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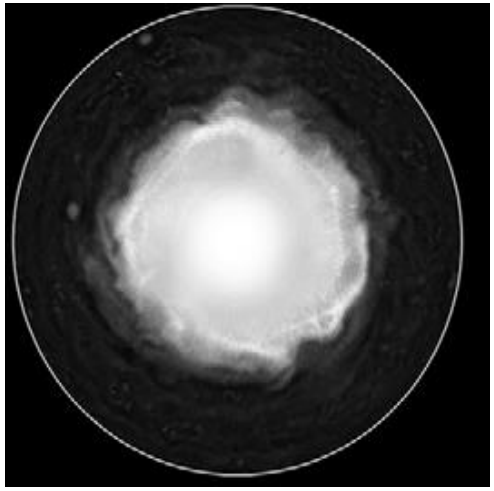
Time variation of wave structure in Jupiter's south polar region observed with ground-based telescope

Department of Cosmosciences, Hokkaido University
Yuya Gouda, Yukihiro Takahashi, Makoto Watanabe

Introduction



The Cassini image of Jupiter's south polar (890 nm) [*Barrado-Izagirre at al*., 2008]

- In Jupiter's both polar regions in the stratosphere, there is stratospheric haze that formed by scattering aerosol particles.
- Observed by the Hubble Space Telescope (HST) from 1994 to 1999 and by the Cassini ISS in 2000.
  - Wave structure propagated in latitudinal range of 60° - 70° S
  - Wavenumber was 12 - 14
  - Westward velocity of the wave structure in System Ⅲ was 0 - 10 m/s

→ It is considered to Rossby wave.

Purpose

- Final goal: Determine whether or not the wave observed at the edge of the stratospheric haze in polar regions is Rossby wave.
  - Previous observation is only year-scale observation and few observational wavelength.

- For preparation, we improve the accuracy of wave structure that was obtained by our observation.

1.6 m Pirka telescope

The 1.6 m Pirka telescope

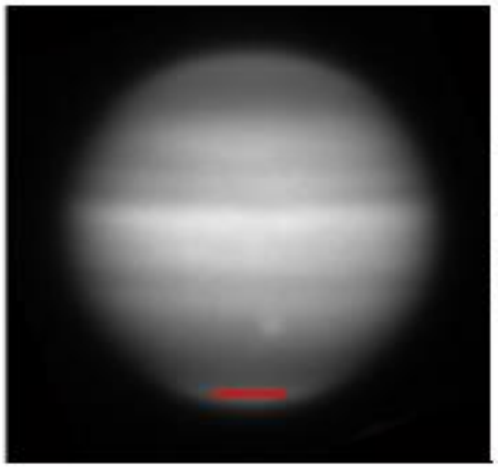
- We have observed Jupiter since 2011 by the 1.6 m Pirka telescope and Multi-Spectral Imager (MSI).
  - We can obtain images with short time exposure, which enables high special resolution.

＜Observation data at 889 nm＞

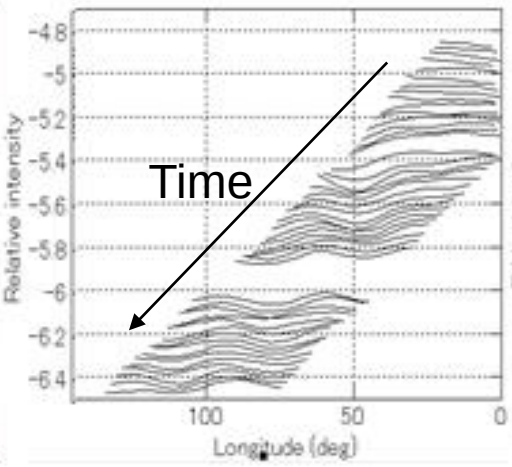
	Angular diameter (arcsec)	Seeing size (arcsec)	Exposure time (ms) ×Number
2011/10/19	49.5	2.0-2.6	500 ms × 200
2011/10/29-31	49.6	1.6-2.0	30 ms × 1000
2011/11/16	48.8	2.3-4.0	30 ms × 1000
2014/3/27	38.8	1.9-4.0	30 ms × 1000
2015/4/8, 9, 13	40.6	1.9-3.8	11 ms × 3000 30 ms × 1000

