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Whole Atmosphere Coupling during the September 2019 Antarctic Sudden Stratospheric Warming

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A sudden stratospheric warming (SSW) is a large-scale meteorological phenomenon, which is most commonly observed in the Arctic region during winter months. In September 2019, a rare SSW occurred in the Antarctic region, providing a unique opportunity to study its impact on the middle and upper atmosphere. Geopotential height measurements by the Microwave Limb Sounder aboard NASA's Aura satellite reveal a burst of westward-propagating quasi-6-day wave (Q6DW) with zonal wavenumber 1 in the mesosphere and lower thermosphere following the SSW. At this time, ionospheric data from ESA's Swarm satellite constellation mission show prominent 6-day variations in the daytime equatorial electrojet intensity and low-latitude plasma densities. The whole atmosphere model GAIA reproduces salient features of the middle and upper atmosphere response to the SSW. GAIA results suggest that the observed ionospheric 6-day variations are not directly driven by the Q6DW but driven indirectly through tidal modulations by the Q6DW. An analysis of global total electron content data reveals signatures of secondary waves arising from the nonlinear interaction between the Q6DW and tides.