

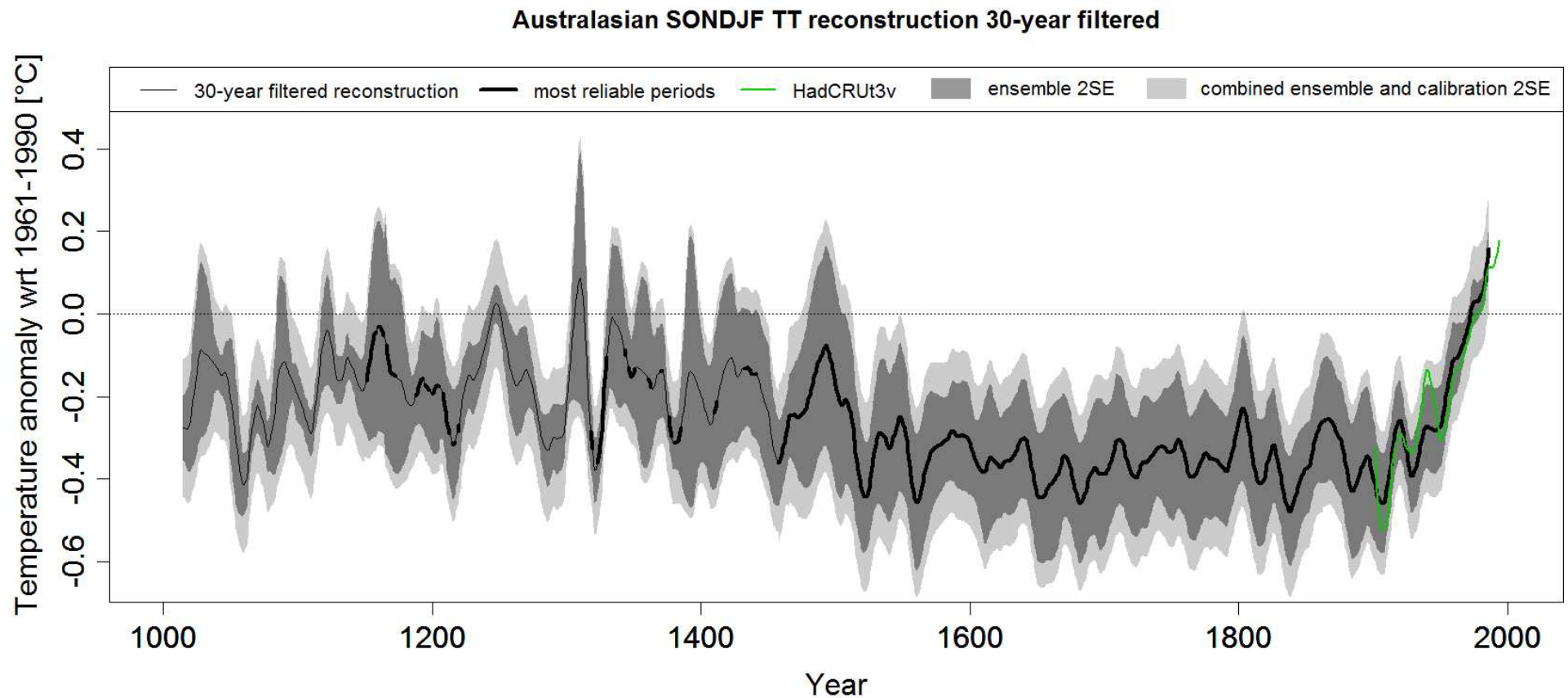
# Insights from the past: the drivers of Australian climate variability over the last millennium

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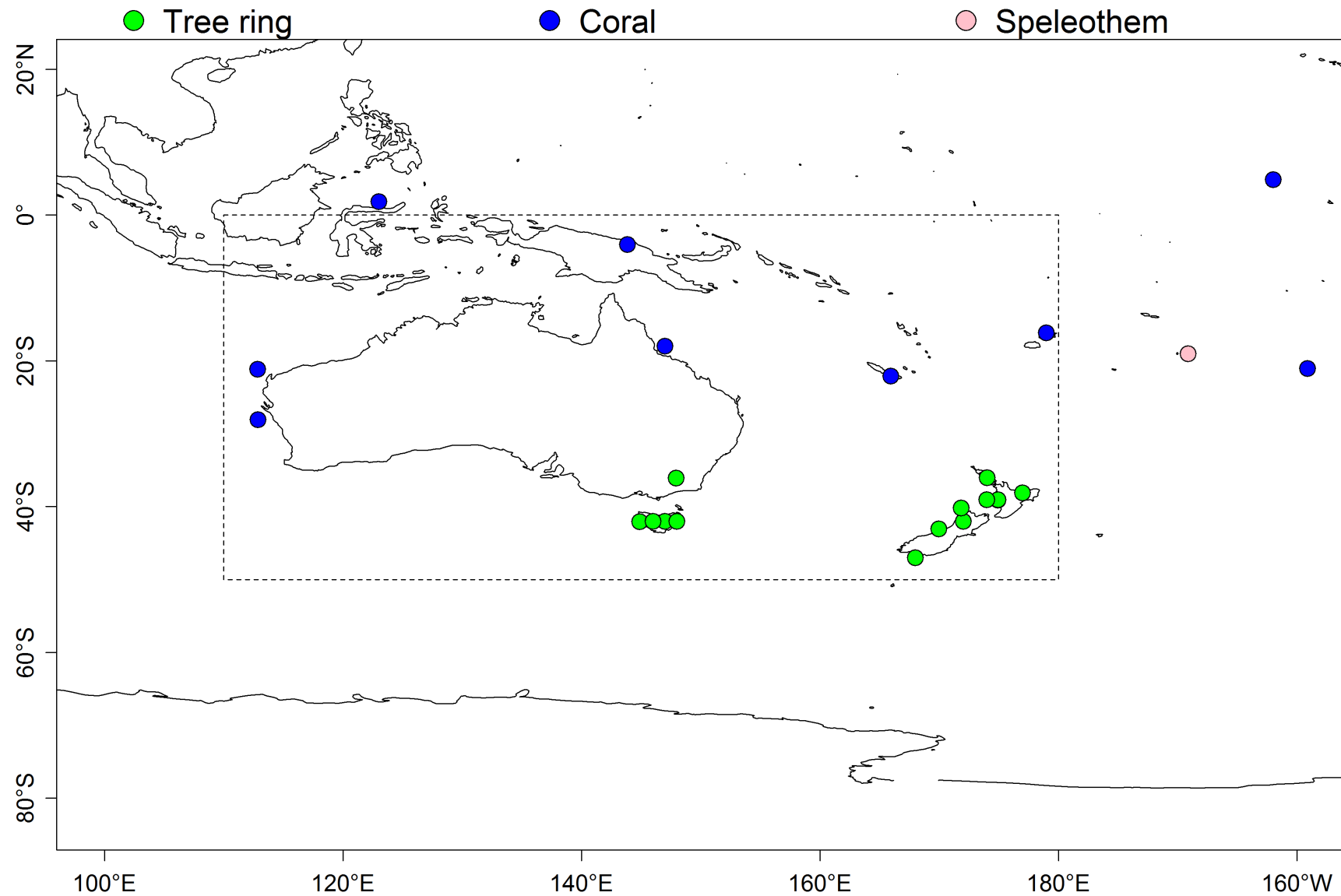
**Acknowledgements:** Joëlle Gergis, Raphael Neukom, Ailie Gallant, David Karoly

