

# Challenges for the Design of Cover Systems in the Australian Environment

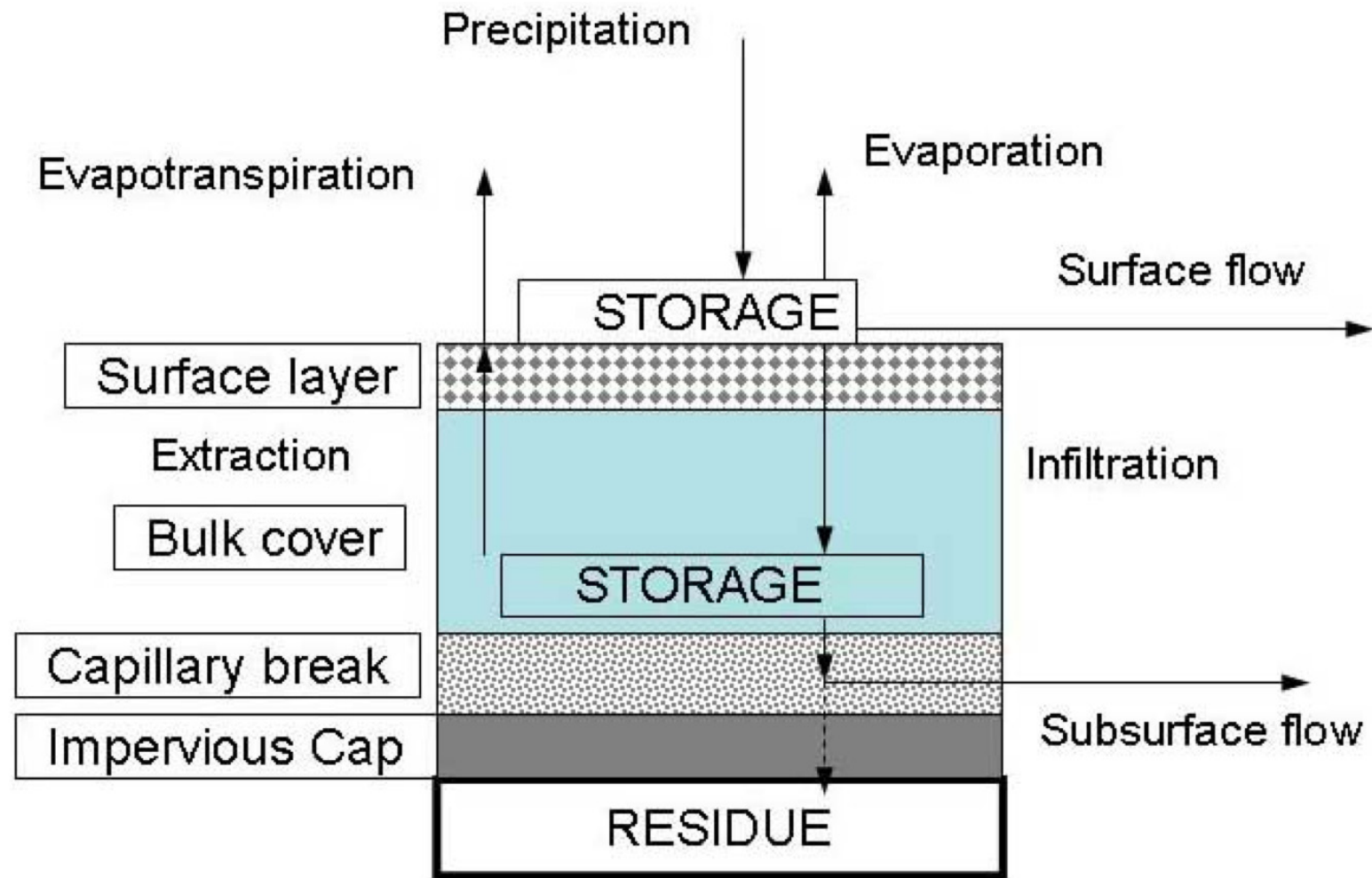
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David Doley, David Mulligan  
Centre for Mined Land Rehabilitation (CMLR)  
The University of Queensland  
Brisbane, Australia

# Main design criteria for covers

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- Control and management of water infiltration
- Minimisation of deep drainage
- Minimisation of erosion
- Provide substrate for plant growth

# Characteristics of a cover



after: Doley et al, 2008

## Definition of arid climates (Koeppen-Geiger):

*Arid climates (B) –*

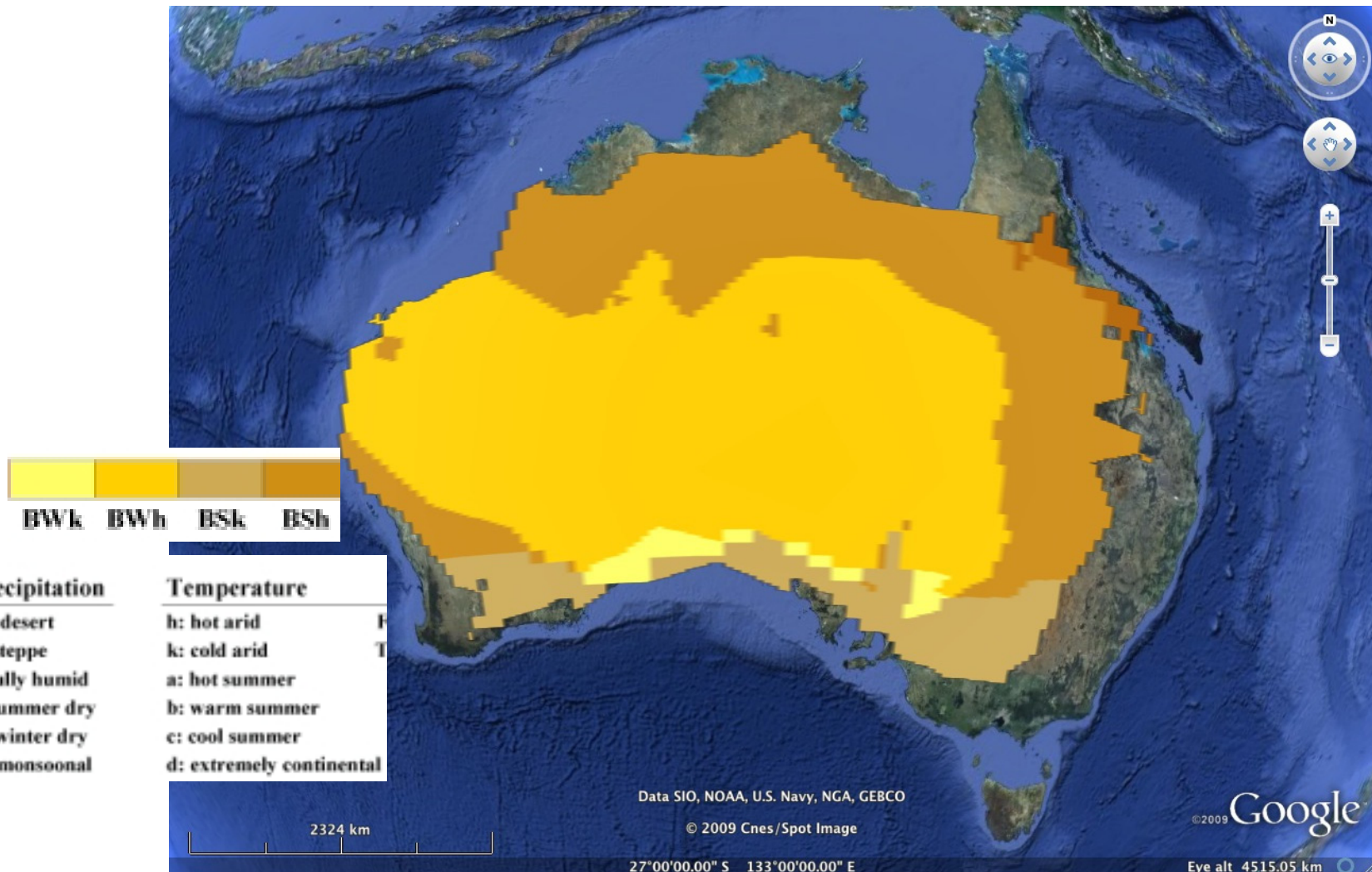
*defined on the basis of the average annual precipitation sum  $R$  (cm) and the annual mean temperature  $T$  (°C):*

*$R < 2T + 28$  (where summer rain is dominating)*

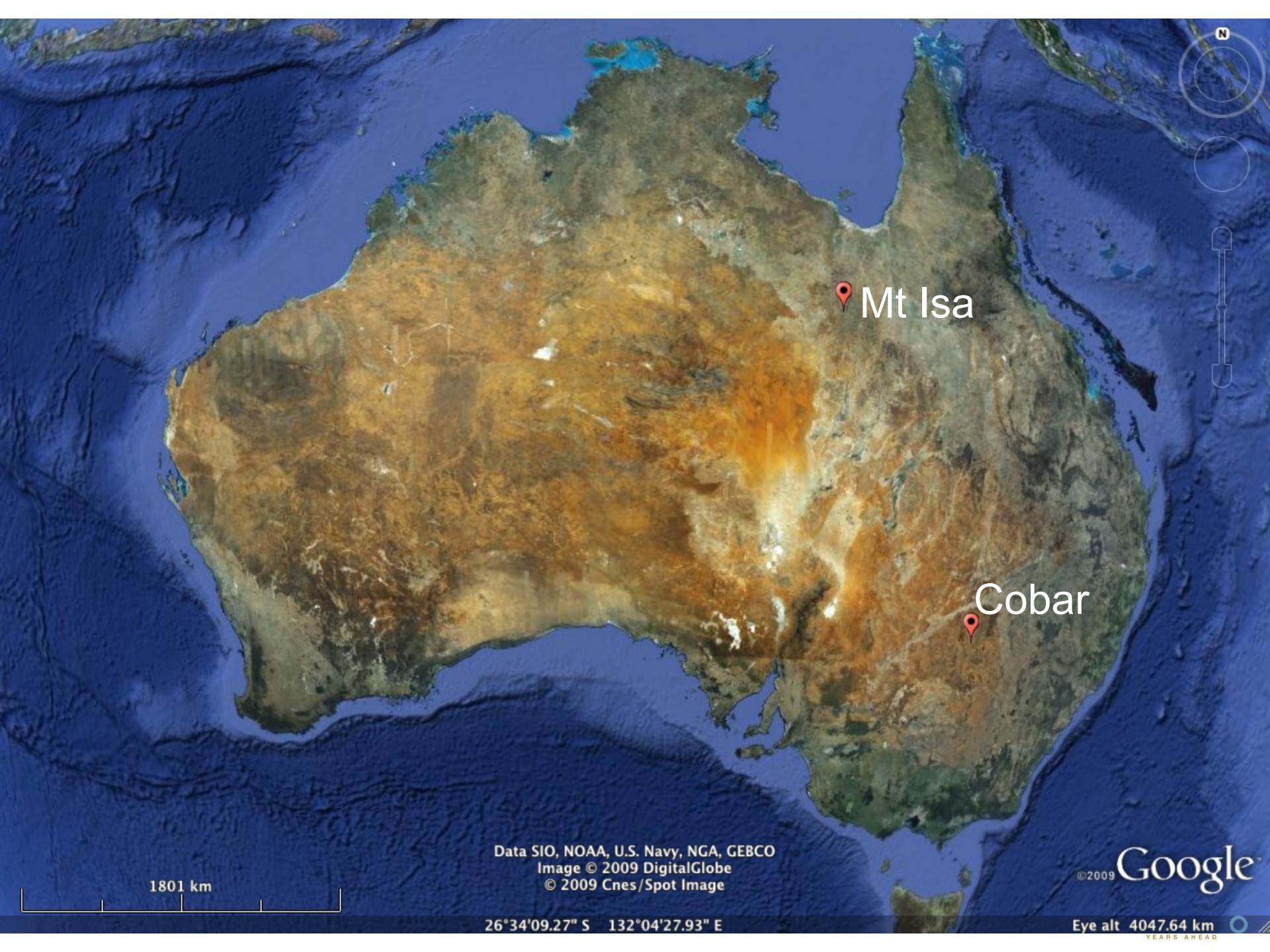
*$R < 2T + 14$  (where no pronounced annual cycle is observed)*

