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Lithospheric structure in the vicinity of the Albany Fraser reflection profiles

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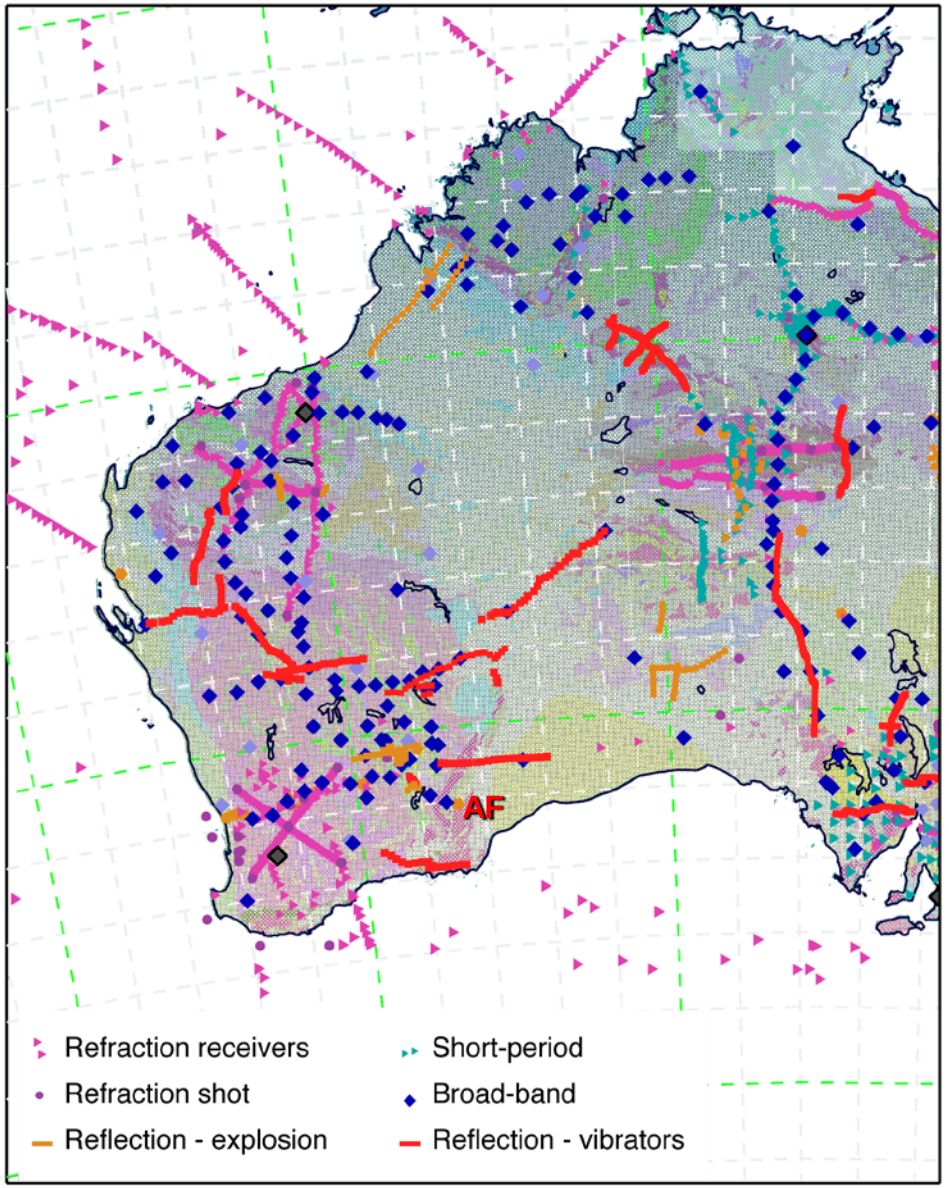
Seismic coverage for Western Central Australia

- The Albany Fraser project is part of a extensive network of seismic information
- Prior refraction work and extensive broad-band deployments (Receiver Functions) provide control additional to the recent reflection work



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AuSREM

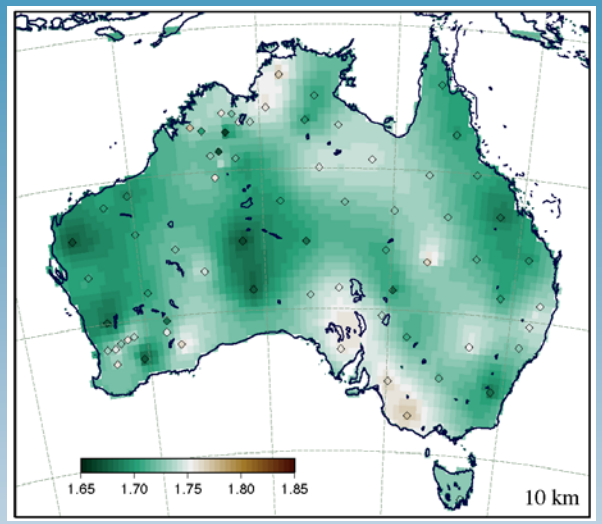
- The Australian Seismological Reference Model (AuSREM) is an effort to bring together existing information on the 3-D structure beneath the Australian area to create a ***representative*** model
- Depends on collaborative support from a wide range of researchers, whose work bears on the structure of Australia
- Published Products :
  - Revised Moho Map of Australia – Kennett, Salmon et al. 2011,
    - Updated 2012 Salmon et al, 2013, Tectonophysics – in press
  - Summary Paper – Kennett & Salmon, 2012 AJES
  - Crustal & Mantle Papers 2013, GJI, vol 192.

