



Australian Government
Bureau of Meteorology

John Nairn

Acknowledgements:

Robert Fawcett Bureau of Meteorology R&D,
High Impact Weather Team

Debra Hudson Bureau of Meteorology R & D, Seasonal Prediction
and Climate Variability

Helen Titley &
Joanne Robbins UK Met Office, Global Hazard Map Project

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



Excessive Heat Factor

(Heatwave Intensity)



$$EHI_{sig} = (T_i + T_{i+1} + T_{i+2})/3 - T_{95}$$

$$EHI_{accl} = (T_i + T_{i+1} + T_{i+2})/3 - (T_{i-1} + \dots + T_{i-30})/30$$

$$EHF = EHI_{sig} \times \text{Max}(1, EHI_{accl})$$

(next three days)

(same three days)

Long term temperature anomaly × (+ve Short term temperature anomaly)

(1971-2000)

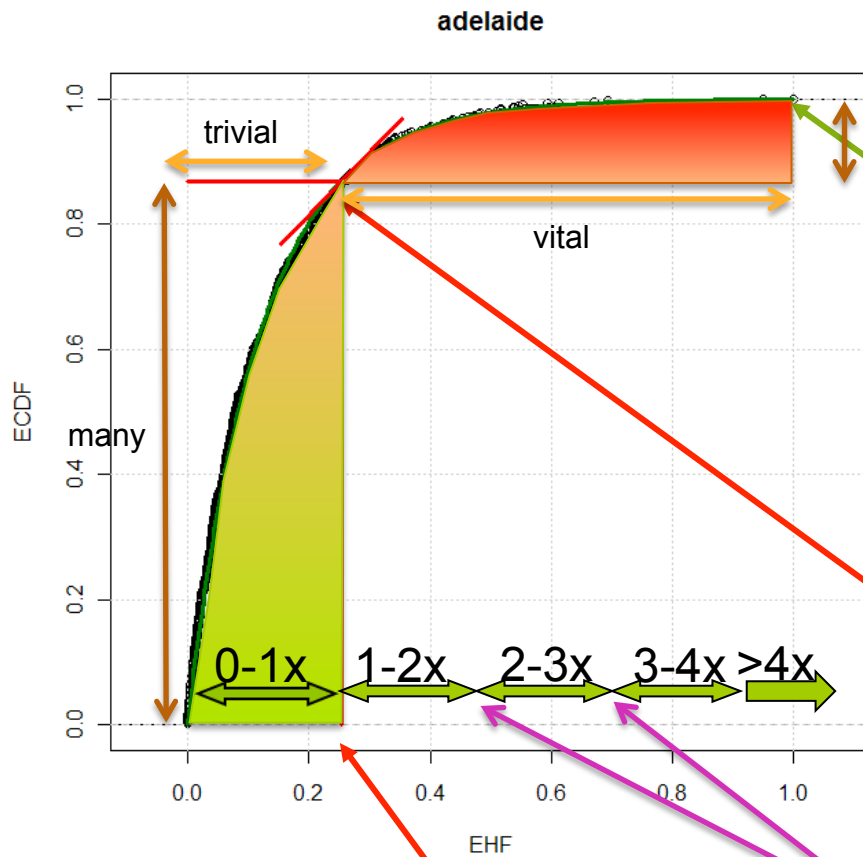
(previous 30 days)