*$R < 2T$  (where winter rain is dominating)*

# Koeppen-Geiger: arid climate







Mt Isa

Cobar

1801 km

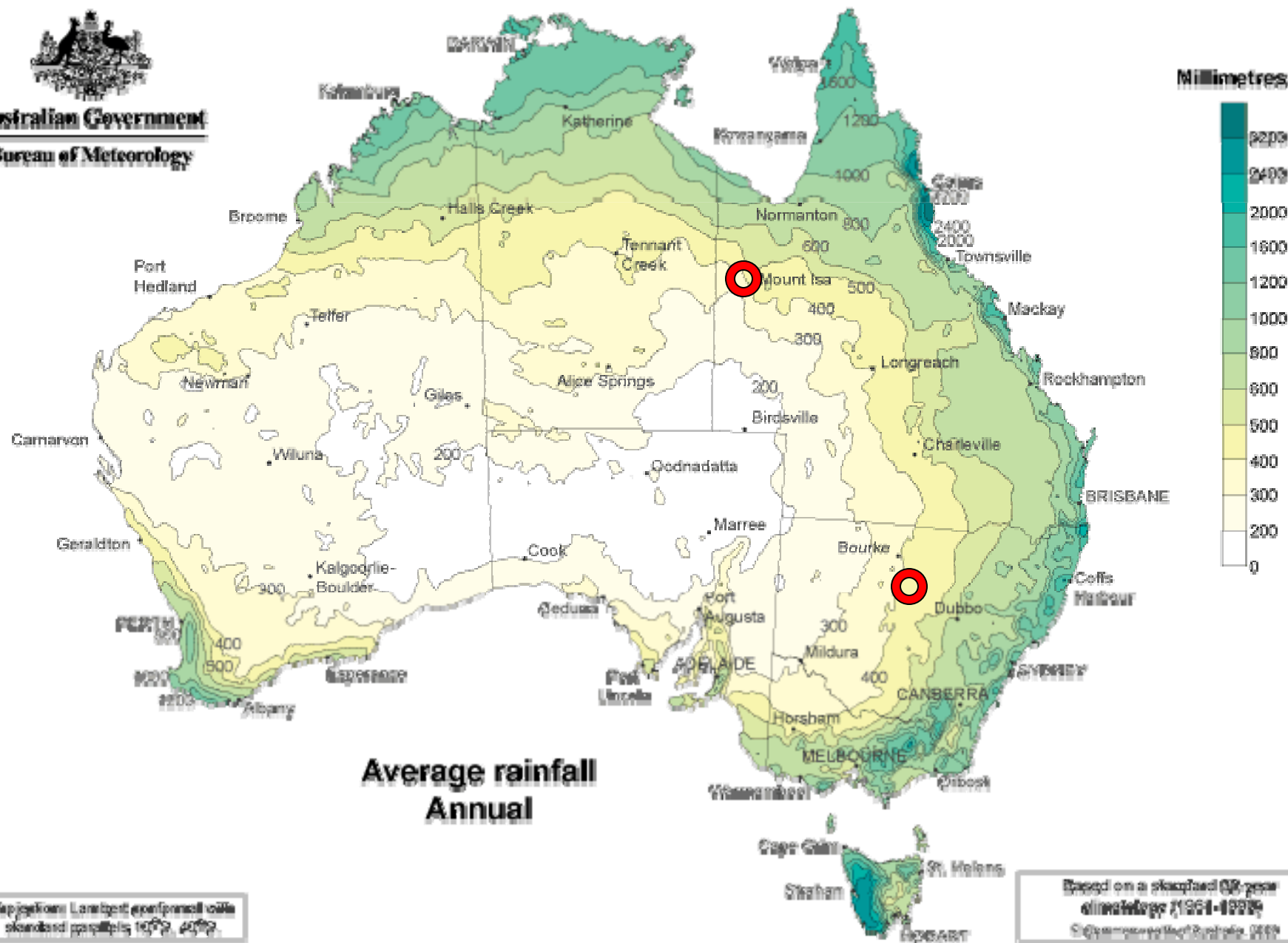
Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image © 2009 DigitalGlobe  
© 2009 Cnes/Spot Image

