Geophysical Research Abstracts
Vol. 20, EGU2018-3926, 2018
EGU General Assembly 2018

The three-dimensional angular widths of CMEs and their relations to the source regions

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The angular width of a coronal mass ejection (CME) is an important factor in determining whether the corresponding interplanetary CME (ICME) and its preceding shock will reach Earth. However, there have been very few studies of the decisive factors of the CME's angular width. In this study, we use the three-dimensional (3D) angular width of CMEs obtained from the Graduated Cylindrical Shell model based on observations of Solar Terrestrial Relations Observatory (STEREO) to study the relations between the CME's 3D width and characteristics of the CME's source region. We find that for the CMEs produced by active regions (ARs), the CME width has some correlations with the AR's area and flux, but these correlations are not strong. The magnetic flux contained in the CME seems to come from only part of the AR's total flux. For the CMEs produced by flare regions, the correlations between the CME angular width and the flare region's area and flux are strong. The magnetic flux within those CMEs seems to come from the whole flare region or even from a larger region than the flare. Our findings show that the CME's 3D angular width can be generally estimated based on observations of Solar Dynamics Observatory for the CME's source region instead of the observations from coronagraphs on board the Solar and Heliospheric Observatory andSTEREO if the two foot points of the CME stay in the same places with no expansion of the CME in the transverse direction until reaching Earth.