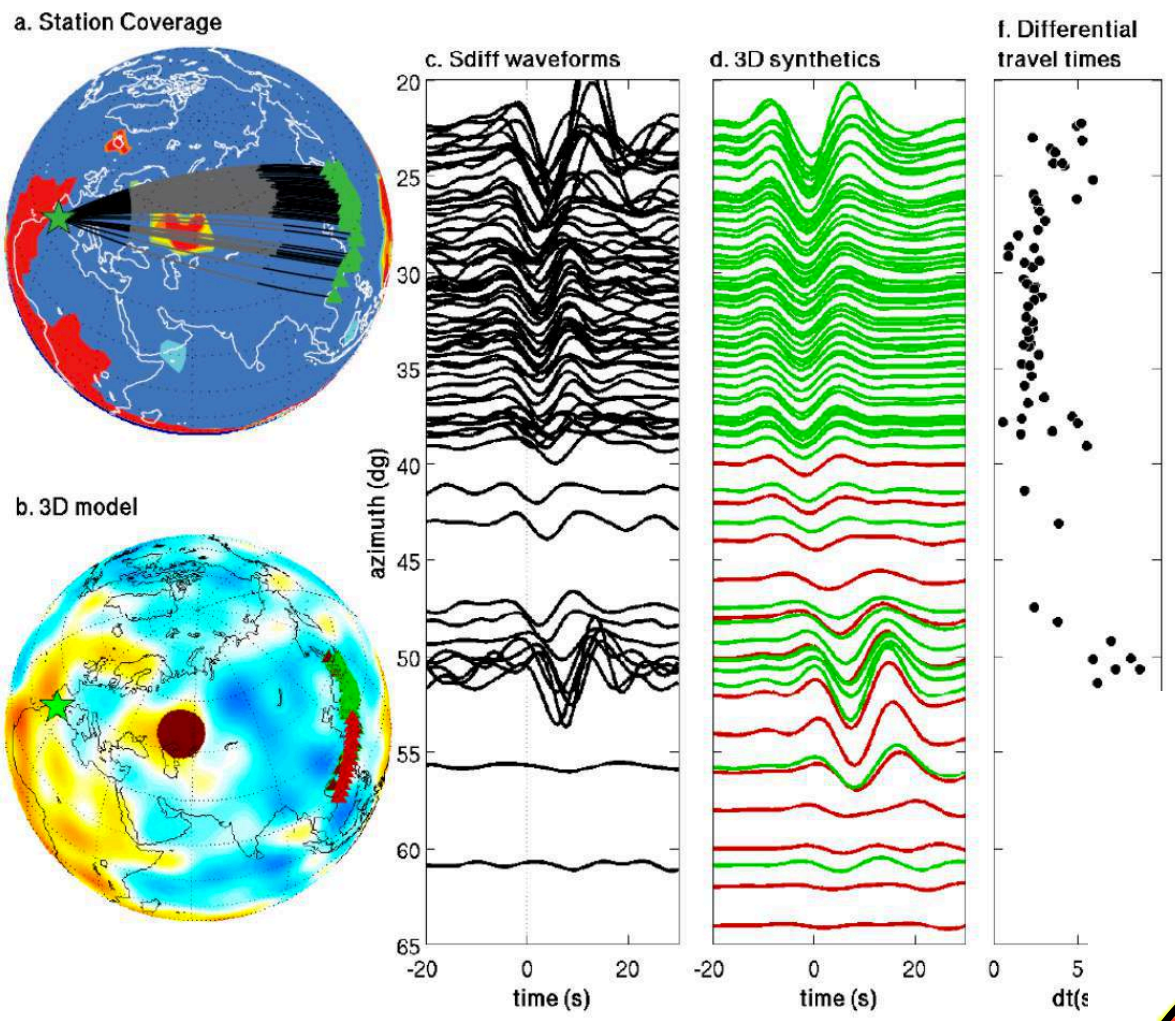
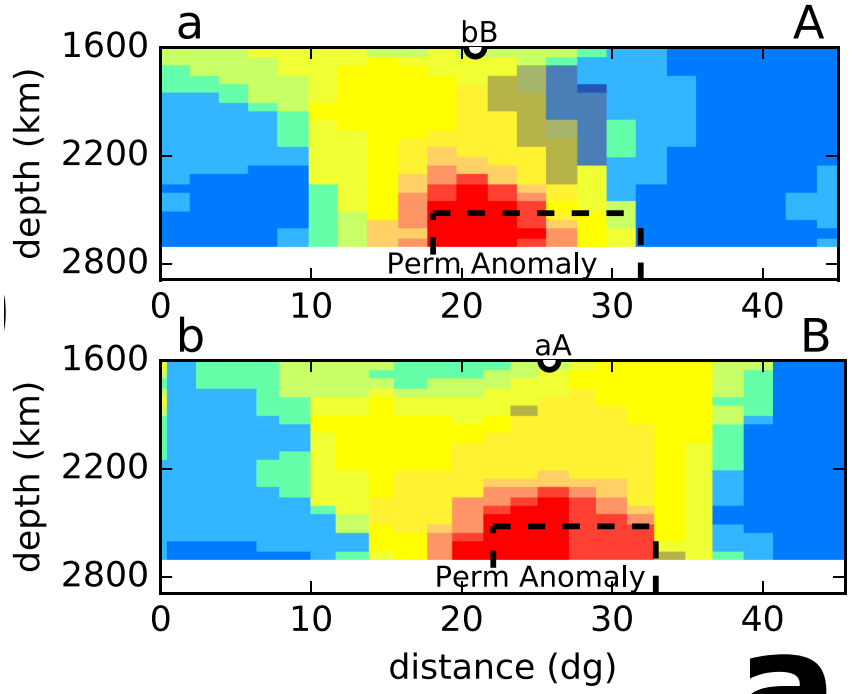
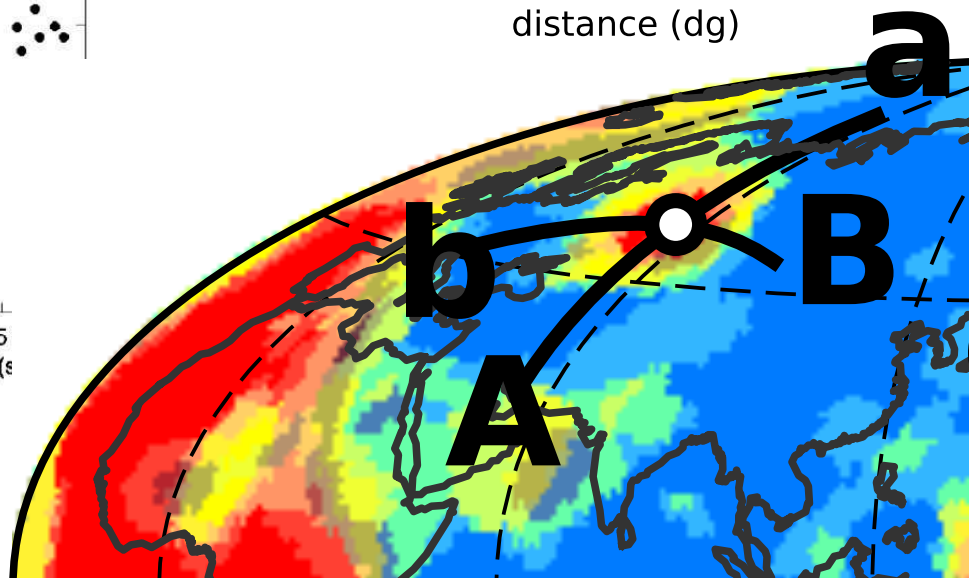
MESOSCALE FEATURES – PERM ANOMALY

