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John Nairn  a/Regional Director South Australia National Heatwave Project Director Churchill Fellow (heatwaves)
Excessive Heat Factor

(Heatwave Intensity)

\[
\begin{align*}
\text{EHI}_{\text{sig}} &= \frac{(T_i + T_{i+1} + T_{i+2})}{3} - T_{95} \\
\text{EHI}_{\text{accl}} &= \frac{(T_i + T_{i+1} + T_{i+2})}{3} - \frac{(T_{i-1} + \ldots + T_{i-30})}{30}
\end{align*}
\]

\[\text{EHF} = \text{EHI}_{\text{sig}} \times \text{Max}(1, \text{EHI}_{\text{accl}})\]

(next three days) \hspace{1cm} (same three days)

Long term temperature anomaly \times (+ve Short term temperature anomaly)

(1971-2000) \hspace{1cm} (previous 30 days)

Heatwave detection \hspace{2cm} Amplifying term
Generalized Extreme Value theory utilizing Peaks over Threshold

Generalized Pareto distribution function – suited to fat tail distributions

80:20 rule for rareness or severity of heatwave intensity

Severe threshold

Extreme threshold
France experienced ~15,000 excess deaths in 2003

Peak amplitude of >3 x sev threshold

International case studies
Chicago 1995 ~ 700 excess deaths, then Chicago 1999 ~ 100 excess deaths

Peak amplitude, ~ 3.5 x sev threshold

Peak amplitude briefly ~ 2 x sev threshold
Heatwave forecasts: from NWP to multi-week
Extending BoM's new heatwave service to multi-week timescales

Example: January 2014
One of the most significant multi-day heatwaves on record affected southeast Australia over the period from 13 to 18 January 2014

Observations for 13-15 January 2014
Heatwave forecasts: from NWP to multi-week

POAMA Forecasts (chance of a heatwave occurring in the period)

Forecast start date on 29 December 2013 for the month of January 2014

Heatwave forecasts: from NWP to multi-week

POAMA Forecasts (chance of a heatwave occurring in the period)

Forecast start date on 29 December 2013 for the month of January 2014

Forecast start date 5 January 2014 for 12 to 25 January (i.e. weeks 2 & 3)

Heatwave forecasts: from NWP to multi-week

POAMA Forecasts (chance of a heatwave occurring in the period)

Forecast start date on 29 December 2013 for the month of January 2014

Forecast start date 5 January 2014 for 12 to 25 January (i.e. weeks 2 & 3)

Weather (NWP) Forecasts for 13 to 15 January

Forecast start date 8 January 2014

Forecast start date 12 January 2014

The Centre for Australian Weather and Climate Research
A partnership between CSIRO and the Bureau of Meteorology
There is significant potential to extend traditional weather forecasts and warnings for extreme events to include longer lead probabilistic guidance.

**Summary**

**Ready**
- Seasonal forecasts
  - Begin monitoring mid-range and short-range forecasts
  - Update contingency plans
  - Train volunteers
  - Sensitize community
  - Enable early-warning system

**Set**
- Mid-Range forecasts
  - Continue monitoring shorter-time-scale forecasts
  - Mobilize assessment team
  - Alert volunteers
  - Warn community
  - Local preparation activities

**Go!**
- Short-Range forecasts
  - Deploy assessment team
  - Activate volunteers
  - Evacuate community

*Figure B5:* Ready-Set-Go tool demonstrating actions to be taken with seasonal, intraseasonal and weather forecasts.

From: iri.columbia.edu/csp/issue3/download
Australian lessons

Feedback from stakeholders:

• 85% of all heatwaves are low-intensity. The public will have good adaptive strategies.
• Change 'heatwave' to 'low-intensity heatwave'
• Lower intensity of yellow used for low-intensity heatwave
• Clearly articulate three-day period in title and words
• Layman explanations of concepts behind heatwave intensity and severity

Creation of Heatwave Services Reference Group:

• Emergency services, Health agencies and Media encouraging Bureau to continue developing service
• Lack of warning capability limits deeper engagement. Lead response agencies developing health warnings around differing heat criteria
• Collaborative studies are establishing epidemiological efficacy of heatwave severity
Pakistan Heat Wave - Model Run: 14/06/2015 00z

Forecast For Day 4:
Wed 17th June 2015

Model Run: 25/05/2015 00z

Model Run: 28/05/2015 00z
Forecast For Day 6: Sat 30th May 2015

Forecast For Day 5:
Thurs 18th June 2015

Forecast For Day 6:
Fri 19th June 2015

Forecast For Day 7:
Sat 20th June 2015