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Determination of the photospheric electric field for data-driven modelling of coronal mass ejections

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The geoeffectivity of coronal mass ejections (CMEs) is largely determined by their magnetic structure. Since the coronal magnetic fields in solar eruptions currently cannot be routinely measured, data-driven modeling employing observations of the magnetic field in the photosphere offers one of the most promising paths towards obtaining long-lead time proxies of the magnetic structures of Earth-impacting CMEs. A critical task for the success of data-driven coronal modeling is the accurate determination of the time-dependent photospheric boundary condition, the electric field. For this purpose we present first results from ELECTRICIT, a practical toolkit for the inversion of the electric field from time series of photospheric magnetic field and plasma velocity measurements. ELECTRICIT computes the photospheric electric field using the latest data processing and electric field inversion methods, and the required high-cadence magnetogram and dopplergram data sequences are provided by the SDO/HMI instrument. Currently, the toolkit includes the use of magnetic field measurements, while the implementation of dopplergrams as well as horizontal plasma velocity inversion based on feature tracking methods will be added in the near future. In addition to serving as input to data-driven coronal models the time series of the electric field, magnetic field and plasma velocity are suitable to a variety of other applications, e.g. for high-resolution studies of photospheric processes. We will also present time-dependent coronal magnetic field modeling using several different electric field inversion techniques applied to the same active region. This allows us to quantify the sensitivity of the coronal model on the driving electric field with respect to the task of determining the magnetic field configuration of erupting coronal structures.