26°34'09.27" S 132°04'27.93" E

©2009 Google  
Eye alt 4047.64 km  
YEARS AHEAD

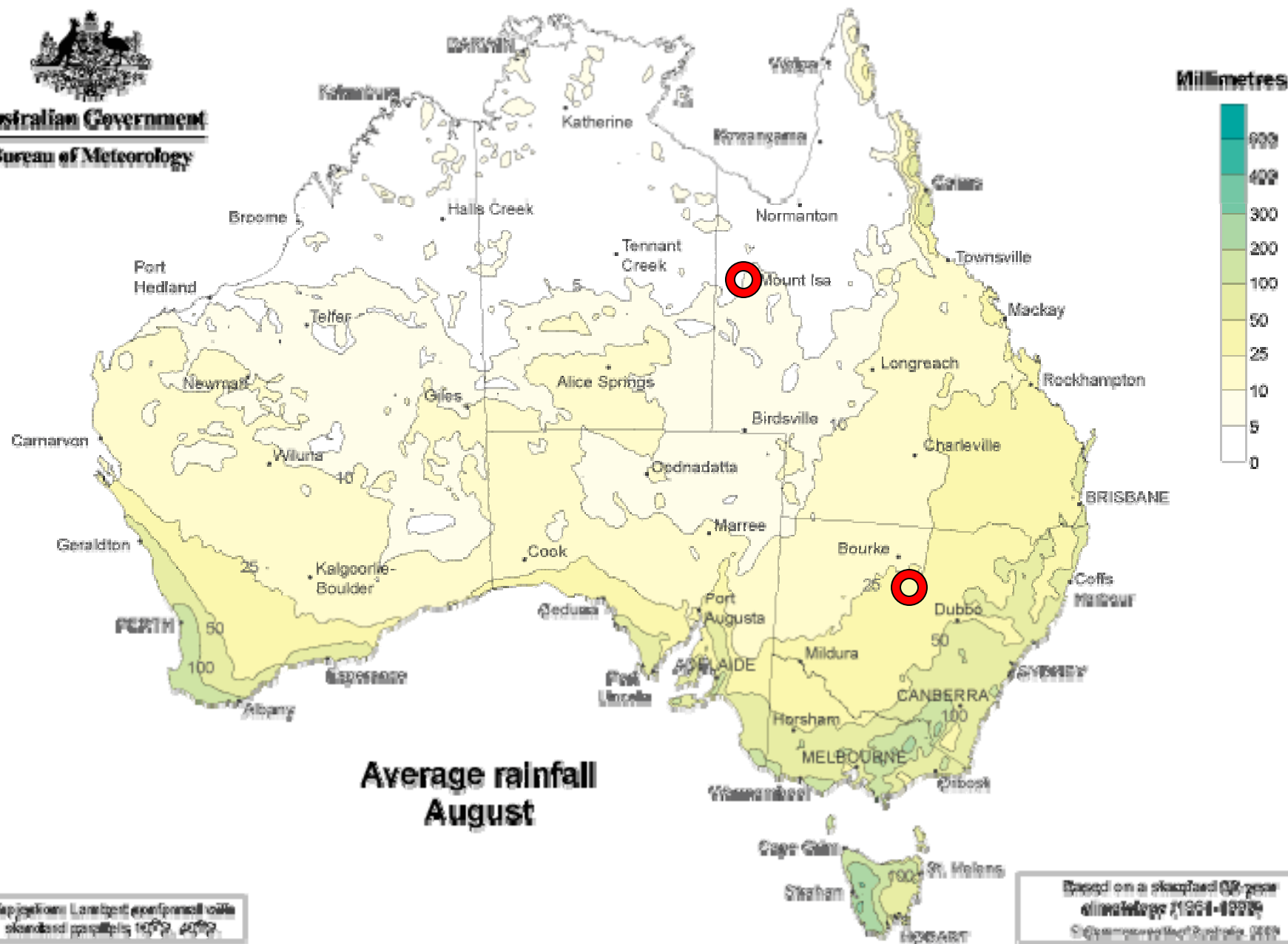


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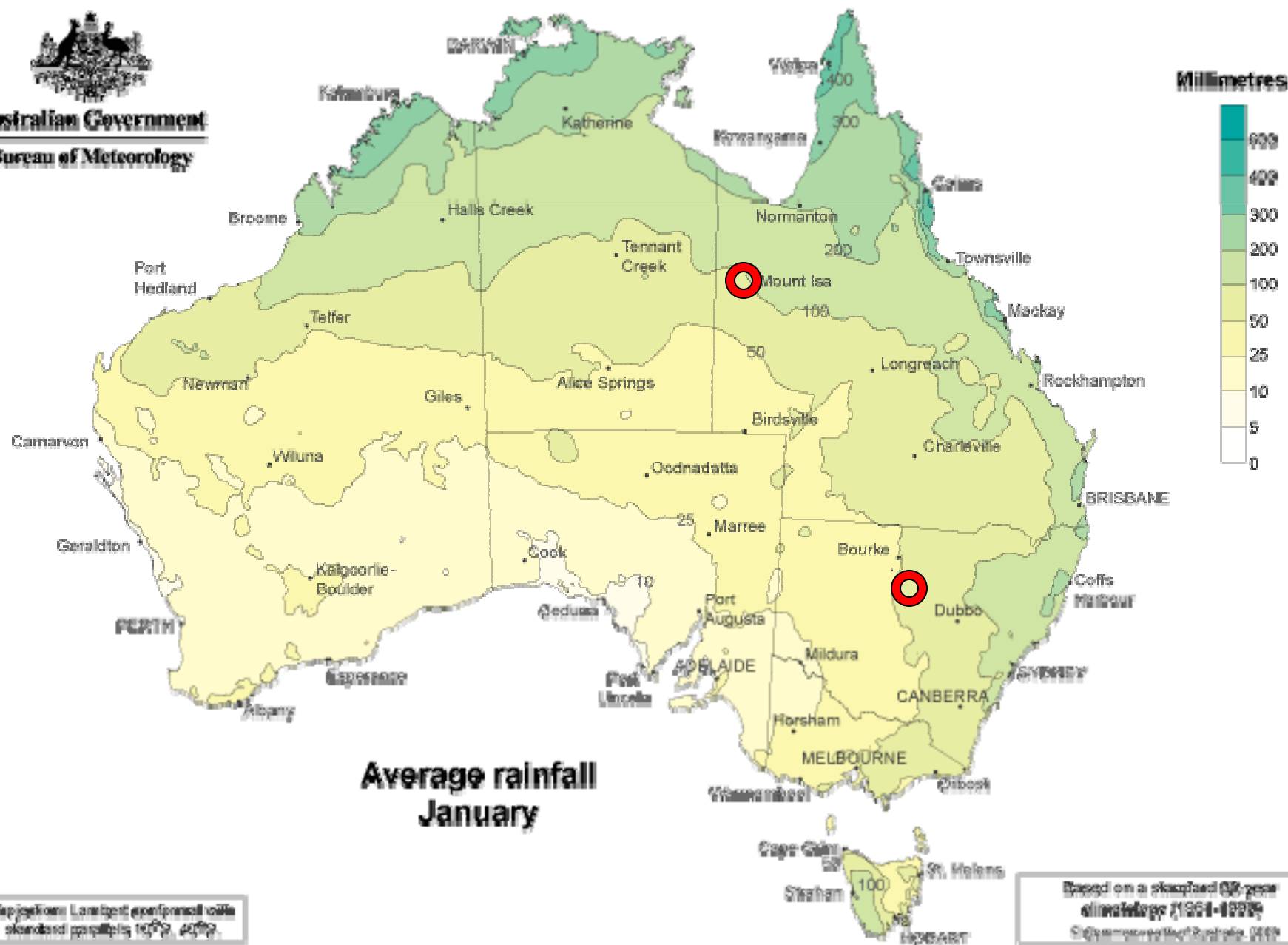
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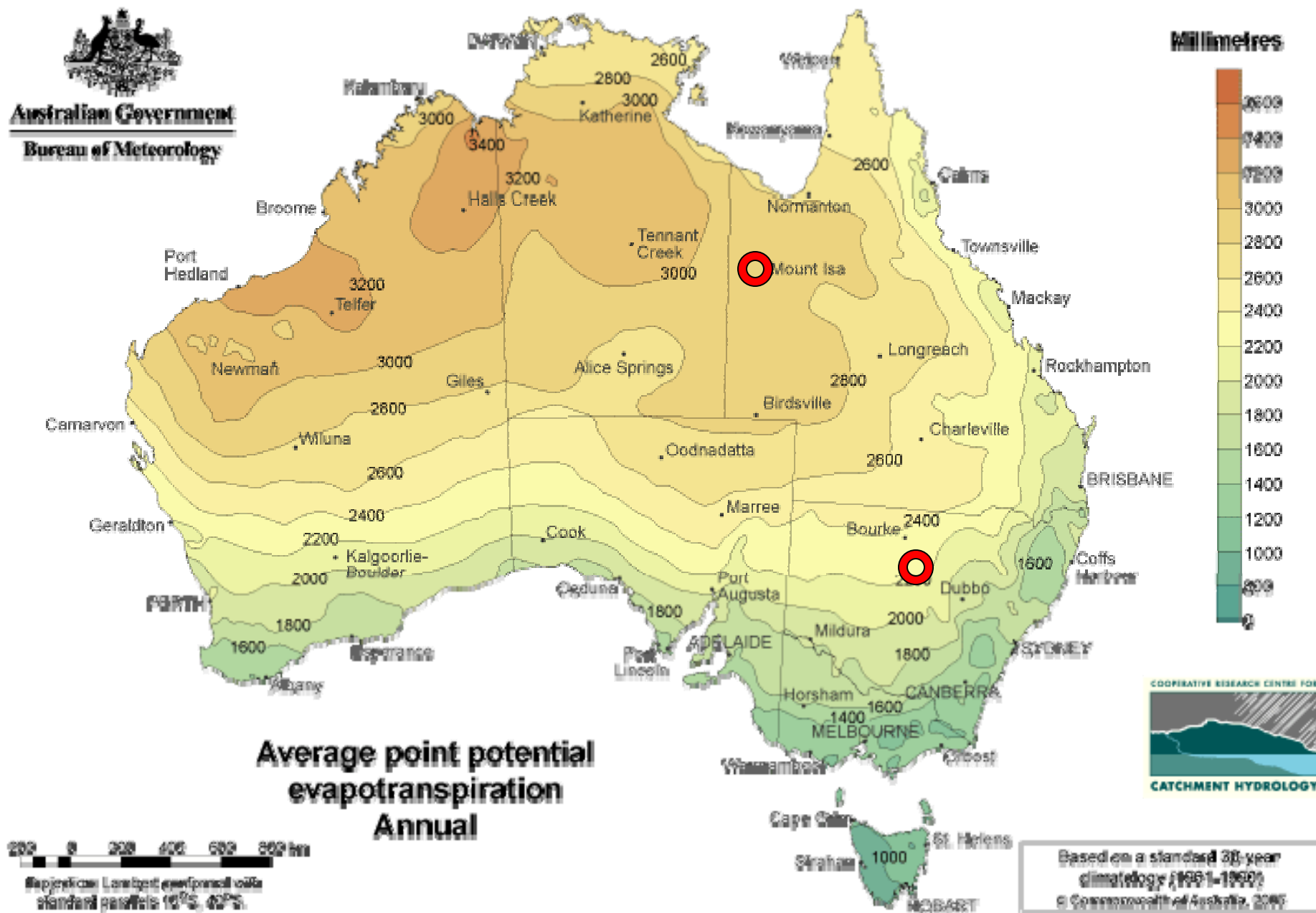
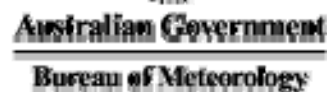






