The GALE and ERICA Experiments

(Roy Jenne, April 2001)

- These were held off the East Coast of the USA
- GALE: 1/15/1986 – 3/15/1986
- ERICA: 12/1/1988 – 2/28/1989
- A CD-ROM for each has the data
- 13 items with 56 pages

The GALE and ERICA Atlantic Storm Experiment

Roy Jenne
11 Jan 2001
Rev 18 Apr 2001

GALE was held to describe the airflow, mass, and moisture fields in east coast winter storms, with a special emphasis on air-sea interaction processes. People also want to understand the physical mechanisms controlling the formation and rapid development of these storms. GALE was held during Jan – Mar 1986. The locations of the specific GALE observations were along the US East Coast and off the east coast over the ocean.

GALE was a $10 million interagency project led by NSF. More than 30 institutions cooperated in GALE. Some of the observing systems were:

- Five extra radars and 5 NWS radars
- Eight research aircraft
- Two research ships
- Nine extra rawinsonde sites
- Eight new meteorological buoys
- And 334 dropwindsondes from aircraft flights
- Plus satellite data

1. Summary of pages here: three sets of papers; 13 items with 50 pages plus 6 pages in front.

2. The two experiments for Atlantic Storms

   The main two experiments about Atlantic storms were held as follows:

Experiment	Data Dates
GALE	1/15/1986 – 3/15/1986 (2 months)
ERICA	12/1/1988 – 2/28/1989 (3 month)

   Location of the data archives: Some of the GALE data files were also held by the Field Projects Office at UCAR. Now in year 2001, I think that the best source and perhaps the only source of all of the data is on the CD-ROMs. Kreitzberg agrees with this.

3. Some papers in the *Bulletin* of the AMS

   - GALE, Feb 1988, *BAMS*, p 148
   - GALE, Feb 1988, *BAMS*, p 161
   - ERICA, Nov 1988, *BAMS*, p 1309

4. Other publications about GALE

   A description of GALE was in the Feb 1988 issue of the *Bulletin* of the AMS. The Feb 1990 issue of the *Monthly Weather Review* (of AMS) was full of research papers based on the GALE experiment.

5. Publications for ERICA

   ERICA: I talked with Carl Kreitzberg in Jan 2001. There was a paper for ERICA in Nov 1988 *BAMS*. There was no Journal issue with a batch of papers. However, a detailed data catalog was prepared.

6. Carl Kreitzberg sends documents to NCAR (Dec 1998)

   In Dec 1998, Carl Kreitzberg (Drexel University, Pennsylvania) sent two boxes to Roy Jenne at NCAR. The boxes have a few extra copies of documents plus a few extra CD-ROMs. Kreitzberg will retire from Drexel in June 2001. We thank him for all of his good work.

   Kreitzberg says (Apr 2001) that they still have about 300 tapes of highest resolution aircraft and radar data. These will be thrown away in May 2001. The most important radar and aircraft information is on CD-ROMs.

   Parts of the Users Guides are on the CD-ROMs, but not all. NCAR may scan all of the pages in the Guides for GALE and ERICA, and put them online.

7. Access to the data

   The observed data were prepared onto CD-ROMs. NCAR has a copy of the CD-ROMs for GALE and for ERICA.

   Note: GALE was managed from the field projects office at UCAR. ERICA was coordinated by Carl Kreitzberg of Drexel University.

8. Data use for reanalysis (for GALE and ERICA)

   The data have not been used for reanalysis as yet (written Apr 2001). Part of the data on the two CD-ROMs is from the usual world network of observations; that data is used for reanalysis. But there are also many observations that were special observations for these experiments. These special data are on the CD-ROMs.
   - The special observations for GALE and ERICA have not been used for reanalysis projects as yet.
   - The special observations **should be used** in reanalysis projects.
   - NCAR has not done the work to prepare them as yet, and there are no plans now (Jan 2001).

