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Data Are Available from Upland Valley Weather Research

Meteorological interest in the dynamics of air circulation in a confined, high mountain valley was the impetus for a collaborative study at Fraser, Colorado, during February and March. Participants in the study were NCAR's Field Observing Facility (FOF), the Denver Research Institute of Denver University (DU), and the Wave Propagation and Aeronomy laboratories of the National Oceanic and Atmospheric Administration (NOAA). Alfred Bedard of the Wave Propagation Laboratory (WPL) Geoacoustics Research Program Area coordinated the Fraser investigation.

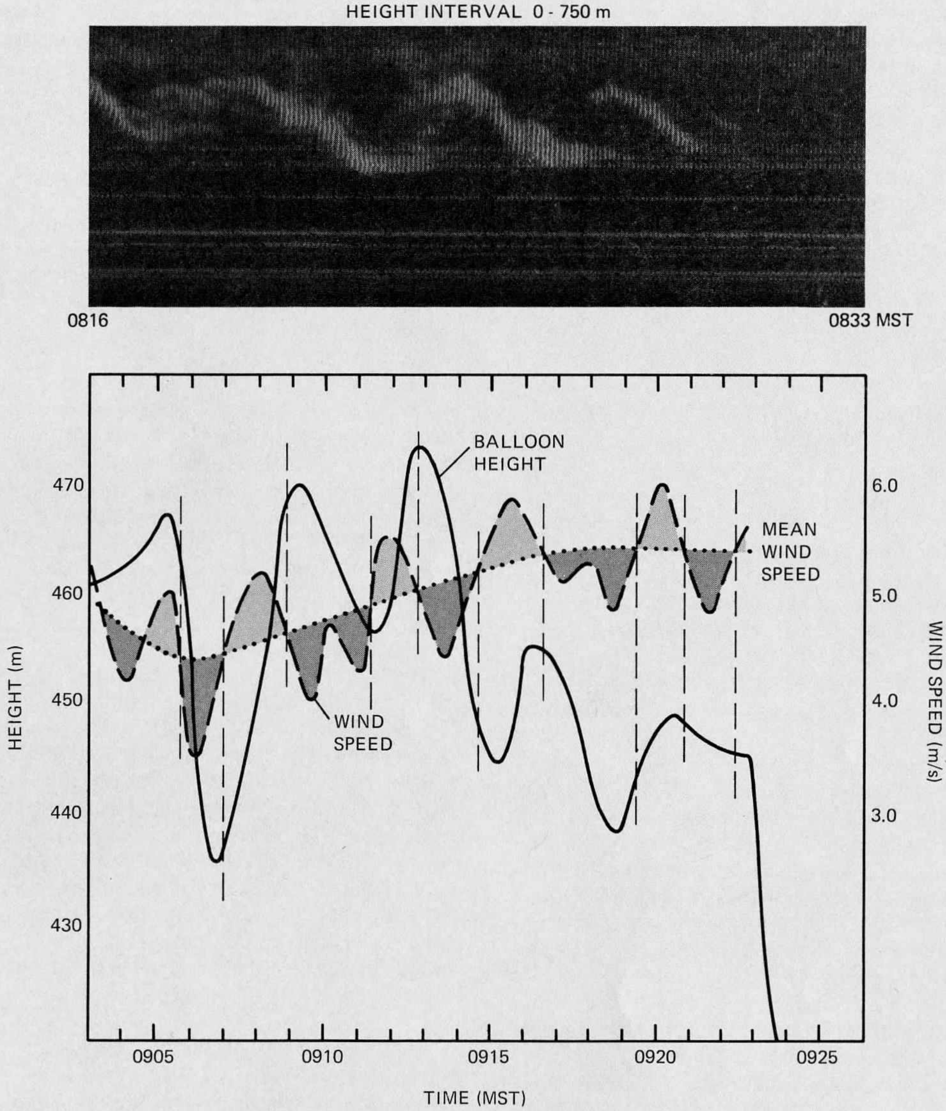
Fraser was chosen because of its location in a high mountain valley, an area of strong winter inversions. Researchers were able to study local air circulation patterns as well as use the Fraser valley as a model for similar problems existing in other such valleys. The movement of air as a function of the time of day——especially pertinent to boundary-layer research——and the movement of pollutants in such an area were among the concerns of the researchers.

