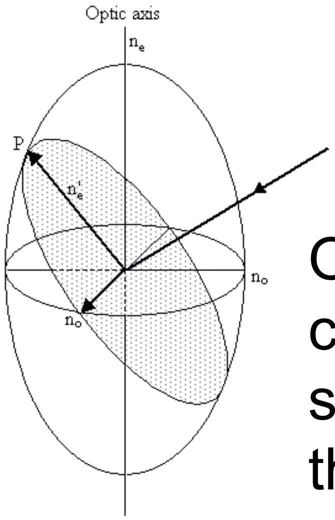
For dielectric materials where polarization is due entirely to electron configuration, the dielectric permittivity is approximately equal to the square of the index of refraction for the material.

E. I. Parkhomenko, 1967
Electrical Properties of Rocks



One may imagine the indicatrix for the dielectric constant of biaxial and uniaxial crystals as being similar to the indicatrix for the refractive index of those crystals.

Daniel S. Helman, Ph.D. danielhelmanteaching@gmail.com
I am looking for a postdoctoral position

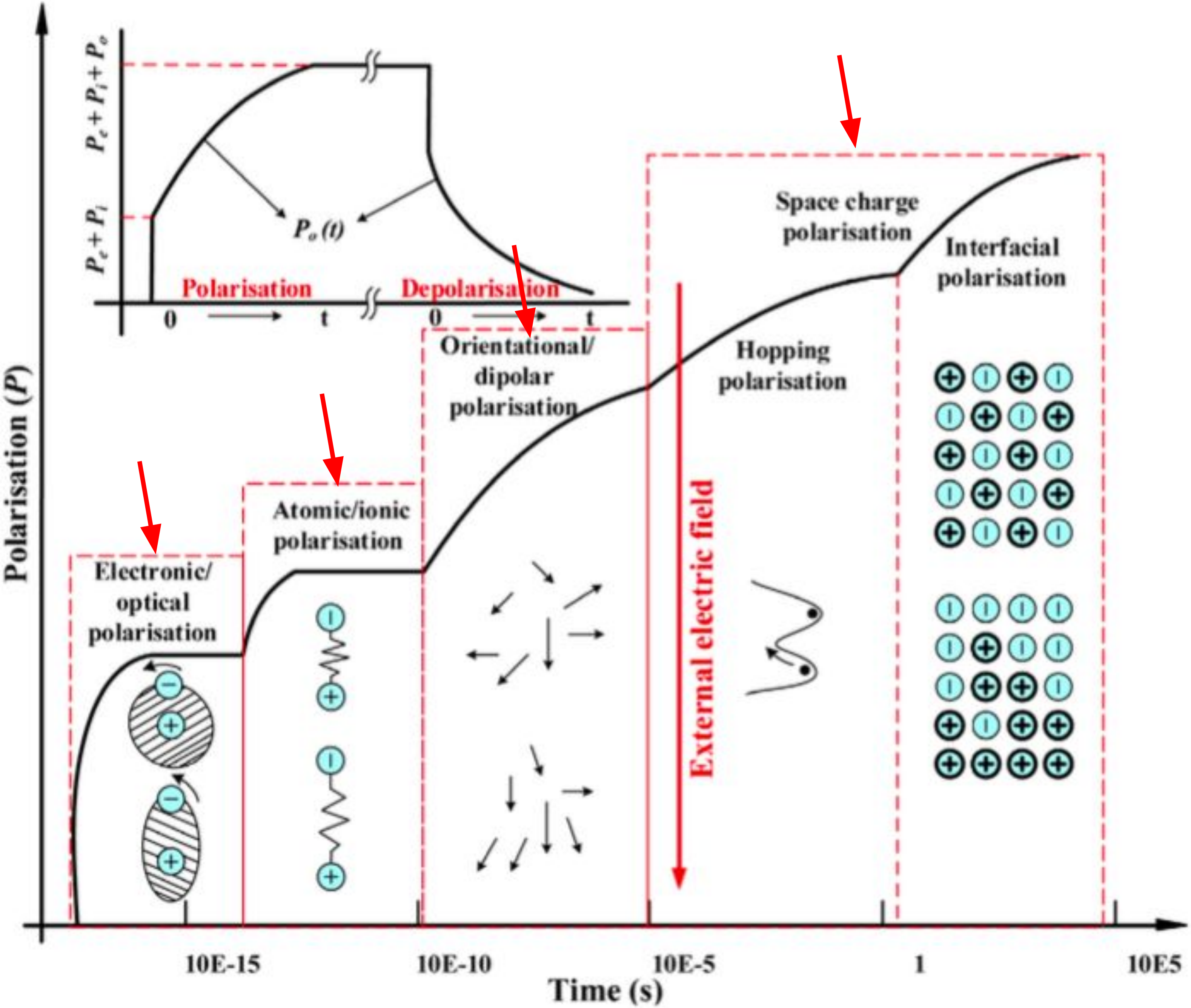


Image Source:

Koa, K. C. (2004). *Dielectric Phenomena in Solids with Emphasis of Physical Concepts of Electronic Processes.* Elsevier: Academic Press.

