

EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Applications and Economic Benefits (5)

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DEVELOPMENT AND OPERATION OF SPACE-BASED DISEASE EARLY WARNING MODELS

Abstract

Millions of people die every year from preventable diseases such as malaria and cholera. Pandemics put the entire world population at risk and have the potential to kill thousands and cripple the global economy. In light of these dangers, it is fortunate that the data and imagery gathered by remote sensing satellites can be used to develop models that predict areas at risk for outbreaks. These warnings can help decision makers to distribute preventative medicine and other forms of aid to save lives. There are already many Earth observing satellites in orbit with the ability to provide data and imagery. Researchers have created a number of models based on this information, and some are being used in real-life situations. These capabilities should be further developed and supported by governments and international organizations to benefit as many people as possible.

To understand the benefits and challenges of disease early warning models, it is useful to understand how they are developed. A number of steps must occur for satellite data and imagery to be used to prevent disease outbreaks; each requires a variety of inputs and may include a range of experts and stakeholders. This paper discusses the inputs, outputs, and basic processes involved in each of six main steps to developing models, including: identifying and validating links between a disease and environmental factors, creating and validating a software model to predict outbreaks, transitioning a model to operational use, using a model operationally, and taking action on the data provided by the model. The paper briefly overviews past research regarding the link between remote sensing data and disease, and identifies ongoing research in academic centers around the world. The activities of three currently operational models are discussed, including the U.S. Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS), NASA carries out its Malaria Modeling and Surveillance program, and the The Mapping Malaria Risk in Africa (MARA) program.

Based on the understanding of basic processes as well as the experience of currently operational programs, the paper offers a number of recommendations to governments and researchers for future development of operational disease early warning programs.