Cottaar & Lekic 2016

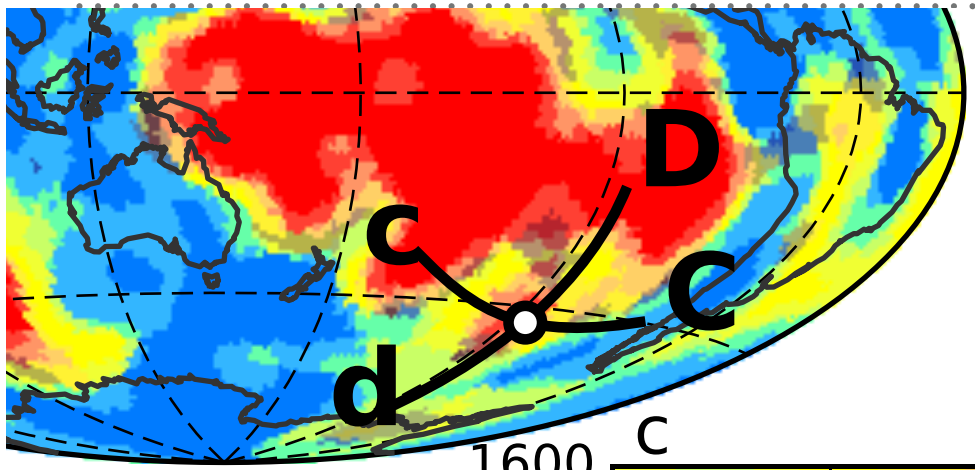


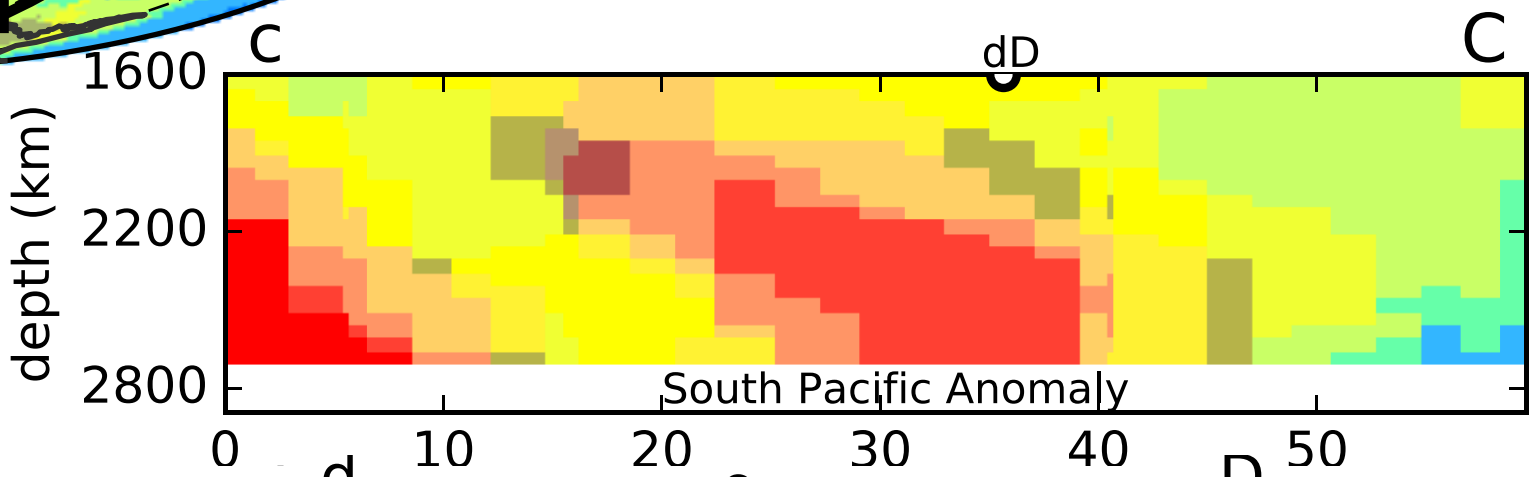


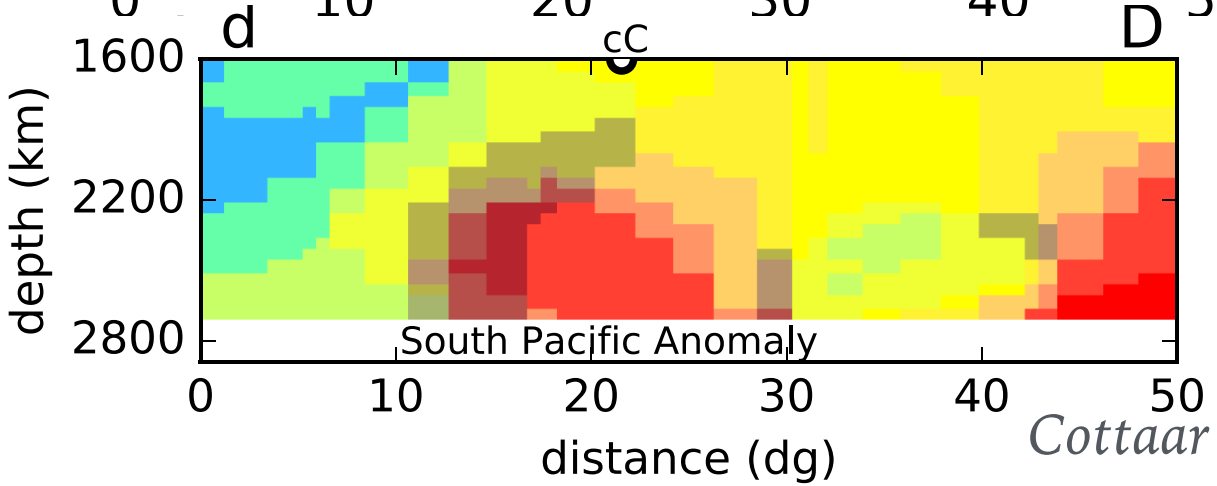


Lekic et al. 2012

MESOSCALE FEATURES – SOUTH PACIFIC ANOMALY



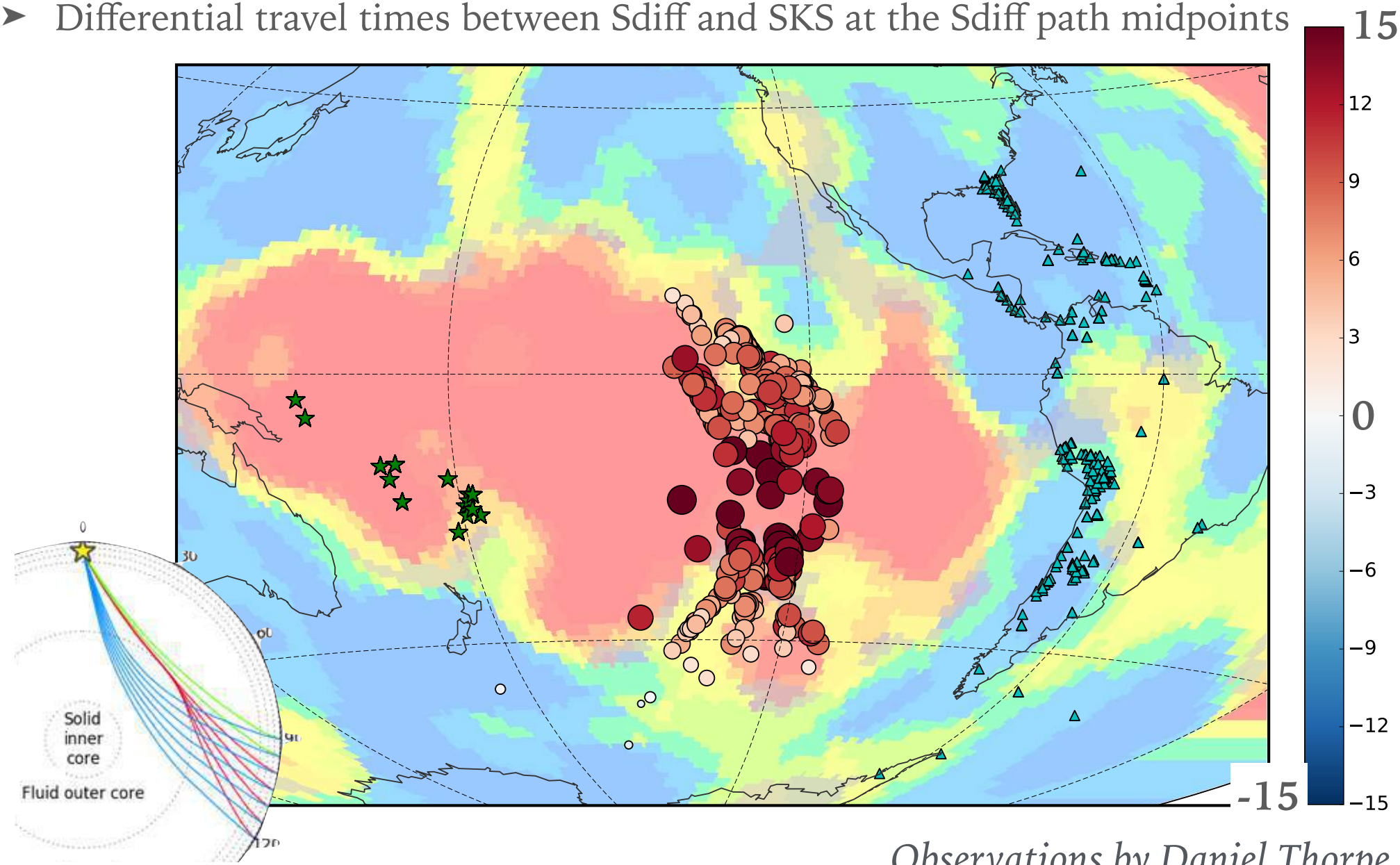




Cottaar & Lekic 2016

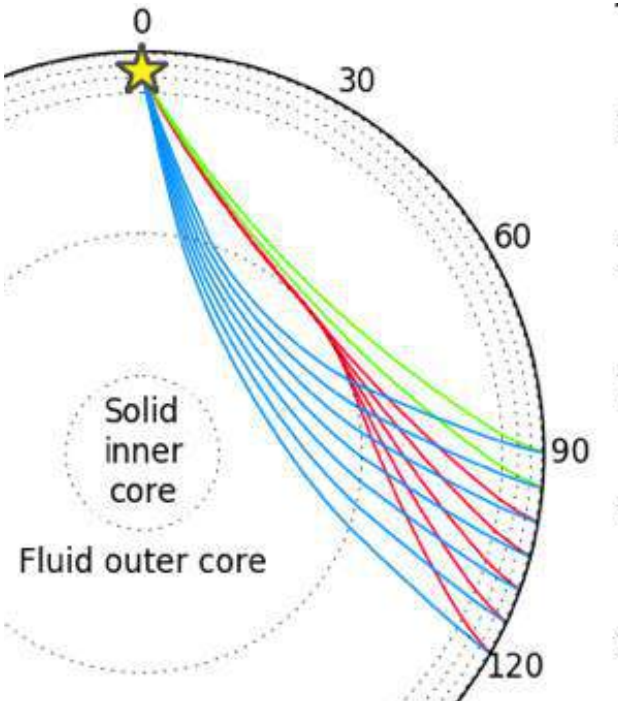
MESOSCALE FEATURES – SOUTH PACIFIC ANOMALY

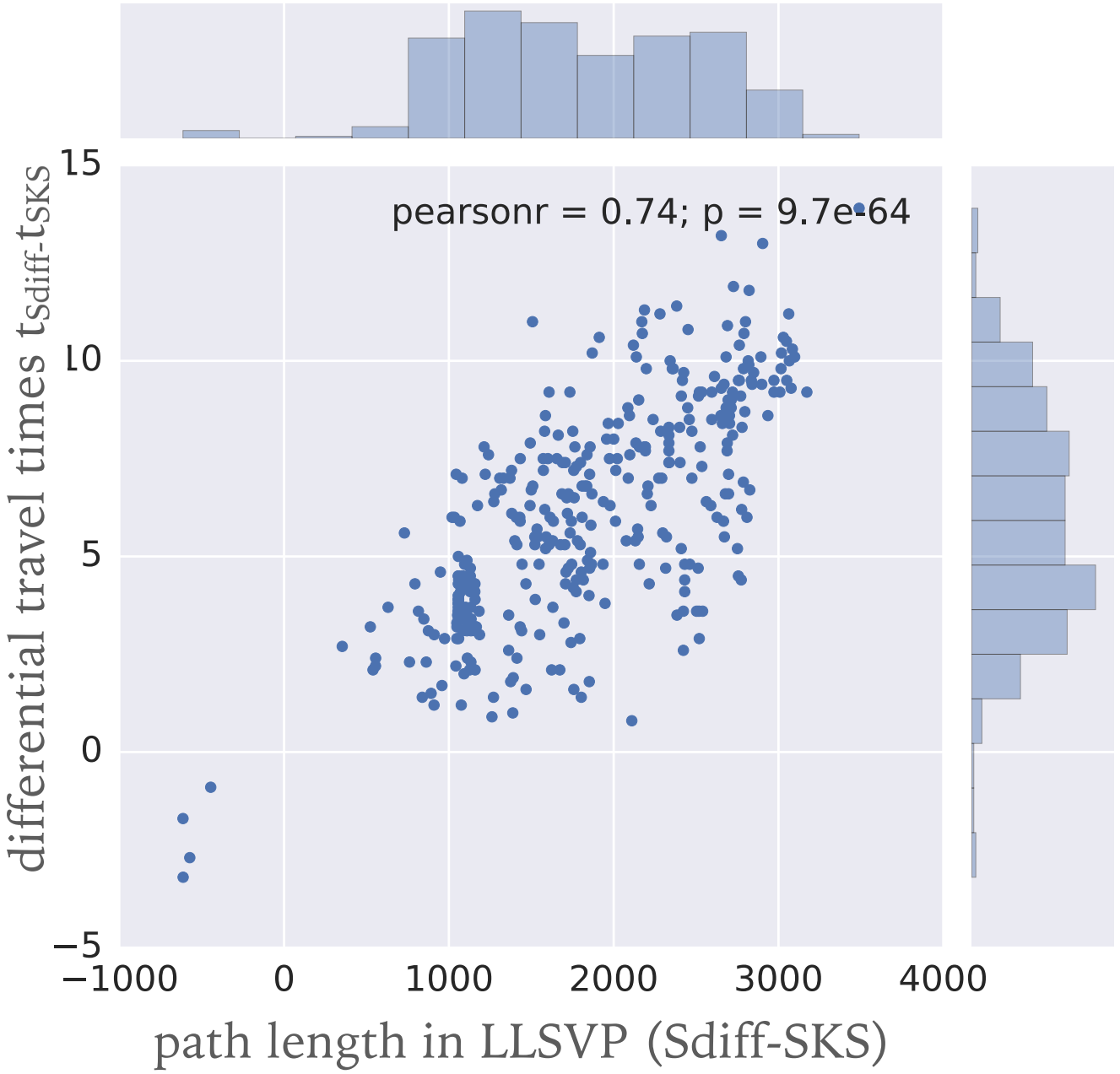
- Differential travel times between Sdiff and SKS at the Sdiff path midpoints



Observations by Daniel Thorpe

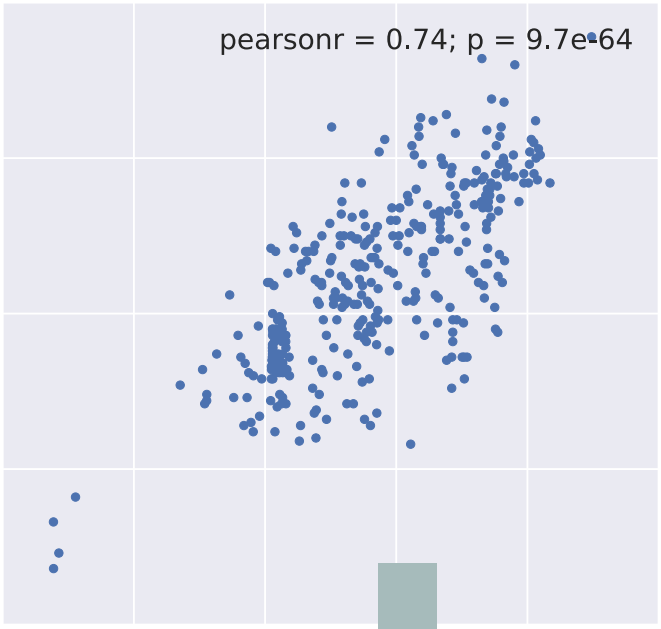
MESOSCALE FEATURES – SOUTH PACIFIC ANOMALY

