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Sensitivity analysis to WRF parameterizations for mountain waves near Madrid airport (Spain)

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Aircraft icing and turbulence associated with mountain waves events are adverse meteorological phenomena potentially affecting aviation safety and air traffic management. This study analyzes 13 mountain wave events in the vicinity of the Adolfo Suárez Madrid-Barajas airport (Spain) for two years (from 2017 to 2019). Mountain waves are formed in the leeward side of the Guadarrama mountains when the wind flows perpendicular to this orographic barrier (north-northwest winds). The thirteen events are simulated using several parameterizations from the Weather Research and Forecasting (WRF) model. Simulated pseudo-satellite images are validated using the observed brightness temperature from satellite images. Then, a sensitivity analysis is developed through several skill scores applied to brightness temperature in order to select the schemes best performing to forecast mountain waves. Finally, the best parametrization is used to assess several atmospheric variables involved in mountain waves formation.