Multivariate assessment of the occurrence of compound Hazards at the pan-Asian region

Davy Jean Abella*, Kuk-Hyun Ahn**

Abstract

Compound hazards (CHs) are two or more extreme climate events combined which occur simultaneously in the same region at the same time. Compared to individual hazards, the combination of hazards that cause CHs can result in greater economic losses and deaths. While several extreme climate events have been recorded across Asia for the past decades, many studies have only focused on a single hazard. In this study, we assess the spatiotemporal pattern of dry compound hazards which includes drought, heatwave, fire and wind across Asia for the last 42 years (1980-2021) using the historical data from ERA5 Reanalysis dataset. We utilize a daily spatial data of each climate event to assess the occurrence of such compound hazards on a daily basis. Heatwave, fire and wind hazard occurrences are analyzed using daily percentile-based thresholds while a pre-defined threshold for SPI is applied for drought occurrence. Then, the occurrence of each type of compound hazard is taken from overlapping the map of daily occurrences of a single hazard. Lastly, a multivariate assessment are conducted to quantify the occurrence frequency, hotspots and trends of each type of compound hazard across Asia. By conducting a multivariate analysis of the occurrence of these compound hazards, we identify the relationships and interactions in dry compound hazards including droughts, heatwaves, fires, and winds, ultimately leading to better-informed decisions and strategies in the natural risk management.

Keywords: Compound Hazards; Drought; Heatwave; Fire; Wind; Multivariate Assessment

Acknowledgment

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT). (No. RS-2023-00208210)

* Graduate Research Assistant, Department of Civil and Environmental Engineering, Kongju National University, Cheon-an, South Korea; e-mail: davyabella@gmail.com

** Associate Professor, Department of Civil and Environmental Engineering, Kongju National University, Cheon-an, South Korea; Corresponding author; e-mail: ahnkukhyun@kongju.ac.kr