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Interhemispheric differences and solar cycle effects of the high-latitude ionospheric convection patterns deduced from Cluster EDI observations

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Here, we present a study of ionospheric convection at high latitudes that is based on satellite measurements of the Electron Drift Instrument (EDI) on-board the Cluster satellites, which were obtained over a full solar cycle (2001-2013). The mapped drift measurements are covering both hemispheres and a variety of different solar wind and interplanetary magnetic field (IMF) conditions. The large amount of data allows us to perform more detailed statistical studies. We show that flow patterns and polar cap potentials can differ between the two hemispheres on statistical average for a given IMF orientation. In particular, during southward directed IMF conditions, and thus enhanced energy input from the solar wind, we find that the southern polar cap has a higher cross polar cap potential. We also find persistent north-south asymmetries which cannot be explained by external drivers alone. Much of these asymmetries can probably be explained by significant differences in the strength and configuration of the geomagnetic field between the Northern and Southern Hemisphere. Since the ionosphere is magnetically connected to the magnetosphere, this difference will also be reflected in the magnetosphere in the form of different feedback from the two hemispheres. Consequently, local ionospheric conditions and the geomagnetic field configuration are important for north-south asymmetries in large regions of geospace. The average convection is higher during periods with high solar activity. Although local ionospheric conditions may play a role, we mainly attribute this to higher geomagnetic activity due to enhanced solar wind - magnetosphere interactions.