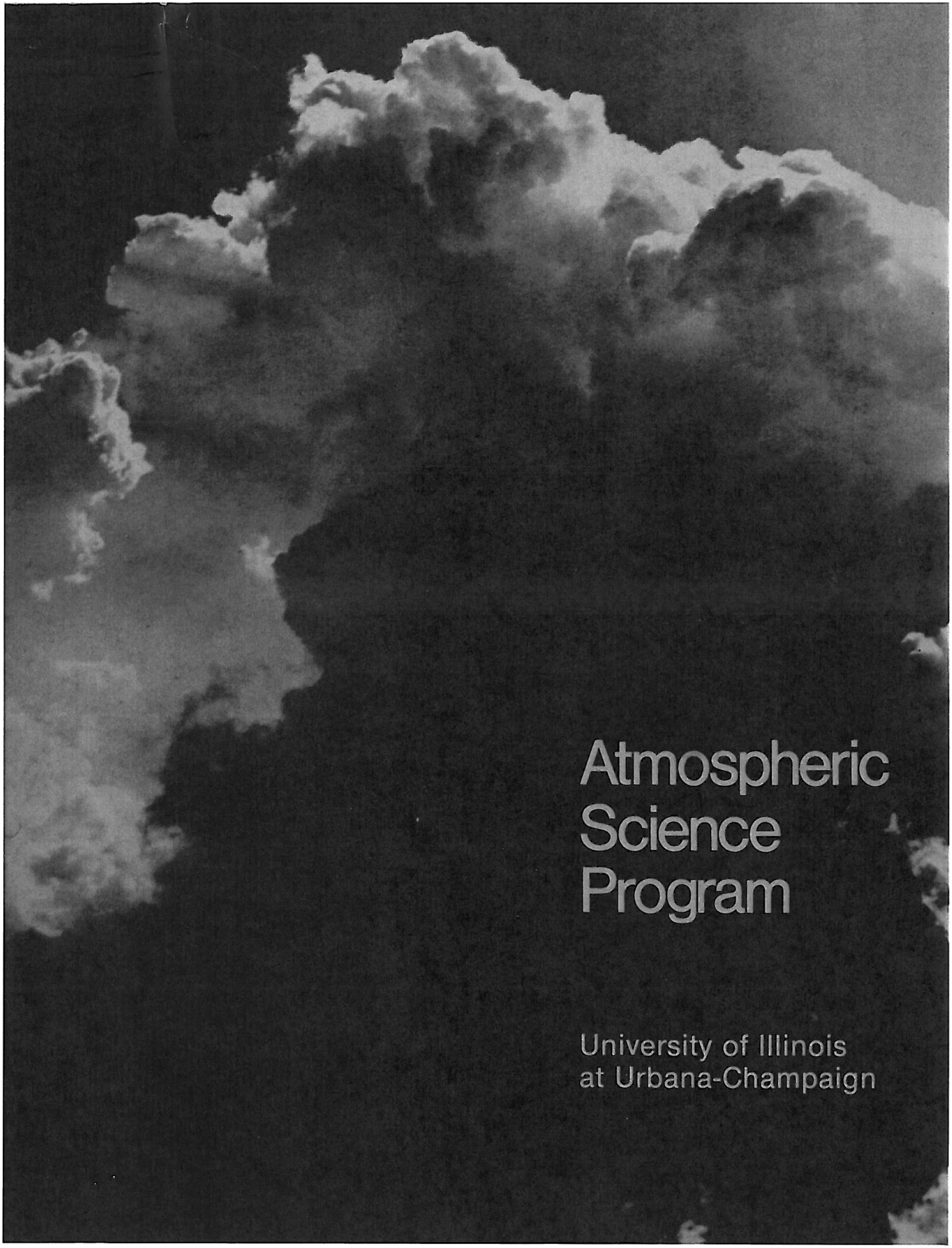
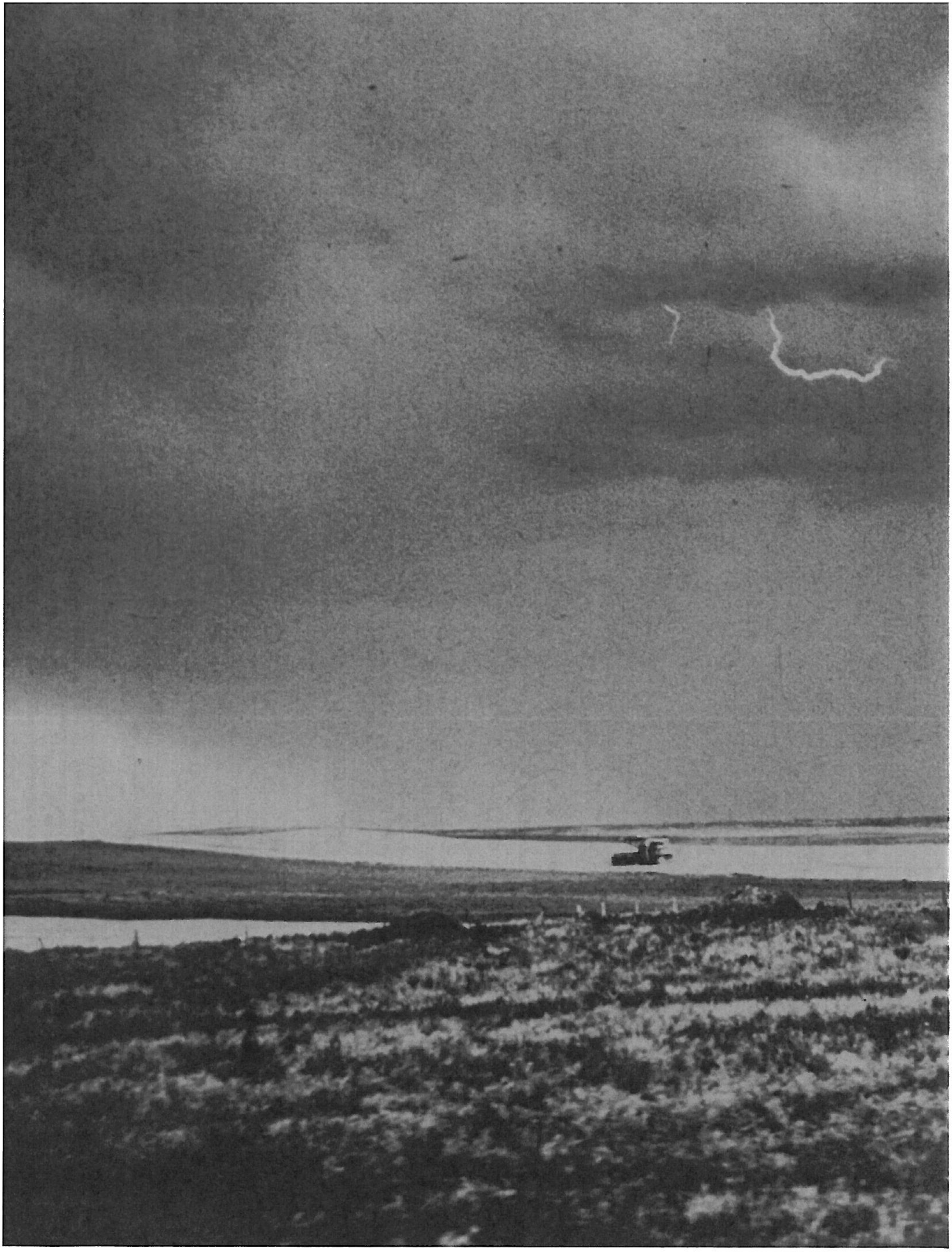
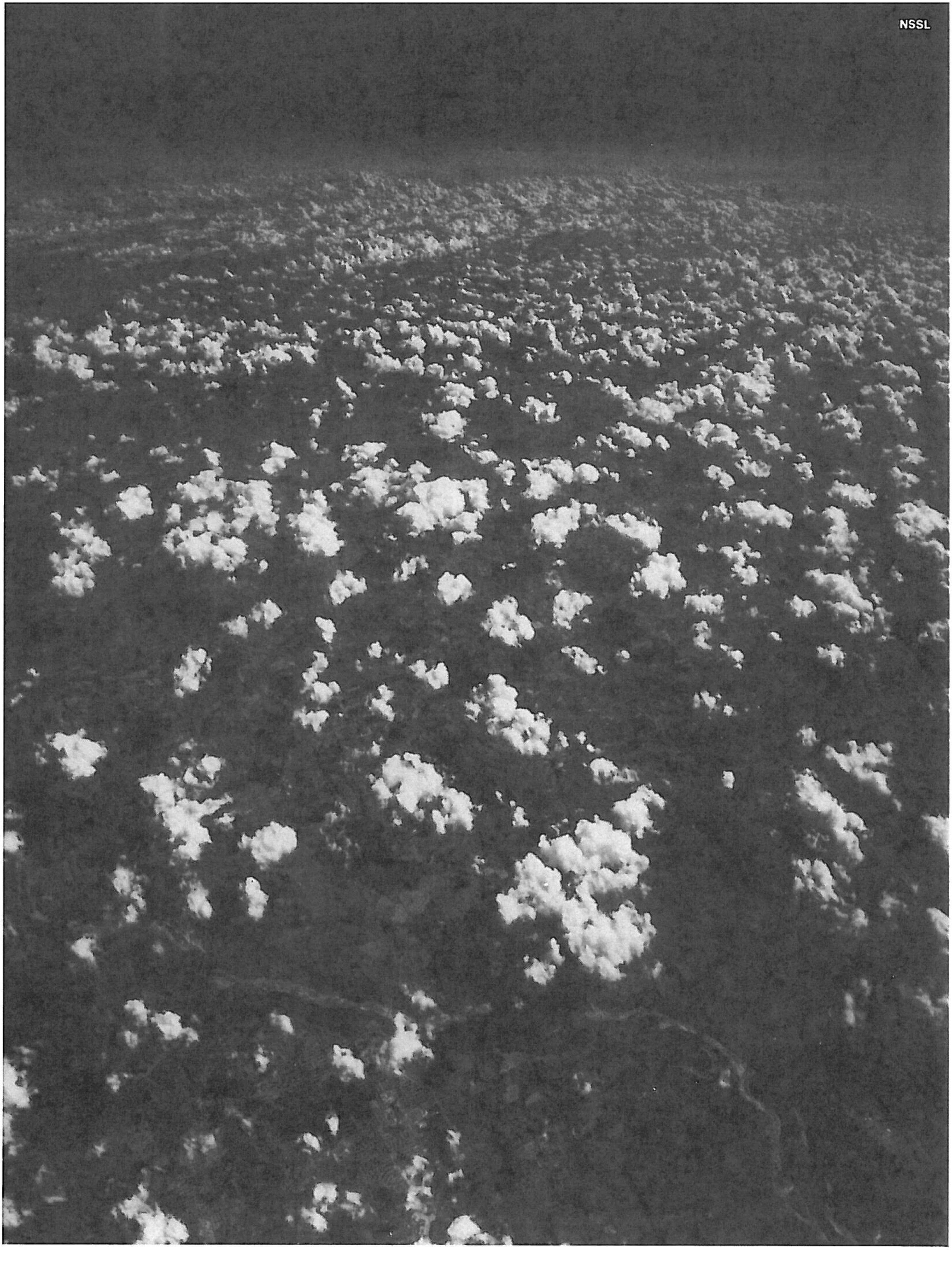