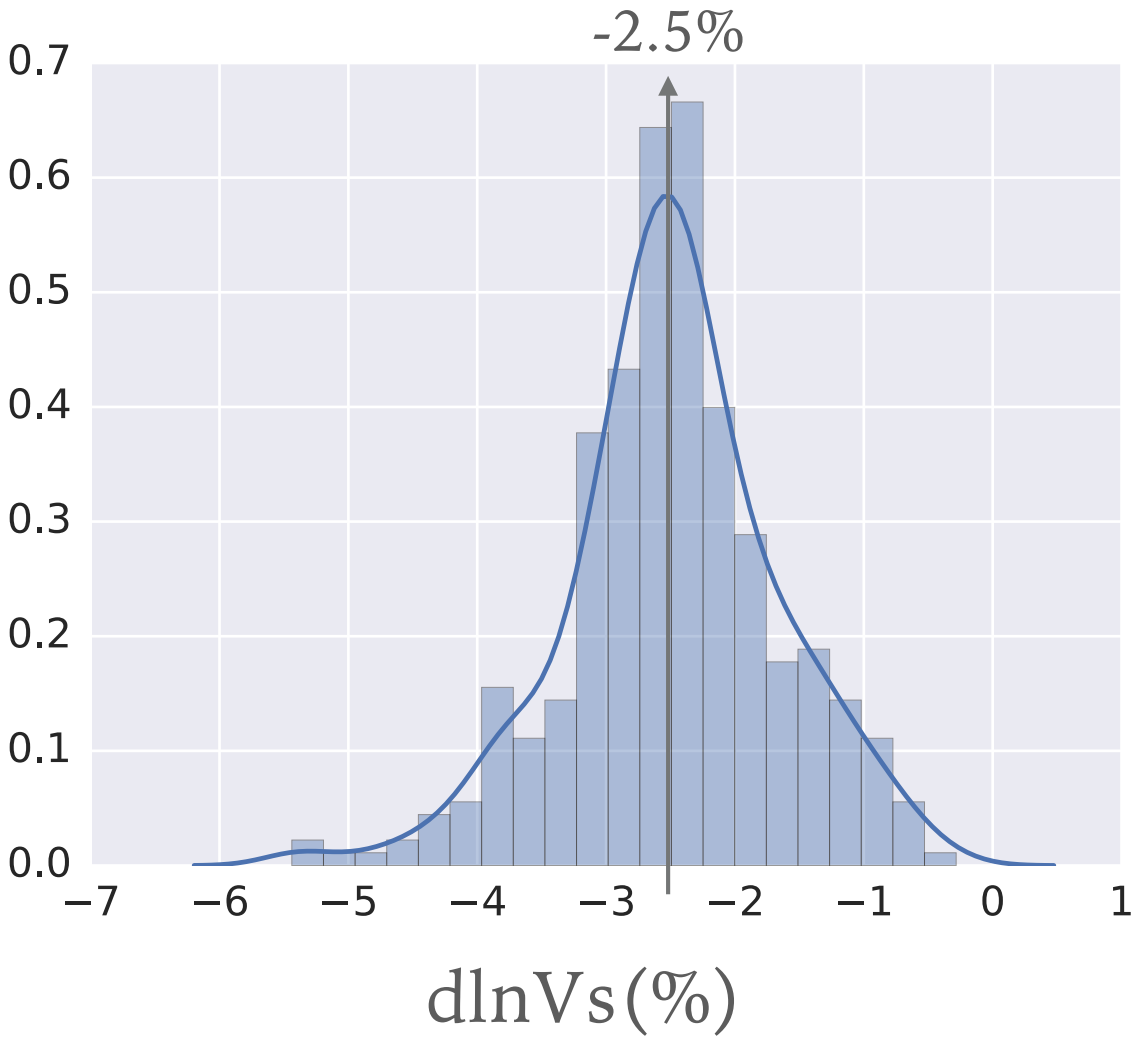




MESOSCALE FEATURES – SOUTH PACIFIC ANOMALY

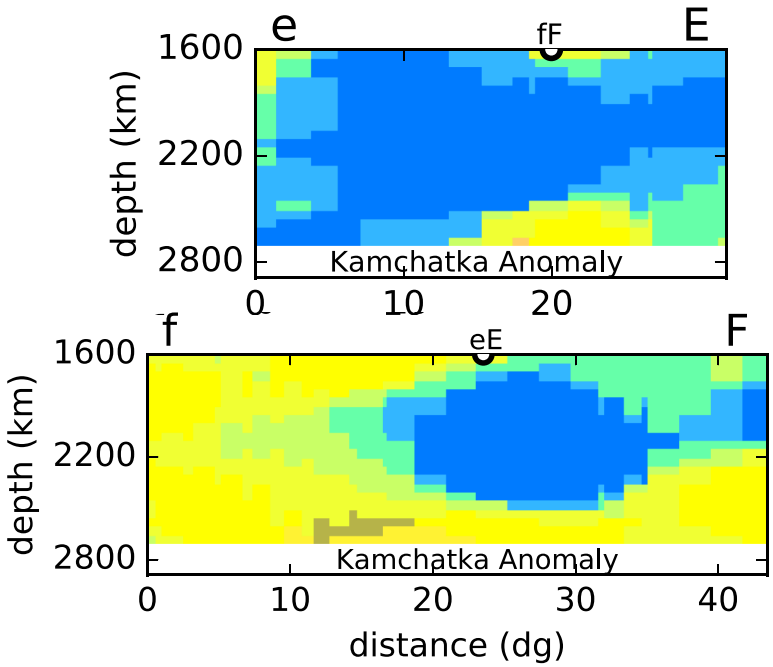
- Average velocity reduction within the LLSVP around -2.5%.



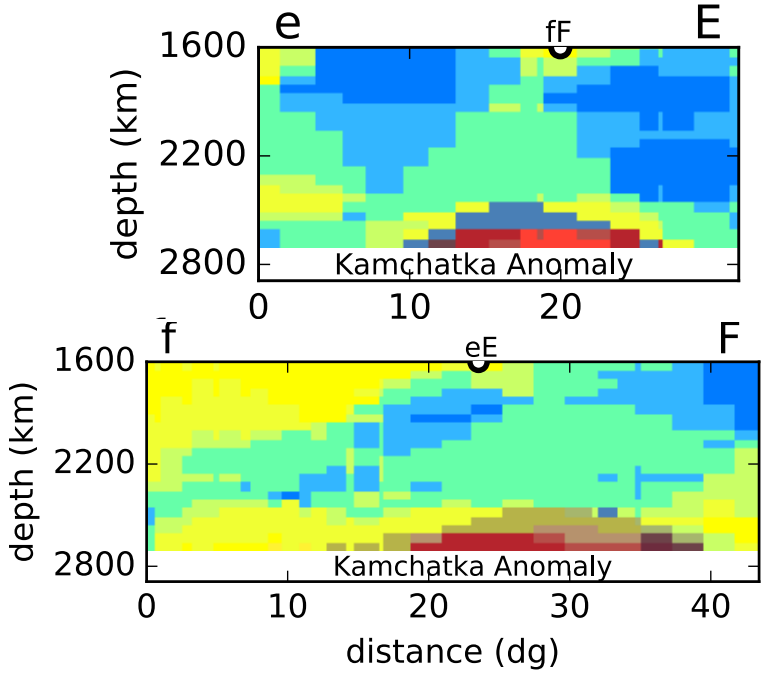


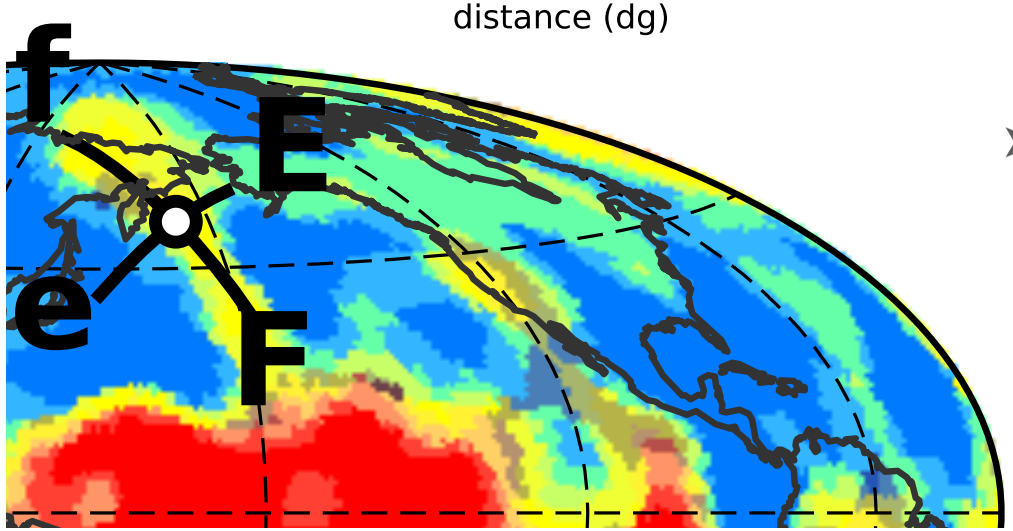
MESOSCALE FEATURES – LOW BULK MODULUS ANOMALY?

Vs models



Vp models



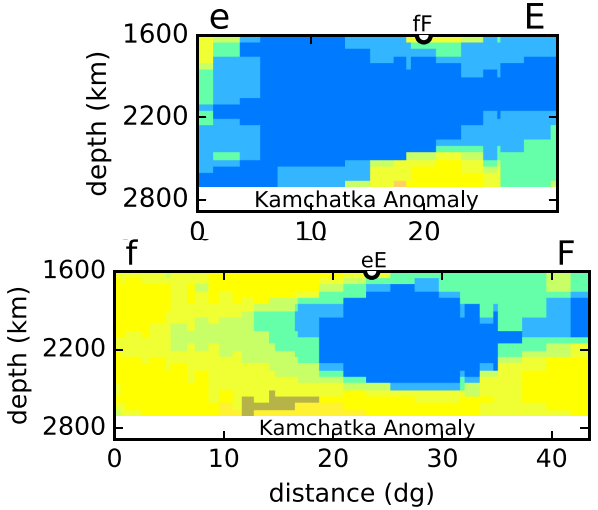


- A matter of resolution or reflection of material properties?

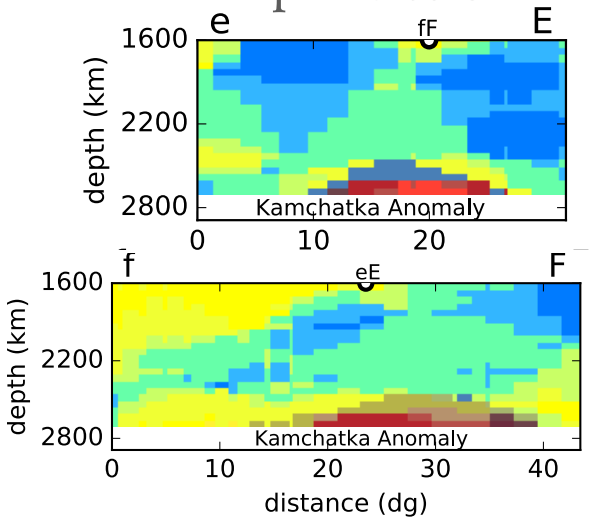
Cottaar & Lekic 2016

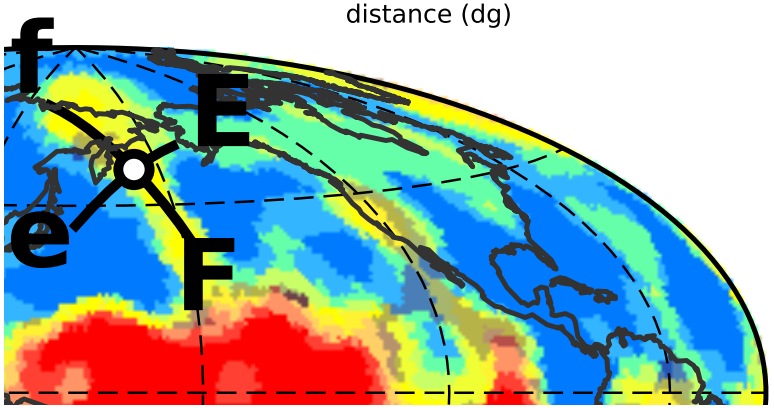
MESOSCALE FEATURES – LOW BULK MODULUS ANOMALY?

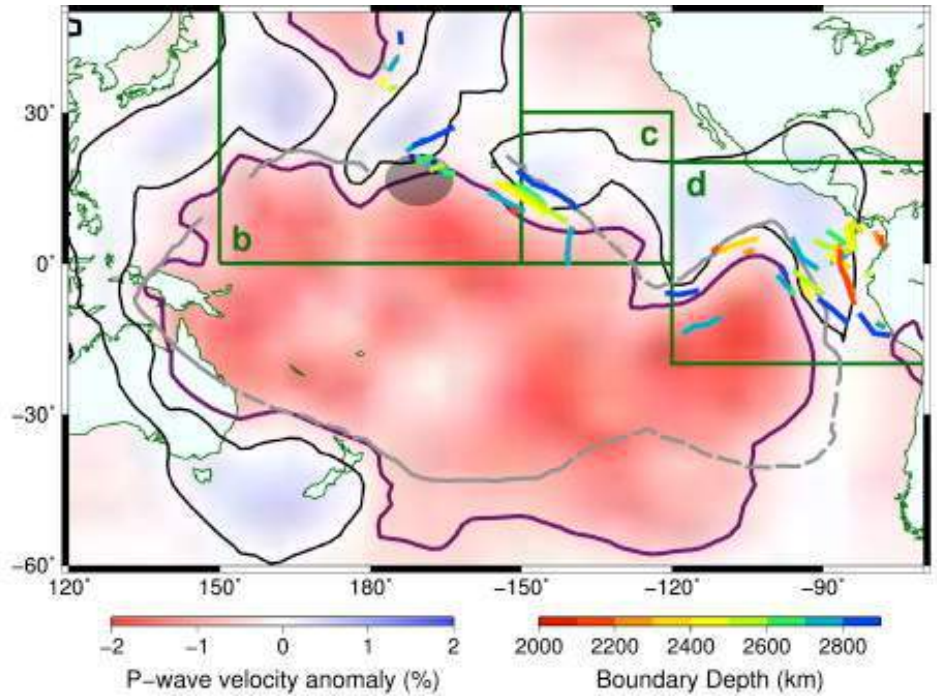
Vs models



Vp models





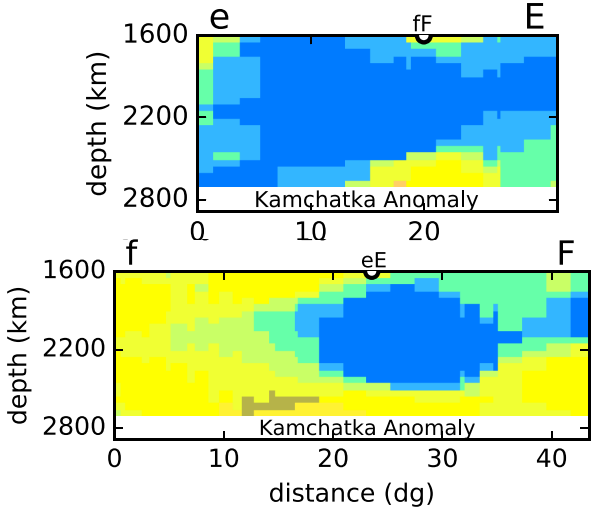


Frost & Rost 2014

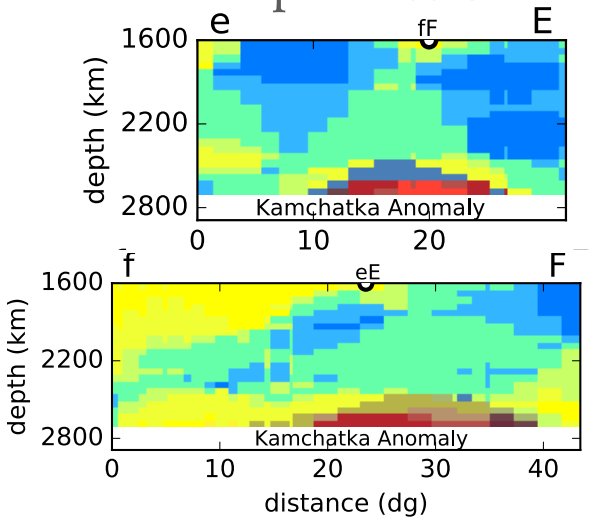
background: GyPSuM (Simmons et al. 2010)

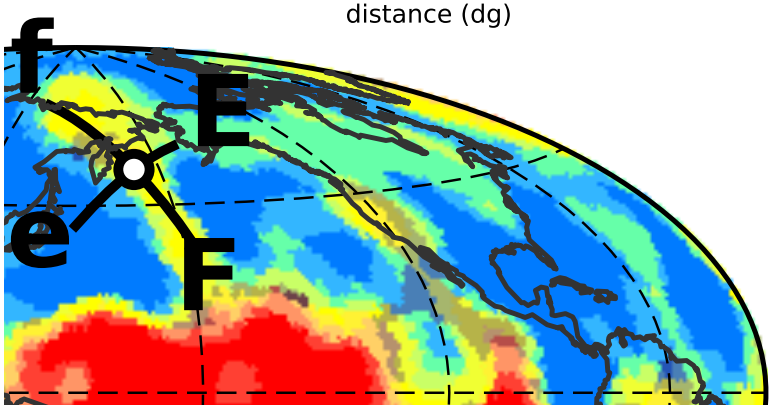
MESOSCALE FEATURES – LOW BULK MODULUS ANOMALY?