Data not yet in Reanalysis; Apr 2001

The pages in this text:

1. Pages from 3 *Bull AMS* papers, 3 pages
2. Newsletter and summaries about GALE, 10 pages
3. Users guide; other publications, 37 pages
   - GALE Data Users Guide (Mar 1987, 124 pages) 9 pages here
   - GALE Field Program Summary (May 1986, 2.5 cm thick) 5 pages here
   - GOES Imagery for the Genesis of the Atlantic Lows Experiment (Jul 1987, 262 pages) 3 pages here
   - GALE Atlantic Ocean Satellite Rain Maps for GALE (Apr 1988, 1.1 cm thick) 1 page here
   - ERICA Data Users Guide (Mar 1990, 117 pages) 6 pages here
   - ERICA Satellite Atlas (Jun 1989, 235 pages) 4 pages here
   - ERICA Information on CD-ROM (Aug 1990) 9 pages

GALE and ERICA, Two CD-ROMs

Roy Jenne
Dec 1998

GALE Dataset CD-ROM
1/15/86 – 3/15/86
Made by Department of Atmospheric Sciences, University of Washington
(Surface, upper air, and aircraft data)

ERICA CD-ROM
12/1/88 – 2/28/89
Made by ERICA Data Center, Department of Physics and Atmospheric Sciences, Drexel University
(Surface, upper air, and aircraft data)

Interested in:
a. ship raobs
b. dropsondes
c. aircraft flight level data
d. surface 3-hr data

3K

Genesis of Atlantic Lows Experiment (GALE): An Overview

R. A. Dirks,[1] J. P. Kuettner,[1] and J. A. Moore[1]

Abstract

The field phase of the Genesis of Atlantic Lows Experiment (GALE) was conducted from 15 January to 15 March 1986. The objectives of GALE were to study mesoscale and air-sea interaction processes in East Coast winter storms, with particular emphasis on their contributions to cyclogenesis. The project area, special observing systems, and field operations are described. There were thirteen special observing periods during the field phase including eight cases of cyclogenesis. Meteorological and oceanographic phenomena on which special observations were collected include: cyclogenesis, rainbands, cold fronts, coastal fronts, cold-air damming, jet streaks, tropopause folding, low-level jets, cold-air outbreaks, lightning and marine boundary layer interactions with Gulf Stream and mid-shelf oceanic fronts. Preliminary research findings and operational implications are presented. GALE data documents are listed. The GALE data set is open to all interested scientists.

1. Introduction

Major winter storms, characterized by "crippling" ice, heavy snow, and gale-force winds, often batter the East Coast from the Carolinas northward. These storms cause unfortunate loss of life and annually cost an average of more than a billion dollars in property damage. Memorable examples include the Presidents' Day snowstorm of 18–19 February 1979, which deposited 60 cm of snow on the middle Atlantic States, the 6–7 April 1982 snowstorm and windstorm in which more than 50 people lost their lives, and the 11–12 February 1983 blizzard with record-breaking snowfalls and freezing rain that paralyzed the northeast and caused 70 deaths.

In particular, those cyclones that develop rapidly just off the Carolina coast and move northward along the coast are often the most poorly predicted by current numerical forecasting models. It is believed that this is at least partly due to an inadequate understanding of subsynoptic-scale and air-sea–interaction processes within these storms and to a lack of data on space and time scales commensurate with their development.

The past decade has seen some significant advances in our understanding of extratropical cyclones and their associated fronts, and in the development of numerical models capable of reproducing some observed synoptic and mesoscale features of these systems. There remain, however, many gaps in our knowledge. For example, little is known about the dynamical-coupling mechanisms between the jet stream and lower-level frontogenesis and cyclogenesis, the role of boundary-layer processes in frontogenesis and cyclogenesis, the contributions of air-sea interaction and Gulf Stream heating to storm energetics, the effects of cloud processes and precipitation processes on the dynamics and evolution of cyclones and fronts, the role of turbulent processes in the vertical transport of heat and momentum, the changes of potential vorticity and the dissipation of kinetic energy within cyclones, the nature of the interactions between mesoscale and microscale processes, and the role of gravity waves in organizing precipitation elements. It also is not known whether conceptual models of the organization and structures of mesoscale rainbands in mature cyclones that have been documented on the West Coast of the United States and in the United Kingdom apply to earlier stages of developing cyclones; the degree to which numerical models can reproduce mesoscale structures in cyclones also has received comparatively little attention.