AuSREM: Crustal Component

- Prior compilations of sediment thicknesses
- P and S wavespeed distributions through the crust.
- The primary information for P wavespeed comes from refraction profiles, for S wavespeed from receiver function studies.
- Ambient noise tomography for S wavespeed links the point observations into national coverage.
- Density values are derived using results from gravity interpretations.
- Updated map of depth to Moho, using latest full crustal reflection profiling

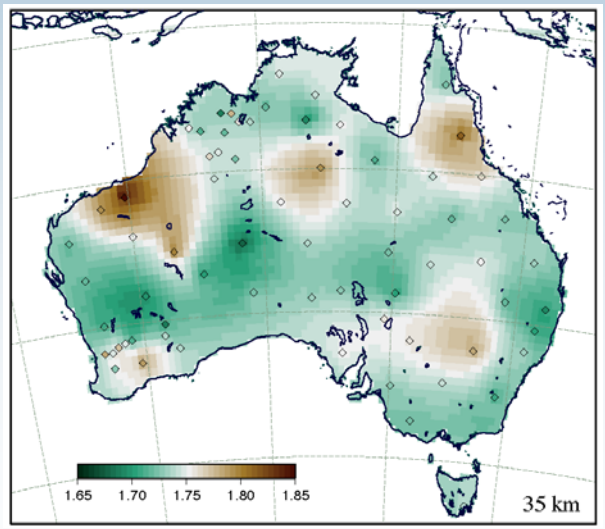
Construction of Crustal component

1. Refraction + receiver function Vp field (onshore & offshore)
2. Vp/Vs field from smoothed receiver functions
3. Vp for continent from ambient noise by conversion of Vs
4. Construct composite P wavespeed field from all P results
5. Create S wavespeed from P using Vp/Vs field
6. Construct density from P wavespeed