The groups involved in the study had several distinct scientific objectives:

- Cloud physics and low-level wind circulation research were done by the DU group under the direction of Myron Plooster. They used a tower north of Fraser for their measurements.

- The vertical atmospheric structure associated with strong shear layers and the general properties of strong-inversion, low-humidity conditions of a cold, upland valley in winter were studied by several NOAA groups. One, directed by Kenneth Moran and Russell Chadwick, used an FM-CW radar; another, led by Vernon Derr, used a lidar. The lidar was central to a study of the spatial and thermodynamic characteristics and water content of clouds forming near the continental divide on a line between Boulder and Fraser.

- The diurnal circulation was a primary interest of Alvin Morris and Robert McBeth, both of NCAR's FOF. They took boundary profile (BP) system data near the DU and NOAA sites and also set up a rawinsonde station in the area.



The wave pattern shown in the photograph above was observed in the NOAA-WPL FM-CW radar record on 12 February 1975 at Fraser, Colorado. The graph below the photograph shows the wave-like variations in height and wind speed observed by the NCAR BP balloon system while it was "parked" at a height of 450 m about 4.5 km north of Fraser on the same day. Note that the balloon displacement oscillation is 90° out of phase with the wind speed oscillation. Although the BP observations were made later than the radar observations and at a different site in the Fraser Valley, the period is nearly identical. The BP data show that the waves were on the upper boundary of the cold air. (Photograph courtesy of NOAA.)

- Infrasound and atmospheric gravity-shear waves were studied by Bedard, using an array of microbarographs.

- The circulation of material injected into the atmosphere as a result of human activity was a focal point for Bedard, Morris, and McBeth, who made time-lapse movies of the smoke plume from a wigwam burner at the Fraser sawmill.

NCAR's mailing address for correspondence with all staff members is:
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Most NCAR telephone extensions can be reached via FTS by dialing (303) 494-5 plus the extension; however, some extensions can only be reached through the switchboard, (303) 494-5151. From commercial telephones, call the switchboard and ask for the extension. This information is noted with the name of the NCAR contact.

Researchers from the NOAA Aeronomy Laboratory, under the direction of John Green, used the Fraser River Valley work—particularly the NCAR rawinsonde data—to check the vertical and horizontal wind measurements they were making with a 7.41 cm pulsed doppler radar located at Sunset, Colorado.

According to Morris, data collected by the NCAR group will be available in early summer and can be obtained by calling him at NCAR ext. 77 - 765 or by writing to him at the NCAR address. Morris anticipates that the data collected by the other participating groups should be processed within a year. University researchers interested in obtaining these data from the participants may do so through Morris.

The NCAR BP and rawinsonde systems used in the Fraser study are available for loan to university researchers. Inquiries should be directed to Robert Serafin, FOF manager, at NCAR ext. 77 - 740 or at the NCAR address.

Computing Facility Begins Minority Student Program

Two Black students from Prairie View A&M University at Prairie View, Texas, have been invited to spend the 1975 summer term at NCAR's Computing Facility. The program is new this year.

The two students, Annie Johnson and Willie Waters, will study FORTRAN, the NCAR job control language, and the NCAR operating system. They will take courses in computer organization, data structures, and numerical calculus; work with data analysis and data structures; and intern with a programmer experienced in numerical methods.

Clyde Christopher, director of Computer Science Education at Prairie View, will spend two weeks as a scientific visitor here this summer.