Analysis

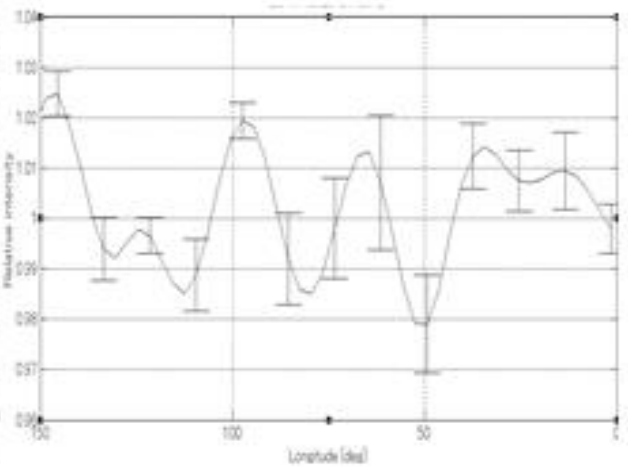
1. Position correction of a series of image.
2. Plotted the brightness of Jupiter image observed by MSI image at 67° S.
3. Composed image taken on different time by same longitude.



Jupiter image



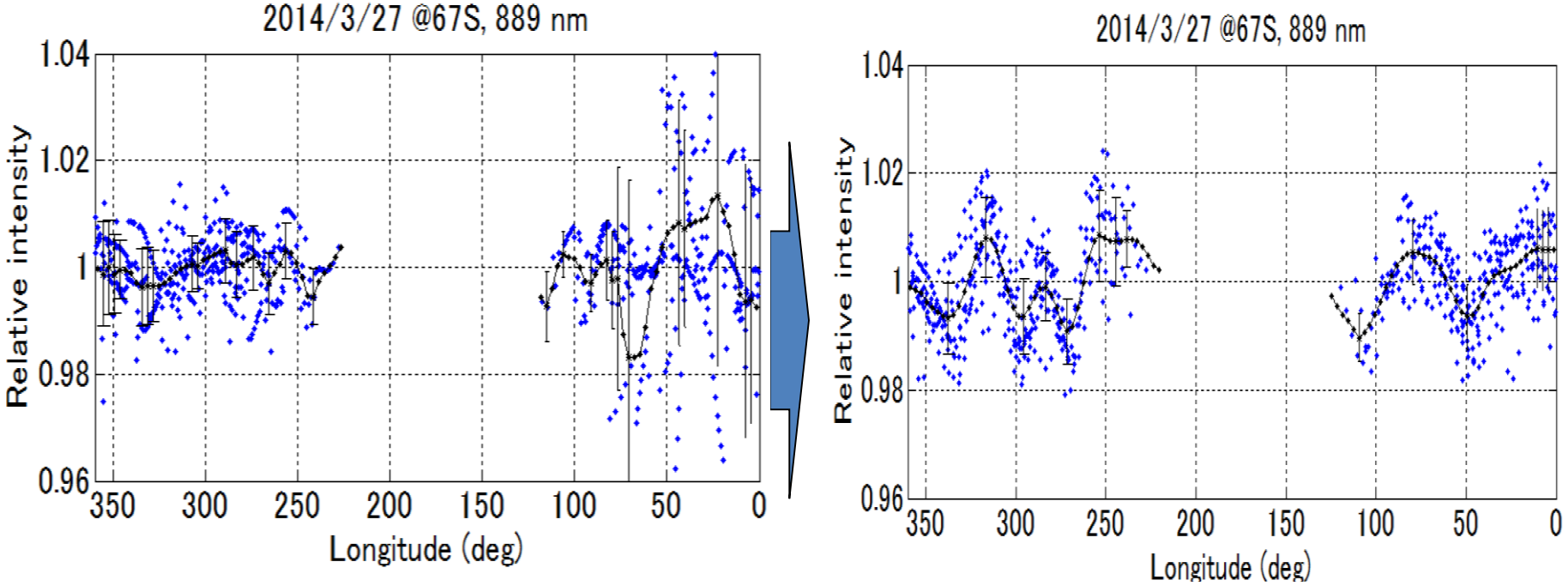
The polar waves



Composite of wave

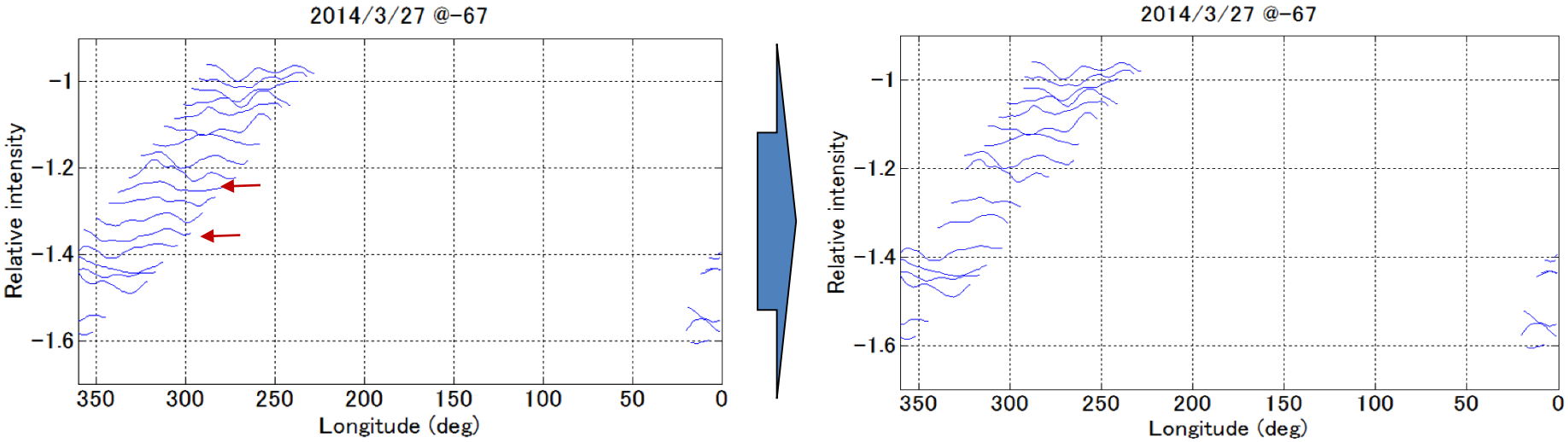
