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JUICE'S 3GM GRAVITY EXPERIMENT AROUND GANYMEDE - COMPARISON BETWEEN NOMINAL AND EXTENDED MISSION

Abstract

The JUpiter Icy Moons Explorer (JUICE) is an European Space Agency (ESA) mission dedicated to investigate Jupiter's icy satellites and Jovian environment. The mission will be launched in 2022 from Kourou, French Guyana, on an Ariane 5 and it will arrive in the Jovian system in 2029. The mission will perform a series of flybys of the icy moons Europa, Callisto and Ganymede before being inserted into a 9-month orbit around Ganymede. The Ganymede orbital phase is divided into a 5-month elliptical orbit (GEO) and a 4-month circular orbit at an altitude of approximately 500 km (GCO-500). JUICE is endowed with a suite of instruments that will investigate the moon's icy crust, interior structure, magnetic field and exosphere. The 3GM (Geodesy and Geophysics of Jupiter and the Galilean Moons) experiment on board the spacecraft will exploit accurate Doppler and range measurements to determine the moons' orbits, gravity fields, tides and therefore infer details about their internal structures. In this work, we focus on the last phase of the mission, the circular orbit around Ganymede. The simulations of the nominal mission (GCO-500) reveals that 3GM can provide a gravity map of the moon's up to degree and order 40. The Love number k_2, modeling the tidal response, is determined with an accuracy of 10^{-4} (1-σ), which will allow us to set a constraint on the internal structure of the moon. The obliquity, φ, and the libration at orbital period, ϕ, can be retrieved with a level of uncertainty of 1 and 2 μrad, respectively. In this paper, we compare the expected results of the nominal GCO-500 phase with a possible extended mission to a 200 km circular orbit (GCO-200). At a lower altitude, the gravity field can be recovered at higher degree, thus, revealing more details about the superficial structures of the moon and about the extension of the likely subsurface ocean.