In September 1979 the challenges and opportunities for extratropical-cyclone research were first crystalized in a workshop[2] held in Seattle, Washington. A National Academy of Sciences committee and panel[3] further recommended enhanced research efforts on extratropical cyclones, with particular emphasis on the analysis and interpretation of data from new field projects.

In September 1982 a group of university scientists (representing Drexel University, Massachusetts Institute of Technology, North Carolina State University, State University of New York, and University of Washington) informally met to consider field-study plans for East Coast storms and initiated the program that later would become known as the Genesis of Atlantic Lows Experiment (GALE).[4]

[1] National Center for Atmospheric Research, Boulder, CO 80307 (The National Center for Atmospheric Research is sponsored by the National Science Foundation.).

[2] *Extratropical cyclones: Progress and Research Needs.* Report of a Workshop on Extratropical Cyclones held in Seattle, Washington, 10–12 Septembe

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Bams Feb 1988

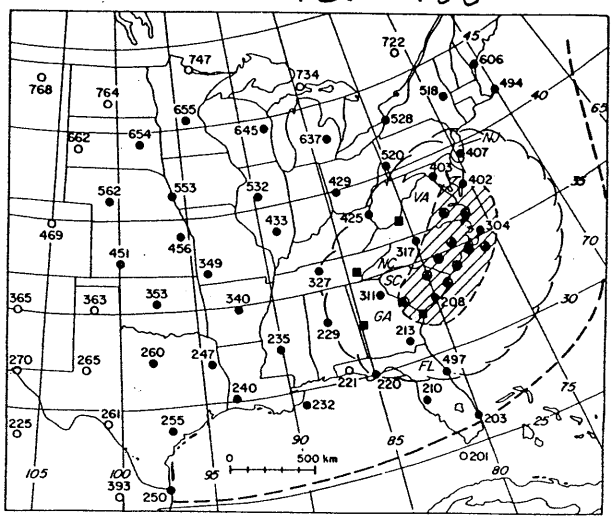


FIG. 3. GALE experimental areas. In the outer GALE area solid circles show sites for 3-h NWS rawinsonde releases and the dashed line shows maximum offshore extent of dropwindsondes. The Regional GALE Area (scalloped boundary) includes enhanced surface and upper-air observations, digitally recorded NWS radar data and special dropwindsondes. The inner GALE area (shaded) contained special facilities—surface stations and buoys, sounding systems, Doppler radars, and ships (elaborated in Fig. 4). State abbreviations are: NJ (New Jersey) VA (Virginia) NC (North Carolina) SC (South Carolina) GA (Georgia) and FL (Florida).

Bulletin Amer. Met. Soc
Vol 69 No 2 Feb 1988

The Genesis of Atlantic Lows Experiment: The Planetary-Boundary-Layer Subprogram of GALE[1]

Sethu Raman[2] and
Allen J. Riordan[2]

Abstract

The Genesis of Atlantic Lows Experiment (GALE), focused an intensive data-gathering effort along the mid-Atlantic coast of the United States from 15 January through 15 March 1986. Here, the general objectives and experimental layout are described with special emphasis on the planetary-boundary-layer (PBL) component of GALE.

Instrumentation is described for buoys, ships, research aircraft, and towers. The networks of the cross-chain long range aid to navigation (LORAN) atmospheric sounding system (CLASS) and the portable automated mesonet (PAM II) are described and their impact on the operation of GALE is outlined. Special use of dual-Doppler radar to obtain detailed wind measurements in the PBL is discussed.

