National Institute of Environmental Health Sciences

# A global model of malaria climate sensitivity: Comparing malaria response to historic climate data based on simulation and officially reported malaria incidence

**Author(s):** Edlund S, Davis M, Douglas JV, Kershenbaum A, Waraporn N, Lessler J, Kaufman JH

**Year:** 2012

**Journal:** Malaria Journal. 11: 331

**Abstract:**

BACKGROUND: The role of the Anopheles vector in malaria transmission and the effect of climate on Anopheles populations are well established. Models of the impact of climate change on the global malaria burden now have access to high-resolution climate data, but malaria surveillance data tends to be less precise, making model calibration problematic. Measurement of malaria response to fluctuations in climate variables offers a way to address these difficulties. Given the demonstrated sensitivity of malaria transmission to vector capacity, this work tests response functions to fluctuations in land surface temperature and precipitation. METHODS: This study of regional sensitivity of malaria incidence to year-to-year climate variations used an extended Macdonald Ross compartmental disease model (to compute malaria incidence) built on top of a global Anopheles vector capacity model (based on 10 years of satellite climate data). The predicted incidence was compared with estimates from the World Health Organization and the Malaria Atlas. The models and denominator data used are freely available through the Eclipse Foundation's Spatiotemporal Epidemiological Modeller (STEM). RESULTS: Although the absolute scale factor relating reported malaria to absolute incidence is uncertain, there is a positive correlation between predicted and reported year-to-year variation in malaria burden with an averaged root mean square (RMS) error of 25% comparing normalized incidence across 86 countries. Based on this, the proposed measure of sensitivity of malaria to variations in climate variables indicates locations where malaria is most likely to increase or decrease in response to specific climate factors. Bootstrapping measures the increased uncertainty in predicting malaria sensitivity when reporting is restricted to national level and an annual basis. Results indicate a potential 20x improvement in accuracy if data were available at the level ISO 3166-2 national subdivisions and with monthly time sampling. CONCLUSIONS: The high spatial resolution possible with state-of-the-art numerical models can identify regions most likely to require intervention due to climate changes. Higher-resolution surveillance data can provide a better understanding of how climate fluctuations affect malaria incidence and improve predictions. An open-source modelling framework, such as STEM, can be a valuable tool for the scientific community and provide a collaborative platform for developing such models.

**Source:** http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3502441

## Resource Description

**Climate Scenario :**

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

**Other Climate Scenario:** variations in ambient temperature and precipitation

**Exposure :**

weather or climate related pathway by which climate change affects health

Precipitation, Temperature

**Temperature:** Fluctuations

**Geographic Feature:**

resource focuses on specific type of geography

None or Unspecified

**Geographic Location:**

resource focuses on specific location

Global or Unspecified

**Health Impact:**

specification of health effect or disease related to climate change exposure

Infectious Disease

**Infectious Disease:** Vectorborne Disease

**Vectorborne Disease:** Mosquito-borne Disease

**Mosquito-borne Disease:** Malaria

**Mitigation/Adaptation:**

mitigation or adaptation strategy is a focus of resource

Adaptation

**Model/Methodology:**

type of model used or methodology development is a focus of resource

Exposure Change Prediction

**Resource Type:**

format or standard characteristic of resource

Research Article

**Timescale:**

time period studied

Time Scale Unspecified

**Vulnerability/Impact Assessment:** ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content