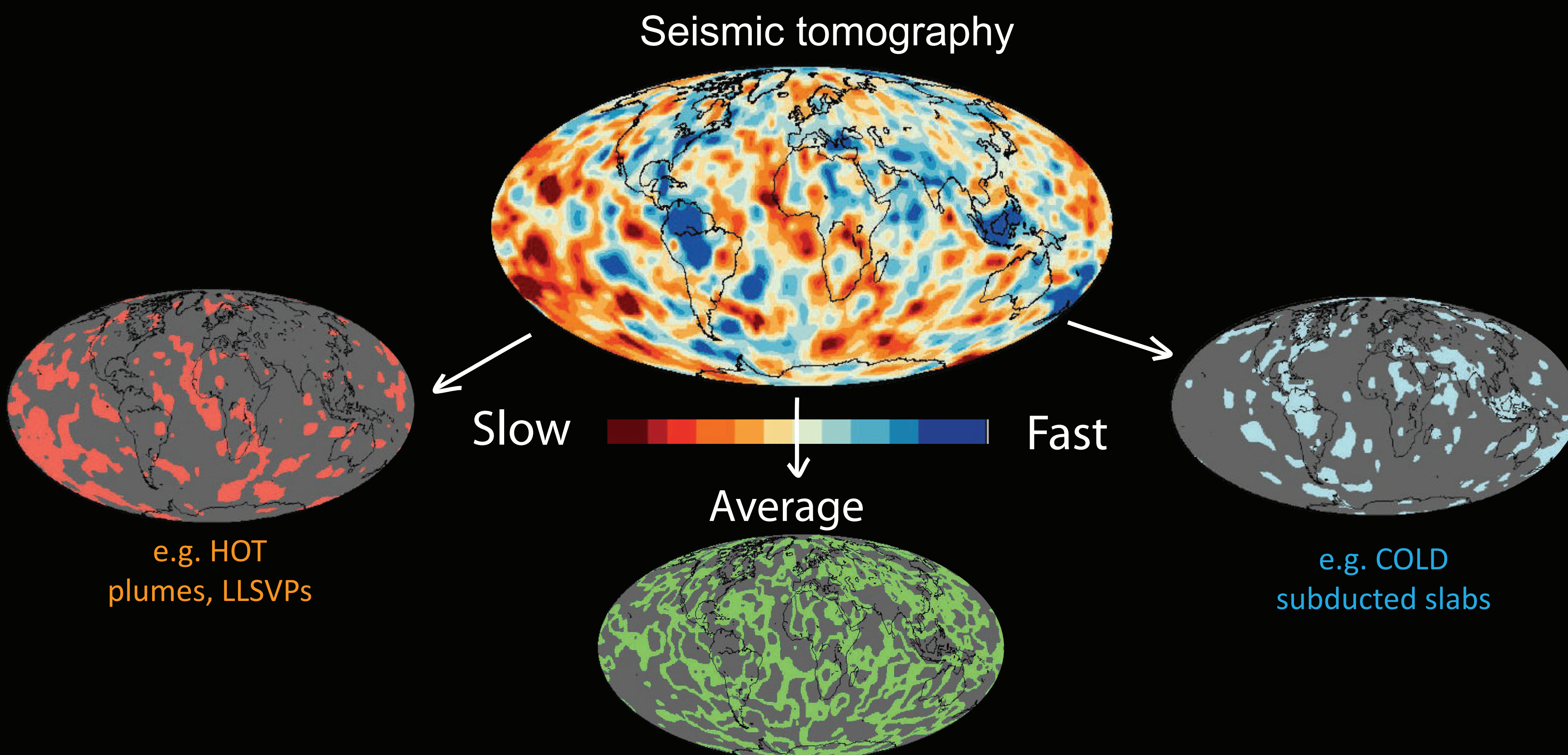
More optically refractive minerals have higher capacitance, provided that the dielectricity is caused by the electron configuration.

What does this mean for the formation of mantle minerals? Simply that the minerals formed may radiate photons (heat) and electric charge more or less easily, and thus may set up feedback mechanisms to favor the stability of certain minerals. Note the potential role of perovskite.

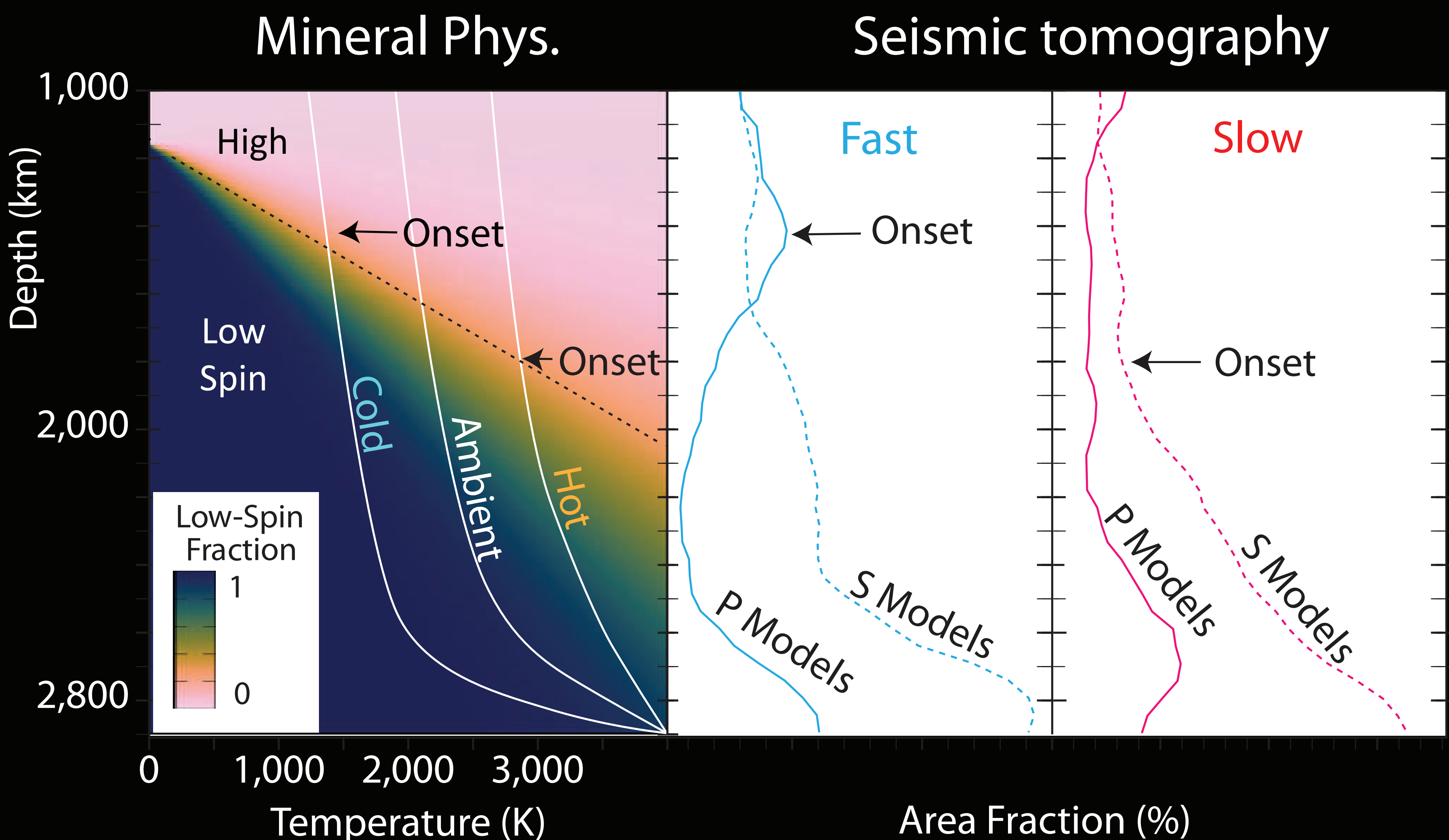
Daniel S. Helman, Ph.D. danielhelmanteaching@gmail.com grace.shephard@geo.uio.no

Mapping out the lower mantle

Grace E. Shephard, John Hernlund, Christine Houser, Reidar Trønnes, Fabio Crameri, Juan J. Valencia-Cardona, Renata Wentzkovitch

