

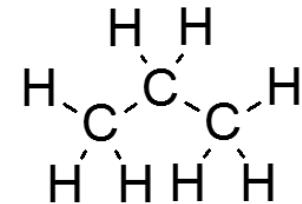
# Dispersal of Cloud Seeding Agents



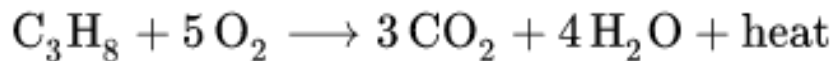
# Release of Cooling Agents: Dry Ice

- Dry ice is almost exclusively an airborne release substance.
  - Put in hoppers on the aircraft and dispensed in pellet form.
  - Pellets fall from the aircraft through the cloud, so the aircraft must get to altitudes higher than the desired point of nucleation.
  - There are some problems with keeping the dry ice in small pellet form.

# Cooling Agents: Liquid Propane



- Main use is in ground releases for fog abatement.
- Obvious drawback is that it is flammable.
- Technically feasible to release from the air.



# Release of Ice Nuclei into the Atmosphere

- Released from ground or air since ice nuclei is normally produced as smoke.
- Primary advantage of ground release is considerably less expensive.
- Primary advantage of airborne release is the certainty of targeting.



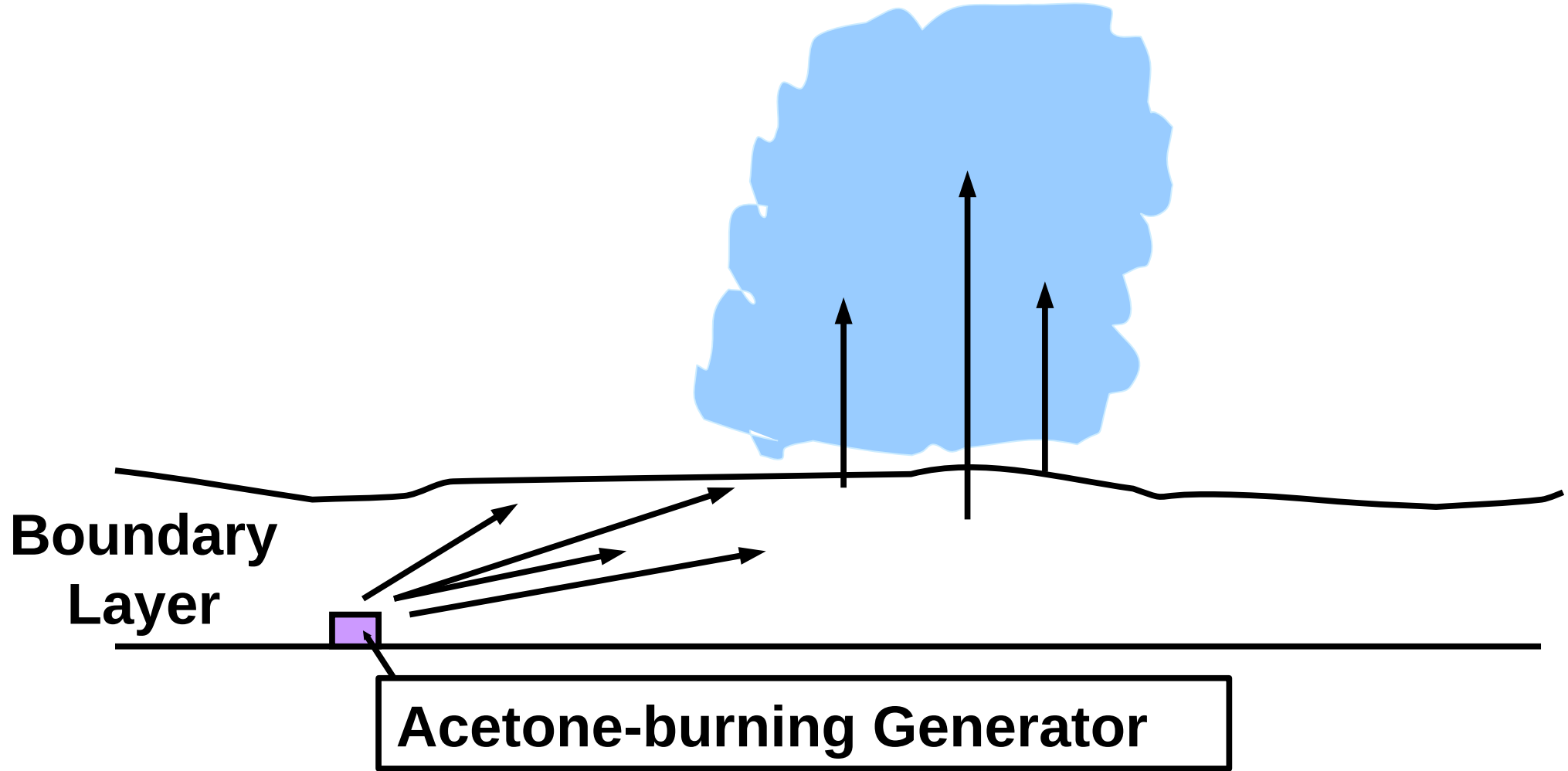


# Ground Release of Silver Iodine (AgI)

- Can be released from ground or from air, since it is normally put out as a smoke.
- Primary advantage of ground release is that it is considerably less expensive.
- Primary advantage of airborne release is that the targeting is much more certain.

