

Opportunity Recognition & Seeding Methods



Operational Program Outline

- Seeding Opportunity
- Cloud Structures
- Seeding Criteria
- Delivery Techniques
- Seeding Procedures
- Strategy



Opportunities to Conduct Cloud Seeding

- Operational Program
 - Seed all Possible Opportunities
 - Produce Maximum Effect
- Pilot's Primary Job
 - Recognize Opportunity
 - Deliver Seeding Material
 - Right Amount
 - Right Time
 - Right Place



What makes a seedable cloud?
Depends on the hypothesis.

Rain Increase Cloud Seeding Opportunity

- Liquid Water
- Updraft
- Lack of Ice
- Cloud Bulk
- Cold Cloud
- Low Bases



Hail Suppression Cloud Seeding Opportunity

- Very strong updrafts.
- High liquid water content.
- High radar reflectivity or hail forecast.
- Occur in a very unstable atmosphere.



Rain Increase – Isolated Tcu- Single Cell

- Visible Growth
- “Hard” Tops
- Solid Base
- Depth of 6,000-8,000’ and Growing
- Lifetime ~15 - 30 minutes
- May, or May Not be sheared.



Rain Increase – Non-Severe Storm Complex

- Multiple Cells, Updrafts
- Cells Develop and Mature, with Precipitation
- New Cells Develop Close to Mature and are Called “Feeder Cells”
- Visible Growth of Turrets
- Often Merge with Mature Storm



Hail Suppression – Multi-cell Storm

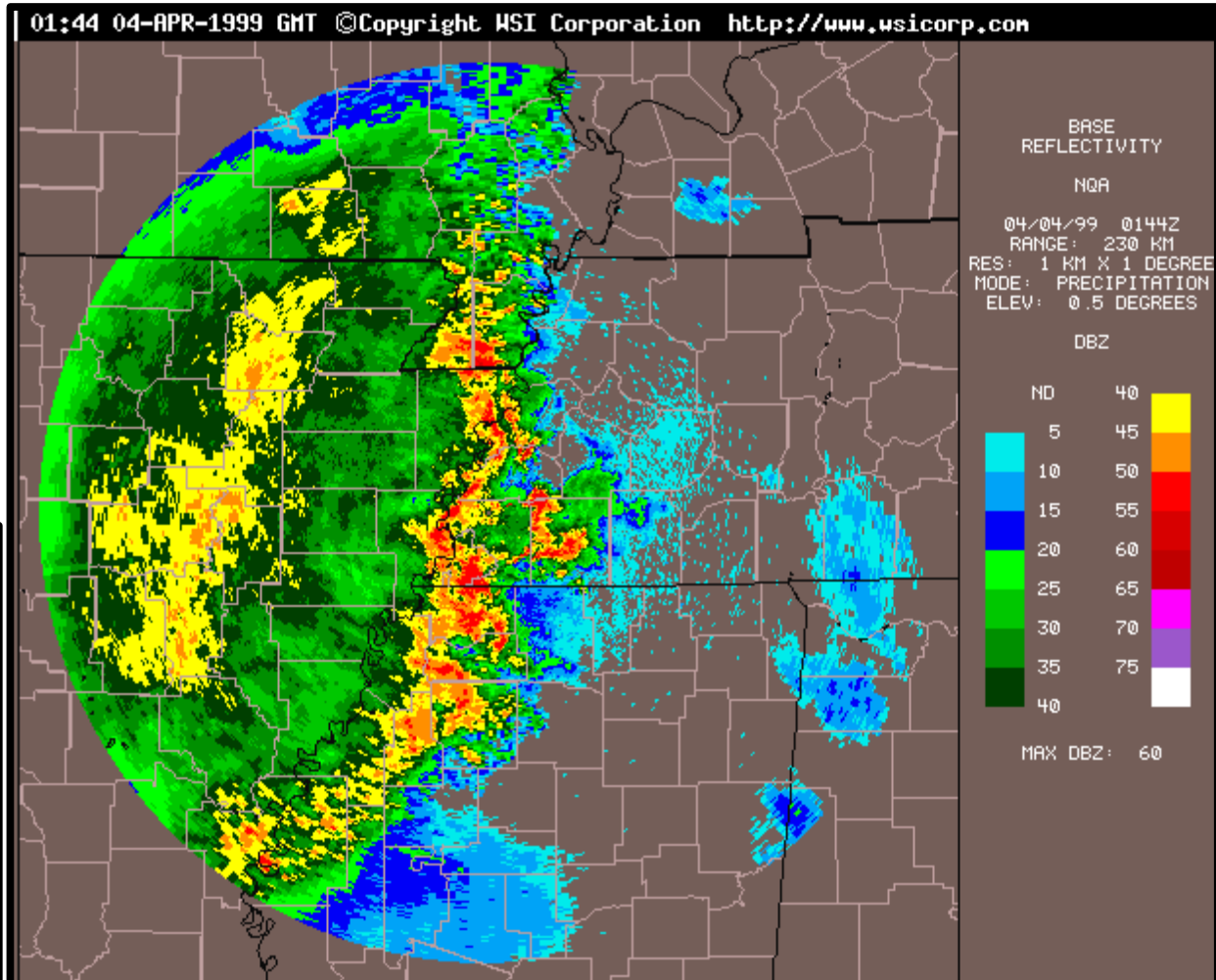
- A stronger convective complex.
- Cells build and merge with mature cell.
- Feeders on side of low level flow, or feeders develop along convergence line.
- Outflow may change location of inflow.



