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Statistical Study of Polar X-ray jets from Hinode/XRT

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The X-Ray Telescope (XRT) aboard Hinode had revealed that X-ray jets occur at very high frequency in the polar region. Savcheva et al. (2007) reported the features of the polar X-ray jets based on 104 events that occurred only in polar coronal hole (PCH). Hence, the difference of the features of the polar X-ray jets that occur in PCH and the quiet region (QR) is not clear. In order to reveal the features of the polar X-ray jets in not only PCH but also QR, we investigated the polar X-ray jets based on 848 jets that occurred around the north pole. We also investigated 96 X-ray jets that occurred around the equator for comparing the polar jets with the equatorial jets.

We used the X-ray intensity for dividing the polar region into PCH and QR. However, generally, the magnetic connectivity is used for dividing into the two regions, and it is possible that the boundary based on X-ray intensity is not correct. To evaluate the uncertainty, we derived the frequency distribution of the minimum distance from the jet to the PCH boundary. The distribution shows that the frequency of the jets in the PCH is roughly uniform and the frequency of the jets in the QR immediately decreases around 10^5 km from the boundary. From the result, we divided the QR into [around coronal hole boundary (CHB)] and [pure polar quiet region (PQR)], based on the distance from the coronal hole boundary. Finally, we divided the jet-producing region into the four regions, PCH, CHB, PQR and equatorial quiet region (EQR), and we compared the features of the X-ray jets that occurred in each region.

From comparing the parameters of the X-ray jets, we found that the ranges, the averages and the frequency distributions of the length, the width, the lifetime and the apparent velocity are independent of the producing regions. On the other hand, the occurrence rate and the frequency distribution as a function of the total X-ray intensity of the flare around the footpoint of the jets differ from the parameters. The occurrence rates of X-ray jets in the PCH and the CHB are higher frequency (16 x 10^-12 events/km^2/hour) than that in the PQR and the EQR (6 x 10^-12 events/km^2/hour). If we assume that the frequency distribution of total X-ray intensity of footpoint flare show the power law distribution, the power law indexes of the frequency distribution at the PCH and the CHB are around -1.8 and the indexes at the PQR and the EQR are around -1.3. From the results, we found that we can divide the jet-producing region into two categories based on the occurrence rate and the frequency distribution of the footpoint flares. One is the category that has high occurrence rates and steep slope of the frequency distribution of the footpoint flares. The category includes the PCH and the CHB. The other category has low occurrence rate and flat slope of the frequency distribution of the footpoint flares and includes the PQR and EQR.

Keywords: X-ray jet, Corona, Flare, Magnetic Field