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Improved input to the empirical coronal mass ejection (CME) driven shock arrival model from CME cone models

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[1] We study the Sun-Earth travel time of interplanetary shocks driven by coronal mass ejections (CMEs) using empirical cone models. Three different cone models have been used to obtain the radial speeds of the CMEs, which are then used as input to the empirical shock arrival (ESA) model to obtain the Sun to Earth travel time of the shocks. We compare the predicted and observed shock transit times and find that the accuracy of the ESA model is improved by applying CME radial speeds from the cone models. There are two ways of calculating the shock travel time: using the ESA model or using the simplified ESA formula obtained by an exponential fit to the ESA model. The average mean error in the travel time with the cone model speeds is 7.8 hours compared to 14.6 hours with the sky plane speed, which amounts to an improvement of 46%. With the ESA formula, the corresponding mean errors are 9.5 and 11.7 hours, respectively, representing an improvement of 19%. The cone models minimize projection effects and hence can be used to obtain CME radial speeds. When input to the ESA model, the large scatter in the shock travel time is reduced, thus improving CME-related space weather predictions.

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