

Characteristics of Radar Echoes formed by Seeding Experiment of Liquid Carbon Dioxide for Enhancing Winter-time Precipitation in the northern part of Kyushu, Japan

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Because of the impact of global warming, many droughts (shortage of water) have broken out by extreme small amount rainfall in recent Japan. So far, in order to prevent these droughts, artificial rainfall methods with 'Agl' or 'dry ice' have been widely used in Japan. However, these methods have many problems, which a large amount of overcooling liquid in the cumulus cloud was not able to be converted into precipitation efficiently.

So as to solve these problems, new artificial rainfall method using the liquid carbon dioxide (LCD) was proposed by Fukuta (1996). This new method consists of the generation of ice particles by homogeneous nucleation using LCD and the subsequent more effective growth for ice particles without competition process.

In our study, using small aircraft, the three LCD seeding experiments were applied to the super-cooled clouds (strata) formed over Karatsu City in the northern part of Kyushu, Japan, from 1335JST to 1342JST on December 26, 2013. Each time of the experiments was 120 seconds, and each seeding rate of LCD was 11.1g/s. And, the seeding height was 2500m (-2.1°C) to 2650m (-3.3°C). The thickness of cloud was about 2600m (the cloud-top: 3600m, the cloud-bottom: 1000m).

This day's weather condition was that the low pressure was near the Korea Peninsula and it was the weak wintry pattern around Japan.

About 45 min. after seeding (1430JST) the JMA (the Japan Meteorological Agency) radar echoes appeared above the Shikanosima Island on the leeward of Karatsu City. The distance between Karatsu City and the Shikanoshima Island was about 50km. These echoes moved to from SW to NE for 35min. We verified that it rained from these echoes at Munakata City in the northern part of Kyushu.