International Research Institute for Climate and Society
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HEAT HEALTH IN BANGLADESH

DEFINING AND PREDICTING HEAT WAVES ACROSS TIMESCALES

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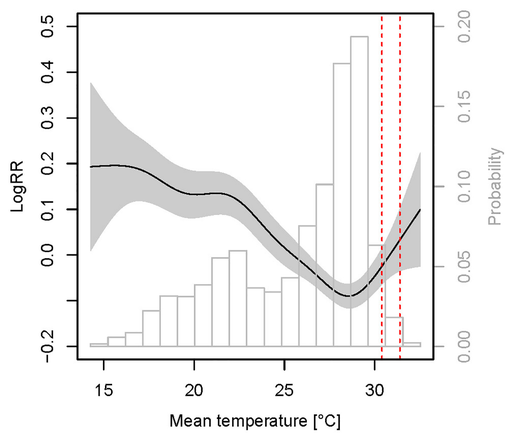
Introduction

It is now well established that extreme heat poses a serious health risk, causing many excess deaths each year. Heat early warning systems are known to save lives by improving preparedness, and should form an important component of a climate change adaptation strategy. However, very little is known about heat waves in Bangladesh.



Log relative risk of mortality with temperature, 2003-2007 (black line and grey range). Average daily temperature distribution (bars).

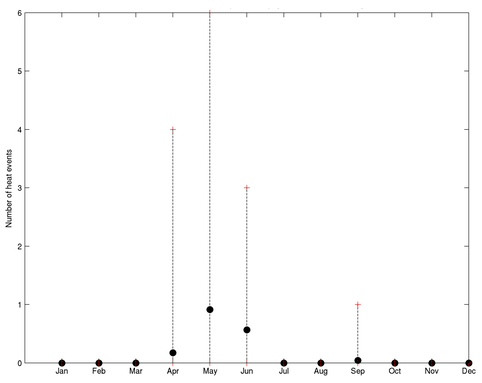
In Bangladesh, both hot and cold mortality effects are evident. A sharp increase in mortality at high temperatures shows that heat waves are a major public health concern.

Defining a heat wave

To prepare for a heat wave, decisions must be taken over when to issue a warning, and this requires a heat wave definition that is both

a) related to human health outcomes
b) forecastable using available weather & climate information.

We used regression modelling to test six possible heat wave definitions against mortality data from 2003-2007.[i] The six definitions tested combined minimum (night) and maximum (day) temperature and heat index. High minimum and maximum temperatures[ii] (>95th percentile) for 3 consecutive days was the best predictor of mortality in Bangladesh.



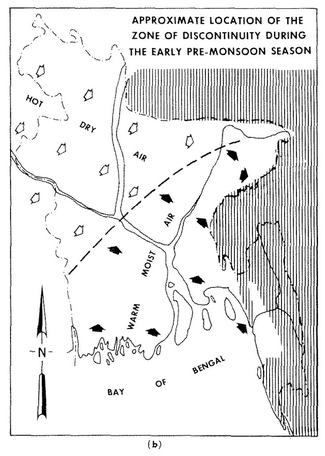
Seasonality of heat wave occurrence

Heat waves in Bangladesh occur during the pre-monsoon season, from April to June.

[i] Mortality data from the Sample Vital Registration System, Bangladesh Bureau of Statistics
[ii] Temperature data from the Bangladesh Meteorological Department

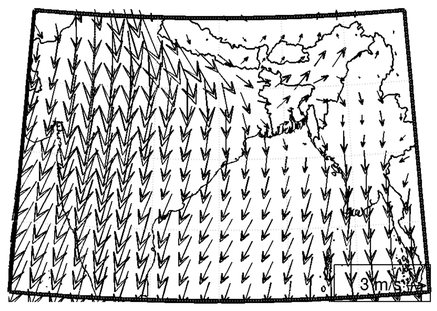
Predicting heat waves

During the heat wave season (April – June), a zone of discontinuity separates two air masses in Bangladesh: dry westerlies from India and moist southerlies from the Bay of Bengal, which bring early pre-monsoon rainfall to the country.



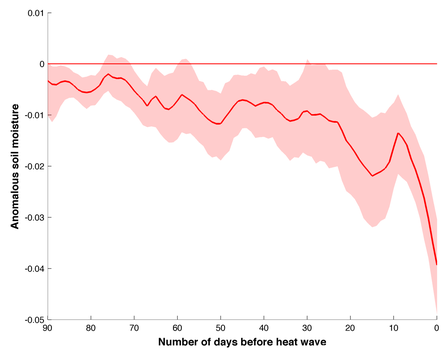
Sanderson & Rafique (2009) Hyd. Sci. Bull. 24:3

On heat wave days, the dry westerlies are stronger, and the moist southerlies are weaker, than normal for this time of year. This reduces rainfall below normal pre-monsoon levels. These warning signs can be seen 8-10 days before a heat wave begins.



Anomaly composite of 850hPa wind on heat wave days, 1989-2011.[iii]

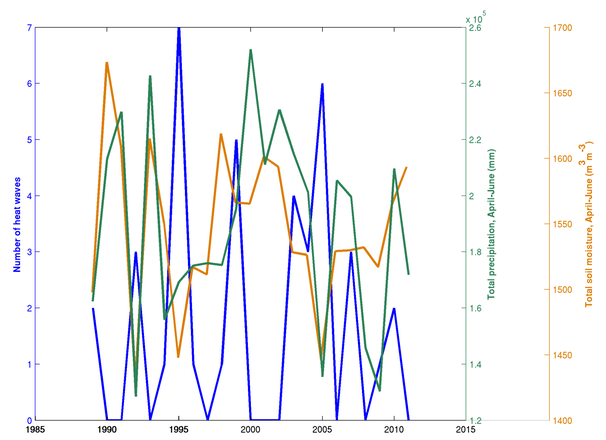
Rainfall is highly variable, but detecting changes in soil moisture would indicate that predictability of heat waves beyond a few days may be possible. We found that heat waves are associated with unusually dry soil moisture during the whole heat wave season. This suggests that seasonal and sub-seasonal forecasts of heat wave risk may be possible by monitoring soil moisture conditions in Bangladesh.



Anomaly composite of total soil moisture in advance of heat waves in Bangladesh, 1989-2011.

Seasonal total number of heat waves (blue), precipitation (green) and soil moisture (orange), 1989-2011.

Correlations between number of heat wave days and total rain and soil moisture were -0.3 and -0.6, respectively.



[iii] Synoptic climate fields taken from the ECMWF ERA Interim Reanalysis from 1989-2011

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