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Solar Cycle Variation of Prominence Eruption Speeds Observed by the Nobeyama Radioheliograph

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We report on the solar cycle variation of prominence eruptions (PEs) observed by the Nobeyama Radioheliograph (NoRH). Except for occasional data gaps, NoRH has observed the Sun routinely for 7.5 hours (22:50 UT - 06:20 UT) each day for 28 years. Shimojo et al. [1] developed an automated limb event detection technique and provided a "Complete List" which includes 1131 PEs during July 1992 and March 2014. We divide these events into four groups: north high ($\varphi \geq 60°$), north low ($0° < \varphi < 40°$), south low ($-40° < \varphi < 0°$), and south high latitudes ($\varphi \leq -60°$) and investigate their properties. We found that the speeds of prominence eruptions from low latitudes are correlated with the Sunspot number (Fig. 1). The average PE speed is ~50 km/s for the solar minimum and ~120 km/s for the solar maximum. The sunspot number in cycle 24 has dropped by ~40% relative to that in cycle 23, while no significant difference is seen in the average PE speeds. The high-latitude PEs start together with the rush-to-the-poles phenomenon and end at the polar field reversal [2]. As expected from the magnetic field strength, high-latitude PEs are slower than low-latitude ones. By investigating the PEs observed by the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamic Observatory (SDO), Yashiro et al. [3] found that the high-latitude PE speed is high at the beginning of the solar maximum and decreases with the deceasing of polar magnetic field. However, the same trend is found only in the south high-latitude PEs. The differences between NoRH and SDO/AIA will be discussed.

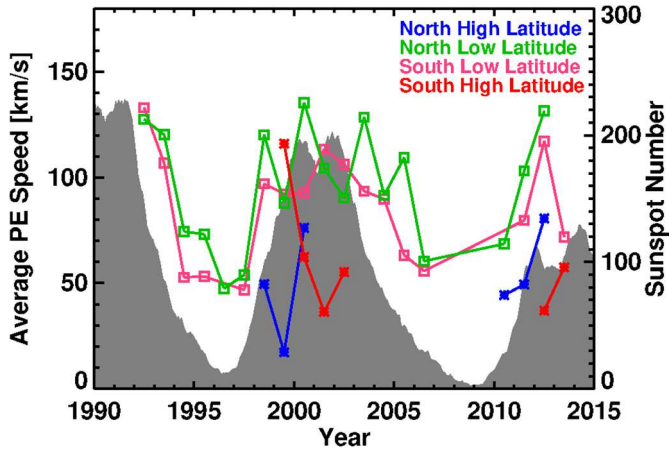

Figure 1. Annual average speeds of the prominence eruptions at north high (blue), north low (green), south low (pink), and south high latitudes (red). The sunspot number is shown as the gray background (right scale).

References

[1] M. Shimojo, T. Yokoyama, A. Asai, H. Nakajima, and K. Shibasaki, "One Solar-Cycle Observations of Prominence Activities Using the Nobeyama Radioheliograph 1992-2004," *PASJ*, **58**, February 2006, pp. 85-92, doi:10.1093/pasj/58.1.85.

[2] N. Gopalswamy, S. Yashiro, and S. Akiyama, "Unusual Polar Conditions in Solar Cycle 24 and Their Implications for Cycle 25," *ApJL*, **823**, May 2016, L15, doi:10.3847/2041-8205/823/1/L15.

[3] S. Yashiro, N. Gopalswamy, S. Akiyama, and P. Makela, "A catalog of prominence eruptions detected automatically in the SDO/AIA 304 Å images," *Adv. Space Research*, **205**, September 2020, 105324, doi:10.1016/j.jastp.2020.105324.