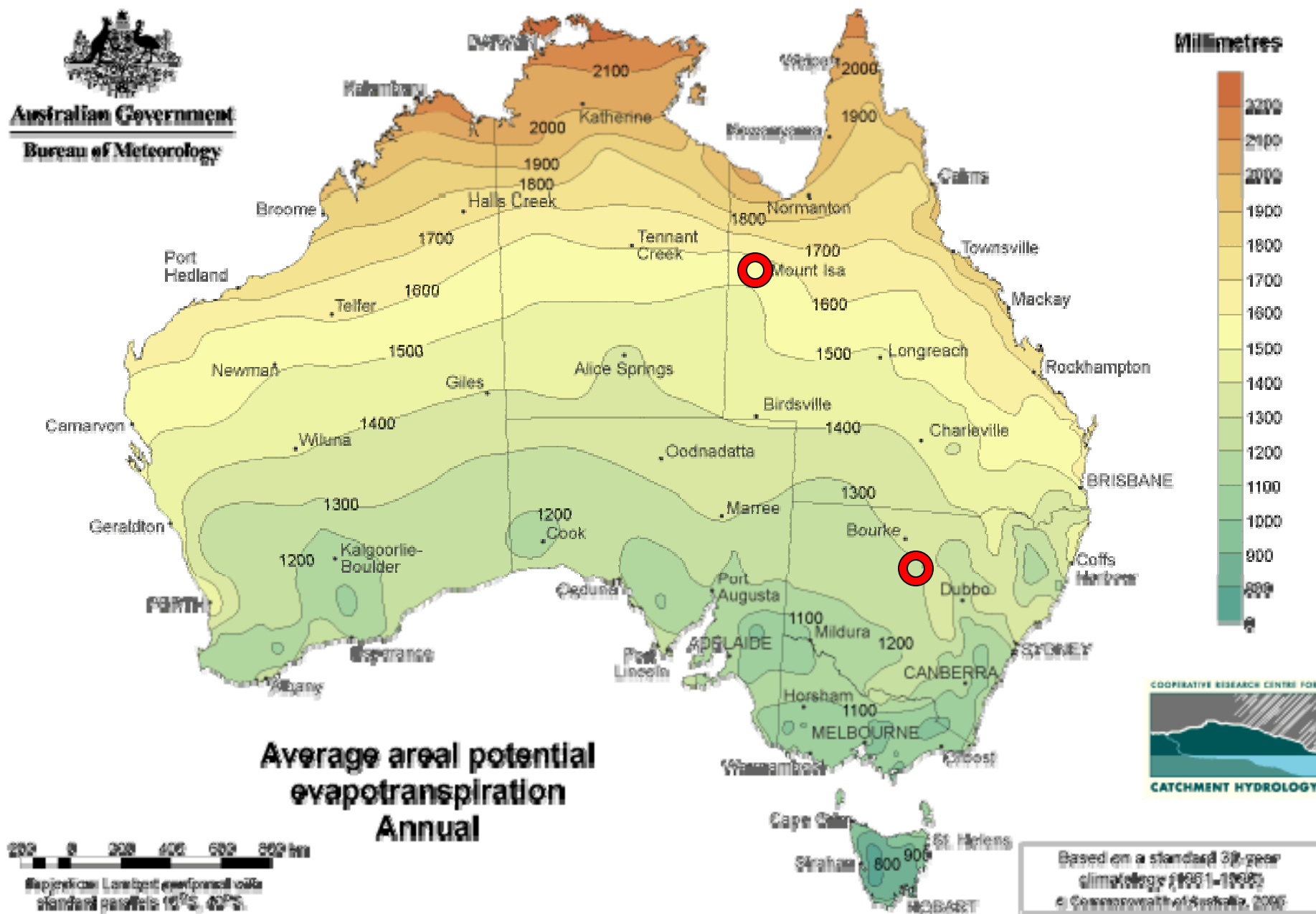
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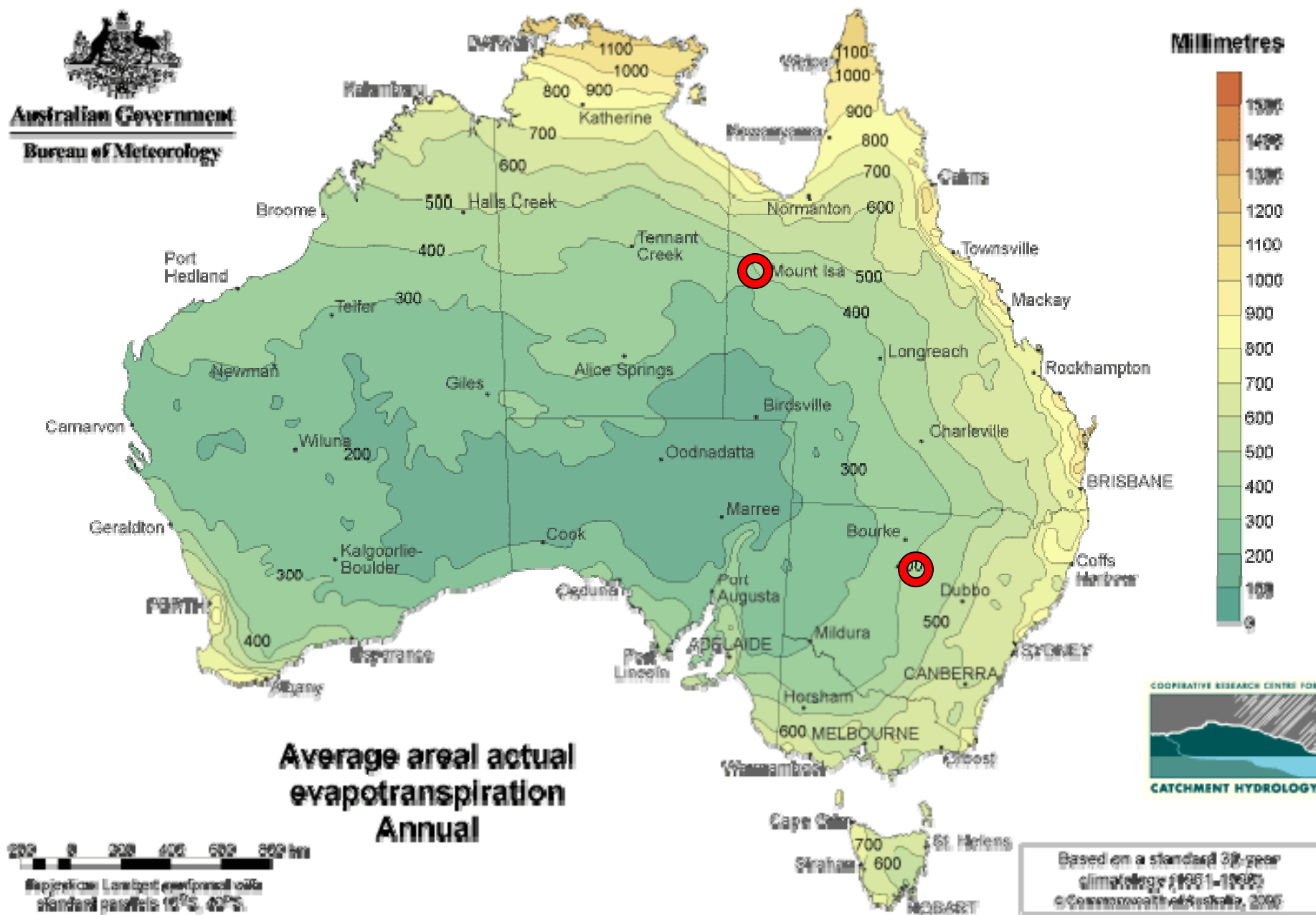


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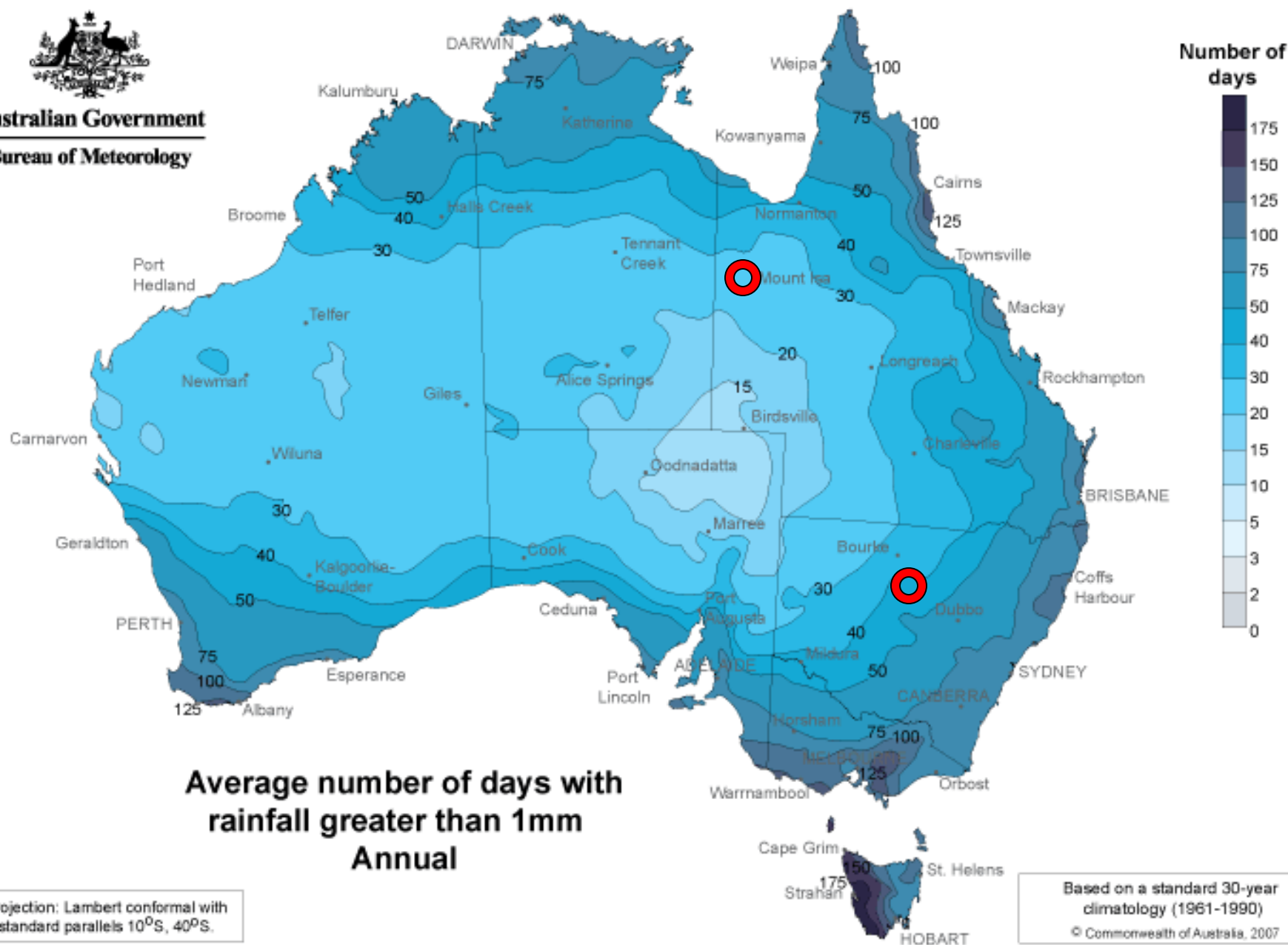
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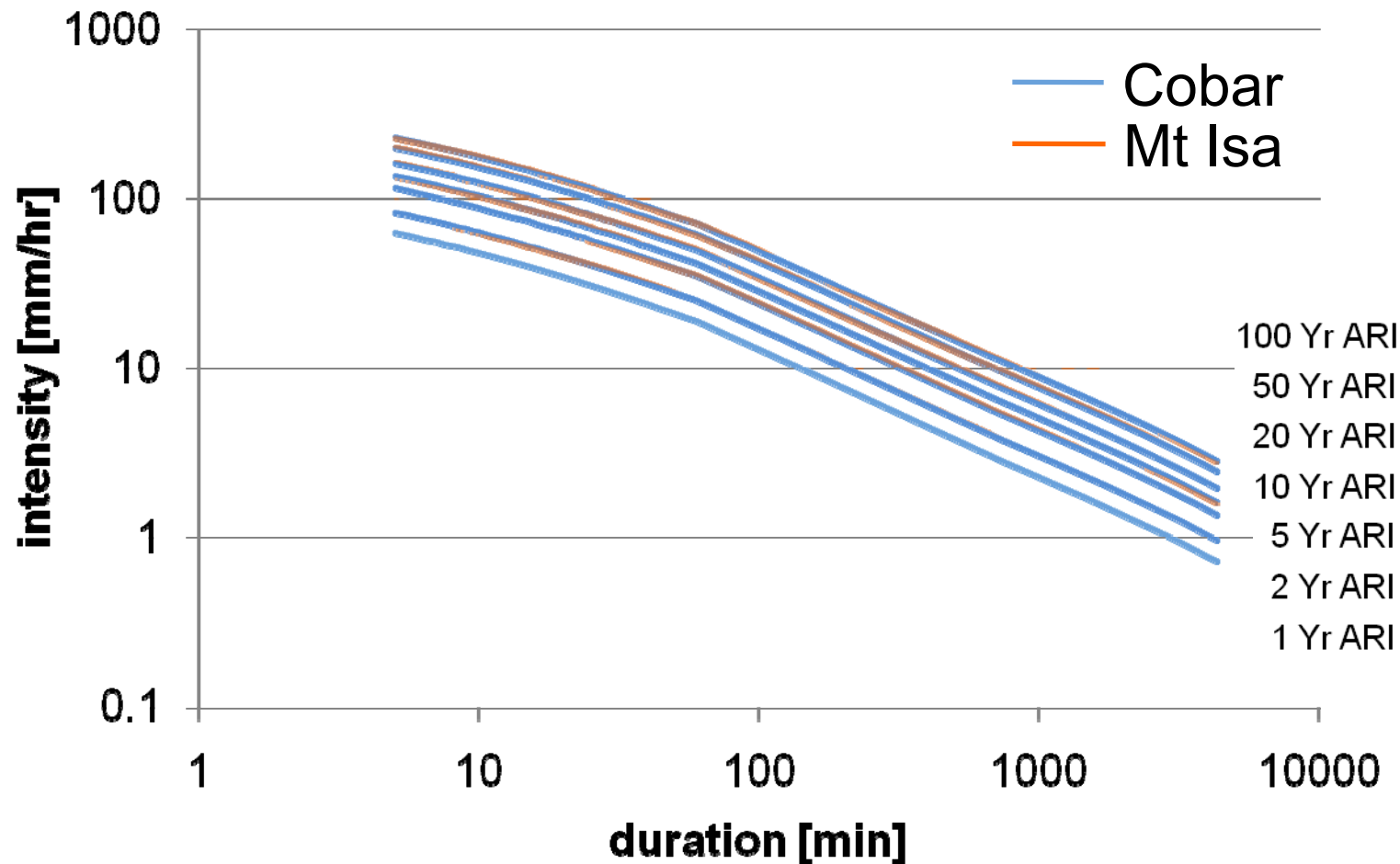