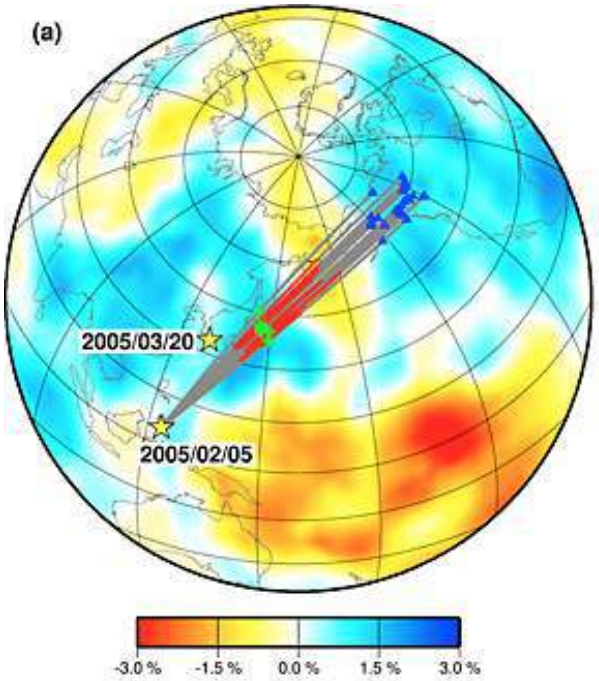
Vs models

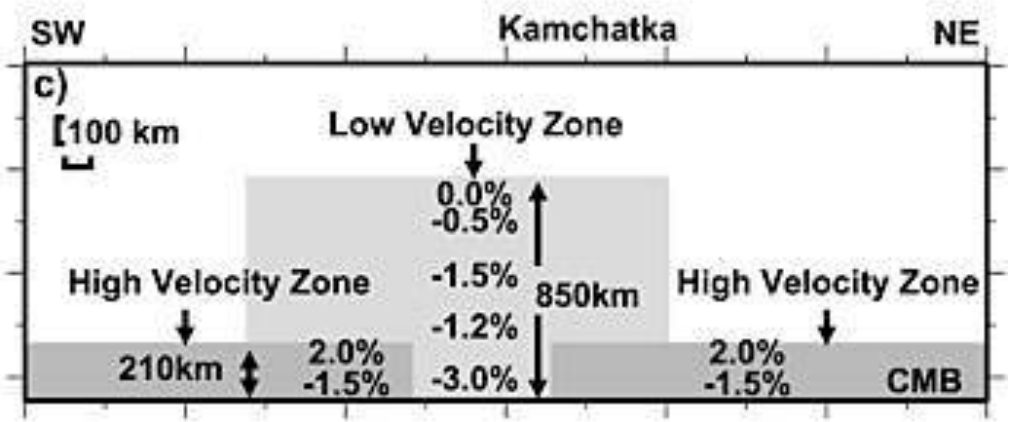


Vp models







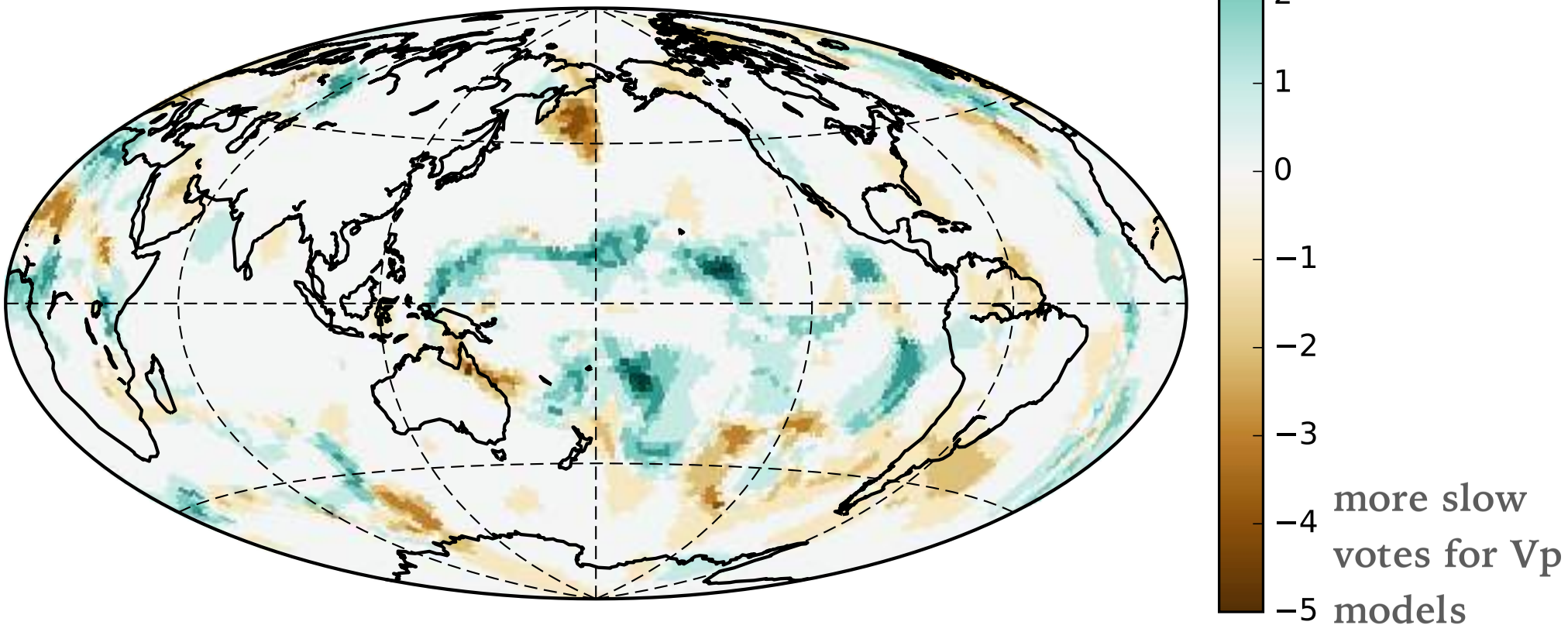


He et al. 2014

MESOSCALE FEATURES – LOW BULK MODULUS ANOMALY?

Differential vote map between Vs and Vp models

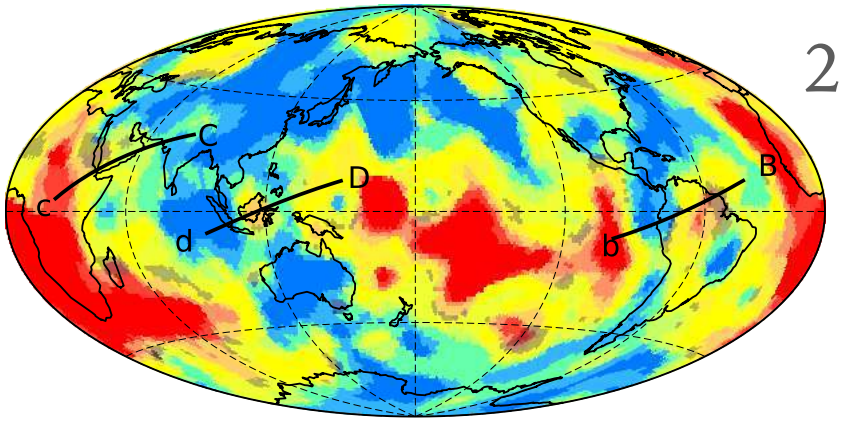
2700 km



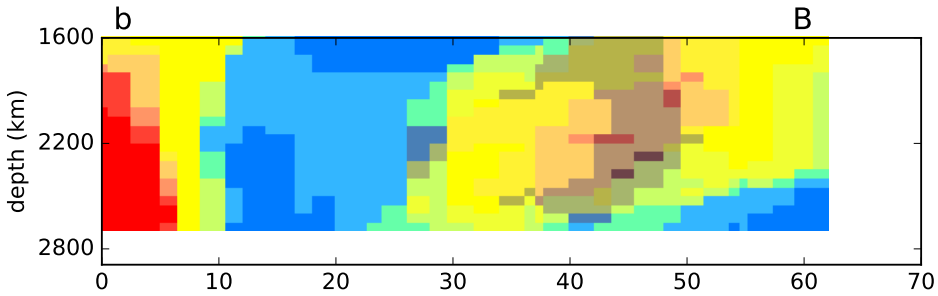
MESOSCALE FEATURES – 'FLOATING' ANOMALIES

S velocity models vote map

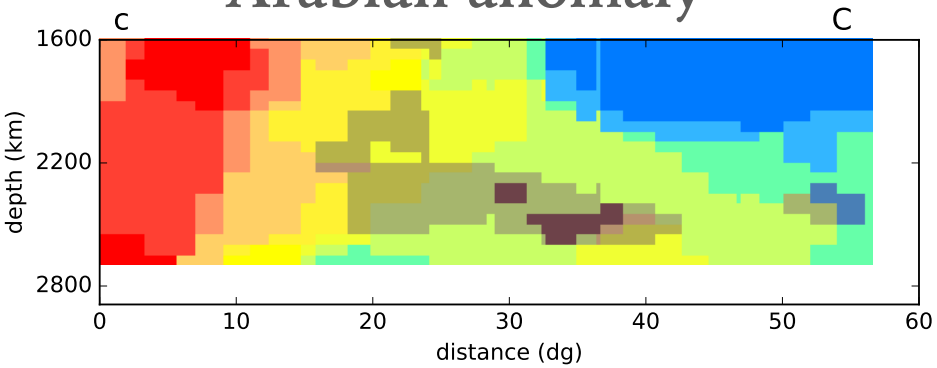
2200 km



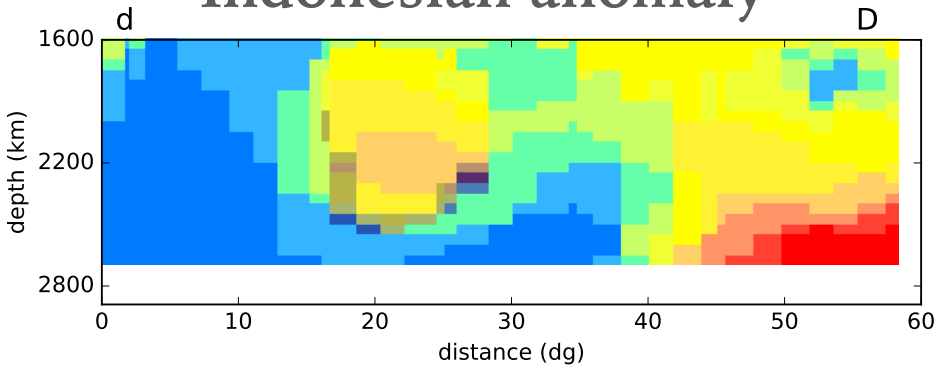
Amazon anomaly



Arabian anomaly



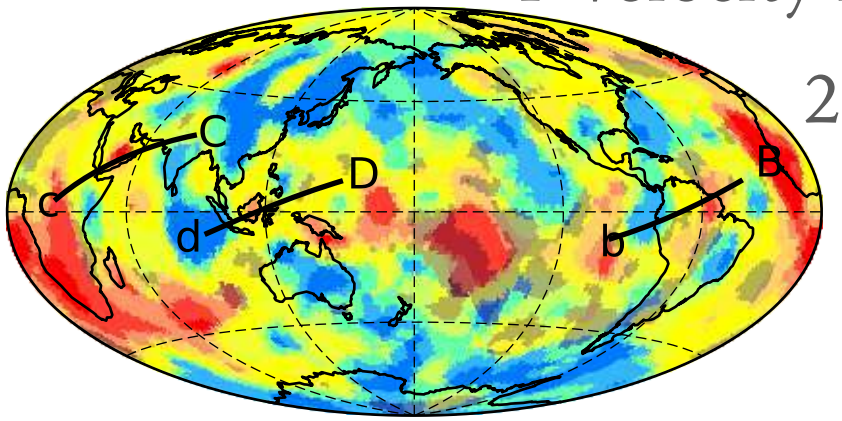
Indonesian anomaly



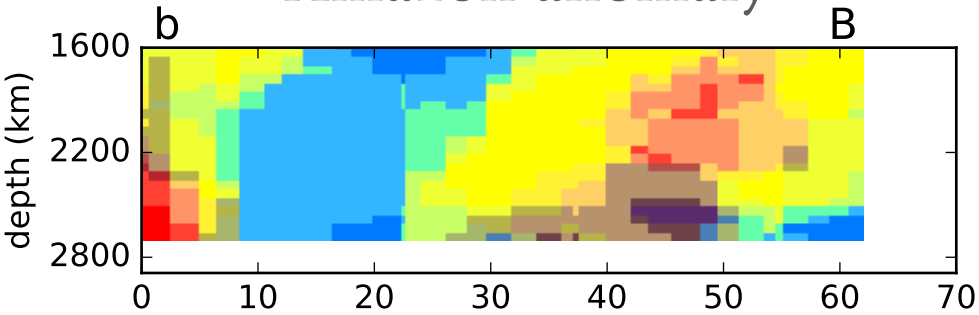
MESOSCALE FEATURES – 'FLOATING' ANOMALIES

