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The ionospheric response to the 2019 and 2021 Northern Hemisphere SSWs

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Owing to the progress that have been made in understanding the vertical coupling mechanisms in the last decade, it is now well established that the thermosphere-ionosphere system under quiet geomagnetic conditions is highly sensitive to lower atmospheric forcing. In this regard, the studies linking the upper atmosphere (mesosphere-lower thermosphere-ionosphere) variability and sudden stratospheric warming (SSW) events have been particularly important. The changes to atmospheric circulation due to SSW events modulate the spectrum of vertically upward propagating atmospheric waves (gravity waves, tides, and planetary waves) resulting in numerous changes in the state of the upper atmosphere. Much of our understanding about the upper atmospheric variability associated due to SSWs events have been gained by studying the 2008/2009 Northern Hemisphere (NH) SSW event, which occurred under extremely quiet geomagnetic conditions. Recently, two major NH SSW events in the winter of 2018/2019 and 2020/2021 occurred under similarly quiet geomagnetic conditions. In this work, both these SSW events have been simulated using Whole Atmosphere Community Climate Model with thermosphere and ionosphere extension (WACCM-X) and the low- and mid-latitude ionospheric response to both these SSW events will be presented.