Heatwave detection

Amplifying term



Experimental Severe & Extreme Heatwave threshold



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

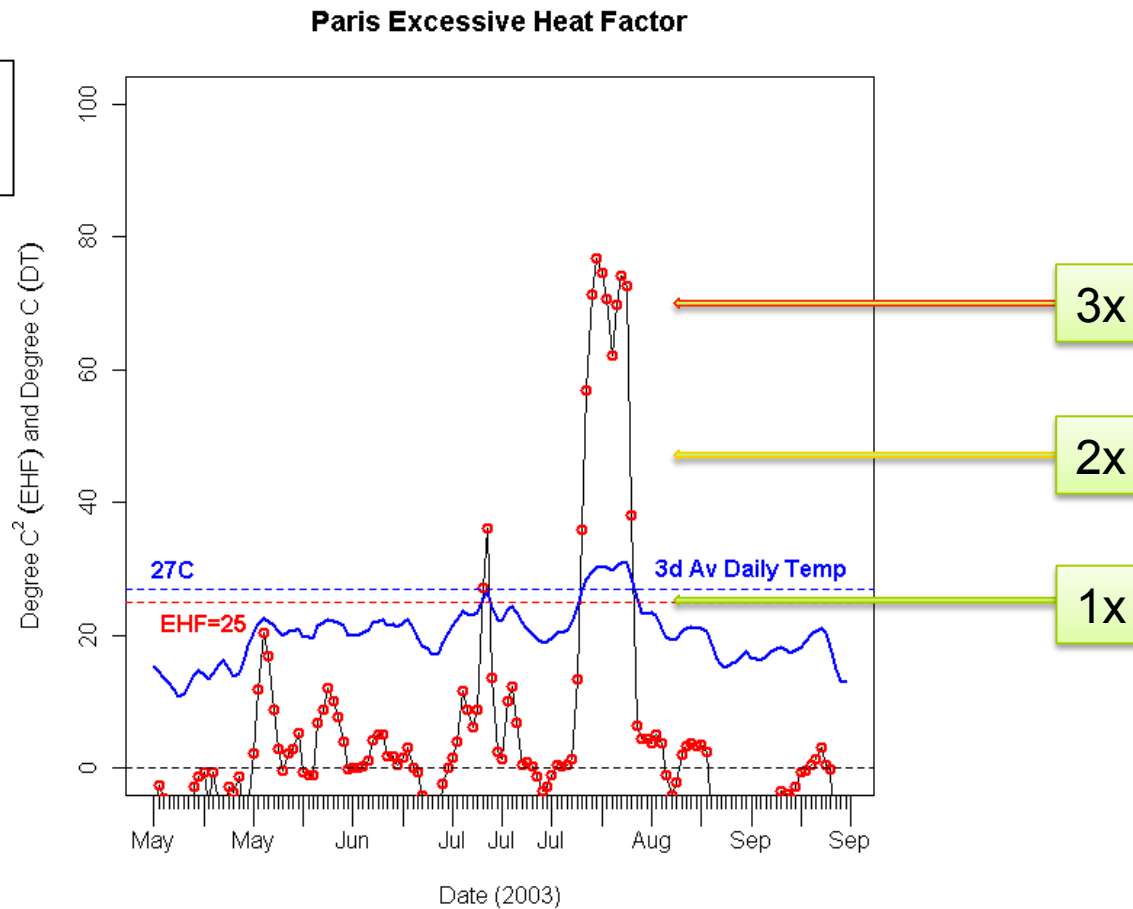
Extreme threshold



International case studies

France experienced ~15,000 excess deaths in 2003

Peak amplitude of
>3 x sev threshold





Australian Government
Bureau of Meteorology



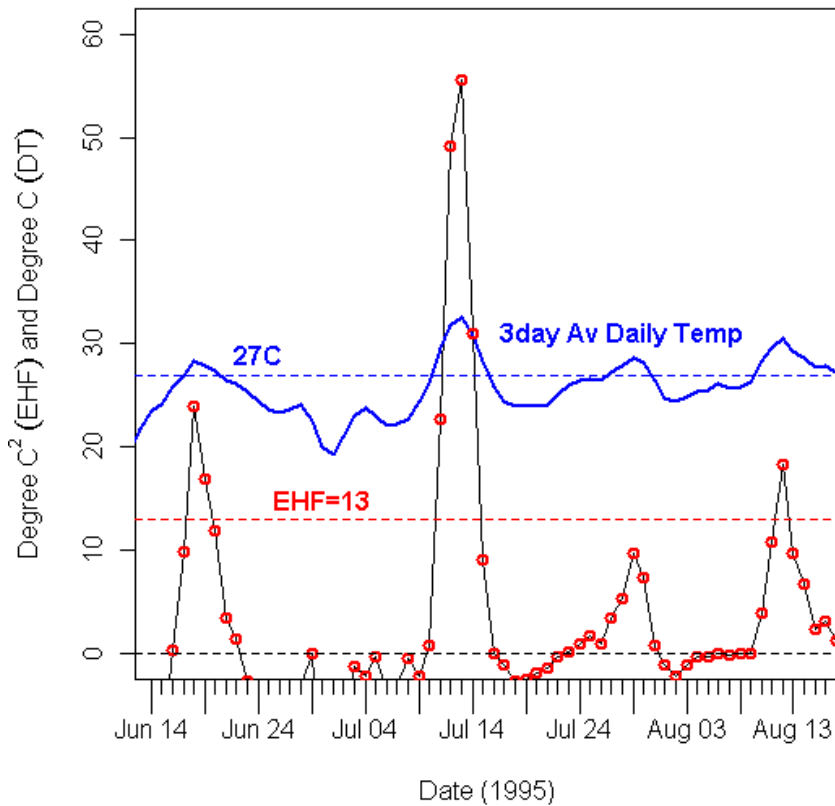
Australian Government
Bureau of Meteorology

