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Abstract

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Variations in modeled dengue transmission over Puerto Rico using a climate driven dynamic model

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Dengue fever is a mosquito-borne viral disease reemerging throughout much of the tropical Americas. Dengue virus transmission is explicitly influenced by climate and the environment through its primary vector, *Aedes aegypti*. Temperature regulates *Ae. aegypti* development, survival, and replication rates as well as the incubation period of the virus within the mosquito. Precipitation provides water for many of the preferred breeding habitats of the mosquito, including buckets, old tires, and other places water can collect. Because of variations in topography, ocean influences and atmospheric processes, temperature and rainfall patterns vary across Puerto Rico and so do dengue virus transmission rates. Using NASA's TRMM (Tropical Rainfall Measuring Mission) satellite for precipitation input, ground-based observations for temperature input, and laboratory confirmed dengue cases reported by the Centers for Disease Control and Prevention for parameter calibration, we modeled dengue transmission at the county level across Puerto Rico from 2010-2013 using a dynamic dengue transmission model that includes interacting vector ecology and epidemiological components. Employing a Monte Carlo approach, we performed ensembles of several thousands of model simulations for each county in order to resolve the model uncertainty arising from using different combinations of parameter values that are not well known. The top 1% of model simulations that best reproduced the reported dengue case data were then analyzed to determine the most important parameters for dengue virus transmission in each county, as well as the relative influence of climate variability on transmission. These results can be used by public health workers to implement dengue control methods that are targeted for specific locations and climate conditions.