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The winds of Saturn: New measurements of the zonal windfield at depth by Cassini-Huygens/VIMS

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We present new measurements of the zonal windfield of Saturn from 27 degrees north latitude to 52 degrees south latitude as determined by cloud-tracking at a wavelength of 5.1 microns by the Visual Infrared Mapping Spectrometer onboard the Cassini/Huygens orbiter. At this wavelength, Saturn's indigenous thermal radiation upwelling from depth predominates over reflected sunlight. Overlying clouds attenuate this radiation, allowing them to be mapped on both the day and nightside. Tracking these backlit clouds enables the determination of winds at a relatively deep level in the atmosphere at or below the 1-bar level near where relatively large particles ($> \sim$5 micron radius) reside. Comparison of these winds with those determined by tracking sunlit cloudtops enables the estimation of vertical windshears. Typically, we track features over multiple planetary rotations during a 4-day period, from distances of $\sim$ 5 million km corresponding to a VIMS IFOV of $\sim$2500 km, thus yielding uncertainties in the derived winds of $\sim$ 10 m/sec. Thus far, we find that winds measured by this technique yield zonal wind speeds close to those measured two decades ago by Voyager, in both high-speed jets and slow-speed regions. In particular, we find Equatorial winds near 11 degrees south latitude comparable to that found by Voyager as re-analyzed by Sanchez-Lavega *et al* (1999, Planetary Space Sci 47, 1277-1283). These are significantly larger ($\sim$ 60 m/sec) than those measured at the cloudtops in 1995-1997 by Sanchez-Lavega *et al*. (*ibid*), indicating that perhaps large windshears exist in this region, with winds increasing with depth near the 1-bar level. Direct comparison with contemporary cloudtop wind measurements by ISS and perhaps VIMS 0.3-2.8 micron daytime observations would help clarify this issue.