Atmospheric Science Program

University of Illinois
at Urbana-Champaign





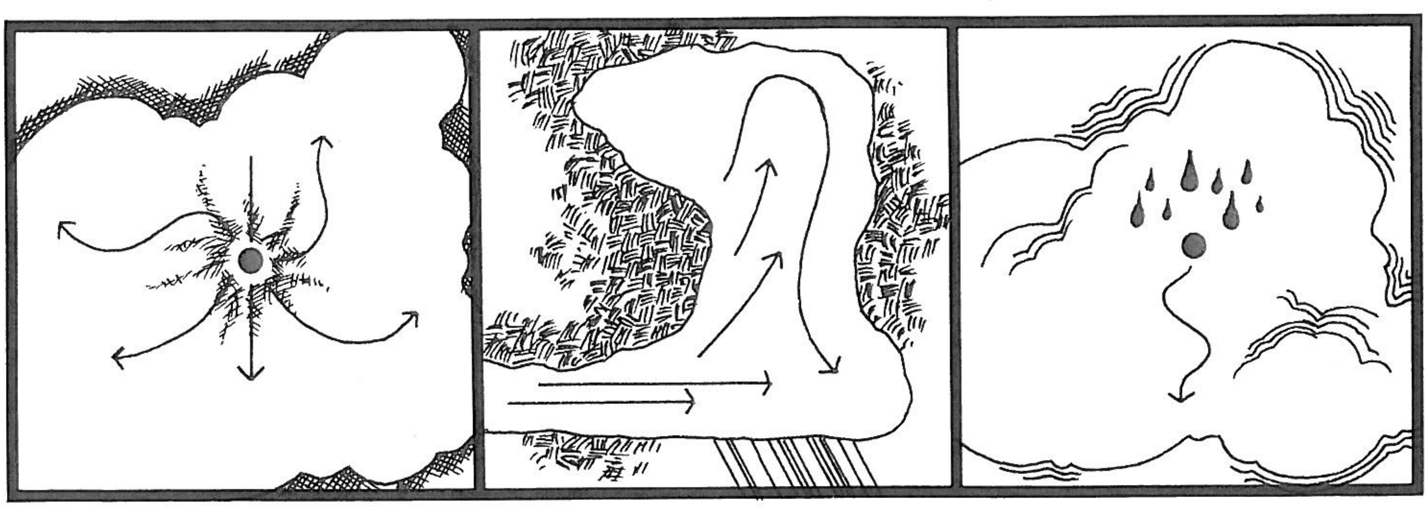
NSSL

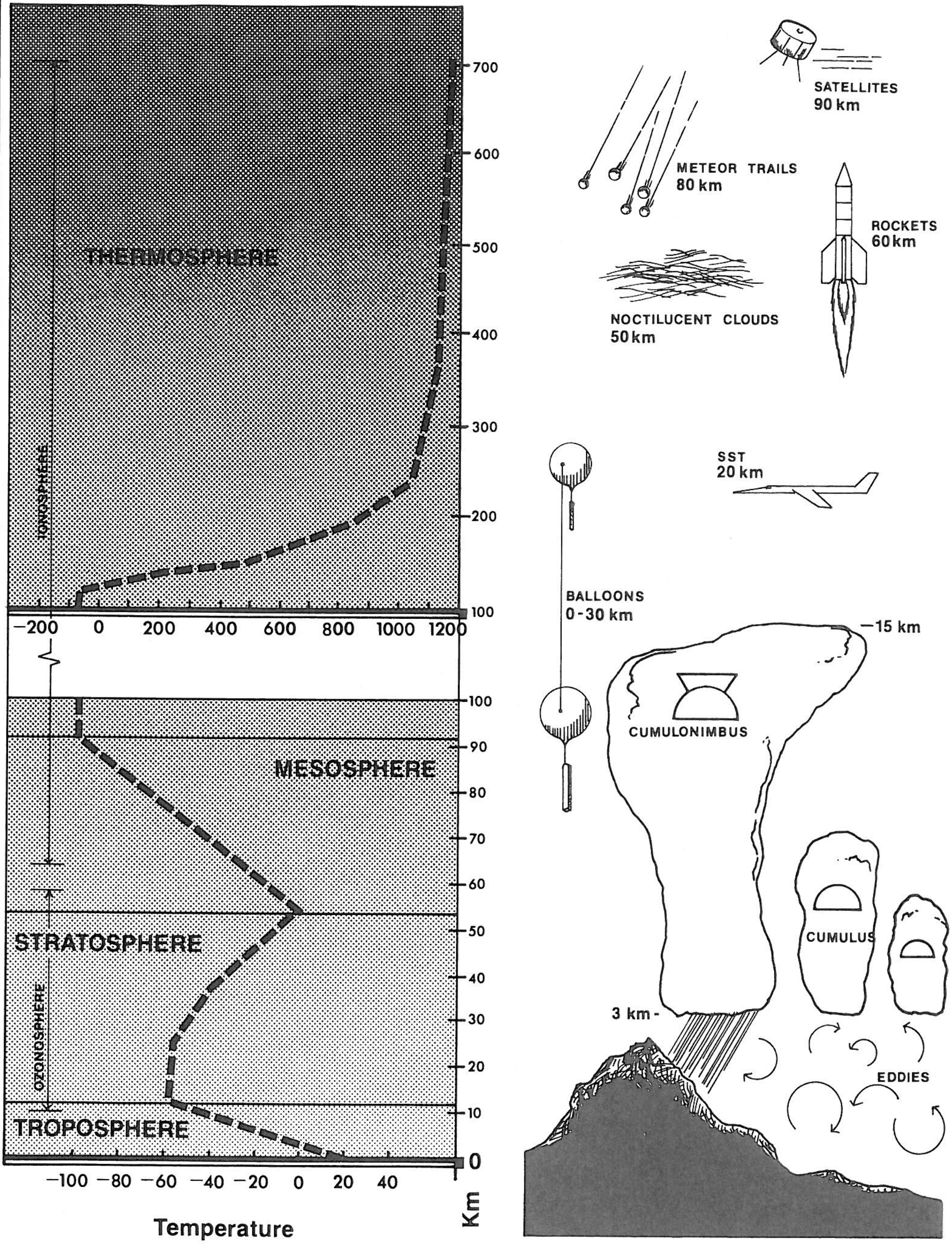
John Lewis received his graduate education at the University of Chicago (M.S., 1963) and the University of Oklahoma (Ph.D., 1969). He has worked in the operations and development divisions of the numerical prediction centers in Washington, D.C. (National Weather Service) and Monterey, California (U.S. Navy). His primary task was formulating automated numerical weather map analysis in data-sparse regions of the atmosphere. Current research interest is focused on the data analysis of the Great Plains squall line. The origin of the squall line as well as its effect on the large-scale environment are under investigation.

“My interest in meteorology was stimulated by visual observations of squall line generation and evolution so apparent over those flat plains of Oklahoma. I feel a sense of excitement when analyzing the data collected in and around the storms, anticipating the unraveling of mysteries neatly nestled within.

My own observational efforts have greatly benefited from discussions with the theoreticians at the U of I. Another source of inspiration has been those undaunted queries from that host of bright young graduate students in our midst.”

Cumulus clouds are being investigated at the University of Illinois by several independent yet complementary approaches. These clouds exhibit varying degrees of organization that range from a familiar isolated columnar cloud to a line-up of tens or hundreds of these clouds in the form of a squall line. These clouds or cloud systems are being studied by combining observations and theory. Observations of basic cloud processes such as condensation and nucleation (formation of raindrops) are studied in the laboratory. In addition to these observations, data in and around actual cumulus clouds are being analyzed. Using these observations, theory about the life-cycle of cumulus clouds and about their collective effect on the surrounding environment is being developed.





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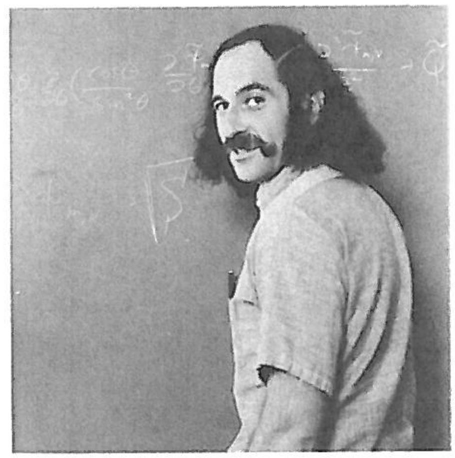
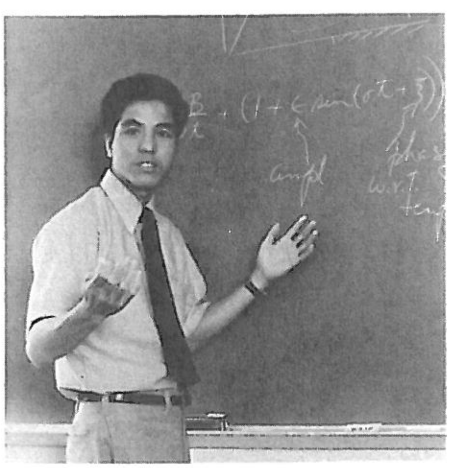
Marvin Geller received his Ph.D. in meteorology from the Massachusetts Institute of Technology in 1969. He then joined the faculty of the University of Illinois where he is now an associate professor of meteorology and of electrical engineering. His present research interests include the study of wave motions in the neutral atmosphere (atmospheric tides, vertically propagating Rossby waves, and internal growing waves) and their effect on the lower ionosphere. He is quite active in several national and international organizations. In 1973 he was chairman of the American Meteorological Society Committee on the Upper Atmosphere. He is also part of a working group of the International Association for Geomagnetism and Aeronomy which is concerned with theoretical problems of atmospheric oscillations.

