Initial speed of the solar wind estimated from limb CMEs

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The region within 20 solar radii from the Sun is important for the acceleration of solar wind plasma, but it is difficult to obtain solar wind speed in that region. Injection speeds of coronal mass ejections (CMEs) are one of the limited information on the solar wind speed in the vicinity of the Sun.

The speeds of propagation of CMEs in interplanetary space are less distributed than their initial speeds. Gopalswamy et al.(2000, 2001) presented a linear relationship between initial speeds of limb CMEs and their average acceleration during their travel time in interplanetary space. The linear relationship suggests that some dragging force is acting on CMEs, depending on difference in speed between the CME and their ambient plasmas. The ambient speed obtained from the coeficcients of the linear relationship was 406 km/s, which is nearly the same as the real solar wind speed.

If similar relationship holds within 20 solar radii from the Sun, it would give information on the initial speed of 'ambient' solar wind in the vicinity of the Sun. SOHO/LASCO CME Catalogue (http://cdaw.gsfc.nasa.gov/CME_list/) was used to investigate the relationship between the initial acceleration and the initial speeds of limb CMEs. The 'ambient' solar wind speed within 20 solar radii was estimated to be 150 - 570 km/s for 27-day periods in 1999 for which coefficients of correlation between the initial acceleration and the initial speeds of low-latitude CMEs were fairly good (from -0.6 to -1). The estimated speeds were close to that of real solar wind detected in interplanetary space. It suggests that low-latitude solar-wind plasma was accelerated within a short distance, and that coronal holes are not the only source of the solar wind. On the other hand, not all the estimated speed for each 27-day period agreed with the simultaneous in-situ measurements in interplanetary space.

Acknowledgments:This CME catalog is generated and maintained by NASA and The Catholic University of America in cooperation with the Naval Research Laboratory. SOHO is a project of international cooperation between ESA and NASA.

Reference:
Gopalswamy et al., GRL, 27, p145, 2000.
Gopalswamy et al., JGR, 106, p29207, 2001.