

D-MOSS Dengue MOdel forecasting Satellite-based System



Project funded by:



D-MOSS is a dengue fever early warning system being developed by a consortium led by HR Wallingford and sponsored by the UK Space Agency's International Partnership Programme. The first implementation is in Vietnam, to be followed by coverage in up to six other countries in South East Asia. It will give beneficiaries several months advance warning of likely outbreaks of dengue fever.

Project partners:



The system also includes a water assessment module that provides the additional benefit of improving water management in transboundary river basins in the region.



The challenge

In Vietnam there is currently no system in place to forecast the probability of dengue outbreaks. Since 2000, there has been an increase of over 100% in the number of cases of dengue fever in Vietnam due to the failure to maintain adequate control of the *Aedes aegypti* species of mosquito that spreads dengue fever. Considering the current regional trends in dengue epidemics, the setting up of a seasonal dengue forecasting system utilising Earth Observation (EO)-based information to provide probabilistic predictions of dengue outbreaks would greatly assist the Vietnamese Government to put cost effective early actions in place.



From a water resources perspective, seven of the nine major river basins that drain to Vietnam are transboundary in nature and it is estimated that some two-thirds of Vietnam's water resources comes from neighbouring countries, making water management challenging. In recent years countries upstream of Vietnam have increased their water use and Vietnam is currently facing increasingly negative impacts from the water policies of upstream countries. The development of an EO-based water availability system will help the Vietnamese Government to improve their water resources monitoring and management in transboundary river basins.

The dengue fever and water management challenges are similar in other countries in South Asia and the project has now been extended to cover Sri Lanka, Laos, Cambodia, Thailand, The Philippines and Malaysia.

Our objective

Our objective is to develop a suite of innovative tools that will allow beneficiaries to issue alerts for dengue fever (with a view to develop the same for Zika virus which is transmitted by the same mosquito species), and provide assessments of vector-borne disease risk under future climate and land-use change scenarios. This will allow local communities to mobilise to pre-emptively eliminate mosquito-breeding sites thus reducing incidents of dengue. In combination with better outbreak response, we expect the project to contribute towards a reduction in dengue incidence over the project lifetime.

The project aims to:

- > Develop an early warning system to improve dengue fever epidemic prevention and increase disease control capacity;
- > Create better understanding of the relationships between environmental stressors, the hydrological-climate system and dengue incidence; and

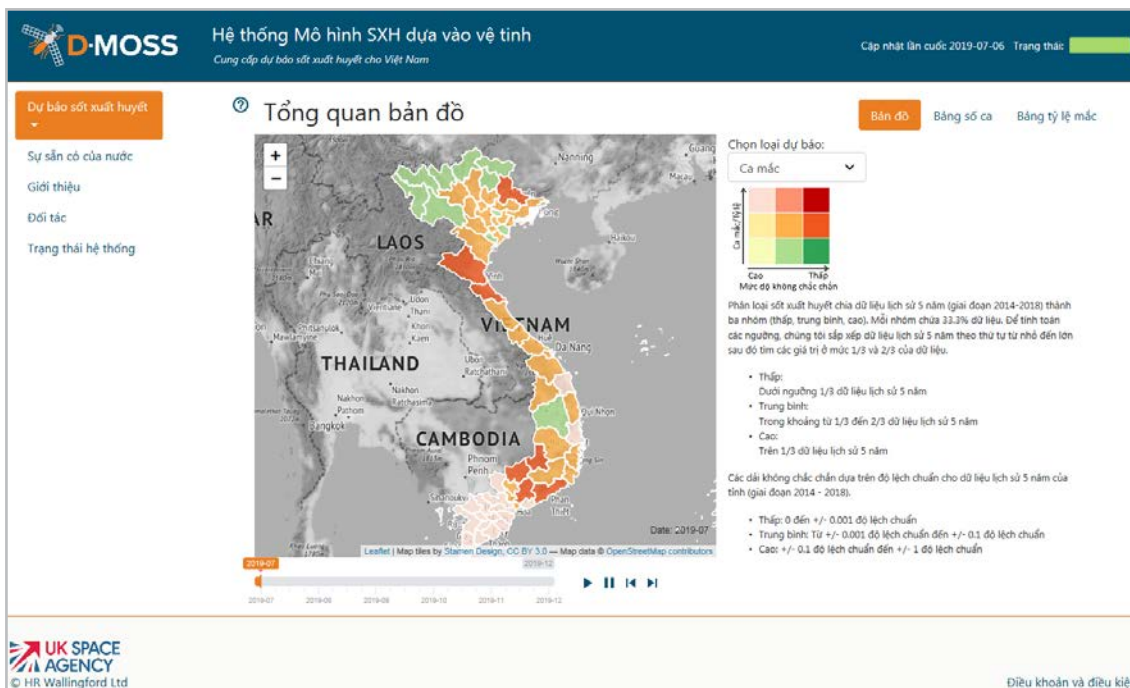
- > Benefit local authorities' planning by providing scenarios of the main stressors and their impacts on dengue incidence.

What are we going to do?

The D-MOSS project is developing a forecasting system in which Earth Observation datasets are combined with weather forecasts and an hydrological model to predict the likelihood of future dengue epidemics up to eight months in advance.

The early warning system includes a water availability component. Although water availability directly impacts dengue epidemics due to the provision of mosquito breeding sites, it is rarely accounted for in dengue prediction models. The water availability forecasts are fed into statistical forecasting models of disease incidence, which integrate a range of other covariates important for dengue transmission (e.g. number of dengue cases, land-cover, precipitation and temperature).

The project started in February 2018 and will end in February 2021. The first release of the full system was achieved in June 2019. Further releases will take place throughout the project covering both Vietnam and South Asia.



D-MOSS Vietnam map portrayal showing an example dengue fever forecast based on unverified test data

The project consortium



The D-MOSS project is funded by the UK Space Agency's International Partnership Programme

and led by HR Wallingford, working with the London School of Hygiene and Tropical Medicine, the UK Met Office and Oxford Policy Management in the UK, and with the following international partners: the United Nations Development Programme, the World Health Organisation, the Vietnamese Institute of Meteorology, Hydrology and Climate Change, the Pasteur Institute Ho Chi Minh City, and the National Institute of Hygiene and Epidemiology in Vietnam.

The project contributes towards three of the United Nations Sustainable Development Goals (SDGs) targets:



SDG 3.3: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

SDG 3.D: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.



SDG 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.