Chicago 1995 ~ 700 excess deaths, then Chicago 1999 ~ 100 excess deaths

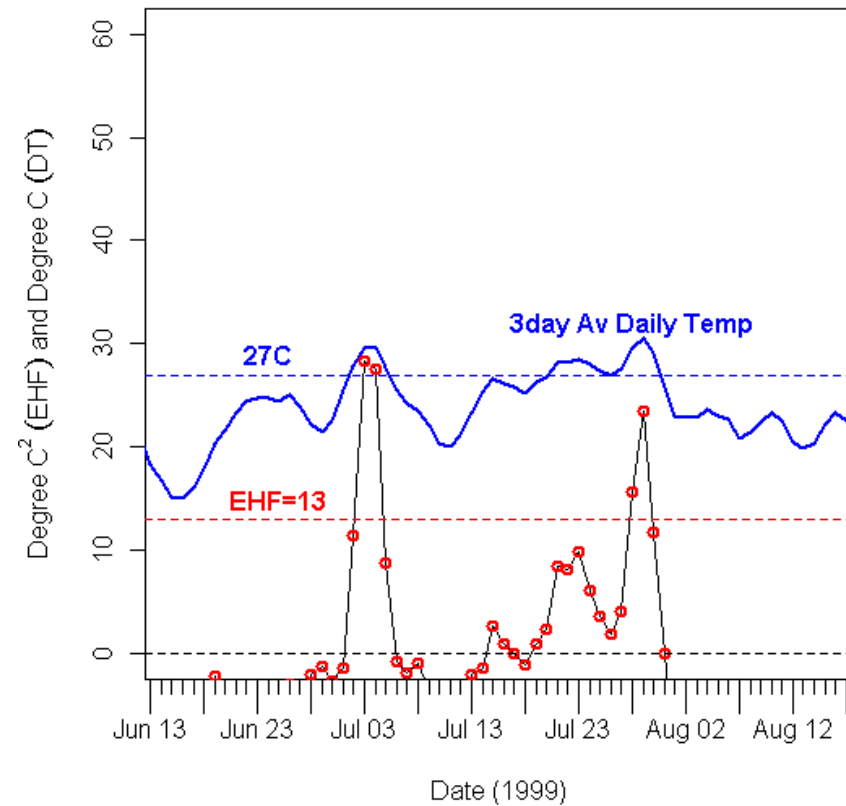
Peak amplitude, ~ 3.5 x sev threshold

Peak amplitude briefly ~ 2 x sev threshold

Chicago Excessive Heat Factor



Chicago Excessive Heat Factor

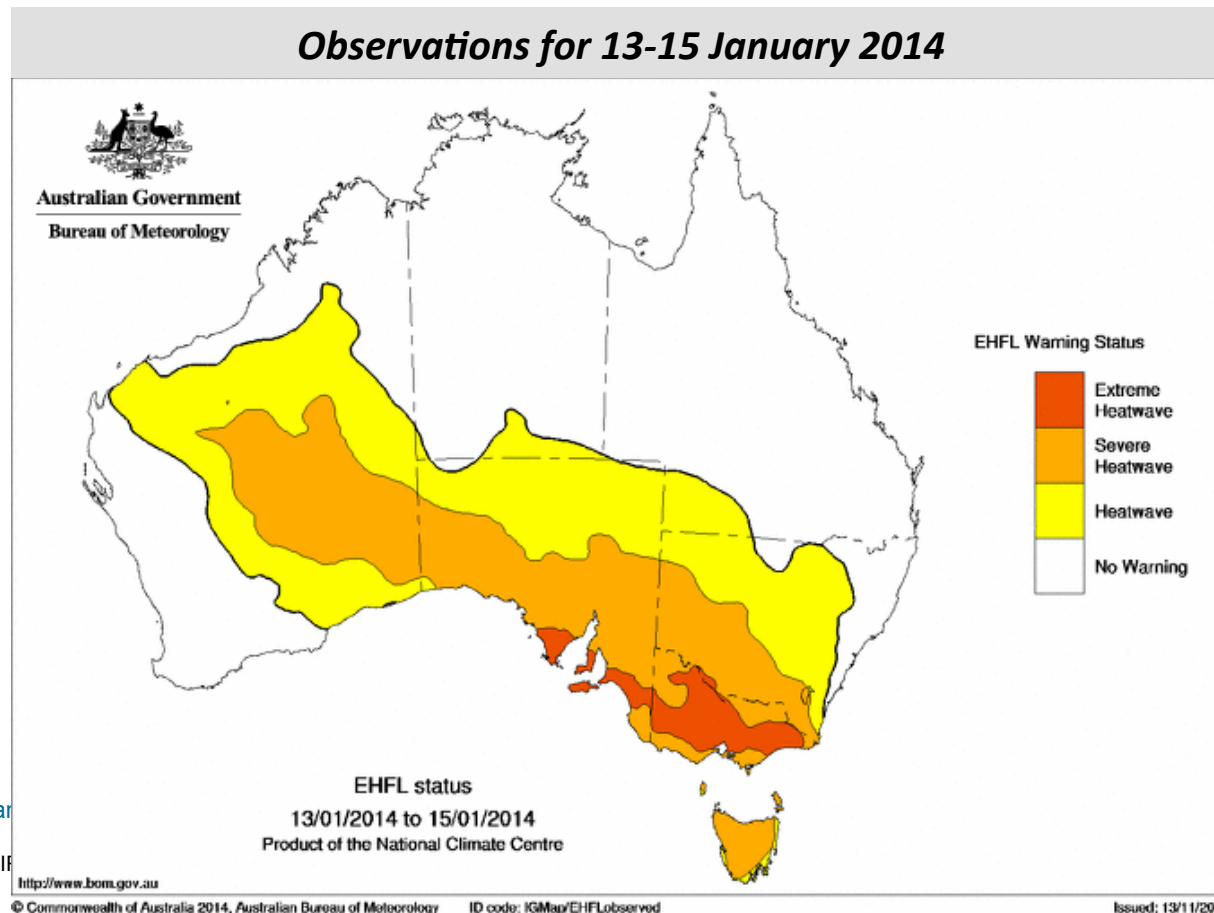


Heatwave forecasts: from NWP to multi-week

Extending BoM's new heatwave service to multi-week timescales

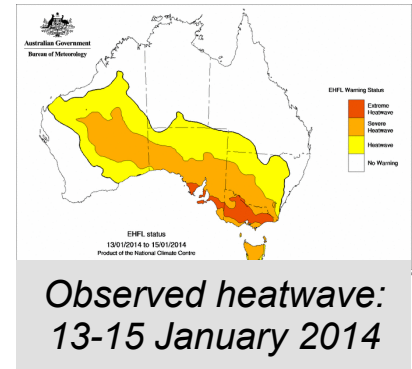
Example: January 2014

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