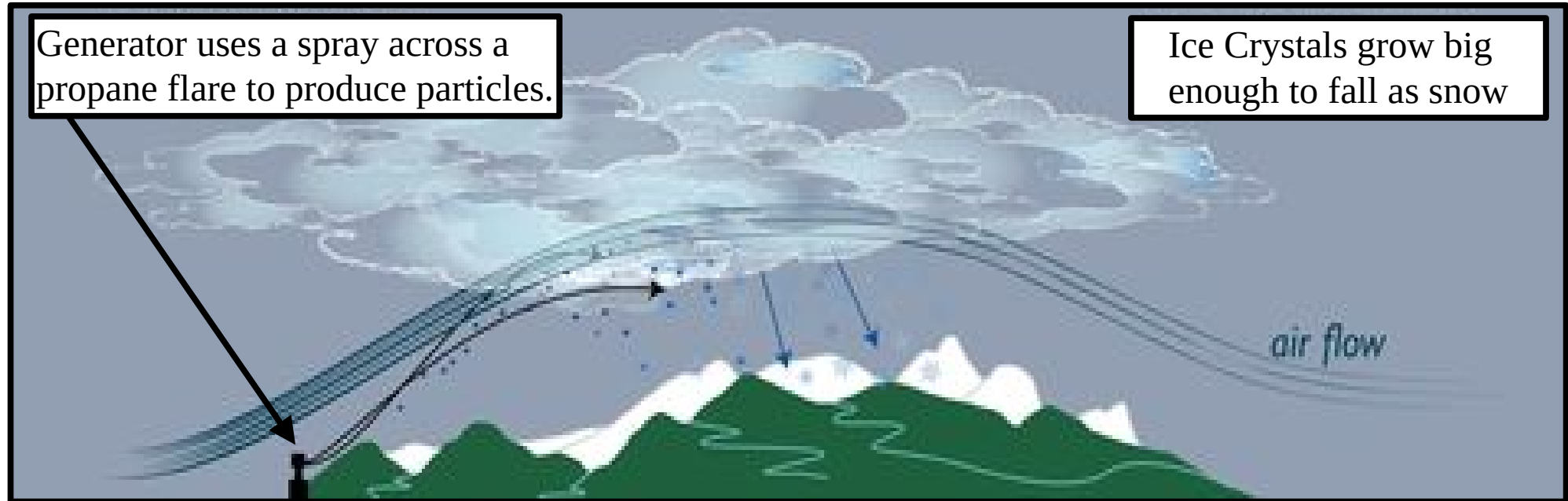


# Overview of Ground Release of AgI



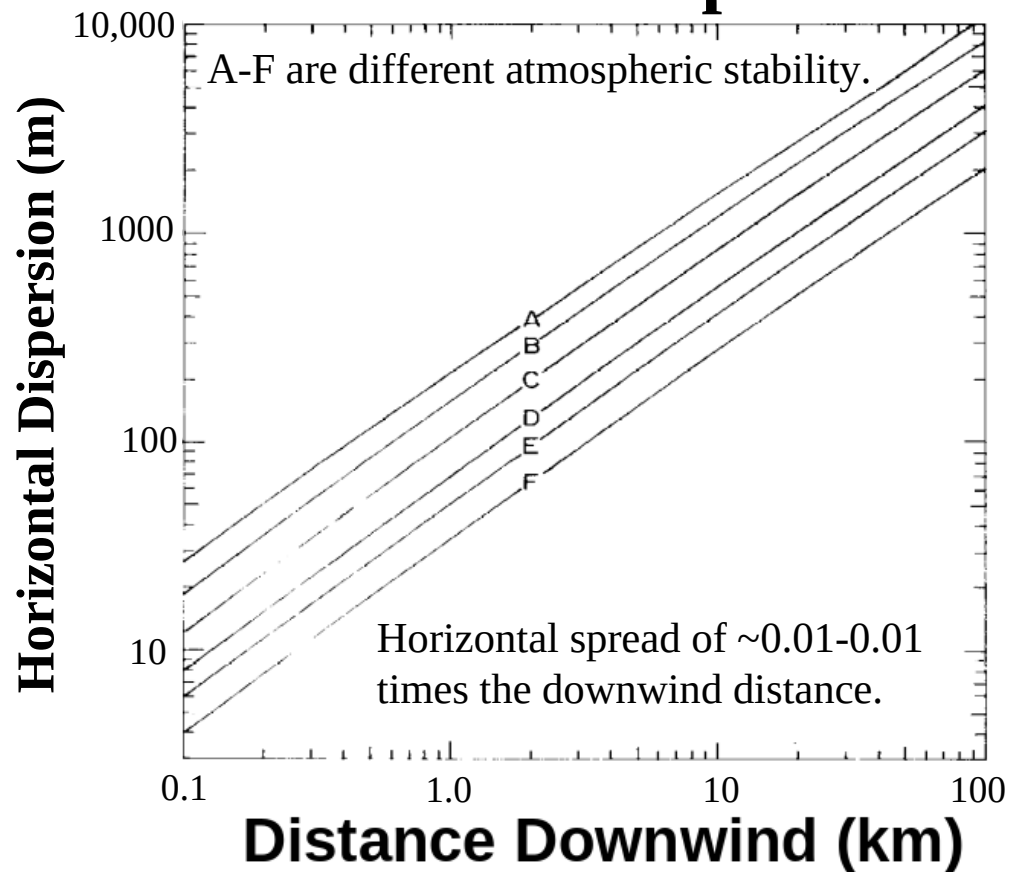
# Ground Release of Silver Iodine (AgI)

- Ground releases of Silver Iodine is very common in winter, orographic cloud seeding.
- Delivery is done by wind carry Silver Iodine particles up the mountain slopes into the orographically induced cloud.

