

Kuo, W.-C., K. Yamashita, M. Murakami, T. Tajiri, and N. Orikasa, 2024: Numerical simulation on feasibility of rain enhancement by hygroscopic seeding over Kochi area, Shikoku, Japan, in early summer. *J. Meteor. Soc. Japan*, **102**, <https://doi.org/10.2151/jmsj.2024-021>.

Plain Language Summary: Hygroscopic seeding is a technique potentially suitable for increasing precipitation from warm, convective clouds during summer. The effects of salt micro-powder (MP) and hygroscopic flare (HF) seeding on the initial cloud microphysical structures were investigated using a detailed bin microphysics parcel model with background atmospheric aerosol data collected on the windward side of the target area and seeding aerosol data collected from the coordinated flights of seeding helicopter and in-situ measurement aircraft.

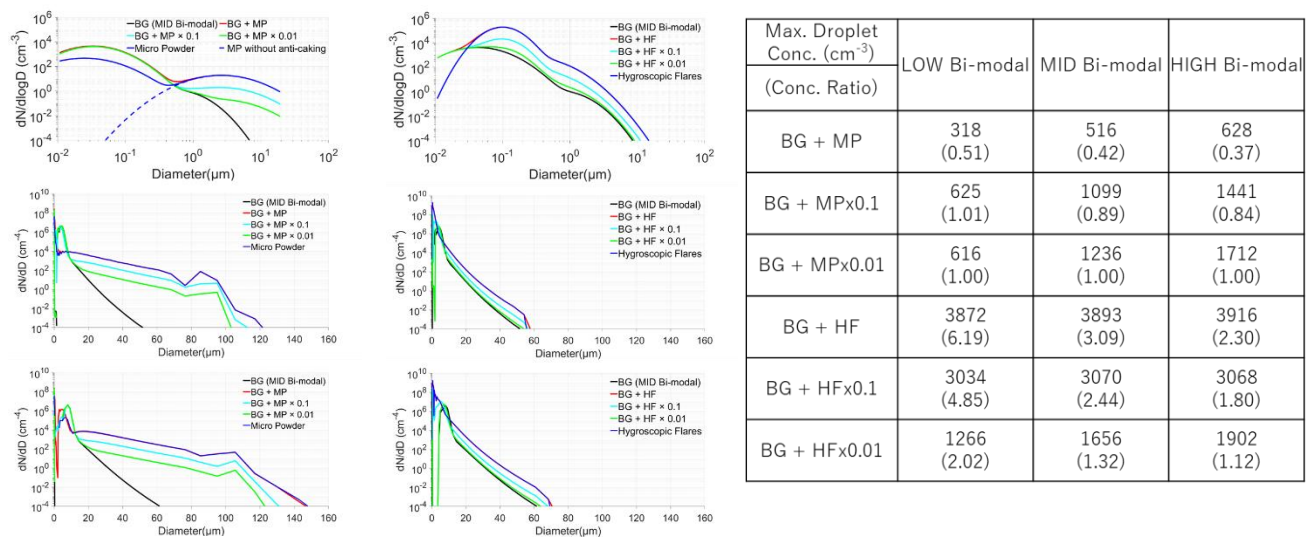


Figure 1. Size distributions of aerosol particles (APs) and cloud droplets. (a) Initial size distributions of dry BG APs with seeding aerosols and droplet size distributions at (b) 500 m and (c) 600 m obtained from the model simulation using the initial size distribution of BG and seeding aerosols shown in (a) and updraft velocity of 1.0 m s^{-1} for the MP case.

Figure 2. Same as Figure 1, but for the HF case.

Table 1. Seeding aerosol amount dependency of MP and HF seeding effects at updraft velocity of 1.0 m s^{-1} for three different BG AP size distributions. The value at the top of each row indicates the maximum cloud droplet number concentration during the simulation period, and the value in parentheses at the bottom indicates the ratio to the maximum cloud droplet number concentration without seeding.

Highlights:

- Cloud droplet size distributions were broadened, and the onset of raindrop formation was accelerated by MP and HF seeding, although MP seeding showed more notable seeding effects than did HF seeding.
- Based on the relationship between the increase/decrease ratios of the cloud droplet number concentration and of the surface precipitation by hygroscopic seeding obtained in previous studies, MP seeding had a positive seeding effect, whereas HF seeding had a negative effect.
- Since seeding a large amount of MP (NaCl) is necessary to enhance precipitation substantially, it is essential to consider the environmental impact.