Saturn's Equatorial Jet Through Reanalysis of Newly Navigated Voyager Data

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Objectives

- Determine Saturn's equatorial wind speed in 1980-81 using a modern cloud tracking method.
- Examine if the slower equatorial jet speed observed by later missions is a true slowing of winds or a consequence of sensing different altitudes.

Data

Voyager:

- Voyager 1 and 2 Imaging Science Subsystem (ISS) Saturn flyby images.
- Spatial resolutions range from 50 km / pixel in the northern hemisphere to 150 km / pixel in the southern hemisphere.
- We initially consider ~21,000 images in the filters listed in Table 1.

Cassini:

- We focus on Cassini ISS Wide Angle Camera views in the filters listed in Table 2, as they have been tied to similar altitudes as Voyager's.
- We will search for changes in the speed of the equatorial jet between the Voyager and Cassini eras.

Processing

- We use two tools to prepare images for cloud tracking:
  - The Integrated Software for Imagers and Spectrometers (ISIS3) for calibration and map-projection.
  - The Open-source Multi INstrument Analysis Software (OMINAS) for navigation correction.
- We track cloud features using the 2D correlation image velocimetry method (2D CIV).
- All IDL and Python processing code used to calibrate and renavigate images as well as our 2D CIV framework will be available as open-source on GitHub. This will allow reproduction of all data produced in our analysis from that hosted publicly by the PDS.

Current Work

- This project was recently selected for funding by the Future Investigators in NASA Earth and Space Science and Technology (FINESST) 2021 solicitation.
- We are currently working on translating our 2D CIV framework from IDL to Python and improving its efficiency.
- We are also modifying our image processing pipeline to take advantage of the re-navigation capabilities of OMINAS.

Filter:	Images:
Clear (280-640 nm)	6100
Violet (350-450 nm)	3880
Blue (430-530 nm)	3865
Orange (590-640 nm)	2466
Green (530-640 nm)	4593
CH_4-U (536-546 nm)	21
CH_4-JST (614-624 nm)	390

Table 1: Filter wavelength ranges and number of available PDS images for the Voyager data to be considered.

Filter:	Images:
CB2 (750 nm)	Full Disk: 4182 Partial Disk: 4169
MT2 (727 nm)	Full Disk: 2826 Partial Disk: 3471
MT3 (889 nm)	Full Disk: 946 Partial Disk: 2206

Table 2: PDS Data available in the CB2, MT2, and MT3 filters over the entire Cassini mission. Data was taken with the ISS Wide Angle Camera. Full body images contain Saturn's full disk while partial body images only contain a fraction of the disk.

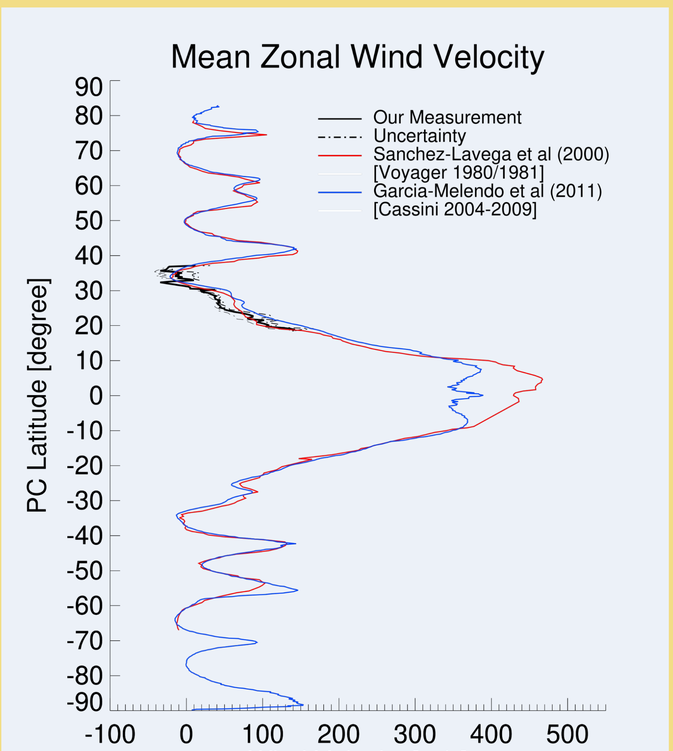

Figure 1: Preliminary zonal wind profile from a single Voyager green filter image pair analyzed by our CIV method (in black). The wind speeds agree with previous mid-latitude results from Voyager (in red) and Cassini (in blue).

About the Presenter

Justin Garland is a fourth-year planetary science Ph.D student at Hampton University. Interests include gas giant atmospheres, exoplanets, and programming.
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