Hail Suppression – Squall Line Storm

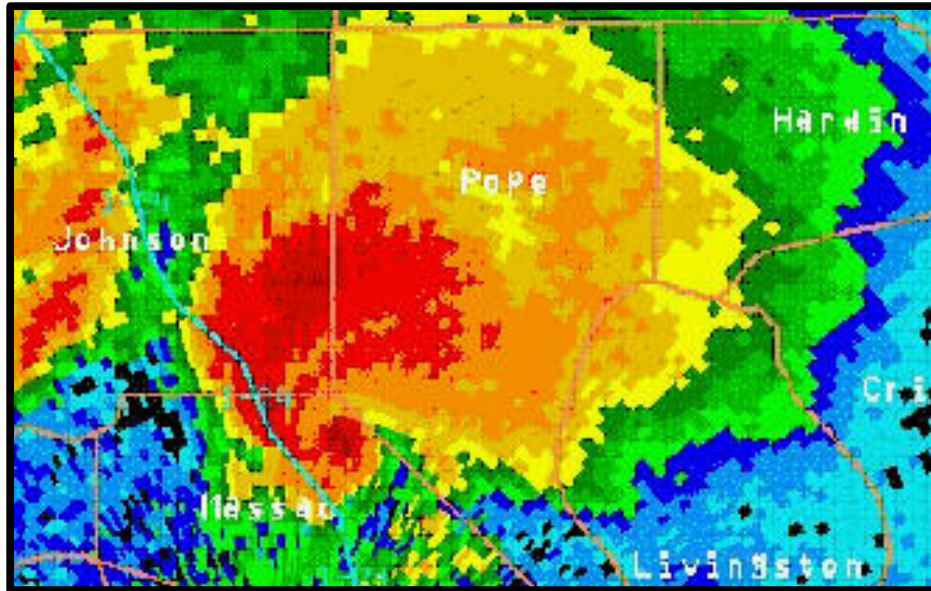
- Long Line of Multi-cell Storms
- Inflow (new development) along Front of Line
- Preceded by Cirrus Shield
- May be Accompanied by Shelf, Roll, Pedestal Clouds
- Inflow Weakens with Distance from Line
- Inflow may be Marked by Scud Clouds

Cloud Structures – Squall Line Storm



Cloud Structures – Supercell Storm

- Steady-state
- Shelf Cloud
- Inflow in Front, on South Portions



Rain Increase – Delivery Techniques

- Best done at cloud top.
- Fly at -5°C to -10°C .
- Stabilize before penetration.
- Look for updraft, liquid water.