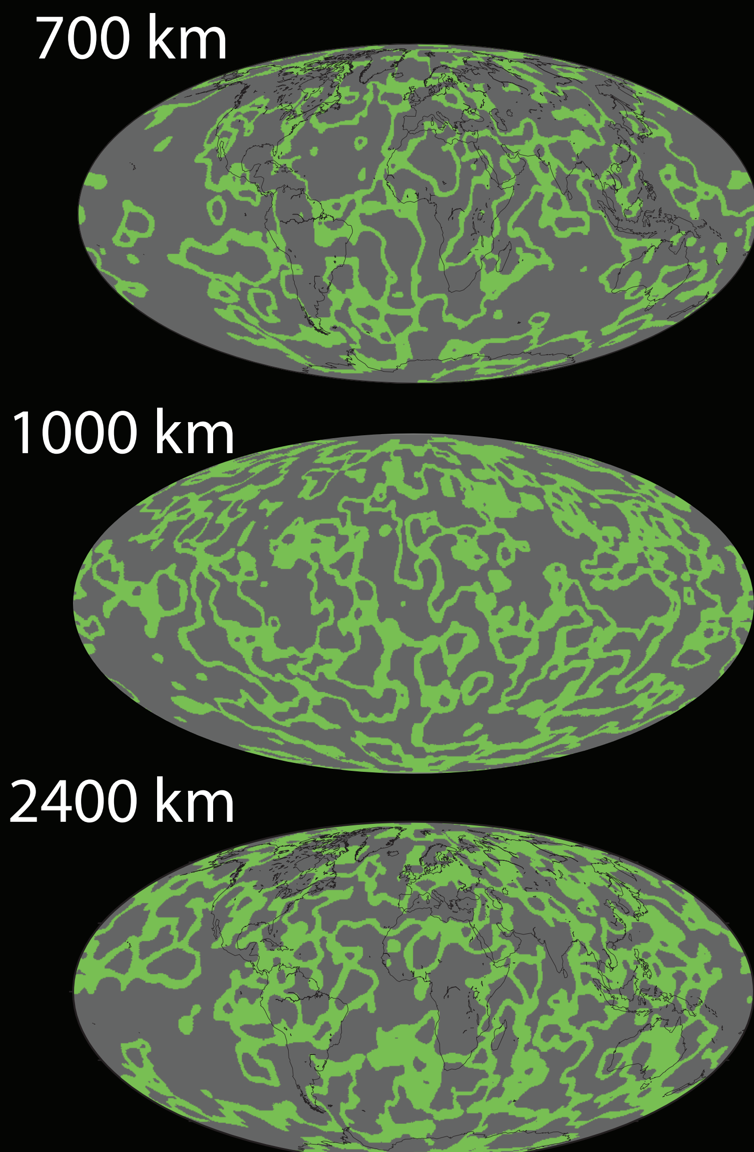


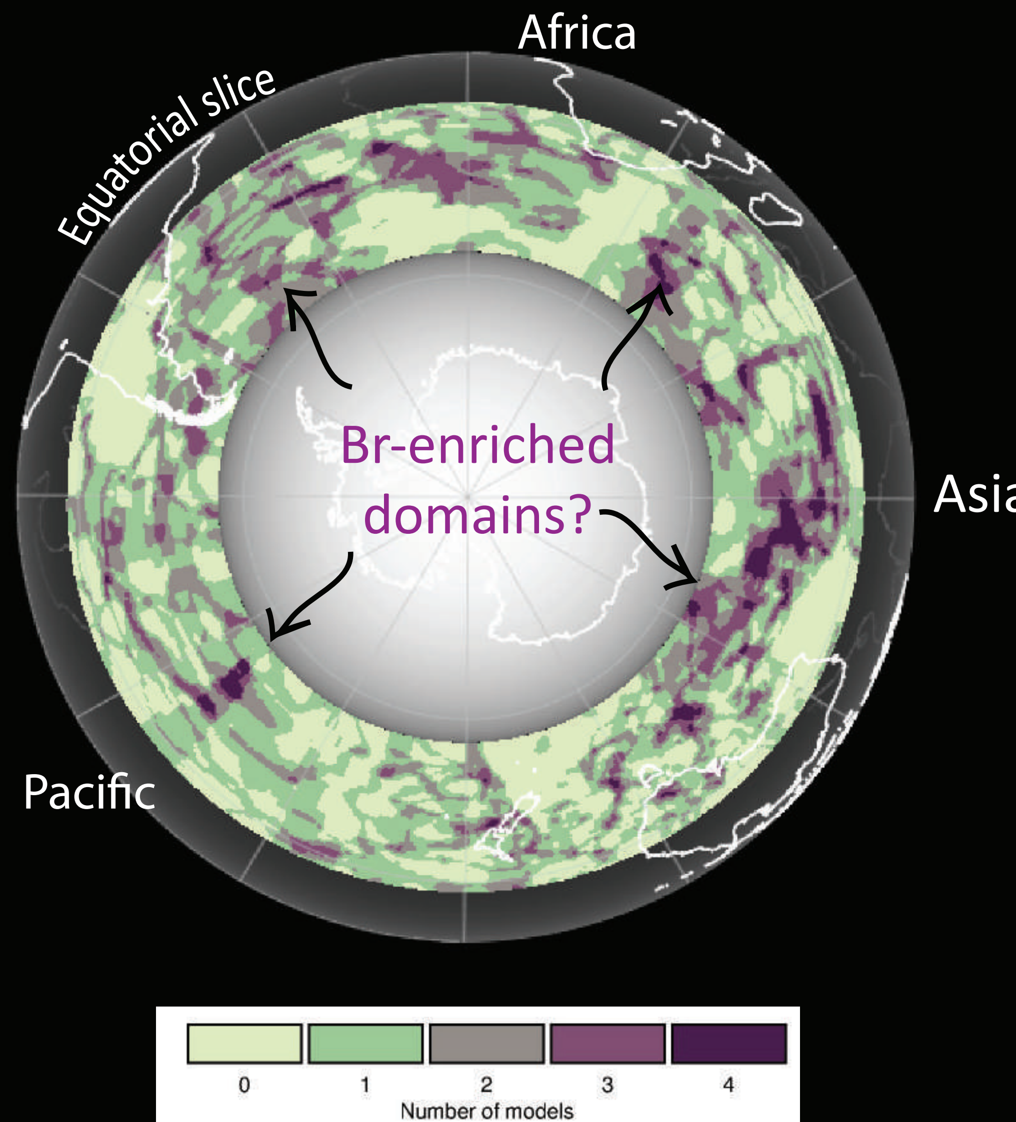
I. HS-to-LS Fe^{2+} spin crossover in Fp



