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Mesospheric and ionospheric responses during sudden stratospheric warming events

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In the last few years, there has been compelling observational evidence that the mesosphere and ionosphere experience significant changes during sudden stratospheric warming (SSW) events. Although such connection was not understood at the beginning, due to more observations and modelling work, the connection is now well established. It is clear that the connection is not directly between the SSW and the upper atmosphere, and both are related to the specific features of the large-scale planetary waves (PWs) and anomalies in the middle atmospheric dynamics. Although several mechanisms involving PWs and a variety of solar and lunar tides have been suggested, the relative importance of these mechanisms is still an open question. In this work we present observational results from the low latitude ionosphere as well as from the mid and high latitude mesosphere during SSWs 2009, 2010 and 2013, as well as initial results from the mid-latitude ionosphere. The 2009 and 2013 events occur during a polar vortex split when the wave number 2 was the dominant wave, and they represent solar minimum and maximum conditions, respectively. On the other hand the 2010 event occurs without the splitting of the polar vortex. We will highlight the common features observed during different SSW events and discuss the possible mechanisms leading to these anomalies.