



Compositional-seismological reference models for Venus's interior.

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Venus is the terrestrial planet in our solar system with a mass and radius closest to that of the Earth, yet despite this similarity we know remarkable little about its internal structure. Basic physical data, like Venus's moment of inertia are unknown, as is the size of its core. Likewise, we lack good estimates of the temperature of Venus's mantle and core, though they are important for understanding why superficially similar Venus is different to the Earth. As we look elsewhere in the galaxy and see exoplanets with radii and masses similar to those of the Earth, it is imperative that we are able to understand the diversity of terrestrial planets in our own solar system.

We derive several compositional-seismological reference models for Venus's interior, corresponding to different compositions and a range of mantle potential temperatures. The ExoPlex and BurnMan software packages are used to consistently calculate both the composition and mineralogy of Venus as a function of radius (and thus pressure), as well as the seismic velocity and density profiles for each model.

For each model we calculate ray theoretical travel times for phases sensitive to both the mantle and the core, as well normal mode centre frequencies. We also compute seismic waveforms for each model. We investigate seismic phases which are sensitive to the depth of the core-mantle boundary beneath Venus's surface. We also assess the variation of mantle transition zone thickness between our different reference models.

Seismological missions to Venus will be challenging, but technological improvements may allow us to explore its interior by either a surface lander or by other means. We show that different self-consistent interior models of Venus give rise to different seismological observations, suggesting that future geophysical missions may provide abundant data to understand our planetary sibling.