Pre-print --> https://eartharxiv.org/deuck/

II. The ambient (average) mantle



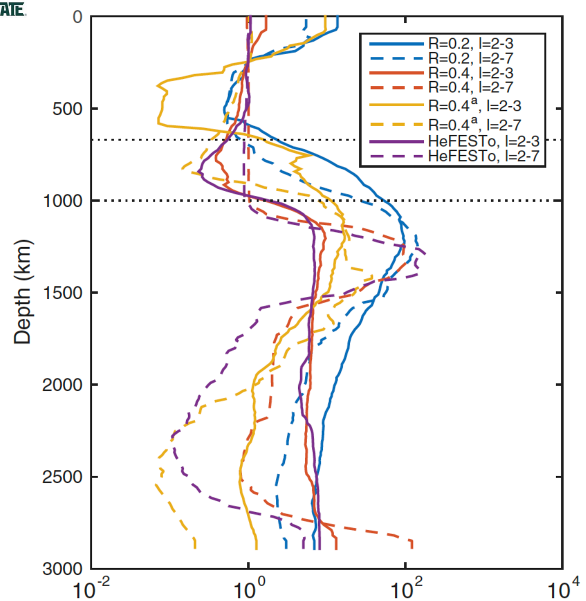


EGU2020 presentation --> EGU2020-11806

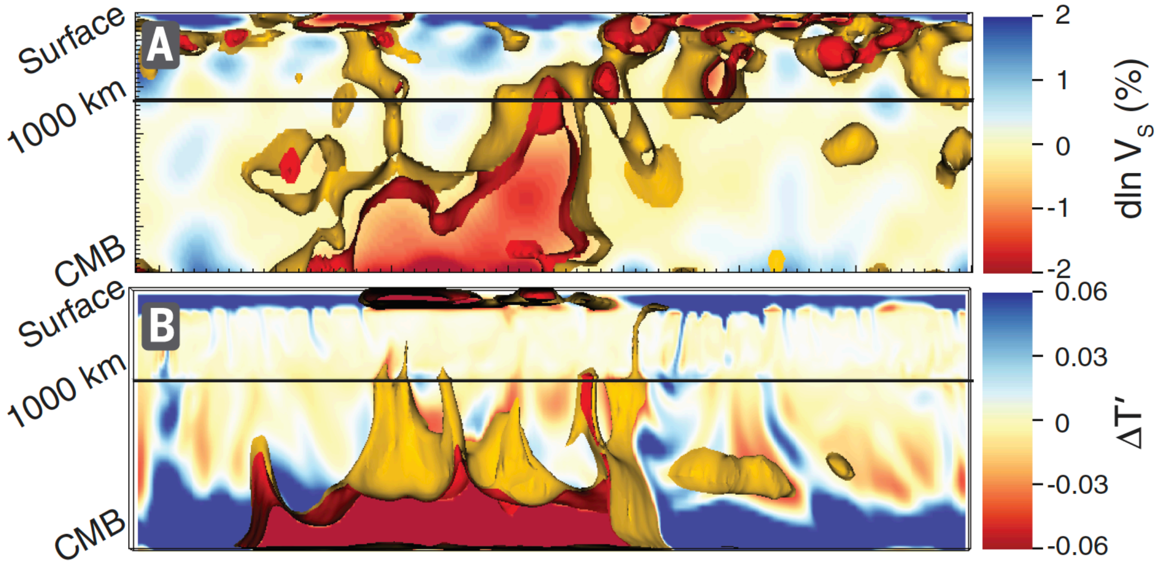
Min Chen (chenmi22@msu.edu)
Computational seismology, tectonics, and environment

Existence of a low-viscosity layer beneath the 660-km discontinuity based on the orphan slabs imaged beneath East Asia

Min Chen, Ziyi Xi, and Antoniette Grima



Rudolph et al. (2015)

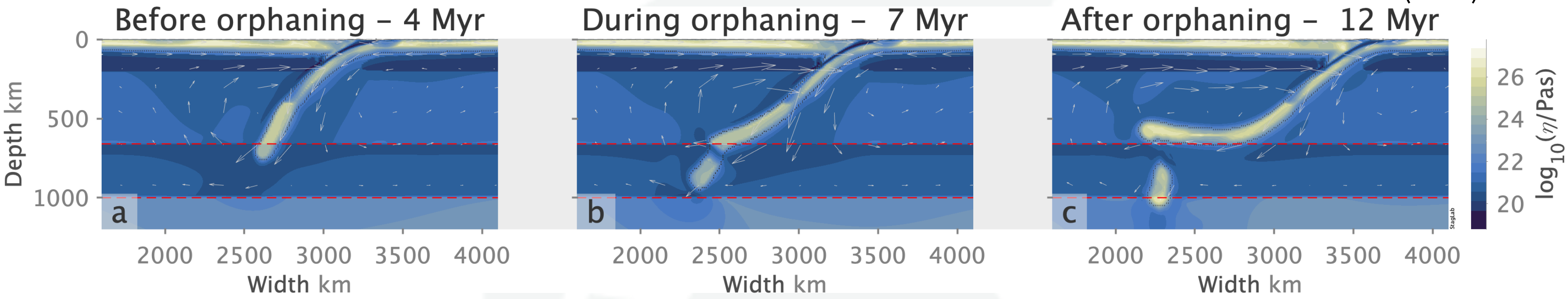


Low-viscosity or high-viscosity between the 660-km and 1000-km?

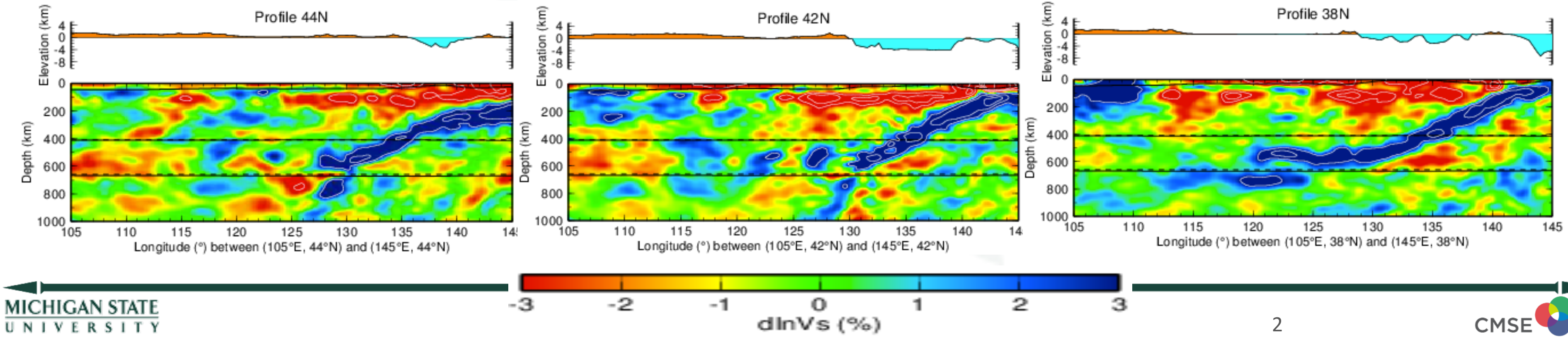
Min Chen (chenmi22@msu.edu)
Computational seismology, tectonics, and environment