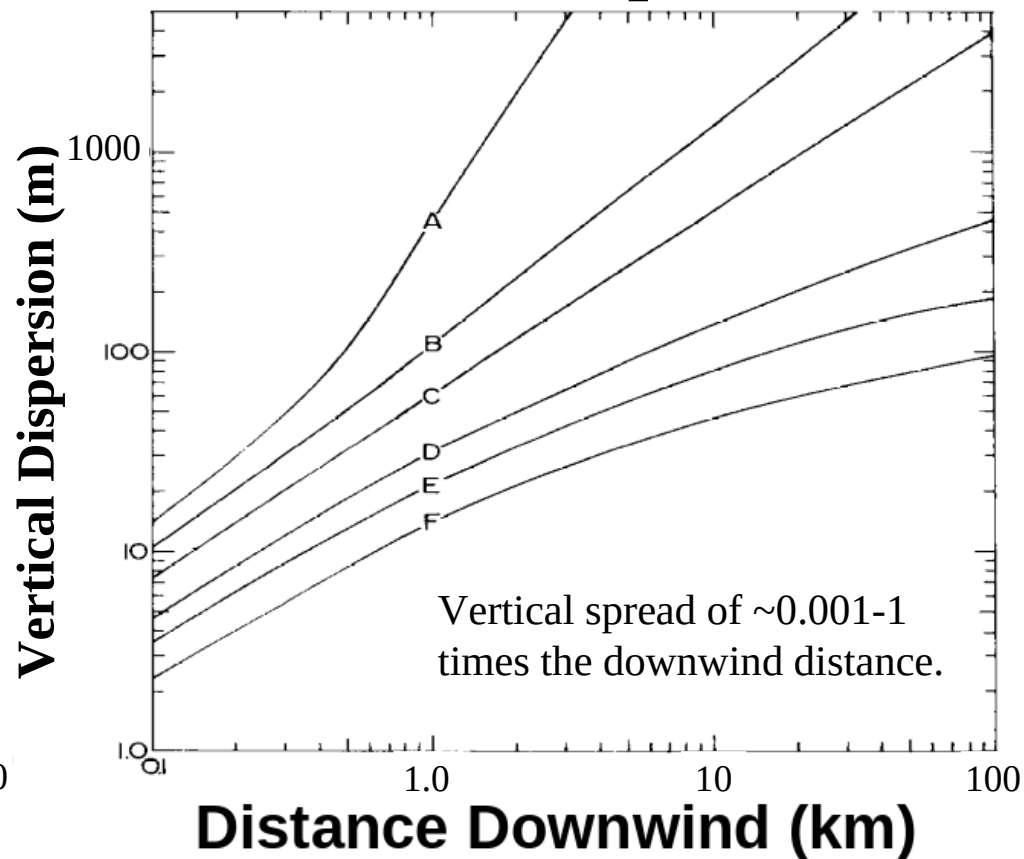


# Spread of Cloud Seeding Plume

## Horizontal Spread



## Vertical Spread



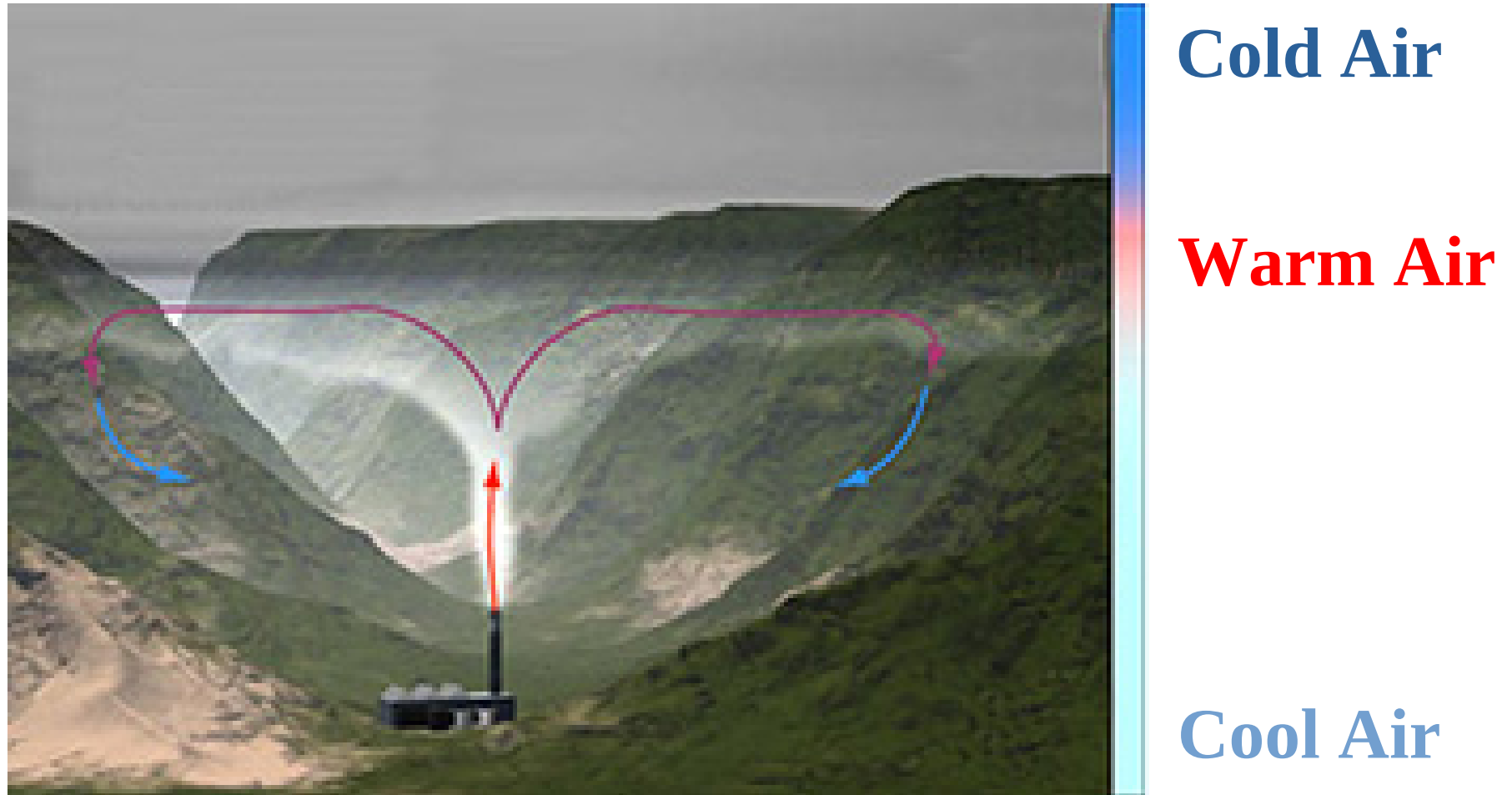


# Problems with Ground Releases

- Photodeactivation
