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EnVision M5 mission project : expected outcomes on the internal structure and dynamics of Venus

Caroline Dumoulin (1), Pascal Rosenblatt (2), Nicolas Rambaux (3), and Jean-Charles Marty (4)

(1) LPG, UMR-CNRS 6112, Université de Nantes, Nantes, France (caroline.dumoulin@univ-nantes.fr), (2) Géoazur, Nice, France, (3) IMCCE, Paris, France, (4) CNES/GRGS, Toulouse, France

EnVision is a project of mission dedicated to Venus, selected in Phase-A by ESA in the M5-program. This project consists of an orbiter carrying a Synthetic Aperture Radar (SAR), an emissivity mapper and a subsurface radar sounder. Furthermore, a radio-science experiment will be conducted using navigation tracking data. Here, we present the expected outcomes of the mission to improve the knowledge of the internal structure and dynamics of Venus.

Simulations of precise orbit determination of the spacecraft on which relies the reconstruction of the gravity field show that the foreseen orbit will allow to improve the spatial resolution of the gravity field compared to Magellan's data, especially in the southern hemisphere. The accuracy of the geoid and the gravity anomalies will also be improved, leading to Geoid to Topography ratios (GTR) better resolved over several regions of interest. GTR are used to constrain the shallow to deeper structures, assuming a compensation mode of the topography (variations of crustal and/or elastic lithosphere thicknesses as well as dynamic support from the mantle).

The signature of the tidal deformation of Venus in the gravity field will be estimated through the determination of the potential Love number, k_2. We show that the expected accuracy on k_2 should allow to better constrain the size and state of the core. If measurable, the tidal lag is an important parameter to constrain the mantle viscosity, which has strong implications in thermal evolution studies.

Spin rate variations will be measured using the control point network method based on SAR images. This would allow confirming the existence and amplitude of length of day variations. At present, it is estimated about 7 minutes, using two types of observations (Earth-ground and spacecraft). However, models of interior and atmosphere could explain only 3 minutes of this variation.