"The study of wave motions in the atmosphere is very appealing to me for several reasons. Meaningful problems can be formulated in this area that allow rather simple physical interpretations in terms of classical wave propagation theory, a well-developed area of applied mathematics. Since atmospheric waves transmit energy over great vertical distances, very interesting coupling mechanisms can occur. For instance, wave motions in the ocean can force waves in the atmosphere. These can drive electric currents in the ionosphere that manifest themselves as variations in the earth's magnetic field. Atmospheric waves also play an important role in the atmospheric general circulation. The ocean-continent topography of the earth's surface gives rise to semipermanent asymmetries in atmospheric fields such as temperature. These asymmetries may be formulated in the context of atmospheric waves."





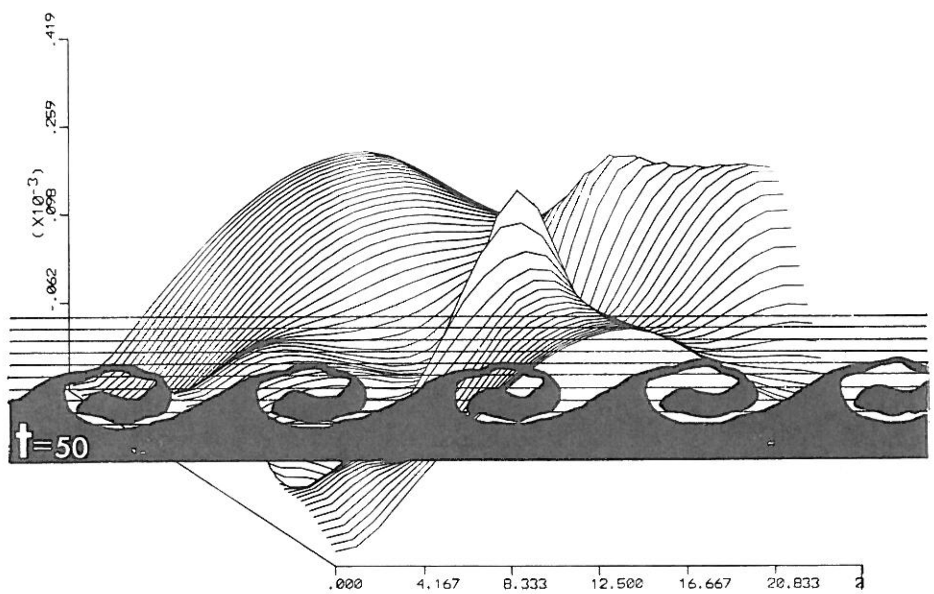
Man-Kin Mak received his graduate education in meteorology from the Massachusetts Institute of Technology (M.Sc., 1966; Ph.D., 1968). He has worked in the research division of the Meteorological Service of Canada, and has taught at the National Taiwan University before joining the faculty of the University of Illinois in 1970. His past research efforts have been concerned with the lateral coupling between the tropical circulation and the mid-latitudinal circulation, as well as with the dynamics of the trade-wind convective layer, and on the problem of sea breeze. These are integral parts of a long-range research program of investigating the dynamics of the tropical circulation systems including the monsoon.

"Seldom have there been so many atmospheric scientists centering their activities for so long around a common goal, namely, the formulation of a unified theory for the tropical circulations. And yet much remains to be done. The vital importance of understanding this region of our atmosphere inspires me to continue as part of this ongoing collective effort in the meteorological community."

“I came to the laboratory in 1969 before any formal programs were initiated. I was excited about the chance to apply my understanding of numerical techniques to simulating atmospheric events. I then learned about the complexity of the atmosphere and something of man's attempt to model some of its features. My own understanding continues to be enlarged and corrected through my own research and through the help of others in the lab. Though staff and students have increased, the lab remains a personable place to try out your understanding of the atmosphere and see how it works.”

Bob Wilhelmson received his M.S. (1969) and Ph.D. (1972) in computer science at the University of Illinois at Urbana-Champaign in the areas of computer software and numerical analysis, respectively. He now holds a joint appointment as research assistant professor in the laboratory and in the Center for Advanced Computation.

He has been involved primarily in numerical studies of the dynamics of cumulus clouds. For example, he has simulated air flow around a cumulus using a three-dimensional model with large data requirements. These studies have led to an increased interest in determining how well the discrete numerical solutions represent the motions described by the continuous mathematical equations. He is also interested in the use of ILLIAC IV, a large array processing computer designed at the University to meet the increasing computer requirements of the scientific community.



PRESSURE FROM CLOUD MODEL PROCESSED AT UCLA-CCN

John Walsh came to Illinois after receiving his Ph.D. in meteorology from the Massachusetts Institute of Technology in 1974. He has done work on the dynamics of sea ice for the Arctic Institute of North America and for the U.S. Naval Oceanographic Office, Polar Oceanography Division. Current research involves the study of land and sea breeze circulations and the development of numerical techniques which will aid in modeling such circulation. Some of the same modeling techniques may ultimately be used to study the atmospheric circulations occurring at the boundary between polar ice and open water.

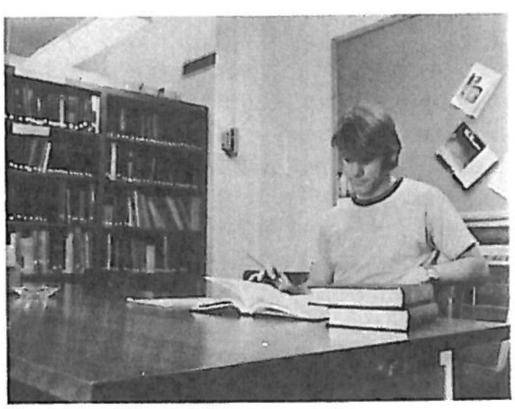
“Meteorology appeals to me because it offers the opportunity to leave the realm of the abstract and to put to some use the principles of mathematics and physics. The goal of improved weather prediction is indeed worthwhile, whether one is concerned with today's sea breeze, next week's rainfall, or the next century's climatic trends. As an added incentive, the understanding of the atmosphere which is required for better prediction leads to an appreciation for the weather we experience each day.”

"Climate is what you expect;
weather is what you get."

Education

Atmospheric science involves the application of physics, mathematics, chemistry, and engineering principles to specific problems. Thus, individuals with varied areas of academic preparation are able to undertake meaningful research into atmospheric problems. A necessary aspect of a student's entry into our program is a solid foundation in mathematics and physical science. The course structure in atmospheric science at Illinois is such that first-year graduate courses use calculus, differential equations, vector analysis, thermodynamics, and mechanics. Courses in numerical methods are also useful. Material from thermodynamics is routinely covered in first-year graduate courses in atmospheric science and a background deficient in this subject is no obstacle.

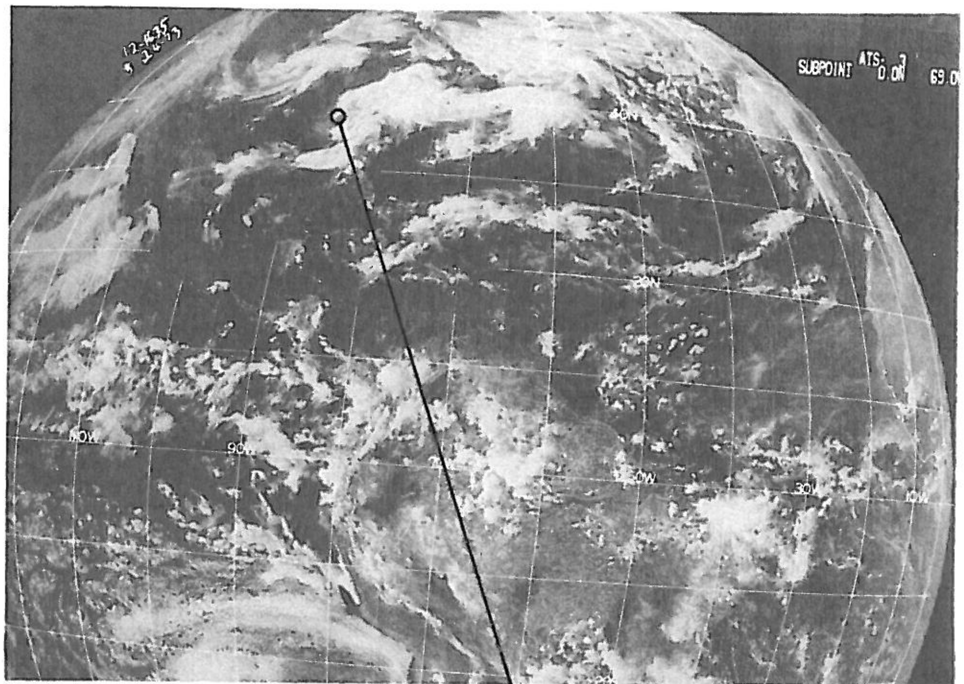
We encourage inquiry from physics, engineering, and mathematics majors, as well as those trained in meteorology. It is interesting to note that many, if not most, of today's eminent researchers in meteorology have had their undergraduate training in areas other than atmospheric science.



Responding to the Weather

Each of us responds to the weather about us. There are many days when we may look upward and see clouds drifting along against a blue sky. The organization of these clouds into lines or other patterns may arouse our curiosity. Why one pattern today and another tomorrow? What does their movement tell us about the atmosphere? We then face the challenge of answering these questions.

There are days when we may scramble for shelter to protect ourselves from a severe thunderstorm or tornado. The estimated damage from the 1965 Palm Sunday tornadoes in the midwest was $300,000,000. Do we accept this destruction as inevitable? Better prediction and warning systems can help reduce the loss of property and lives. Perhaps man can even alter the atmosphere's behavior and prevent such disasters.