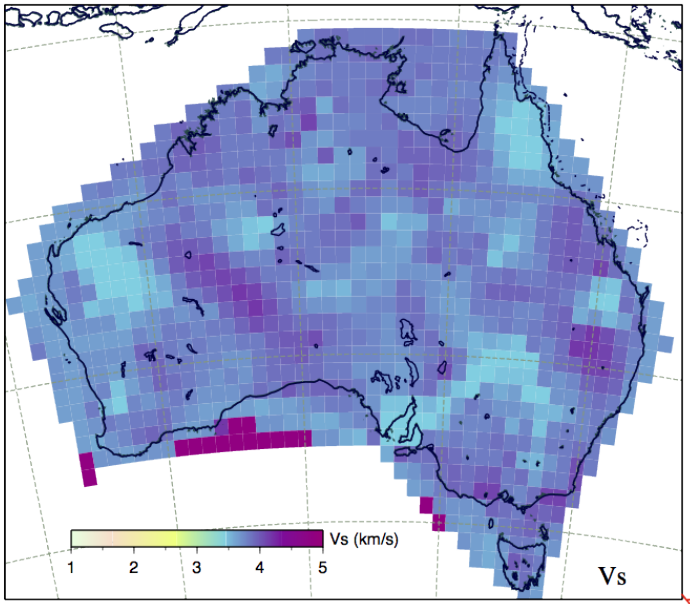
Vp/Vs

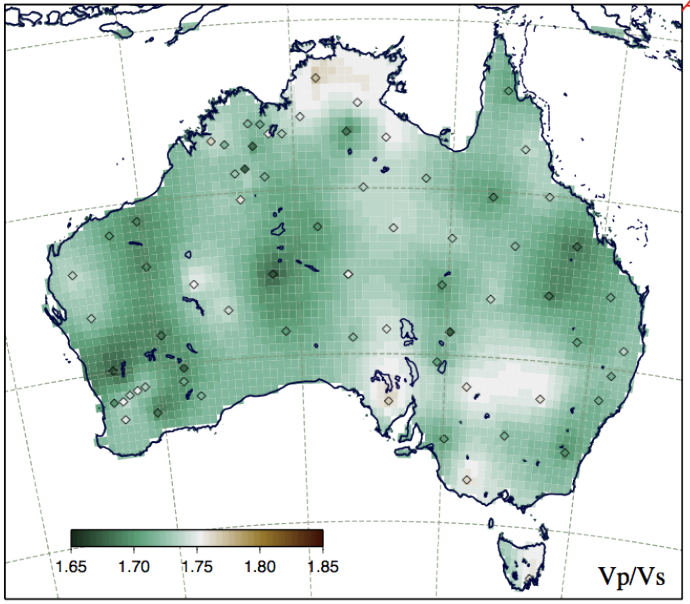
10 km



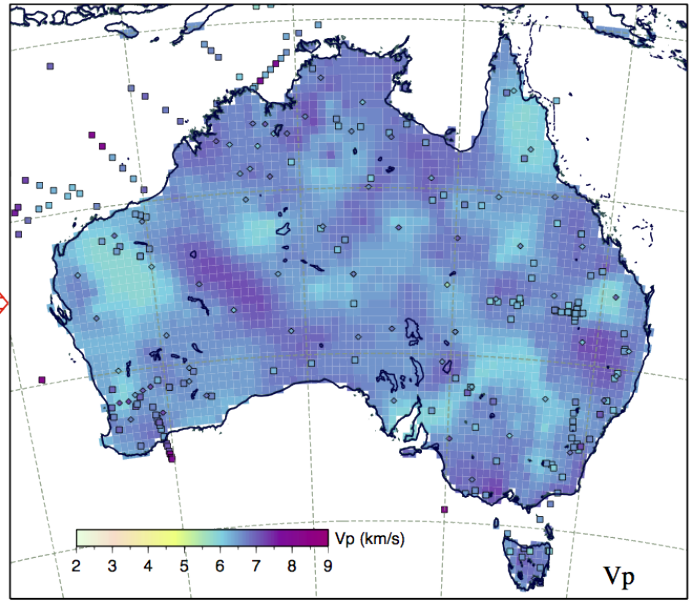
Vp/Vs

35 km

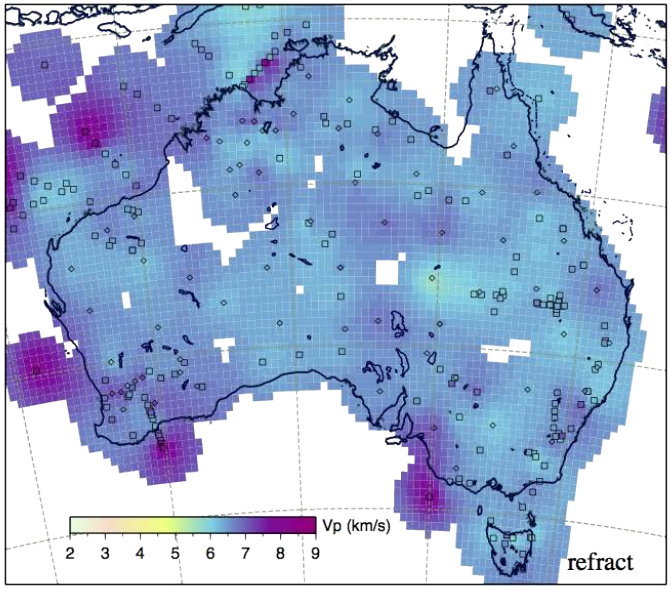


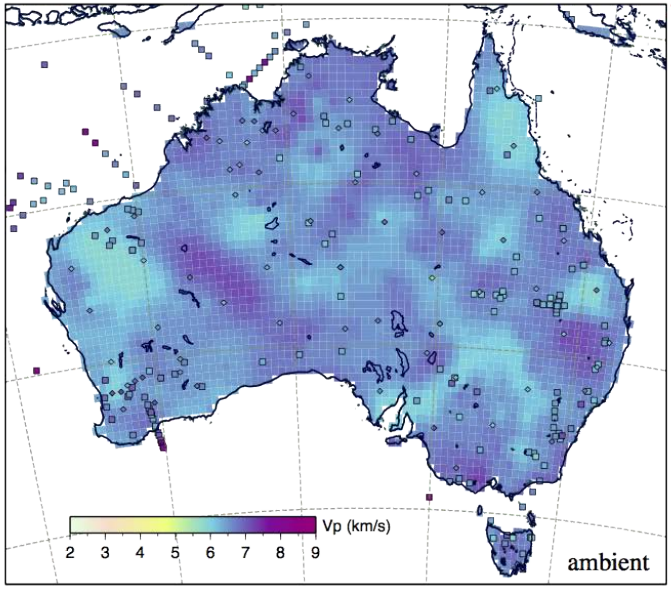


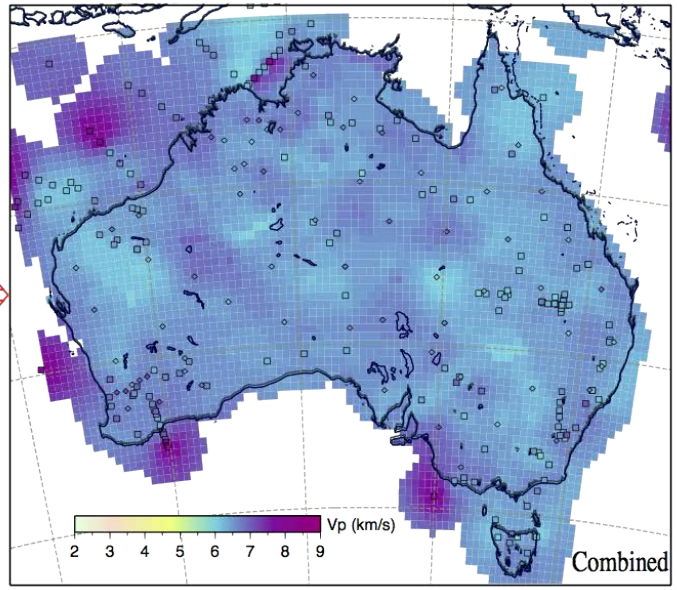
Construction of Vp field
from ambient noise results



