高緯度と低緯度コロナホール起源の太陽風変動と地球磁気圏応答
Solar wind variations originating from the high-latitude and low-latitude coronal holes and their response to the Earth's magnetosphere

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Coronal holes are frequently observed in the declining phase of the solar cycle and have open magnetic fields expanding to the interplanetary space. The solar atmospheric plasma flows out along the magnetic field line from the coronal hole, and causes a major disturbance of the Earth’s magnetosphere such as geomagnetic storm and substorm. Tsurutani et al.(2006) proposed that analyses of the temporal area of polar coronal holes over the solar cycle [Harvey et al., 2000; Harvey and Recely, 2002] provide a good idea of the geoeffectiveness of high speed streams over the solar cycle, but the effects of isolated equatorial coronal holes has yet to be evaluated. In order to clarify the effects of the Earth's magnetosphere and ionosphere associated with solar wind disturbances originating from the equatorial coronal hole, we conducted the superposed epoch analysis of the variations of coronal hole area, solar wind, interplanetary magnetic field, and geomagnetic indices (AE and SYM), and investigated a difference of the solar wind variations from between the high-latitude and low-latitude coronal holes and their response to the Earth's magnetosphere. In the present analysis, we used the Sun whole two-dimension images taken by the solar whole the extreme ultraviolet imaging telescope (EIT) onboard the Solar and Heliospheric Observatory (SOHO). Solar wind data are obtained from the advanced composition explorer (ACE), Wind, and OMNI2 data provided by NASA CDAWeb. The data period is October 1996 –May 2013. For the coronal holes area, we defined the threshold of the solar brightness in the EUV range as a half of the median value of the intensity in a whole area and divided the solar surface in four regions: (-60 - -30, -30 - 30), (-30 - 0, -30 - 30), (0 - 30, -30 - 30), and (30 - 60, -30 - 30) (degrees) in the solar latitude and longitude, respectively. Moreover, we determined the coronal holes area as a ratio of pixel numbers less than the threshold to each region. As a result, we found 5 low-latitude coronal holes. For the response to the Earth’s magnetosphere, we used the SYM-H and AE indices provided by World Data Center (WDC) for Geomagnetism, Kyoto University. The superposed epoch analysis results showed that when the coronal hole area become maximum, the solar wind density increased from 3 to 13 /cc, rapidly. At this time, the solar wind speed was minimum, and the Bx, By, and Bz were directed sunward, dawnward, and northward, respectively. After that, the solar wind density decreased to 3 /cc, and the solar wind speed increase from 350 km/sec to 600 km/ sec within 3 days. At the same time when the solar wind speed increased rapidly, the Bx, By, and Bz were directed earthward, duskward, and southward, respectively. On the other hand, the AE and SYM indices showed a significant increase and decrease within 3 days after the solar wind speed increased and the IMF Bz component became negative. However, the magnitude of the AE and SYM variations was small in a case of the solar wind originating from the high-latitude coronal hole. Therefore, it can be concluded that the effects of the Earth's magnetosphere are larger for the equatorial coronal hole than the high-latitude one.

キーワード：共回転相互作用領域、コロナホール、太陽風変動

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Keywords: Co-rotation Interaction Region, Coronal holes, Solar wind variations

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