Geophysical Research Abstracts
Vol. 12, EGU2010-7369, 2010
EGU General Assembly 2010

Variability of Jupiter's zonal winds on multiple timescales

Xylar S. Asay-Davis (1), Michael H. Wong (2,3), Imke de Pater (2), and Philip S. Marcus (2)

(1) Los Alamos Naotional Laboratory, Los Alamos, NM, USA (xylar@lanl.gov), (2) University of California, Berkeley, Berkeley, CA, USA, (3) Space Telescope Science Institute, Baltimore, MD, USA

Jupiter's zonal wind profile in 2008 changed compared with previous epochs. Eastward jets near 24 deg N and 8 deg N (planetographic) increased by about 15 and 30 m/s, respectively. The changes are statistically significant, and not biased by local meteorological phenomena. A connection with the global upheaval of 2007 is possible. As part of the upheaval, cloud changes were observed in the equatorial zone, and large convective plumes erupted at 23 deg N.

We derived velocities from new data acquired in May 2008 with the Wide Field Planetary Camera 2 (WFPC2) on the Hubble Space Telescope (HST) and from navigated Cassini imaging data obtained from NASA's Planetary Data System, demonstrating changes between 2000 and 2008. Velocities were measured using automatic correlation of navigated image pairs, rather than with mosaics of navigated images. The method was validated by comparing our velocities derived from Cassini data to published velocities based on the same data set (Porco et al., 2003, Science 299, 1541-1547). We report on decadal-scale variability of the zonal winds based on comparison with Voyager observations in 1979 (Limaye, 1986, Icarus 65, 335-352) and HST observations between 1995-1998 (Garcia-Melendo and Sanchez-Lavega, 2001, Icarus 152, 316-330).

Prior studies based on Voyager and 1995-1998 HST data found fluctuations in zonal wind speeds on the order of 10 m/s on timescales ranging from a Jovian rotation to weeks to months. (Fluctuations over weeks and months are of the same magnitude as the uncertainty in correlations over the 10 hour Jovian rotation period, which may indicate that the zonal velocity fluctuates on even shorter timescales.) These fluctuations impose a fundamental limit on the accuracy of zonal wind measurements, and lead to two key conclusions: First, it is difficult to demonstrate change in "the" zonal wind profile, because continual change is observed on many timescales. Second, because these are actual fluctuations in mean zonal wind speeds, it is inaccurate to assume that they have a zero time average. Thus, a suite of zonal wind profiles spanning months or years cannot be averaged together under the assumption that the associated velocity uncertainties will decrease with the square root of the number of zonal wind profiles. Only new observational data sets with high temporal resolution and long campaign durations will be able to differentiate between short-term and long-term variability of Jupiter's zonal winds.