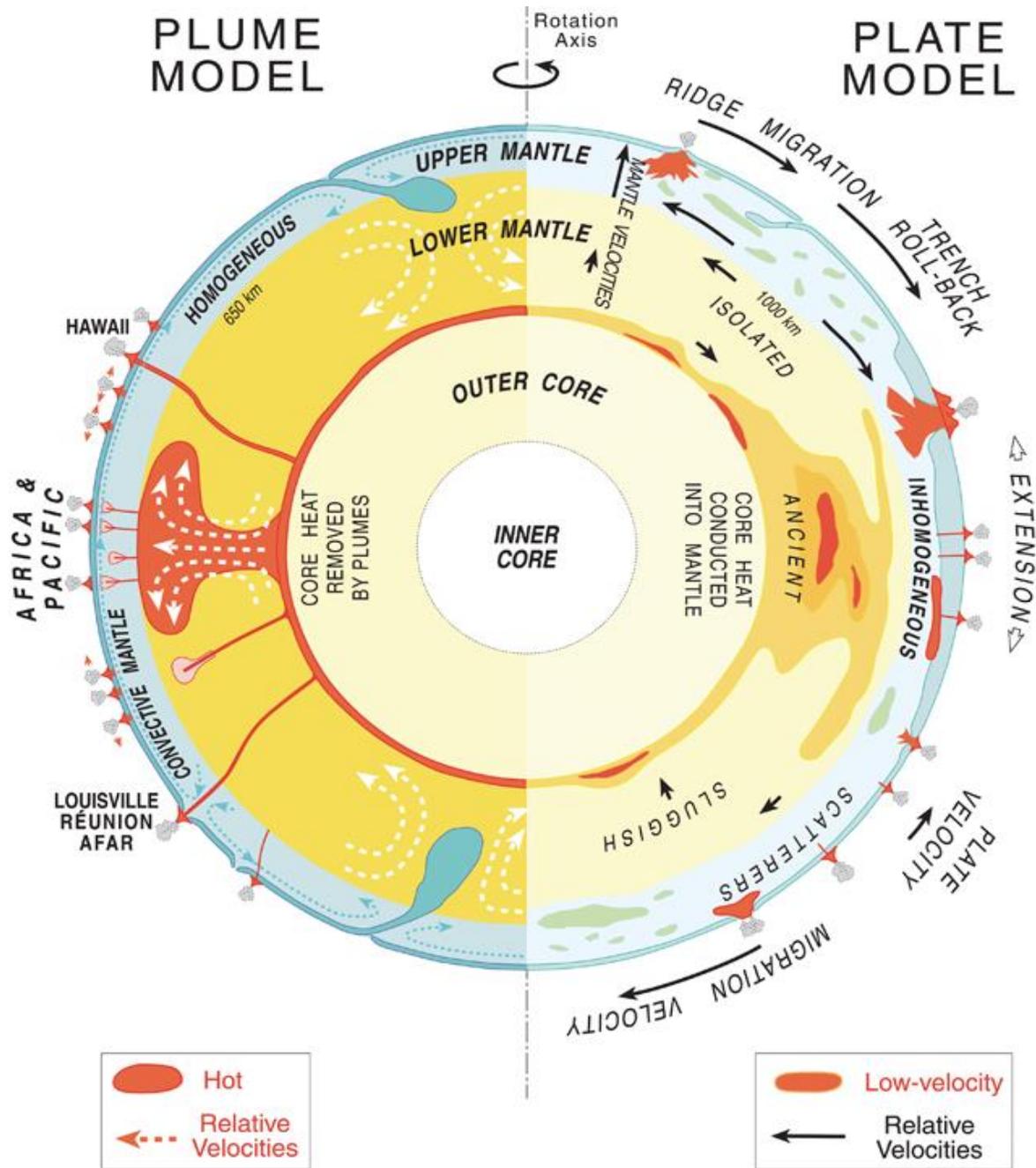


COMPARING VENUS PLUME DISTRIBUTIONS: MODELS AND OBSERVATIONS

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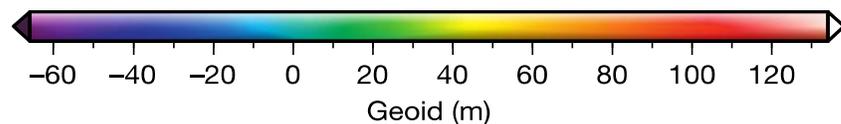
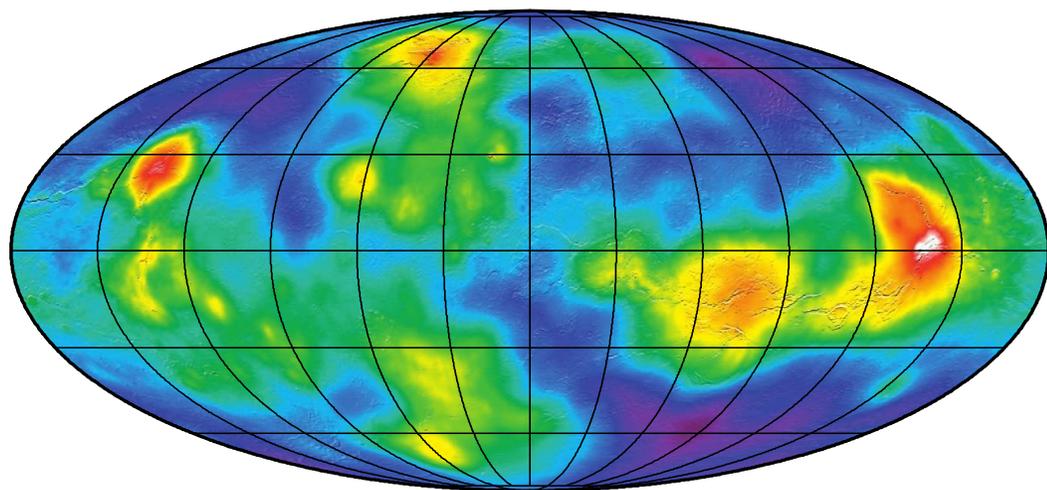