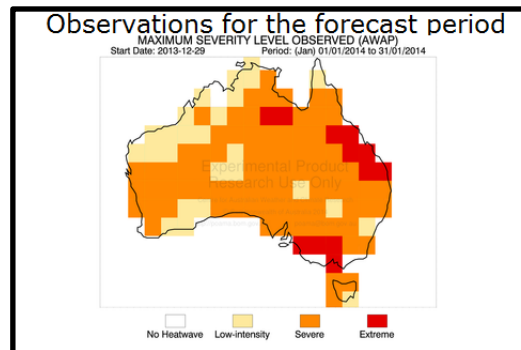
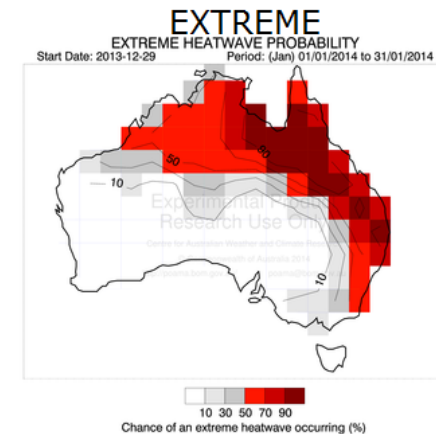
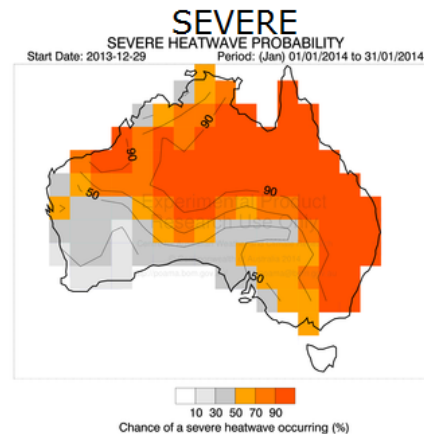
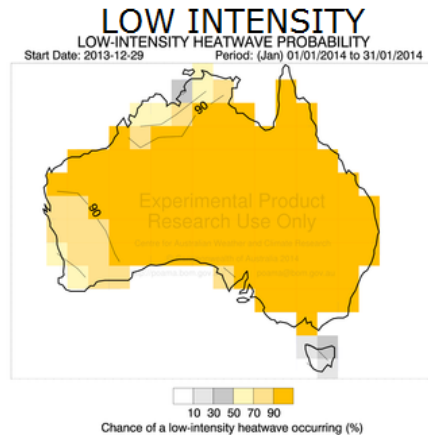


Heatwave forecasts: from NWP to multi-week

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



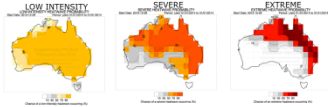
Forecast start date on **29 December 2013** for the month of **January 2014**



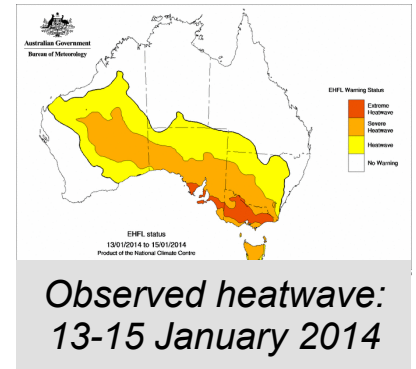
The Centre for Australian Weather and Climate Research
 A partnership between CSIRO and the Bureau of Meteorology

