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Quantification of disturbance periods of solar wind speed in interplanetary space due to coronal mass ejections

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Interplanetary space is characteristically structured mainly by high-speed solar wind streams emanating from coronal holes and transient disturbances such as coronal mass ejections (CMEs). While high-speed solar wind streams pose a continuous outflow, CMEs abruptly disrupt the rather steady structure causing large deviations from the quiet solar wind conditions. We present a quantification of the duration of disturbed conditions (preconditioning) for interplanetary space caused by CMEs by investigating the plasma speed component of the solar wind and the impact of in situ detected CMEs (ICMEs), compared to different background solar wind models (ESWF, WSA, persistence model) for the time range 2011–2015. We obtain for periods within an ICME interval an increase of 18-32% above the expected quiet Sun background and for the period of 2 days after the ICME an increase of 9-24%. The total duration of enhanced deviations is about 3 and up to 6 days after the ICME start, which is much longer than the average duration of an ICME disturbance itself (about 1.3 days), concluding that interplanetary space needs about 2-5 days to recover from the impact of ICMEs. The obtained results have strong implications for studying CME propagation behavior and also for space weather forecasting.