Abstract
We examine the meteorology of the giant planets using our automated cloud feature tracker. Through pattern recognition and correlation optimization, our software returns a dense, regular grid of wind vectors. We measured the winds within Jupiter's Great Red Spot (GRS) and uncovered its distinctive "hollow" structure, its counter-rotating interior, and a newly discovered cycloidal ring around its periphery. This cycloidal ring suggests the presence of a thermally indirect, downwelling secondary circulation at the periphery of the GRS. We also analyzed a time-series of images of Jupiter's White Ovals. Over a decade, the system has evolved from three discrete, white anticyclones to one reddish vortex (Oval BA). Our measurements revealed a modest, cyclonic circulation in seemingly turbulent regions near these anticyclones. We have also directly measured the power spectrum of the turbulent kinetic energy present within Jupiter's atmosphere. Our results provide evidence consistent with an inverse cascade of energy from small to large scales that may fuel Jupiter's impressive jet streams and vortices.

Finally, our analysis of VIMS near-infrared images of silhouetted clouds in Saturn's atmosphere demonstrated that the measured latitudinal zonal wind profile is largely similar to previous measurements utilizing visible-wavelength images. This result, accompanied by a statistical analysis of the imaged cloud features, yields constraints on the vertical structure and latitudinal temperature gradients of Saturn's atmosphere.

Future Work
-2D Power Spectra of Wind Vector Maps
-Construction and continual analysis of full-longitudinal wind vector maps for Jupiter and Saturn.
-Additional analysis and numerical simulations of Jovian 5-micron hotspots
-Application of software to stereo imaging data sets to extract topography

Future Algorithm Improvements
-Accounting for shear and rotation in the tracked cloud features, improvement of algorithm utility.
-Optimization of code structure and algorithms.
-Additional selection of correlation box size parameters.
-Neural network integration, parallel processing