P velocity models vote map

2200 km



Amazon anomaly



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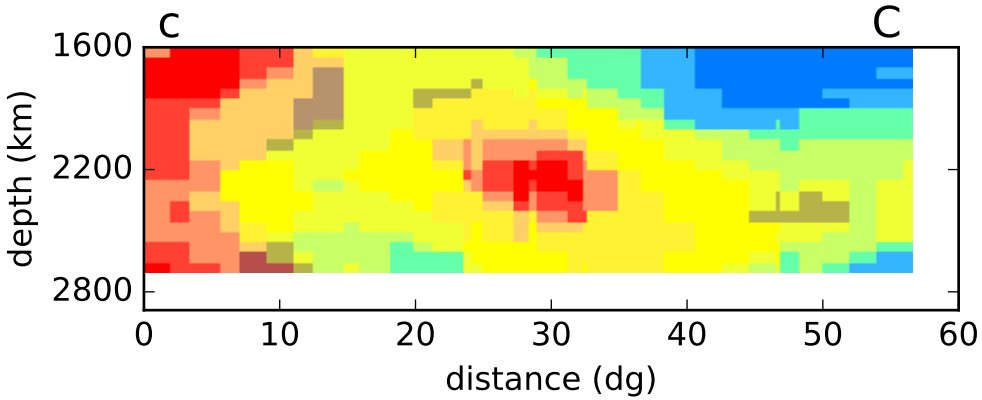

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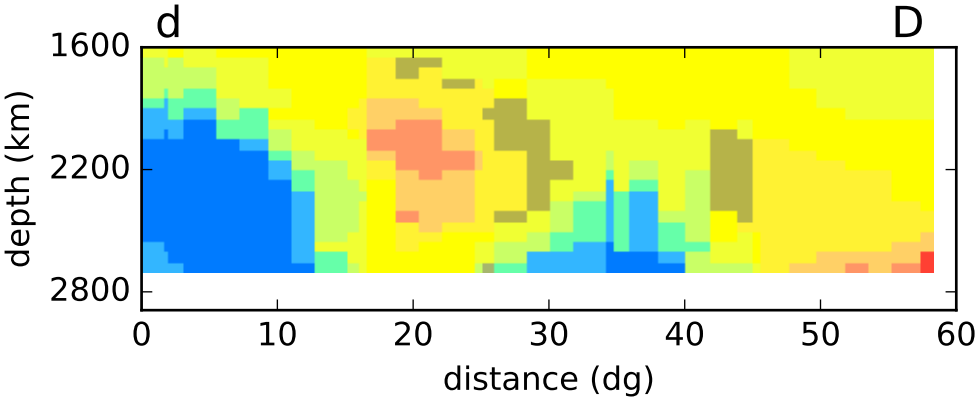
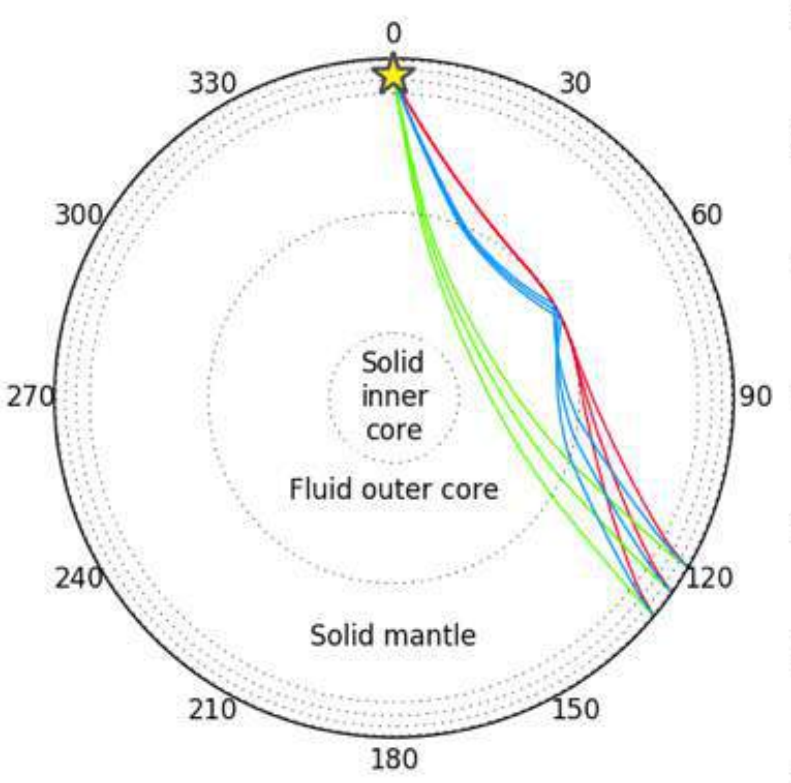


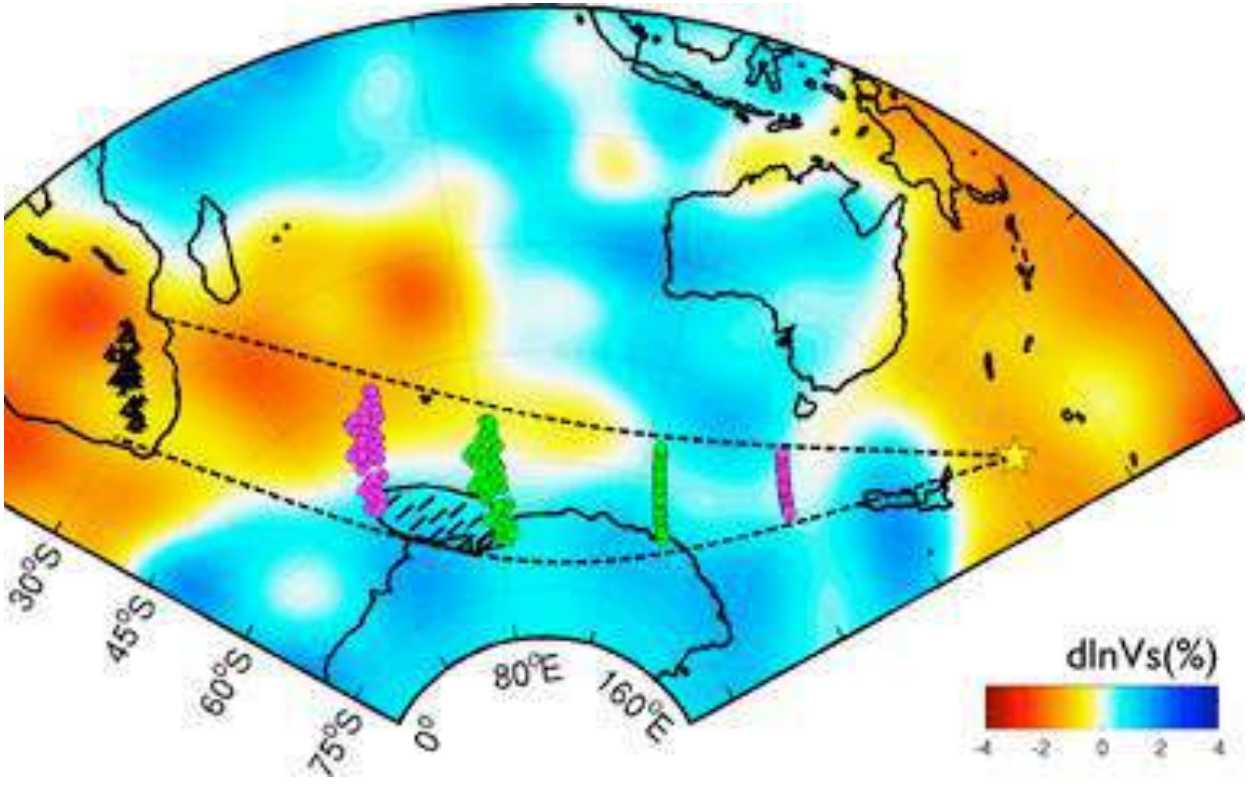
- Are these anomalies rising, sinking, or floating?

VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES

- Observing anomalous splitting using Sdiff phases large distances (>118 deg)



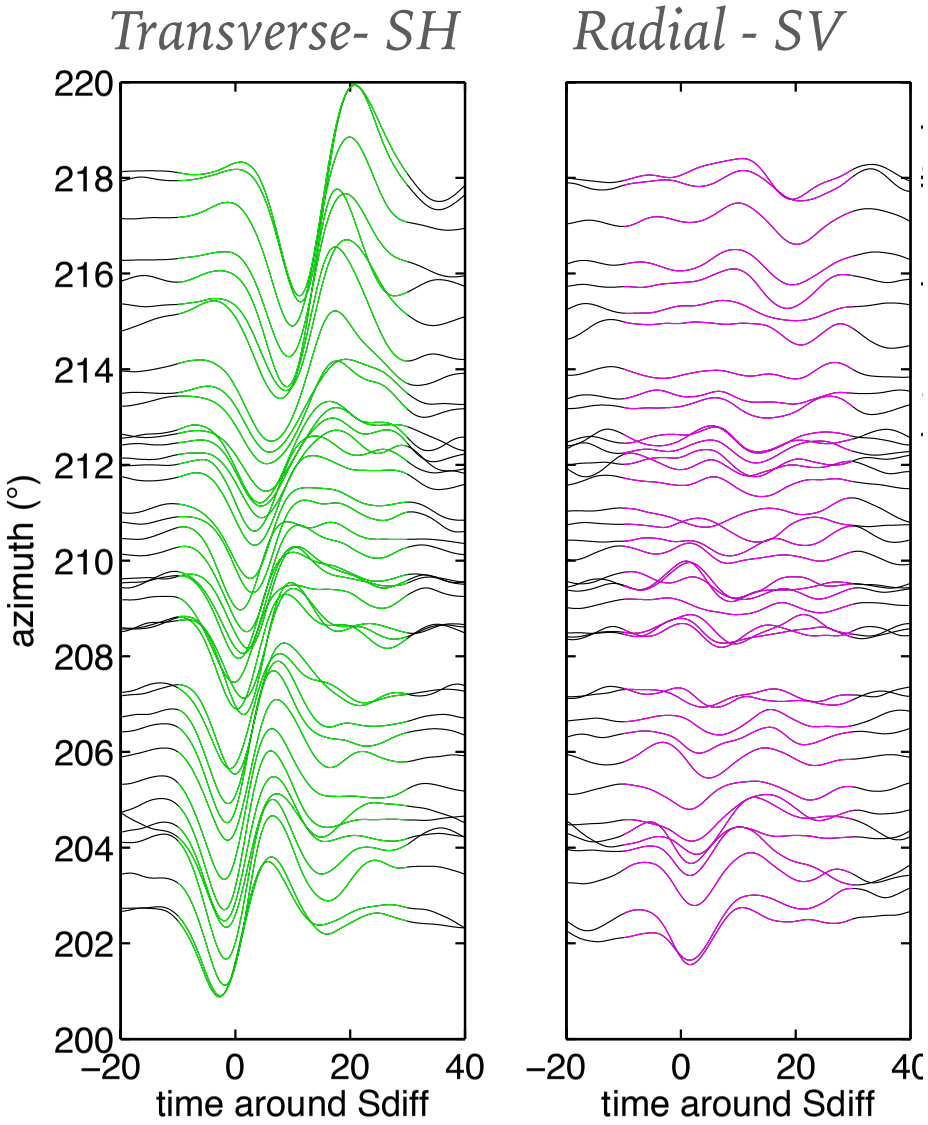
background: SAW24B16 Mégnin and Romanowicz, 2000