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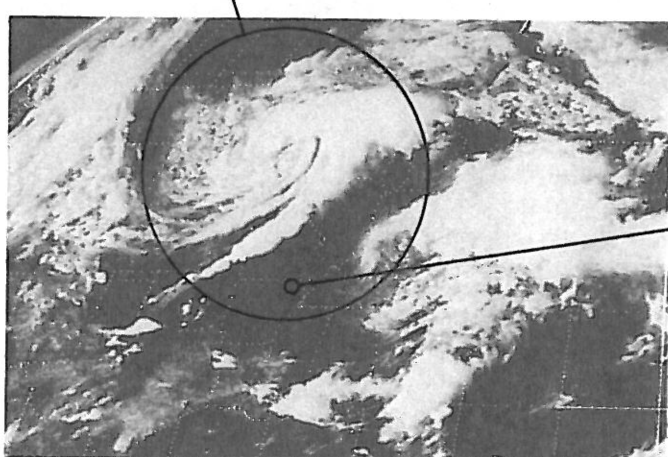

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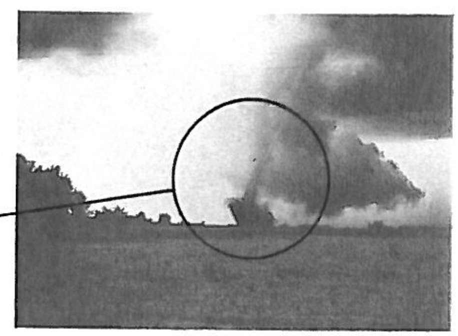
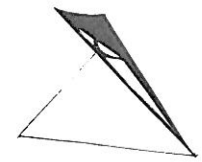


Atmospheric phenomena exhibit distinct scales of motion. This extra-tropical cyclone over the midwest gave rise to a squall line in Oklahoma which, in turn, spawned a tornado.

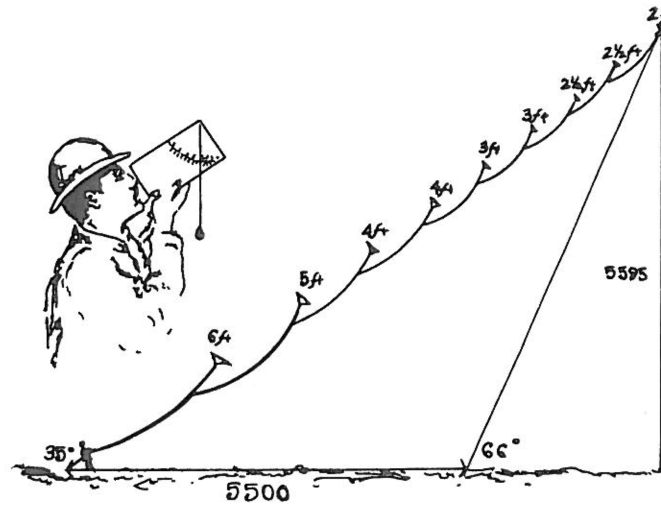
There are days when haze may cover cities and countryside. Whatever our reaction, we are being told that our treatment of the atmosphere can significantly affect our health and well-being. At times the atmosphere is benevolent and carries away unwanted pollution. This is not always so, however, and we must learn to assess the effects of our activities on the atmosphere in order to increase our chances for survival.

Atmospheric Science: The Past and the Present

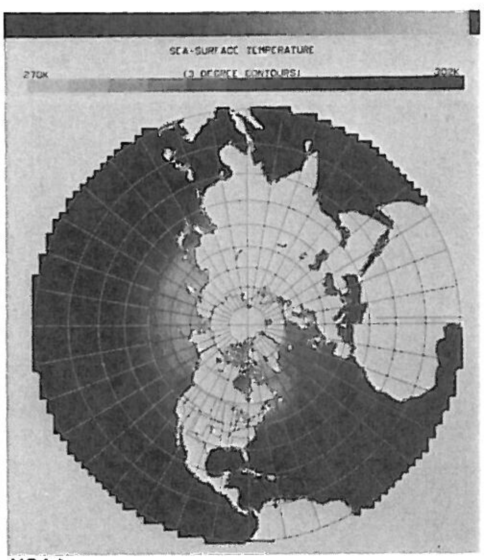


The study of the atmosphere has changed considerably during this century. The earlier emphasis was on describing features of the atmosphere and on classifying different climate regions. Of the many advances made since then, perhaps the most significant have been in the area of atmospheric dynamics. The dynamic approach consists of a systematic application of Newton's laws and other conservation principles to obtain quantitative predictions of changes in the atmosphere. The system of equations, which may include such processes as radiation and condensation, is often referred to as a "model" of the atmosphere. This kind of approach is very important because controlled experimentation with the atmosphere is generally impossible.

The development of dynamic prediction models dates back to the early 1920s, when British scientist Louis Richardson attempted to use a mathematical model along with surface and upper air data to predict the weather for the next day. Although his attempt failed, Richardson maintained that his



Method of triangulation for measuring altitude.



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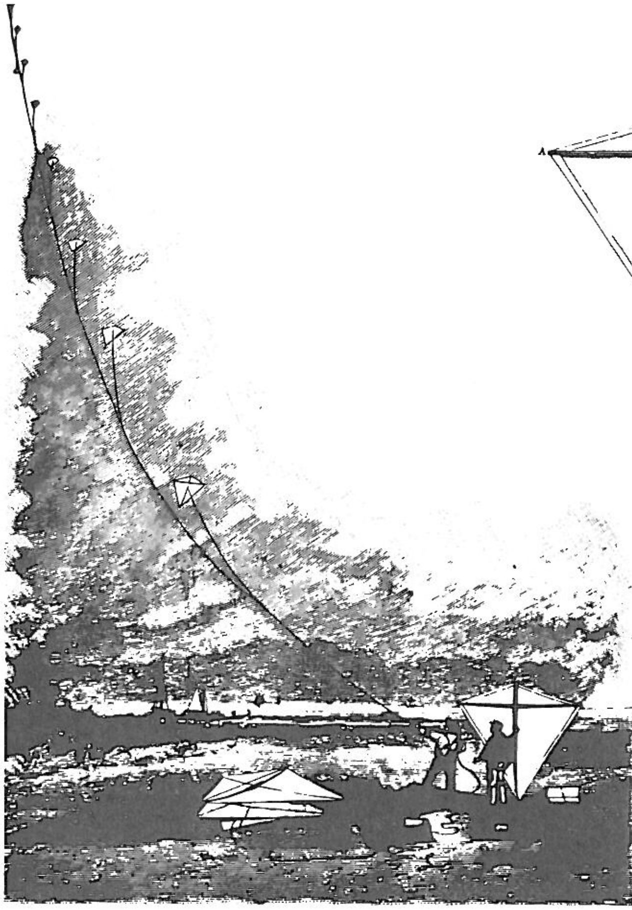
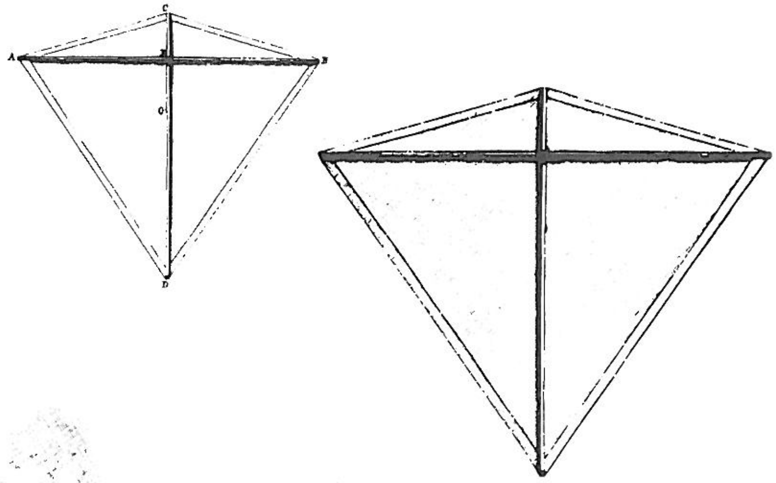
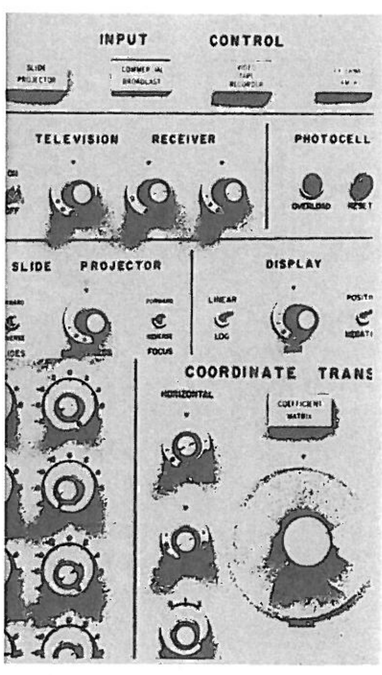


Scientific American





dynamic approach was sound. Later investigations indicated that he was right and that his failure was related to inaccuracy of observed wind data.

The dynamic approach was paralleled by the development of two tools which have revolutionized the atmospheric sciences: the computer and the satellite. Richardson had estimated that he would need the services of approximately 64,000 people to solve his model and keep pace with the weather. This was as unfeasible then as it is now. In the 1940s, however, the electronic computer was developed. Advances in computer technology have made it possible to perform millions of arithmetic operations per minute. High-speed computers have provided the only means by which predictions can be obtained from many of today's atmospheric models. They are also indispensable for handling the large amounts of weather data needed in research.

Remote sensing of the environment by weather satellites and radar has greatly augmented the conventional weather-observing network. It is now possible to obtain data over oceans, polar regions, and uninhabited land. Instrumented aircraft and rockets have also been valuable observational tools.

Thanks to these technological advances, atmospheric scientists have modeled atmospheric motions on a number of scales. The modeling of global scale features, referred to as the general circulation, is leading us into a study of climates and climatic change. The development of synoptic scale prediction models has improved the accuracy of daily weather forecasts. Models of smaller scale features, such as cumulus clouds and tornadoes, have helped to explain the details of cloud generation and development. Increased understanding of interactions between scales is needed because it is not feasible to model all scales simultaneously. An international program known as GARP (Global Atmospheric Research Program) is currently underway and has been expressly designed to improve the range and accuracy of weather forecasts.


University of Illinois
MORROW PLOTS WEATHER STATION
OPERATED BY
ILLINOIS STATE WATER SURVEY
CONTINUOUS OPERATION SINCE 1888
CLIMATOLOGICAL BENCHMARK STATION
OF THE
U. S. WEATHER BUREAU

Atmospheric Science at the University of Illinois

In the mid 1960s atmospheric research at the University of Illinois at Urbana-Champaign included studies of the ionosphere, air pollution control, bioclimatology, and water resources. There was, however, no graduate program in atmospheric science. At that time the study of the atmosphere was recognized as one of the most rapidly growing areas of science. It was felt that existing research and educational efforts would not only provide a good background for the development of a strong atmospheric science program, but would also benefit from interaction with such a program. As a first step towards establishing a department of atmospheric science, the University established the Laboratory for Atmospheric Research in the summer of 1969. Dr. Y. Ogura was chosen as its director.