# Australasian warm season temperature ...

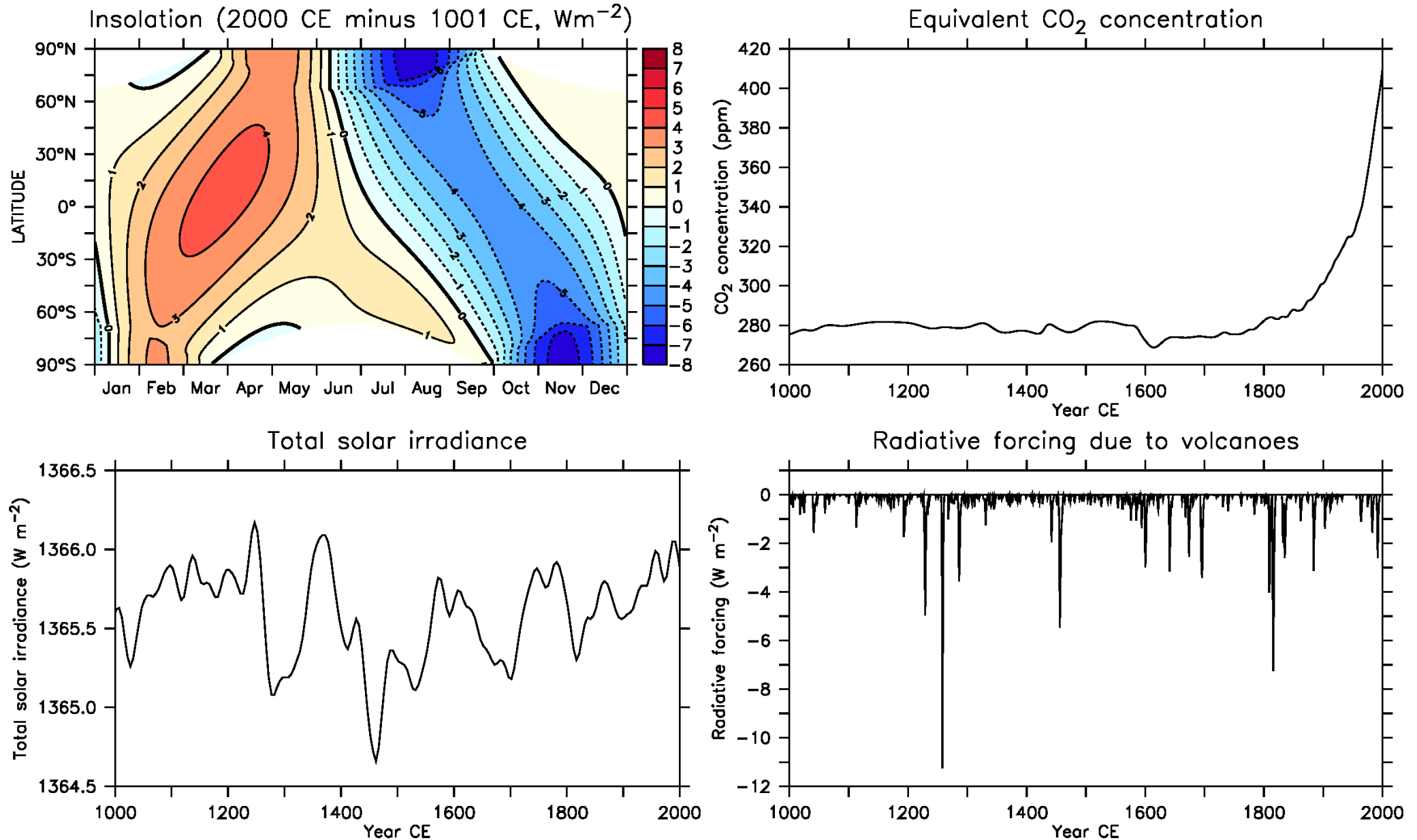


Gergis et al. (submitted), *J. Climate*

... derived from a network of 28 natural archives



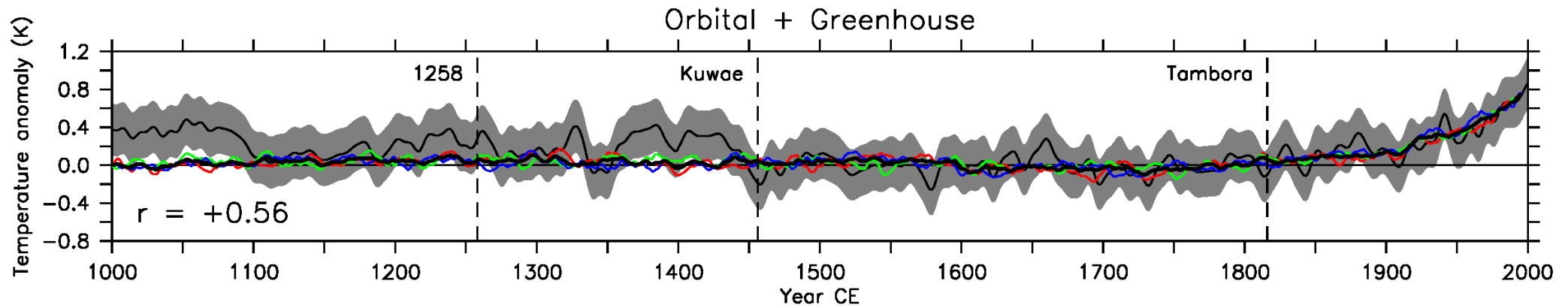
# Boundary conditions over the last millennium



# Data and methods

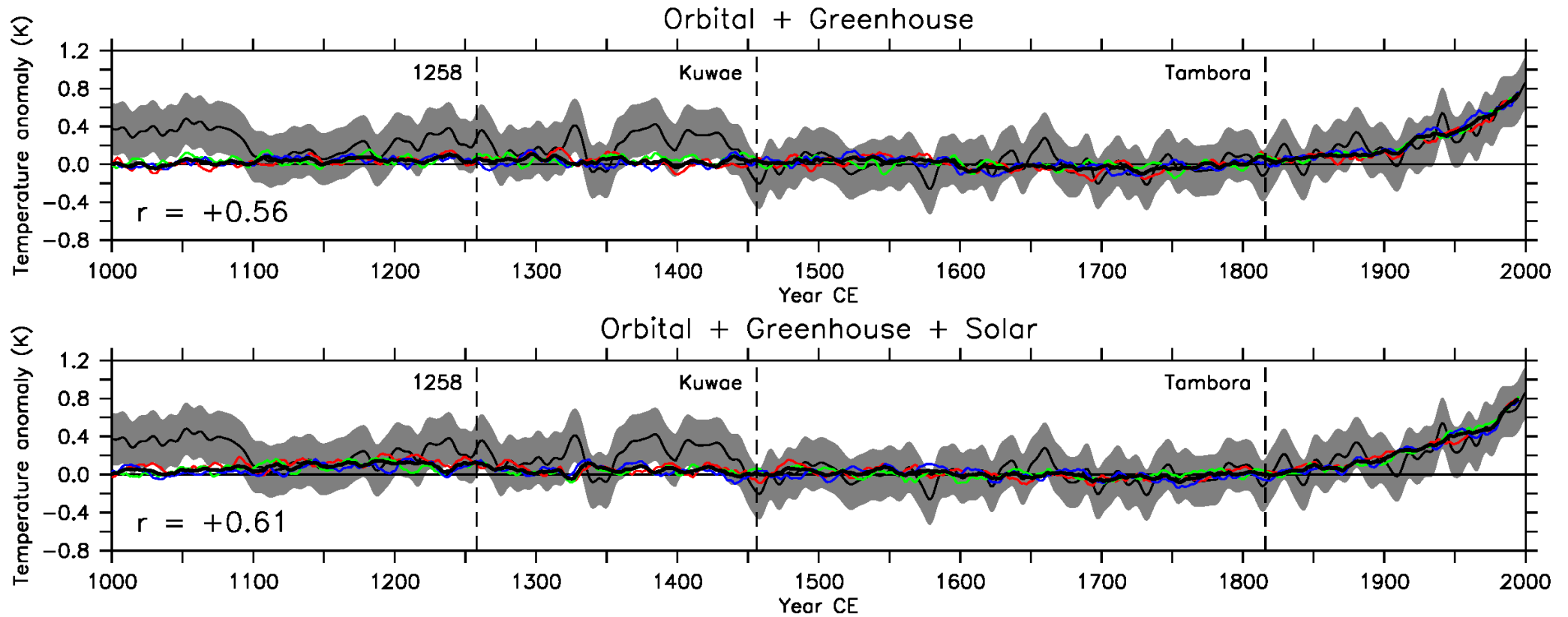
- The CSIRO Mk3L climate system model (Phipps et al., 2011, 2012)
  - Atmosphere-land-sea ice-ocean general circulation model
  - Multiple transient simulations of the last millennium
  - Orbital, greenhouse gas, solar and volcanic forcing
- Southern Hemisphere temperature reconstruction (Mann et al., 2008)
  - Global network of 1209 annually- and decadal-resolved proxies
  - Used to reconstruct annual-mean temperature
- Australasian temperature reconstruction (Gergis et al., submitted)
  - Network of 28 annually-resolved terrestrial and marine proxies
  - Used to reconstruct warm season (September to February) temperature

