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Diversity of severe space weather effects on middle latitude ionosphere

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Current understanding of the ionospheric response to severe space weather-induced magnetic storms has been obtained through different observations, modelling and theoretical studies. As long as variations in the ionosphere are related in regular patterns, ionospheric models, e.g. the IRI model, sufficiently estimate corrections for the ionospheric effects on radio wave propagation. During a magnetic storm variability of the ionospheric parameters increases substantially and makes forecasting more complicated. According to long-term ionospheric observations above European middle latitudes, storm-induced variations of the F2 region ionisation during storm main phase often change from large enhancements (positive phase) to depletions (negative phase). Such a change of sign of the storm effect makes a systemic description and prediction of the disturbed ionosphere rather complicated. Strong longitudinal and latitudinal asymmetries or the completely different storm-induced disturbance behaviour of the ionospheric F2 region above two comparable locations are frequently observed. Moreover, the distribution of storm effects may vary substantially from one event to another. In the present study we report observational results of 65 strong-to-severe ionospheric storms that occurred in the period 1995-2005 over middle latitudes. We examined variability of the foF2 and hmF2 during storm main and recovery phase, focusing on an alternation of a sign of the storm effect, on the height profile of the effects, and on similarities and unexpected differences in their morphology.