# Spatiotemporal Variations of Saturn's Zonal Winds based on Cassini Long-term (2004-2017) Multi-Instrument Observations

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Abstract

The Cassini mission spanned thirteen years, providing scientists data and images that will expand our insight into Saturn for decades to come. The Cassini spacecraft carried a complex suite of instrumentation onboard, specifically designed to provide imagery deep into Saturn's atmosphere. The Composite Infrared Spectrometer (CIRS), the Imaging Science Subsystem (ISS), and the Visual and Infrared Mapping Spectrometer (VIMS) were specifically designed to observe from the stratosphere, across the tropopause, and into the upper troposphere.

The research is divided into three tasks: 1) Utilize VIMS data to examine spatiotemporal patterns in the tropospheric winds; 2) Utilize data from the ISS and the CIRS to examine spatiotemporal patterns in the upper troposphere, across the tropopause, and into the stratosphere; 3) Utilize combined data from Tasks 1 and 2 to examine spatiotemporal variations of Saturn's atmosphere during the time period of 2004 through 2017.

Preliminary results from Task 1 examine tropospheric winds at both the 300–500 and 2,000 hPa levels. A comparison of zonal winds across the troposphere shows a general consistency of wind structure at the global scale between the two pressure levels, but the magnitude of zonal winds differs at some latitudes. The equatorial zonal winds are stronger at the 2,000 hPa, while the zonal winds in the middle and high latitudes are generally stronger at the 300–500 hPa. These wind measurements also imply that barotropic and baroclinic instabilities probably exist through the relatively deep atmosphere at some latitudes. Finally, our analysis reveals that the VIMS winds in the two polar regions are generally constant with time with an exception found in the Northern Hemisphere's polar jet.