THE
ATMOSPHERIC RESERVOIR
Examining the Atmosphere and Atmospheric Resource Management

CCN: Small Wonders

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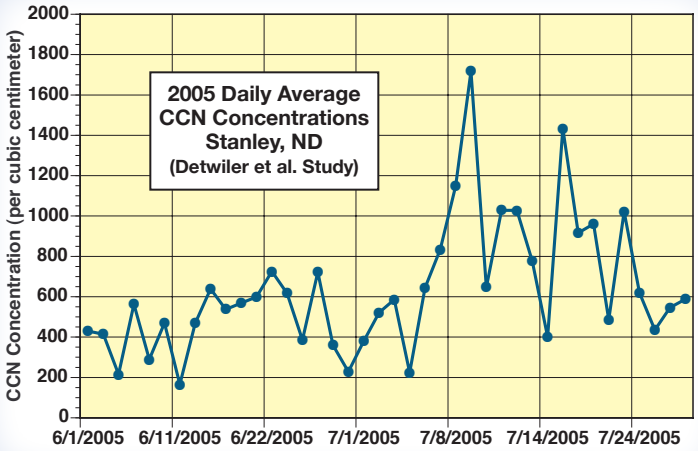
A study published in the January issue of the *Journal of Applied Meteorology and Climatology* sheds more light on North Dakota's CCN, or cloud condensation nuclei. But what are CCN and why are they important? Simply stated, CCN are small particles onto which water vapor condenses. This broad definition includes dust, clay, smoke, and salt particles that are small enough to become suspended in the air. Water vapor may condense onto these CCN forming the tiny droplets in clouds, one of the building blocks of rain and snow.



During the 2005 North Dakota Cloud Modification Project (NDCMP), special instruments were used to measure the number of CCN at the NDCMP radar facility in Stanley. The CCN counter works by ingesting an air sample into a small chamber containing humidity levels just above 100 percent. Then, droplets are given a specified time to grow in the chamber before being counted and recorded. The more droplets are formed, the higher the CCN concentration. While this may sound like a good thing, if the droplets are many and of similar size, it may produce a cloud with an inefficient precipitation formation process.

The findings of the study support other research showing that landlocked states such as North Dakota typically have classic "continental" CCN concentrations of greater than 500 particles per cubic centimeter. This means that clouds in North Dakota are usually composed of many, small droplets compared to clouds near oceans that have fewer, larger droplets.

During the study, only two out of 17 days with precipitating clouds had low CCN concentrations. Further, of the 40 days of usable data, only four had CCN concentrations that could be characterized as "clean," with CCN numbering less than 300. This supports the idea that North Dakota clouds may be suitable for hygroscopic cloud seeding and provides valuable background information for ongoing research, namely the Polarimetric Cloud Analysis and Seeding Test (POLCAST).

The study also looked at the geographic source regions of air masses. These source regions provided CCN concentrations ranging from less than 200 per cubic centimeter to more than 1700 throughout the summer. The HYSPLIT computer model, created by the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory, was used to compute three-day back trajectories from the observation site in Stanley. The findings showed that while air arrived at Stanley from almost every direction, air from the north, near Lake Winnipeg and the Hudson Bay region was typically cleaner than air originating over the southern and central high Plains. Results were so widely varied, however, that back trajectories alone cannot be counted on for reliable CCN concentration forecasts.

Additional research will provide a better understanding of North Dakota's atmosphere. The sources and composition of these little particles are many, but increasing our knowledge will improve precipitation forecasting and possibly enhance precipitation further down the road.

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