# Annual-mean Southern Hemisphere temperature

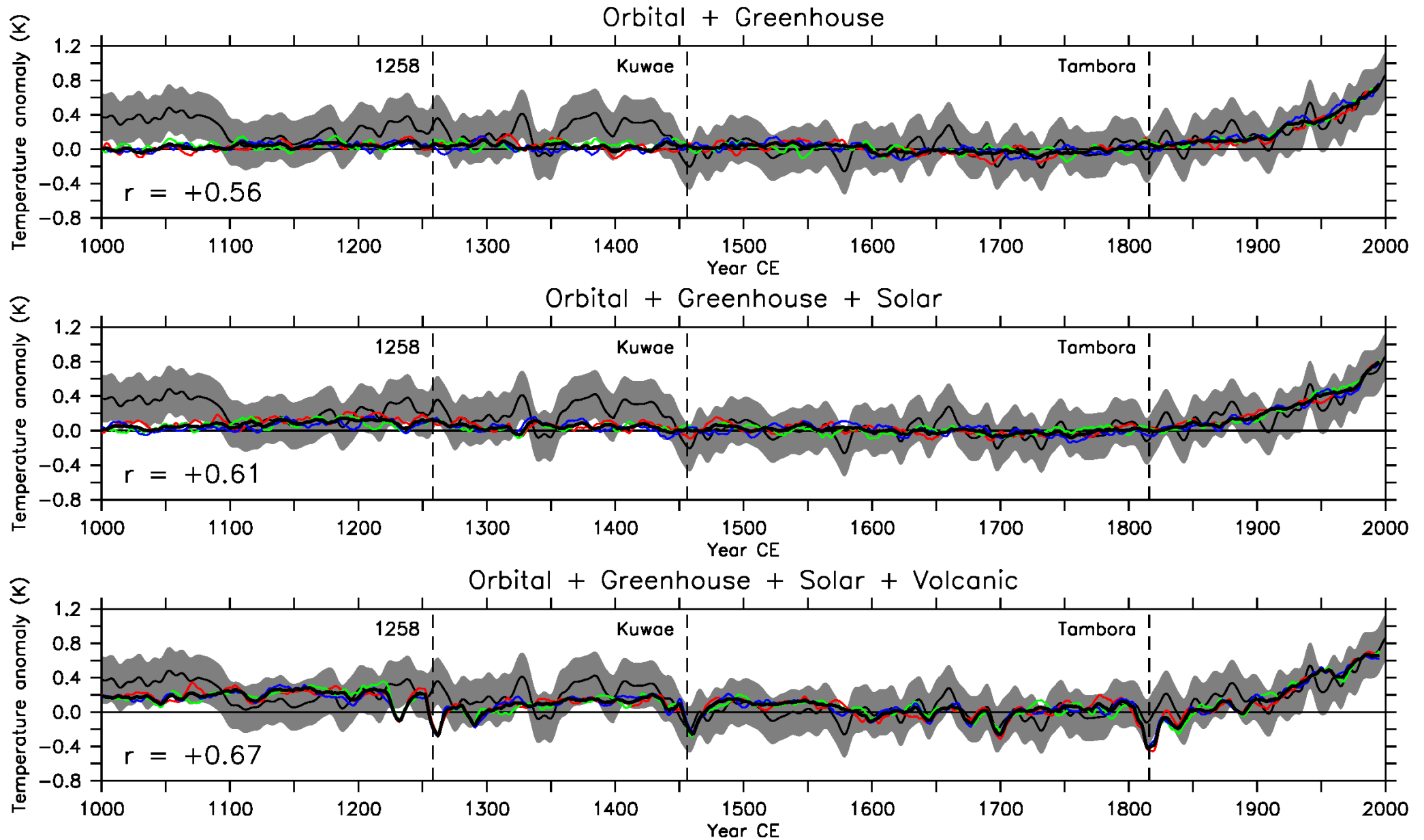




# Annual-mean Southern Hemisphere temperature

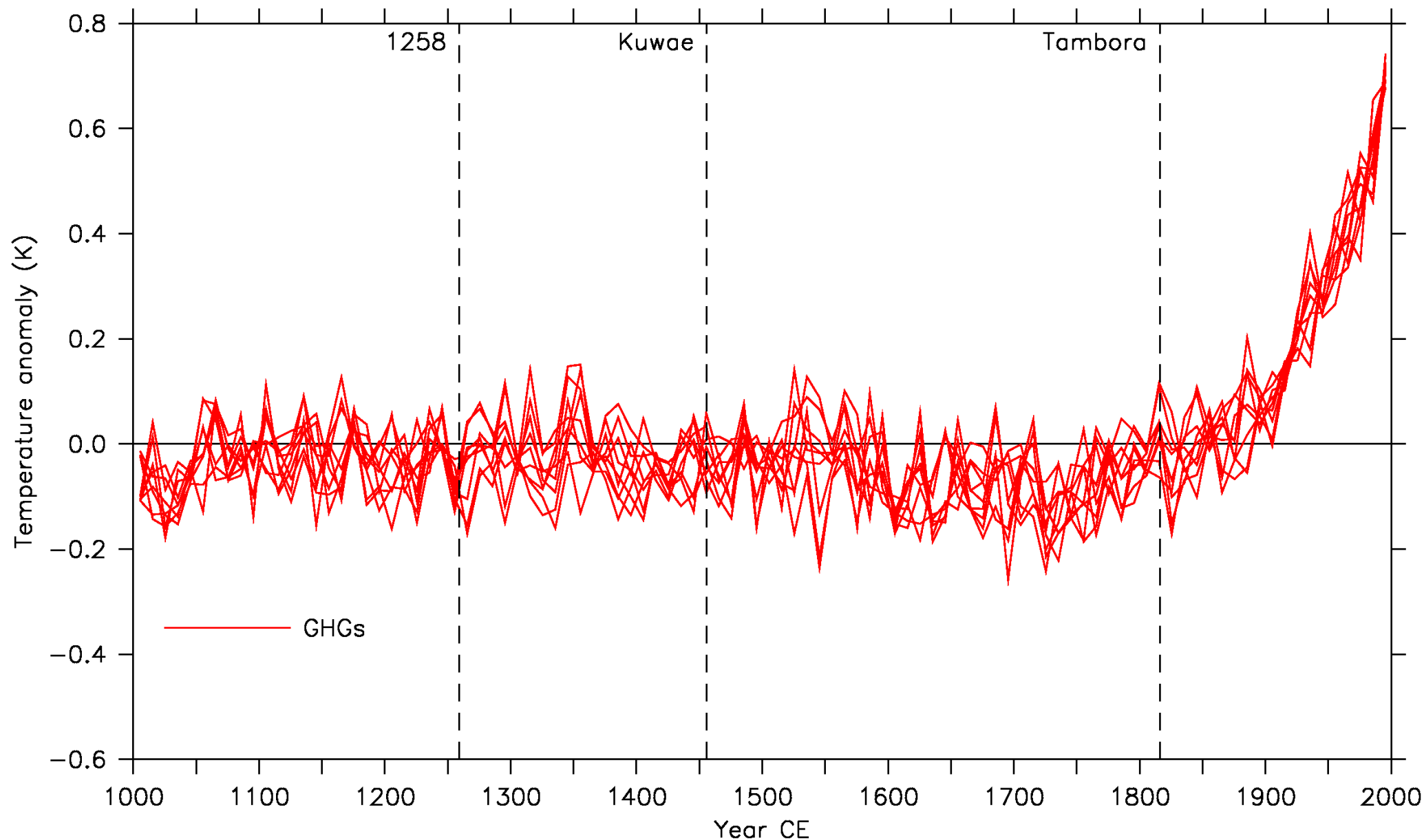


# Annual-mean Southern Hemisphere temperature

