meteorology

Gathered at the International Conference on Cloud Physics in Toronto

MODELS

Mine shafts as a physical facility

Mine shafts offer a means of simulating certain conditions in the atmosphere on a previously unavailable scale. They offer a wide range of conditions covering all the concentrations and sizes of water drops found in natural clouds.

Dr. A. E. Carte of the National Physical Research Laboratory in Pretoria, South Africa, reported his investigations of artificial rain formation in several shafts and of the fall rate of model hailstones made from polyethylene in six different shapes. He also tested replicas of hailstones of various irregular shapes, made of wax or epoxy resin.

He concludes that mine shafts are of doubtful value for studying the evolution of large raindrops formed by collision and coalescence of smaller drops. They are, however, useful for conducting free fall experiments with hailstone models or replicas.

CLOUDS

Ice crystal aggregation

Ice crystal aggregation is the result of a complicated process in which aerodynamic and electrostatic forces, as well as turbulence of the air stream, take a role, and is also affected by the variety of different shapes of the crystals themselves.

Dr. Josef Podzimek of the Czechoslovak Academy of Sciences in Prague has studied the growth of ice crystals through laboratory observations of how models of individual crystals move in a tank filled with glycerol.

In the case of two plate-shaped crystals of differing sizes, he finds that if the smaller one gets into the vortex region behind the larger one, it is drawn into the vortex and its fall slowed.

Drs. Pauline M. Austin and Michael J. Kraus of Massachusetts Institute of Technology outlined a numerical model of ice crystal aggregation based on a uniform distribution of size and type.

NUMERICAL SIMULATION

Computer models of drop formation

Progress in using computers to calculate how individual cloud droplets grow was reported by several meteorologists.

One study required seven hours on the CDC-6600 high speed computer at the National Center for Atmospheric Research in Boulder, Colo. The long computation time required for this simulation study makes it impractical to use this approach for larger cloud volume or longer times.

Drs. Pnina Kornfeld and Uri Shafrir of Tel Aviv University, Israel, and Milford H. Davis of NCAR nevertheless find their numerical experiments worthwhile:

"The extreme simplicity of this simulation process makes it possible to include additional parameters, such as turbulence, updraft and electricity, and to study their effects on the evolution of the spectrum of a droplet with time, as well as such complicated processes as charge separation."

Dr. Edwin X. Berry of the University of Nevada has devised a simple equation that summarizes growth of droplets in each of three distinct regions—the initial phase, an intermediate phase and a final one, in which the coalescence rate gradually decreases as larger drops are formed.

Dr. Berry's numerical model takes about one million computations for each time step.

Dr. Philip Duncan Thompson, scientific director of NCAR, has worked out a set of partial differential equations that cuts Dr. Berry's time for calculating drop coalescence to only 1,000 to 10,000 computations per time stage, a considerable saving in machine use.

INSTRUMENTATION

Distribution of aerosol size

An instrument adapted from the nuclear physics laboratory is making rapid determinations of the size distribution of the aerosol particles, the nuclei around which rain, hail and snow form, in the Los Angeles area.

Light reflected from the aerosol particles is registered by a photomultiplier detector; the resulting electrical pulses are amplified, then sized and counted automatically, using the physicist's multichannel pulse height counting technique.

Its advantage over previous methods is that a complete count of particles of every size can be made, which was not possible before.

Their preliminary results are still being analyzed, reported Drs. Franklin S. Harris Jr. and Frank L. Morse Jr. of the Aerospace Corporation, El Segundo, Calif.

PHYSICAL CHEMISTRY

Fertilizer proposed as seeding agent

The use of fertilizer as a seeding agent to wring rain out of warm clouds and feed crops is under study at the U.S. Naval Air Facility, Naval Air Station, Norfolk, Va.

Clement Todd says computer studies he and co-workers have made show that increasing the natural salts in warm clouds, around which raindrops form, from one part-per-million to fifty parts per million should result in rain. This level is much too low to be noticeable; as Mr. Todd points out, Colorado River water carries 500 parts per million of dissolved salts.

The idea behind using fertilizer, such as ammonium nitrate, is economic. Only a few grams of silver iodide, for instance, are needed to seed cold supercooled clouds. Warm clouds, on the other hand, need to be sprinkled with several hundred kilograms of nucleating agent before yielding rain.

Since farmers use fertilizer anyway, Mr. Todd's theory is to give a small part of it to their crops in the also-needed rain.