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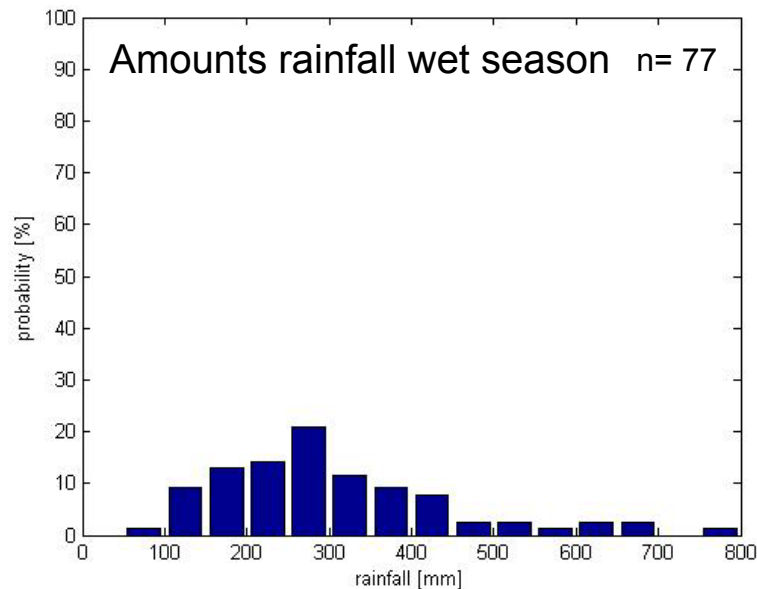
# Intensity and Duration of Rainfall



ARI: Average Recurrence Interval

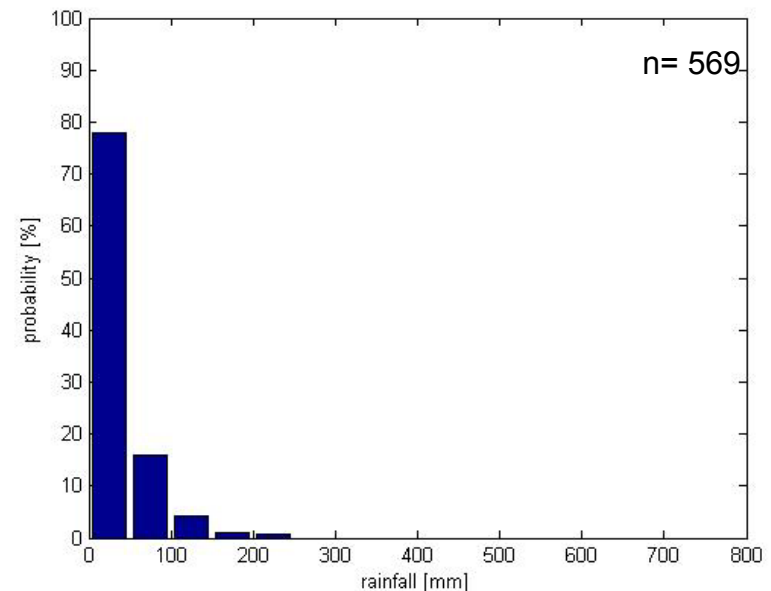
# Variability of rainfall

## Monthly rainfall probability in area with distinct wet and dry season



Long term mean annual  
rainfall: 419 mm

## Monthly rainfall probability in area without distinct wet and dry season (Cobar)



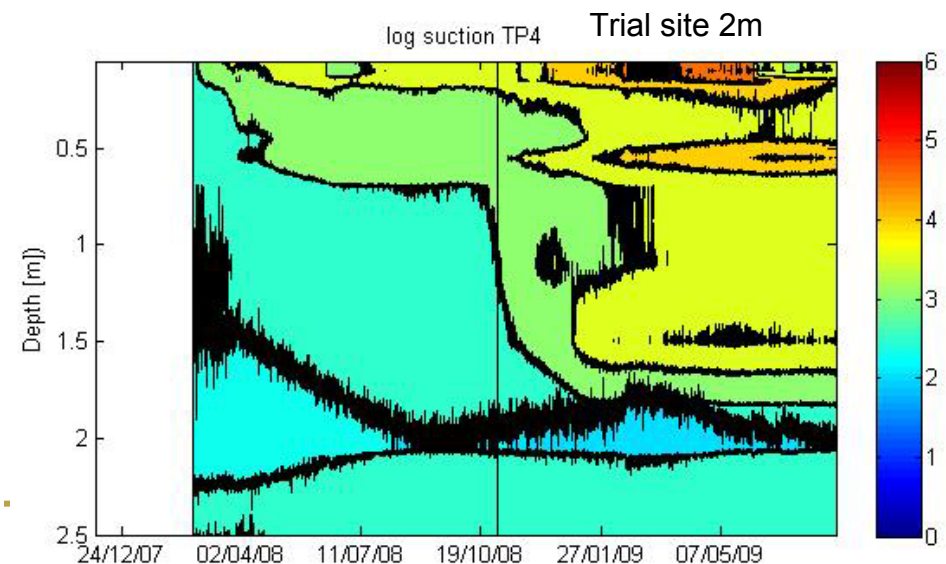
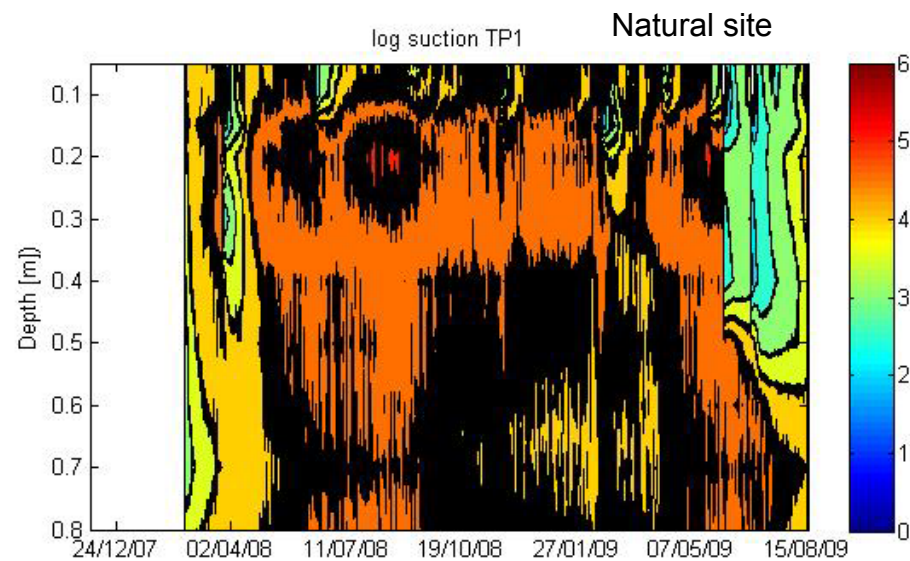
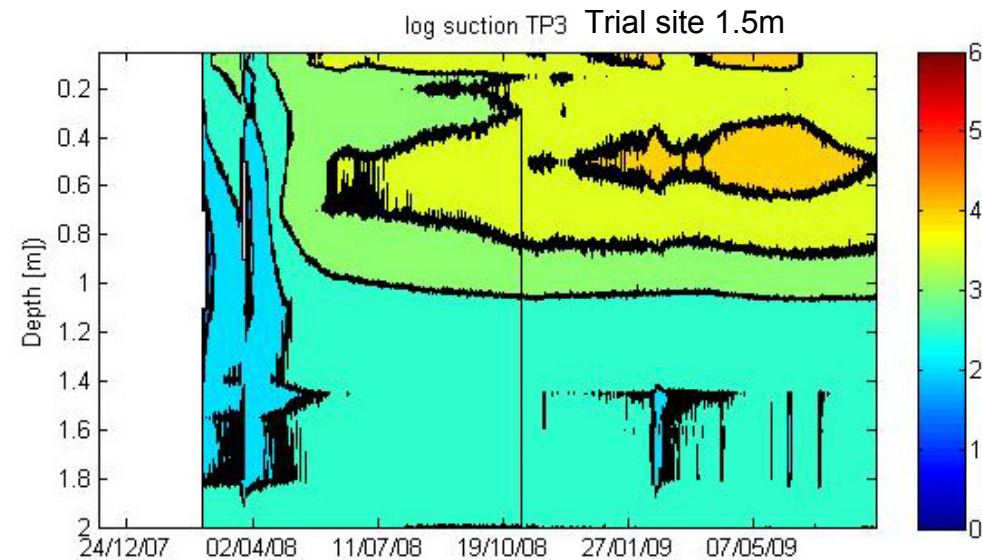
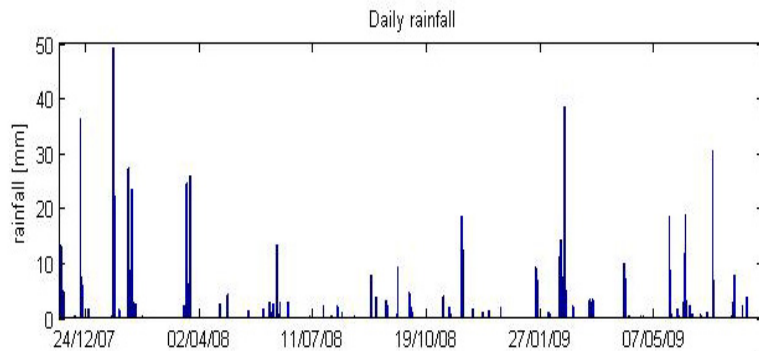
Long term mean annual  
rainfall: 400 mm