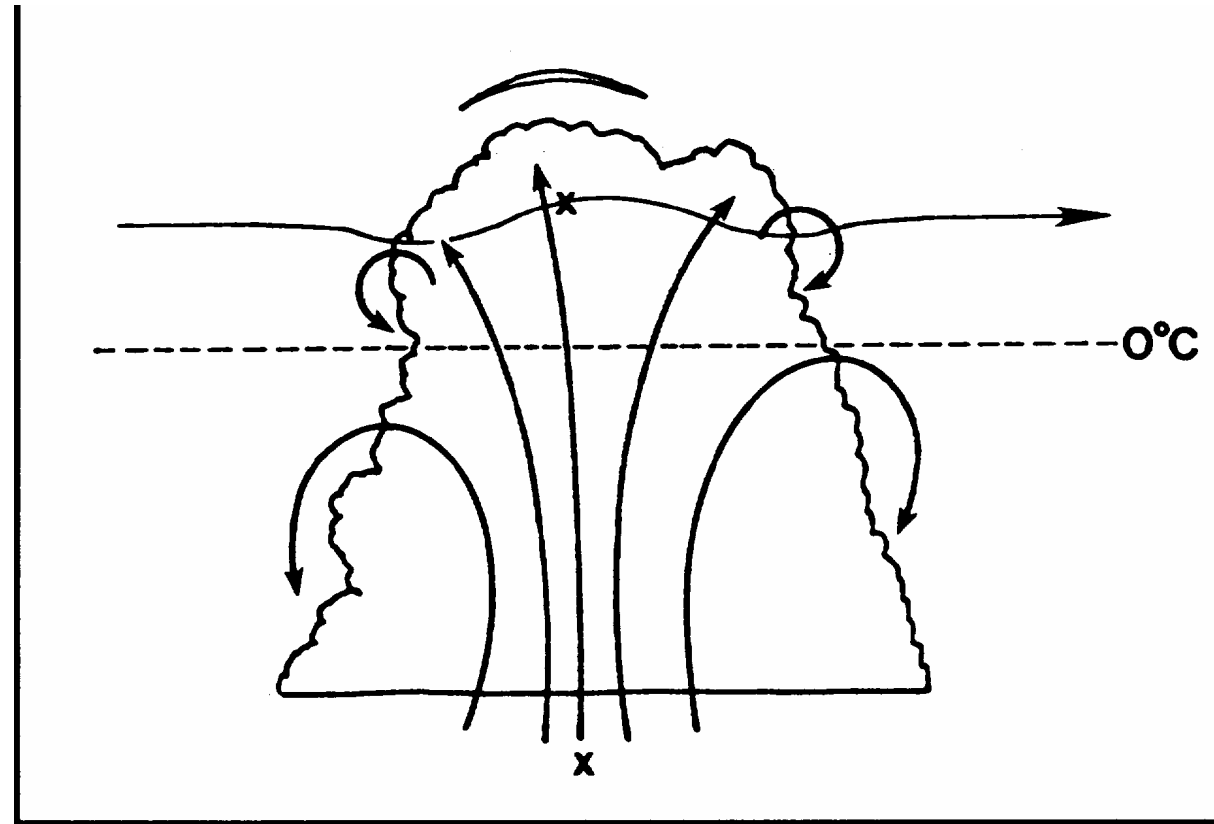
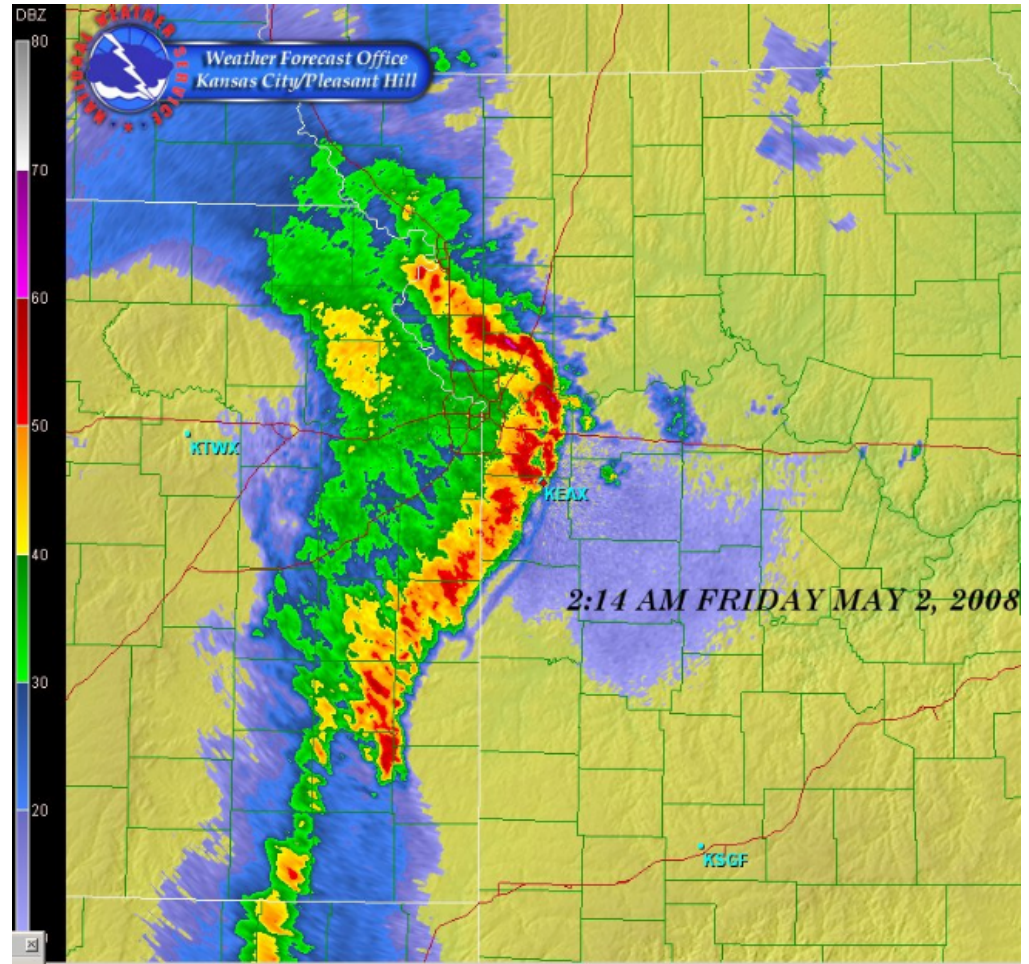