Heatwave forecasts: from NWP to multi-week

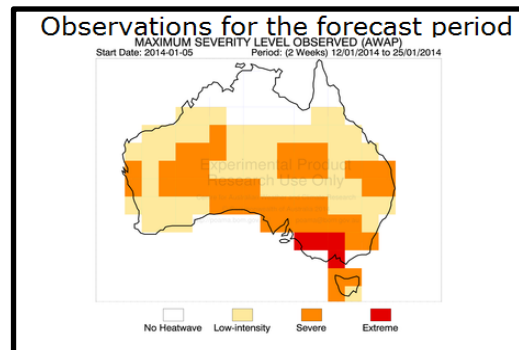
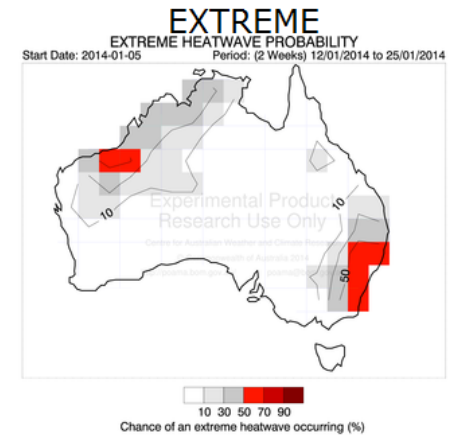
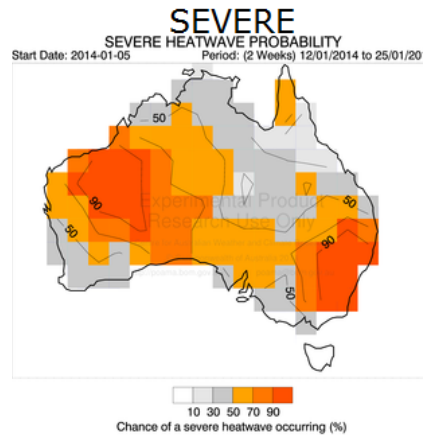
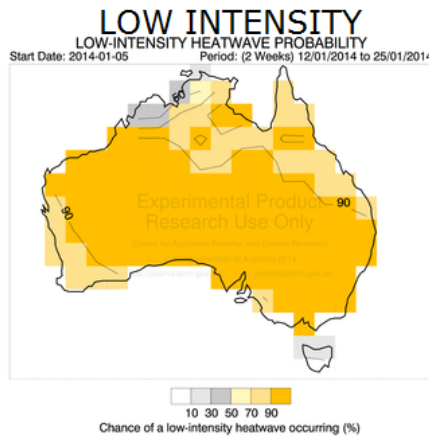
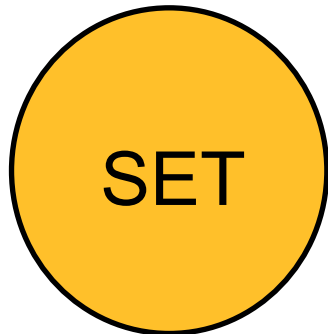
POAMA Forecasts (chance of a heatwave occurring in the period)



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

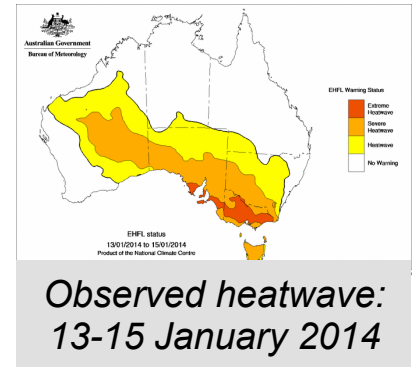


Forecast start date **5 January** 2014 for **12 to 25 January** (i.e. weeks 2 & 3)

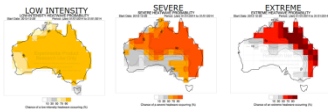


The Centre for Australian Weather and Climate Research
A partnership between CSIRO and the Bureau of Meteorology

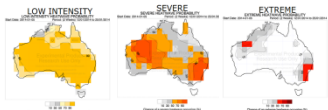
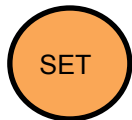
Heatwave forecasts: from NWP to multi-week



