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Two-dimensional cone models of geoeffective coronal mass ejections

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Strong geomagnetic storms (Dst ≤ -100 nT) are mainly caused by ICMEs [1] and forecasting of coronal mass ejections (CMEs) arrival to the Earth‘s orbit is one of important problems of space weather. The drag-based model (DBM) [2] is often used for modeling CMEs heliospheric propagation. DBM is based on the magnetohydrodinamic drag concept – at a certain distance from the Sun motion of CME is influenced by the drag force. MHD drag is determined by the interaction of the CME with solar wind. CME may propagate through ambient solar wind, high-speed stream or interact with another CME.

In this work, we examine propagation of CME through different types of solar wind for geoeffective events. We model time of CME arrival to Earth’s orbit and CME speed with three types of geometry: 1) concentric model (all points are at equal distance from the Sun), 2) self-similar model (CME front does not change its shape) and 3) flattening model (each plasma element of the CME front propagates independently) [3]. As the coordinates of CME source on the solar disk we used coordinates of associated coronal dimming, which is observed as decrease in intensity in EUV.

Dimming parameters obtained from the SDO/AIA images are presented in the Solar Demon database (https://www.sidc.be/solardemon/). CME parameters obtained from the SOHO/LASCO images are presented in the CACTus database (https://www.sidc.be/cactus/). To associate CME forecast with ICME we used ICME list (https://swx.sinp.msu.ru/tools/icme_list.php).

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