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Investigation of the ionospheric trough using satellite tomography

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Tomographic images of the high latitude F region, covering one year of routinely based observations, have been used to investigate the seasonal morphology of the ionospheric trough, width and relationship between its occurrence and the terrestrial and interplanetary magnetic fields. The density plots are obtained by means of statistical inversion tomographic experiment using results of the Finnish chain of receivers from Tromsø (69.66˚N, 18.94˚E), Kilpisjärvi (69.02˚N, 20.86˚E), Kiruna (67.84˚N, 20.41˚E),Luleå (65.58˚ N, 22.17˚E) and Kokkola 63.83˚N, 23.06˚E). Our study shows that the occurrence of the trough depends on the season, with important differences between equinoxes, summer and winter. These seasonal differences are found also in the well-known movement of the trough towards lower latitudes when the time progresses and/or for increased geomagnetic activity and, to a lesser extent, in the width of the trough. An important finding of our study is that the orientation of the By and Bz components of the interplanetary magnetic field play an important, though different, role in the occurrence of the trough for different levels of the geomagnetic activity. Our results contribute to the understanding of the contribution of the large scale plasma transport induced by the convection electric field to the formation of the trough. Also, since our results are established using a large database of F electron density plots, they can be used to test various ionospheric models attempting to predict the location of the main ionospheric trough.