According to Jeanne Adams, manager of the facility's university liaison and information services, the program will be continued either in the fall 1975 or spring 1976 semester, with two more minority students. Further information on the program can be obtained from Adams at NCAR ext. 523 or by writing to her at the NCAR address.

NCAR Is Developing LLAMB Balloon

Long-term monitoring of trace elements in the stratosphere may become more practical with a new "poor man's satellite"—a balloon being developed at NCAR. Vincent Lally and Sigvard Stenlund of NCAR's Global Atmospheric Measurements Program (GAMP) invite university researchers with an interest in stratospheric problems to participate in the new development at all stages.

Lally, who directs GAMP, and Stenlund, a GAMP project engineer, are tentatively calling the new balloon LLAMB—Long-Lived Atmospheric Monitoring Balloon. It is conceived as a superpressure balloon 13 m in diameter carrying a 50 kg payload. The payload will be divided between sensors, to be located on top of the balloon, and a telemetry package, to hang beneath the balloon.

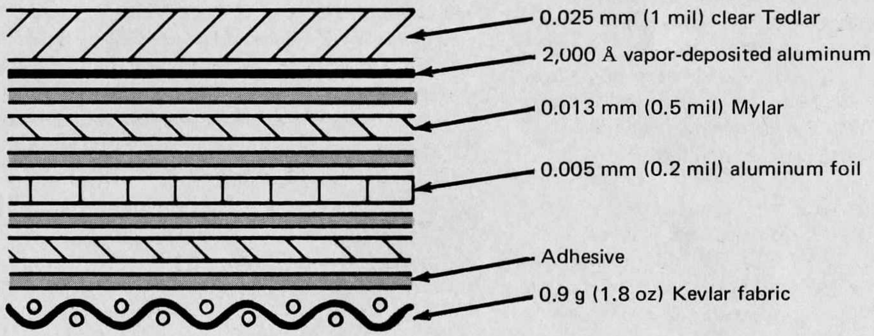
LLAMBs, says Lally, would have several advantages over the satellites now used as platforms for many stratospheric measurements. The instruments on top of the balloon could look upward through the stratosphere, eliminating the need to subtract or difference out the lower atmosphere that satellite instruments now observe. The signal-to-noise ratio of the instrumental data would also benefit from the concomitant absence of background infrared radiation from the earth's surface. Balloon-borne sensors would not have to cope with the shocks or difficult environment of a rocket launch, as satellite sensors must; furthermore, no coolant would be needed for balloon-borne instruments, which would be cooled environmentally at night. Thus LLAMBs might be excellent climatological monitoring vehicles. Not least, says Lally, is the relatively low cost—a rough estimate per vehicle is less than $10,000.

As currently designed, the balloon would float at the 100 mb level (approximately 16 km), just above the tropopause. Its lifetime is expected to be at least ten years.

The long lifespan, Stenlund says, will be possible because of a new type of balloon construction. Superpressure balloons, flying above cloud levels, fail because of pinholes, diffusion, or deterioration of the transparent balloon material. In recent years the use of laminates and better manufacturing techniques have resulted in pinhole-free materials. Use of an aluminum-foil lamina in the balloon produces a diffusion-limited life of 10^6 years. The remaining problem has been the deterioration of balloon materials at high altitudes because of the sun's ultraviolet (UV) radiation. The balloon construction shown in the diagram is intended to eliminate this problem. The outer shell is a material called Tedlar, 0.025 mm (1 mil) thick, with an aluminized backing that will reflect most of the damaging UV radiation. The trilaminate of Mylar and aluminum foil will prevent diffusion. And the strength member is a woven plastic called Kevlar, rated at several hundred pounds per inch.

GAMP has let a contract to the G. T. Sheldahl Company in Northfield, Minnesota, to build a test model of a LLAMB 2 m in diameter to undergo stress, leakage, diffusion, and cold-temperature tests. The next step would be a field prototype 8 m in diameter.

