LITHOSPHERIC STRUCTURE OF VENUSIAN CRUSTAL PLATEAUS. J. S. Maia[1] and M. A. Wieczorek[1], [1]Observatoire de la Côte d'Azur, Laboratoire Lagrange, Université Côte d'Azur, Nice, France (julia.maia@oca.eu).

Introduction: Crustal Plateaus are prominent highland features found on Venus and are characterized by strongly tectonized fabric known as tessera. Since they are the stratigraphically oldest surfaces on Venus [1], these regions likely recorded a significant fraction of the planet's geological history. It is in fair agreement that the high topography of these plateaus is associated with some amount of crustal thickening, but which mechanisms are responsible for this thickening are not well understood [e.g., 2,3]. Thus, investigating the internal structure and formation mechanisms of the plateaus is crucial to better understand the early tectonics and geodynamics of Venus.

Our study is based on using gravity and topography data to investigate the lithospheric and crustal structure of 6 crustal plateaus: Alpha, Ovda, Western Ovda, Thetis, Tellus and Phoebe regiones. Although several gravity studies have been performed on these regions [e.g., 4,5,6], the development of new analyses techniques, more complex lithospheric models and better gravity and topography motivated us to perform a new investigation.

Methods: In this study, we made use of the 180-degree gravity model MGNP180U [6] and the topography model from [7]. At each studied region we localized the datasets in both spatial and spectral domain using the technique introduced by [8]. These are used to compute the wavelength-dependent ratio between gravity and topography, called spectral admittance, of each plateau.

The localized observed admittances are then compared with theoretical admittance curves estimated from a loading model of the lithosphere. We adopt the model used in [9] which treats the lithosphere as a thin elastic shell and allows for loads both on and below the surface. We investigate two subsurface load arrangements: either as a low-density layer in the mantle, such as from a mantle plume, or a high-density layer in the crust, such as a dense magmatic intrusion.

Our investigation considered three free parameters: the elastic thickness T_e, which controls the amount of deflection of the lithosphere, the crustal thickness T_c, and the ratio between surface and subsurface loads L. We systematically varied these parameters to generate theoretical admittance curves and used the root-mean-square error between the models and the observation to compute the misfits. For each parameter we estimated the accepted range of values by defining a threshold based on the average of the admittance uncertainties.

Results and conclusion: For most regions, the inclusion of subsurface loads is not necessary to fit the data. In fact, the models with $L = 0$ correspond to the best-fitting curves in many cases although the presence of a small dense layer in the crust is generally acceptable within uncertainties. These estimations indicate that, overall, the plateaus are supported elastically by the lithosphere with no indications of an active support component, except for Phoebe Regio as we will discuss later. The best-fitting elastic thickness of all investigated regions vary from 5 to 25 km and $T_e = 0$ is accepted for most cases, confirming that plateaus are in, or very close to, an Airy isostasy regime.

Since the load ratio and the elastic thickness are overall consistent with being zero, we also tested two simpler loading scenarios to investigate the crustal thickness of the plateaus: one including only surface loads ($L = 0$) and a second that is an Airy isostasy regime ($L = 0$, $T_e = 0$). Figure 1 shows the crustal thicknesses obtained for the 6 studied regions considering the 3 investigated models.

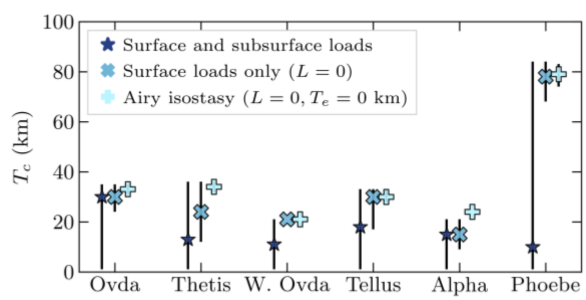

Figure 1: Crustal thickness estimations for the crustal plateaus considering the three investigated loading scenarios.

In most cases the three different scenarios do not have a major impact on the crustal thickness estimations, although decreasing the number of free parameters reduces the uncertainties. The best-fitting crustal thicknesses vary from about 15 km to 35 km, except for Phoebe Regio. At Phoebe, crustal thickness values that are compatible with other plateaus are only obtained when a buoyant mantle layer is included, otherwise only values above 70 km are obtained. Phoebe is thus the only region studied that potentially requires the support from an underlying mantle plume.

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