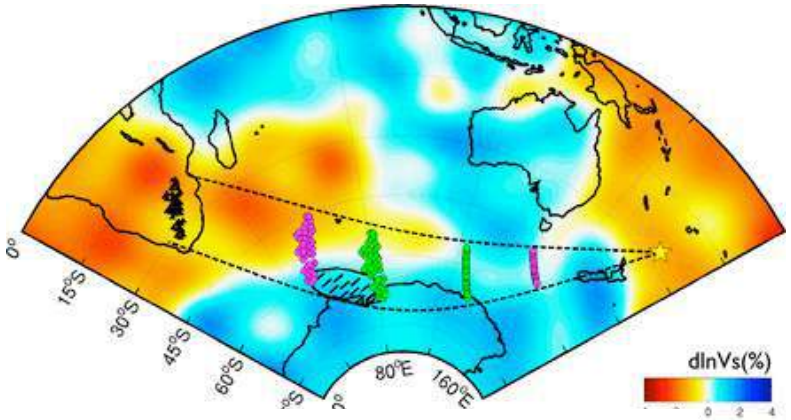


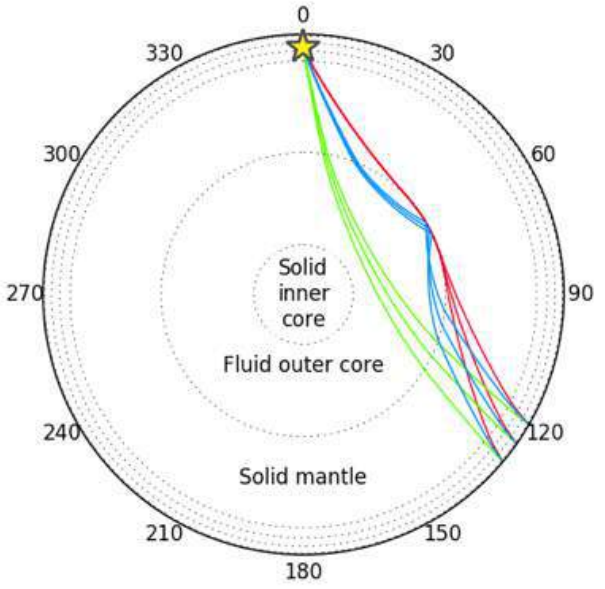
Cottaar & Romanowicz 2013

VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES

- Anomalously strong SVdiff energy



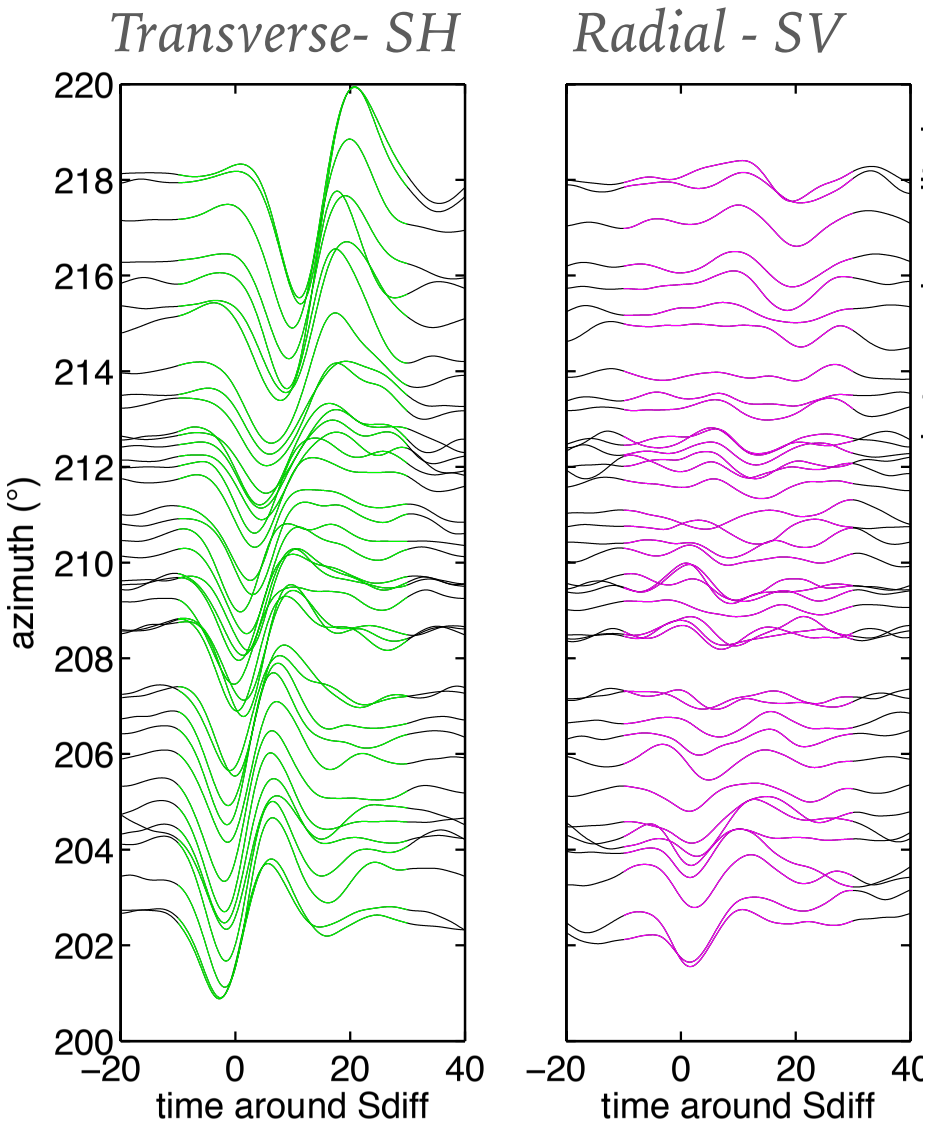


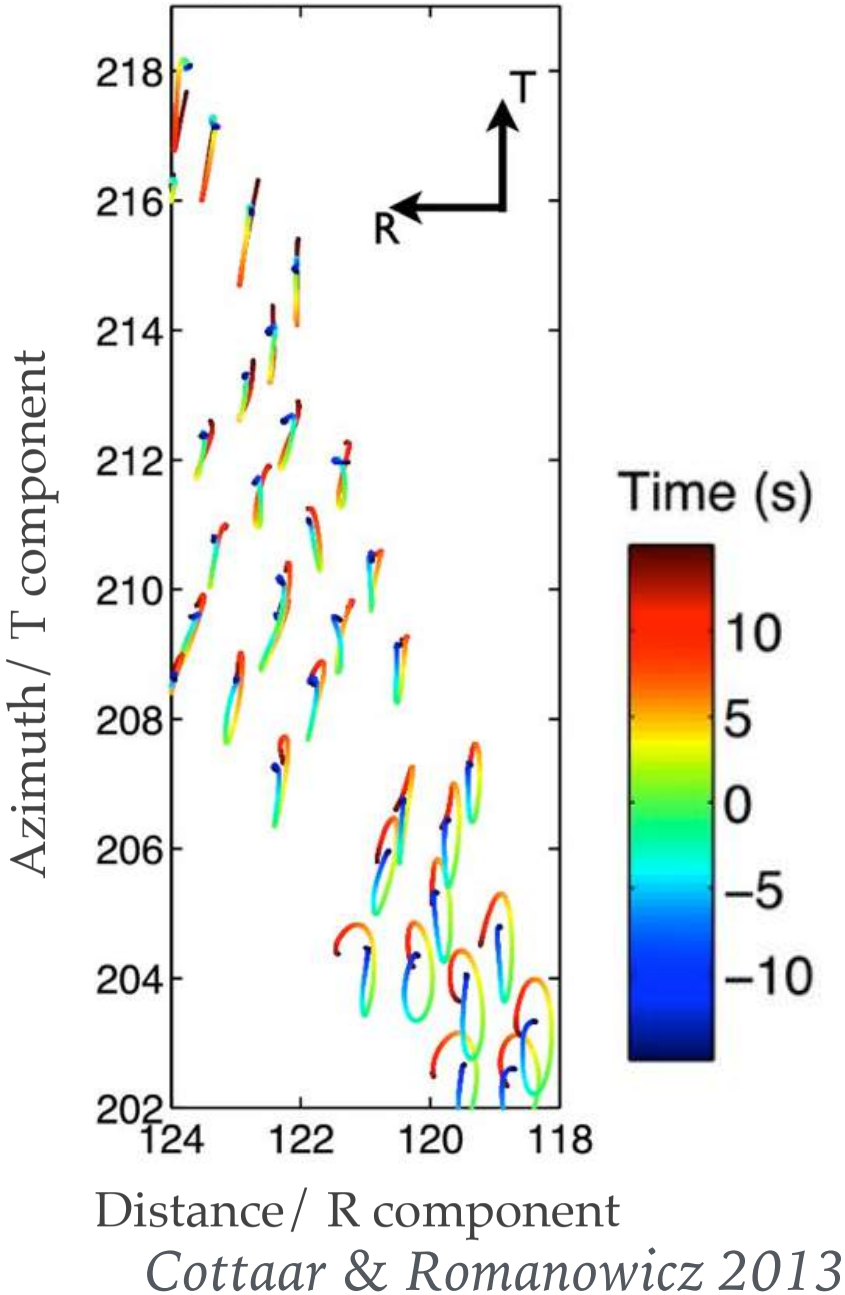


Cottaar & Romanowicz 2013

VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES

- Anomalously strong SVdiff phases

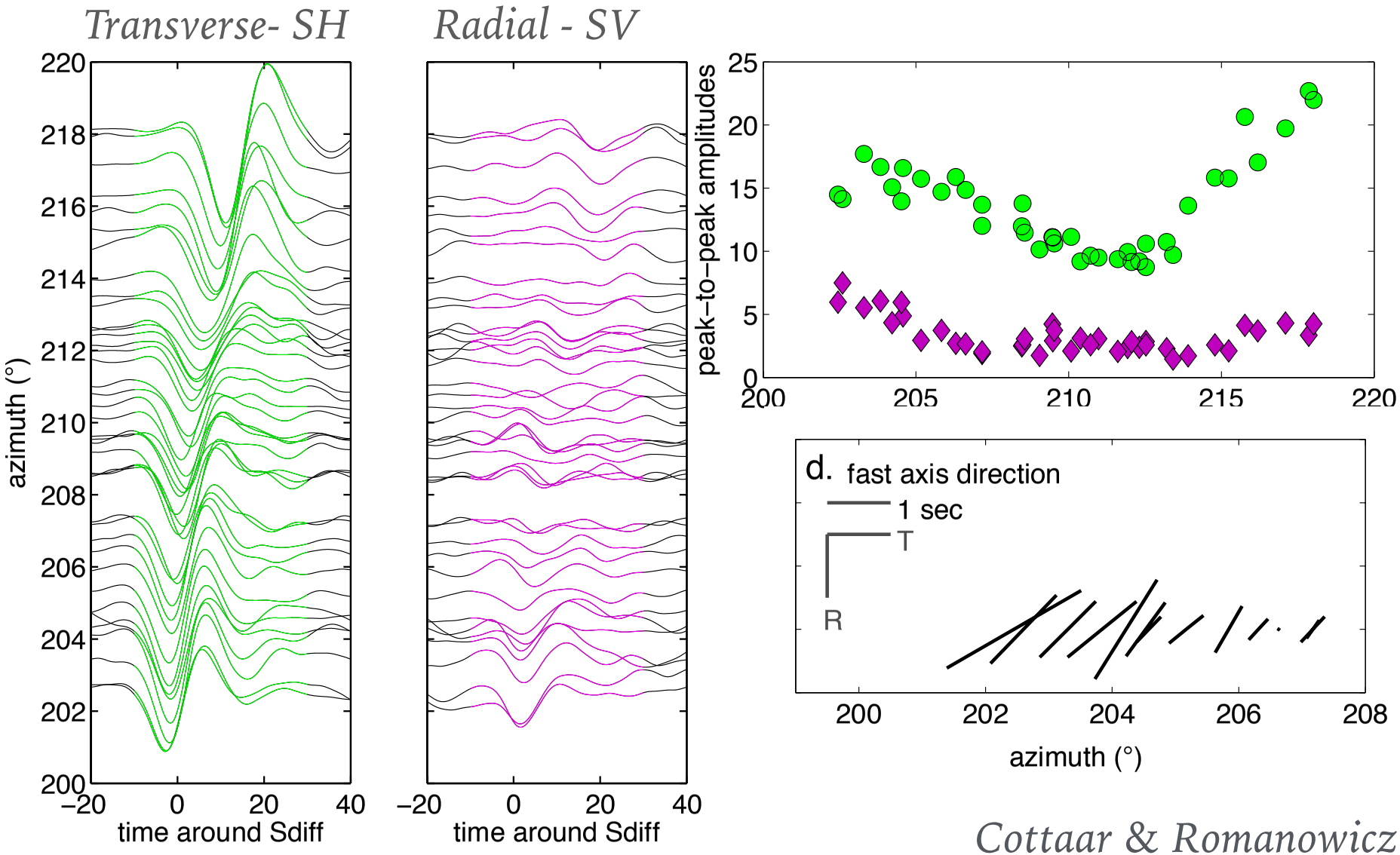




Cottaar & Romanowicz 2013