Balloon development, however, must be combined with instrument development. Lally and Stenlund welcome ideas and inquiries from the university research community concerning possible LLAMB instrumentation. A fundamental requirement for a LLAMB instrument, for example, is that it remain fairly well calibrated for the life of the balloon. Interested researchers should call Stenlund at NCAR ext. 77 - 776 or Lally at NCAR ext. 77 - 730 or write to them at the NCAR address.



Balloon shells constructed as shown here will be used for LLAMB.

AMTEX II Field Phase Completed

The second field phase of the Air Mass Transformation Experiment (AMTEX II) to study severe weather over the East China Sea began 14 February. A "Taiwanese depression" on the first day was followed by more than a week of cold-air advection into the experimental area, creating good conditions for the investigation.

AMTEX is a subprogram of the Global Atmospheric Research Program (GARP), which was developed by the Japanese National Committee for GARP. The second field season ended 1 March; the first field season had taken place a year earlier.

In the AMTEX experimental area, severe storms develop rapidly in the wintertime under the influence of cold air masses traveling eastward from the Asian mainland over the warm Kuroshio (also called the Japan Current). Storms that build up over the East China Sea buffet the Ryukyu Islands south of Japan's main islands. To study the evolution of these storms, the Japanese-led AMTEX experimenters obtained data from observation platforms on islands, ships, airplanes, balloons, and satellites. The data will yield information on the rapid cyclogenesis and the modification of the air passing over the warm ocean current.

In addition to Japan, countries participating in AMTEX included Australia, Canada, and the United States. U.S. participation was coordinated by Donald Lenschow of NCAR's Research Aviation Facility. A number of university investigators took part in the aircraft research program using NCAR's Electra aircraft. Other U.S. support to AMTEX II included instrumented buoys, tower measurements, and satellite data.

The Electra flew a total of 50 h on nine research flights during the two-week field season. The aircraft is instrumented to measure winds, humidity, air and surface temperatures, infrared and solar radiation, heat and moisture fluxes, and several cloud physics parameters. Investigators from Purdue University, the University of Miami, the University of California at San Diego, the Desert Research Institute of the University of Nevada, and the Woods Hole Oceanographic Institution flew with NCAR scientists and scientists from several Japanese institutions. The good experimental weather held, and the research flights were accomplished without major instrumental or aircraft difficulties. The researchers made measurements of boundary-layer structure, air-mass modification, mesoscale cellular convection, frontal structure, turbulence, surface radiation, and cloud structure.

Data from the first field phase of AMTEX are available in written reports, and Lenschow expects that they will soon be available on magnetic tapes and microfilm. Data from the latest phase will become available in the fall. Researchers interested in the scope and availability of the data should call Lenschow at NCAR ext. 78 - 33 or write to him at the NCAR address for further details.

Three-Dimensional Data from a Modeled Boundary Layer Are Available

Magnetic tapes containing detailed fields of the three velocity components, virtual potential temperature, specific humidity, subgrid-scale turbulence energy, and pressure fluctuations are available for use by the scientific community in a variety of studies, according to James Deardorff, leader of the Small-Scale Analysis and Prediction Project (SSAPP). A similar announcement appeared in the December 1974 *Newsletter.*

The data are from Deardorff's numerical simulation of day 33 of the Australian Wangara data of Reginald Clarke (Commonwealth Scientific and Industrial Research Organization). They cover a simulated time period from 1227 to 1321 Local Time, when there was a well mixed layer 1,200 m thick under clear skies. The modeled region is 5 km square and 2 km high, with data located at 64,000 grid points every 8 s in time.

A set of 24 seven-track tapes, with words packed 4 to 1, can be borrowed over a short term for copying purposes; alternatively, a smaller set of nine-track tapes can be used at NCAR or through a remote terminal to NCAR's Control Data 7600 computer.

