dence at specific sites. But such climate and malaria data sets must be considered at comparable spatial and temporal scales. For example, in a comparison of monthly climate and malaria data in highland Kakamega, Kenya[10], we found a close association between malaria transmission and monthly maximum temperature anomalies from 1997 to 2000, using data from the same location and over the same period of time. Hay and colleagues simply compared point-incidence rates with downscaled gridded climate data, rather than coincident longitudinal malaria and climate data.

We conclude that a reliable assessment of long-term relationships between climate and malaria incidence requires increased local monitoring of appropriate climate and disease variables to establish data sets that can support long-term trend analysis. Interdisciplinary teams are needed to analyse processes as diverse as climate and human disease.

Jonathan A. Patz*, Mike Hulme†, Cynthia Rosenzweig‡, Timothy D. Mitchell†, Richard A. Goldberg‡, Andrew K. Githeko§, Subhash Lele||, Anthony J. McMichael¶, David Le Sueur#

**Department of Environmental Health Sciences, Johns Hopkins University, Bloomberg School of Public Health, Baltimore, Maryland 21205, USA*
e-mail: jpatz@jhsph.edu
†*Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, UK*
‡*NASA, Goddard Institute for Space Studies, and Columbia University, New York, New York 10025, USA*
§*Climate and Human Health Research Unit, Centre for Vector Biology and Control Research, Kenya Medical Research Institute, PO Box 1578, Kisumu, Kenya*
||*Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton AB T6G 2G1, Canada*
¶*National Centre for Epidemiology and Population Health, Australian National University, Canberra, ACT 0200, Australia*
#*South African Medical Research Council, PO Box 17120, Congella, Durban 4013, South Africa*

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Hay et al. *reply* — In our study[1] we did not address the impact of predicted climate change on malaria incidence because a complete global assessment is reported elsewhere[2]. Regarding the climate surfaces we used, the data set has superior spatial resolution compared with other data sets of similar temporal extent[3,4], and has been used to quantify climate change across Africa at $0.5\times0.5°$ spatial resolution[5] (although the resulting maps are smoothed to emphasize regional changes). It is inconsistent to assert that these same data are insufficient to demonstrate a lack of climate change.

Furthermore, these smoothed patterns[5] are at odds with the marked and variable trends in temperature identified across east Africa using long-term temperature records from meteorological stations[6]. Events occurring at the $0.5\times0.5°$ resolution will be less variable when averaged over wider areas, but we know of no evidence that climate surfaces interpolated from meteorological stations consistently fail to reveal trends in climate experienced at those locations.

Crucially, further work has confirmed a very high degree of correspondence between the climate surfaces[3,4] and meteorological-station data from Kericho. Moreover, these station data show no significant trend in temperature or rainfall during the 1966–95 period over which complete longitudinal hospital records show malaria incidence to have increased significantly[7].

The malaria resurgences documented at these four sites are not "point-prevalence rates", but estimates from longitudinal records of health facilities, whose catchment populations range over continuous highland areas that are similar in size to a pixel of the climate surface that we used[3,4].

The sparse coverage of meteorological stations in the data set[3,4] before 1910 in the east African region is problematic[4], and these data were excluded from our analyses. The full 1901–95 data set was used by one of the correspondents, however, in their trend analyses of African climate[5]. Moreover, our conclusions remain unaltered in the light of tests repeated for the 1970–95 period, which is coincident with the malaria resurgences and represents the most consistent meteorological-station coverage.

Patz *et al.* estimate a temperature deviation of 3 °C arising from the difference in the mean elevation of the climate surface pixels[3,4] and the elevation of meteorological station sites that contribute to them. However, the thin-plate spline procedure[8] used to generate the 1961–90 climate normals[3] that formed the basis of the entire climate data set[4] explicitly takes account of altitude to correct for the elevational dependency of temperature.

Application of our methodology[1] to the regional time-series cited by Patz *et al.* shows that the purported warming trend is not significant (details available from the authors). It is critical to test for climate changes that coincide in both space and time with the disease data[7,9], so changes on regional scales or at distant sites (such as Kakamega and Nairobi) are irrelevant, whether or not they achieve significance.

The more subtle impacts of non-significant long-term changes in climate on malaria incidence deserve to be investigated, but have not been demonstrated, so we cannot attribute significant increases in malaria incidence to non-significant changes in climate. It is because malaria incidence is related to climate that any study of long-term climate change must factor out seasonality, unlike the cited study on seasonal variability over four years[10]. Finally, windowed Fourier analysis of the meteorological station data for Kericho also showed no change in annual temperature or rainfall variability since 1966 (ref. 11), a conclusion that is corroborated by global-scale analysis of climate variability during this century[12].

Rather than climate change, variations in environmental, social and epidemiological factors are more plausible explanations for the malaria resurgences at the four sites we examined[1] and at three others in Ethiopia, Madagascar and Tanzania[13]. Evidence against the epidemiological significance of climate change in the recent malaria resurgences in Africa is mounting[7,9,13] and remains unmatched by any contrary evidence.

Simon I. Hay*†, Jonathan Cox‡, David J. Rogers*, Sarah E. Randolph§, David I. Stern||, G. Dennis Shanks¶, Monica F. Myers#, Robert W. Snow†**

**TALA Research Group, and §Oxford Tick Research Group, Department of Zoology, University of Oxford, Oxford, OX1 3PS, UK*
e-mail: simon.hay@zoo.ox.ac.uk
†*Kenya Medical Research Institute/Wellcome Trust Collaborative Programme, PO Box 43640, Nairobi, Kenya*
‡*Department of Infectious and Tropical Diseases, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK*
||*Department of Economics, Rensselaer Polytechnic Institute, Troy, New York 12810, USA*
¶*US Army Medical Research Unit, PO Box 30137, Nairobi, Kenya*
#*Decision Systems Technologies, Rockville, Maryland 200850, USA*
***Centre for Tropical Medicine, University of Oxford, John Radcliffe Hospital, Oxford OX3 9DU, UK*

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