On Earth, many hotspots have long, age-progressive tracks. On Venus we see no tracks associated with the large swells inferred to be of volcanic origin.

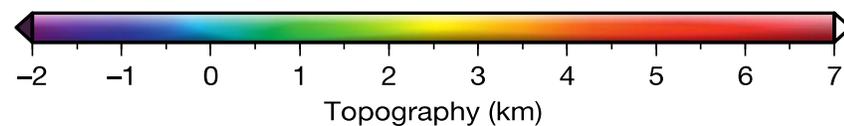
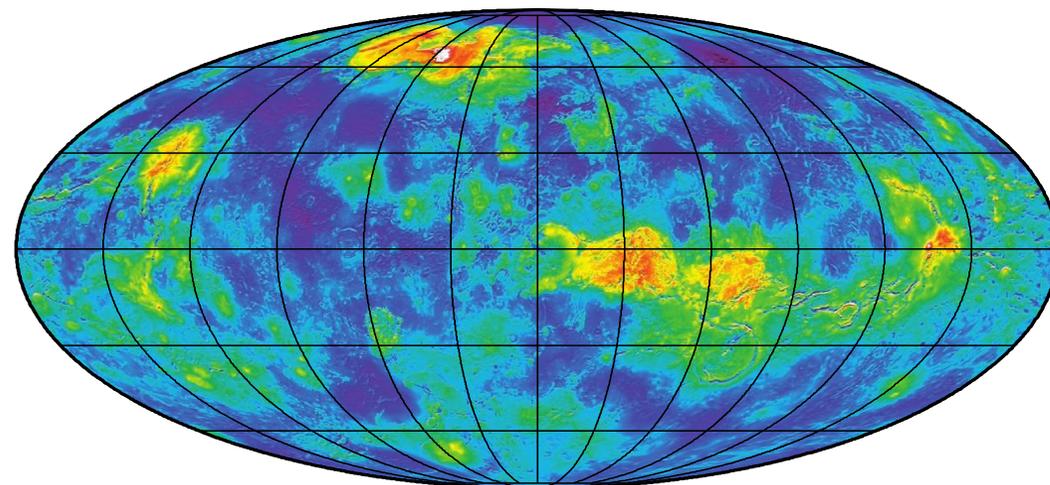
Convection within the mantle of Venus

