**Reading notes**

**Ebi 2009**

**Evaluation of thermal stress**

**Spain, France, UK, Portugal utilize maximum and/or minimum temperature thresholds in determining heat stress**

**USA, Australia (Heat Index) and Canada (Humidex) used as an apparent temperature measure**

**20 newer HHWWS across USA use Spatial Synoptic Classification. (Sheridan and Kalkstein 2004).**

**Also in Italy (Michelozzi and Nogueira 2004).**

**Canada, South Korea and China (Tan et al. 2003).**

Synoptic approaches take into account entire suite of meteorological variables and thus holistically categorize the atmospheric situation at a given moment for a particular location or region. E.g. cloud cover or solar radiation may be an important component.

**Germany HHWWS utilise the HeRATE system (Koppe and Jendritzsky 2005).**

HeRATE system is based on modelling the response in the human thermoregulatory system to ambient weather conditions. The thermal stress of ambient conditions is combined with an evaluation of short-term adaptation in assessing overall level of heat stress upon the average individual. It requires the most detailed array of meteorological conditions

**Considerations in evaluating thermal stress**

**Geography**

**Few HHWWS modify the threshold values to account for local climatology. The number of times different locations will excess these thresholds varies greatly.**

USA uses ‘northern’ and ‘southern’ regions with thresholds of 3C difference.

Portugal utilizes a single threshold of 32C (Paixao and Nogueira 2002)

Italy (Michelozzi and Noguiera 2004), Spain (Ministero de Sanidad y Consumo 2005), UK (Department of Health 2004), and France (Institute de Veille Sanitaire 2005) incorporate regionally defined thresholds)

**Systems using synoptic methods have an inherent spatial component**

US, Canada, Italy (Sheridan and Kalkstein 2004)

**HeRATE is inherently spatial also (Koppe and Jendritzky 2005)**

**Urban-rural**

**Urban-rural vulnerability difference is rarely acknowledged**

Wilmington, Ohio uses lower thresholds for urban areas than rural areas (G. Tipton 2006)

Recent work (Sheridan and Dolney 2003) suggests differences in vulnerability from rural to urban areas are minimal

**Intra-seasonal acclimatization**

**Well-documented that early season heat waves elicit a stronger response than late season heat waves of identical character (WHO/WMO/UNEP 1996)**

**Despite its importance, relatively few systems account for intra-seasonal variability.**

Italian cities utilize apparent temperature thresholds (Michelozzi and Nogueira 2004)

HeRATE system accounts for change in seasonal acclimatization by altering thresholds throughout the year (

**Persistence of EHE**

**Vulnerability, as expressed by increasing mortality, generally increases through the first several days of an EHE, and then may decrease thereafter**

Swiss heat warning system based upon the exceedance of a heat index of 32C on three consecutive days (MeteoSwiss 2006)

**Determination of thresholds**

**Excess mortality used via an inductive method to place thresholds.**

Mortality of all causes, or almost all causes (sometimes with the exception of accidents) are used in place of just those deaths that are termed by a medical examiner as ‘heat-related’, since this restriction would result in a significant undercount of vulnerability (Sheridan and Kalkstein 2004).

France’s HHWWS threshold is 50% extra mortality in Paris and 100% in rural locations (Pascal et al. 2006)

Portugal’s ICARO system requires a 31% increase for a warning to be called (Paixao and Nogueira 2002)

Germany’s HeRATE uses inherent level of thermal stress that are utilized to determine the warning (Koppe and Jendritzky 2005)

Swiss and original US National Weather Service system, thresholds are defined without any mortality threshold.

**PWWS (Kalkstein 1996)**

St. Louis WBGT experiment to look at (City of St. Louis 1994)

Also Chicago and Phoenix