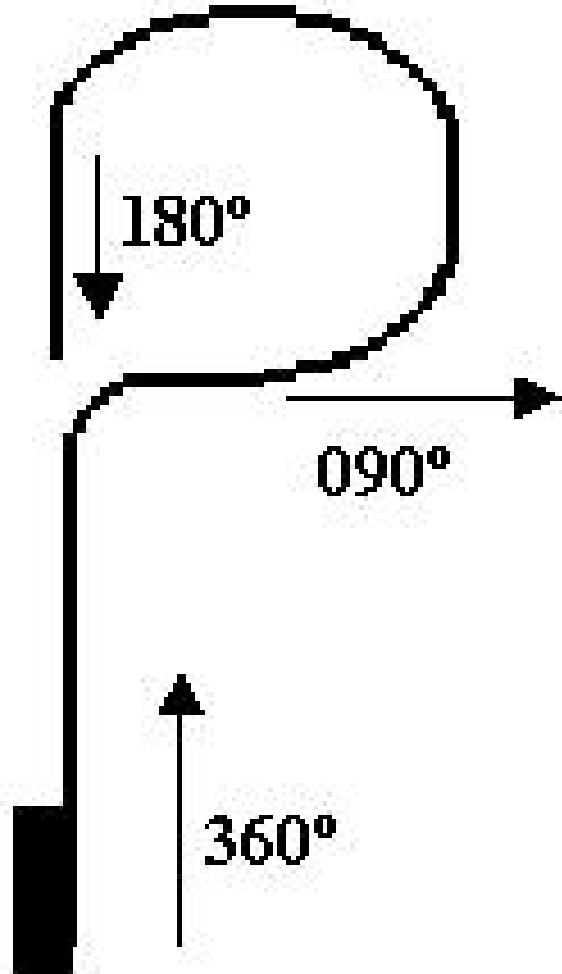


