Geophysical Research Abstracts
Vol. 21, EGU2019-7056, 2019
EGU General Assembly 2019

Evaluation of artificial rain dispersal in water cloud: A feasibility study

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An aircraft cloud seeding experiment was conducted over eastern coast of Zhejiang, China in September 4, 2016. Hygroscopic agent seeded sufficiently in water cloud to dissipate precipitation, and its effectiveness was discussed. Considering the cloud seeding region are mainly SC (stratiform clouds) with patchy small convective cells. A radar-domain-index algorithm (RDI) based on radar grid data was proposed to analyze the operation effect. In this study, domain 1 represents effective detection scope of radar, immoveable; domain 2 represents possible region affected by cloud seeding, immoveable; domain 3 is the target echo of seeding cloud and the Tracking Radar Echo by Correlation (TREC) technique is performed, moveable. Radar echo parameters such as avg_ref (mean echo reflectivity), σ (the anomaly percentage of the effective echo grid data intensity), FCRi (the frequency contribution of grid reflectivity, i indicate reflectivity within a specific range of values), VIL (vertical integration liquid water content) were statistical analyzed during and after seeding process in a diverse region to show the spatial difference. The experimental result indicated that about 12min after seeding ended, CR in domain 3 decrease to a minimum ($\sim$10dBz) and VIL of seeded cloud was $\sim$ 0.2 kg m-3. The echo top height dropped to $\sim$3.5km and the surface echoes were also weakened. But there was no significant variation of echo parameters in the background field for comparison. Since the seeded cell shows apparently the shortest life cycle compared with other identified cells, the cloud-cluster tracking and identification algorithm also verify the above-mentioned conclusion. The airborne CDP data captured the small cloud drop (ED<15μm) decreased and the widen spectrum probably due to the hygroscopic growth of small droplets. Excessive agents seeded might cause competition for cloud water which limit cloud development and decrease precipitation. Altogether, the physical phenomenon was captured, but the specific principle still needs more quantitative in-depth analysis.