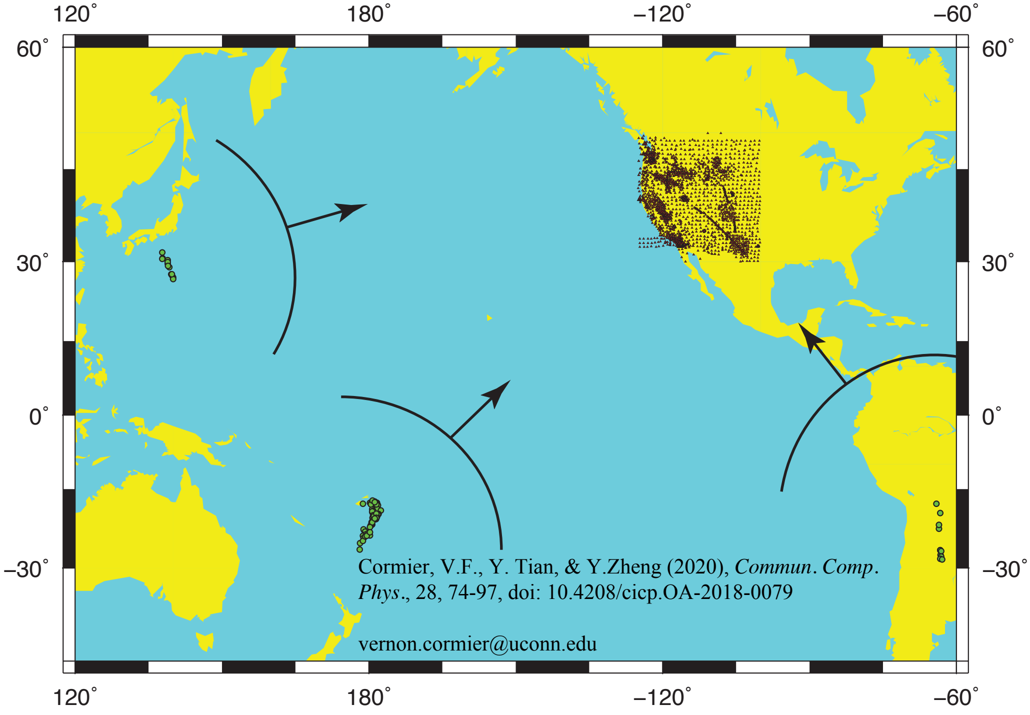
The prediction of slab orphaning based on the geodynamic modeling of a low-viscosity layer between the 660-km and the1000-km discontinuities.

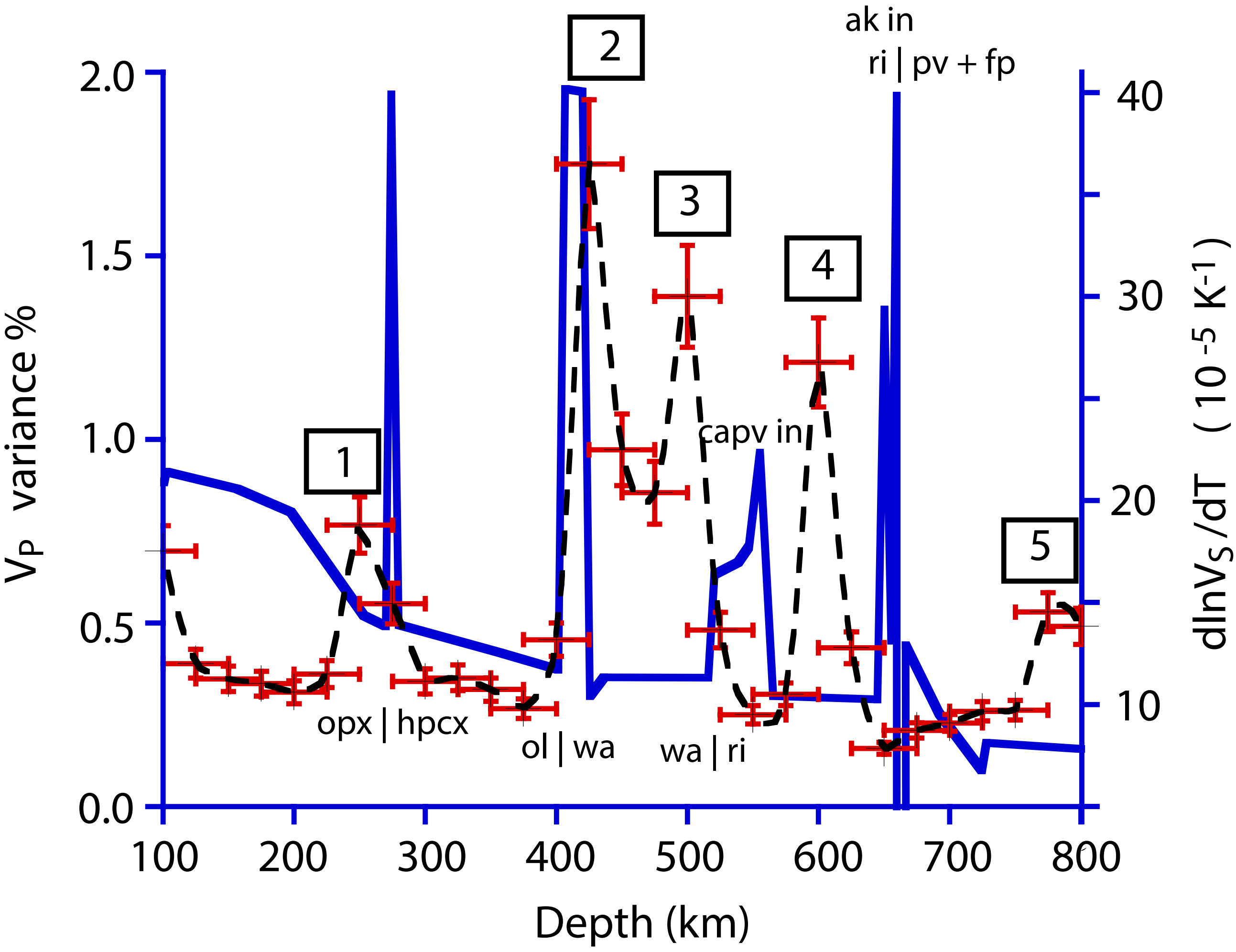
Grima et al. (2020)



New high-fidelity seismic images beneath East Asia show the evidence of slab orphaning and imply the existence of a low-viscosity layer beneath the 660-km in the uppermost lower mantle *Chen et al. (in preparation)*