- High Rayleigh number (10^4 - 10^5 times critical)
 - Vigorous convection, mobile plumes, *initial conditions are not important*
- Currently in “stagnant lid” mode of convection
 - Some researchers think the young surface age is the result of an earlier “mobile lid” event
- Predominantly internally heated
 - Decay of radiogenic elements
 - Cooling core
- There are also some constraints
 - Relatively young surface age
 - No magnetic field



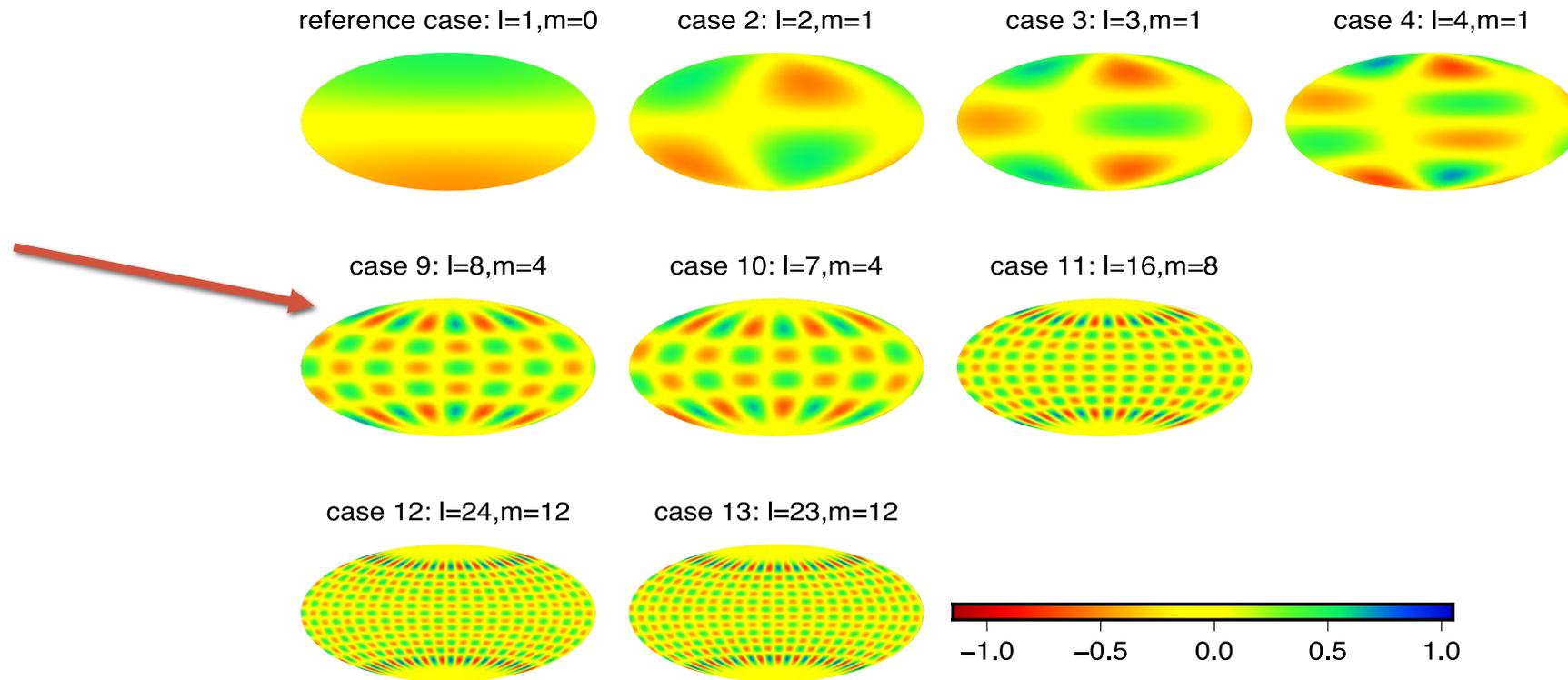
Large topographic highs interpreted (by some) as upwelling swells but no obvious hotspot tracks