Construction of Vp field







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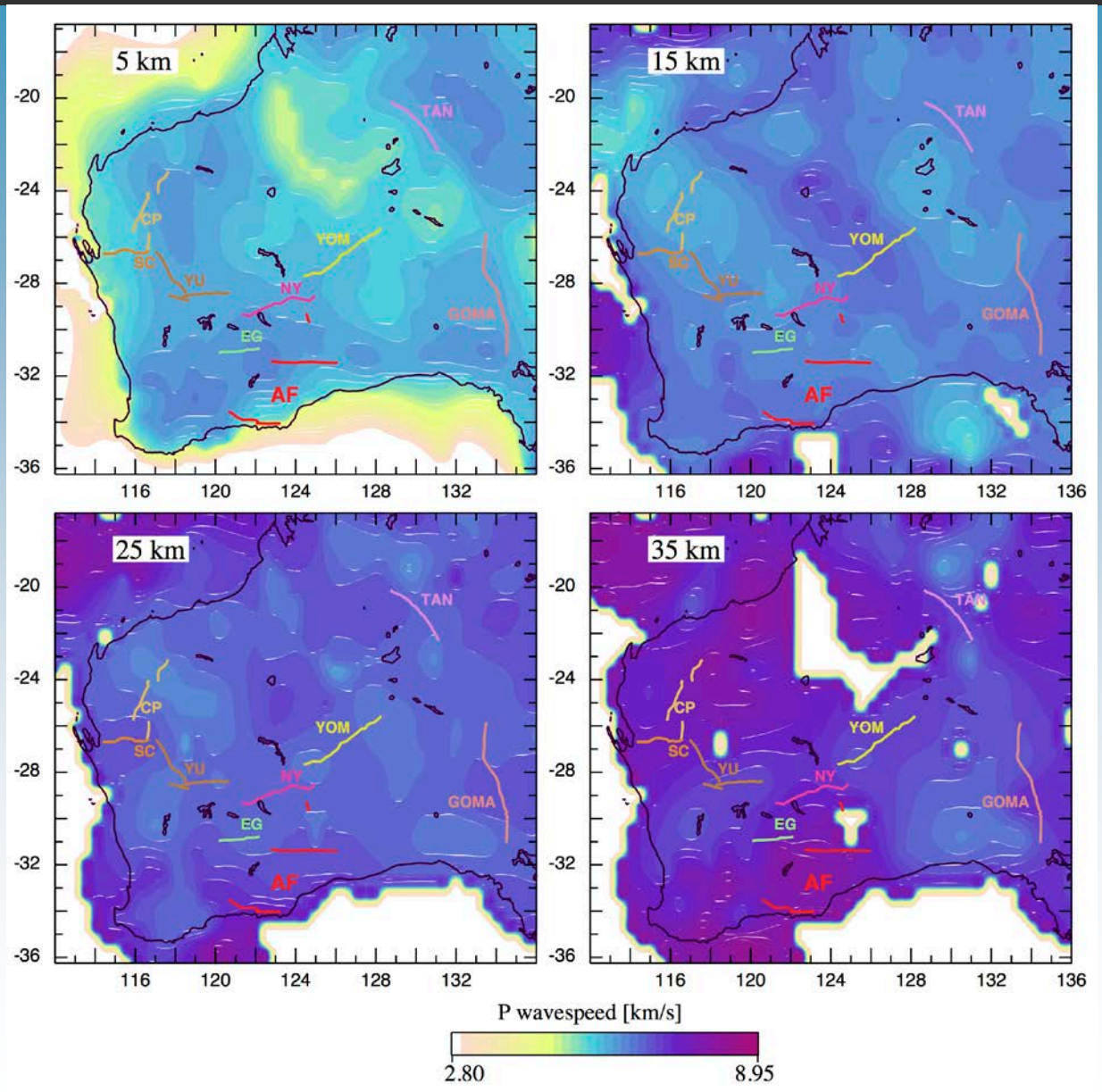
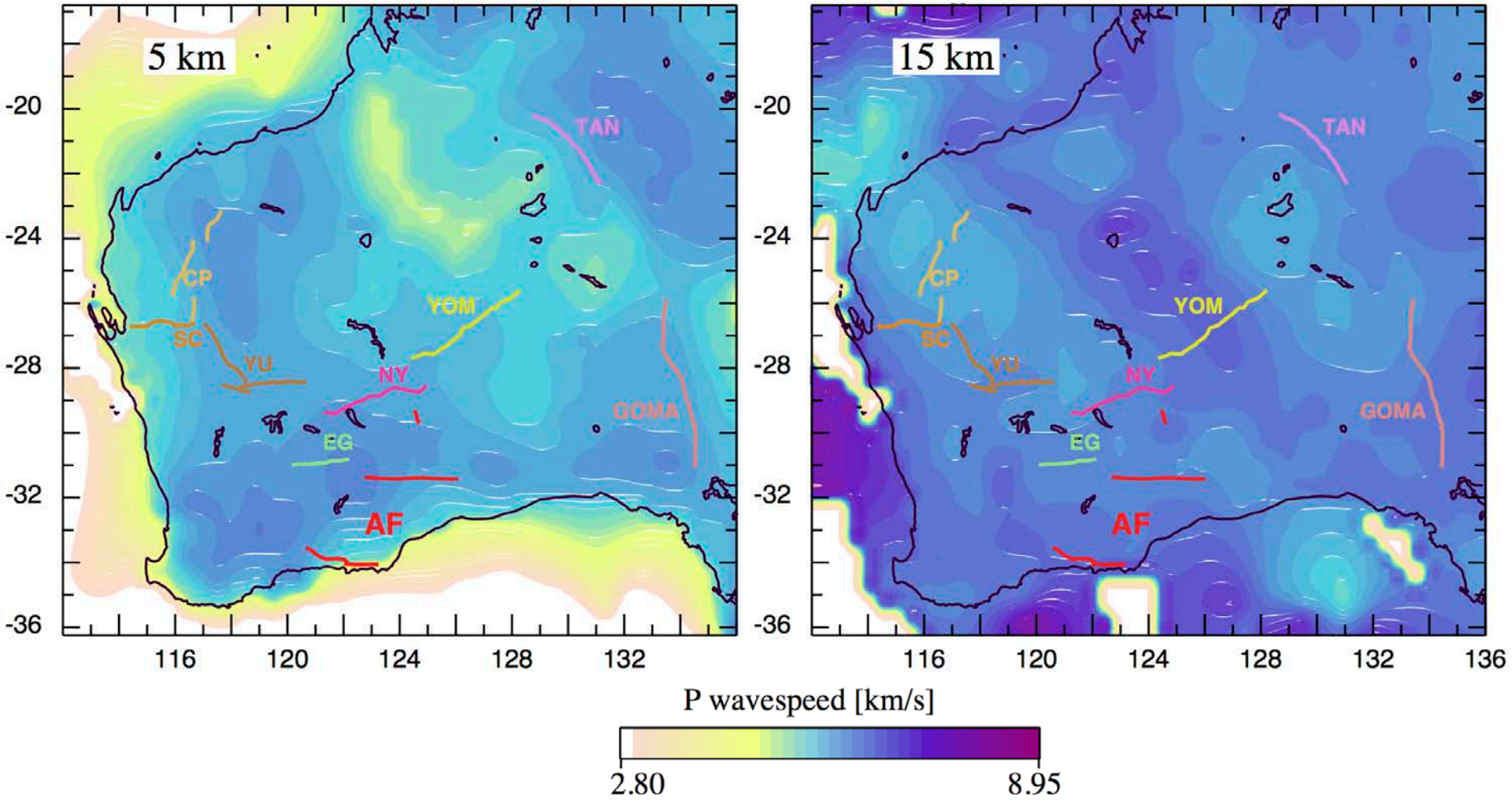
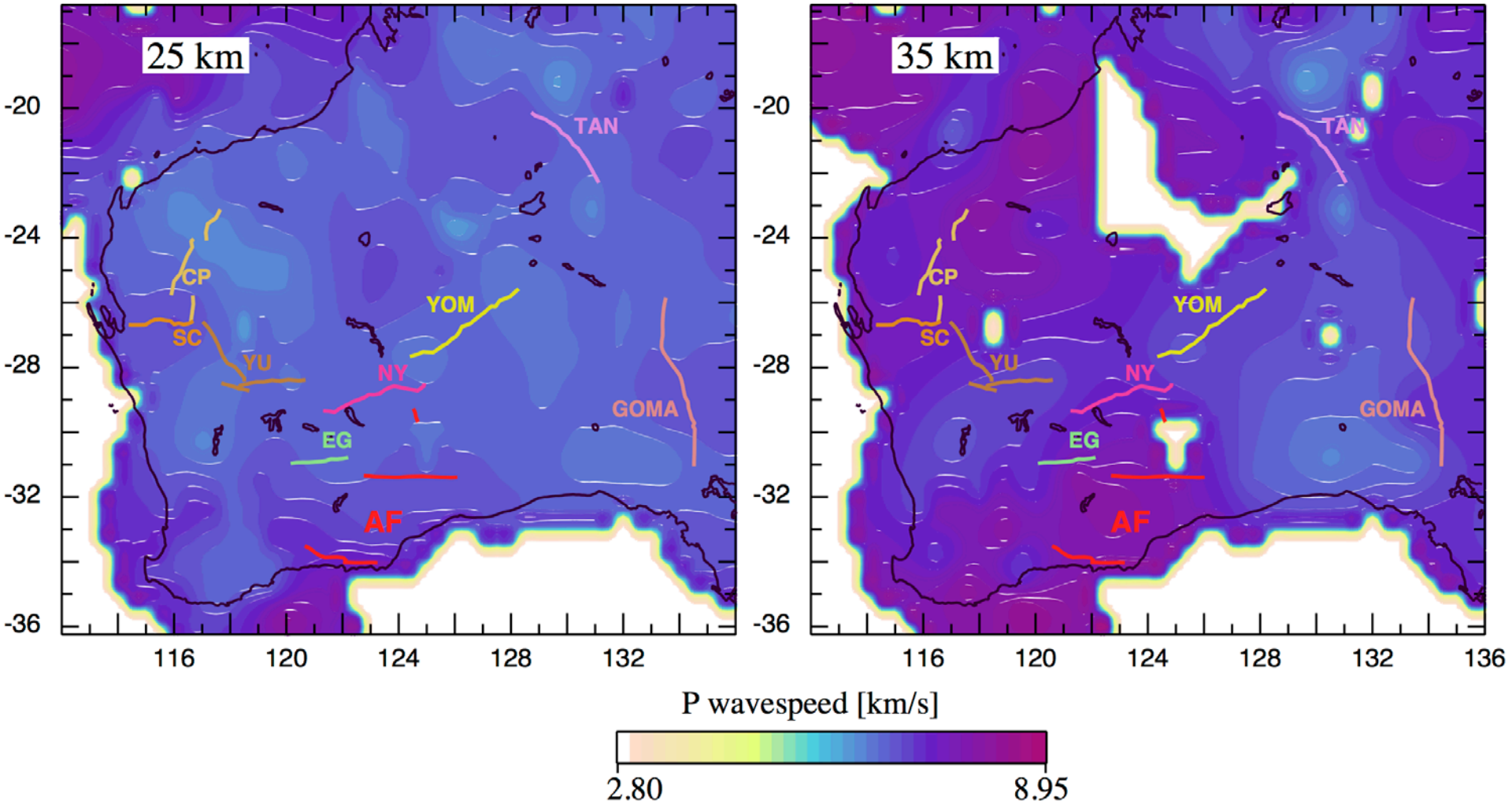
Crustal Structure near AF