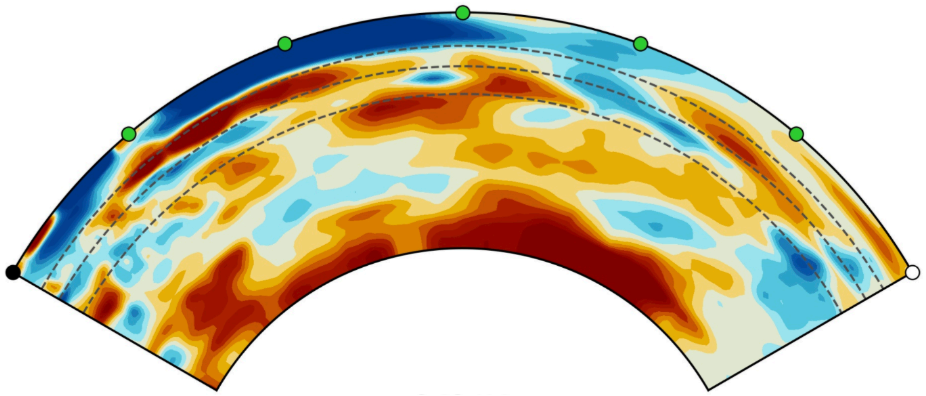
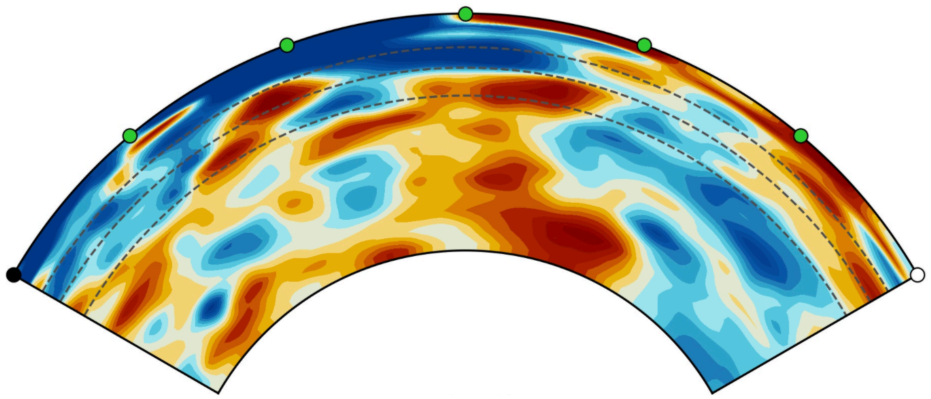

120°
180°
−120°
−60°
60°
30°
0°
−30°
Cormier, V.F., Y. Tian, & Y.Zheng (2020), *Commun. Comp. Phys.*, 28, 74-97, doi: 10.4208/cicp.OA-2018-0079
vernon.cormier@uconn.edu



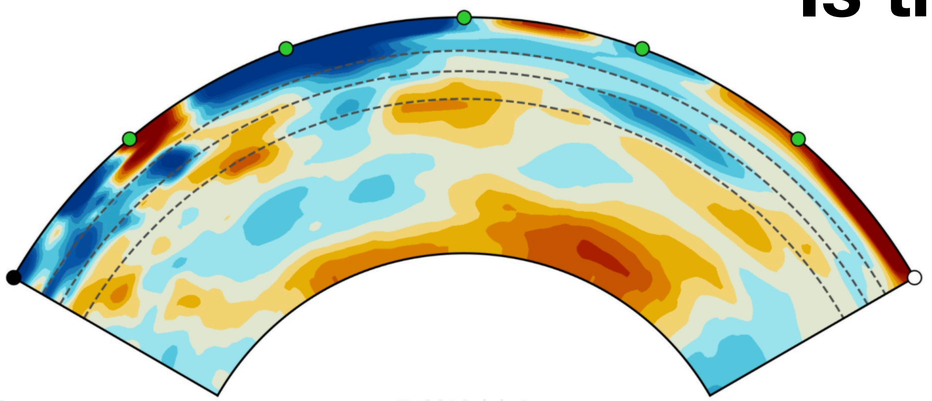
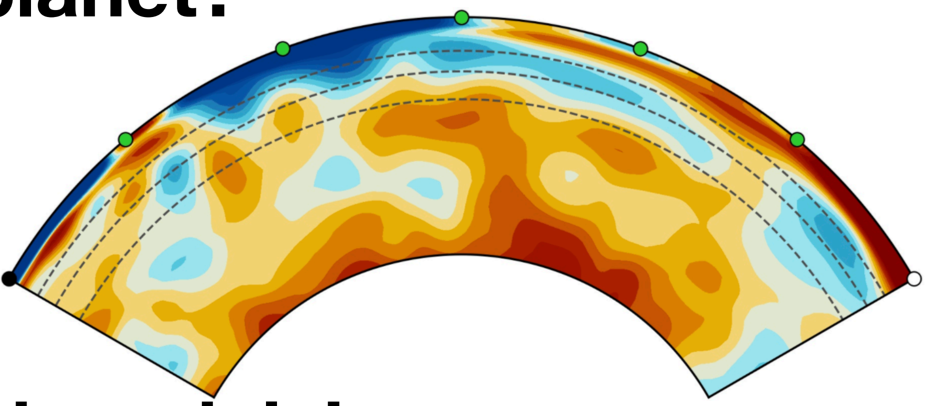
ak in
ri | pv + fp
2
3
4
1
5
capv in
opx | hpcx
ol | wa
wa | ri
2.0
1.5
1.0
0.5
0.0
40
30
20
10
100
200
300
400
500
600
700
800
V_P variance %
$dlnV_S/dT$ (10^{-5} K^{-1})
Depth (km)

The Future of Mantle Tomography

For tomography to have future, we need to understand:
- **the differences in the models we have**
- **how to interrogate the models of the future**

Is this even the same planet?

These are all commonly used models!

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https://members.elsi.jp/~chouser/

Earth-Life Science Institute
Tokyo Institute of Technology

The current landscape of models is too vast to be useful.

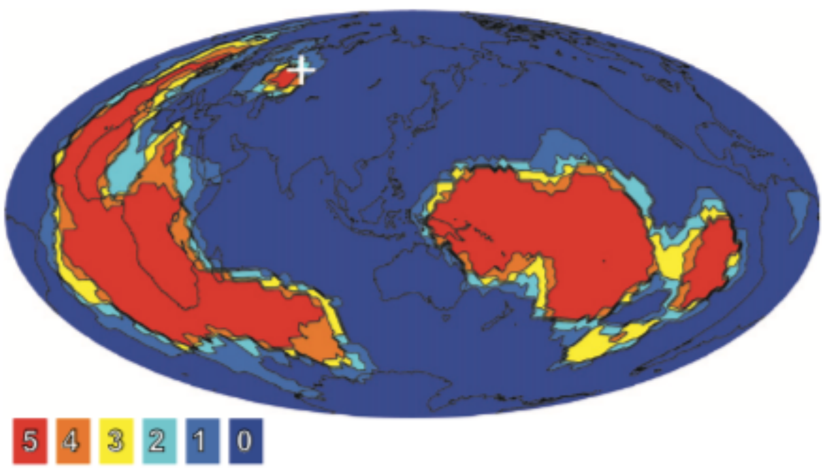
More models should improve our understanding of Earth's interior, but the discrepancies are now actually holding back progress.