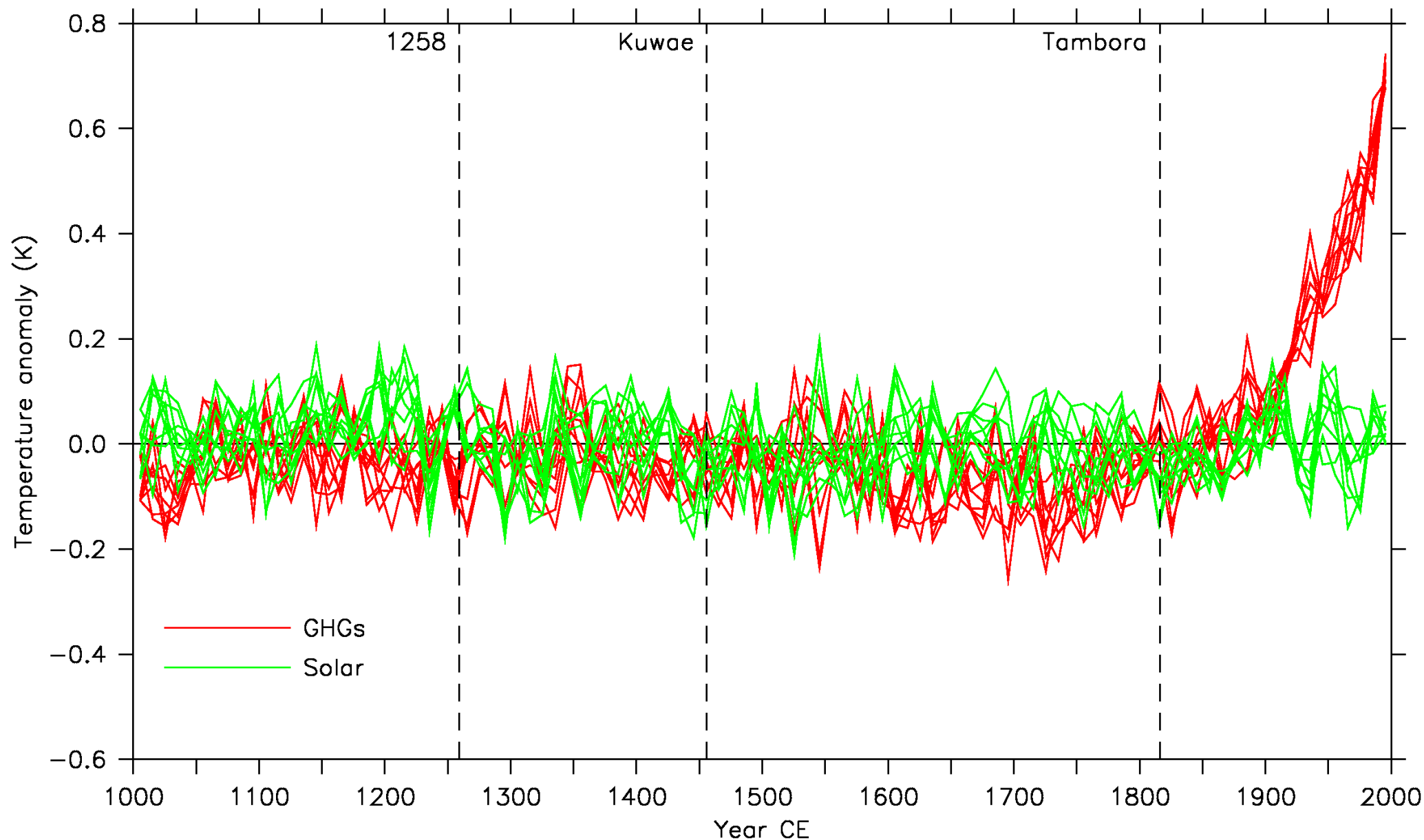




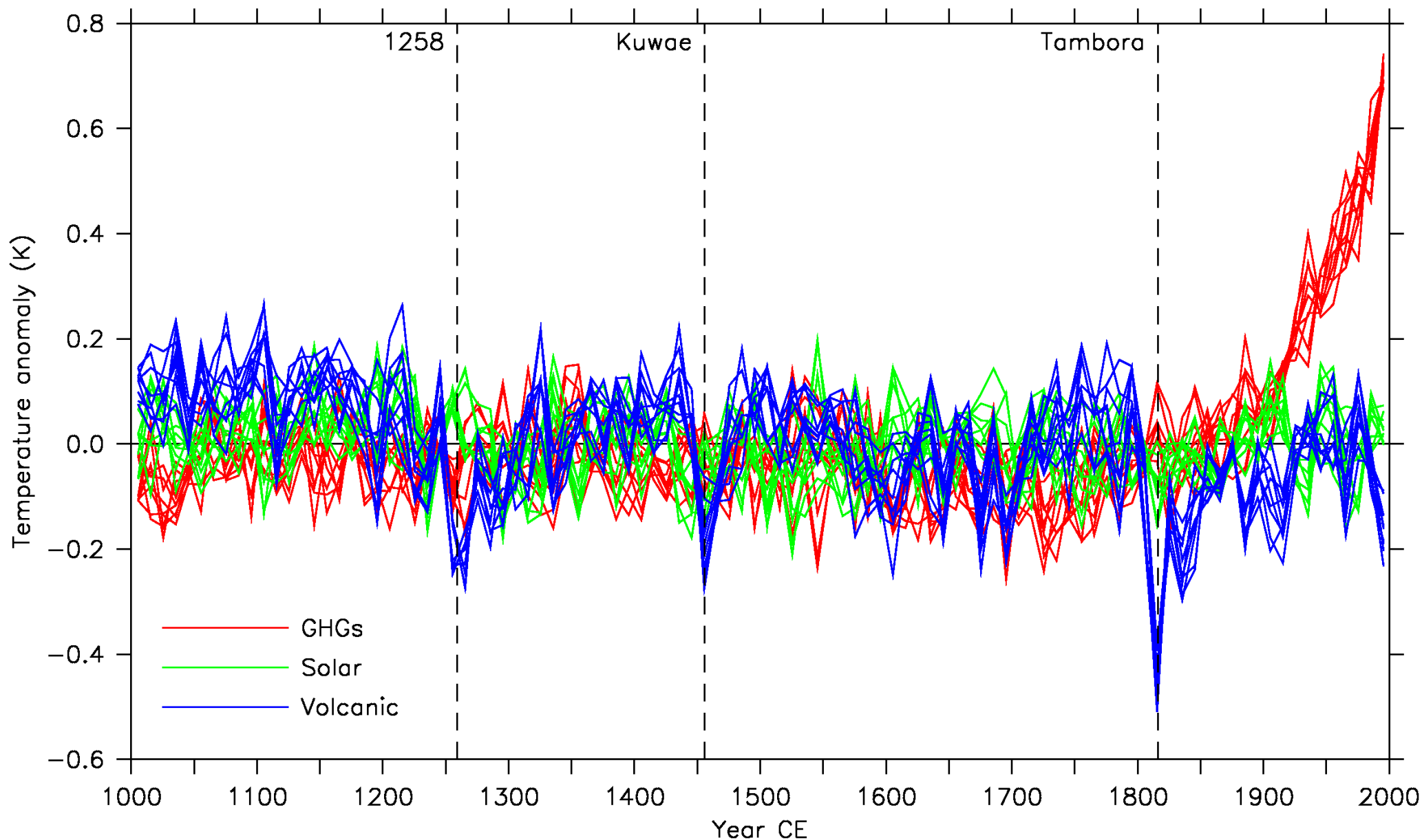
# Simulated “fingerprints” of external forcings



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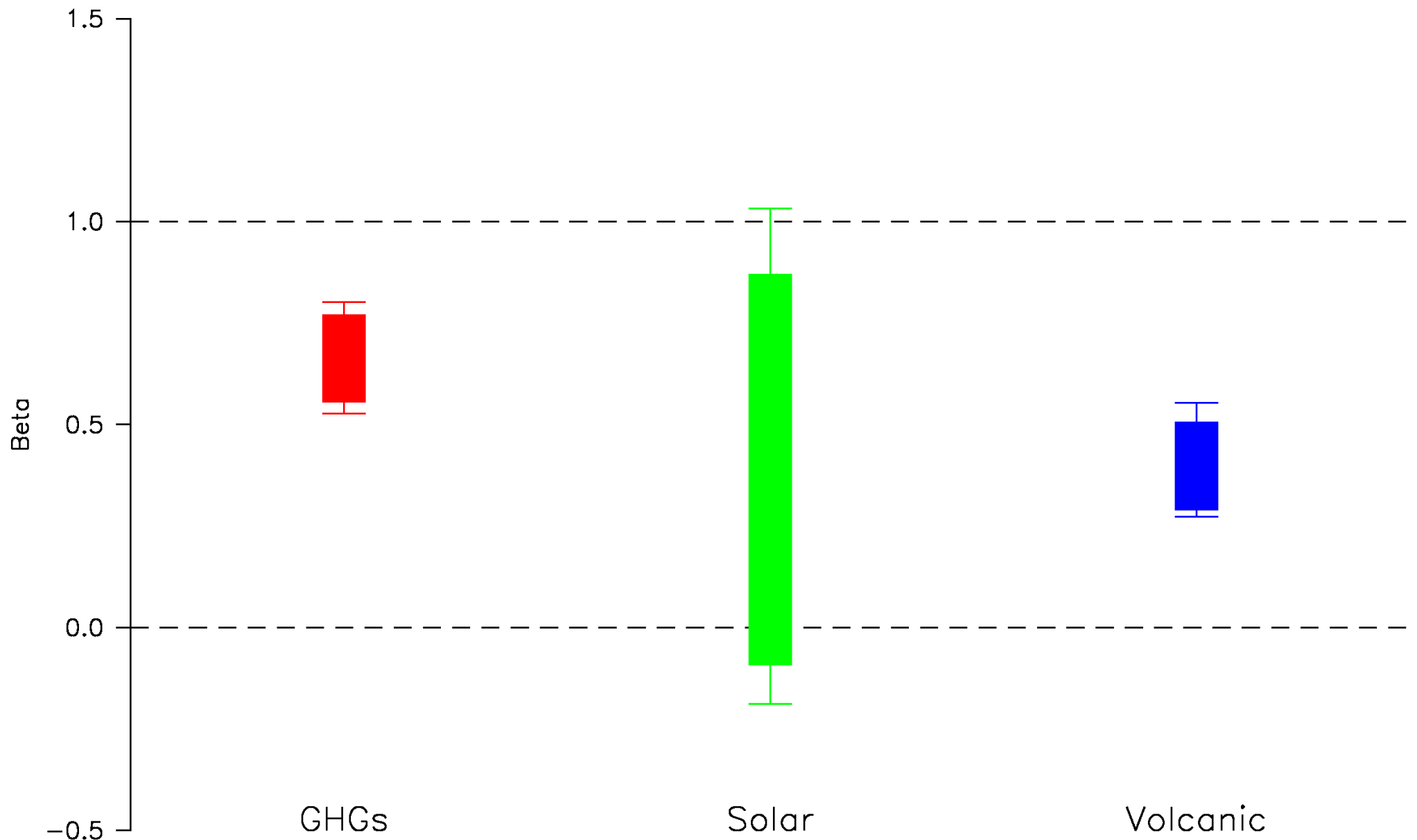