Figure 14. Seeding in the absence of shear. The "X" denotes the approximate seeding position.

View Effects of Seeding (90/270 Turns)



Multicell Storm – Delivery Techniques

- Smooth, dark base.
- 500' below base.
- Racetrack pattern.
- 500 fpm updraft.
- Adjust power, configuration to hold altitude.
- Back off if updraft increases.

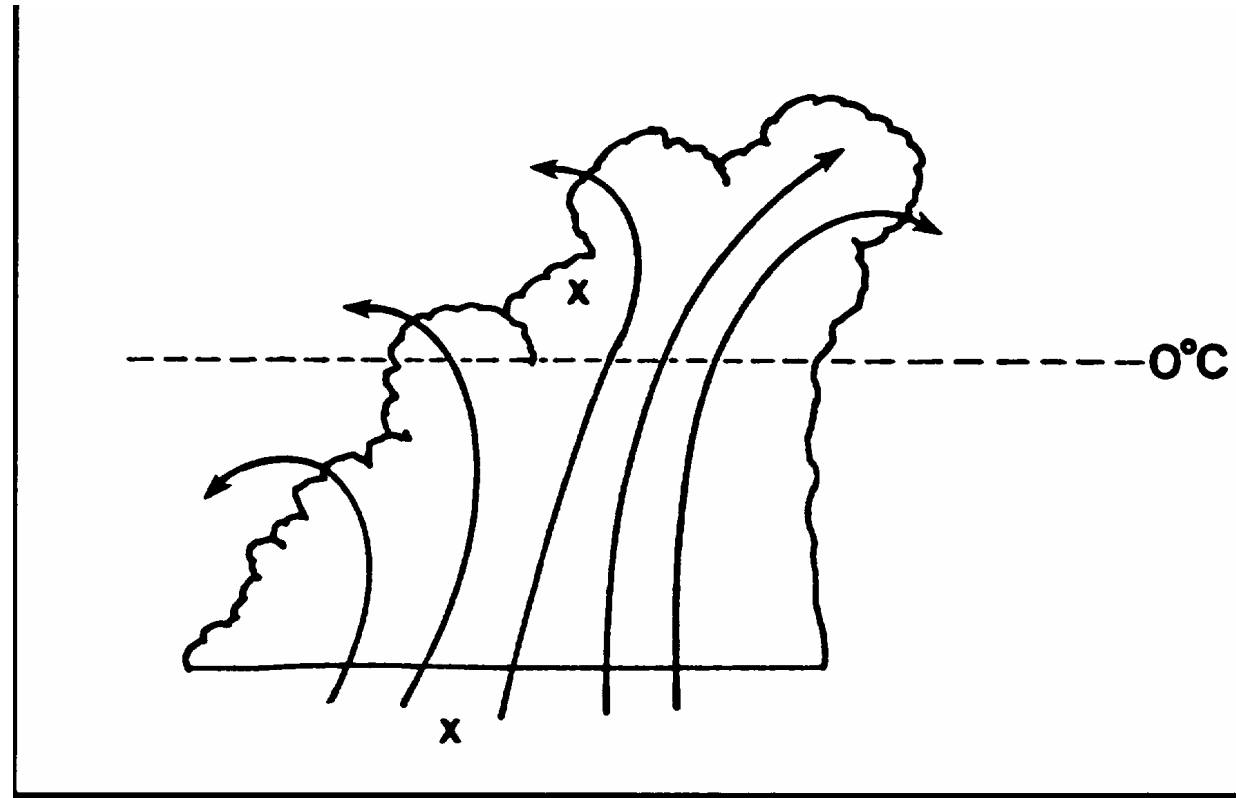
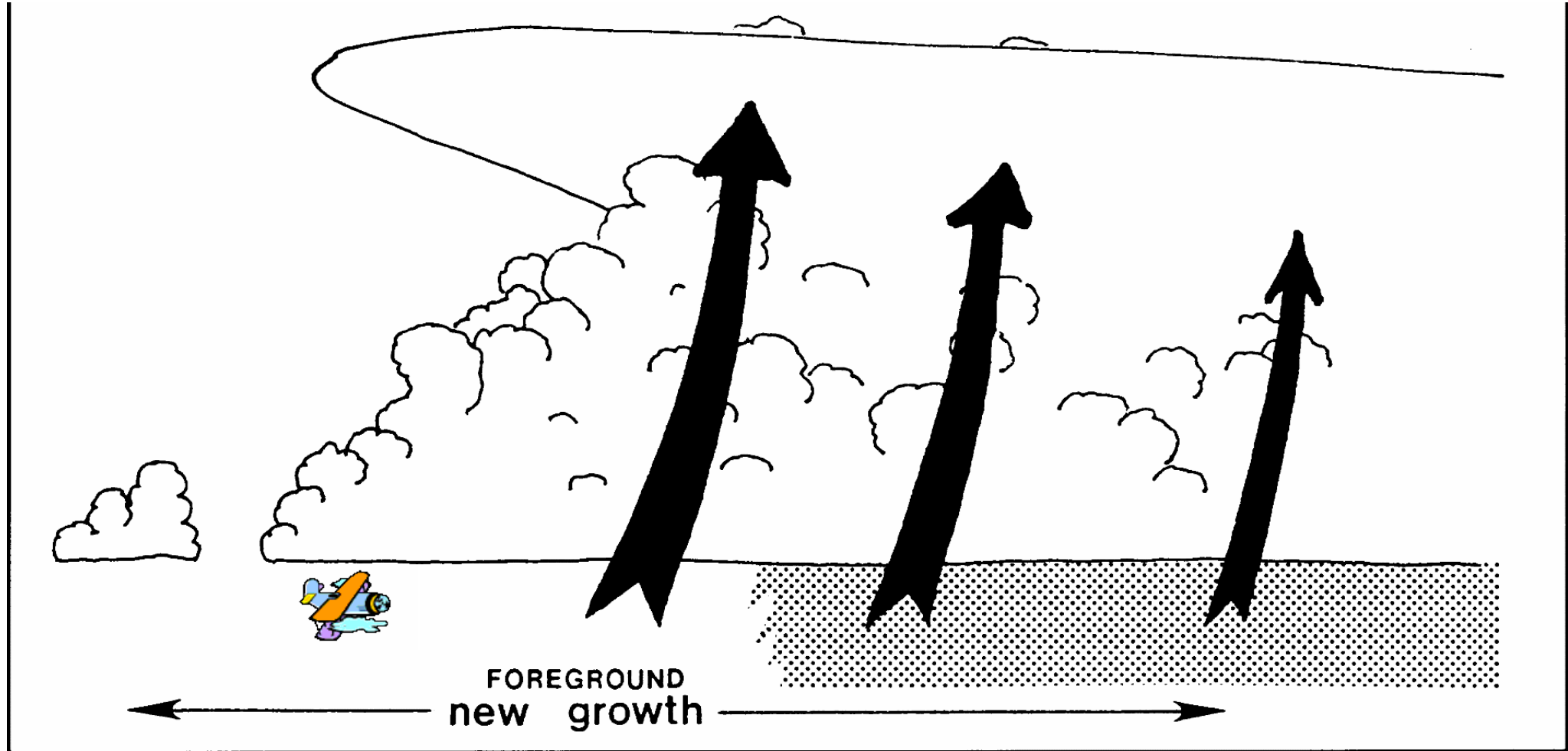