Be Alert When You Invert!

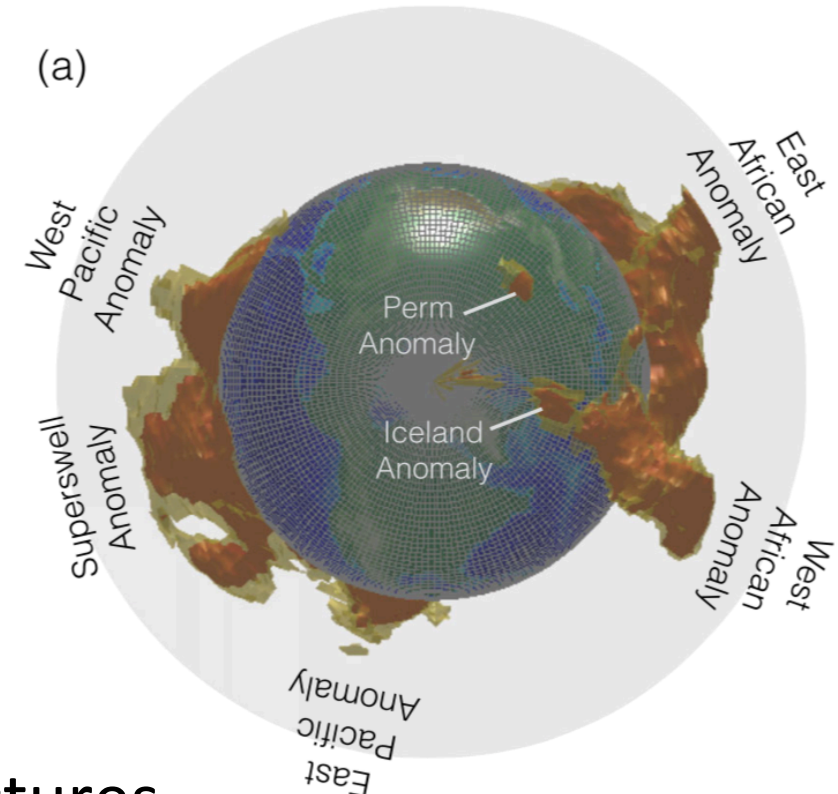
We, the tomographers, need to work together to develop assessment tools and strategies to make our models truly accessible to the deep Earth community.

LLSVPs: bundles of mantle thermochemical plumes rather than thick stagnant "piles"

Anne Davaille (CNRS / Univ. Paris-Saclay)
Barbara Romanowicz (UC Berkeley / Collège de France / IPGP)



(Lekic et al, 2012)



(Cottaar & Lekic, 2016)

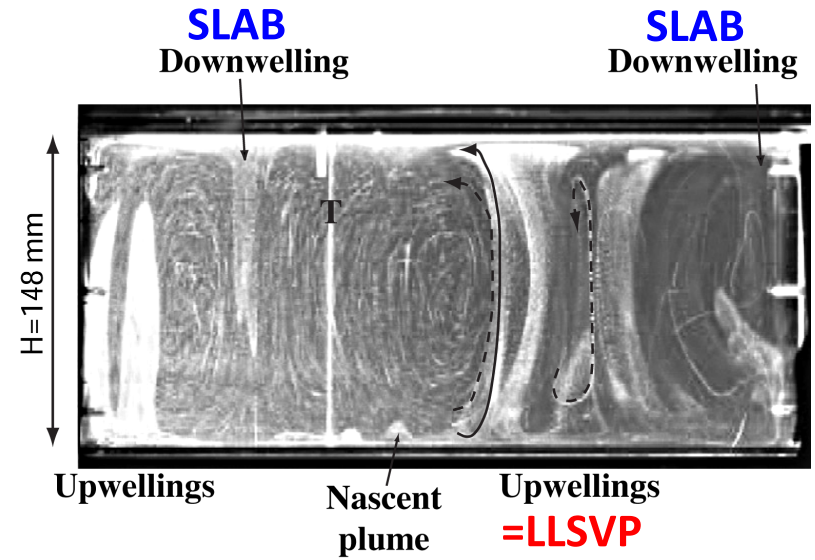
VOTING MAPS => large-scale structures

=> LLSVPs = thick « piles »

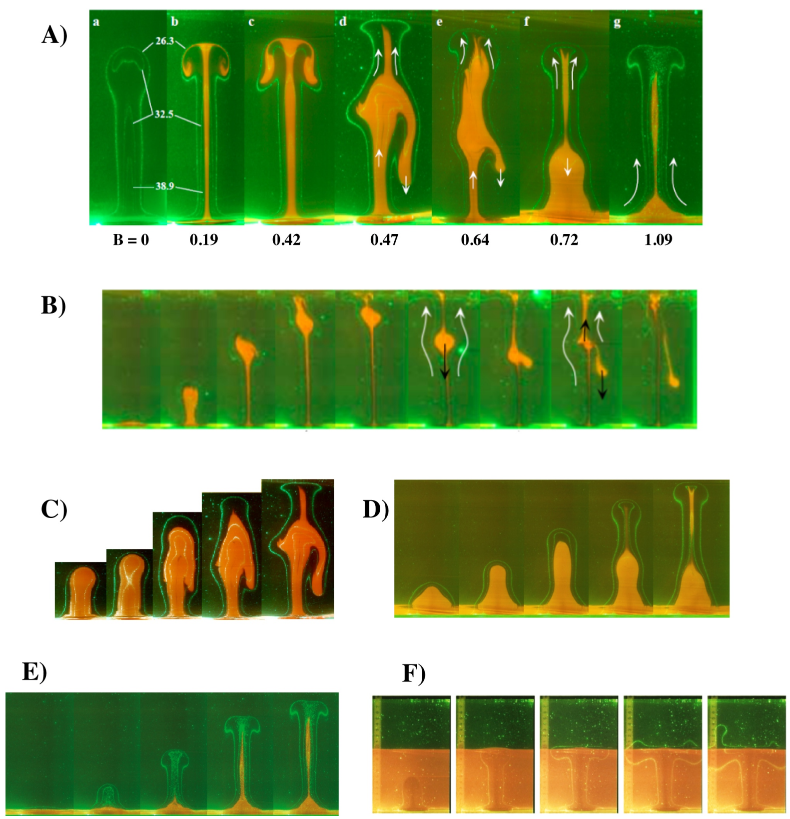
FLUID MECHANICS : convection in an heterogeneous mantle

1- Size of a LLSVP

=> **several** hot instabilities



(Androvandi et al, 2011)