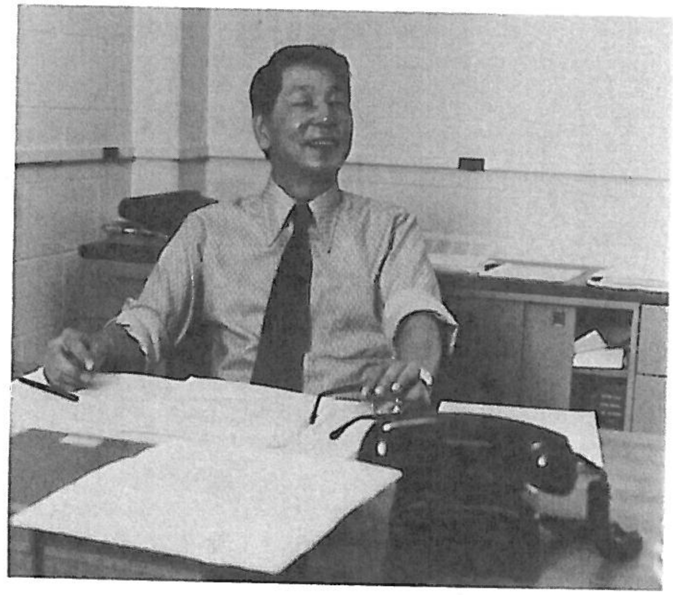
Over the next few years the laboratory expanded its staff, its educational activities, and the scope of its research. In 1973 both master's and doctoral programs in atmospheric science were established.

The laboratory is surrounded by an excellent tradition at the University of Illinois at Urbana-Champaign. The College of Engineering, for example, ranks consistently in the top four in the country. Research accomplishments in computer science, chemistry, and physics are well known. By becoming a part of this tradition, the laboratory should enjoy a long and productive future.

Faculty

Yoshi Ogura began his research career by studying atmospheric turbulence, boundary layers, and dispersion processes at the Geophysical Institute at the University of Tokyo. For this work he received his Ph.D. in 1952 and later became the first recipient of the Japanese Meteorological Society Award in 1954. He then continued his work on turbulence at the Department of Aeronautics of the Johns Hopkins University (1954–1957) and the Department of Meteorology at the Massachusetts Institute of Technology (1958–1964), including large-scale two-dimensional turbulence and a closure problem. At MIT he also studied the dynamics of moist convection. This included the numerical simulation of thunderstorm cells, squall lines, and hurricanes. In 1964 he moved to the Ocean Research Institute at the University of Tokyo and served as professor of marine meteorology and also as the director of the institute. Since 1969 he has been the director of the Laboratory for Atmospheric Research and professor of meteorology and physics at the University of Illinois at Urbana-Champaign. Currently he is interested in cumulus clouds in relation to other scales (small, meso, intermediate, large) of atmospheric motions.

He has been active in many international and national organizations which include the WMO/ICSU Joint Organization Committee for GARP, the U.S. GARP Committee of the National Academy of Sciences, the International Advisory Panel for the GATE Boundary Layer Subprogram, and the American Meteorological Society (associate editor of the *Journal of Atmospheric Science*).



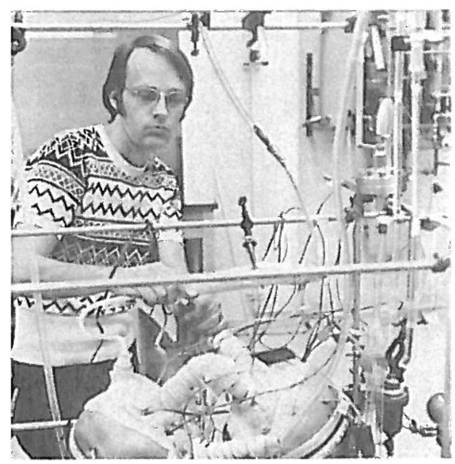
"Atmospheric science is a science for young people. I enjoy working and talking with bright young meteorologists. I take care of telephone calls and attend business meetings so they have the opportunity to jump to the forefront of the research field.

Atmospheric science is an international science. Air knows no boundaries and thus close international cooperation is essential for the advancement of this science. There are many international scientific conferences, planning meetings, and observational programs.

Atmospheric science is a science for people with different interests. Some may enjoy numerical modeling using the most advanced computer in the world. Others may enjoy collecting and interpreting observations from polar-orbit or geostationary satellites or may enjoy developing and analyzing concepts with a pencil, yellow pad, and a nice cold drink (not to mention a long uninterrupted lapse of time). All of these can make important contributions."

“A cloud is beautiful. A cloud is dreadful.
I enjoyed watching the coming and going of clouds on many leisure afternoons at the beach of a small town on the east coast of Taiwan. I was also terrified by the awesome monsoon rain and the great power of the typhoon. These reactions have been followed by an effort on my part to understand and explain why weather behaves as it does. Research, just like a cloud, needs a proper environment in which to develop. That's why I enjoy being part of the Laboratory for Atmospheric Research.”

Su-Tzai Soong received his Ph.D. in atmospheric science from the University of Missouri in December 1971. His research was on large-scale kinetic energy variations and the energy transformation associated with cyclonic and anticyclonic disturbances. He worked on cloud modeling and cumulus dynamics after coming to the University of Illinois. This included a numerical study of the parameterization of microphysical processes within clouds. He is currently interested in the initial formation of clouds and in the interaction between the clouds and their environment.



Ken Beard is an assistant professor of meteorology and also a professional scientist at the Illinois State Water Survey. His interest in meteorology stems from his graduate years at the University of California at Los Angeles where he helped to develop a vertical wind tunnel for cloud physics research. He received his Ph.D. in 1970 for studies on the fluid dynamics of cloud drops. Since then he has worked both at UCLA and the National Center for Atmospheric Research. Recently, he has been investigating the interaction of raindrops with aerosol particles. This research includes a numerical model of the microphysics of scavenging along with an experimental program. His latest research involves the incorporation of the scavenging results in an aerosol washout model, the use of cloud microphysics in numerical cloud models, and the experimental and numerical investigation of the microphysics of cloud drop interactions.

“I find it very challenging to work on problems in cloud physics, because it includes such a wide range of studies. My task is not only to understand the individual mechanisms, but how they combine to produce precipitation. At the nearby Illinois State Water Survey, I can get the latest details from the summer field programs. This is helpful to my research in cloud physics.”

Degree Programs

The Laboratory for Atmospheric Research offers programs leading to the degrees of Master of Science and Doctor of Philosophy in Atmospheric Science. The structure of the program encourages close contact between the students and faculty in both the classroom and research. The curriculum is highly flexible and can be tailored to meet the academic and professional goals of the individual student. In addition to the flexible curriculum, the student can take advantage of cooperative programs between the laboratory and facilities such as the State Water Survey.

Admission

Most students enter the program with little or no prior training in atmospheric science. Undergraduates should make an effort, however, to acquire a solid background in classical physics and applied mathematics. Topics which are particularly useful include thermodynamics, vector calculus, fluid mechanics, and, in some cases, physical chemistry.

Applicants must satisfy the general requirements for admission to the Graduate College and must have an equivalent grade-point average of at least 4.0 out of a possible 5.0. Students with an equivalent grade-point average between 3.75 and 4.0 are considered on an individual basis. Applicants whose native tongue is not English are required to demonstrate proficiency in English before registration.

Prospective students who wish to begin their programs in the fall semester should try to submit their applications by March 1. Admission decisions are made as soon as possible after an applicant's file is complete. Announcements concerning assistantships are made no later than April 15.

Financial Aid

It is the policy of the Laboratory for Atmospheric Research to offer teaching or research assistantships to graduate students accepted into the program. Students may also apply for other aid including graduate fellowships from federal agencies or from the University. Tuition and service fees are waived for most students who are receiving support in the form of an assistantship or fellowship.

Research assistantships are usually half-time appointments for twelve months including one month paid vacation. Teaching assistantships are usually nine-month appointments, although a separate summer appointment as a research assistant can usually be arranged.

Degree Requirements

a. Requirements for the degree of Master of Science in Atmospheric Science

The Graduate College requirements for the master's degree include at least eight units of credit. Three of the eight units must be 400 level courses, and two of these three in the atmospheric science program. The laboratory requires that the candidates complete Atmos. 301, 302, and 401, or the equivalaent, and a master's thesis.

b. Requirements for the degree of Doctor of Philosophy in Atmospheric Science

The doctoral program includes three stages. In the first stage the student takes a variety of the courses offered by the laboratory and other departments. This stage ends when the student passes a qualifying examination, which is based largely on laboratory course material. The examination is normally taken at the beginning of the student's second year.

In the second stage the student prepares a written dissertation proposal in consultation with his/her dissertation supervisor. This proposal forms the basis for the oral preliminary examination which the student is expected to take no later than two years after completing the qualifying examination.

In the final stage the student completes the doctoral dissertation which must be an original and significant research contribution in atmospheric science. In addition, the candidate must take and pass an oral final examination. The credit requirement for the doctorate is twenty-four units of course work and research credit (Atmos. 499).