- Uncertainty in trajectory of AgI with respect to the desired target area.
- In mountains, the generators are often placed below the typical inversion levels.



# Temperature Inversion Level



# Airborne Research of Silver Iodide (AgI)

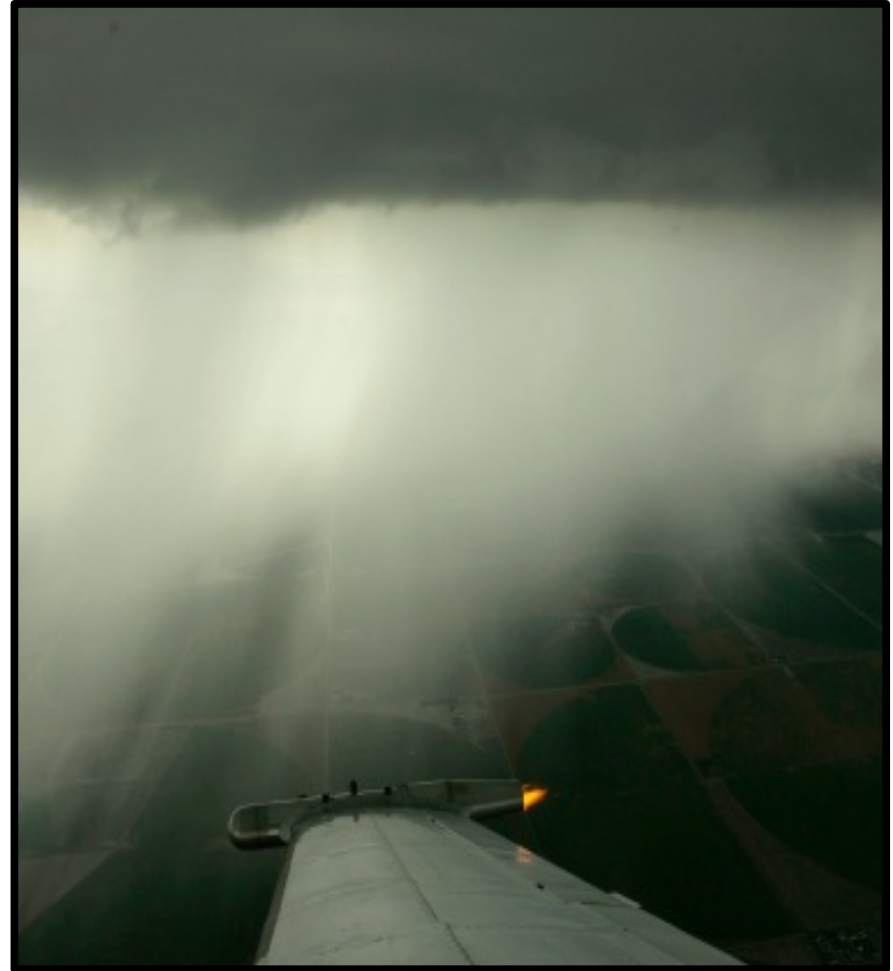
- Wing tip or under wing acetone-burning generators.
- Burn-in-place flares.
- Ejectable pyrotechnics.