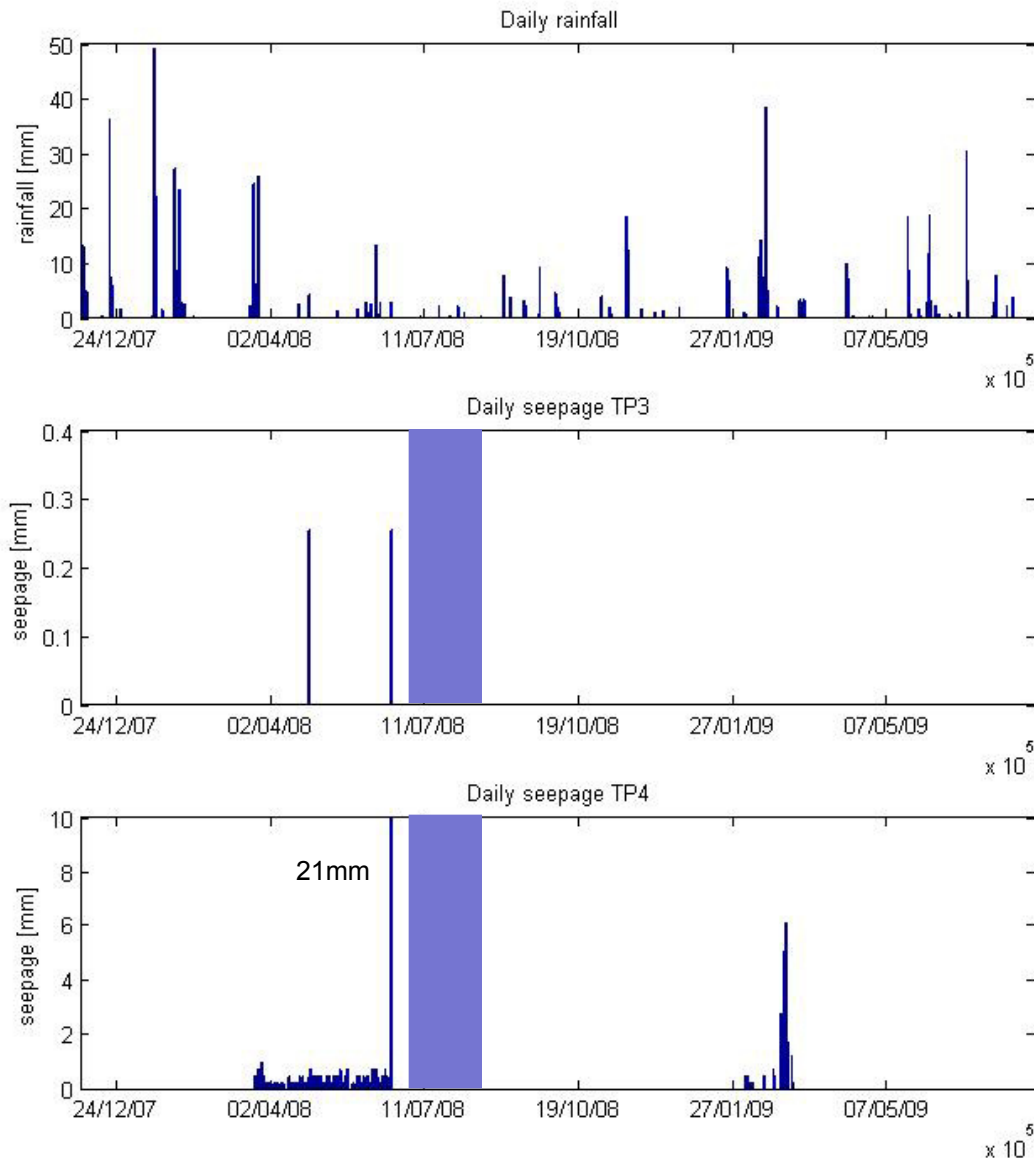


# Distribution moisture – water potential





# Seepage



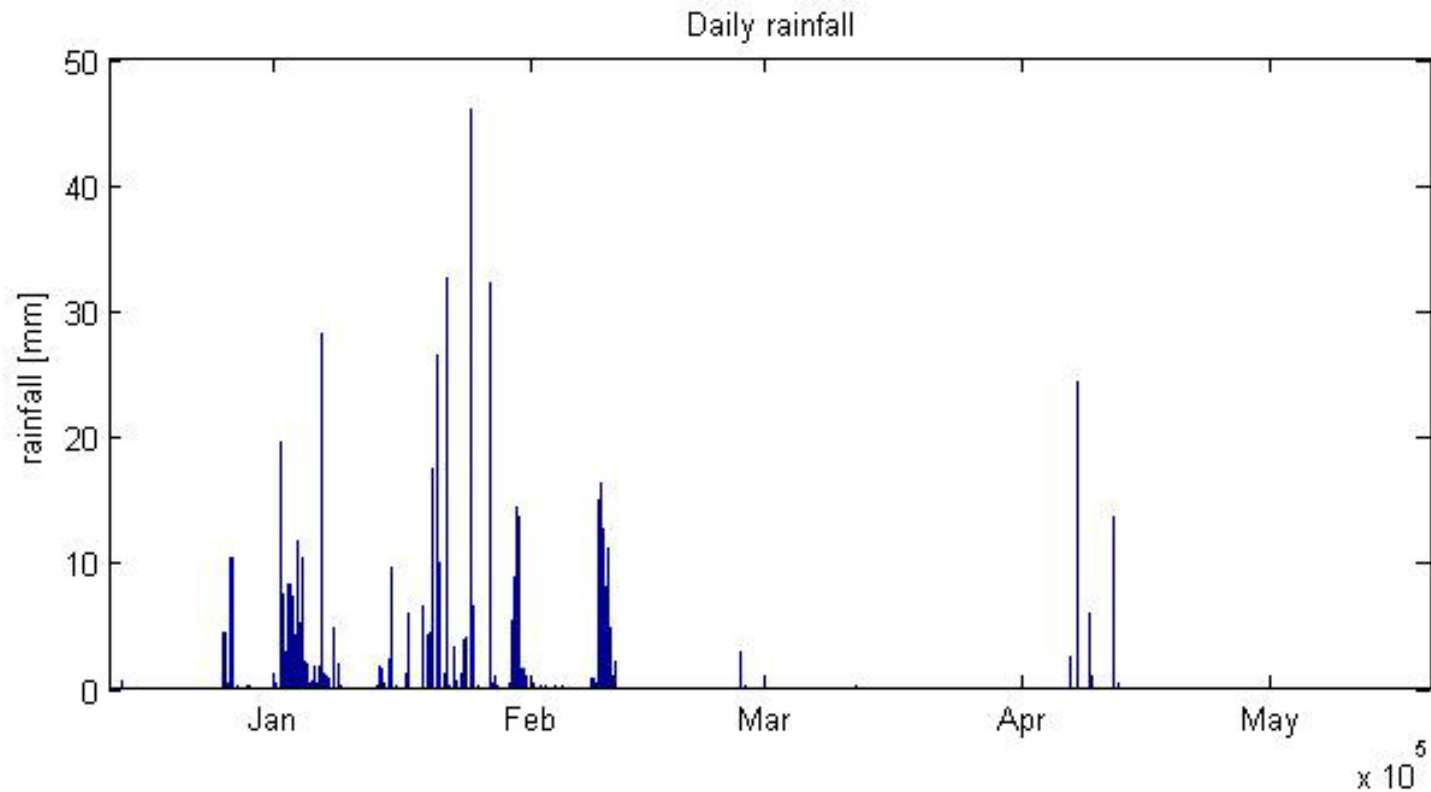




# Mt Isa

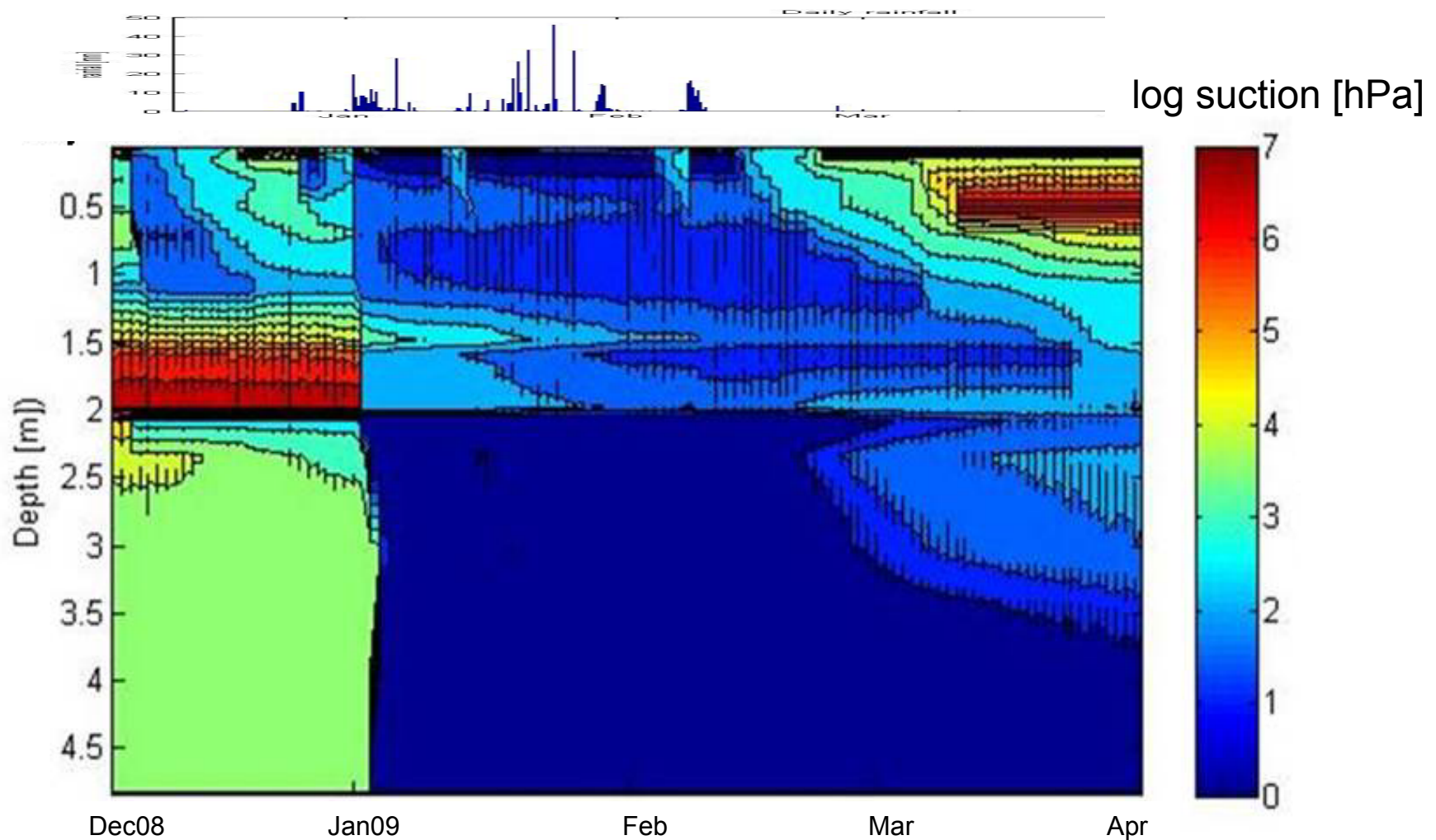


