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D-MOSS: An integrated dengue early warning system in Vietnam driven by Earth Observations

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D-MOSS, Dengue MOsquito Simulation from Satellites, is a dengue fever early warning system for Vietnam being developed by a project funded by the UK Space Agency's International Partnerships Programme. The D-MOSS project is developing a suite of innovative tools that will allow public health authorities to identify areas of high risk for disease epidemics before an outbreak occurs, in order to target resources to reduce spreading of epidemics and improve disease control.

Since 2000, there has been an increase of over 100% in the number of cases of dengue fever in Vietnam, with ∼185,000 cases occurring in 2017 alone, and there is currently no system for forecasting future dengue outbreaks.

The D-MOSS early warning platform includes a water availability component. Water availability directly impacts dengue epidemics due to the provision of mosquito breeding sites. These dynamics are often non-linear; too much rainfall can fill outdoor containers, while too little can lead to people storing water in open containers within their homes. Both increase the population of Aedes aegypti mosquitoes and in turn the risk of dengue outbreaks. However, water availability or water resource management is rarely accounted for in dengue prediction models.

The system generates monthly water stress assessments and uses them as inputs to a component of the dengue early warning system which also improves the skill of the system's predictions. In addition, these forecasts of water stress will help to improve Vietnam's water management. Vietnam's Sustainable Development Strategy for 2011-2020 identifies one of the major challenges facing Vietnam as the issue of transboundary water management, because 63% of the surface water comes from upstream countries.

The D-MOSS project is developing a forecasting system in which Earth Observation datasets are combined with weather forecasts and a hydrological model to predict the likelihood of future dengue epidemics up to eight months in advance. The system is calibrated against historical data. The water availability forecasts are fed into statistical forecasting models of disease incidence. This dengue early warning system model integrates the water stress forecast with a range of other covariates important for dengue transmission.

The D-MOSS project is within the first year of its three-year term and is currently focused on platform and model development, while gathering the key input data and engaging with the Vietnamese government to ensure that all components are fit for purpose. The portrayal system is designed to communicate the dengue and water availability forecasts to the Vietnamese Ministries of Health and Natural Resources and Environment, respectively. A user interface will also incorporate supporting information on recommended actions, provided by the decision makers and based on the forecasts and associated uncertainty.