Courses

Courses for undergraduates

Atmos. 222 Weather Processes

Courses for advanced undergraduates and beginning graduates

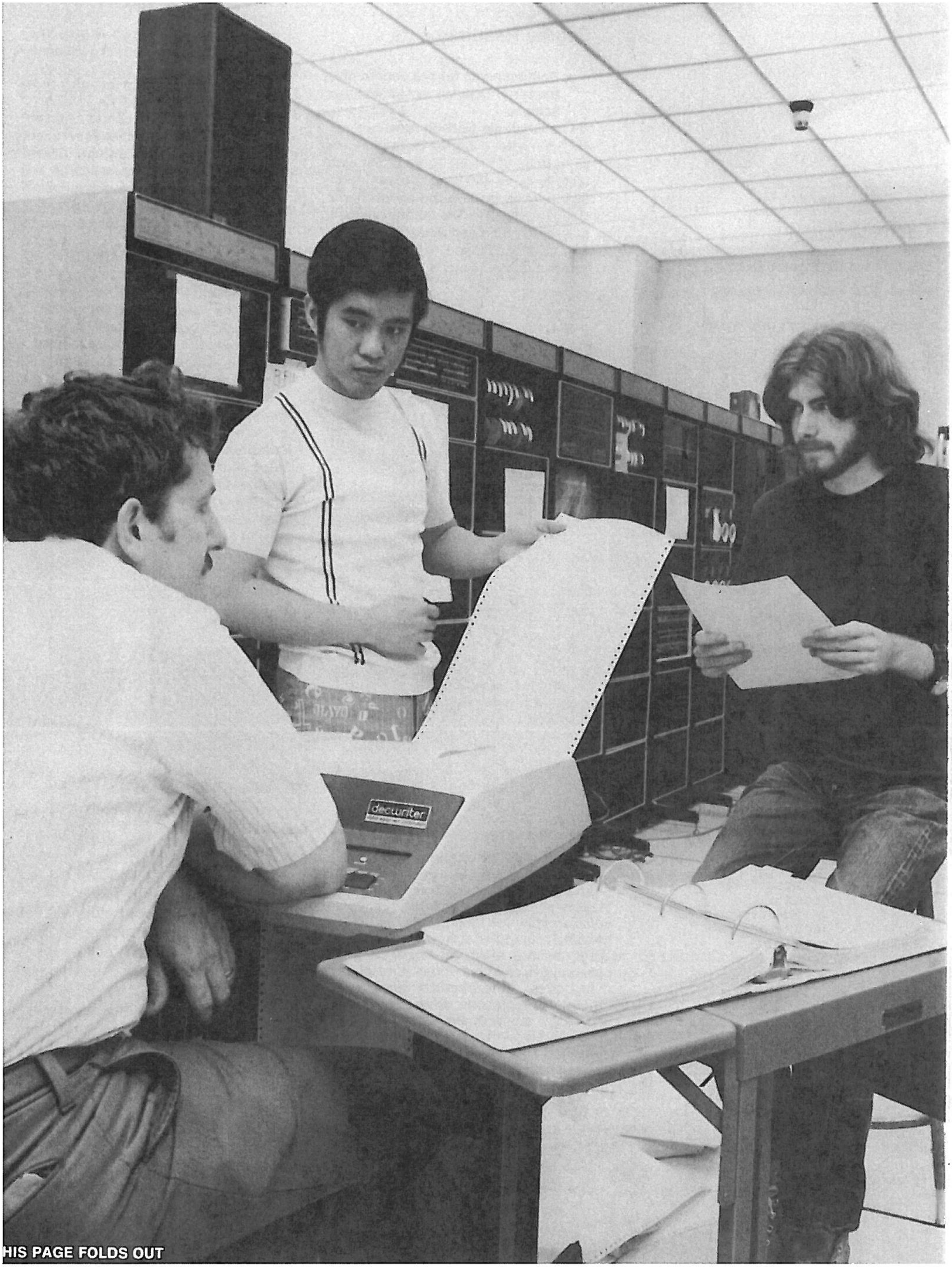
Atmos. 301 Principles of Atmospheric Physics
Atmos. 302 Principles of Atmospheric Dynamics

Courses for graduates

Atmos. 401 Weather Analyses
Atmos. 405 Simulation of Atmospheric Dynamics — Numerical Techniques
Atmos. 406 Simulation of Atmospheric Dynamics — Physical Aspects
Atmos. 408 Atmospheric General Circulation
Atmos. 490 Individual Study
Atmos. 491 Seminar in Atmospheric Science
Atmos. 497 Special Topics in Atmospheric Science
- a. Upper atmosphere dynamics
- b. Atmospheric convection
- c. Physical meteorology
- d. Atmospheric turbulence and boundary layers
- e. Physics of clouds and precipitation
- f. Advanced topics in atmospheric dynamics (These topics will be covered in semester offerings on a regular basis)

Atmos. 499 Thesis Research

In addition to the offerings listed above, many courses offered by other units in the University are useful supplements to a program in atmospheric science. Among these are courses in aeronautic and astronautical engineering (aerodynamics of compressible and incompressible fluids, aerodynamic heat transfer); computer science (numerical analysis, computer programming); electrical engineering (basic aeronomic processes, physics of the upper atmosphere and space); geography (climatology, atmospheric ecology, air pollution); mathematics (differential equations, advanced calculus, statistics, vector and tensor analysis, mathematical methods of physics); physics (thermodynamics, mechanics, electromagnetic wave theory); theoretical and applied mechanics (theory of ideal and viscous fluid flow, turbulence).



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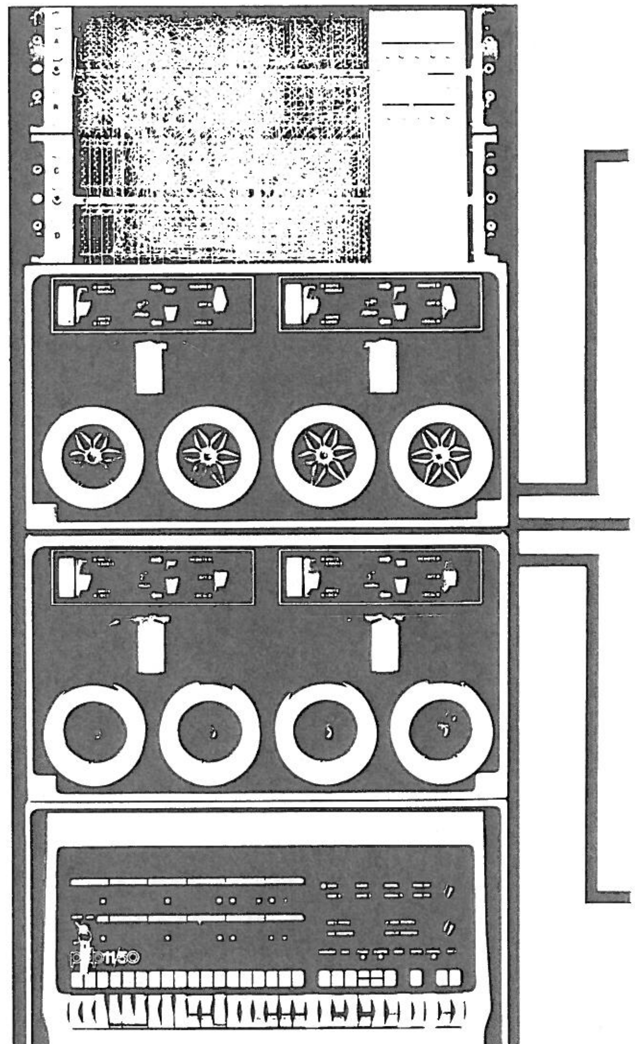
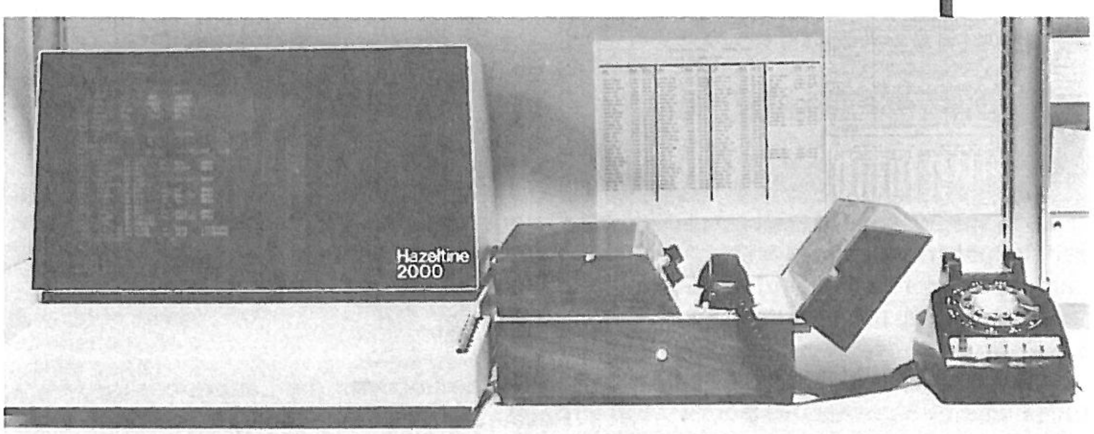
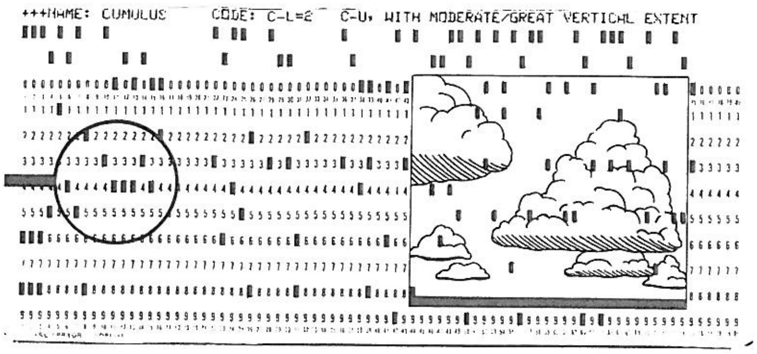
Computer Facilities

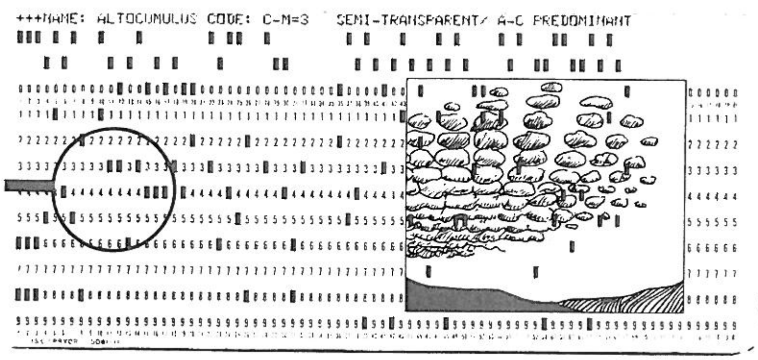
Laboratory staff and students often find the computer to be helpful in their research. The major campus computer is an IBM 360/75. When time and memory requirements are not too large, this computer is sufficient. Although it is located only one block from the laboratory, many problems are coded and run without leaving our building. One simply picks up the telephone, dials the appropriate number, and connects the telephone receiver to one of the laboratory's portable terminals. Programs, data, and messages can then be sent to and received from the IBM 360/75. This is called remote access.

