Using Satellite Imagery to Measure Evaporation from Storages

Richard Evans[1], Sharon Hulbert[1], Erin Murrihy[1], Wim Bastiaanssen[2,3], Robert Molloy[1] and Ivo Miltenburg
[1] SKM, [2] WaterWatch, [3] Delft University of Technology

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Presentation Outline

- How can satellite based measurements of water loss from storages improve on current measurement techniques?
  - Importance of evaporation from storages
  - Current methodologies
  - SEBAL 2009 methodology
  - Comparison and results
  - Conclusions

Acknowledge contributors

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National Water Commission

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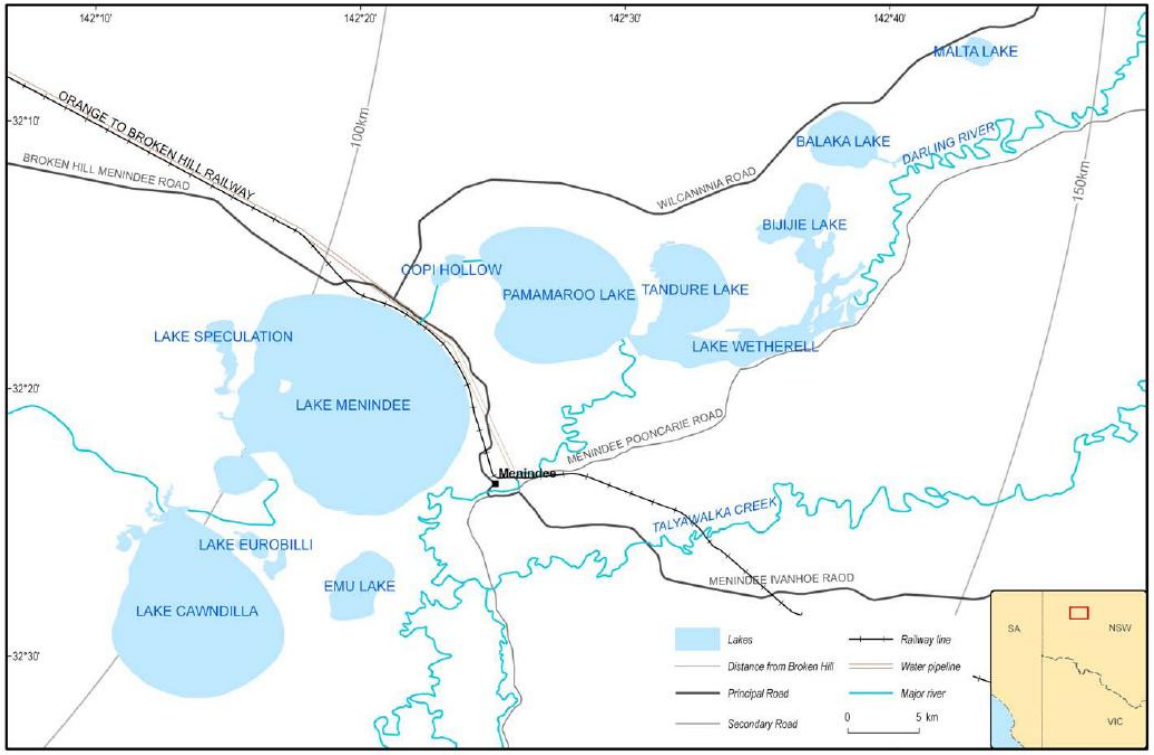
Department of Water and Energy

Why is E from storages important?

- Evapotranspiration – fundamental component of the water balance
- Evaporation from water storages important component of total Evapotranspiration
  - Quantification of losses from storages is often limited
  - Significant implications by improving the accuracy in measure of evaporation losses from storages
- Improved measurement of E from water storages
  - Improved confidence of available resources for allocation planning

Case Study – Menindee Lakes

- Comprises four main lakes; Wetherell Lake/Tandure Lake, Pamamaroo Lake, Menindee Lake and Cawndilla Lake.
- Combined capacity of 1,700 GL at full supply level
- High annual evaporation due to hot semi-arid environment and shallow large surface area of the lakes