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



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

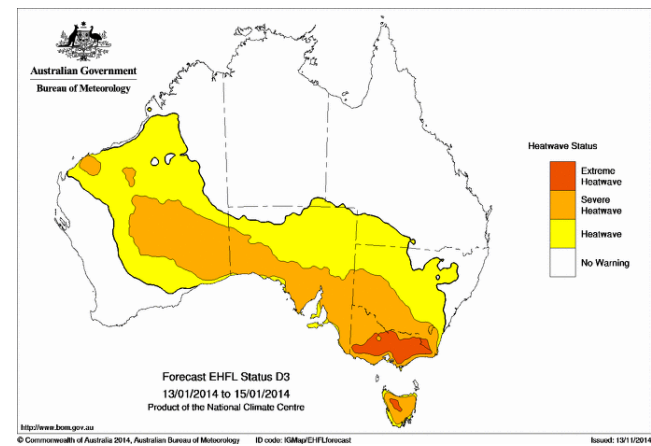
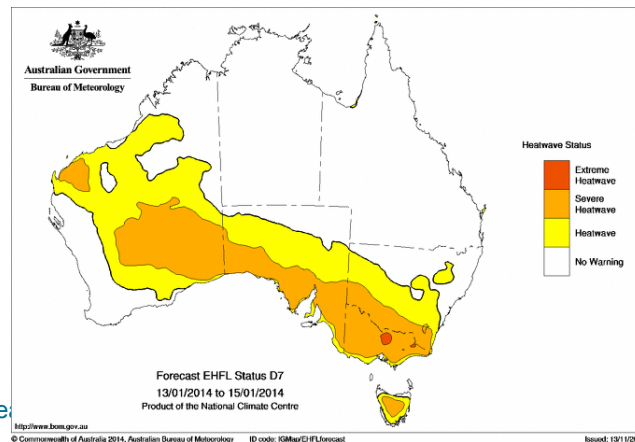
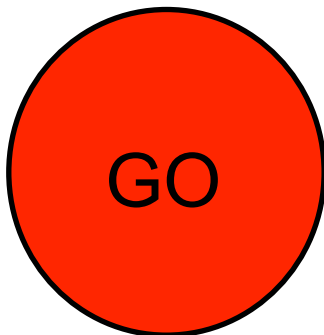


Forecast start date **5 January** 2014 for **12 to 25 January** (i.e. weeks 2 & 3)

