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Reacting to climate change and temperature extremes: A case study on the tiger mosquito in Italy

Miguel Garrido Zornoza[1], Cyril Caminade[2], and Adrian Tompkins[2]
[1]University of Copenhagen, Niels Bohr Institute, Biocomplexity, Copenhagen, Denmark (miguel.zornoza@nbi.ku.dk)
[2]ICTP, Earth System Physics, Trieste, Italy

Native to tropical and subtropical regions of Southeast Asia, *Aedes albopictus*, commonly known as the tiger mosquito, has been spreading worldwide with the aid of human activity. The geographical distribution and temporal dynamics of this mosquito are of special interest, given its role as a vector for arboviruses such as dengue (DENV) and chikungunya (CHIKV). Climate change, and its consequent increase in both mean surface temperatures and the frequency and intensity of heat waves, has the potential to affect the behavior and seasonal activity of this mosquito, thereby posing a significant risk to human health. Understanding the impact of mean temperature changes and extremes on potential vector-borne disease risk is paramount to forecasting future trends as well as developing meaningful intervention strategies.

In this work, we study the dynamics of *Ae. albopictus* over three decades, spanning 1990-2019, with a particular emphasis on the Italian Peninsula, which has remained a significant hotspot in Europe, since its introduction in the 1990s. We employed and adapted VECTRI, a climate-sensitive dynamical model that was originally designed for malaria. The model has been modified to parameterize *Ae. albopictus* and successfully calibrated to reproduce the seasonality of the vector using ovitrap data from various locations in Italy. Driving the model using high resolution EOBS gridded observation data, we perform various experiments to isolate the impact of temperature trends and late-spring to summer temperature extremes. Our results show a temperature-driven linear increase in the length of the mosquito season, with larger increases over the southern regions. Overall, temperature extremes tend to increase the bulk egg population across the country, although different spatial trends are highlighted: warm events tend to reduce vector populations in the Po valley and southern regions of Italy,already subject to the highest temperatures, while they tend to increase vector abundance over fringe highland areas. Our results indicate that 10-day temperature forecasts could be utilized to predict mosquito activity and consequently guide vector control intervention strategies such as insecticide spraying in the higher altitude regions identified in this study.