Crustal Structure near AF

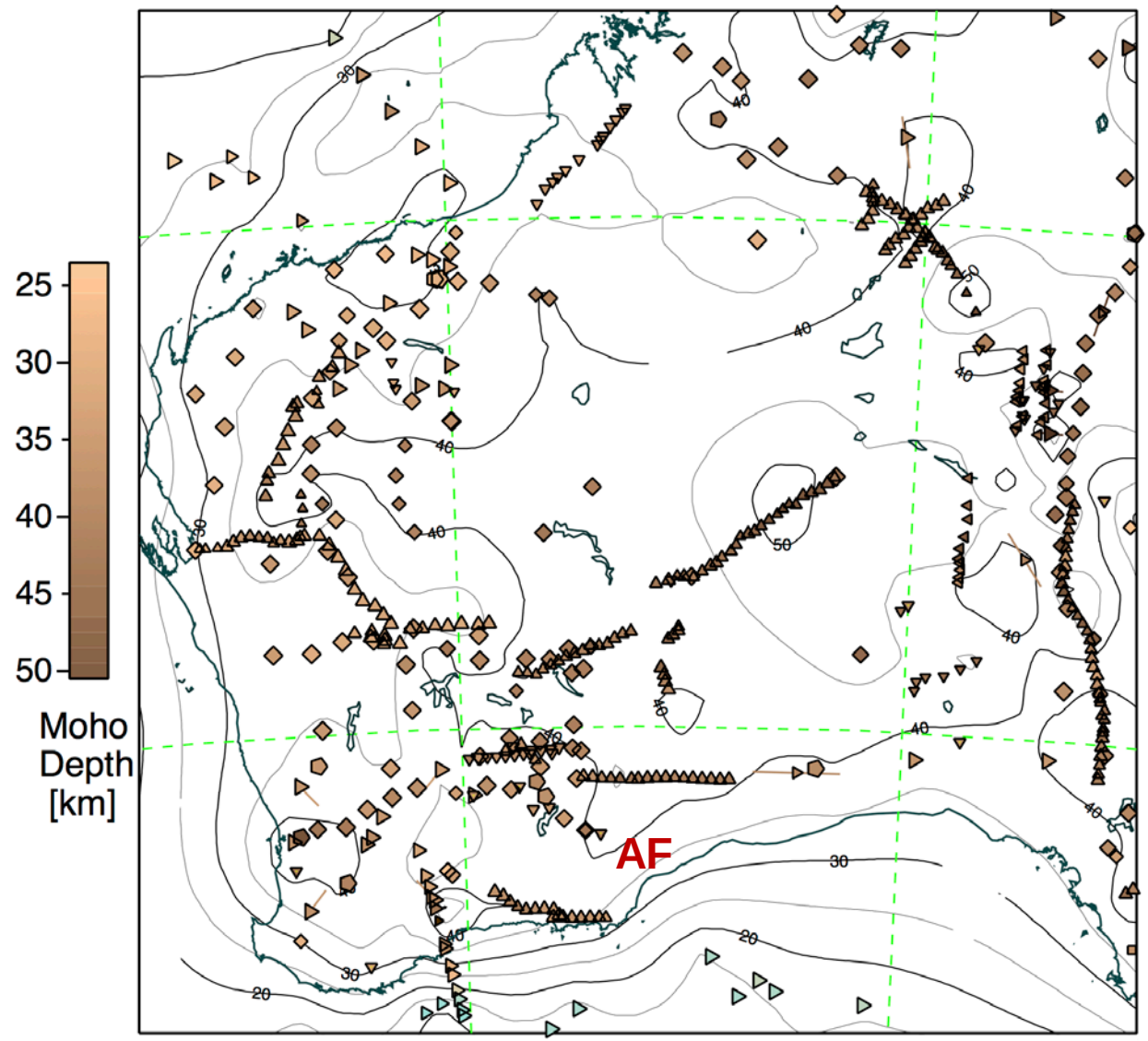


Crustal Structure near AF



Comparison of Moho Depth estimates

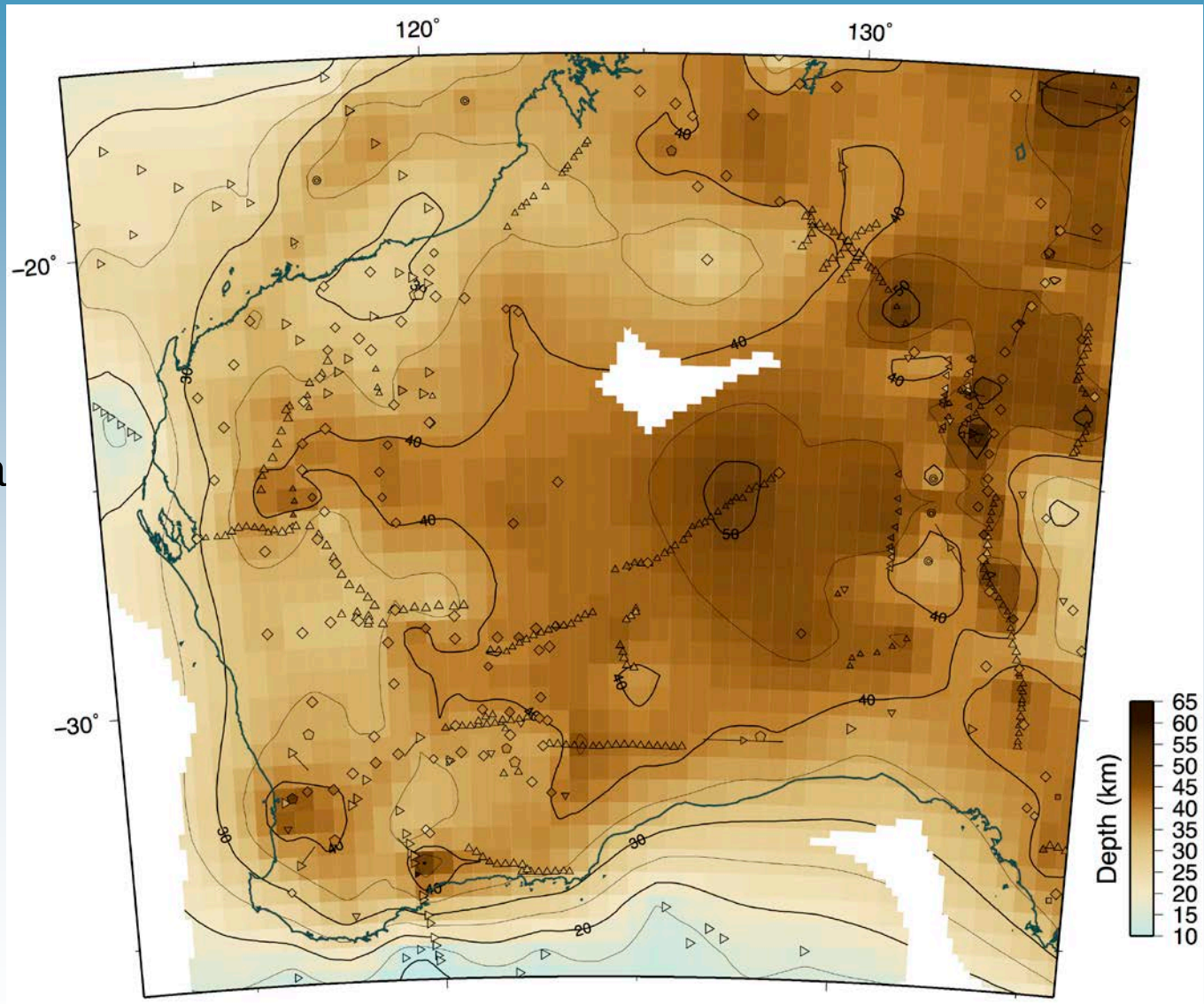
- The map summarises all the estimates for Moho depth in the neighbourhood of the AF lines
- Triangles denote depth estimates from reflection work and refraction.
