Chikungunya in the Americas: The Value of Earth Observations

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Abstract
Emerging and re-emerging diseases of global public health concern are recognized to be closely associated with variations in global climate. Recent chikungunya outbreaks in the Americas (2013-2017), Africa, Indian Ocean islands and Asia (2004-2007) have been associated with extreme departures in climate parameters including rainfall and temperature. We have developed a global chikungunya mapping and forecasting application system to map areas at risk for chikungunya concurrently and 1 to 3 months ahead of time to assist public health organizations including Pan American Health Organization (PAHO), World Health Organization etc. in real-time monitoring and surveillance efforts.

Introduction
Emerging and re-emerging diseases of global public health concern are recognized to be closely associated with variations in global climate. Recent chikungunya outbreaks in the Americas (2013-2017) (Figure 1), Africa, Indian Ocean islands and Asia (2004-2007) have been associated with extreme departures in climate parameters including rainfall and temperature. Chikungunya in particular has illustrated the potential for global spread as demonstrated with the recent epidemics in the Americas.

Results: Outbreak Patterns

Figure 2. Distribution of Chikungunya outbreaks 2013-2016

2021 Outbreaks & Forecasts

Figure 3

Composite Risk Map, FMA 2021

Figure 4

Forecast Chikungunya Risk, August 2021

Summary
This nascent effort illustrates how massive amounts of Earth Observations combined with publicly biosurveillance data information using machine learning methods, can be brought to address an issue of public health concern. Information products include historical disease outbreak distributions, baseline risk maps, and current and forecasts risk maps for Chikungunya available via the CHIKRisk App at https://vbd.usra.edu/. This project also provides a template that can be employed in the immediate and near future to develop applications relevant to other vector-borne and ecologically coupled diseases.

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