# Rainfall

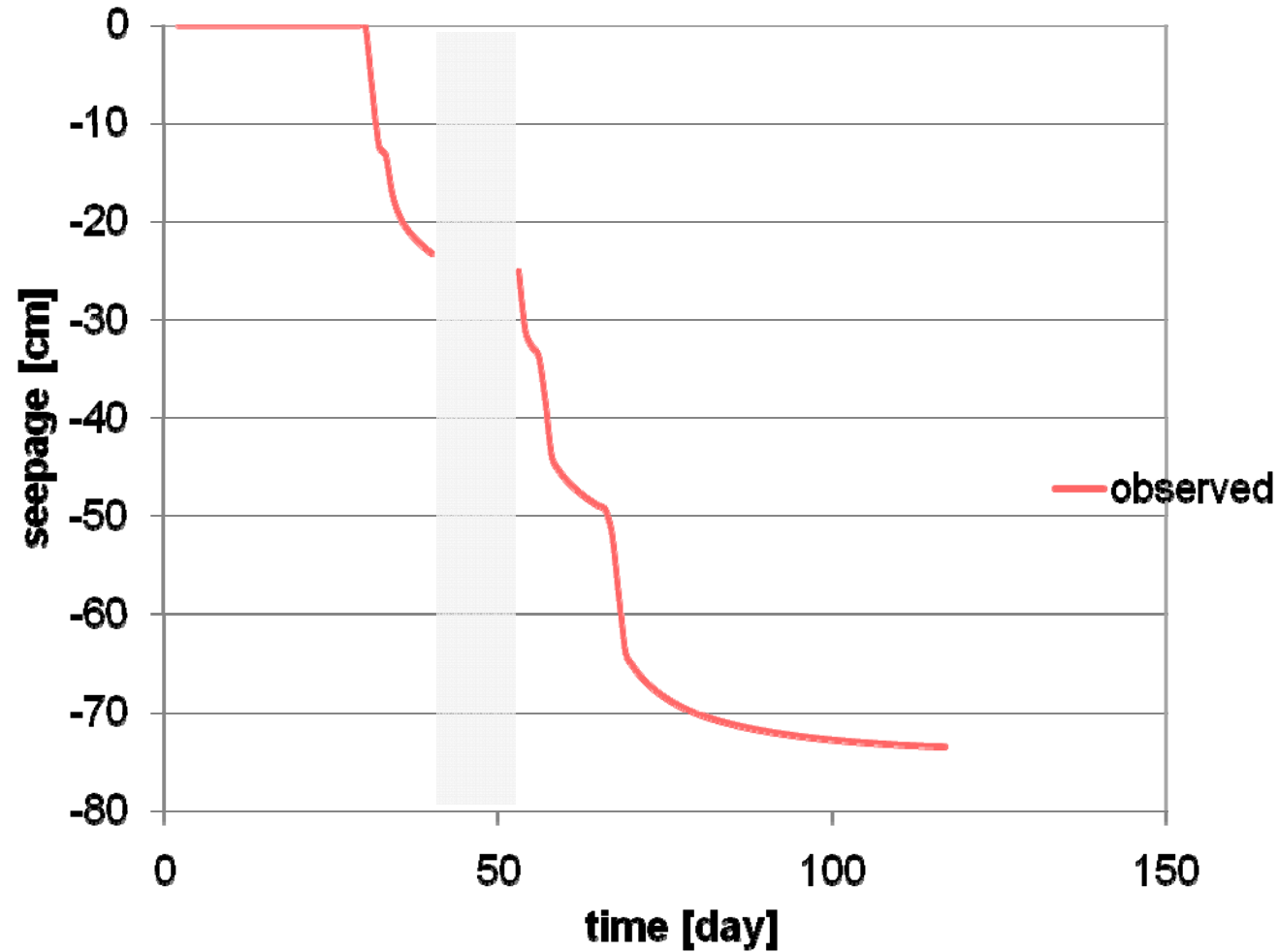


Cumulative rainfall: 916 mm

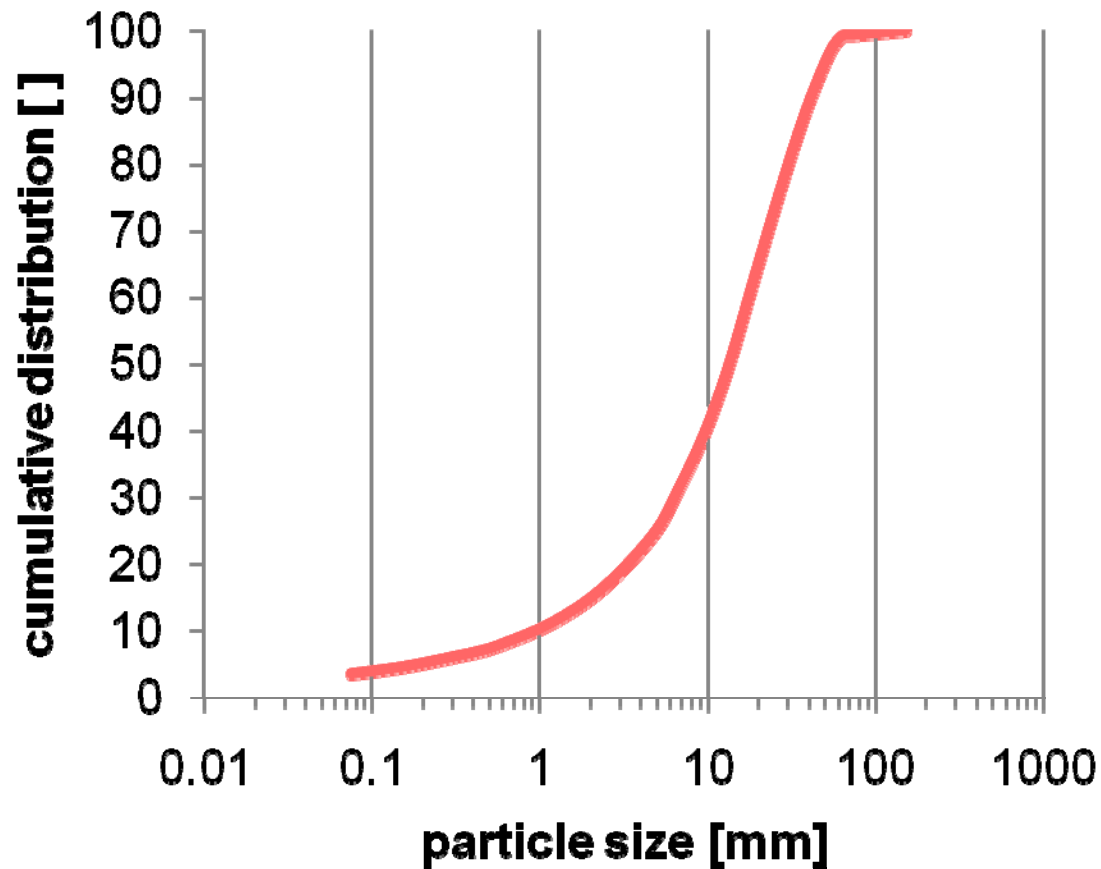
# Distribution moisture – water potential