Preliminary analyses for a selected observational period are given. Detailed observations of the offshore coastal front reveal direct mesoscale circulations imbedded in the frontal zone. Later in the period, during an intense cold-air outbreak, sensible-heat and latent-heat fluxes over the coastal ocean each attain values of about 500 $W \cdot m^{-2}$. Coordinated aircraft operations are outlined for this case and a few early findings are given.

1. Introduction

Each winter, coastal storms blast sections of the East Coast of the United States with strong winds, rain, sleet and snow, flood low-lying areas, erode beaches, disrupt commerce, damage property, and injure many persons. The genesis of these storms, often initially as weak waves developing along a shallow coastal front just offshore of the mid-Atlantic coast is not well forecast. Their subsequent tracks and intensities are not particularly well-depicted by present operational-forecast models.

To better understand the development of winter storms the Genesis of Atlantic Lows Experiment (GALE), equipped with an ambitious array of surface and airborne sensors was conducted from 15 January through 15 March 1986. The objectives of GALE were to describe in detail the airflow, and mass and moisture fields in developing storms, to explore the links between mesoscale systems (such as rainbands, coastal fronts, and dry "tongues," for example) and the development of the larger-scale systems in which they are imbedded, and to improve numerical models to better predict these storms.

To meet these objectives, existing operational measurement networks were supplemented with specialized observing systems concentrated along the mid-Atlantic coast. During the field phase, National Weather Service (NWS) and other routine measurements were supplemented through: 1) additional radiosondes at 39 existing NWS sites; 2) Air Force dropwindsondes deployed over offshore waters of the Atlantic and the Gulf of Mexico; 3) digitized recording of NWS radar data from Athens, Georgia to Volens, Virginia; and 4) an augmented research and operational satellite program.

The NWS radiosonde network included essentially all routinely operational sites in the United States east of the Rocky Mountains and was supplemented by eleven sites in eastern Canada that were coordinated through the Canadian Atlantic Storms Project (CASP), a research effort concurrent with GALE that has been described by Stewart et al. (1987). During intensive observing periods (IOPs) of GALE, all or selected parts of the NWS network and relevant CASP sites launched sondes as frequently as every three hours to provide information over a larger outer area.

A variety of meteorological satellites provided data support for GALE. This support was particularly valuable since much of the area of interest was over the data-sparse ocean. Standard products from polar orbiters *NOAA-9, NOAA-6, DMSP F-7, NIMBUS-7,* and standard and specialized products from *NOAA-9, NIMBUS-7,* and the geostationary *GOES-6* platform were archived for the experiment.

Infrared imagery from *NOAA-9* is being processed by GALE investigators to produce detailed atmospheric-corrected sea-surface–temperature analyses. Ozone mapping from *NIMBUS-7* has been produced for GALE by Larko et al. (1986). Finally, up to five sounding sets daily "plus" wind fields derived from "cloud-drift" vectors and "water-vapor–drift" vectors up to three times daily have been produced from *GOES-6* data (Velden, 1987).

During the experiment, a McIDAS work station was located at Raleigh, North Carolina, for continuous monitoring of GOES-derived products. Ready access to satellite data proved invaluable in monitoring the progress of weather-system development, and updating aircraft missions, particularly those directed over oceanic areas.

Special new GALE systems added much detail to mesoscale observations along the piedmont, coastal plain, and near-shore waters of North and South Carolina. The locations of these systems are illustrated in Fig. 1. The systems included: 1) sixteen additional sounding sites, including eight Cross-chain–LORAN Atmospheric Sounding Systems (CLASS) recently developed by the National Center for Atmospheric Research (NCAR); 2) eight instrumented meteorological buoys, including six from North Carolina State University (NCSU) and two from the National Oceanic and Atmospheric Administration (NOAA); 3) a network of 50 portable automated mesonet (PAM II) surface stations; 4) eight research aircraft including NCAR's Lockheed Electra, Beechcraft Super King Air, and

[1] Genesis of Atlantic Lows Experiment.