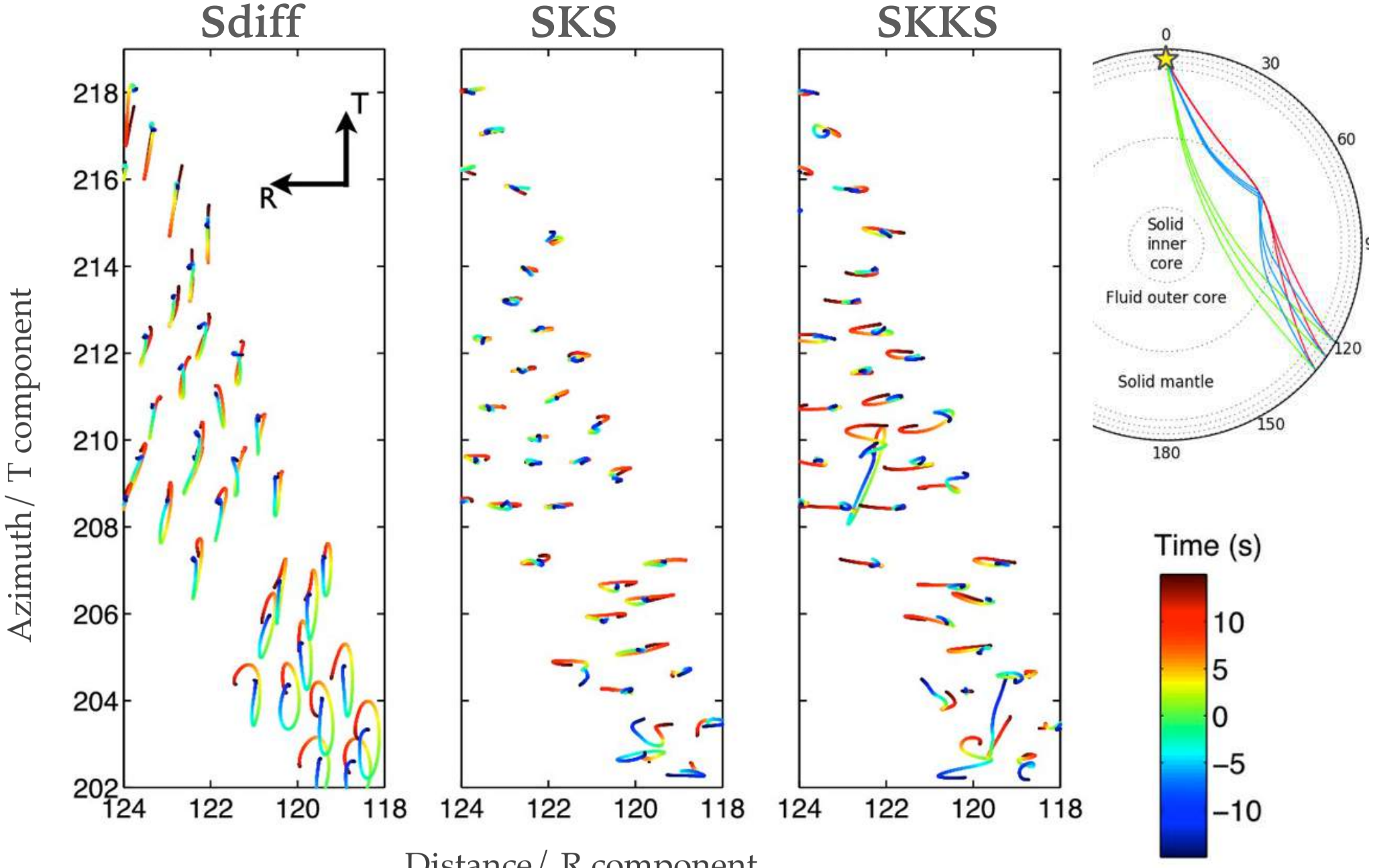
VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES

- Anomalously strong SVdiff phases

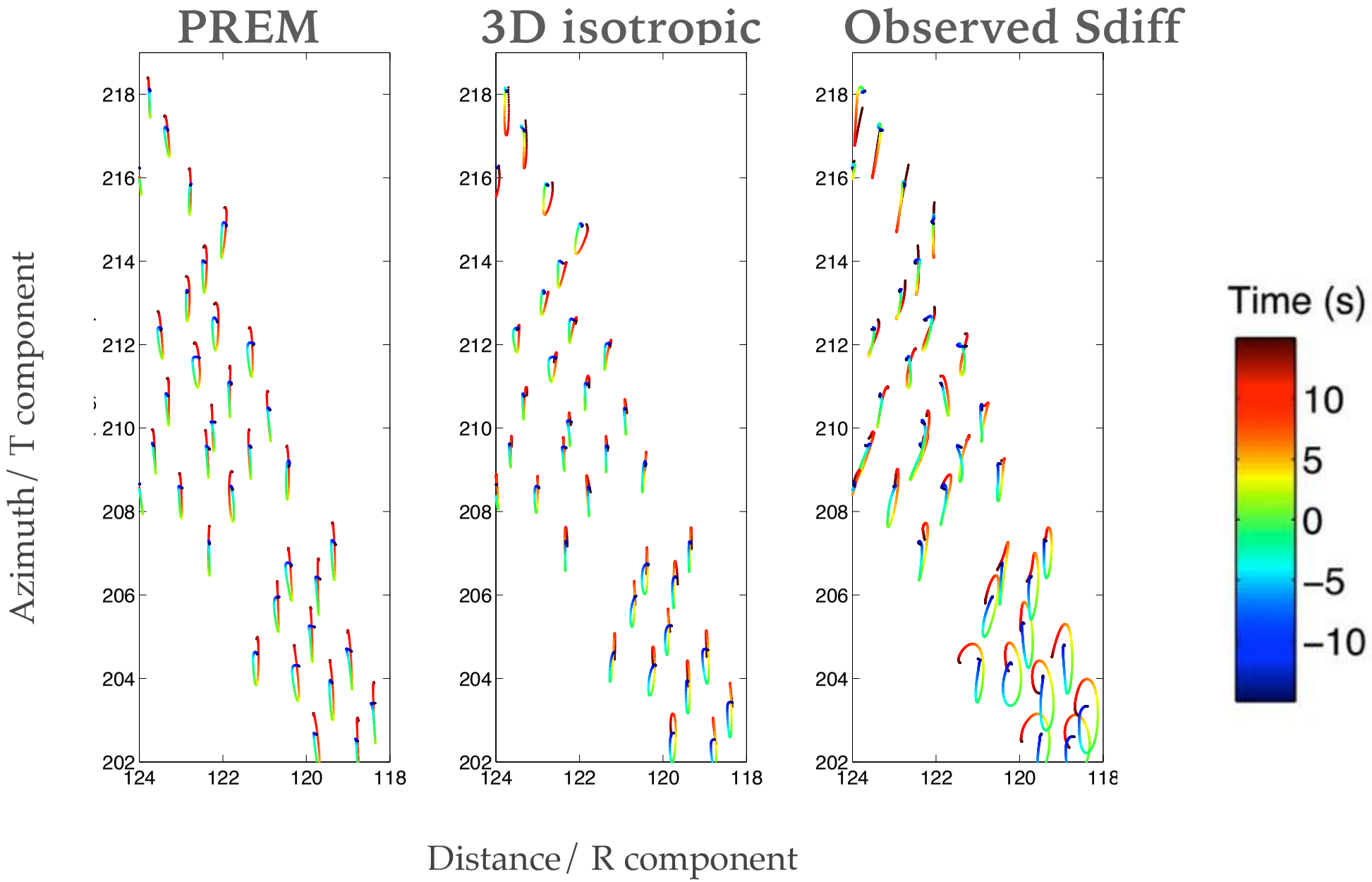


Cottaar & Romanowicz 2013

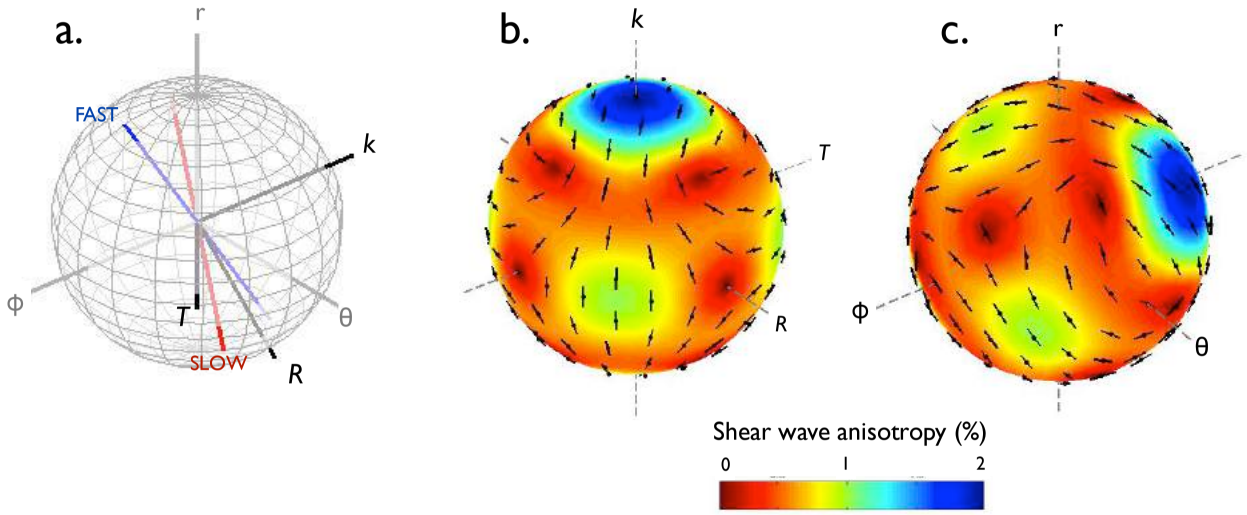
VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES

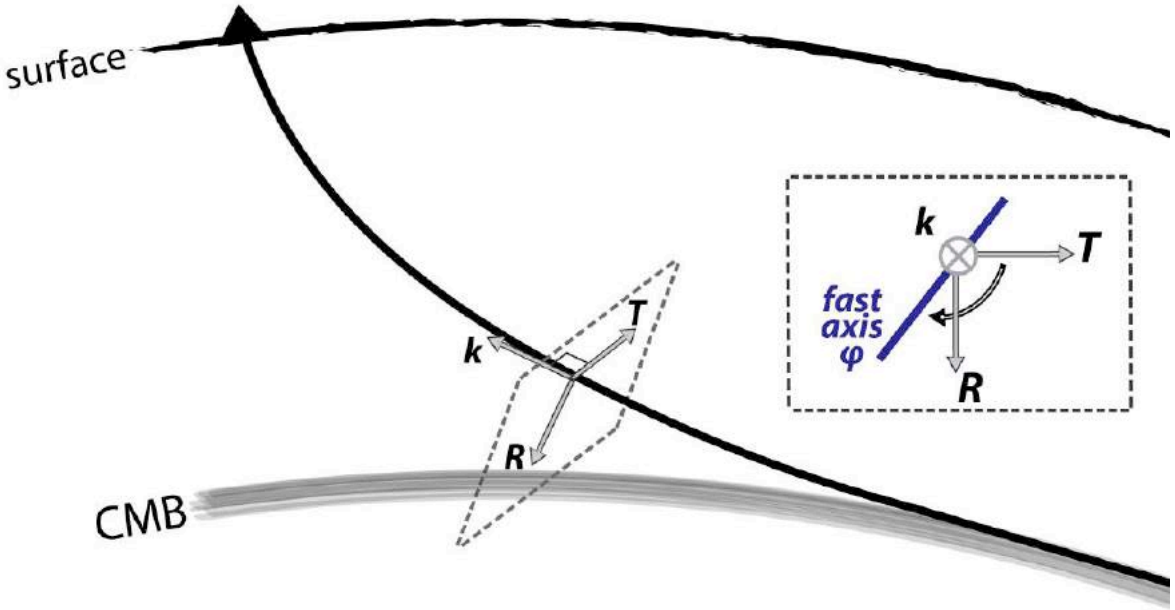


VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES



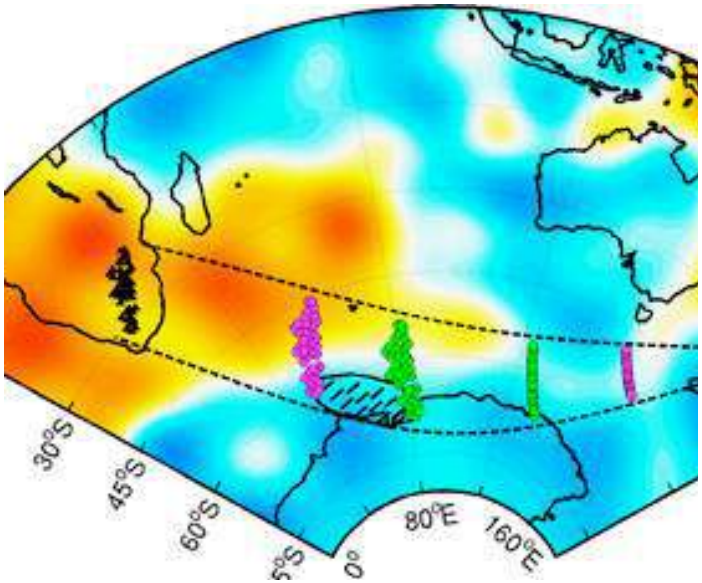
VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES

