

Ice particle formation in clouds subjected to firing from a prototype hail cannon: laboratory simulation experiments

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Weather modification using hail cannons is considered a cost-effective method for hail mitigation by farmers. However, this method has not yet been supported by conclusive scientific evidence. Our laboratory experiments showed that firing a prototype hail cannon or high-intensity sound pulse into a cloud promotes the formation of ice crystals, suggesting that the impact of shockwave/soundwave effectively promotes ice nucleation within a mixed-phase cloud. These findings show that acoustic methods, including hail cannon shockwaves and sound vibrations, can transform supercooled droplets into ice crystals, providing a cost-effective and efficient approach to mitigate hail damage.

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smoke produced during the firing would help to disturb the cloud and provide more condensation nuclei⁵. However, if we consider injecting smoke into a cloud at the height at which a hail cannon fires and where hail forms in the cloud, it appears practically difficult to reach this altitude. So, the question here is what exactly forces to suppress the hail due to the hail cannon: a shock/sound wave or the smoke? During an experimental study on ice nucleation due to electrical discharge, it was observed⁶ that there was a loud cracking noise, followed by ice nucleation in the cloud. Several theories exist on how the hail cannon could modify natural clouds⁷. Pressure perturbation resulting from shockwaves generated when firing a cannon is one of the proposed mechanism⁷. A pressure perturbation of 3 hPa was measured after the cannon was fired at a distance of 40 m horizontally from the cannon⁷. A sound in-