J3.3 A NATIONAL HEAT/HEALTH WARNING SYSTEM: IMPROVEMENT OVER CURRENT SYSTEM

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1. INTRODUCTION

Excessive heat accounts for an estimated 1,000 deaths annually in the U.S. (Kalkstein et al. 1993). The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) currently issues a suite of excessive heat products to provide the Nation with advance notice of excessive heat events for the protection of life and property. These products are issued based on a single Heat Index (HI) value, derived from temperature and humidity, originated by Steadman (1979). Recent research has shown that often, one HI value cannot fully predict when excessive heat becomes sufficient to stress a population causing a heat-related increase in mortality. A national Heat/Health Warning System (HHWS) based upon empirical data would provide the NWS with tailored excessive heat guidance related to human health. This paper will describe how a national HHWS will provide a more accurate and standardized guidance system to warn the public of excessive heat events.

2. CURRENT NWS EXCESSIVE HEAT WATCH/WARNING PROGRAM

NWS provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. For excessive heat, NWS currently issues a suite of products to provide the public advance warning of dangerous or life threatening heat conditions. The suite of products follows a multitiered concept to increase awareness and promote a proper response to an approaching excessive heat event. The suite of excessive heat products are:

- **Excessive Heat Outlook** - used when the potential exists for an excessive heat event to develop in the next three to seven days
- **Excessive Heat Watch** - used when conditions are favorable for an excessive heat event to develop in the next 12 to 48 hours
- **Excessive Heat Warning** - used when an excessive heat event is occurring, imminent, or has a high probability of occurrence in the next 36 hours and poses a threat to life and property
- **Heat Advisory** - used when a heat event is occurring, imminent, or has a high probability of occurrence in the next 36 hours and causes significant inconvenience and, if caution is not exercised, could become life threatening

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From 1992 to 2002, the NWS (1992) issuance criteria for excessive heat products were based on a single HI value. Currently, NWS (2003) guidance recommends issuance of Excessive Heat Warnings based on the following criteria:

1) Maximum daytime HI $\geq$ 40.5 °C (105 °F) for northern areas to 43.3 °C (110 °F) for southern areas for at least two consecutive days
2) Minimum nighttime temperature > 23.9 °C (75 °F)

While some leeway is given to the local forecaster in the decision to issue an excessive heat warning, the guidance is not sufficiently regionalized to accommodate the sensitivity of the local population. For example, a HI value of 40.5 °C will have differing impact on people living in Boston versus Dallas (Kalkstein and Valimont, 1986). Additionally, excessive heat warnings currently are not verified by NWS.

3. NEW HEAT/HEALTH WARNING SYSTEM

Research by Kalkstein and Greene (1997), and Kalkstein (1993) has shown that the current WFO-based warning system, using HI as the only indicator of excessive heat threat to the population, is not sufficient to reduce the risk of heat-related fatalities at all locations in the U.S. HI is either too liberal, too conservative, and/or too simplistic. Kalkstein (1991) has identified nearly 20 atmospheric variables characterizing oppressive airmasses likely responsible for heat-related mortality.

To improve its excessive heat warnings, NWS needs locally-tailored guidance that will address the problems of regional sensitivity of the local population and identification of location-specific conditions leading to heat-related mortality. This will allow NWS to *"expand and improve the existing weather, water, and climate product and service line,"* and *"increase the accuracy and timeliness of NWS warnings,"* (NWS, 2001).

NWS, other federal agencies, and state and local government and health agencies have funded implementation of tailored excessive heat guidance in eleven cities in the southern, eastern, and western U.S. This guidance is based on synoptically evaluating weather-health relationships through the identification of high-risk air masses that may affect human health (Kalkstein, et al., 1996).

The uniqueness of the guidance stems from is being developed for each urban area, based on specific meteorology for each locale, as well as urban structure and demographics, and the guidance being based on actual weather-health relationships, as determined by daily variations in human mortality.

The basis of the weather-health relationship is based on offensive airmasses. For each location, the characteristics of the airmass that makes it detrimental to health are determined. Once the relationships are found,

a system is developed to utilize NWS Interactive Forecast Preparation System (IFPS) model forecasts with the opportunity for forecast modification by the local Weather Forecast Office (WFO).

4. NATIONALIZATION PLAN FOR HEAT/HEALTH WARNING SYSTEMS

NWS is developing a plan for implementation of locally-tailored guidance for improved excessive heat warnings nationwide. This includes expanding locally-tailored guidance from the current eleven cities to each U.S. municipality with population exceeding 500,000 which also has a co-located NWS WFO. Once location-specific weather-health associations are made, additional municipalities in close proximity, but with a unique forecast, may be implemented by utilizing the weather-health associations found in the larger municipality.

In all, roughly 60-70 U.S. cities meet the criteria. Plans call for tailored excessive heat guidance to be phased in based on susceptibility to excessive heat related mortality and funding considerations. If funding is approved, all guidance could be in place as early as 2007.

The guidance will be available to NWS WFOs for excessive heat warnings. It will also be available to public health officials to improve mitigation activities. The general public will have access to the guidance through officially issued watches and warnings.

A method of national verification will also be developed, coincident with the guidance. Location-specific results will be examined for improvement opportunities and to verify the performance improvement over existing NWS excessive heat guidance. This may include assessing false positives as well as the accuracy in estimating impacts of offensive weather.

This new guidance, along with the verification, will allow improved mitigation during oppressive conditions. It may allow cities to develop scientifically-based excessive heat intervention plans. It has already been shown to save lives. In just three years, tailored guidance implemented in Philadelphia, PA, returned an estimated savings of over 100 lives and created an estimated $450 Million net dollar benefit (Teisberg et al., in prep). Extrapolating the benefit across the U.S., a national HHWS could save 1,000 lives per year with an associated savings of billions of dollars.

5. REFERENCES

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