## Detection of externally-forced changes

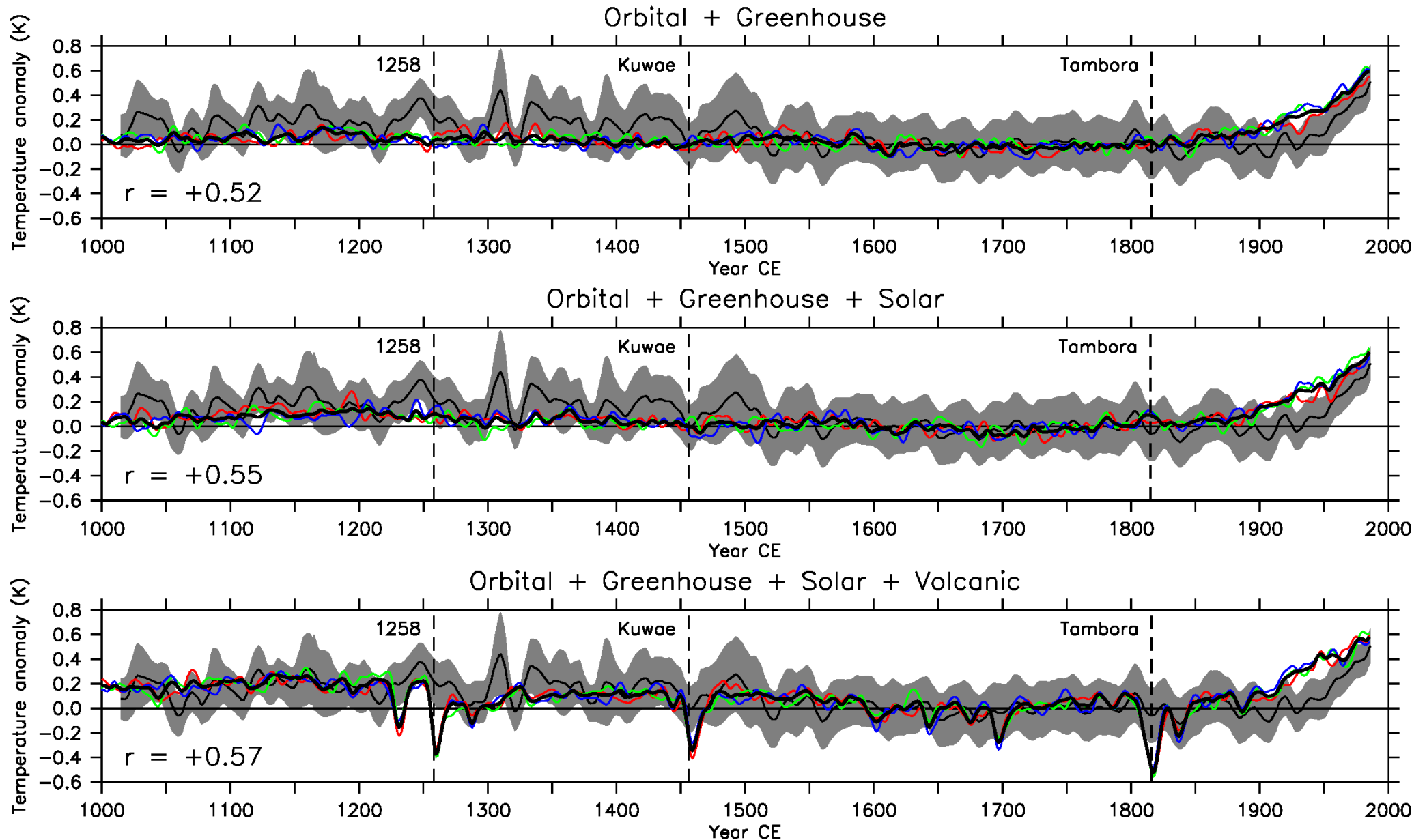
$$T = \beta_g \Delta T_g + \beta_s \Delta T_s + \beta_v \Delta T_V + \epsilon$$

- $\epsilon$  will include contributions from:
  - internal climate variability within the reconstruction
  - errors in the reconstruction and model simulations
  - errors in the model simulations

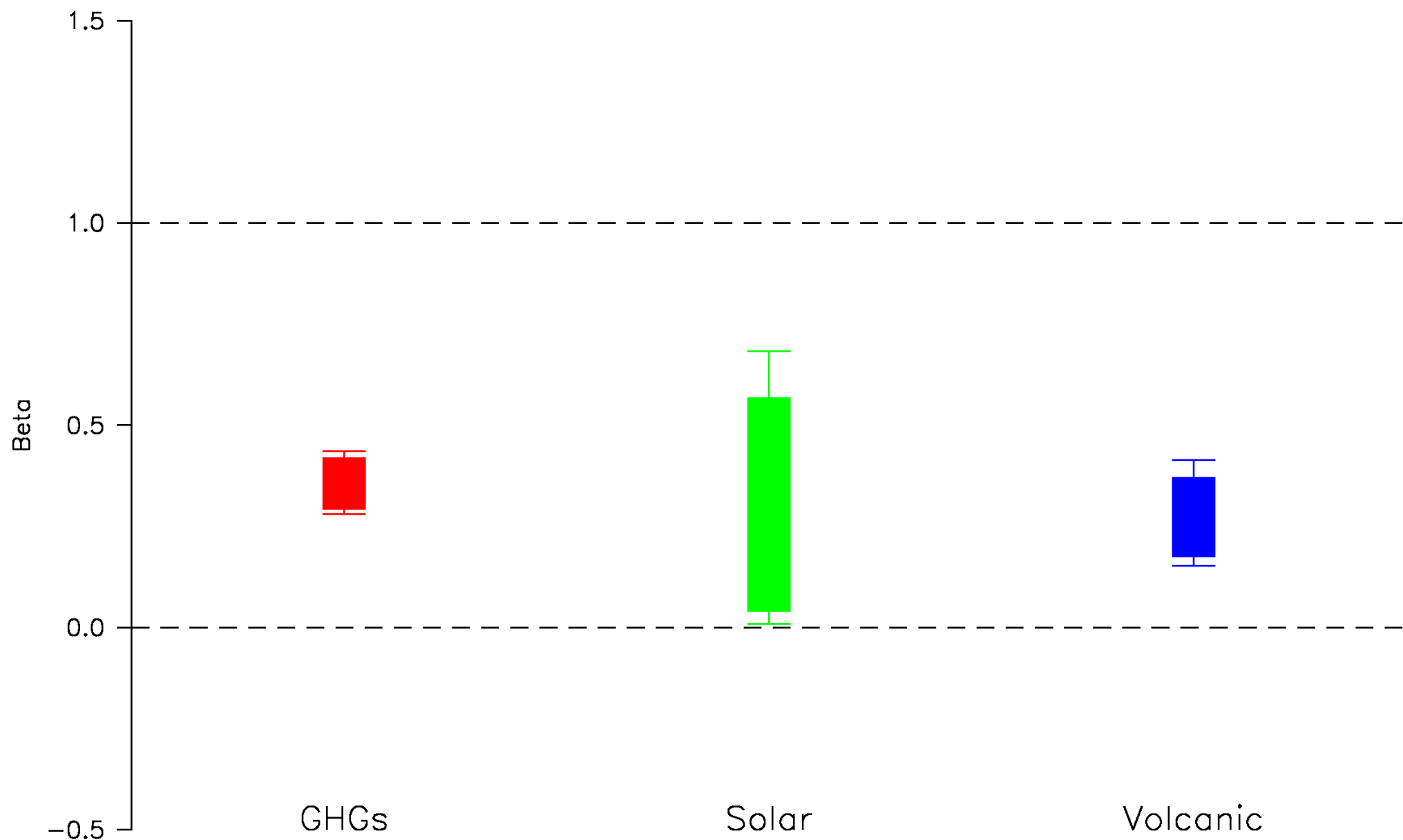
# Southern Hemisphere (1001–2000 CE)