[2] Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, NC 27695-8208.

The Experiment on Rapidly Intensifying Cyclones over the Atlantic (ERICA) Field Study: Objectives and Plans

Ron Hadlock[1] and Carl W. Kreitzberg[2]

Bull AMS
• Nov 1988

ERICA

Abstract

The Experiment on Rapidly Intensifying Cyclones over the Atlantic (ERICA) field study is designed to determine physical mechanisms and processes, and their critical spatial and temporal combinations, which can account for the wintertime phenomenon of explosively developing over-ocean atmospheric storms. Theoretical and numerical modeling research, during the five-year Office of Naval Research (ONR) Heavy Weather at Sea Accelerated Research Initiative ERICA program, comprises continuing effort, including the field study scheduled for 1 December 1988–28 February 1989. The ONR core field study is supplemented by the substantial participation of many other agencies and universities from the United States and Canada. Data will be obtained over the North Atlantic Ocean from Cape Hatteras to beyond Newfoundland, centered east of Cape Cod and south of Nova Scotia. The general timing and siting is chosen through consideration of historical storm occurrence data. Measurements in individual rapidly intensifying storms will be made from aircraft, buoys, and satellites, and by soundings and radars. Observations made during the pre-ERICA field test, January 1988, are discussed. This article describes the measurement objectives and the ways by which the field data will be collected.

1. Introduction and background

The Office of Naval Research (ONR) initiated and base-funded the Experiment on Rapidly Intensifying Cyclones over the Atlantic (ERICA) for a five-year duration, 1986 to 1991. The objectives of the program are to: (1) understand the fundamental physical processes occurring in the atmosphere during rapid intensification of cyclones at sea, (2) determine those physical processes that need to be incorporated into dynamical prediction models through efficient parameterizations if necessary, and (3) identify measurable precursors that must be incorporated into the initial analysis for accurate and detailed operational model predictions. The producing of tools such as improved operational numerical analysis and prediction models is not a part of ONR's research initiative; such follow-on work will be done in other programs and is of central concern to several organizations participating in the field study.

ERICA is part of the ONR Marine Meteorology Accelerated Research Initiative's Heavy Weather at Sea program. In turn, ERICA consists of two interacting components: (1) theoretical, numerical-modeling, and analysis studies and (2) field measurements. The acronym "ERICA" has become used equally for the whole program and for the 1988–1989 field study. Research instrumentation and support of personnel within the Genesis of Atlantic Lows Experiment (GALE, to which ERICA is linked as a follow-on field study) and the Canadian Atlantic Storms Program (CASP), both conducted from January to March 1986, have also been provided by the ERICA program.

Scientific study of rapidly intensifying over-ocean cyclones will have spanned only about a decade when the ERICA program is completed (see References). In the seminal paper on storm climatology and characteristics, Sanders and Gyakum (1980) used the term "meteorological bomb," which they defined as "an extratropical surface cyclone whose central pressure fall averages at least 1 mb h^{-1} for 24 h" (normalized for 60-degree latitude). Research has continued on storm climatology and structure (Sanders 1986a), numerical studies and evaluations (Sanders 1986b; 1987), and dynamical and case studies (Nuss and Anthes 1987; Rogers and Bosart 1986; Uccellini 1986). These papers cited are recent contributions in each area.

One reason for ERICA's merit is the history of death, damage, and expense that these storms are known to have caused. Commercial shipping and fishing have been disrupted, drilling rigs have been capsized, ocean liners and naval vessels have been damaged, and naval sea and air operations have frequently been hindered. With development of better position, motion, and intensity forecasting, it is likely that the storms will cause less havoc because better evasive and preparatory actions will be possible. Past numerical forecast schemes have been imperfect because the storms are relatively small in size and develop rapidly, because the physical processes and structure are not fully understood, and because data from over the oceans are relatively few. The ERICA research will have fundamental value in producing new scientific understandings which will be applied to improve forecasting.