Processing of no value pixel

In some image, which is included no value pixel and it makes quality of wave structure worse.
→Remove image which include no value pixel.



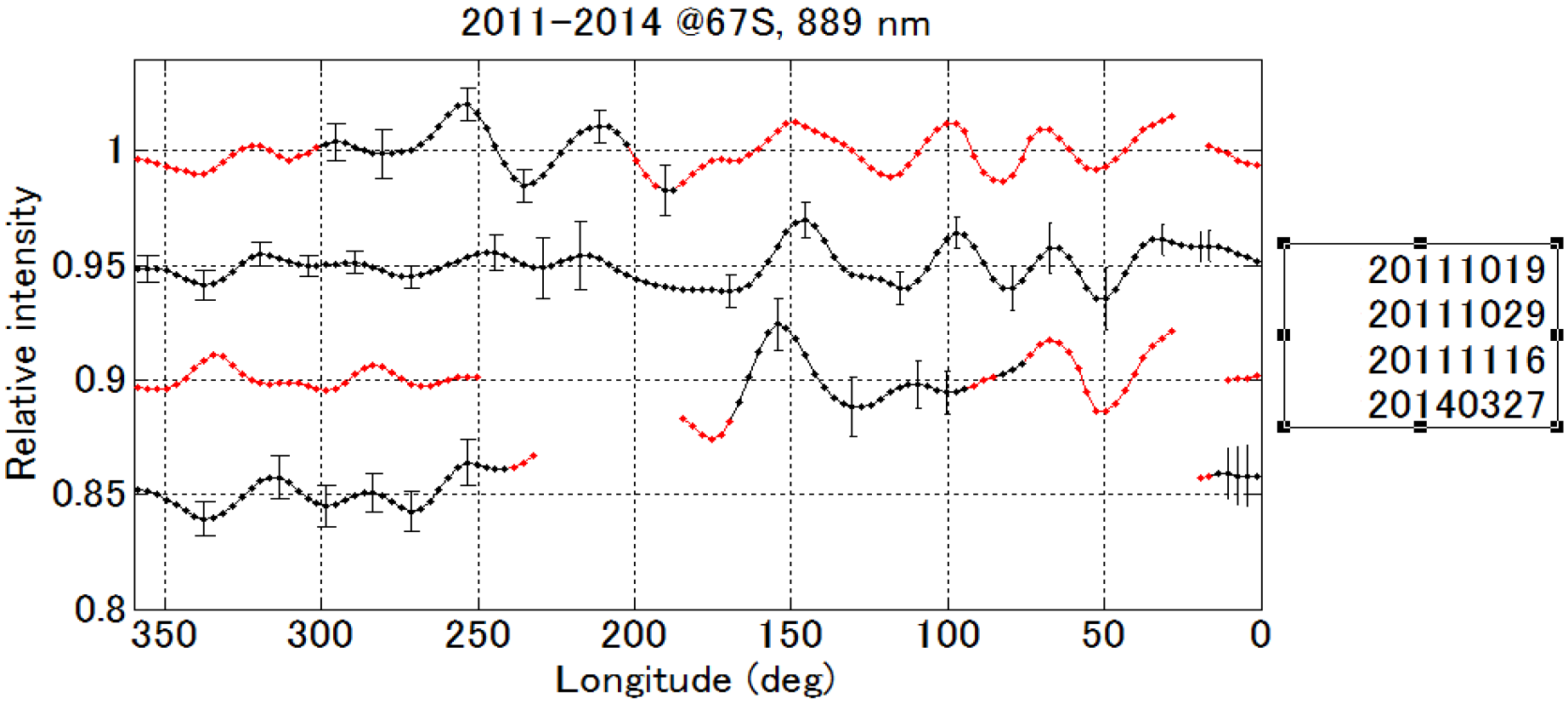
Correction by seeing

A resolution of wave structure changes with effect of atmospheric seeing (worse than 1.3”).
→Reflect seeing in wave structure.



