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Possible external sources of terrestrial cloud cover variability: the solar wind

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Cloud cover plays an important role in the terrestrial radiation budget. The possible influence of the solar activity on cloud cover is still an open question with contradictory answers. An extraterrestrial factor potentially affecting the cloud cover is related to fields associated with solar wind. We focus here on a derived quantity, the interplanetary electric field (IEF), defined as the product between the solar wind speed and the meridional component, Bz, of the interplanetary magnetic field (IMF) in the Geocentric Solar Magnetospheric (GSM) system. We show that cloud cover at mid-high latitudes systematically correlates with positive IEF, which has a clear energetic input into the atmosphere, but not with negative IEF, in general agreement with predictions of the global electric circuit (GEC)-related mechanism. Since the IEF responds differently to solar activity than, for instance, cosmic ray flux or solar irradiance, we also show that such a study allows distinguishing one solar-driven mechanism of cloud evolution, via the GEC, from others. We also present results showing that the link between cloud cover and IMF varies depending on composition and altitude of clouds.