- Diamonds, pentagons and squares represent results from Receiver Functions.
- The AF results provide important constraints for an undersampled area.



Moho variation across Western to Central Australia

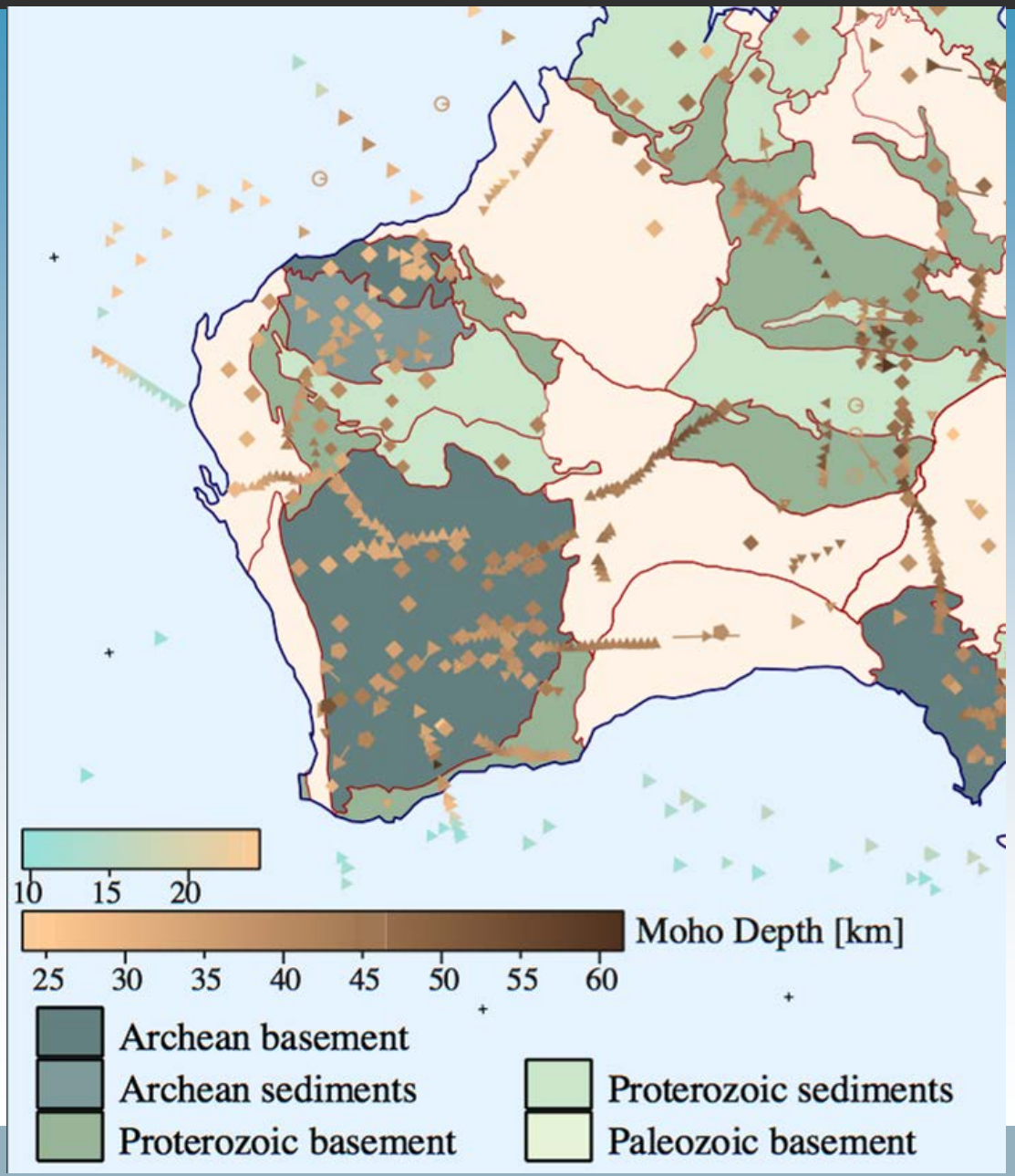
Portion of the 2013 Moho map for Australia (Salmon et al. 2013., Tectonophysics)