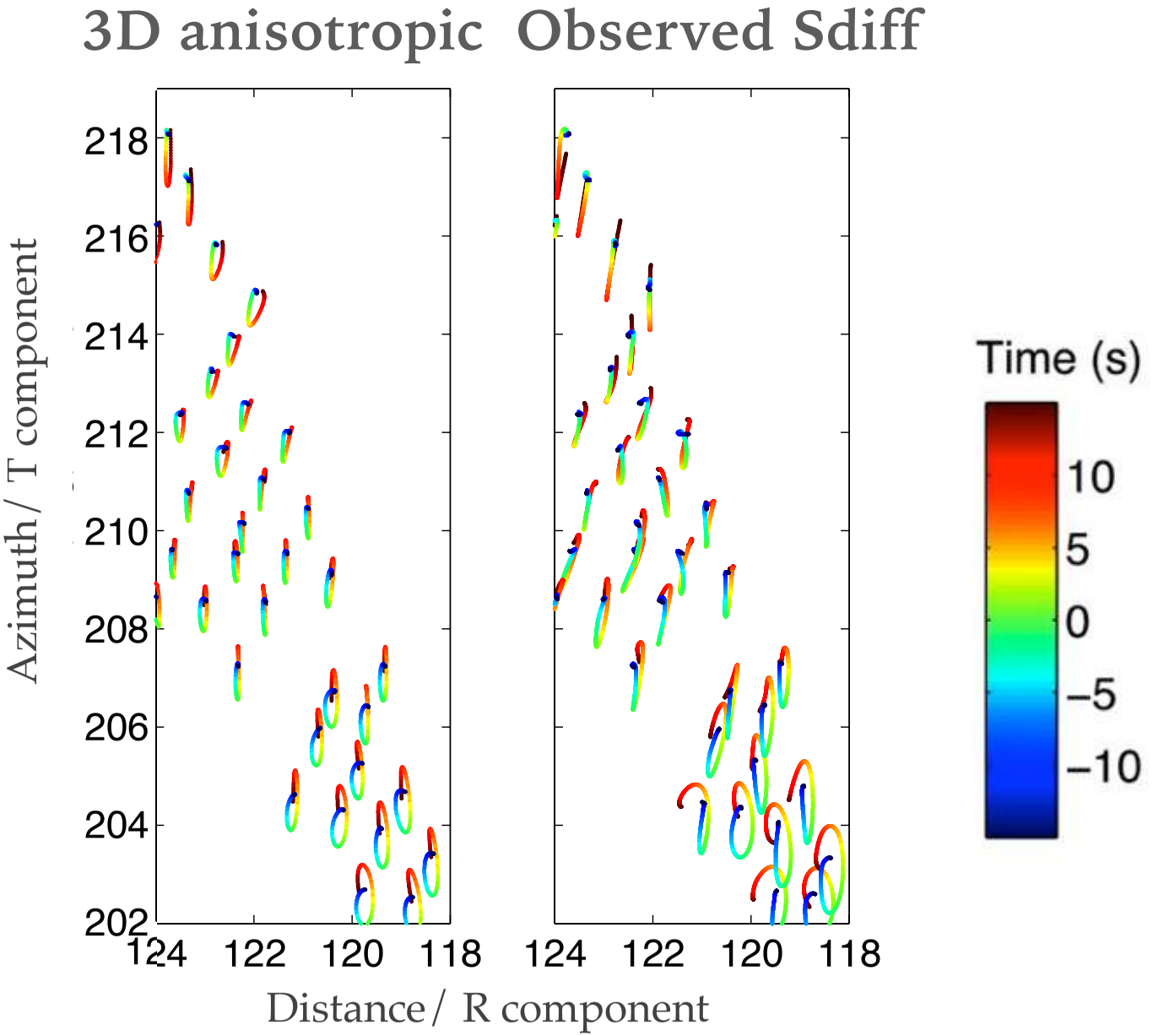




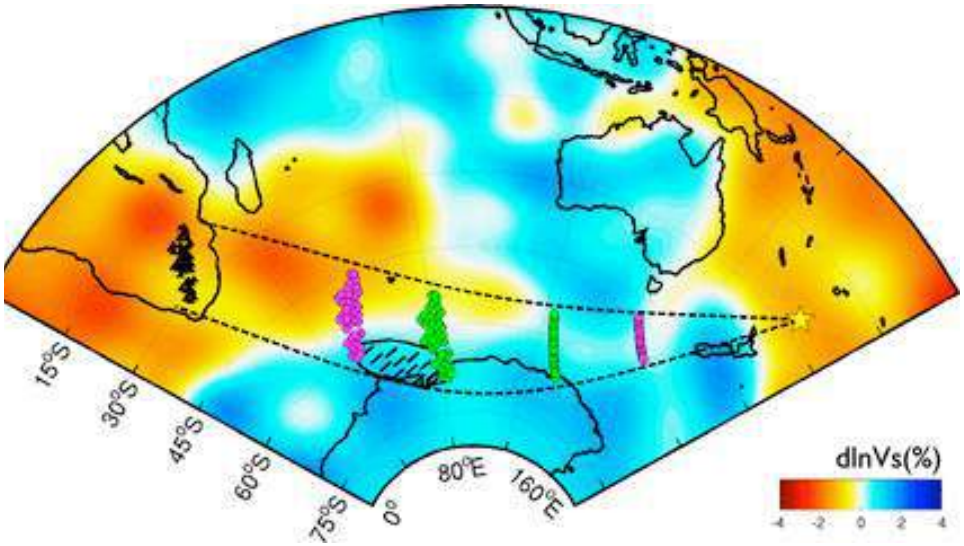
Cottaar & Romanowicz 2013

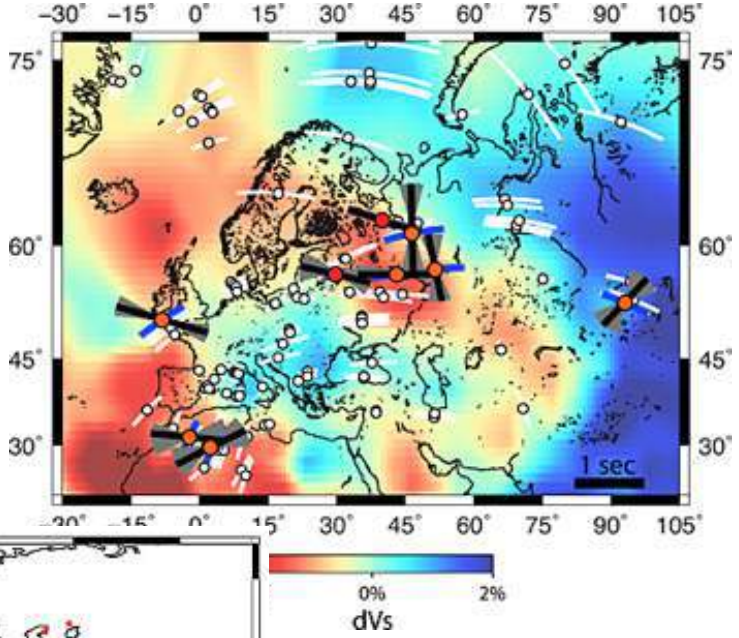
VARIATION IN OBSERVED ANISOTROPY ACROSS LLSVP BOUNDARIES



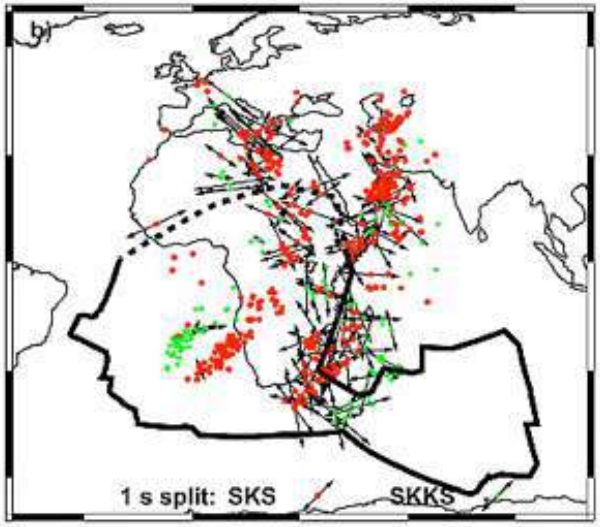


STRONG ANISOTROPY OUTSIDE LLSVPS

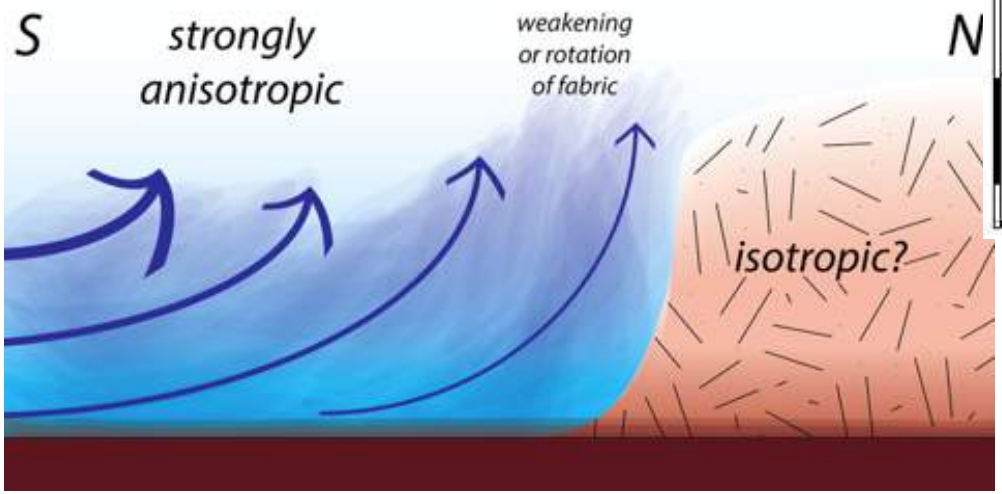




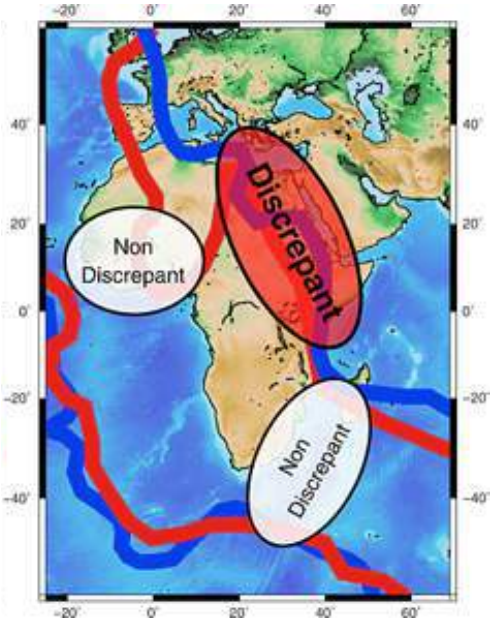
Long & Lynner 2016



Wang & Wen 2007



Cottaar & Romanowicz 2013



Lynner & Long 2014

CONCLUSIONS

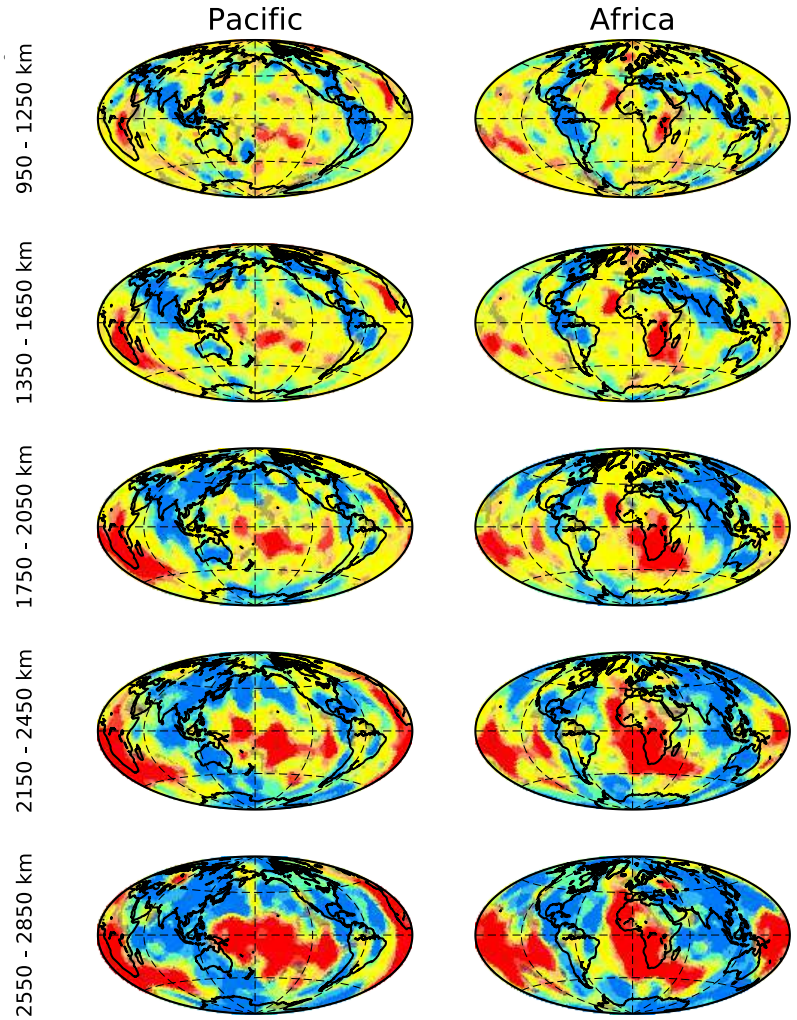
- The lower mantle can be best characterized in three clusters, which qualitatively are then interpreted as LLSVPs, slabs and 'background lower mantle'
- The morphology of the 'slow cluster' or LLSVPs agrees well with waveform studies and is highly variable, from shallow sloping to overhang. Suggesting variations in composition or interaction with surrounding dynamics.
- The 'slow cluster' or LLSVPs makes up 6-8% of the entire mantle.
- Various mesoscale features appear in the vote maps, although not always with consensus or equally among Vs and Vp vote maps.
- The LLSVP boundaries also appear to correlate with variation in anisotropy.
- Thanks (amongst others) to:

ObsPy
A Python Framework for Seismology

Instant Global Seismograms
Based on a Broadband
Waveform Database

INCORPORATED RESEARCH INSTITUTIONS FOR SEISMOLOGY

MSAT- Matlab Seismic Anisotropy Toolkit


Pacific
Africa
950 - 1250 km
1350 - 1650 km
1750 - 2050 km
2150 - 2450 km
2550 - 2850 km