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University Corporation for
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The University Corporation for Atmospheric Research (UCAR) is a consortium of over 60 universities in the United States and Canada with doctoral programs in the atmospheric or related sciences. Through the contributions of each member, and primary support from the National Science Foundation, UCAR oversees a wide range of basic and applied research programs and facilities that help to build and strengthen partnerships among the universities, national laboratories, federal agencies, industry and policy makers. UCAR manages and operates the National Center for Atmospheric Research and the UCAR Office of Programs.

Science Briefs is provided quarterly to policy makers and Congressional staff to communicate current science activities within the framework of national policy issues. The UCAR community is committed to linking science and technology results to government and societal needs.

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SCIENCE BRIEFS

Science and Technology

Spring, 2000

Scientists Enjoy a New Chemistry Set

The recent launch of NASA's Terra satellite was celebrated by atmospheric chemists who want to learn more about two gasses: carbon monoxide and methane. Carbon monoxide is a common air pollutant that plays a big role in our health. When it is highly concentrated, it is a deadly poison, and as it rises in the atmosphere, it converts into carbon dioxide, a green house gas.

An instrument on the Terra satellite is now providing researchers with much-needed longterm, continuous data on carbon monoxide and methane. Ground- and aircraft-based instruments provide only a patchwork of measurements in space and time. MOPITT, an instrument on Terra, will give the complete picture, covering virtually the whole globe in three days' worth of orbiting. MOPITT stands for Measurements of Pollution in the Troposphere (the lower five miles of the atmosphere; the area where most clouds and weather reside). MOPITT will give a more precise count of carbon monoxide emissions, and will track the movement of carbon monoxide in the lower atmosphere.

Scientists from NCAR and the University of Toronto are pleased with the first satellite images tracking the movement and distribution of carbon monoxide in the atmosphere -- for the first time they have a detailed picture of carbon monoxide on a global

scale. These preliminary images produced by MOPITT show high levels of carbon monoxide in the Northern Hemisphere, where most of the world's industrialized countries are. The images also reveal high levels of carbon monoxide over western Africa, where it's burning season this time of year. Information on carbon monoxide levels and dispersion for individual cities will soon be available. The data from this project will be available for other users in a data archive at NASA. NCAR is planning to use the data for further studies, including how the gases are transported, information that can be used by health and environmental safety regulators. The data collected will also be used to study carbon monoxide source regions and may begin to answer questions about how pollution originating in Asia affects the U.S.

Electrifying Research Project

Those spectacular, bell-shaped thunderstorms aren't just photogenic, they're a scientific mystery. Low precipitation (LP) storms produce dramatic cloud formations, but don't produce much rainfall. Scientists are now realizing that LP storms may hold a key to understanding the microphysics and electrification of other kinds of thunderstorms. Scientists from NCAR, NOAA, and a number of universities will spend almost two months in northwest Kansas and eastern Colorado this summer for the Severe Thunderstorm Electrification and Precipitation Study (STEPS-2000). Observations of the electrical properties of storms and the rain and hail they produce, will result in improved

understanding of the relationships between thunderstorm electrification and precipitation production. A basic question researchers hope to answer is how and why embryonic storms develop into low-precipitation storms that fail to produce much rain. These LP storms contain as much water vapor as their wetter counterparts, but are far less efficient at producing precipitation. Scientists also don't know how these storms evolve into larger storm systems later on. One of the benefits of this work will be to improve real-time forecast models.

Science & the Environment

Springtime in the Arctic

As people use more fossil fuels, ozone plumes form in polluted cities and drift around the world. Scientists are worried that an overburdened atmosphere may lose its ability to adequately cleanse itself. Ozone levels in the lower atmosphere (troposphere) in the Arctic increase in the spring just as the returning springtime sun triggers chemical reactions that deplete ozone, creating a smaller, northern version of the Antarctic ozone hole. The peculiar chemistry of the Arctic Spring is key to understanding ozone and pollution processes across the northern latitudes.

To discover more about this process, a former military transport plane packed with scientists and specialized instruments, has been flying from Colorado to the brutal cold of the Arctic Circle to scrutinize an annual springtime rise in ozone levels. For the first time researchers are measuring an array of chemicals that could

shed light on ozone production, atmospheric cleansing, and pollution transport in the northern latitudes. Scientists hope to answer a number of puzzling questions: Why these springtime highs and lows of ozone? Scientists suspect that some ozone sinks from the upper atmosphere into the lower atmosphere, but in what quantity? As springtime weather changes circulation patterns, ozone and ozone-producing compounds travel into the far north from the polluted regions of northern and central Europe. To what extent does this influx speed up the chemical processes that accompany the return of sunlight? Scientists believe measurements of over 20 chemical species will provide answers. Preliminary measurements are already helping scientists fine tune their atmospheric chemistry models to better understand the chemistry and dynamics of the Arctic's lower atmosphere as winter gives way to spring.

Emissions Tests on Planes and Rockets

Soot and other particles emitted by aircraft could have a subtle, indirect impact on the atmosphere. For instance, they may tweak the planet's radiative balance by affecting cloud formation. On a more local scale, rocket plumes inject a concentrated mix of chemicals into the atmosphere. Despite the significant progress made in assessing the stratospheric impact of industrial emissions, much uncertainty remains with respect to particulate emissions from aviation operations. Sampling the air left behind by aircraft and rockets was the task of a NASA study, ACCENT (Atmospheric Chemistry of Combustion Emissions Near the Tropopause). Researchers studied the emissions by flying in and near

rocket plumes, by sampling the air inside and outside the favored commercial flight tracks across North America, and by flying to the upper tropical troposphere. Scientists hope the data will result in a better understanding of the effects of these emissions on cloud formation and ozone levels.

Science and Education

Lessons from a Big Drip

A UCAR website, *Web Weather for Kids*, won the AAAS-Unisys Prize recently for Achievement in Online Science Education. With a cartoon raindrop guiding students, *Web Weather for Kids* illustrates how thunderstorms and tornadoes are formed, teaching sound scientific principles through an imaginative and whimsical approach. The site was chosen from among 15 web sites built through grants from Unisys as part of National Public Science Day 2000. Development of the sites and the contest were sponsored by the American Association for the Advancement of Science (AAAS). Each of the websites emerged through a collaboration between a local school or school system and one or more entities involved in informal science education. The Web Weather site can be found at:

www.ucar.edu/40th/webweather

For more information on these updates at UCAR/NCAR, contact Laura Curtis, (303) 497-2106. NCAR is sponsored by the National Science Foundation.