Geoscience Australia, 2009

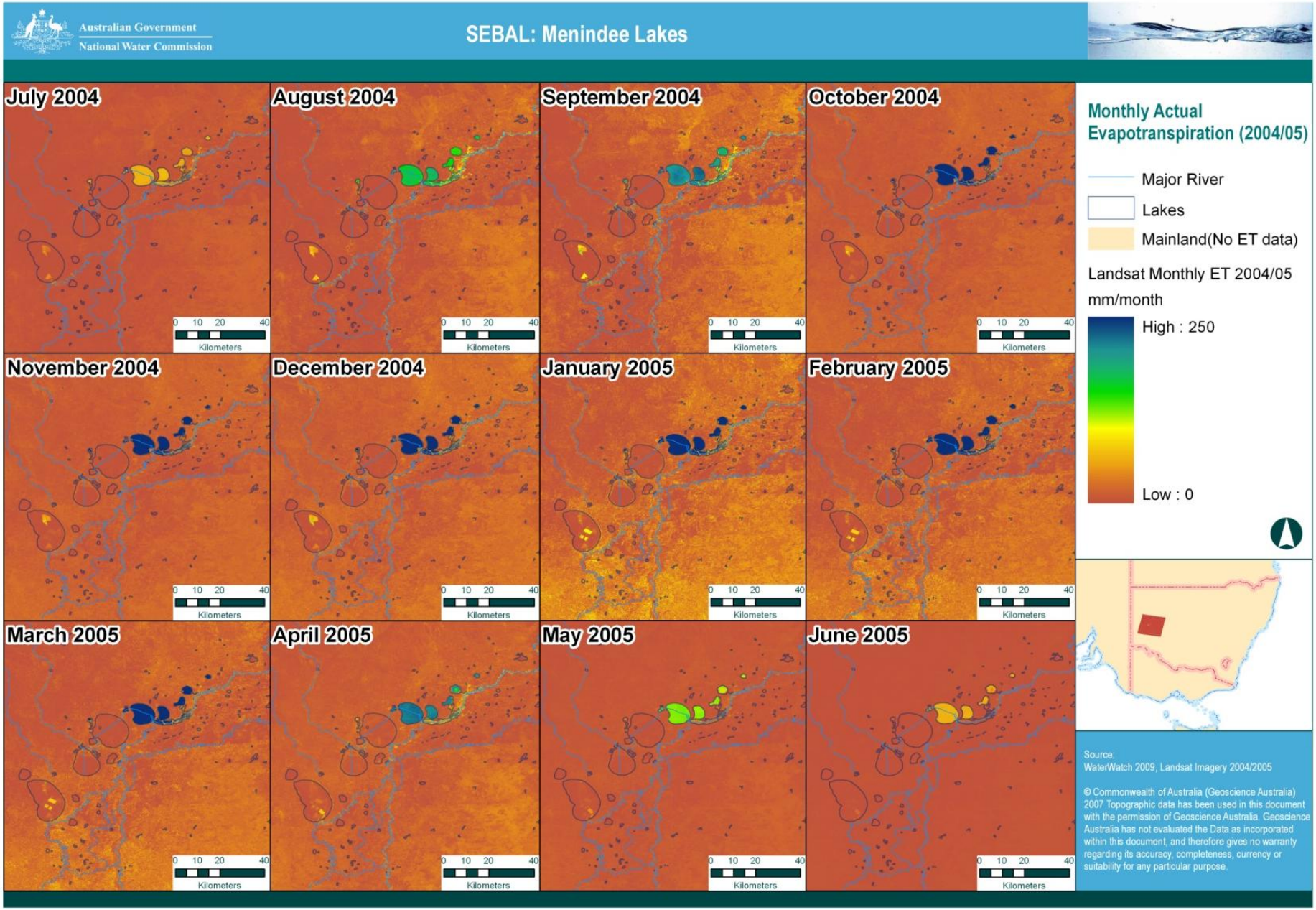
Current Methods of estimating Evaporation

- Methods range from very simple (pan evaporation) to complex (Penman-Monteith)
- Methods considered in this study:
  - Water Balance
    - Recorded inflows and outflows (DWE), recorded change in storage (DWE), recorded rainfall (DWE), estimated groundwater recharge
  - Pan Evaporation
    - Recorded pan evaporation (DWE-Menindee township)

