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The Range of Jupiter's Flow Structures that Fit the Juno Asymmetric Gravity Measurements

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The asymmetric gravity field measured by the Juno spacecraft has allowed the estimation of the depth of Jupiter's zonal jets, showing that the winds extend approximately 3,000 km beneath the cloud level. This estimate was based on an analysis using a combination of all measured odd gravity harmonics, J_3, J_5, J_7, and J_9, but the wind profile's dependence on each of them separately has yet to be investigated. Furthermore, these calculations assumed the meridional profile of the cloud‐level wind extends to depth. However, it is possible that the interior jet profile varies somewhat from that of the cloud level. Here we analyze in detail the possible meridional and vertical structure of Jupiter's deep jet streams that can match the gravity measurements. We find that each odd gravity harmonic constrains the flow at a different depth, with J_3 the most dominant at depths below 3,000 km, J_5 the most restrictive overall, whereas J_9 does not add any constraint on the flow if the other odd harmonics are considered. Interior flow profiles constructed from perturbations to the cloud‐level winds allow a more extensive range of vertical wind profiles, yet when the meridional profiles differ substantially from the cloud level, the ability to match the gravity data significantly diminishes. Overall, we find that while interior wind profiles that do not resemble the cloud level are possible, they are statistically unlikely. Finally, inspired by the Juno microwave radiometer measurements, assuming the brightness temperature is dominated by the ammonia abundance, we find that depth‐dependent flow profiles are still compatible with the gravity measurements.