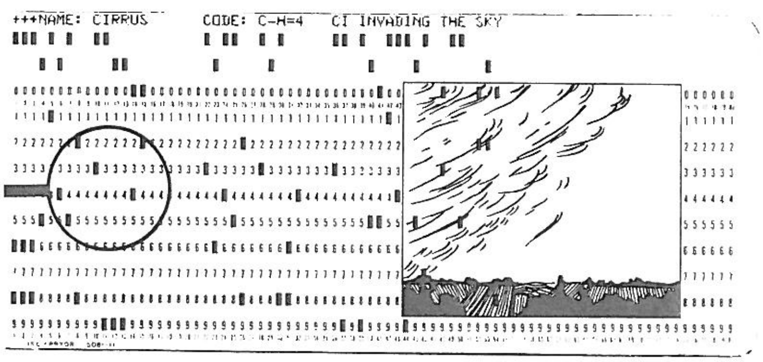




Remote access is also used to connect to computer resources on the ARPANET, a communications network between a number of computer systems and users throughout the United States. This network, initiated by the Advanced Research Projects Agency (ARPA) of the Department of Defense, allows users access to computer resources not available in their own vicinity. This is accomplished via high-speed data transmission lines that give transfer rates up to 50,000 bits of information per second. In comparison, telephone transfer rates typically go up to 300 bits per second.



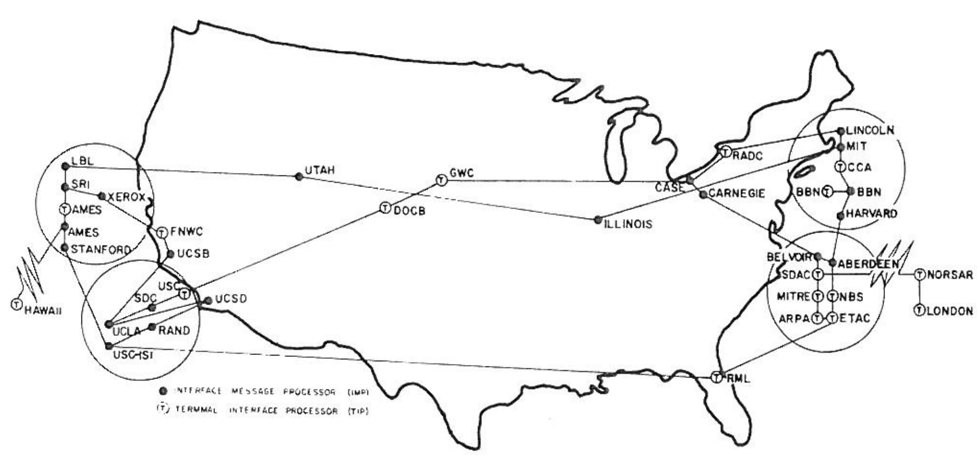


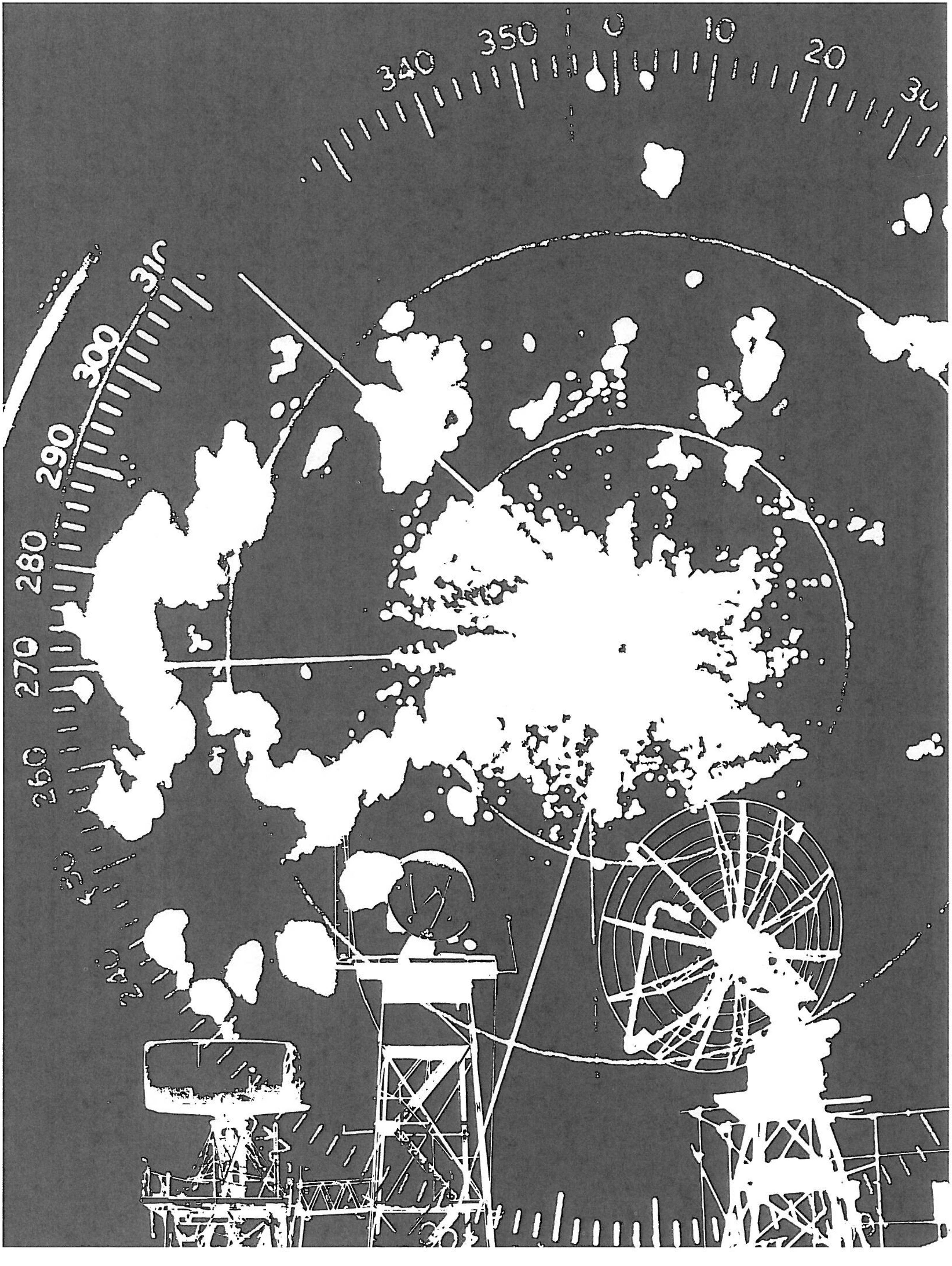


We are using the high-speed network to develop and run codes on the IBM 360/91 at the University of California at Los Angeles. This computer is about four times faster than the 360/75, and coupled with a larger memory, it meets some of our larger job requirements. The network speed allows reasonably fast transfer of the resulting data to our network site next door. Equipment at this site includes a card reader, printer, several display scopes, a combination printer-plotter, and a drum plotter.

Another computer we access through the network is the ILLIAC IV vector processor. This computer was designed at the University of Illinois at Urbana-Champaign to solve certain computational problems. Among these is the solution to partial differential systems such as those used for weather prediction. In many weather codes, the same operation or algorithm is applied at many different space locations. The algorithm can then be thought of in terms of vector operations. On ILLIAC IV a given operation can be carried out on up to 64 vector elements simultaneously.

Another available computer system is the powerful CDC 6600/7600 complex at the National Center for Atmospheric Research in Boulder, Colorado. At present, one can use this system only by visiting NCAR. In the future, remote access may be possible from the Urbana-Champaign campus.

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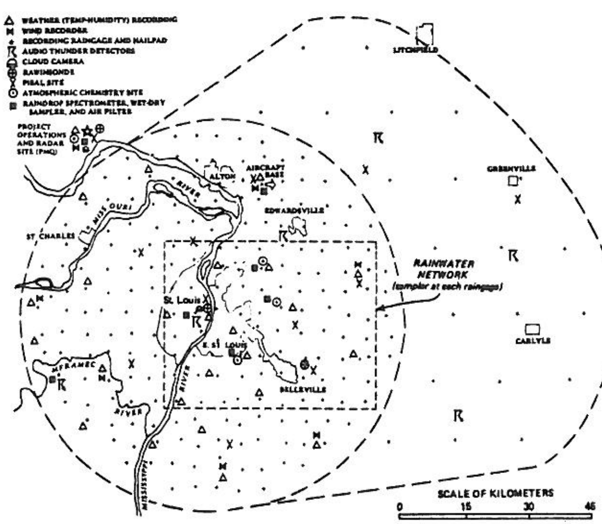
Supporting Research Groups

The Illinois State Water Survey

The goal of the Illinois State Water Survey is the scientific study of the water resources of Illinois. This includes data collection, services to the public, and pioneering research in water resources. The survey is located on the Urbana-Champaign campus and is within two blocks of the Laboratory for Atmospheric Research. The Survey is a unique organization in that no similar state agency laboratory exists anywhere else in the United States.

The Water Survey has five research sections including one devoted to atmospheric science that is headed by Stanley Changnon, Jr. The activities of this section are heavily oriented towards applied research. Naturally, most of this research is aimed at investigating precipitation. Major research includes studies of inadvertent weather and climate modification, hydrometeorology, planned weather modification, severe storms, and climatology. For example, a major study in the St. Louis, Missouri, area concerns the possible effects of urban-industrial areas on precipitation and climates.

The atmospheric science section has a staff of 22 meteorologists, 2 climatologists, 6 radar engineers, 20 technician-analysts, and about 40 student employees. Extensive facilities include 4 weather radars, 2 dense networks of 350 rain guages and 30 weather stations, 3 radiosondes, a cloud physics laboratory, field operational sites in two locales, and all the historical weather records for Illinois in digital form.



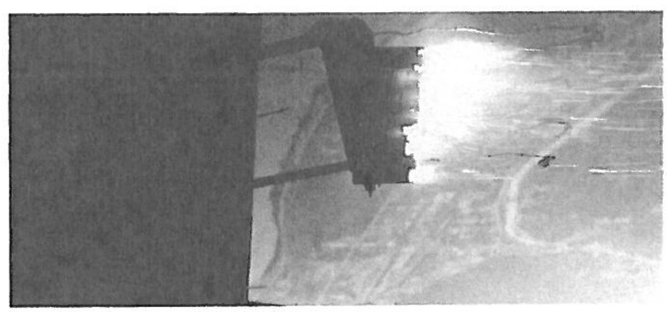
METROMEX networks and facilities of Illinois State Water Survey, summer 1973.

A strong link has been established between the State Water Survey and the Laboratory for Atmospheric Research. In fact, students in the atmospheric science program can receive research assistantships (half time) from the Survey. Recipients of these assistantships are able to work on thesis topics that complement research activities of the State Water Survey.