# Australasian warm season temperature

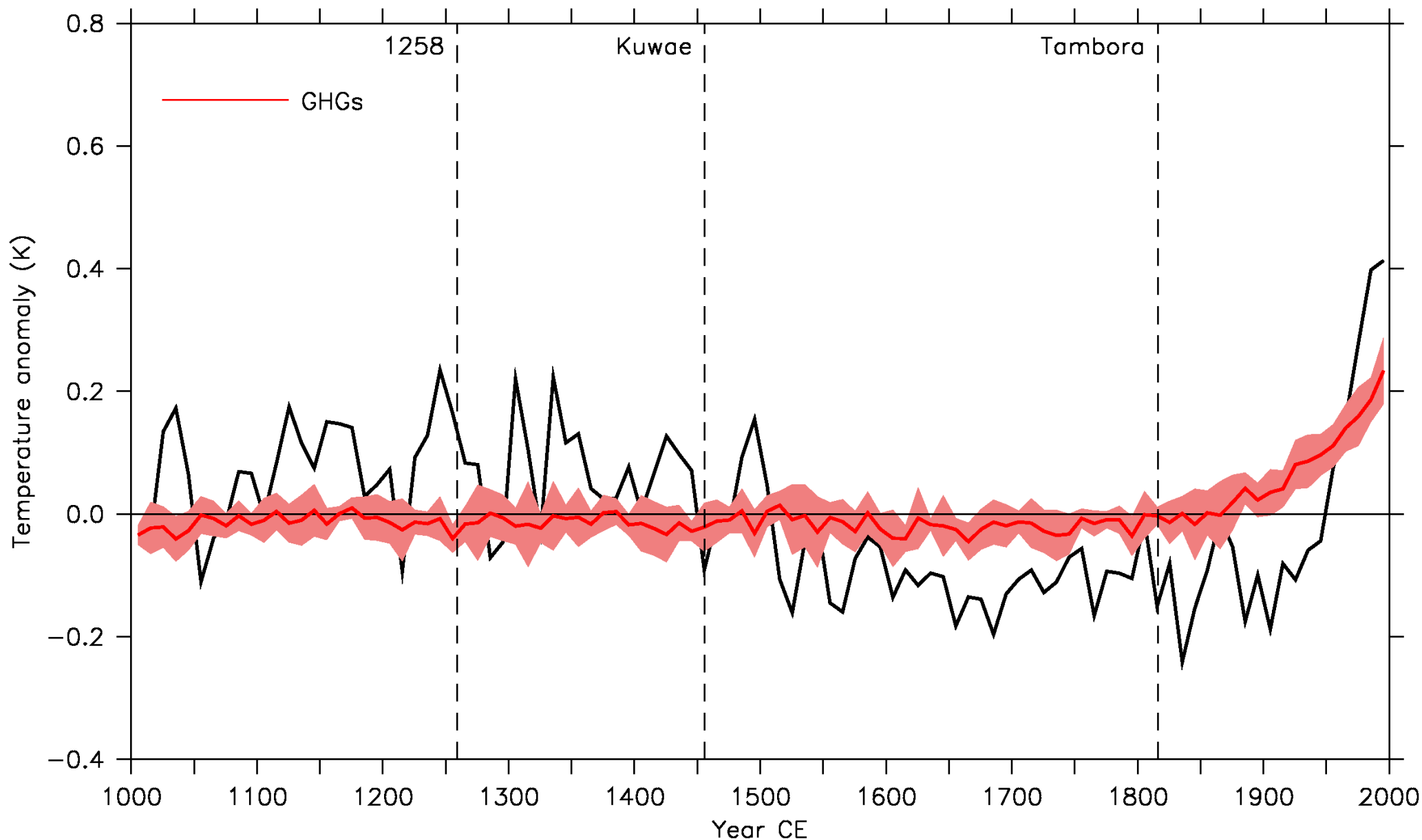


# Australasia (1001–2000 CE)

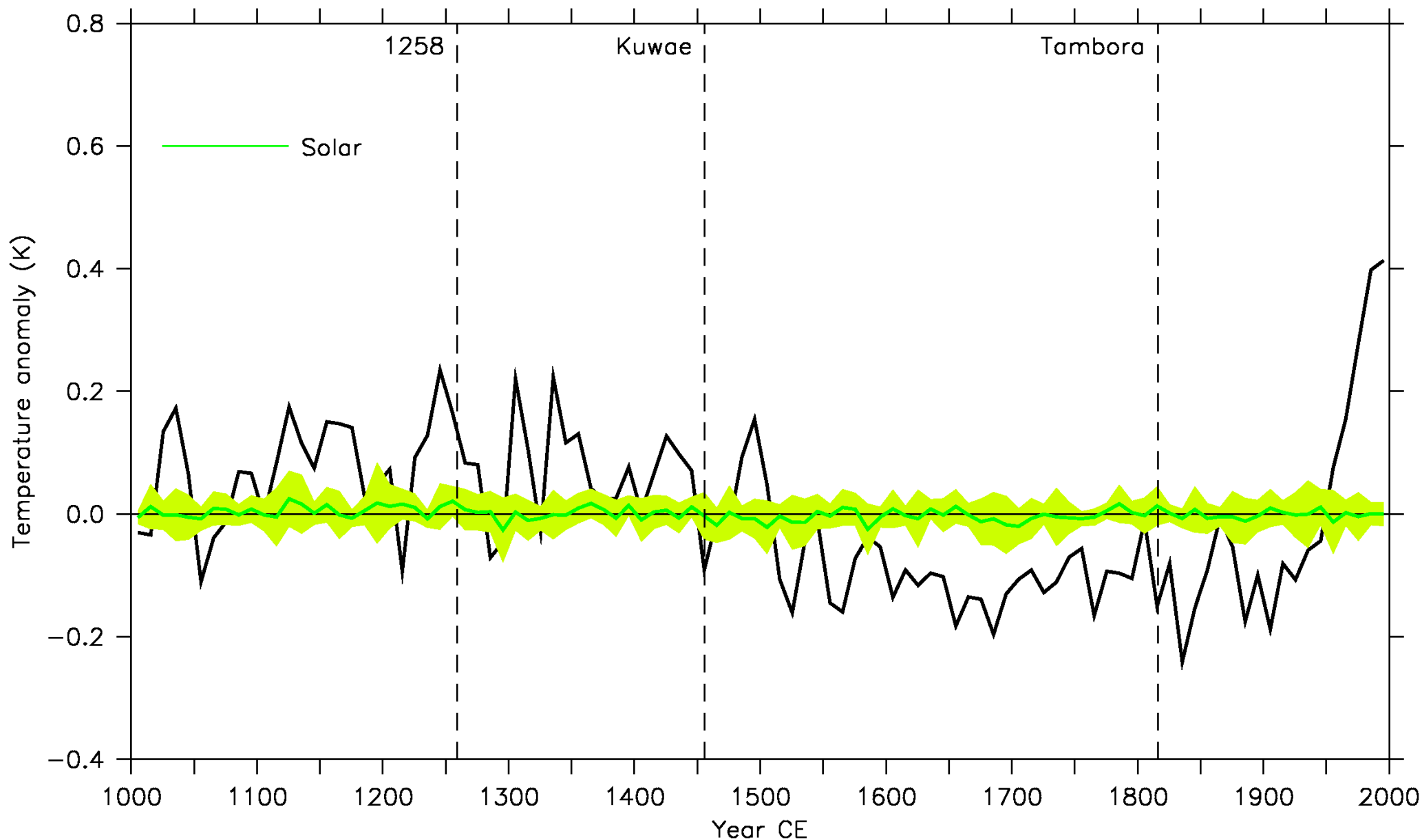




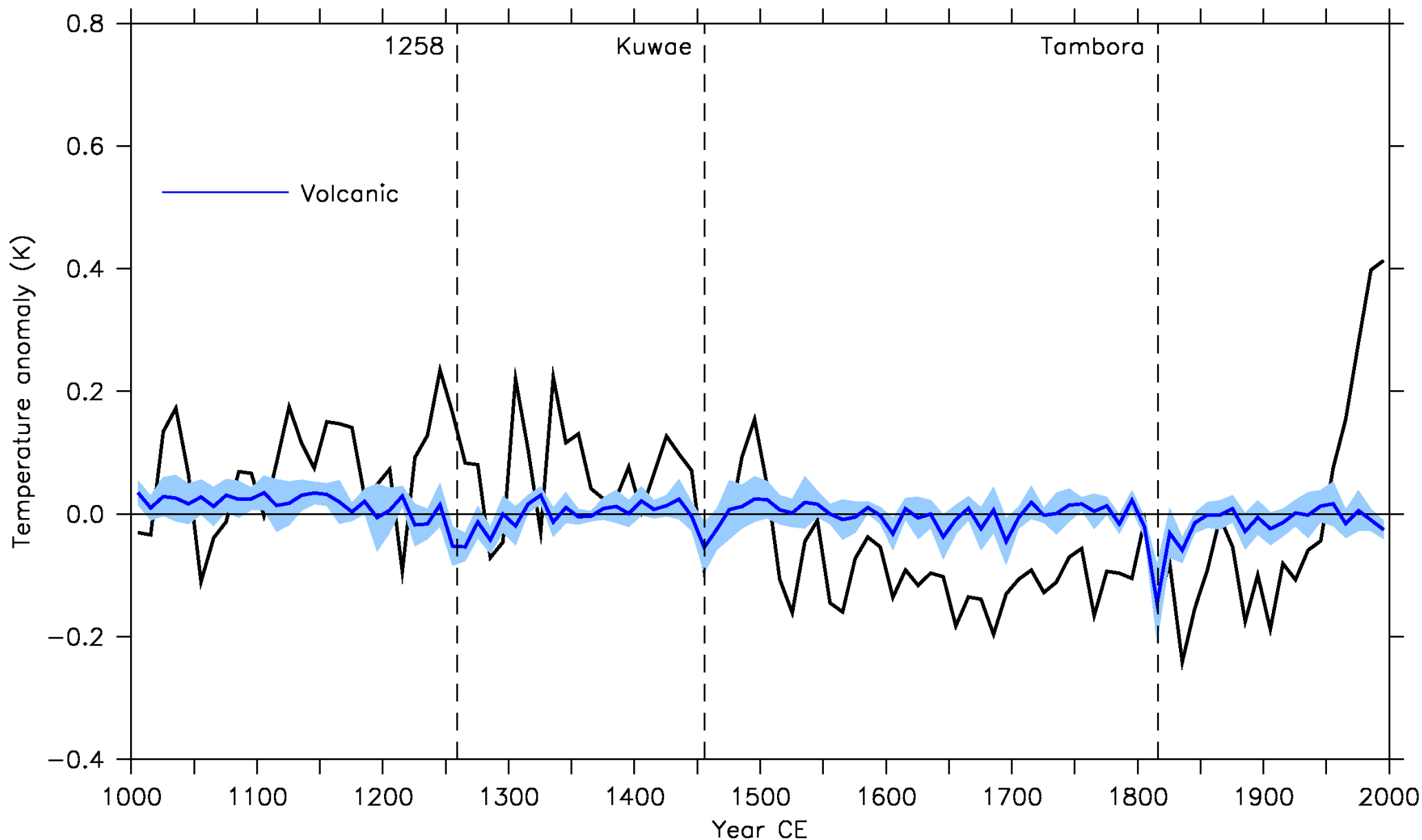
# External signals in Australasian temperature



