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Simulating Mesoscale and Planetary Wave Propagation in the Atmosphere at High and Low Solar Activity

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Numerical models are used for studying changes in characteristics of acoustic-gravity waves (AGWs) and planetary waves (PWs) propagating from the ground to the upper atmosphere at background wind and temperature conditions corresponding to different solar activity (SA). AGW propagation at altitudes 0 â€“ 500 km is simulated with a high-resolution three-dimensional nonlinear model. Profiles of background temperature, molecular viscosity and heat conduction at high and low SA were specified using standard models of atmosphere and ionosphere. Numerical modeling shows that AGW characteristics in the middle and upper atmosphere may change due to SA variations. The wave amplitudes at altitudes above 150 km are larger at high SA because of smaller molecular heat conduction and viscosity. Wave accelerations and velocities of the wave-induced mean flows are generally larger at low SA. PWs are simulated at altitudes 0 â€“ 300 km using the Middle and Upper Atmosphere Model (MUAM). SA changes are specified by changing the solar radio flux F10.7 in the MUAM radiation block at altitudes above 100 km. The mean temperature, wind and PW amplitudes strongly depend on SA above 100 km altitude. PW amplitudes are generally smaller at high SA there. Statistically confident differences in the mean temperature, wind and PW amplitudes due to changes in thermospheric SA impact are also found in the middle atmosphere at altitudes below 100 km. Aknowledgements. AGW simulating was supported by the Russian Basic Research Foundation #17-05-00458.