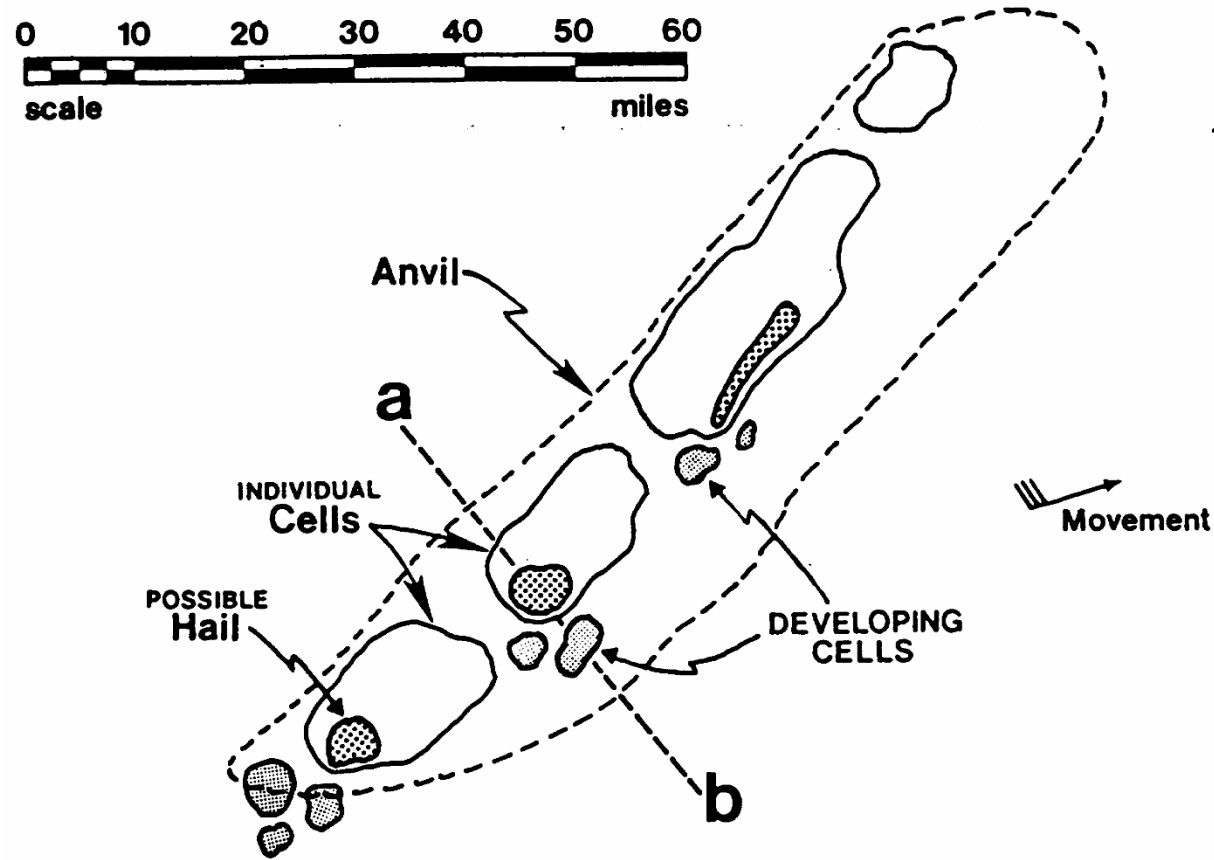
Figure 15. *Rainfall augmentation seeding in a forward-shear environment.*

