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Heat-related impacts of climate change in the East Mediterranean

Christos Giannakopoulos*, Anna Karali, Vassilis Psiloglou, Giannis Lemesios

National Observatory of Athens, Athens, GREECE

***Corresponding author:** cgiannak@meteo.noa.gr

Abstract

This study investigates the heat-related impacts of climate change on public health in the East Mediterranean. Most of the health problems in the East Mediterranean are related mainly to the warming already occurred as well as to extreme weather events such as heatwaves. In addition projections indicate that warming and extreme events will increase in future posing serious threats on human health. To examine the potential negative impacts of climate warming on human life for the greater East Mediterranean area, the HUMIDEX index, employed to express the temperature perceived by people, was examined. HUMIDEX is applied in summer and generally warm periods and describes the temperature felt by an individual exposed to heat and humidity. The analysis revealed a significant increase in the HUMIDEX in future period mainly during summer months.

Keywords: regional climate modeling, climate change, public health, HUMIDEX, Eastern Mediterranean

Introduction

One of the major concerns of climate change is its impact on human health. The Fourth IPCC assessment report (Parry *et al.* 2007) provides evidence that climate change currently contributes to the global burden of disease and premature deaths. In fact, it plays an important role in the spatial and temporal distribution of some of the most deadly infectious diseases such as malaria, dengue fever, tick-borne diseases, etc. It is also affecting the seasonal distribution and concentrations of some allergenic pollen species, and it has increased heat-related as well as extreme weather-related morbidity and mortality (Parry *et al.* 2007).

Eastern Mediterranean is already experiencing some of the impacts of climate change on public health (Paz *et al.* 2010). Most of the health problems in the area are related mainly to the warming already occurred as well as to extreme

weather events such as heat waves, floods, fires, etc. (D'Ippoliti *et al.* 2010). Even if milder winters have the potential to decrease cold-related mortality and morbidity locally (Donaldson *et al.* 2001), the direct and indirect effects of climate change are expected to have adverse impacts on human health and well-being at the global scale in the future, in particular in the Mediterranean (Paz *et al.* 2010). From the 1960's until today, the mean intensity, duration and number of heat wave events in the Eastern Mediterranean, have increased by a factor of around 7.5, 7.5 and 6 respectively posing serious threats to human health (Kuglitsch *et al.* 2010).

Materials and Methods

HUMIDEX is applied in summer and generally warm periods and describes the temperature felt by an individual exposed to heat and humidity. More specifically, the HUMIDEX parameter (in $^{\circ}$C) is calculated by the following equation:

$$T(h) = Tmax + \frac{5}{9} \times (e - 10), \qquad e = 6.112 \times 10^{\left(7.5 \times \frac{Tmax}{(237.7+Tmax)}\right)} \times \frac{h}{100},$$

where *e* is the vapour pressure, *Tmax* is the maximum 2m air temperature ($^{\circ}$C) and *h* is the humidity (%).

Furthermore, 6 classes of HUMIDEX ranges are established to inform the general public for discomfort conditions:
1) <29°C comfortable, 2) 30–34°C some discomfort, 3)35–39°C discomfort; avoid intense exertion, 4) 40–45°C great discomfort; avoid exertion, 5) 46–53°C significant danger; avoid any activity 6) >54°C imminent danger; heart stroke.

All calculations were performed using PRECIS (Providing Regional Climates for Impact Studies) regional Climate Model based on the United Kingdom (UK) Meteorological Office Hadley Centre HadRM3P model (Jones *et al.* 2004). The model simulations were performed at the Cyprus Institute within the framework of the CIMME project (www.cyi.ac.cy/climatechangemetastudy), which studies 'Climate Change and Impacts in the Eastern Mediterranean and Middle East'. In all simulations the period 1961–1990 was used as the base period (control run) providing a reference for comparison with future projections for the period 2040–2069. The future period simulations of the model are based on the IPCC SRES A1B scenario (Nakićenović *et al.* 2000), which provides a good mid-line scenario for carbon dioxide emissions and economic growth (Parry *et al.* 2007).

Results

In the control period (Figure 1), most parts of Greece and Western Turkey appear to have around a month of thermal discomfort. This value reaches 3 or

more months for North Africa and south parts of the Arabian Peninsula. Coastal and island regions appear equally vulnerable.

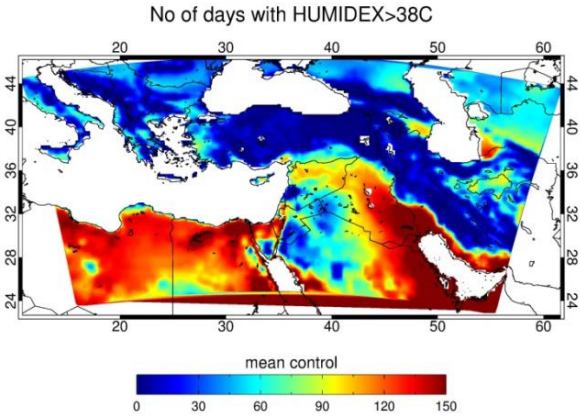

Figure 1. Number of days with HUMIDEX > 38°C for the control period using PRECIS RCM Model

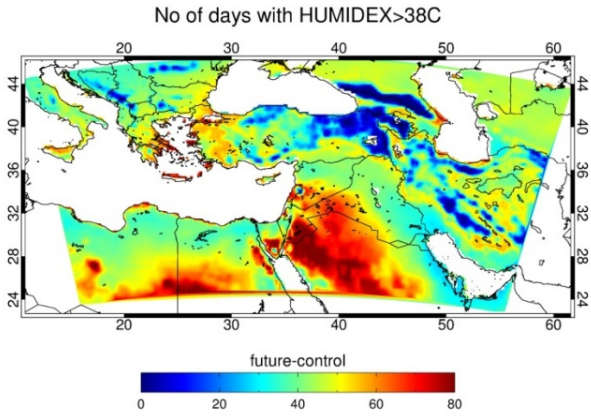

Figure 2. Potential near future changes in the number of days with HUMIDEX > 38°C using PRECIS RCM model

For coastal regions in the Eastern parts of Greece, Crete, western/central Turkey and Cyprus, the duration of HUMIDEX >38°C is projected to increase by as many as 50 days in 2020-2050 (Figure 2). Increases of 80 days are projected for the Arabian Peninsula. Smaller changes are evident in mountainous areas (e.g. Balkans, Anatolia) i.e. their cool summer climate should be maintained.

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