The ONR ERICA Steering Committee[3] first met in November

[1] ERICA Field Director, Battelle Ocean Sciences, Richland, WA 99352.
[2] ERICA Associate Field Director, Drexel University, Philadelphia, PA 19104.

[3] The composition of ONR's Steering Committee is: Bob Abbey, ONR; John Bane, University of North Carolina; Lance Bosart, State University of New York at Albany; Greg Forbes, Pennsylvania State University; Ron Hadlock (chairman), Battelle Ocean Sciences; Carl Kreitzberg, Drexel University; Steve Lewellen, Aeronautical Research Associates of Princeton; Rao Madala, Naval Research Laboratory; Fred Sanders, Marblehead, Massachusetts; Joe Schaefer, National Weather Service; Ron Stewart, Atmospheric Environment Service; and Chuck Wash, Naval Postgraduate School.

UCAR NEWSLETTER

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH

Volume 10, No. 3, May-June 1986

GALE: How an Atlantic Storm Is Born

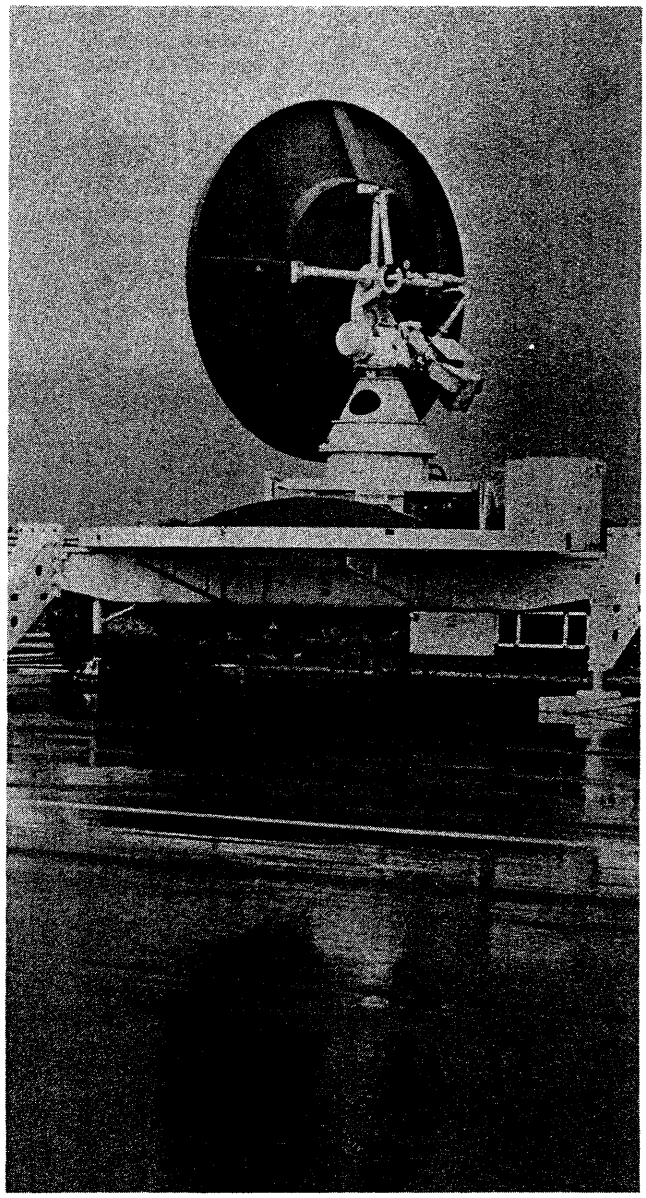
Last winter, some of North American meteorology's finest minds and most sophisticated observing facilities were trained on the coastal regions of North and South Carolina in the largest field experiment ever to examine winter storms in the United States. The focus of the Genesis of Atlantic Lows Experiment, or GALE, was the area thought to generate most of the severe winter storms that pelt the heavily populated East Coast. Blizzards created by these Atlantic lows south of Cape Hatteras move north to affect more than 30 million people and may cause a billion dollars in property damage in a single year. They appear to form through complex interactions between the ocean, air, and land, processes that are only partially understood.

