency, or iv) call for international assistance. While disasters are classified into different meteorological events, they have not yet been linked to anomalies in climate variables. Here we investigate climate anomalies associated with droughts, heat waves, floods and cold waves using superposed epoch analysis (SEA). Because of limited spatial and temporal information on disaster occurrence, climate data are averaged across the country of interest and year during which a disaster took place. We find that on average heat waves are associated with significant increase in annual mean temperature by 0.1°C and a significant decrease in annual precipitation of 3.2%. Droughts show anomalies of 0.1°C in temperature increase and 4.9% precipitation decrease. Disasters classified as droughts and heat waves are thus associated with significant anomalies in both temperature and precipitation. For floods, precipitation increases by 2.8%. Cold waves show a significant temperature decrease of 0.1°C , but no significant signal for precipitation. Albeit being small because of the averaging across large temporal and spatial scales, these numbers denote a significant deviation from non-disaster cases. We further find a tendency that climate anomalies tend to be larger in smaller countries, which is to be expected as in larger countries the climate anomaly is smoothed out when averaging over the whole country. Furthermore, our results suggest that developed countries are typically associated with larger climate anomalies than developing countries. This effect could be due to different levels of vulnerability, as a climate anomaly needs to be much larger in a developed country to lead to a measurable impact as compared to a developing country. Our analysis provides a first link between climate data and recorded disasters and may serve as a starting point for evaluating disaster databases. More detailed analyses are needed to constrain the climate anomaly to the temporal and spatial extent of the actual event.