Examples of uses for the data are:

- Studies of turbulence closure assumptions of one-dimensional models of the unstable atmospheric boundary layer
- Studies of diffusion of particulate matter released in any desired configuration and advected by the three-dimensional, time-dependent velocity field
- Construction of movies of the evolution of eddies within the mixed layer.

A more complete description of Deardorff's model and of procedures for extracting data from the tapes can be obtained by writing Lois Gries, SSAPP secretary, or calling her at NCAR ext. 492.

Conference Aids PAM Development

Thunderstorms, sea breezes, and the spread of air pollution over cities are all candidates for study with the aid of the Portable Automated Mesonet (PAM), a sophisticated observational system under development at NCAR.

That was one conclusion of a "Mesoscale Microconference" sponsored by NCAR's Research Systems Facility (RSF) and Field Observing Facility (FOF). Sixteen mesoscale meteorologists and statisticians from six universities and several other institutions came to NCAR on 7 - 9 April to confer with the PAM development team. They had been asked to help in identifying useful applications of the PAM system, and they made recommendations for experimental design techniques and means to extend the new system's capabilities as it approaches readiness for the field.

Conference participants were Richard Anthes, Pennsylvania State University; E. Pat Avara, Atmospheric Sciences Laboratory, White Sands Missile Range; Stan Barnes, National Oceanic and Atmospheric Administration (NOAA); Patrick Brady, Claude Duchon, and Amos Eddy, all of the University of Oklahoma; Mariano Estoque, Institute of Atmospheric Science, University of Miami; Peter Grose, NOAA; Floyd Huff, Illinois State Water Survey; Patrick Hurley, Division of Atmospheric Water Resources Management, Bureau of Reclamation; Charles Moore, New Mexico Institute of Mining and Technology; Robert Rapp, The Rand Corporation; J. J. Stephens, Florida State University; and James Tillman, University of Washington. Participants from NCAR were Fred Brock, head of the PAM development team in RSF; David Bargen, manager of RSF; P. K. Govind of RSF; Donald Lenschow of the Research Aviation Facility; Douglas Lilly of the Small-Scale Analysis and Prediction Project; and Robert Serafin, manager of FOF.

PAM has been under development at NCAR for two years; the first operational deployment of the system will take place in the summer of 1976 in support of the National Hail Research Experiment (NHRE).

PAM was conceived as a way to improve the field observing of standard parameters (temperature, pressure, and humidity, for example) at ground level. This has traditionally been done using an array of sensors that record data on strip charts. Although many technological refinements have been made in such systems, scientists using them are still hampered by the inherent lack of time-synchronism and by data-processing delays. The experience of NCAR and university scientists over the past dozen years in such large experiments as NHRE led to the effort to replace the usual array with PAM, a system that would permit real-time investigation of atmospheric phenomena with high resolution and a continuous check on the quality of data as they are received.

Consequently, Fred Brock has led a team of RSF and FOF scientists, engineers, and technicians in the design and construction of PAM. The system comprises a trailer-mounted base station and a network of remote stations that sample data synchronously and telemeter them to the base station. At present, says Brock, RSF has completed construction of the base station and is operating a minimal network of three remote stations for performance evaluation.

PAM could be used in areas up to 160 km in diameter, with remote stations placed 1 - 10 km apart. The base station has a Nova 840 minicomputer for automatic data-logging, real-time data quality checking, and real-time data analysis and display. The remote stations sense temperature, pressure, humidity, precipitation, and wind speed and direction. Spare channels are available for the future addition of other sensors. A programmable microprocessor at the remote station samples the data at a frequency of one set of readings per second, then averages each parameter for transmission by radio to the base station when the base "interrogates" the remote station. Interrogation is done at fixed time intervals, usually once a minute. An array of 40 stations could be "polled" by the base station in 17 s.