To help understand the intricacies of such storm development, more than 30 institutions cooperated in GALE, a $10 million interagency project with NSF as the lead agency and NCAR housing the project office. The field phase of the program ran from mid-January through mid-March, with 200 scientists, engineers, and technicians centered at the field headquarters in Raleigh, North Carolina. The study area was scrutinized with a large and diverse array of research equipment (see box), including Doppler radars, research ships, aircraft, portable automated mesonet stations, offshore buoys, and various sounding devices. Not only did the project give researchers finely resolved data on the mesoscale, it also gave them sorely needed data on processes over the ocean, processes that have been neglected since the demise of weather ships a few years ago.

According to Richard Dirks (NSF), director of the project office, which oversaw all the field operations, "Looking back, it appears that the project was quite successful." Despite the absence of a major winter blizzard, researchers were able to glean data on six major cyclonic storms during 13 intensive observing periods of one to five days' duration, giving them an unprecedentedly detailed picture of weather dynamics over land and sea.

The consequences of their findings should be important for more than just weather forecasting, although this was a major focus of the project. They will give atmospheric scientists a better picture of the processes that contribute to storm formation in broader terms.

(Continued on next page.)

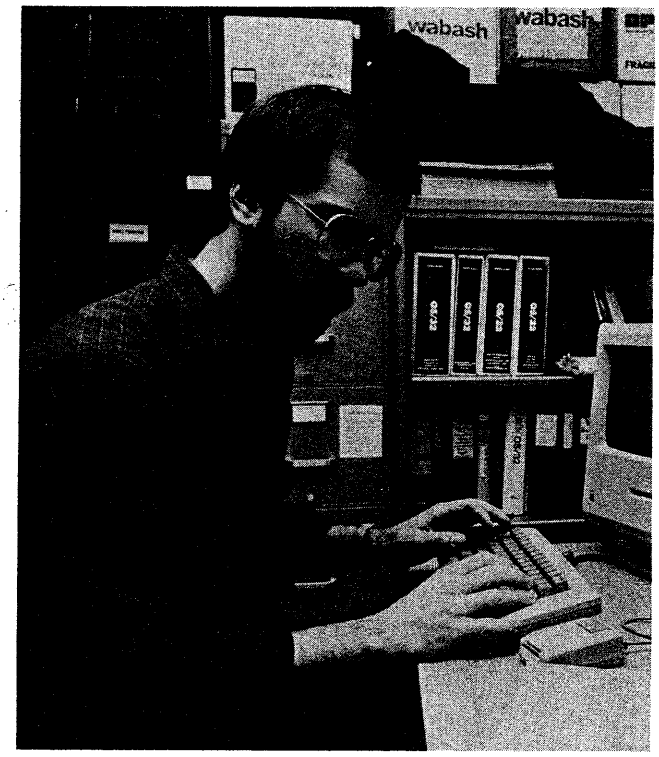


NCAR's CP-3 radar takes measurements from the airport runway at Ocracoke, North Carolina, during GALE. (Photo by Charlie Semmer.)