The map is rendered using 0.5x0.5 deg pixels



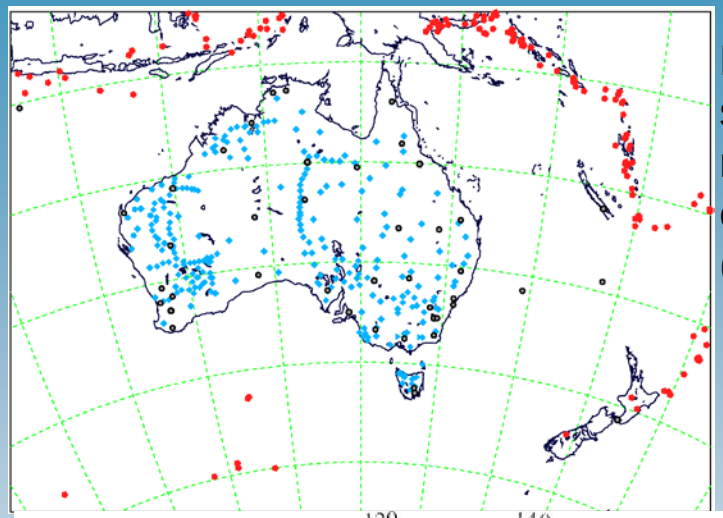
Moho depth superimposed on tectonic framework

The correlation of thinner crust with the ancient Archean blocks is very clear, as also is thickening at the craton margins.

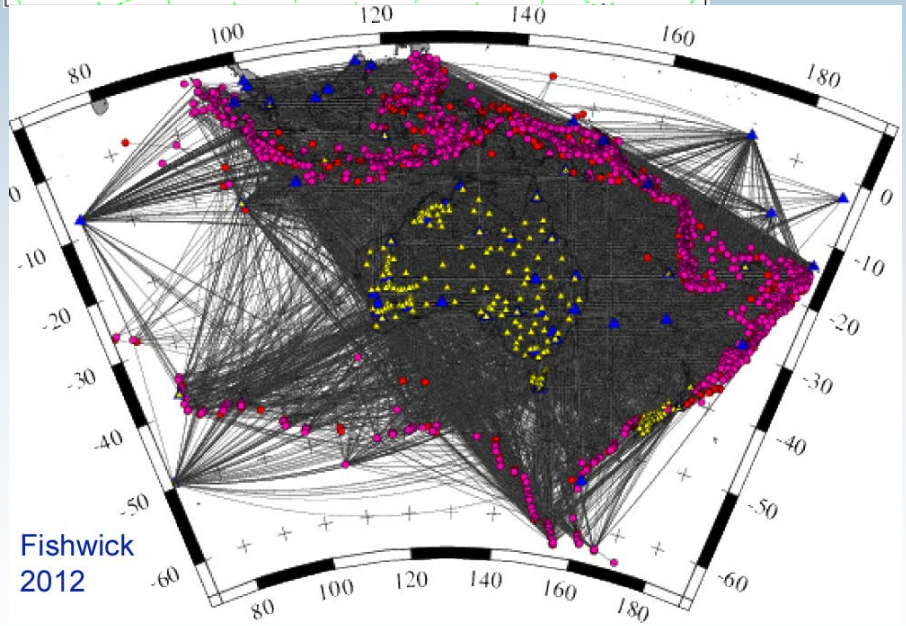


Passive Seismology – Mantle Studies

- A major tool for studying the mantle lithosphere is the use of surface wave tomography exploiting the large amplitude surface waves generated by shallow earthquakes
- Waveforms are matched with calculations to extract information on structure and build 3-D models
- Can also use higher frequency body wave arrivals



Broad-band stations and regional events (one year)



AuSREM: Mantle Component

- Primary source of information comes from seismic surface wave tomography (multiple studies)
- Representative model has been developed to capture the features of a range of studies for SV and SH
- Body wave studies and regional tomography provide useful constraints on the relation between P and S wavespeeds.
- The mantle model extends beyond the continent and so covers a larger area than for the crust.
- Below 300 km and in the surrounding area AuSREM is linked to the S40RTS model (Ritsema et al., 2011).