2- Thermochemical instabilities

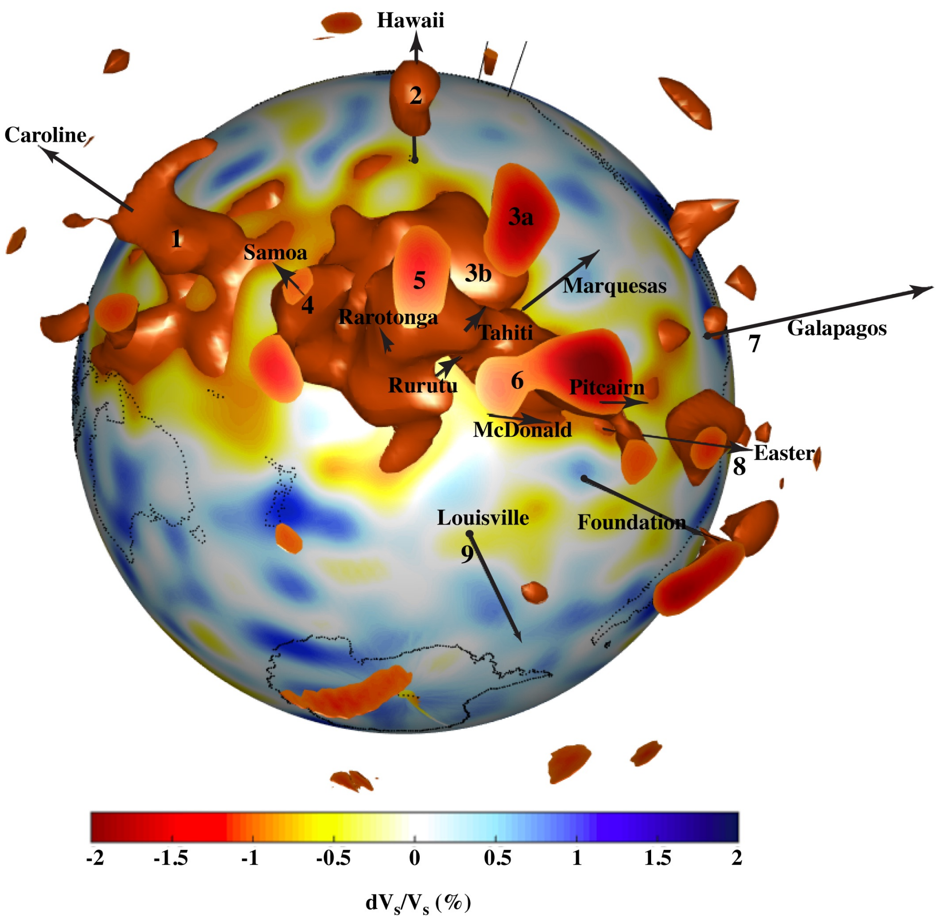
=> **zoology of shapes**

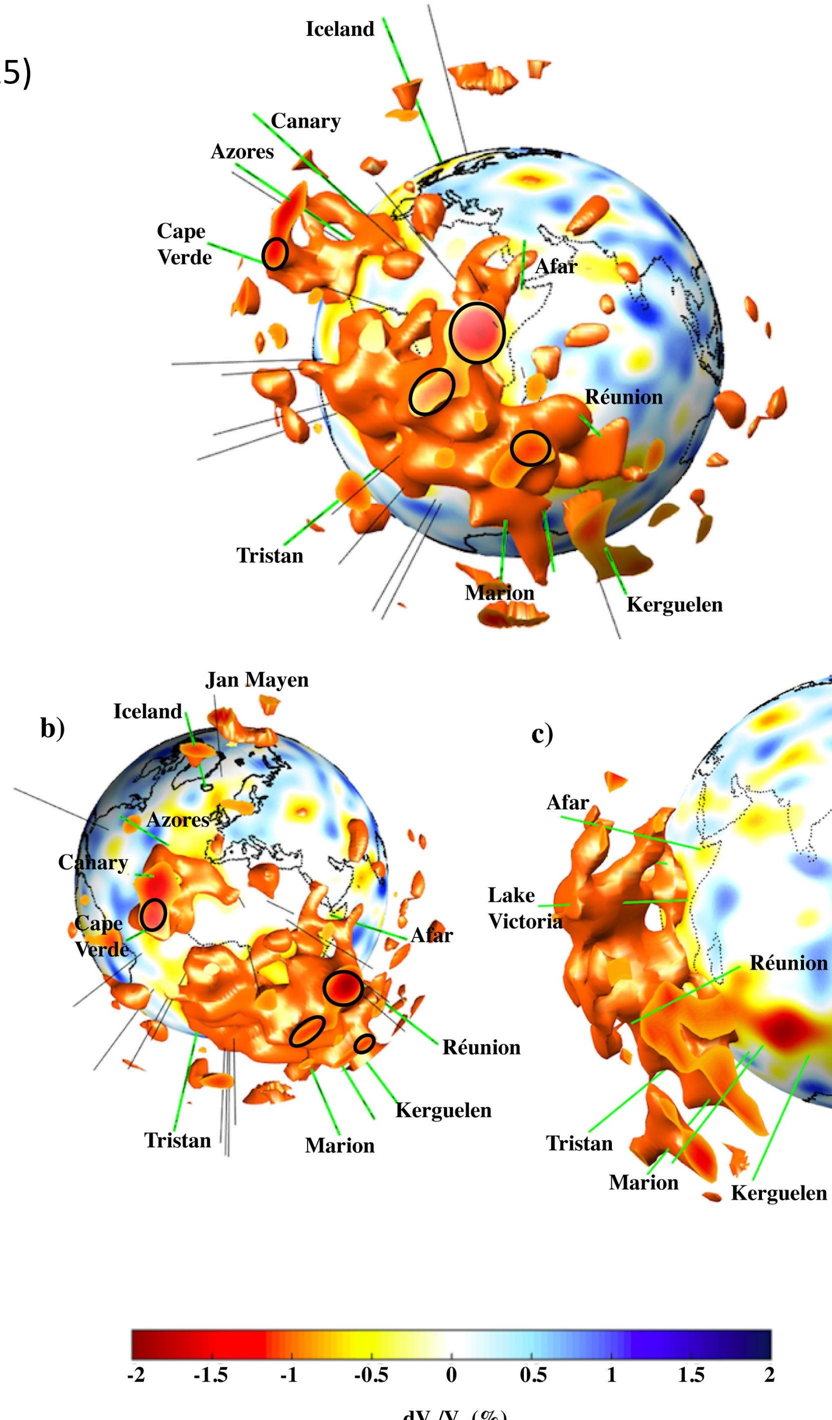
+ time-dependence

$$B_L = \Delta\rho_x / \rho_0 \alpha \Delta T$$

(Kumagai et al, 2007, 2008)

SEMUCB-WM1 (French & Romanowicz, 2014, 2015)





⇒ **At least 2 bundles of thermochemical plumes**

(Davaille & Romanowicz, in press, Tectonics)