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Saturn's equatorial atmosphere from Cassini radio occultations

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We present results from several earth-occultation soundings acquired within 10 degrees of Saturn's equator in May – September, 2005. The retrieved vertical profiles of temperature in the stratosphere and tropospheric region, above the 100-mbar level, are marked by large undulations that are probably associated with vertically propagating waves. In the troposphere, the vertical profiles are much smoother below the 200-mbar level, and the overall trend is for temperatures to increase away from the equator. This smooth behavior suggests that the horizontal variation in temperature (and pressure) is primarily meridional, and the thermal wind equation indicates a decay of zonal winds with altitude. Although the ray-tracing inversions rely on an assumed geopotential shape based on a zonal-wind model, residual zonal winds can be estimated directly from the retrieved pressure field, using the gradient wind relation. These in turn can be used to update the geopotential, iterating the inversions to obtain a best-fit internally consistent solution. The occultation data therefore offer a new way of constraining Saturn's low-latitude winds. Recent cloud-tracking studies have indicated lower equatorial winds than deduced from Voyager-era studies, but whether this indicates a real change in the winds or a change in the altitudes of the features tracked has been controversial.