

Fan, P., Chun, K.P., Mijic, A., Evaristo, J.A., Yetemen, O. and Tan, M.L., 2021, December. A framework of nature-based solutions with spatial non-stationarity for water hazard management. In AGU Fall Meeting 2021. AGU.

Abstract

Integrating information on spatial non-stationarity (SNs) of land use is critical to the implementation of nature-based solutions (NBSs) for water hazard management. How SNs in landscape patterns improve the effectiveness of water hazard, however, is poorly understood. Here we propose a new framework for mitigating water hazards, e.g., flood and drought, by integrating SNs into NBSs using empirical evidence of landscape patterns and hydrological measures. We quantified landscape patterns using a series of multiscale landscape metrics, which indicate the compositions and spatial configurations of land use. We then used the standardized precipitation index (SPI) as proxy for hydrological drought associated with land surface property. Heretofore, relationships between stationary landscape metrics and SPI have been a standard approach for developing NBSs. Our new framework is superior to this approach in that we considered the spatial effects in landscape patterns and drought conditions based on spatially-varied outcomes. We applied geographically weighted regression (GWR) models to capture the SNs of the relationships between landscape metrics and SPI. Our goal was to develop spatially explicit empirical models, e.g., the locations of diverse land types, that can then be provided to planners to determine NBSs for managing place-specific water hazard. To this end, we applied our newly developed SNs-NBSs framework to the Guangdong-Hong Kong-Macau Greater Bay Area (GBA) and Dongjiang River Basin (DRB) in southern China. The GBA is an emerging regional development initiative for further socioeconomic strengths, and the DRB located beside the GBA is a key water source of the east wings of GBA. The application of our SNs-NBSs framework provides insights into spatial considerations for water management and contributes to developing spatially-varied strategies for effective hazard control based on local situations.