Brock asked participants in the conference to take up a number of questions relating to the further development and use of PAM. Several specific recommendations resulted from the discussions. The conferees decided that PAM would have obvious applications in studies of thunderstorms and severe weather patterns (covering areas of 100 - 20,000 km^2) and of sea breeze phenomena. Air pollution studies in and around urban areas were pointed to as another set of important applications. Studies of other boundary-layer phenomena will also be logical choices.

The conference participants urged the NCAR team to build at least 25 remote stations. Investigators could then set up such configurations as a 5 X 5 grid or an array of four concentric hexagons, with sufficient redundancy of observation for statistically valid conclusions.

The conference also recommended that RSF or FOF provide a full-time experimental design expert to assist prospective users of PAM and to advise the facilities on the merits of alternative experiment proposals. This would not exclude the use of PAM in empirical observational programs whose experimental design would be difficult to specify in advance.

On behalf of prospective university users, the participants suggested that NCAR graduate assistantships could be a vehicle for involving degree candidates with PAM in the early stages of experimental design to ensure its effective use in ensuing field programs.

Regarding the system itself, the conference participants recommended that a software package be developed for the minicomputer to do objective analysis of any scalar field—–to produce contoured plots of temperature or pressure, for example—– and to superimpose the wind vector field on the contoured plot, in real time, to appear on the base station cathode ray tube display.

"PAM will be a powerful tool," commented participant Robert Rapp. "It has great—–but not unlimited—– flexibility; properly and skillfully used, it should help to solve some of the pressing meteorological problems of the day."

For more information on the PAM system, call Fred Brock at NCAR ext. 77 - 718.

ASP Summer Fellowships Awarded to Minority Students

Six college students have been selected to participate in the Advanced Study Program's (ASP) third summer fellowship program, an effort aimed at increasing the number of Black and other ethnic minority students who will enter graduate programs in meteorology and related fields.

The six ASP fellows, their schools, and the NCAR scientists they will work with are:

- Marcus Aguilar, Rice University, Houston, Texas. Aguilar will work with William Mankin (Upper Atmosphere Project) on laboratory spectroscopy.

- Jeffrey Coleman, Prairie View A&M University, Prairie View, Texas. Coleman will work with Charles Knight (National Hail Research Experiment) on ice physics experiments.

- Elizabeth Guerra, Del Mar College, Corpus Christi, Texas. Guerra will work with Roland Madden (Empirical Studies Project) on problems of climatological data analysis.

- Wanda Malone, Spelman College, Atlanta, Georgia. Malone will work with Thomas Schlatter (Numerical Weather Prediction Project) on analysis of atmospheric winds.

- Dudley Moseley, Prairie View A&M University. Moseley will work with Margaret LeMone (GATE Project) on analysis of data from the GARP Atlantic Tropical Experiment (GATE).

- Shelia Smith, Spelman College. Smith will work with Robert Grossman (GATE Project) on analysis of tropical wind data from GATE.

The fellows will also be given an intensive course in computer programming offered by the NCAR Computing Facility and a two-month introduction to the atmospheric sciences through a series of lectures, seminars, and discussions led by John Wallace of the University of Washington.

Another aspect of the program is designed for faculty members at colleges with significant ethnic minority enrollments. This year, one faculty member from Spelman College, one from Del Mar College, and one from Metropolitan State College (Denver, Colorado) will spend several months in ASP learning more about atmospheric sciences and developing their own atmospheric research interests in order to influence more minority students to consider careers in the atmospheric sciences.

In late summer, Peter Gilman, chairman of ASP, will circulate information on each ASP student fellow to the UCAR universities, in case they wish to recruit any of these students for their graduate programs. For more information on the program, call Gilman at NCAR ext. 400 or write to him at the NCAR address.