SEBAL 2009 Methodology

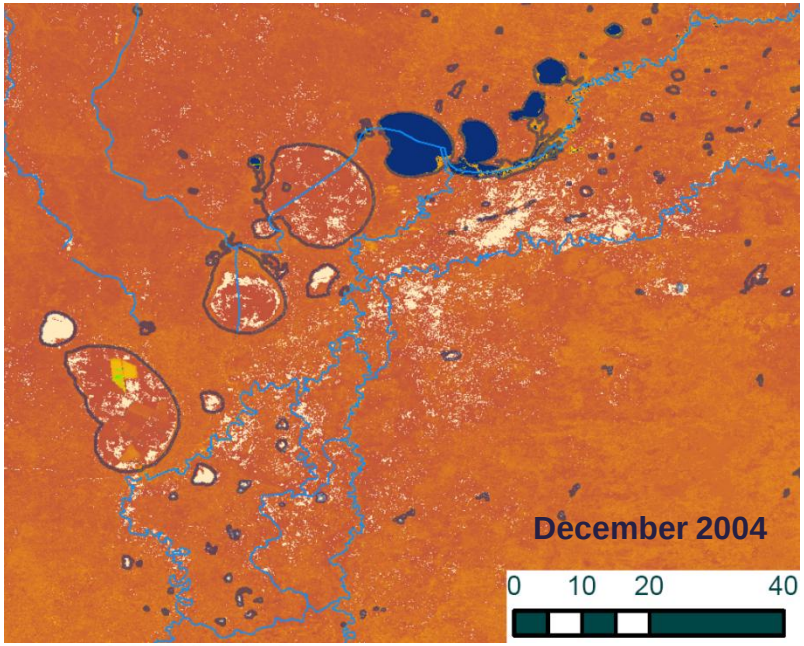
- Complex radiation and energy balance to derive evaporation
- SEBAL 2009 combines MODIS and Landsat Imagery to calculate ET
- Derive evaporation estimates on a monthly, quarterly and annual basis for 2004/05
  - Evaporation rates (mm/month)
  - Evaporation losses (GL)