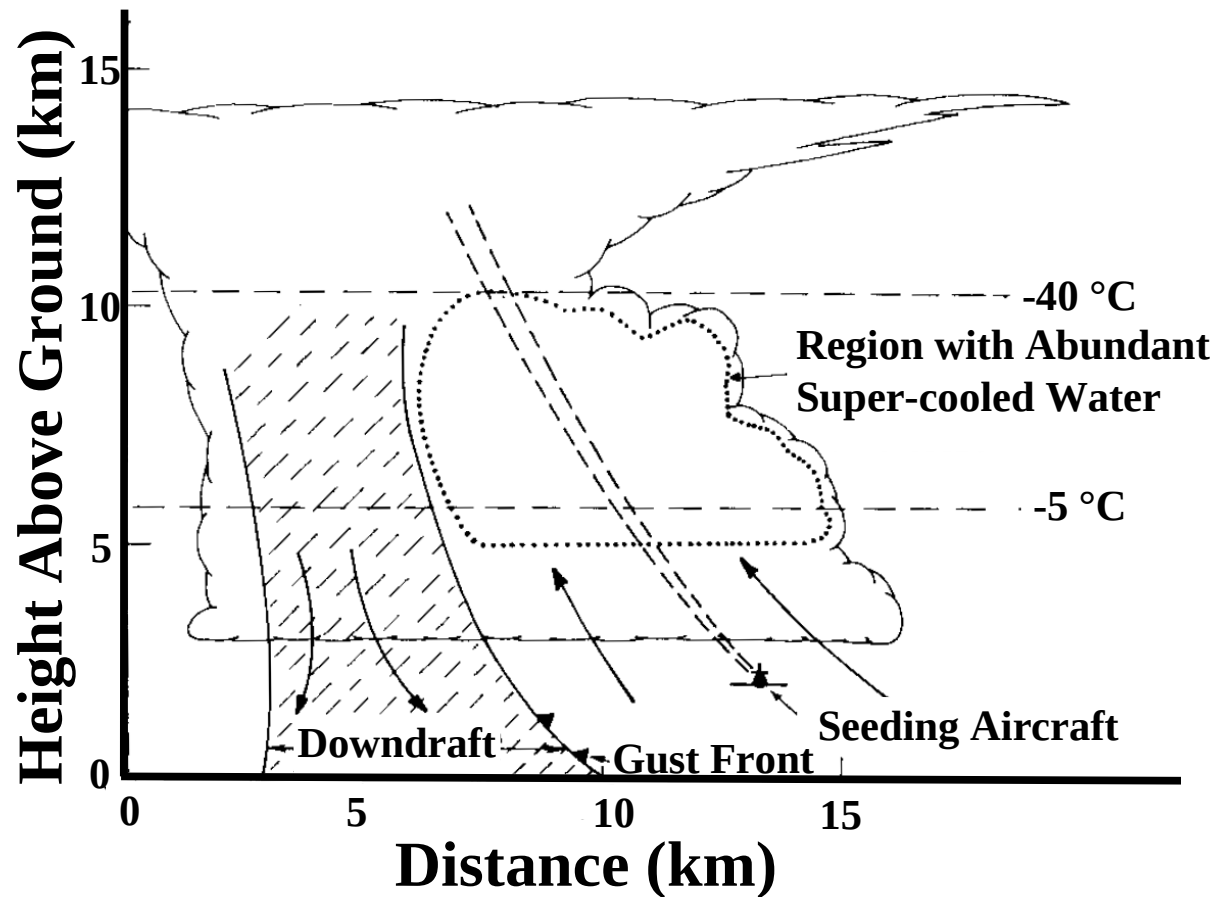
# Cloud Base Releases of Silver Iodine (AgI)

- Using acetone-burning generators or burn-in-place flares, aircraft is below the level where AgI is desired.
- Updrafts carry the material up further in the cloud.
- The aircraft will often circle at cloud base with either of these generating systems.





# Clouds Base affect ~1-2 % of the Updraft Passing upward through the $-5^{\circ}\text{C}$ level



# Ejectable Pyrotechnics

- When using ejectable pyrotechnics, the aircraft flies above the desired level and lets the burning flare fall through the cloud.
- Produces a curtain of seeding material not a line.
- Dropping dry ice has the same effect.