HAO Announces 1975-76 Visitors

Solar flares and coronal disturbances, line formation, solar dynamo theory, and plasma instabilities are among the research topics of the group of astrophysicists who will be visiting NCAR's High Altitude Observatory (HAO) during the 1975 - 76 academic year. In addition to several short-term visitors, there will be five one-year visitors:

- *Laurence Auer*, professor in the Department of Astronomy at Yale University, received his Ph.D. in astrophysics from Princeton in 1967. He will work with HAO scientist Dimitri Mihalas on multi-dimensional radiative transfer in static media of various geometries and on radiative transfer problems in rotating and expanding stellar atmospheres.

- *Peter Hoyng*, who will receive his Ph.D. from the University of Utrecht, Holland, in 1975, will work with several HAO scientists on problems of plasma astrophysics, flare theory, and electron acceleration mechanisms.

- *Arthur Richmond* is returning for a second year to continue his work with HAO scientists Sadami Matsushita and Thomas Holzer on magnetosphere/ionosphere questions. He received his Ph.D. from the Department of Meteorology at the University of California at Los Angeles in 1970. He is modeling the dynamics of the terrestrial thermosphere in response to the auroral currents, and he will be working with Holzer on the effects of trapped radiation-belt particles on magnetospheric convection.

- *Richard Steinolfson* has been a National Research Council Research Associate at the National Oceanic and Atmospheric Administration. He received his doctorate from the University of Colorado Aerospace Engineering Sciences Department in 1970. He will work with scientists in HAO's interplanetary modeling group, and he will also continue work he has begun on large computer codes to solve formulations of the adiabatic, nonlinear, time-dependent equations of motion.

- *Donat Wentzel*, professor of astronomy at the University of Maryland, has worked with NASA space astronomy programs for a number of years. He will work on problems of plasma physics and magnetohydrodynamics while at HAO.

Short-term visitors to HAO during the summer of 1975 are as follows:

- *Ian Roxburgh*, Department of Applied Mathematics, Queen Mary College, University of London, will collaborate with several HAO scientists on the structure of coronal streamers, plasma instabilities, and energy transport in the solar wind.

- *George Rybicki*, of the Harvard-Smithsonian Center for Astrophysics, will work with Mihalas on velocity-dependent problems of line formation. He will also work with David Hummer of the National Bureau of Standards/University of Colorado Joint Institute for Laboratory Astrophysics.

- *James Turner*, associate professor of physics at Morehouse College in Atlanta, Georgia, will work with HAO scientist Joseph Hollweg on Alfvén wave processes in the solar atmosphere.

- *Hirokazu Yoshimura*, of the University of Tokyo Department of Astronomy, has been visiting the Hale Observatories in California. During the summer at HAO, he will continue to work on solar dynamo theory with self-consistent dynamics included.

HAO's regular visitor program offers a limited number of one-year appointments for new and established Ph.D.s interested in problems in solar physics, solar-terrestrial physics, and related subjects. Visitors pursue research with members of the scientific staff or other visitors, or they may work on projects begun at their home institutions. The HAO program encourages applications from women and members of minority groups. Detailed information about the HAO visitor program may be obtained by calling G. William Curtis at HAO, NCAR ext. 381.

NOAA Seeks FGGE Project Office Director

The National Oceanic and Atmospheric Administration (NOAA) is recruiting applicants for director of the U.S. First GARP Global Experiment (FGGE) Project Office. This office is responsible for coordinating the activities of all U.S. agencies, universities, and other institutions participating in FGGE. The Project Office is also the contact for the international organizations involved in the experiment.

According to Edward Epstein, NOAA Associate Administrator for Environmental Monitoring and Prediction, the director will be called upon to analyze and resolve complex scientific and technical alternatives in the course of the experiment. He or she must have a strong background in the atmospheric science principles and applications on which the Global Atmospheric Research Program (GARP) is based.

Applicants interested in the position should direct inquiries to Douglas Sargeant, Director, World Weather Program Office, NOAA, Rockville, Maryland 20852, telephone (301) 496 - 8415. The deadline for all applications is 30 May.