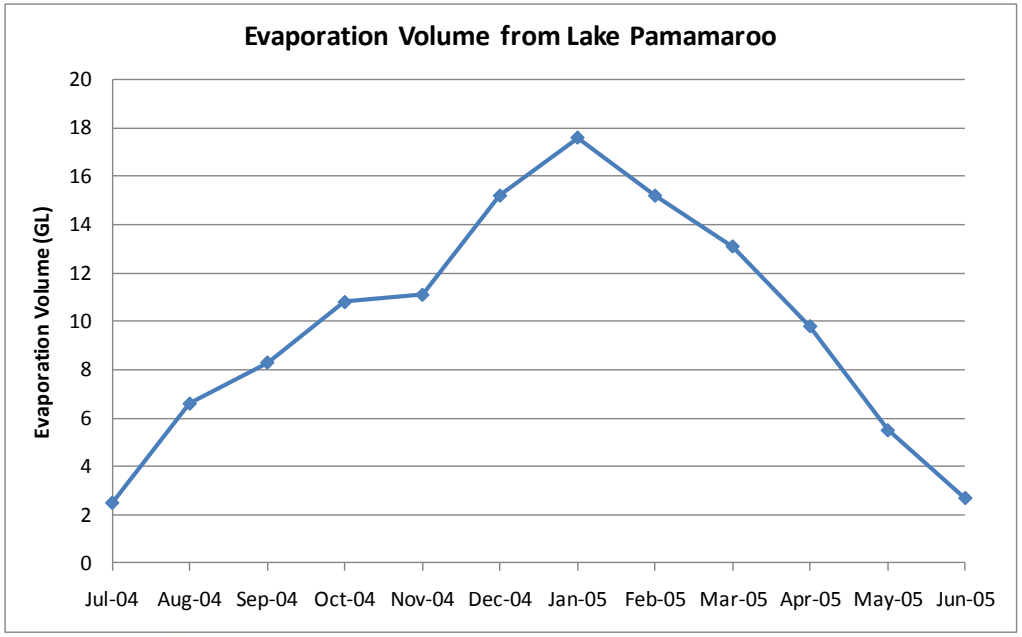
SEBAL 2009 Results



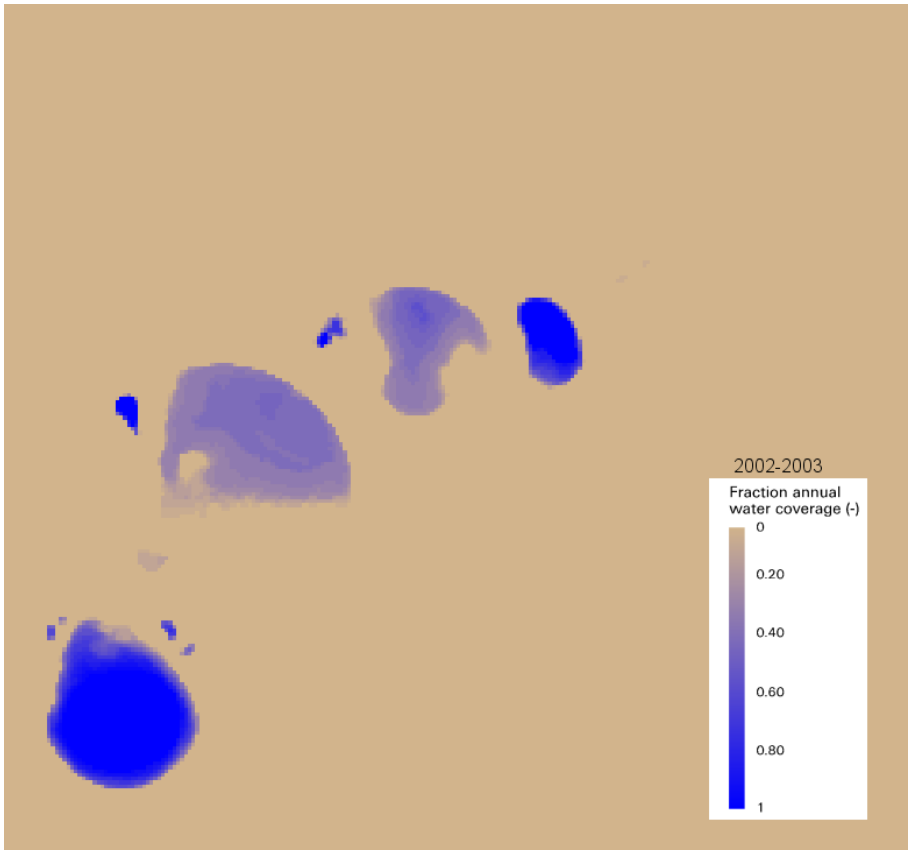
SEBAL 2009 Results