The geoid and topography are strongly correlated at all wavelengths



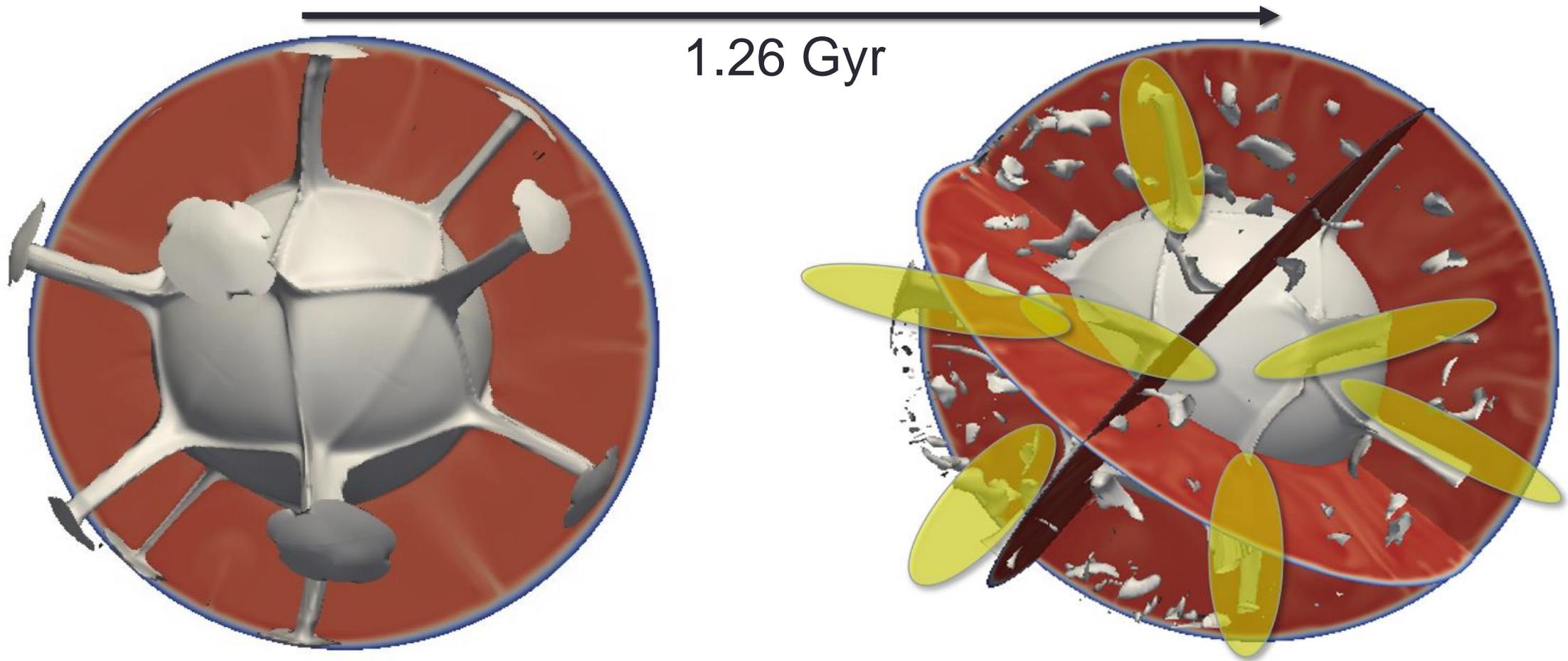
from Wieczorek, 2015

King (2018) looked at a variety of imposed perturbations



Need an anti-polar component (degree 1) in the imposed perturbation to kick-start episodic, mobile-lid convection