Weather (NWP) Forecasts for 13 to 15 January

Forecast start date
8 January 2014

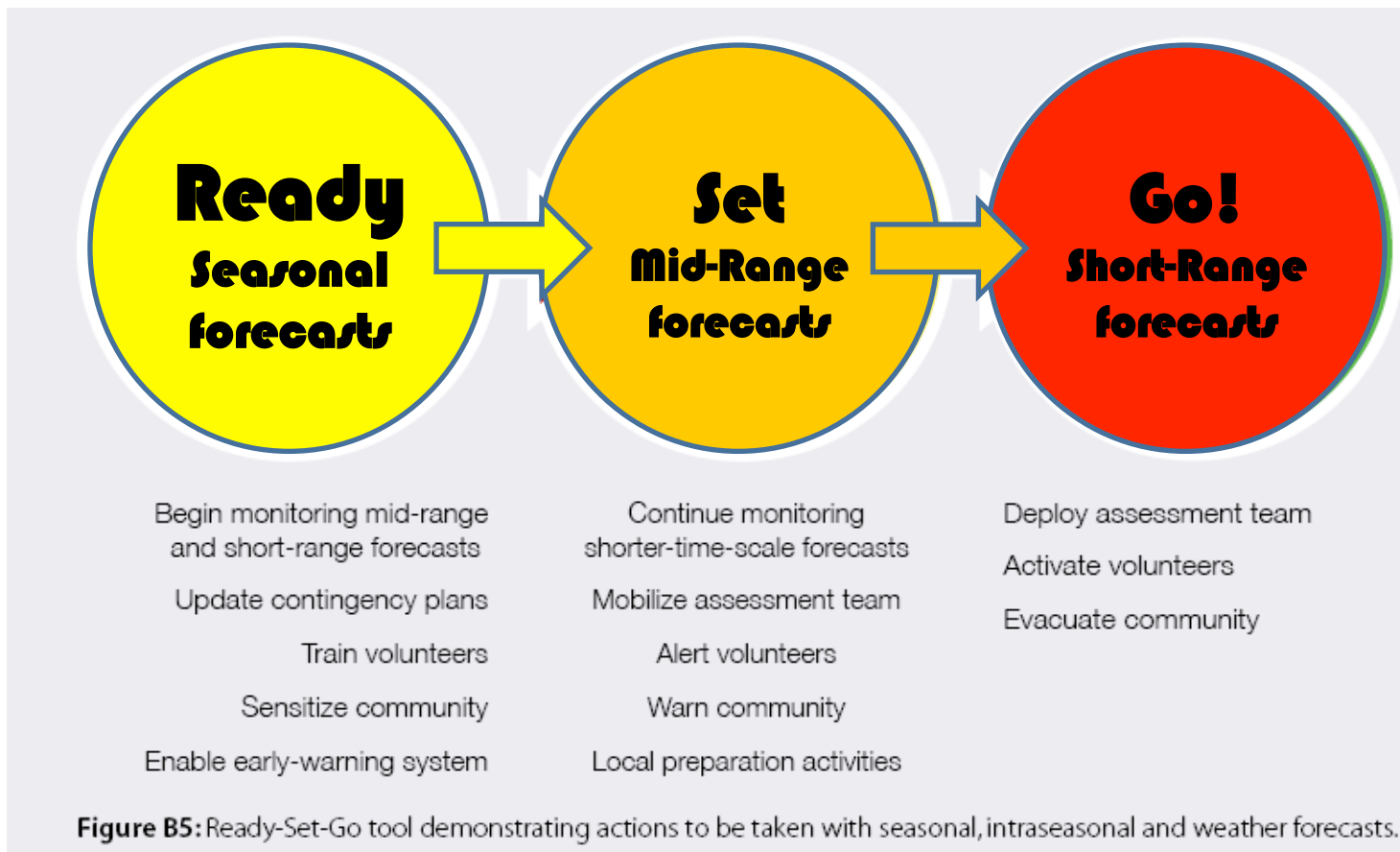
Forecast start date
12 January 2014



The Centre for Australian Weather
Climate Research
A partnership between CSIRO and the
Bureau of Meteorology

Summary

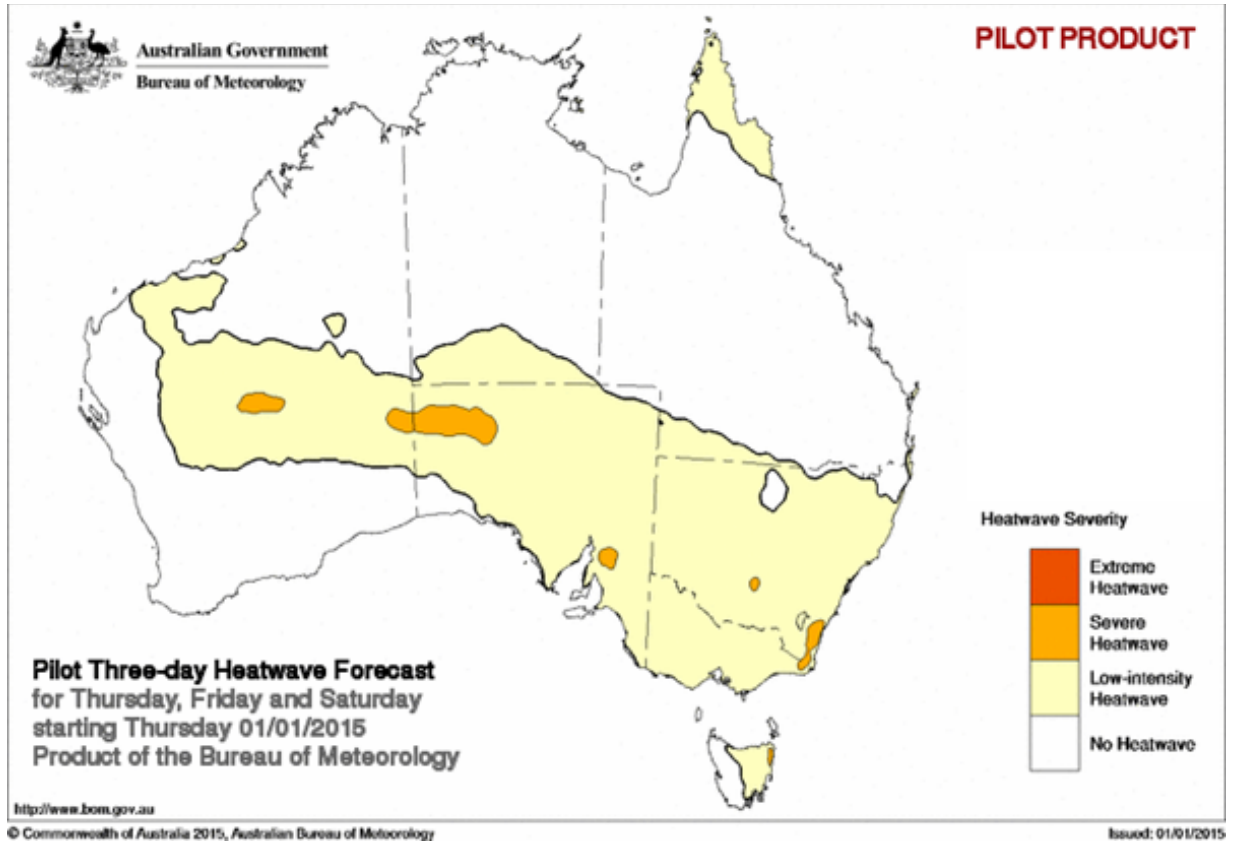
There is significant potential to extend traditional weather forecasts and warnings for extreme events to include longer lead probabilistic guidance



Australian lessons

Feedback from stakeholders:

