Using data science to provide crucial information for reliable modelling of climate drivers of malaria in South Africa

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ABSTRACT

Malaria remains a major challenge globally and in Africa where climate change is likely to increase its prevalence among communities with low adaptive capacity. We aimed to determine characteristics of malaria dependance on meteorological drivers, to be able to project incidences and spread of this disease. We had reasonably long malaria case load (from weekly epidemiological reports on hospital admissions) datasets available for the five district municipalities in Limpopo province, South Africa. We used these data to derive cross-correlations with corresponding regional temperature, rainfall, and evapotranspiration. We used wavelet transform spectral analysis (WTS) to calculate disease-climate cross-correlations and to further identify time lags characteristic for malaria development. We presumed that all the WTS peaks that we found in our data are characteristic times connected to the periods of development, distribution, and survival of either mosquitoes, as disease vectors, or the pathogens they transmit, or are the periods needed for human incubation of the disease. In this way, using this crucial information extracted from data, we were able to propose a regression model for the number of admissions cases, and to provide critical values of temperature, rainfall and evapotranspiration that in combination initiate the spread of the disease. This further enabled us to calculate disease projections for 2021-2050 and 2051-2080 for Representative Concentration Pathways (RCPs) RCP2.6 and RCP8.5.