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Jupiter's Zonal Vorticity Profile Observed by JunoCam

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We derive Jupiter's zonal vorticity profile from JunoCam images, with Juno's polar orbit allowing the observation of latitudes that are difficult to observe from Earth or from equatorial flybys. We identify cyclonic local vorticity maxima near 77.9°, 65.6°, 59.3°, 50.9°, 42.4°, and 34.3°S planetocentric at a resolution of ~1°, based on analyzing selected JunoCam image pairs taken during the 16 Juno perijove flybys 15-30. We identify zonal anticyclonic local vorticity maxima near 80.7°, 73.8°, 62.1°, 56.4°, 46.9°, 38.0°, and 30.7°S. These results agree with the known zonal wind profile below 64°S, and reveal novel structure further south, including a prominent cyclonic band centered near 66°S. The anticyclonic vorticity maximum near 73.8°S represents a broad and skewed fluctuating anticyclonic band between ~69.0° and ~76.5°S, and is hence poorly defined. This band may even split temporarily into two or three bands. The cyclonic vorticity maximum near 77.9°S appears to be fairly stable during these flybys, probably representing irregular cyclonic structures in the region. The area between ~82° and 90°S is relatively small and close to the terminator, resulting in poor statistics, but generally shows a strongly cyclonic mean vorticity, representing the well-known circumpolar cyclone cluster.

The latitude range between ~30°S and ~85°S was particularly well observed, allowing observation periods lasting several hours. For each considered perijove we selected a pair of images separated by about 30 - 60 minutes. We derived high-passed and contrast-normalized south polar equidistant azimuthal maps of Jupiter's cloud tops. They were used to derive maps of local rotation at a resolution of ~1° latitude by stereo-corresponding Monte-Carlo-distributed and Gauss-weighted round tiles for each image pair considered. Only the rotation portion of the stereo correspondence between tiles was used to sample the vorticity maps. For each image pair, we rendered ~40 vorticity maps with different Monte-Carlo runs. The standard deviation of the resulting statistics provided a criterion to define a valid area of the mean vorticity map. Averaging vorticities along circles centered on the south pole returned a zonal vorticity profile for each of the perijoves considered. Averaging the resulting zonal vorticity profiles built the basis for a discussion of the mean profile.

JunoCam also images the northern hemisphere, at higher resolution but with coverage restricted to a briefer time span and smaller area due to the nature of Juno's elliptical orbit, which will restrict our ability to obtain zonal vorticity profiles.