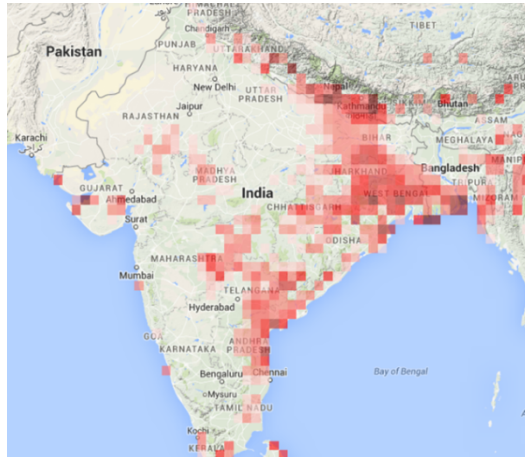
- 85% of all heatwaves are low-intensity. The public will have good adaptive strategies.
- Change 'heatwave' to 'low-intensity heatwave'
- Lower intensity of yellow used for low-intensity heatwave
- Clearly articulate three-day period in title and words
- Layman explanations of concepts behind heatwave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



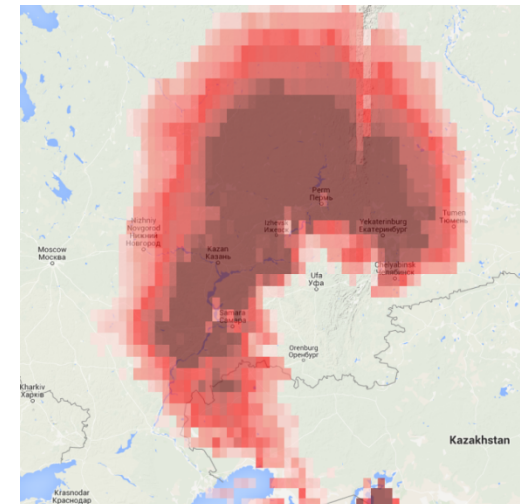
Creation of Heatwave Services Reference Group:

- 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

Model Run: 25/05/2015 00z
Forecast For Day 3: Wed 27th May 2015



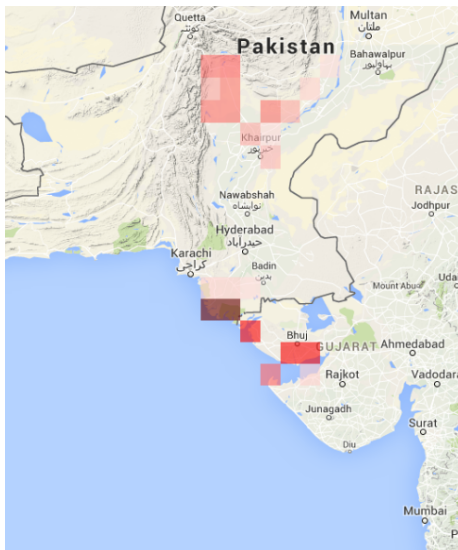
Model Run: 28/05/2015 00z
Forecast For Day 6: Sat 30th May 2015



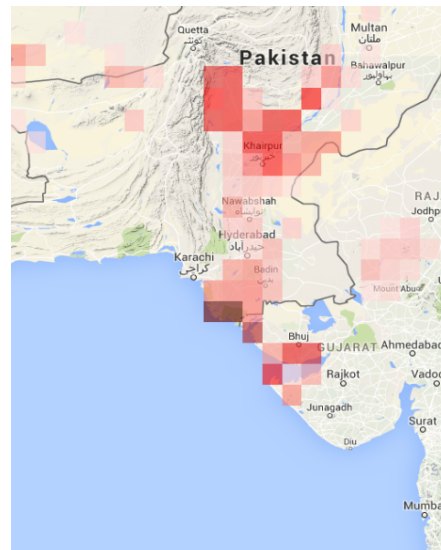
UK Met Office
Global Hazard Map
evaluation

Pakistan Heat Wave - Model Run: 14/06/2015 00z

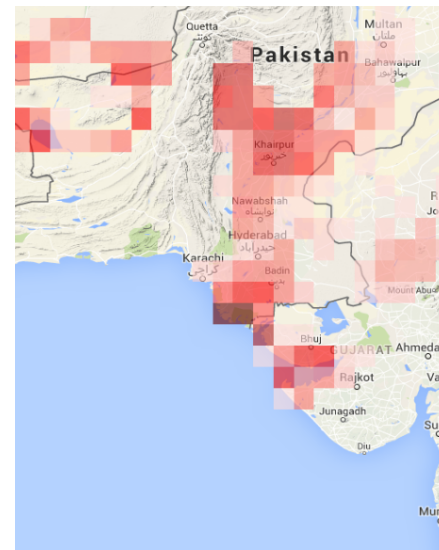
Forecast For Day 4:
Wed 17th June 2015



Forecast For Day 5:
Thurs 18th June 2015



Forecast For Day 6:
Fri 19th June 2015



Forecast For Day 7:
Sat 20th June 2015