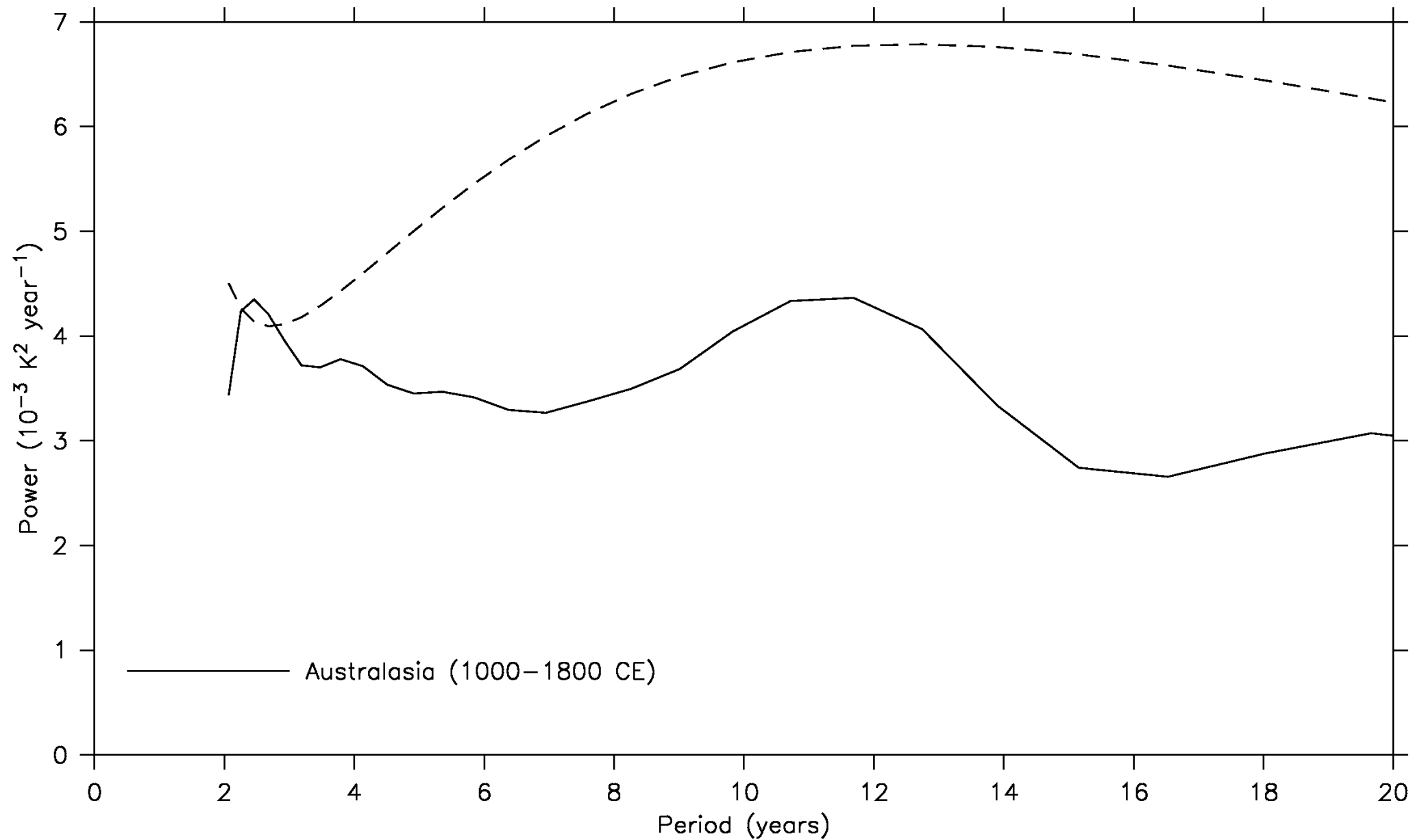
# External signals in Australasian temperature



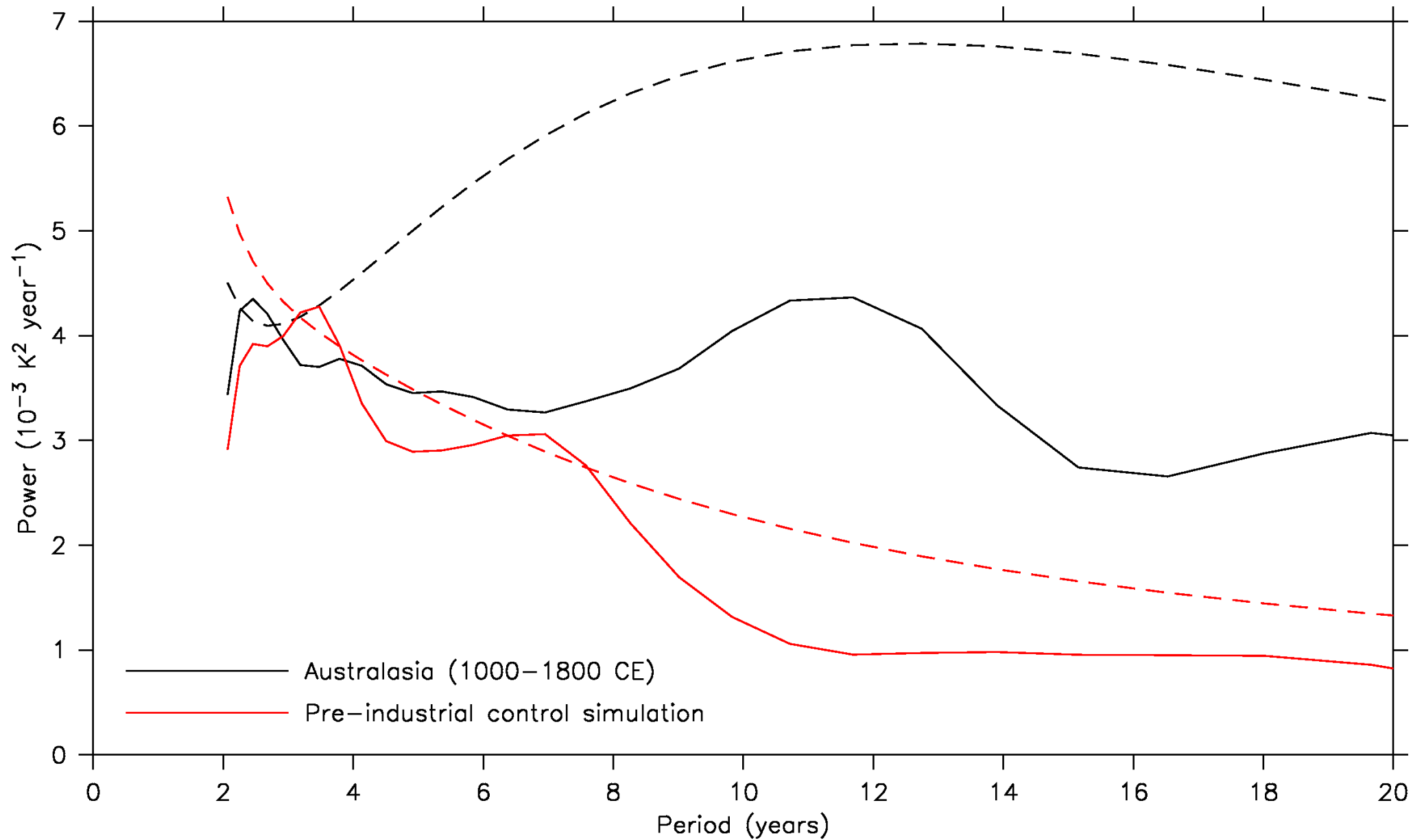
# External signals in Australasian temperature



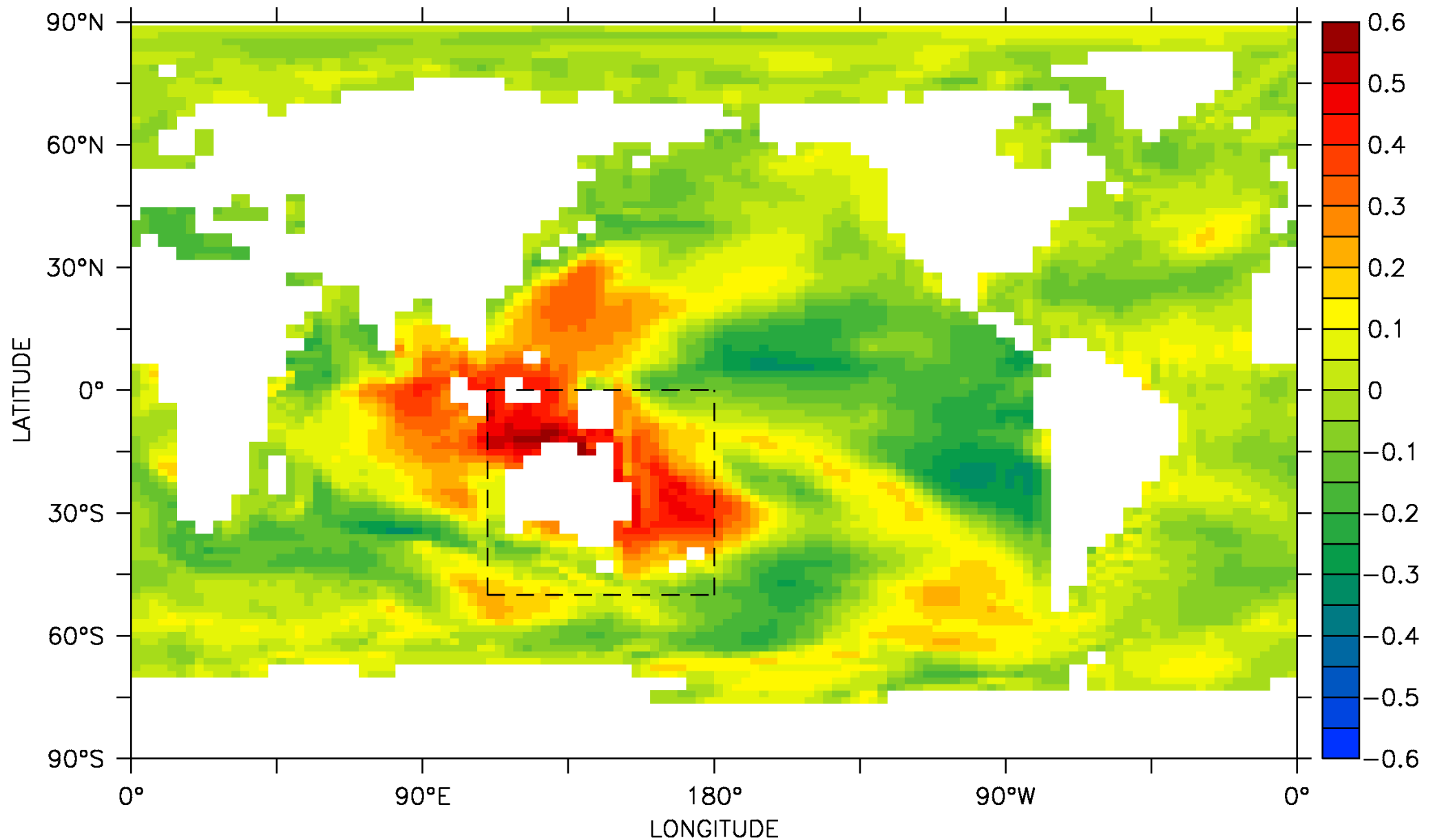
# Power spectrum of Australasian temperature



