# A stress-test of the Ahmedabad Heat Action Plan under climate change

## Introduction

Heat waves can cause a significant increase in morbidity and mortality in vulnerable populations.1,2 In response, many national and regional administrations have developed their own heat health warning systems and action plans designed to minimise extreme heat exposure of the most vulnerable.3,4

Heat waves, however reasonably defined, are expected to increase in frequency and duration over the next century under all viable future climate change scenarios.5 This casts a special focus on how action plans are designed and equipped to handle heat waves in the next century. It is thus incumbent on those in the climate and health research communities to scrutinise the limits and tolerance levels of such plans, and to understand how prepared we will need to be for future heat waves.

In our analysis, we ‘stress-test’ a representative selection of warning system and action plans. By using a future global climate projections of the 21st century in conjunction with thresholds explicit in identified warning systems, we will assess the number of times actions plans will need to be implemented, as well as how exposure to alert days are projected to change by using population projections.

This study will provide a quantitative framework on the requirements of future action, in terms of financial and human cost. The aim of the study is to judge the feasibility of such action plans under projected climate change. The aim is also to highlight the importance of iterating Heat Health Warning Systems to adapt in order to become sustainable and consistently effective in the future.6

## Method

The Ahmedabad Heat Action Plan 20177 provides warning thresholds for maximum daily temperature (Tmax) (Table 1):

Table 1. Ahmedabad Heat Action Plan warning thresholds based on daily maximum temperatures

|  |  |  |
| --- | --- | --- |
| **Yellow alert** | Hot Day Advisory | 41.1-43°C |
| **Orange alert** | Heat Alert Day | 43.1-44.9°C |
| **Red alert** | Extreme Heat Alert Day | ≥45°C |

Using the KNMI Climate Explorer, projections for daily Tmax in 1961-2000, 2046-2065 and 2081-2100 were obtained for the Ahmedabad grid square using the Canadian Centre for Climate Modelling and Analysis (CCCma) Coupled Global Climate Model (CGCM) 3.1 under the A2 scenario.8

The A2 scenario family ‘describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.’ [ref]

## Results

The statistics of the alert days under the A2 scenario are shown in Table 2, where it can be shown that there is a change of over 20 days to the number of Red alert days when comparing 1961-2000 to 2081-2100.

Table 2. Statistics of average number of alert days in Ahmedabad for 1961-2000, 2046-2065, 2081-2100 under A2 scenario.

|  |  |  |  |
| --- | --- | --- | --- |
| **Alert level** | **Average number of alert days** | | |
| **1961-2000** | **2046-2065** | **2081-2100** |
| **No alert** | 245.6 | 229.2 | 237.6 |
| **Yellow alert** | 23.0 | 21.2 | 16.8 |
| **Orange alert** | 23.0 | 22.3 | 16.4 |
| **Red alert** | 73.4 | 92.3 | 93.8 |

The information is also displayed graphically in Figure 1.

../../../../../output/alert_stats/ahmedabad/cccma_cgcm3_1/ahmedabad_cccma_cgcm3_1.pdfFigure 1. Statistics of average number of alert days in Ahmedabad for 1961-2000, 2046-2065, 2081-2100 under A2 scenario.

## Discussion

Under this framework, we have a quantitative analysis of the frequency of the alert days, as well as the population exposed. It could be a framework for pre-analysis of future viability of the Ahmedabad Heat Action Plan, and contributes an essential component of each review of a heat action plan, as recommended every few years.6

Other scenarios apart from A2 will be analysed, and uncertainty will be obtained from using an ensemble of models, available in the IPCC CMIP5 ensemble.

This also provides a good quantitative framework to understand how plans in other cities will perform under climate change.

# References

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