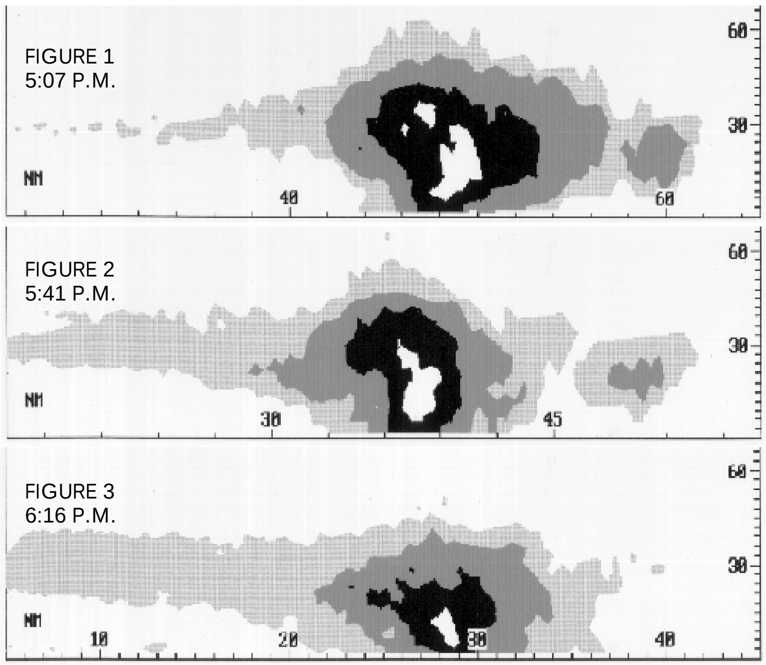
THE
ATMOSPHERIC RESERVOIR
Examining the Atmosphere and Atmospheric Resource Management

A Radar Case Study

One of the best tools available for assessing and tracking severe thunderstorms is the digital weather radar. On August 27, 1997, a line of severe thunderstorms plowed across Divide County and into Williams and Mountrail Counties. The radar images shown here reveal a perspective not generally seen by the public, and show how the storm's character changed after being seeded by the aircraft of the North Dakota Cloud Modification Project (NDCMP).



Much can be learned by examining the structure of the storm in the vertical. To do this, the radar antenna rotation is stopped, and the dish scanned upward from the surface through the storm top. This creates the vertical cross sections shown here. Four levels of precipitation are revealed: the light gray indicates light rain, the dark gray a moderate rain, the black a moderate-to-heavy rain, and the white, heavy rain and hail. The experienced radar meteorologist looks primarily for two things that might indicate the presence of hail: very high cloud tops, and very strong radar echoes, especially high in the storm.

The intense storm produced severe hail as it moved southeast; a tornado warning for central Divide County expired at 5:00 p.m. CDT. At 5:07 (Fig. 1), the cloud top was about 48,000 feet high (the radar exaggerates maximum cloud height of very strong storms), and several areas of white echo are seen—some above 30,000 feet!

Seeding of the storm complex began at 5:31 p.m., 30 minutes after expiration of the tornado warning, after the storm had entered the NDCMP target area (Williams County). At that time, the system was still producing considerable damaging hail. The vertical profile of the storm at 5:41 p.m. is shown in Fig. 2. A large area of strong echo remained, but was located slightly lower in the cloud. Maximum cloud tops remained quite high, around 45,000 feet.

However, as seeding began to affect the storm, the maximum cloud height and height of the strongest echo began to diminish. This is well-illustrated by Fig. 3, which shows that by 6:16 p.m., the cloud tops had dropped to less than 40,000 feet, and the maximum height of the strongest echo was less than 15,000 feet. At the same time, the area of rainfall reaching the ground had actually increased, especially the areas of light and moderate rainfall. This is typically the case after seeding.

In most cases, within 20 minutes or so after seeding begins, the maximum cloud top heights begin to decrease, and likewise, the height of the strongest echoes begins to descend. Both indicate the storm is becoming less severe. This direct physical evidence is observed repeatedly each summer, as threatening storms are seeded.

In addition to providing useful real-time information to those directing NDCMP operations, the radars located in Bowman and Stanley boost local civil defense efforts, and augment the information base used by the National Weather Service in issuing severe weather warnings. By June of 1998 the real-time data from these radars will probably be available on the Internet as well. ■

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