Multit-cell Storm – Delivery Techniques



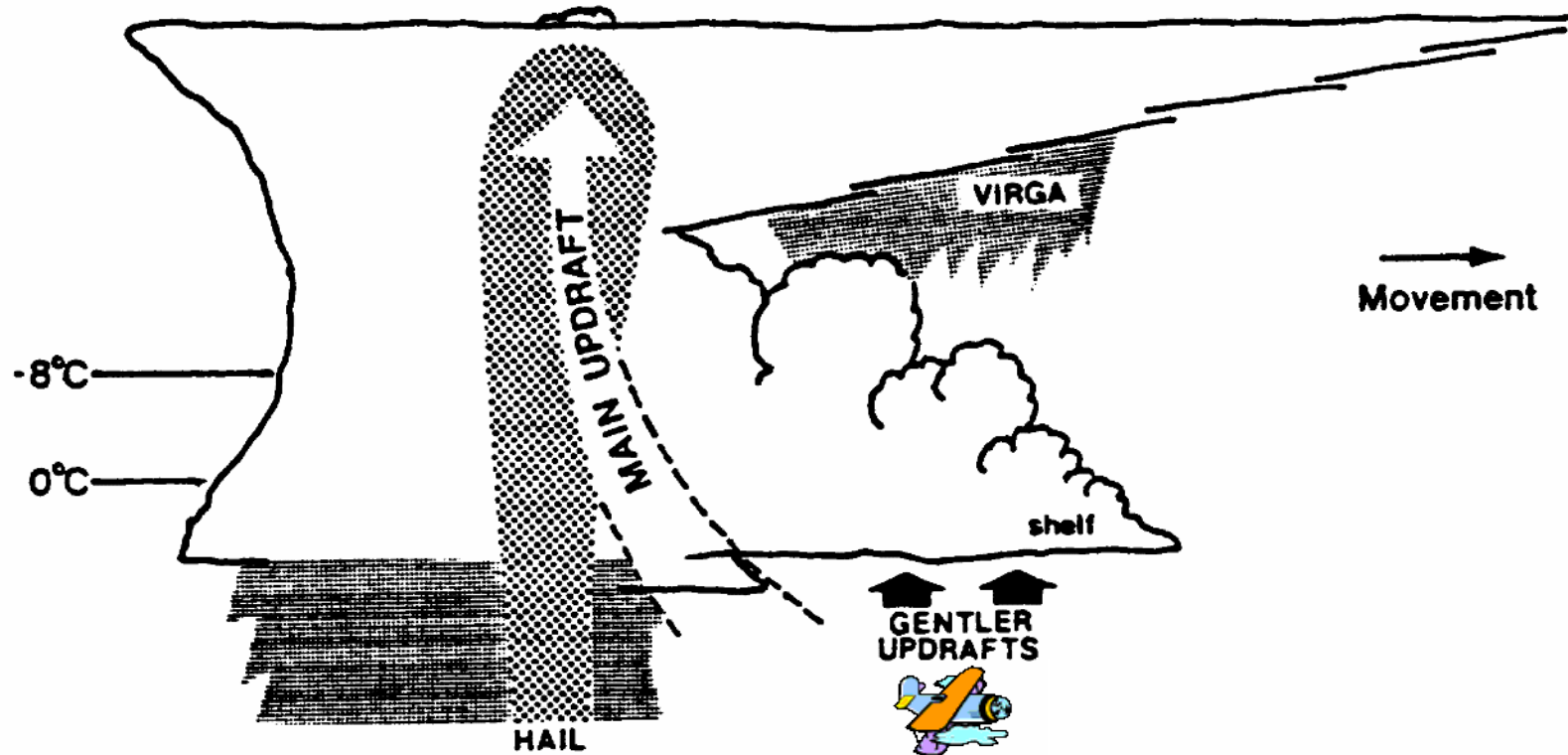
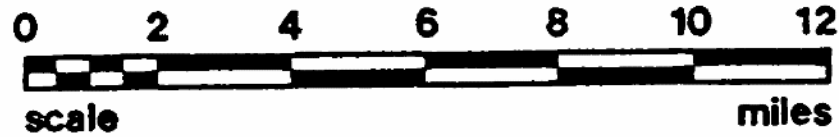
Squall Line Storm – Delivery Techniques

