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Numerical Simulations of Airborne Glaciogenic Cloud Seeding using the WRF Model with the Modified Morrison Scheme over the Pyeongchang Region

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Numerical simulations of actual airborne cloud seeding experiments were carried out using a WRF model while considering changes in the seeding position and the ice nucleation process according to the movement of the aircraft. We also determined the utility of the enhanced snowfall simulation for three cases of airborne cloud seeding experiments in 2016. Spatial patterns of the simulated precipitation and liquid water path (LWP) agree with observations at least qualitatively. Considering the observed wind fields during the seeding, the simulated spatiotemporal distributions of the seeding materials (AgI) and snowfall enhancements are also reasonable. Observations in the target areas and the start time of the simulated snowfall enhancement are close, especially for the first case. In the enhanced snowfall cases, the process of cloud water and vapor converted into ice particles after seeding is also reasonable. It is also noted that the AgI residence time (> 1 hr) above the optimum AgI concentration (100000 m-3) and high LWP (> 100 g m-2) are important factors for snowfall enhancements. Timing of the simulated snowfall enhancement agrees with observations; this supports that the seeding of AgI resulted in enhanced snowfall in the experiment. The model developed in this study will be useful for verifying the effects of cloud seeding on precipitation.

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