Estimation of the drift rate and intensity of Neptune’ s storm by Pirika telescope

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A storm more than 4,000 km in diameter occurs occasionally in Neptune. In previous study, Voyager 2 observed Neptune on May 24, 1989 and discovered a storm of 13,000 km in diameter called Great Dark Spot (GDS). GDS was located in southern hemisphere like Great Red Spot of Jupiter. But GDS became extinct when Hubble Space Telescope observed it in 1994. It is unknown whether it is a sudden thing or storms such as GDS always occur in Neptune. In addition, a huge storm of 9,000 km was observed on July 2 and June 26, 2017 by Keck observatory. It’ s considered that storms of Neptune occurs at mid latitude in the north and south that an ascending air occurs. However, this huge storm occurred near the equator. A rotation axis of Neptune is 29.6 degrees, and the storm possibly occurred near the equator because of seasonal change. Neptune is observed by large telescopes such as Keck observatory and the Hubble Space Telescope, but it is difficult to always use those telescopes for Neptune observation. Therefore Neptune is not observed for long term on a short time scale. We developed the technique to estimate the drift rate and intensity of storms by observing a whole spectrum of Neptune in this study. When seeing is bad, it’ s possible to observe and acquire the observation data of Neptune for a long term on a short time scale. The purpose is to deepen the understanding of the atmosphere convection structure of Neptune by chasing the detailed change of storms. In this study, we observed Neptune by using 1.6 m Pirka telescope that Hokkaido University owned. The observation time is from August 7, 2017 to January 17, 2018 and from October 22, 2018 to November 26 2018. The wavelength is 650-1050 nm in 2017, and 890, 855 nm in 2018. In this study, we used methane absorption 890 nm. Storms look brighter at 890 nm because the altitude of storms is higher than that of other areas. In addition, the appearance size of storms from the observation point changes by the rotation of Neptune, so an 890 nm flux changes by the rotation. We took the ratio of an 890 nm flux and an 855 nm flux to correct the effect of the earth atmosphere and calculated the theoretical values of the relative intensity by the rotation. We assumed storm's area and fit the observed values with the theoretical values in the least squares method to estimate the drift rate and 890 nm reflectance of the storms. We estimated that the drift rate and the 890 nm reflectance are 47.5°/ day, 0.252 in 2017, 24.9°/ day, 0.054 in 2018, respectively. In 2019, we assumed that there are three storms and estimated that the drift rate and 890 nm reflectance of the first storm are 22.8°/day, 0.128, those of the second one are 39.6°/ day, 0.081, those of the third one are 51.9°/ day, 0.149, respectively. Molter et al., (2019) study shows that 2017 storm is located at 2°N and the drift rate is 237.4±0.2 m/s or 47.78±0.04°/day. This drift rate is consistent with the drift rate estimated in my study. We will compare the results of 2018 and 2019 with observations of other reseacher and amateur, and then discuss in the future.

Keywords: Neptune, Ground-based telescope

