Improving Venus gravity field with the Envision candidate mission

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The gravity field of Venus is merely known from tracking data of two spacecraft: Magellan and Pioneer Venus Orbiter. It shows highly variable resolution preventing the detection of possible lateral variations of the lithospheric and crust thicknesses and the precise knowledge of the size and state of the core. The EnVision mission, which is ongoing selection at ESA, offers the opportunity to improve the current solution of the gravity field of the planet. Precise Doppler tracking data of the spacecraft are indeed foreseen to be performed during telemetry slots of the payload instrument data, providing at least 7 hours of effective tracking per day. This tracking will use the Ka-band carrier frequency, which allows less noisy Doppler data than in X-band (Magellan data). In this study, simulations are performed to assess the expected improvement of the gravity field solution, taking into account a realistic Doppler noise budget and the misleading of the knowledge of the full dynamics of the spacecraft motion. Preliminary results show that a spatial resolution better than 200 km can be reached over the southern hemisphere when the spacecraft altitude is lower than 300-350 km, thus allowing to fill the major gaps in the resolution of the current solution. The precision on the potential tidal Love number k2 allows to better constrain the size and state of the core. The improvement would also allow to investigate more tiny gravity variations due to the mass transfer in the atmosphere related to the thermal tides in the atmosphere.

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