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Formulation of an approach for integrating Earth Observations, climate forecasting and land-surface modelling in order to predict outbreaks of Dengue fever and Zika virus in Vietnam

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Abstract: Dengue fever occurs in 141 countries with 122,000 cases reported in Vietnam in 2016. The epidemiological situation there has been worsened by the failure of health systems to maintain adequate control of the species of mosquito that spread Dengue. Several studies have emphasised the significant links between weather variability and infectious diseases, highlighting the potential for developing early warning systems for epidemics. Similar methods could also be used to forecast outbreaks of Zika, which has recently begun to be reported in Vietnam. This presentation describes the results of a study, supported by the UK Space Agency, resulting in a high-level method for integrating multiple stressors such as water availability, land-cover, precipitation and temperature in order to forecast future outbreaks of dengue fever. The approach uses a common spatio-temporal analysis grid with a 'Grid Series' structure to integrate historical stressor datasets which each other and with historic dengue fever incidents which are then input into a statistical model which provides forecasts based on future seasonal forecasts of these stressors. Earth observation data can help countries understand the dynamics of these integrated stressors on the health and water sectors, especially in regions with poor or non-existent ground monitoring, or in identifying aspects such as urban growth – indicative of building sites with un-managed small standing surface water – which are not usually monitored in other ways. However, the associated evidence base is only just emerging and applying this work using remote sensing data is expected to make a significant contribution. The resultant tools will be used to understand changing health risks at different scales under future climate change scenarios and will also include a water assessment module that will feature the additional benefit of improving water management in Vietnam's transboundary river basins. This multidisciplinary application of open socio-environmental modelling also extends to on-the-ground practitioners tasked with acting upon the predictions in a way that will best mitigate the risks; particularly in conveying results, changing behaviour in allocating and applying budgets, and responding in advance of potential outbreaks.

***Keywords**:* Dengue forecasting; Earth Observations; data integration; climate forecasting; land-surface modelling.