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A climate-based spatiotemporal prediction for dengue fever epidemics: a case study in southern Taiwan

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Dengue Fever (DF) has been identified by the World Health organization (WHO) as one of the most serious vector-borne infectious diseases in tropical and sub-tropical areas. DF has been one of the most important epidemics in Taiwan which occur annually especially in southern Taiwan during summer and autumn. Most DF studies have focused mainly on temporal DF patterns and its close association with climatic covariates, whereas few studies have investigated the spatial DF patterns (spatial dependence and clustering) and composite space-time effects of the DF epidemics. The present study proposes a spatio-temporal DF prediction approach based on stochastic Bayesian Maximum Entropy (BME) analysis. Core and site-specific knowledge bases are considered, including climate and health datasets under conditions of uncertainty, space-time dependence functions, and a Poisson regression model of climatic variables contributing to DF occurrences in southern Taiwan during 2007, when the highest number of DF cases was recorded in the history of Taiwan epidemics (over 2000). The obtained results show that the DF outbreaks in the study area are highly influenced by climatic conditions. Furthermore, the analysis can provide the required "one-week-ahead" outbreak warnings based on spatio-temporal predictions of DF distributions. Therefore, the proposed analysis can provide the Taiwan Disease Control Agency with a valuable tool to timely identify, control, and even efficiently prevent DF spreading across space-time.