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Effects of multiple glaciogenic artificial cloud seeding in summer

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Numerical experiments of glaciogenic seeding method are conducted on a cloudy day with weak rain in summer. Released latent heat of freezing has been supposed to play a role to enhance rainfall amount in the method through stimulated convection in a cloud warmed by the released latent heat and the process is not included in the hygroscopic seeding method. Therefore, effects of the released latent heat are, also, investigated. A seeding area is settled about 72 km upwind of a catchment area of a dam. Four kinds of seeding methods are investigated. In the first case, cloud portion upper than the -8°C level is seeded to estimate seeding effects with AgI. The second is a case with 1 kg dry ice seeding in the seeding area. The third is a massively seeded case with 15 kg dry ice. And the fourth is a multiply seeded case with 15 times seeding of 1 kg dry ice at 5 minute intervals tracking the seeded cloud. Accumulated rainfall amount and increasing ratio at the catchment area for 90 minutes in the four seeded and the control cases (without seeding case). The increasing ratio in the multiply seeded case is the largest. Differences of vertical velocity and atmospheric temperature distributions between the multiply seeded and the control cases at 60 minutes after the seeding, 20 minutes before the cloud reaches over the catchment area are shown. An area of 0.55 g kg^{-1} snow mixing ratio, which is about 8 times larger than that in the control case, is formed over 139.3°. The snow is supported by the upward flow of 0.2 or 0.4 ms^{-1}. The upward flow is caused by warmed atmosphere by the released latent heat between 5 and 7 km levels.

Biography

Kikuro Tomine is a Professor in National Defense Academy, Japan, studying aviation weather such as turbulence, thunder, fog, gust and artificial cloud seeding.

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