- Below shelf, 1000' below base.
- 500 fpm updraft
- 2-10 miles from precipitation.
- Racetrack pattern.
- Move out if updraft increase.



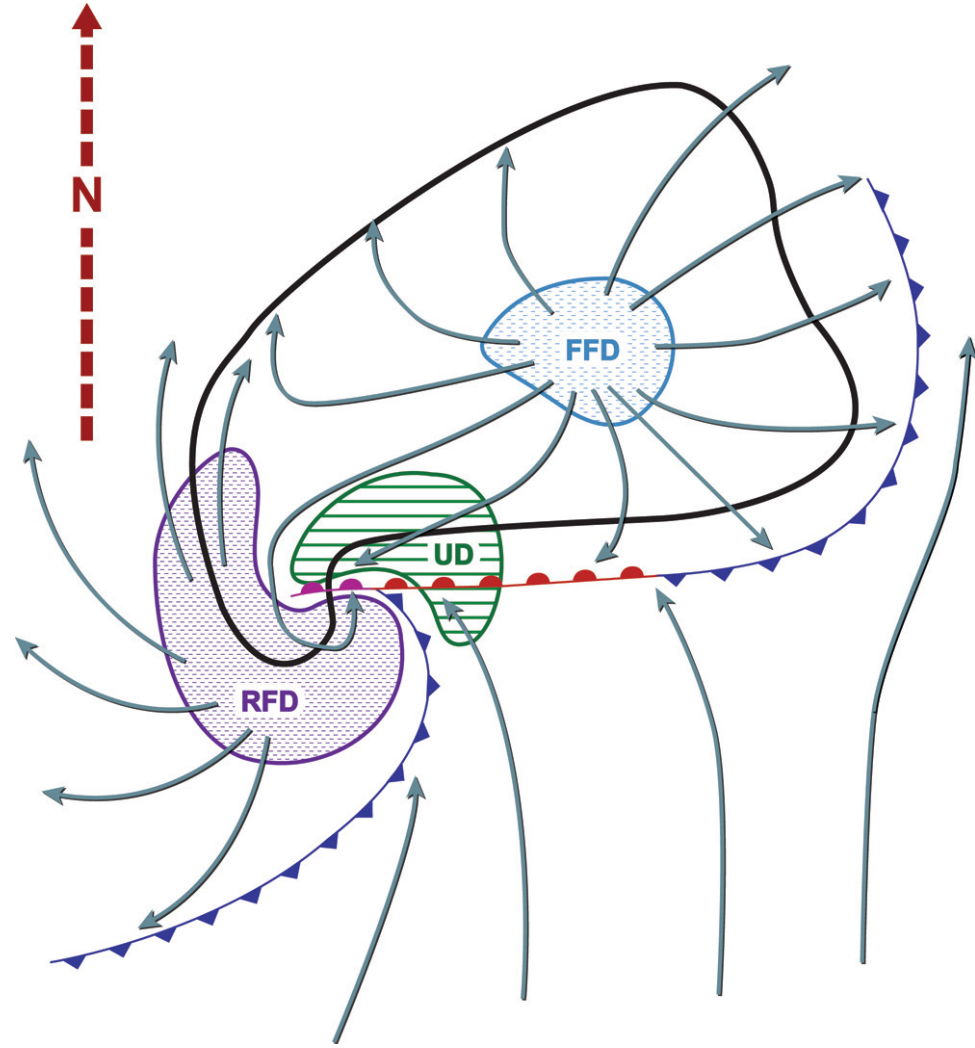
If on top, fly parallel to line, turns away from line.

Squall Line Cloud – Delivery Techniques



Supercell Storm – Delivery Techniques

- 1000'-2000' below base.
- 500 fpm updraft.
- On top may be hazardous.



Supercell Storm – Delivery Techniques