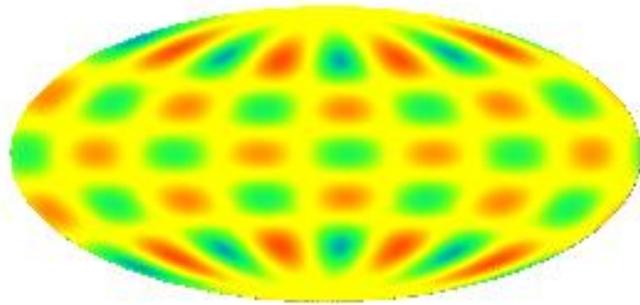
Initial structures persisted through time



from King, 2018

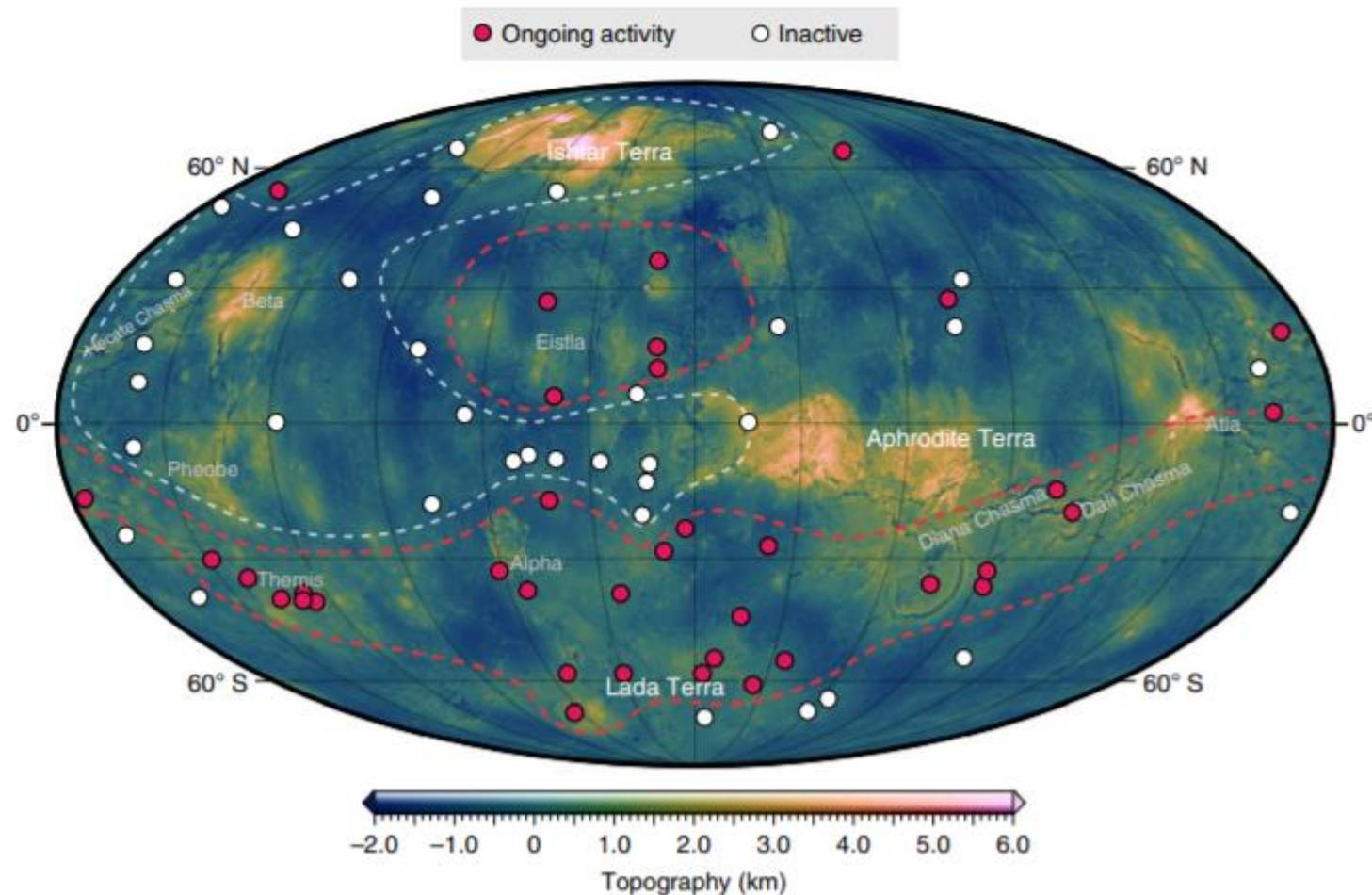
Case 9 was surprisingly stable

case 9: $l=8, m=4$



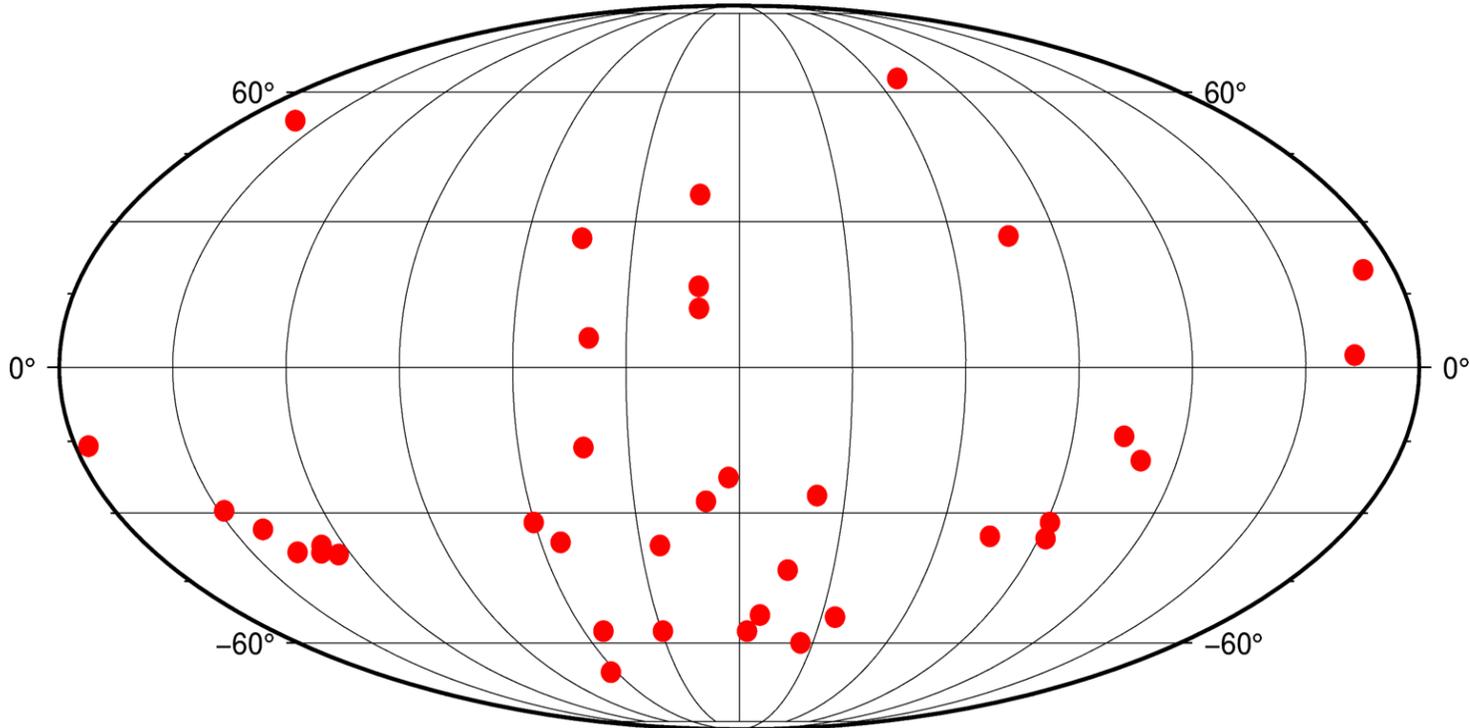
- Plumes from the initial perturbation remained in pattern for 1-2 Gyr in many cases
- Other down- and upwellings occurred, but original plume structure persisted
- For case 9, the original pattern lasted >2.0 Gyr
- This gives potential for surface expression of long-lived structures