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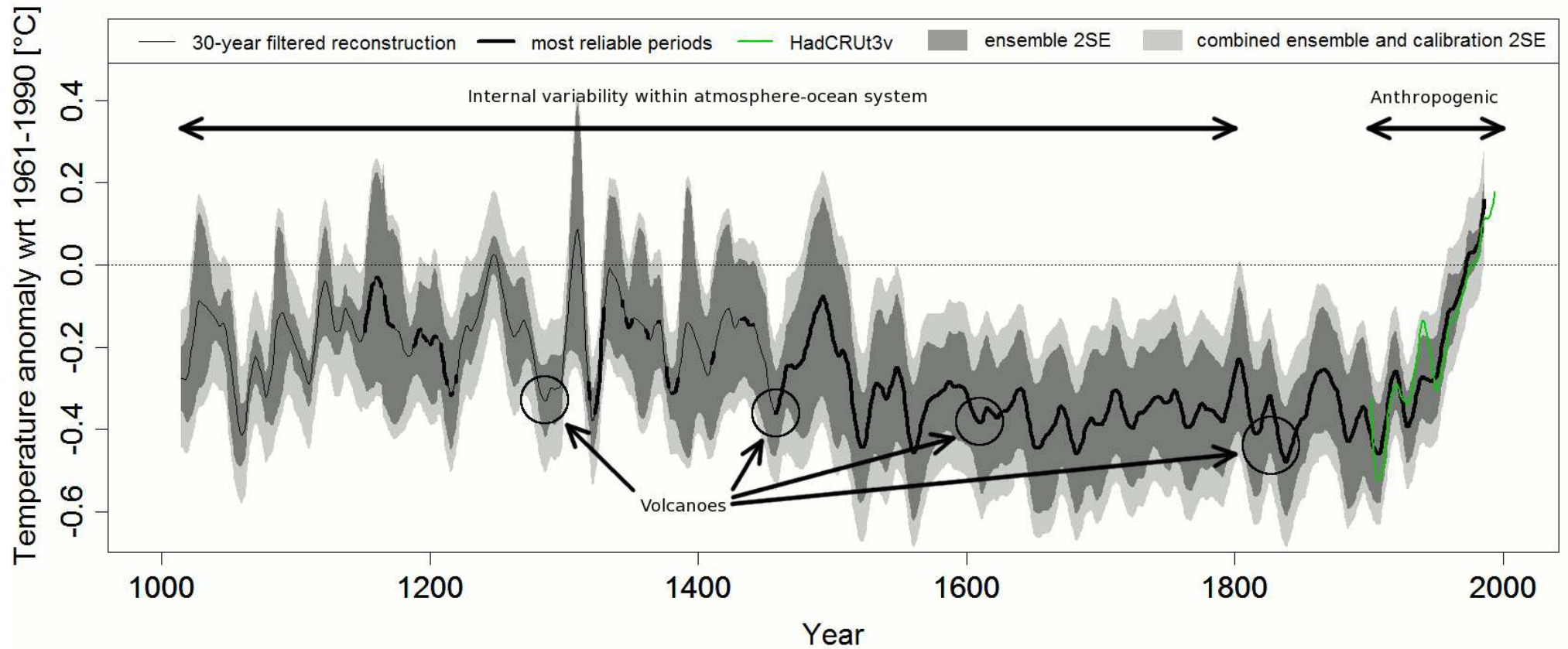


# Correlation Australasian T vs. SST (<5 years)

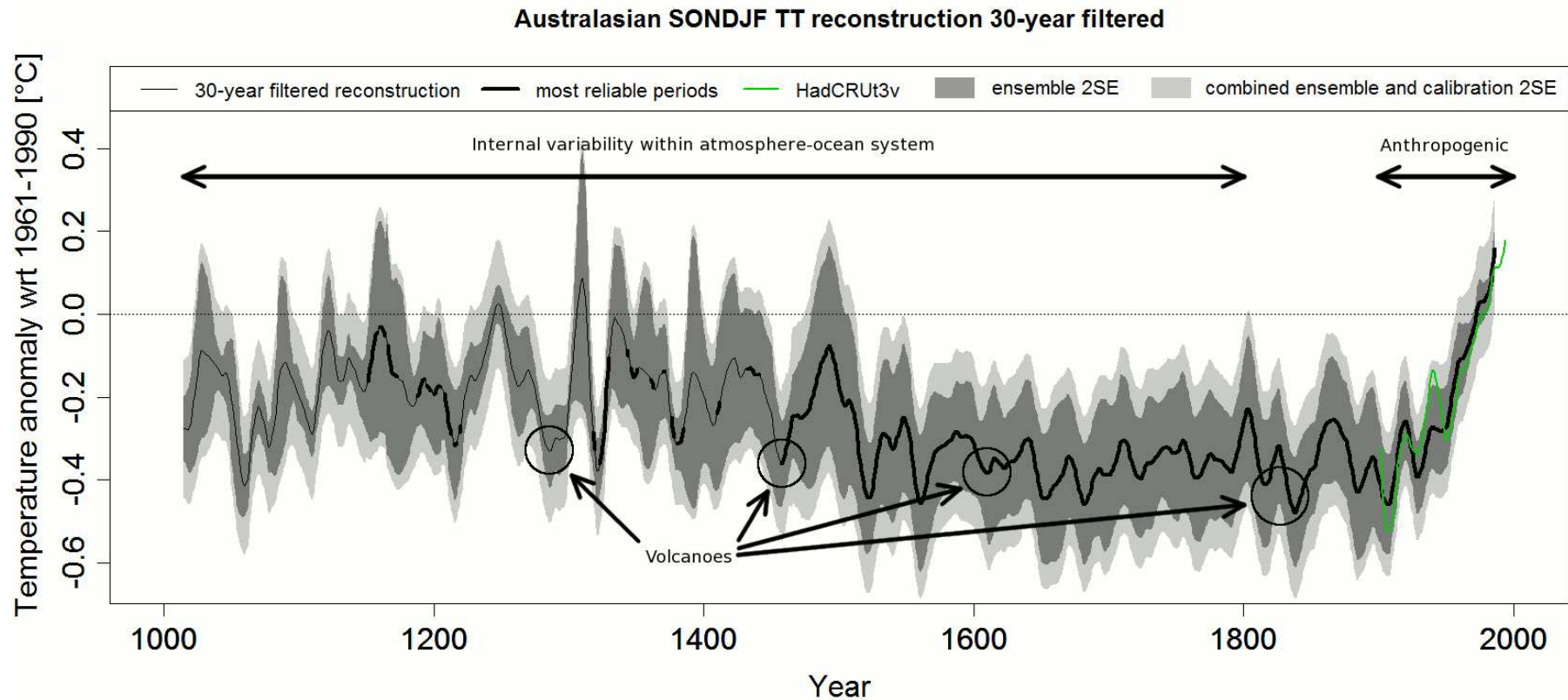


# Conclusions

Australasian SONDJF TT reconstruction 30-year filtered







## References

- PAGES Aus2k special issue of *Journal of Climate*, due to appear in 2013.
- Gergis, Neukom, Gallant, Phipps, Karoly and PAGES Aus2k Project Members (submitted), Evidence of unusual late 20th century warming from an Australasian temperature reconstruction spanning the last millennium.
- Phipps, McGregor, Gergis, Gallant, Neukom, Stevenson, Ackerley, Brown, Fischer and van Ommen (in revision), Paleoclimate data-model comparison and the role of climate forcings over the past 1500 years.