Engineering and Geography Departments

Research in atmospheric science is going on in other laboratories and departments in the University. Theoretical and observational studies of the neutral and ionized upper atmosphere are underway in both the Aeronomy Laboratory and the Ionospheric Radio Laboratory (Department of Electrical Engineering). Research in the Ionospheric Radio Laboratory includes activity in ionospheric physics and in the generation and propagation of acoustic gravity waves. In the Aeronomy Laboratory, ground-based radar observations of the upper atmosphere are being used to provide information on chemical structure, temperature, and air flow patterns. In one experiment wind patterns are being determined from radar observations of ionized meteor trails.

In the Department of Geography, research in atmospheric science is focused on the study of climates. Of particular concern are those aspects which may enhance the understanding of man's interactions with the earth's atmosphere. These interests include bioclimatology, air pollution climatology, and urban climatology.

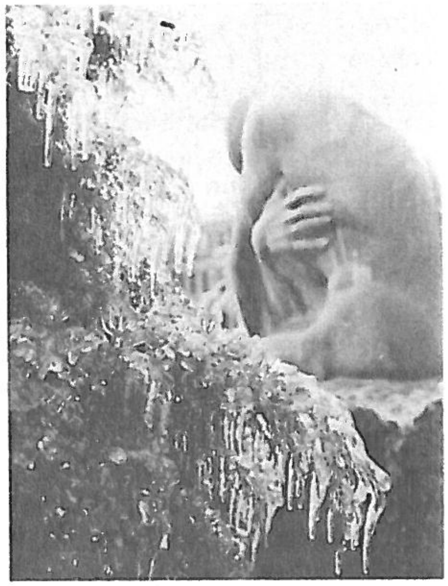


In the area of pollution, the Institute for Environmental Studies has a task force studying environmental pollution by lead and other metals. In the environmental engineering division of the Department of Civil Engineering, an atmospheric model is being developed to predict local movement of pollutants containing lead. Extensive field measurements are being made, including detailed measurements of lead concentrations emitted and residing near interstate highways.

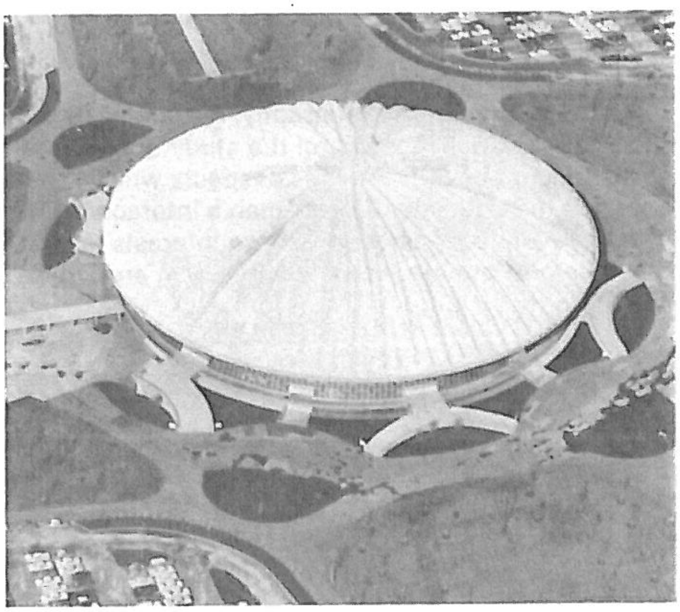
A library is maintained by the laboratory for student and staff use. Books on meteorology, oceanography, geophysics, fluid dynamics, and numerical analysis are included. Current and back issues of major U.S. and foreign journals and periodicals in these areas are kept. Despite the short history of the laboratory, issues of the *Monthly Weather Review* as far back as

1894 can be found. A substantial number of technical notes and reprints are also available. Additional resource material can often be found in the Physics, Computer Science, Engineering, and State Water Survey Libraries. The University of Illinois Library is the largest of any public institution of learning in the United States. Its more than 5,000,000-item collection is an aid to nearly all research programs.

The Urbana-Champaign Community



Urbana-Champaign is near the Indiana border, about 130 miles south of Chicago and 150 miles northeast of St. Louis. The twin cities have a population of 90,000 and are separated by a north-south line cutting

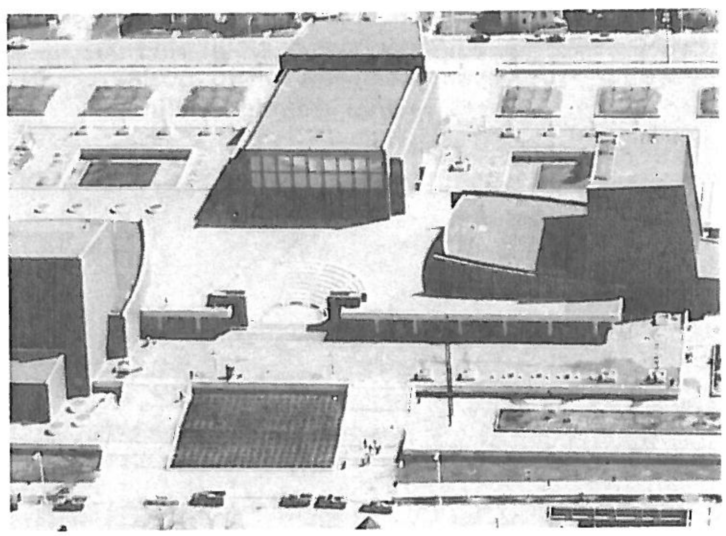


through the University campus. The University population is roughly 30,000 and includes about 8,000 graduate students. Despite the large enrollment in the University, the graduate program in atmospheric science enjoys a closeness characteristic of smaller schools.

There are advantages of a large university also. The Krannert Center for the Performing Arts is a modern theatrical complex. This $20 million structure contains five separate and specialized theatres for orchestra, opera, choral organizations, theatre, and dance.

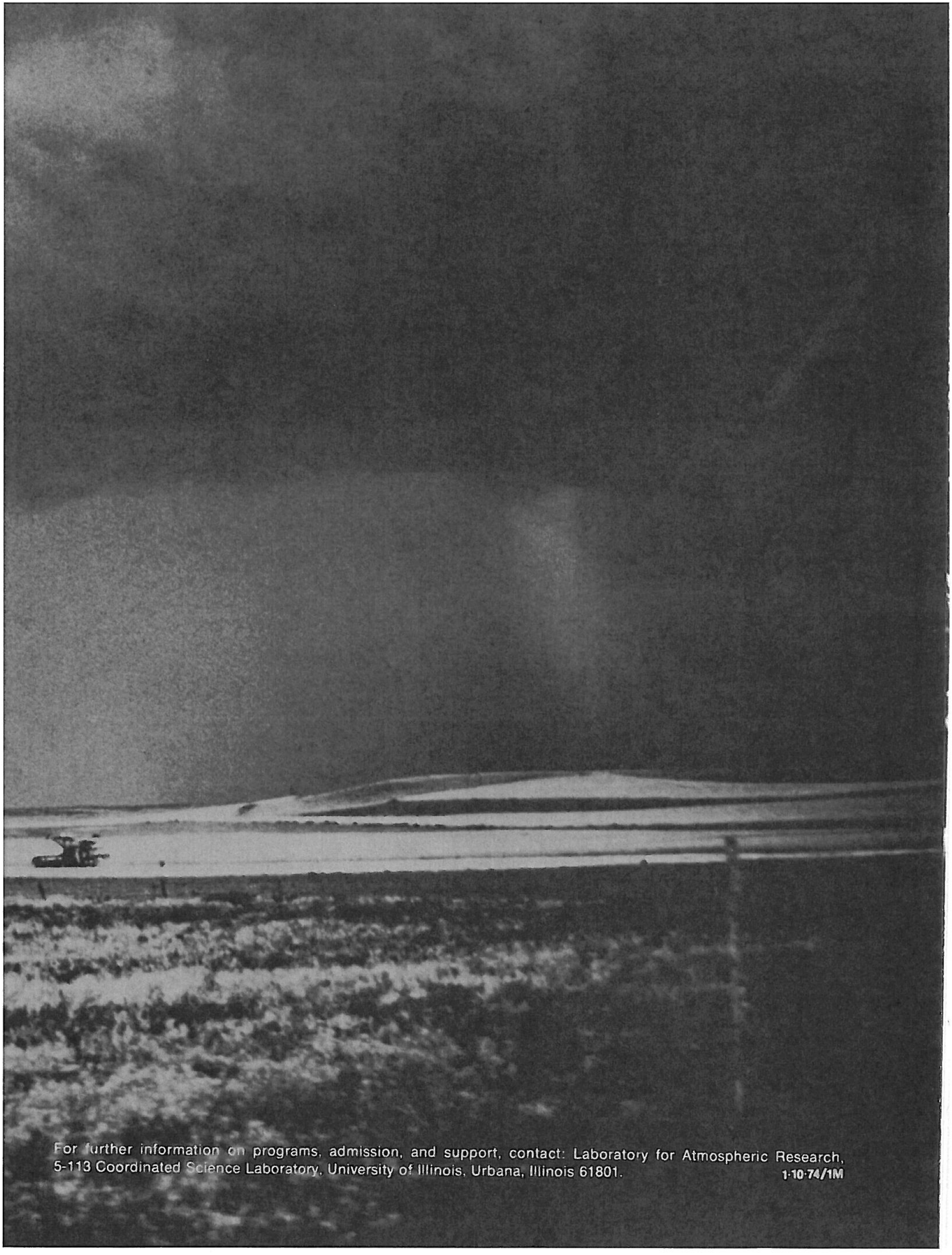
Entertainment is often provided at the Assembly Hall, including pop artists, plays, ice skating shows, circuses, and basketball. If you have the time you can walk around the topmost row of seats. It's about a one-quarter mile trip.

There are good athletic facilities available for students and staff. The Intramural and Physical Education



Building (IMPE) was designed to accommodate the large student body. It includes three large gymnasia set aside for basketball, badminton, and volleyball, two Olympic size pools (one indoors and one outdoors), an ice skating rink, tennis courts, and many other facilities.

The land surrounding Urbana-Champaign is primarily farmland. There are some picturesque rivers and woods within a short distance from the University. Just across the Indiana border there are several parks along the Sugar Creek. Deep, rock-walled canyons and gorges provide the scenery, and canoeing is a popular activity for visitors.



For further information on programs, admission, and support, contact: Laboratory for Atmospheric Research, 5-113 Coordinated Science Laboratory, University of Illinois, Urbana, Illinois 61801.
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