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Initial results for the depth of atmospheric and interior flows on Jupiter as inferred from the Juno gravity measurements

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The Juno spacecraft is now in orbit around Jupiter, performing close flybys of the planet. One of the primary goals of the mission is to obtain a high precision gravity spectrum of the planet. Such data can be used to estimate the depth of Jupiter's observed cloud-level wind, and decipher the possible internal flows within the planet. In light of the Juno gravity measurement first results, we discuss the Juno gravity experiment and the implications regarding Jupiter's differential rotation and atmospheric flows. Particularly we focus on the odd gravity moments, which reflect asymmetries between the northern and southern hemispheres and therefore are a pure signature of the dynamics with no contribution from the static planet. We use a hierarchy of models including a layered Concentric Maclaurin Spheroid model for determining the static component of the gravity spectrum, and a non-spherical analysis of the vorticity balance for inferring the dynamical contribution to the gravity spectrum. In order to invert the gravity measurements into flow fields we use an adjoint based inverse model. The model is constructed to be as general as possible, allowing for both cloud-level wind extending inward, and a decoupled deep flow that is constructed to produce cylindrical structures with variable width and magnitude, or can even be set to be completely general. Implications of the results regarding the physics governing the atmospheric and internal flows on Jupiter are discussed.