Effect of cold surges on extreme tides in the Western Maritime Continent

Shrinjana Ghosh

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Abstract

Extreme weather phenomena, such as excessive rainfaill and sea-level anomalies (SLAs), make the Western Maritime Continent (WMC) vulnerable to flooding. Frequent flooding between November and February occurs due to the combination of high speed winds over the South China Sea (SCS) and SLAs. These winds are characteristic of the boreal winter monsoon cold surge (CS) events that occur during the northeast monsoon season. The role of precipitation anomalies is evident from the recent flooding that occurred in Jalan Seaview this January, where rainfall higher than the monthly average of 224.2mm coincided with a high tide of 2.8m. The role of SLAs in such cases is undeniable, but the literature on this topic remains incomplete. The primary objective of this study is to quantify the role that CS events play on 'extreme tides'. We use research-quality water level data from tide gauges, obtained from the University of Hawaii Sea Level Centre from $1990 - 2013$ along the WMC. By defining 'extreme tides' as water levels about the 99^{th}-percentile, we have quantified the co-occurrences of CS events and 'extreme tides', along with the associated increase in average water levels. Henceforth, we develop and test a model based on water level, wind speed, and pressure-level anomalies, to obtain a relation between CS events and extreme water levels. Development of this model can improve understanding of surge-induced floods, with implications for disaster preparedness in Sotuh-East Asia, thus aiding government agencies in constructing early warning systems and risk mitigation for vulnerable areas.