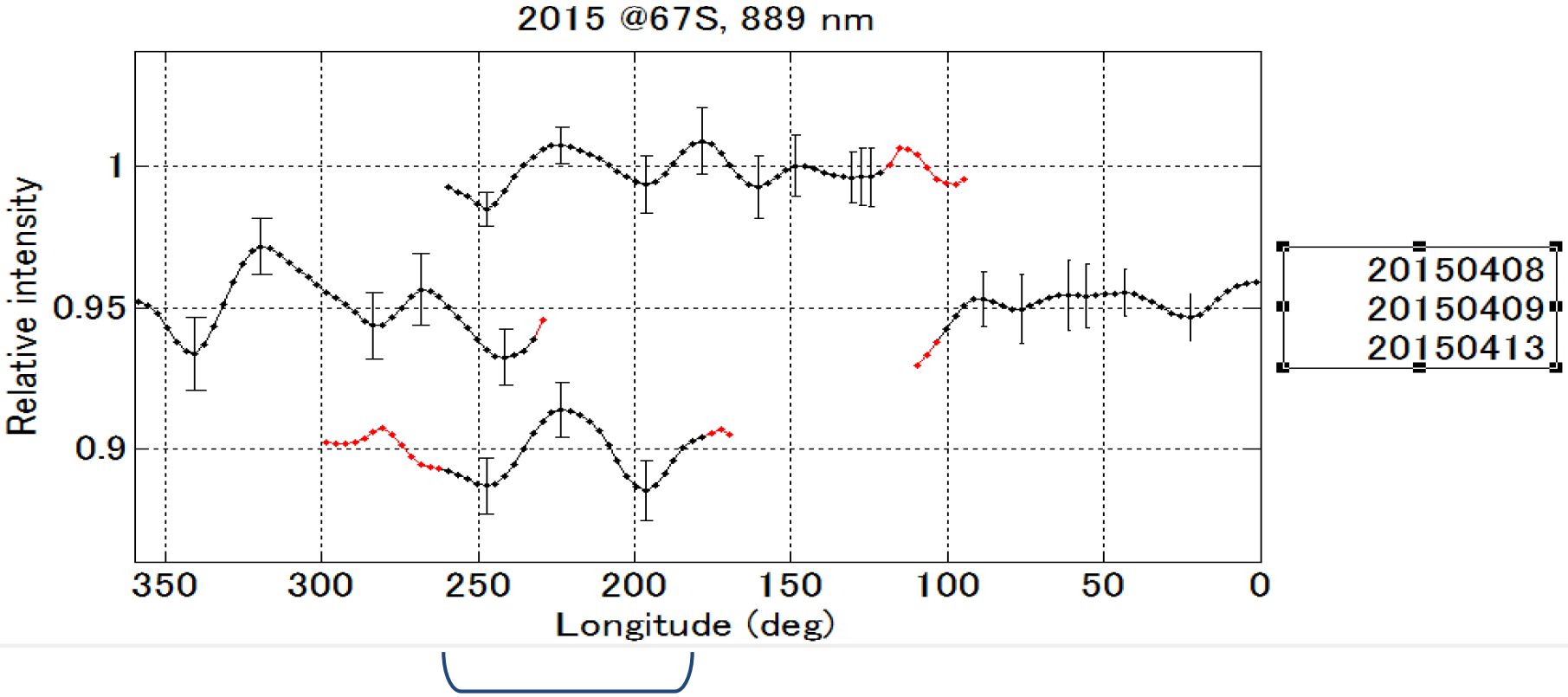
Result

Time variation of wave structure in 2011 and 2014.



Result

Time variation of wave structure in 2015.



Wave structure is very similar

Discussion

- Observation data in 2015, we found that wave structure wasn’t change in this period.
  - It is possible that the wave doesn’t large change about 5 days.
- Comparing image in 2011 to 2015, wave peaks and troughs are at varying locations in a longitudinal direction.

Summary & Future work

-*Summary*

- Adding some step to analysis, we achieve a good wave structure.
  - We can make out time variation of wave structure.

-Future work

- Using analysis of this method, we will make wave structure of different latitude and wavelength.

  →It leads to determine Rossby wave.

Reference

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