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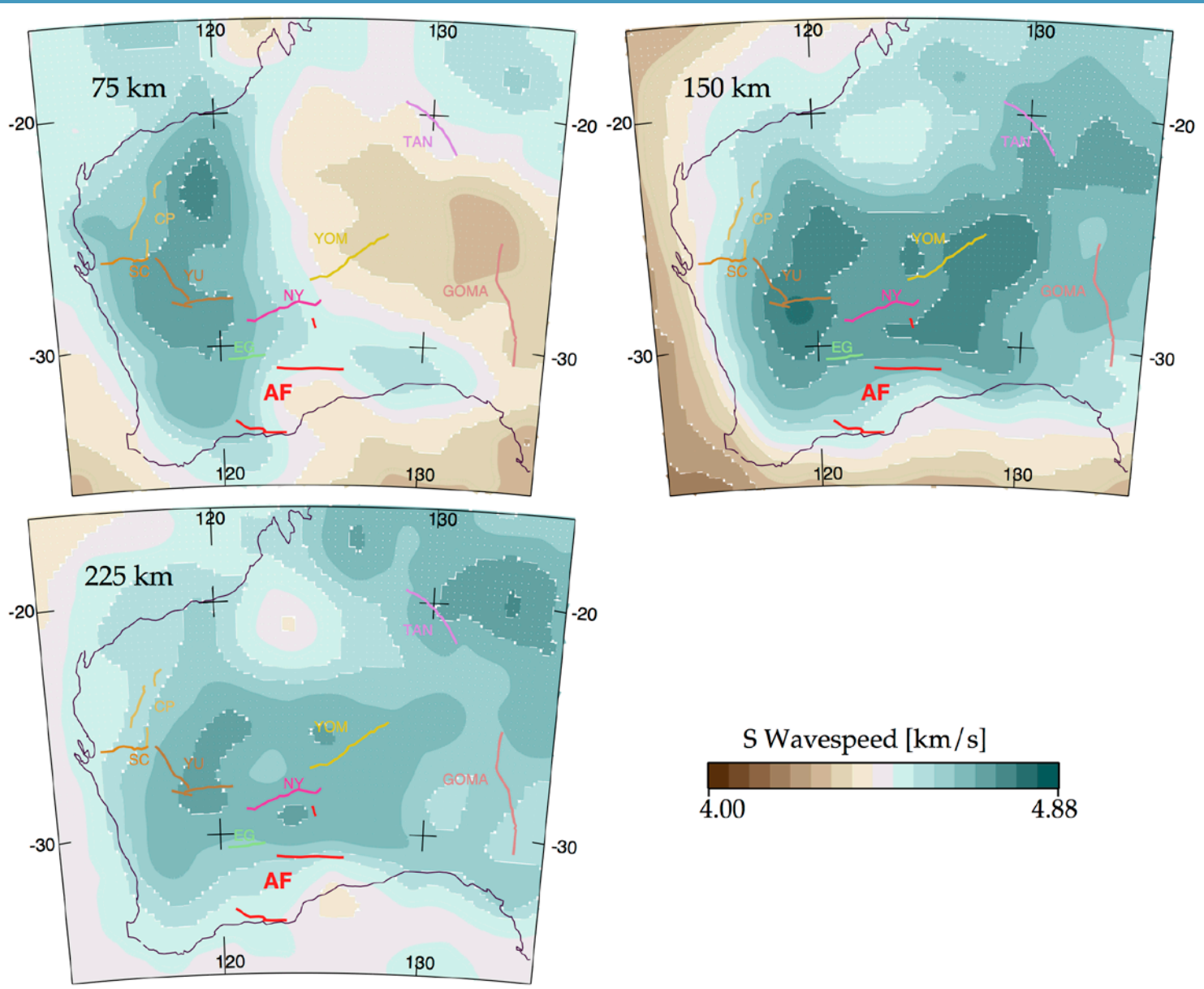
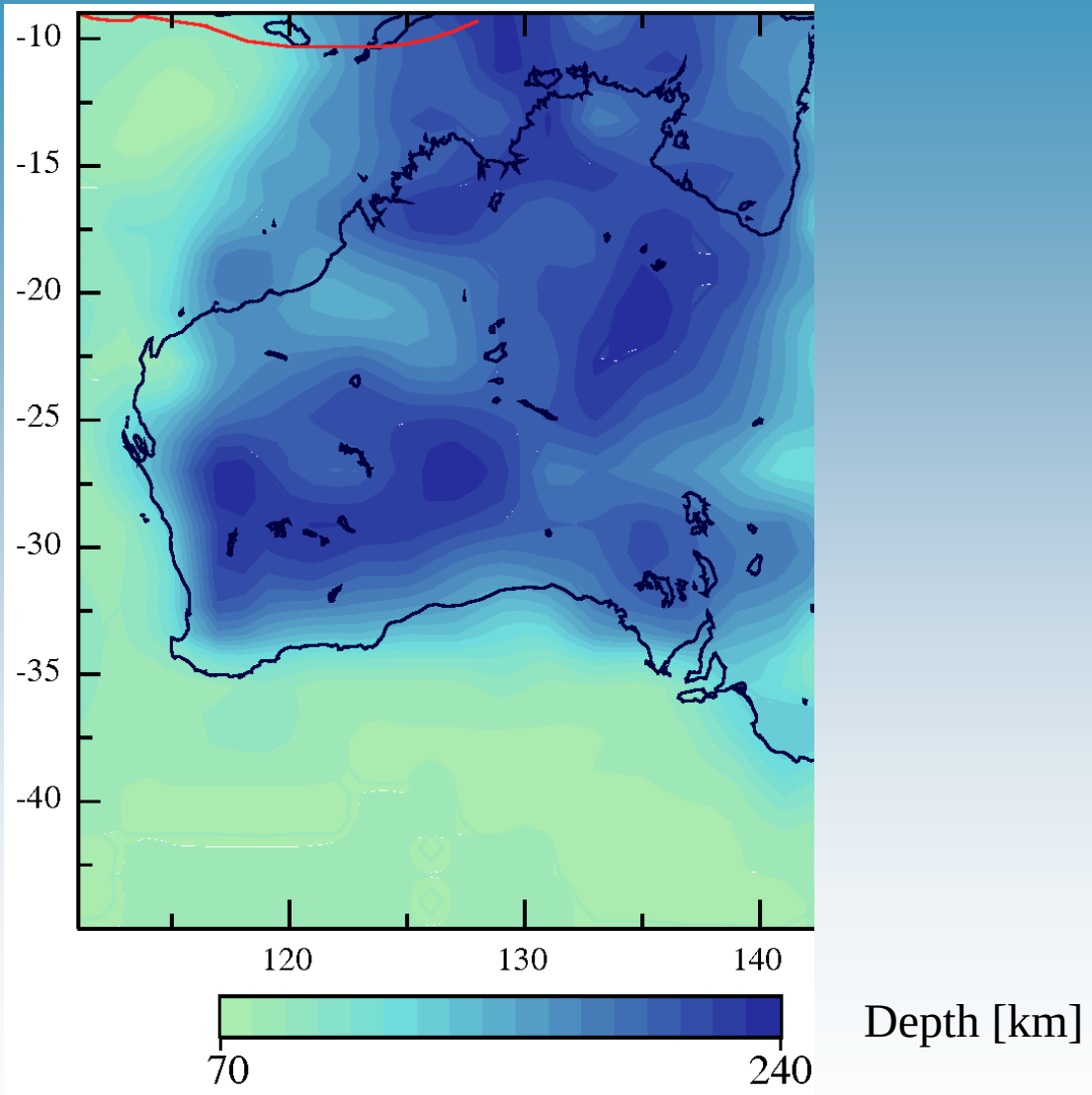
SV wavespeed in mantle



Base of Lithosphere



Depth to base of lithosphere based on wavespeed gradients

Acknowledgments

- Surface Wave Tomography: S. Fishwick, K.Yoshizawa, A. Fichtner
- Receiver Functions (WA): A. Reading
- Ambient Noise Tomography: E. Saygin
- AuSREM Crust & Moho map compilation: M. Salmon

- All the members of RSES who have helped with the collection of portable seismic data and subsequent data handling.