Locations of some of the coronae

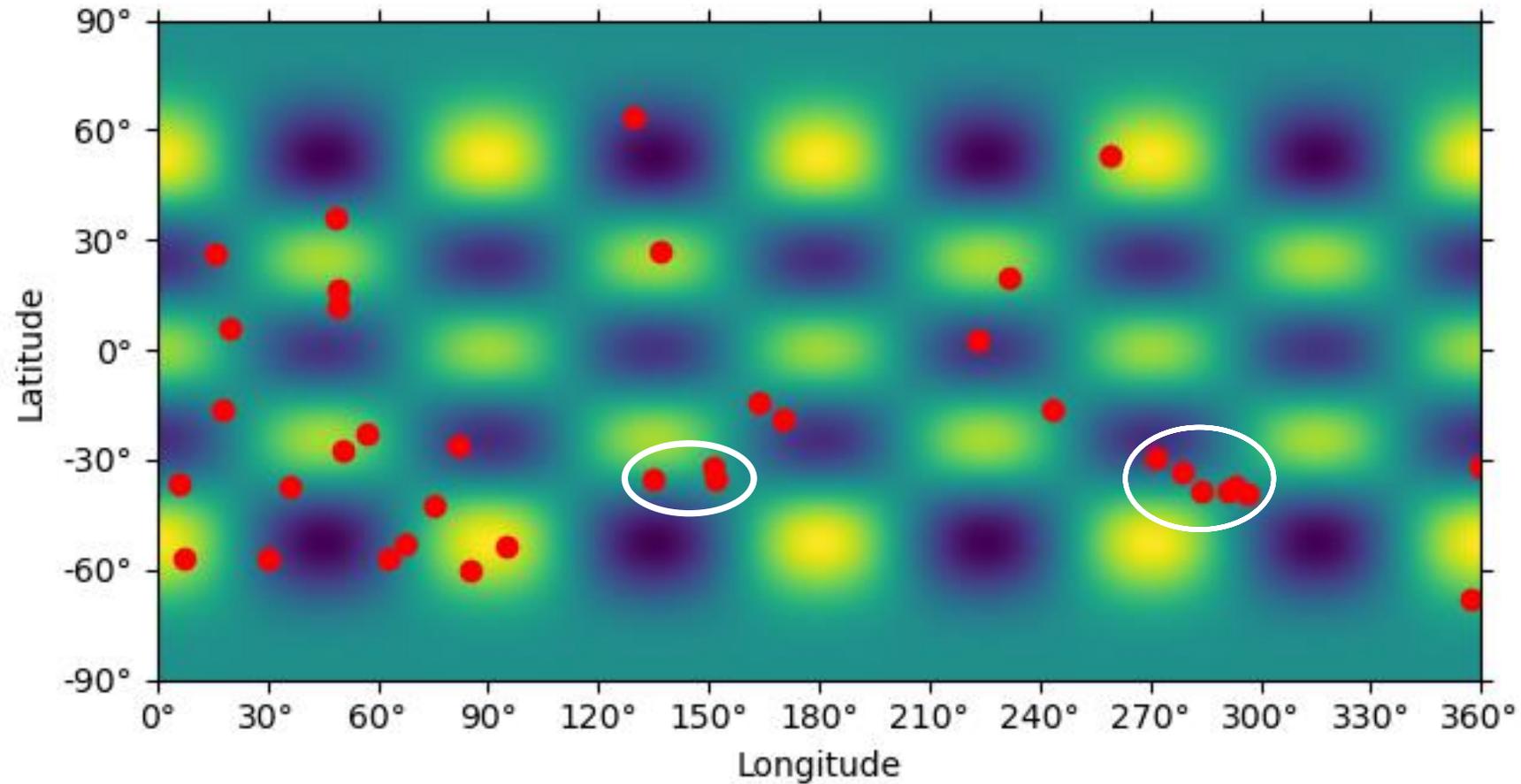


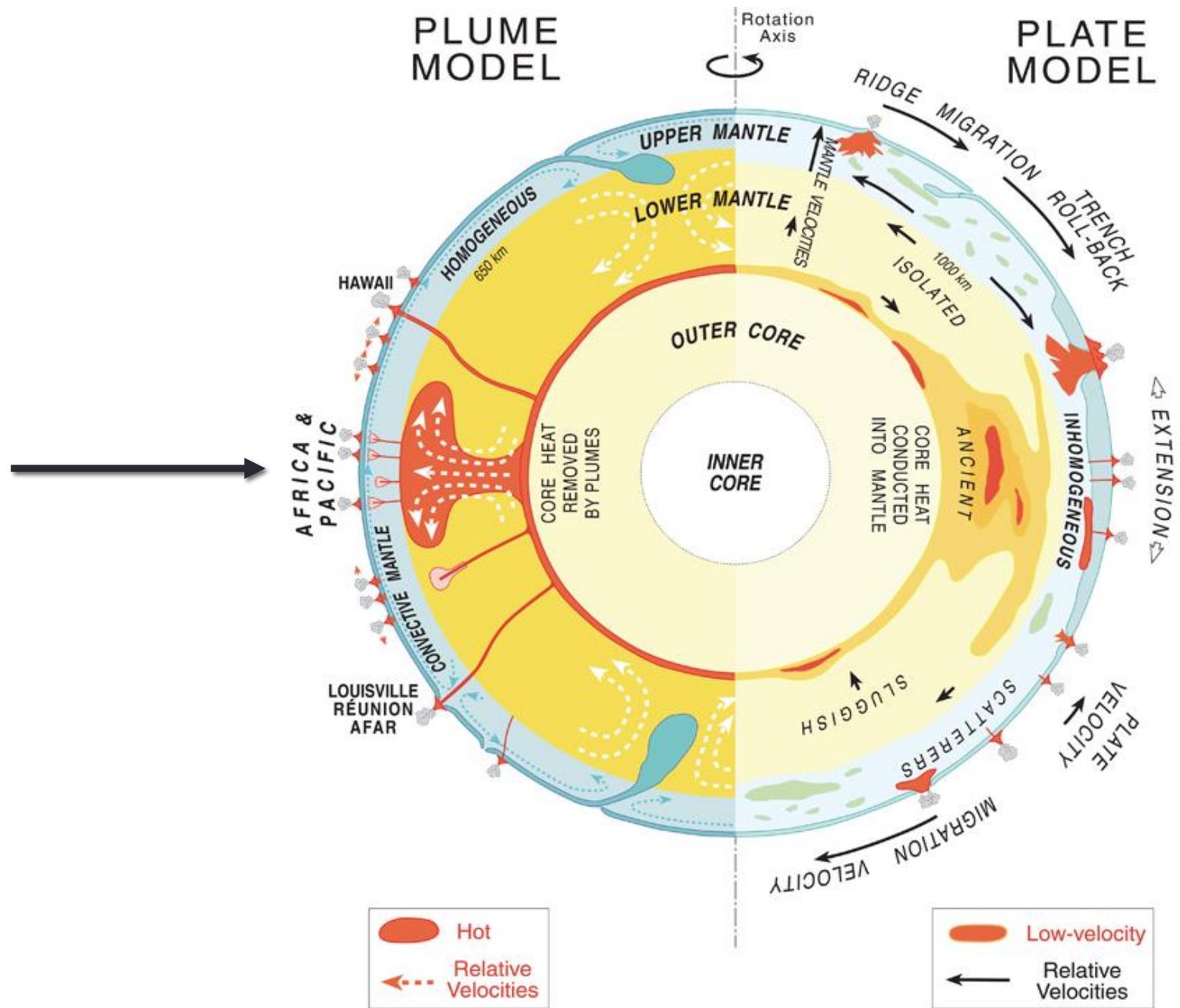
from Gülcher et al, 2020

Reducing to only active coronae



Superimposing spherical harmonics





Continuing Work

- Continue analyzing the spherical harmonic structure of the coronae
- Compare coronae locations for statistically significant variations from random
- Use varying cluster analysis techniques to try to pinpoint locations of plumes
 - Utilize different subsets of coronae to form a more robust picture

Conclusions

- A degree 8, order 4 spherical harmonic pattern could allow for long-lived plume tail structure within Venus mantle conditions
- If coronae are surface expressions of plume structures, coronae clusters could represent single, larger plumes
- Analysis is ongoing