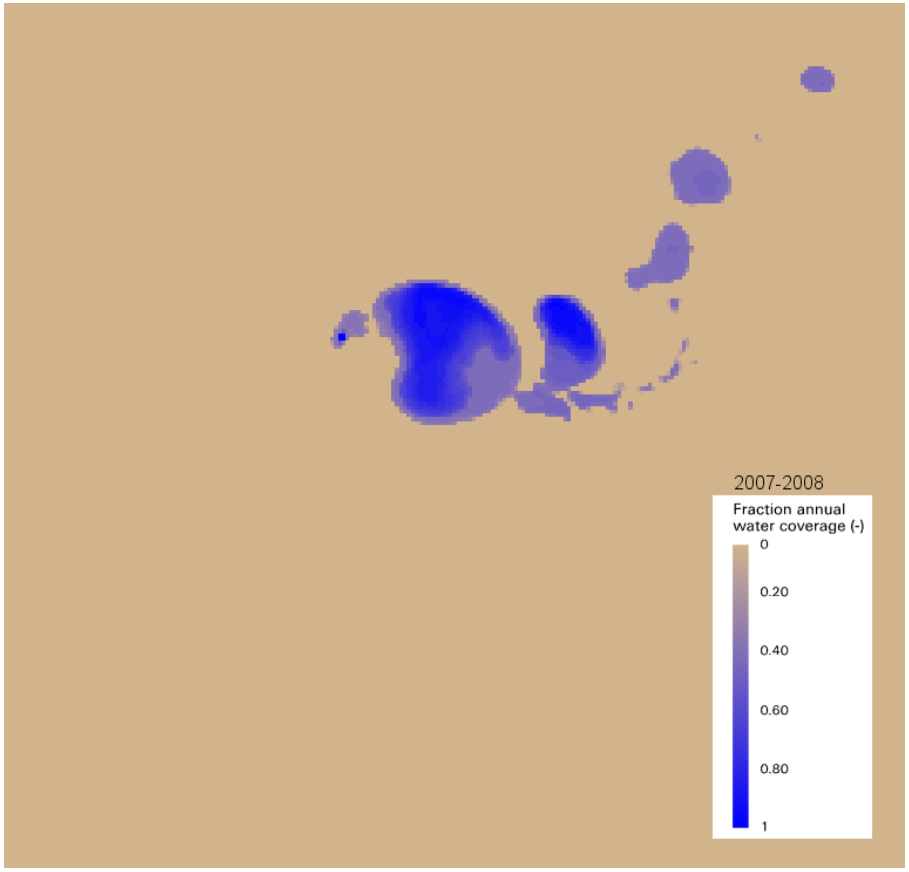
- Temporal and spatial variation
  - can calculate monthly water loss through evaporation from each individual Lake