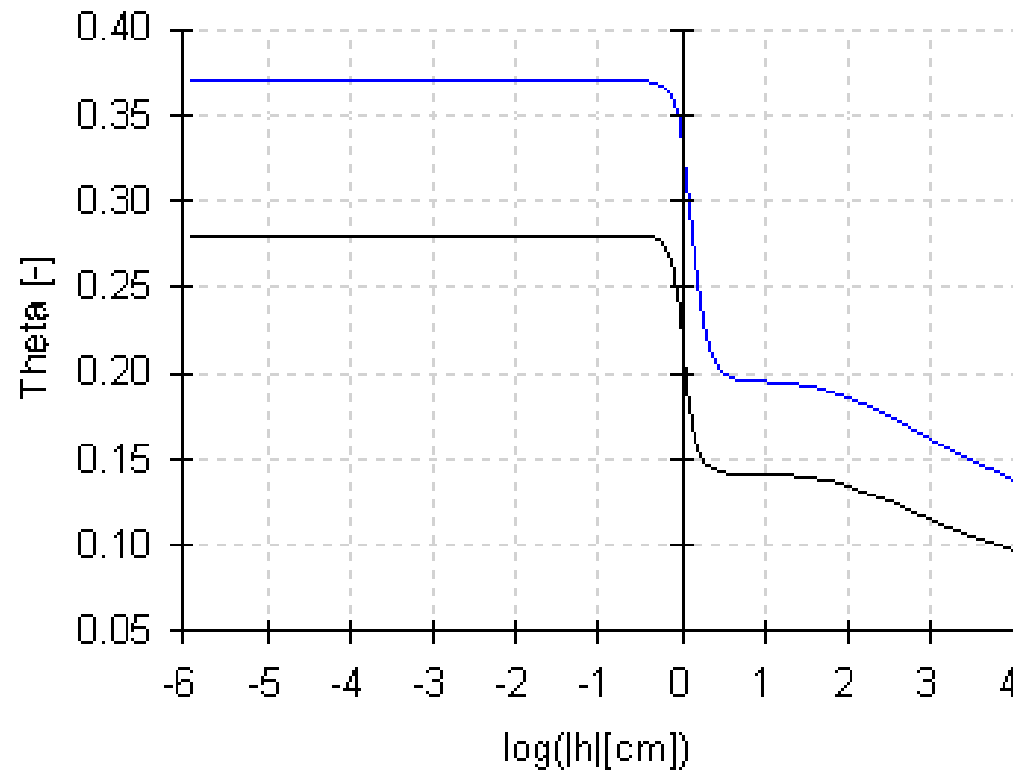
# Seepage



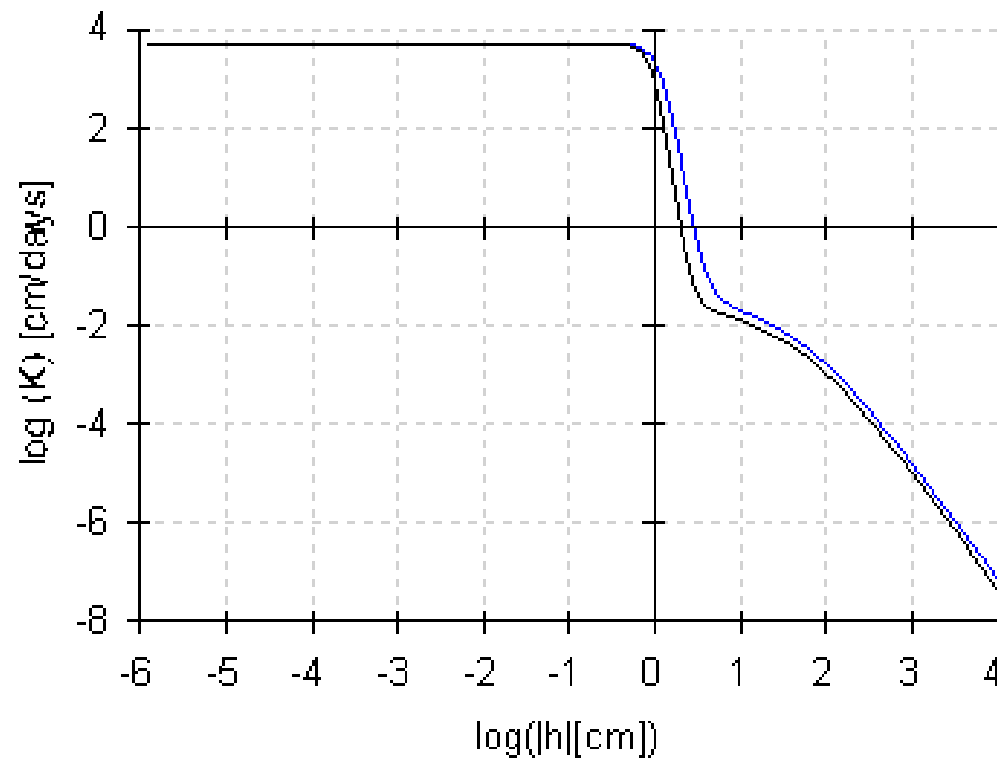




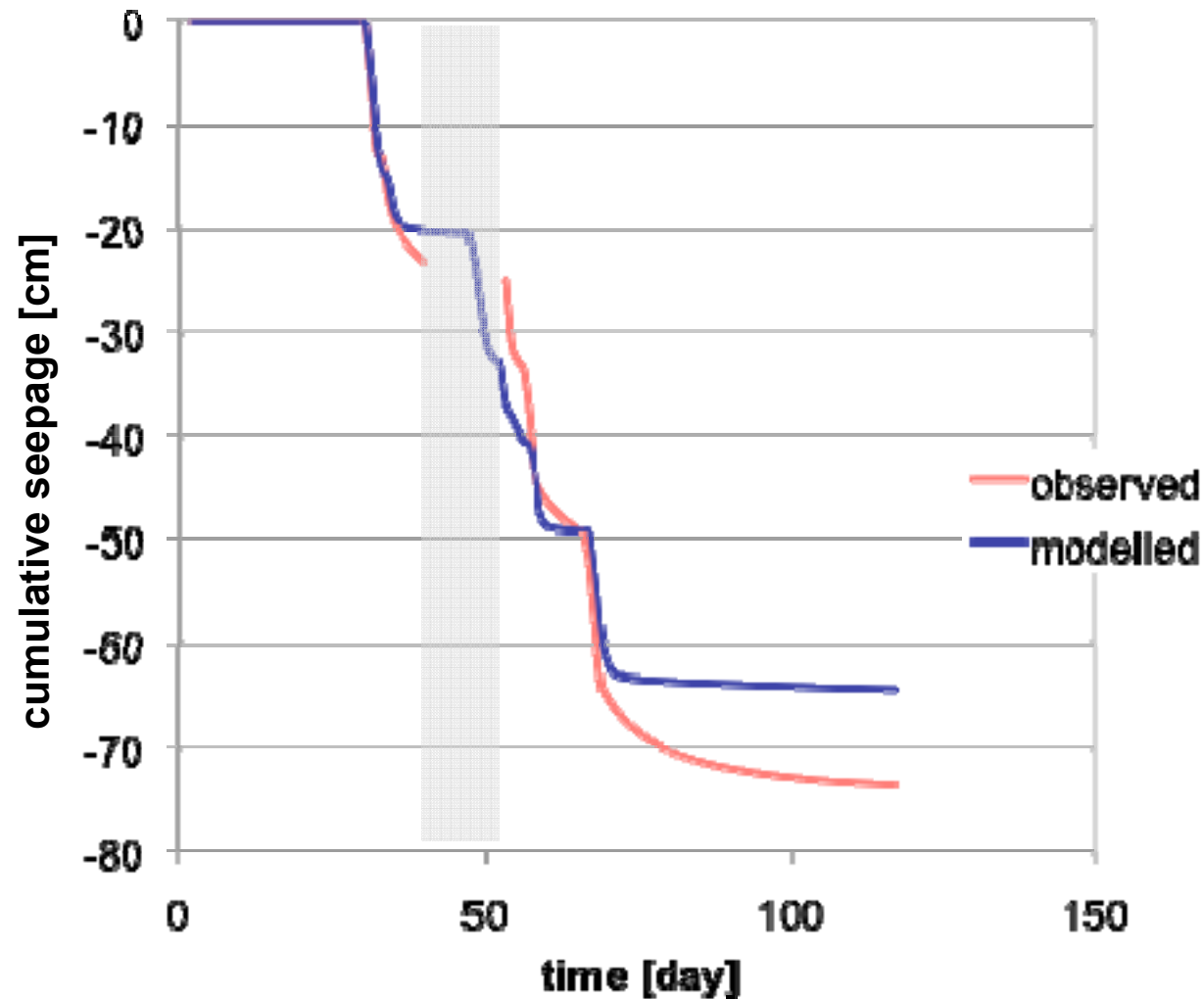
## Bi-modal pore system: WRC



## Bi-modal pore system: hydraulic conductivity

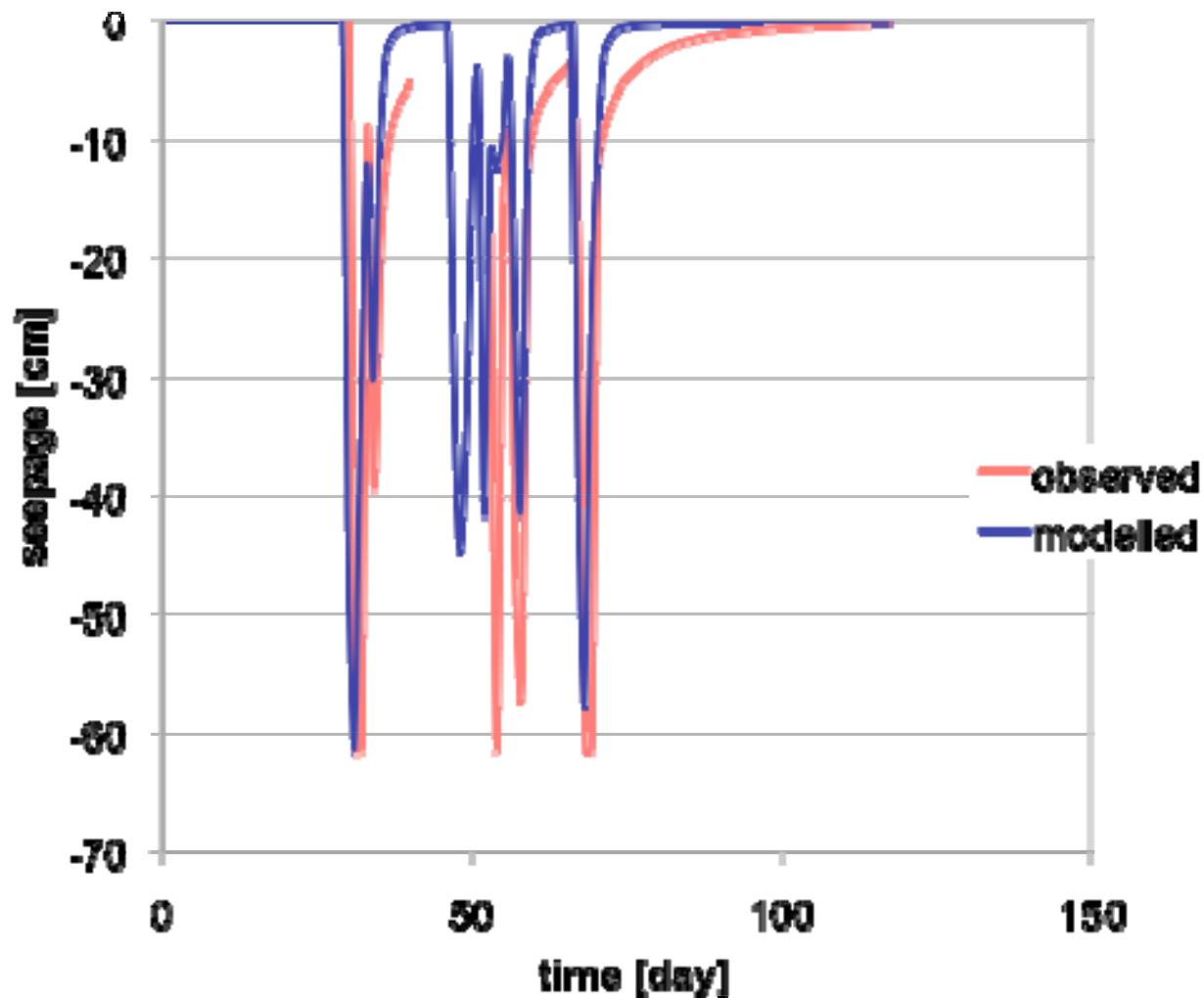


# Material properties





# Material properties



- Design of covers can be challenged by extremes in climatic conditions in the Australian environment
- Trade-off for decision between
  - Infiltration  $\longleftrightarrow$  deep drainage
  - runoff (erosion)  $\longleftrightarrow$  infiltration
  - (type of) vegetation  $\longleftrightarrow$  no vegetation
- material availability