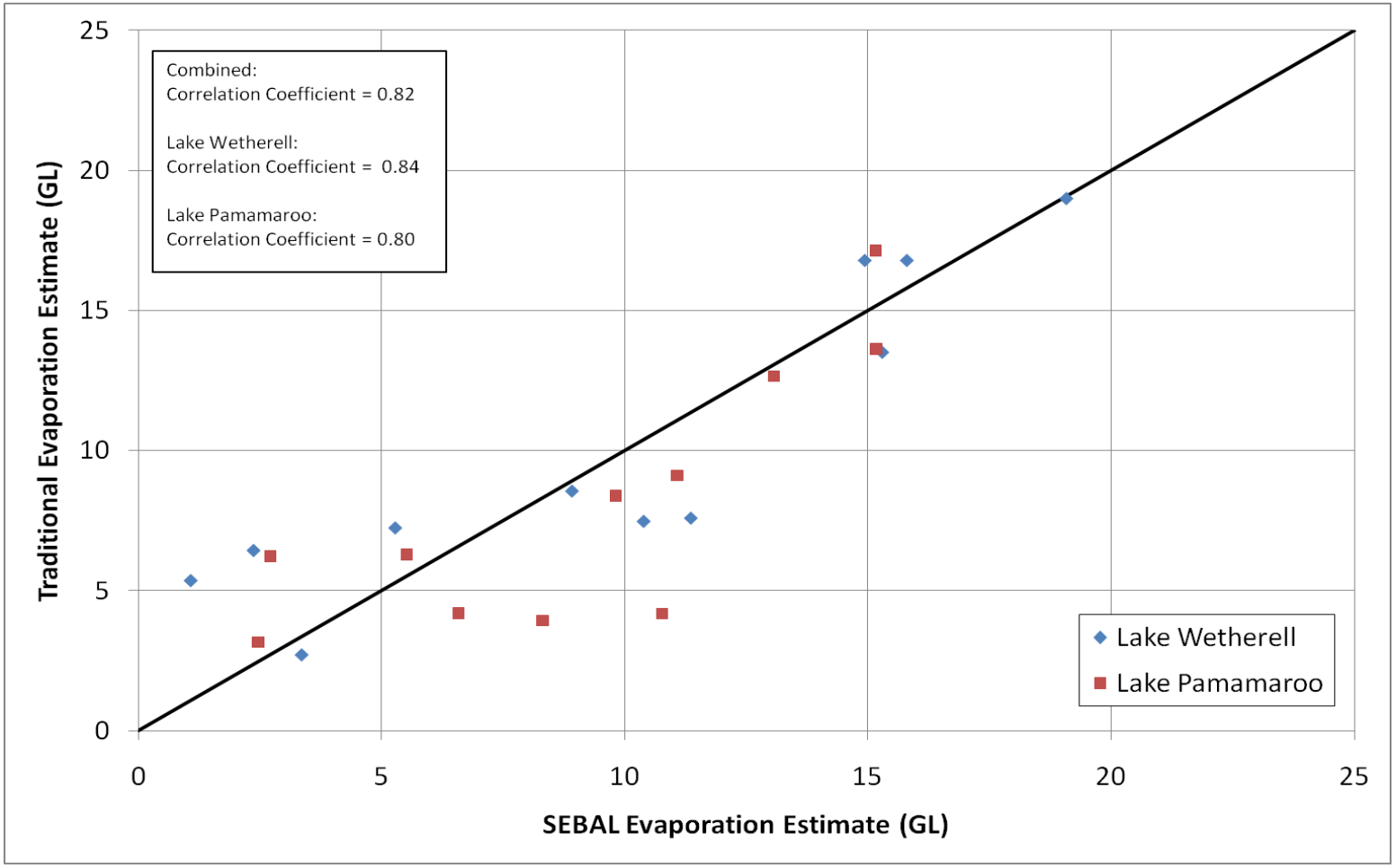


Lake Dynamics



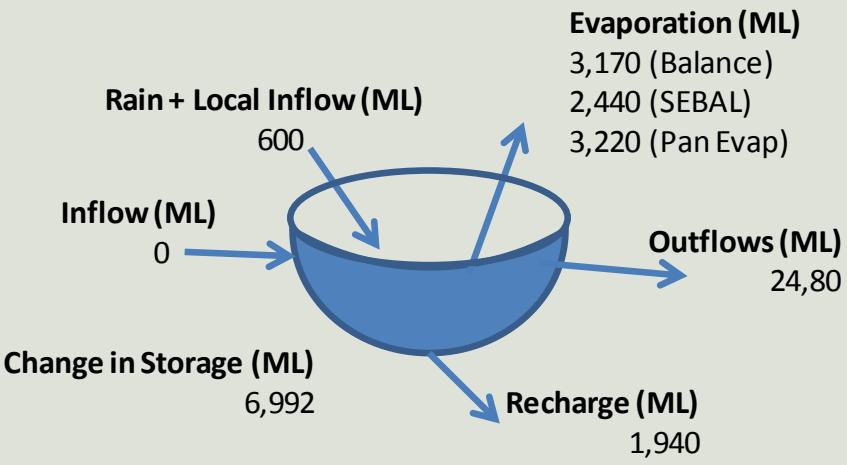


Comparison – Water balance with SEBAL 2009

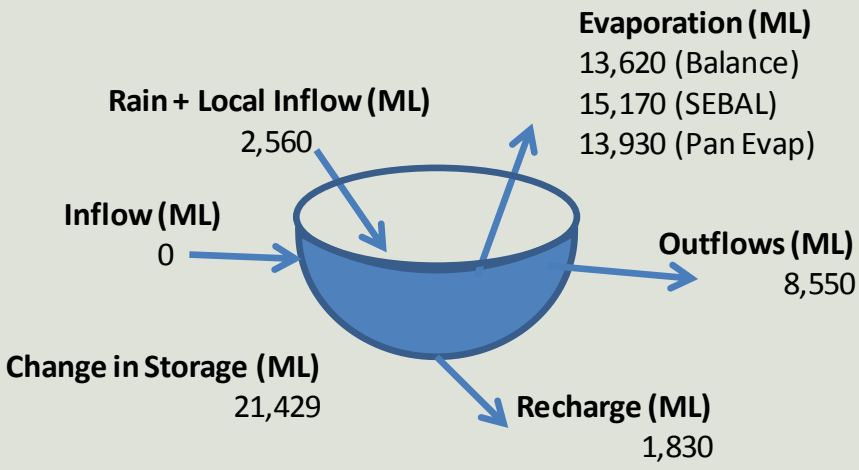


Comparison – Water Balance to SEBAL 2009

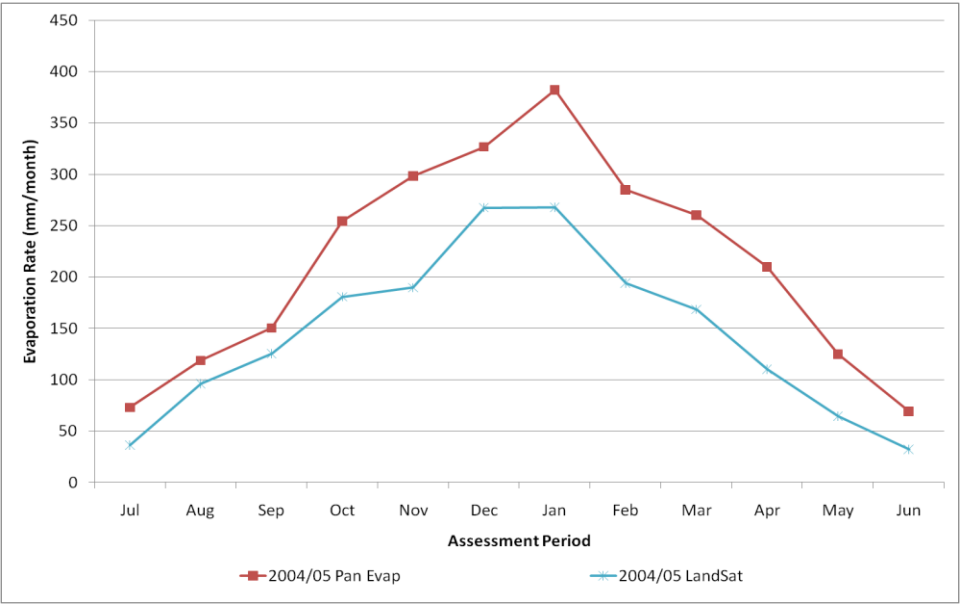
Lake Pamamaroo - Jul 2004

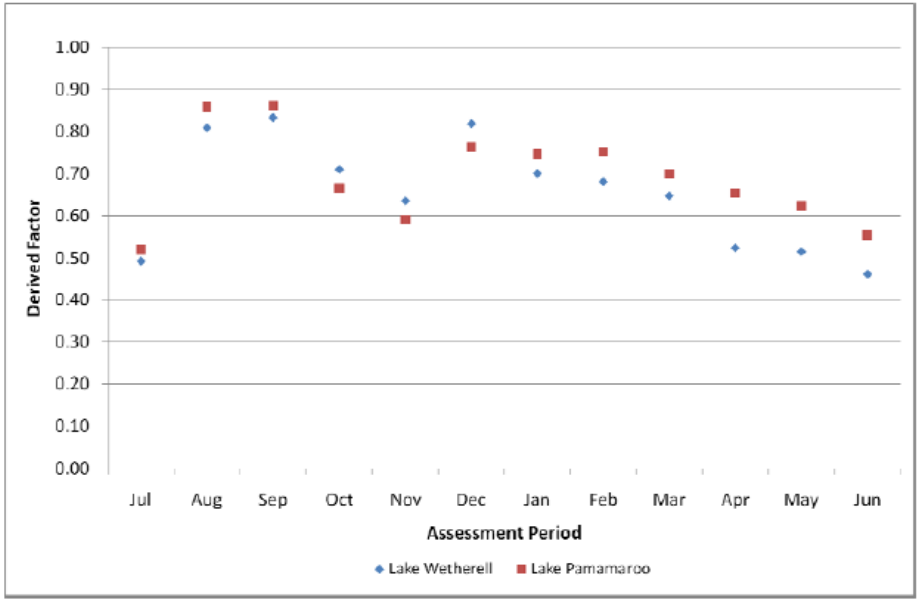


Lake Pamamaroo - Dec 2004



Comparison – Pan Factors to SEBAL 2009





- Annual pan factors are applied uniformly on a monthly or seasonal basis
- SEBAL evaporation rates when compared to evaporation rates at the pan evaporation station can be used to derive monthly pan factors

Conclusions

- SEBAL determined an evaporative loss of 133 GL from Lake Wetherell, and 118 GL from Lake Pamamaroo in 2004/05
- SEBAL estimates of evaporation highly correlated to traditional (water balance) estimates
- SEBAL could be used to improve accounting of evaporation from water supply storages across Australia
- SEBAL can be used in regions where there is no data for traditional methods