GALE participants are anxious to dissect the interworkings of three important contributors to storm genesis in this area: the Gulf Stream, the Appalachian Mountains, and the jet stream. Unraveling how these and other elements come together to create major winter storms is, of course, the work of years to come. However, some preliminary findings are already emerging. Rapid cyclogenesis (storm formation) appears to require fairly precise timing in the development or occurrence of several interrelated mesoscale phenomena such as cold-air damming (produced by the Appalachian barrier), the formation of coastal fronts, Gulf Stream energy release, jet streak position, and critical temperature for the snow phase. Peter Hobbs at the University of Washington has noted that intense rainbands frequently form off Cape Hatteras, reflecting the boundaries of the Gulf Stream. The energetics associated with the rainbands may play an important role in cyclogenesis. Kerry Emanuel and colleagues at the Massachusetts Institute of Technology have preliminary data to indicate that the cores of storms forming over the Atlantic coast may be warmer than the surrounding air, unlike storms forming inland, which typically have cold cores. The findings suggest that these cyclones resemble tropical cyclones.

GALE is also producing some new data on lightning formation. "The squall system over the Gulf Stream was more active than expected," according to Dirks, "and the storms carried a lot more lightning than anyone supposed. In fact, a map of lightning almost defines the western boundary of the Gulf Stream." Recent research has indicated that lightning over the sea may transfer a positive charge to the ground, unlike lightning over land.

Now that researchers are back at their desks contemplating the reams of data their field efforts have produced, Dirks and others centrally involved in GALE's planning and execution have time to assess the success of their massive initiative. "It was our impression that everyone left feeling pleased with the program," Dirks comments, "both overall and in terms of their own projects. We believe that practically all of the scientific objectives were fulfilled."



Tom Mercer (Drexel University), head of data management for GALE, works out of field headquarters in Raleigh, North Carolina. (Photo by Charlie Semmer.)

GALE Observing Systems

- Radars. Five Doppler radars (two from NCAR, one from the Massachusetts Institute of Technology, one from the University of Washington, and NASA's SPANDAR radar); five NWS radars
- Aircraft. Eight research aircraft, including three from NCAR, two from NOAA, two from NASA, and one from the University of Washington
- Ships. Two research ships, one from Duke University and one from the University of Rhode Island
- PAM stations. Fifty portable automated mesonet stations from NCAR, spaced approximately 60 kilometers (36 miles) apart
- Rawinsondes. Nine of NCAR's new CLASS (Cross-chain Loran Atmospheric Sounding System) stations (six land based and three amphibious), from which weather balloons were launched every three hours during intensive observing times; six other special sounding sites were operated by military and project personnel; special soundings were launched from 41 NWS sites
- Buoys. Eight new meteorological buoys (two from NOAA and six from North Carolina State University)
- Satellites. Special GOES (Geostationary Operational Environmental Satellite) rapid-scan data, NOAA orbiter soundings, and high-resolution data, as well as routine satellite readings
- Dropwindsondes. 334 Omega dropwindsondes, developed by NCAR, parachuted from aircraft over the ocean during flights at six-hour intervals

GALE Participants

Universities

University of Colorado

Drexel University

Florida State University

University of Illinois

Louisiana State University

Massachusetts Institute of Technology

University of Miami

State University of New York at Albany

University of North Carolina

North Carolina State University

Old Dominion University

Pennsylvania State University

Research Triangle Institute

Skidaway Institute of Oceanography of the University of Georgia

University of Washington

University of Wisconsin

U.S. Naval Postgraduate School

Yale University

Other Sponsoring and Research Institutions

Department of Energy

Federal Aviation Administration

National Aeronautics and Space Administration

National Center for Atmospheric Research

National Oceanic and Atmospheric Administration

National Science Foundation

Naval Research Laboratory

Office of Naval Research

U.S. Air Force Air Weather Service

U.S. Air Force Office of Scientific Research

U.S. Army Corps of Engineers

U.S. Army Research Office

U.S. Coast Guard

Oceanographers Invited to Use NCAR Computing Facilities

With the arrival of the CRAY X-MP/4800 in the fall, NCAR's computing services will be broadened to include a wider spectrum of researchers with interests in all areas of basic oceanography. During the past decade, NCAR has extended an increasing amount of its computing resources to oceanographers and has become a major resource for physical oceanographic modeling. This link will be formalized effective 1 September, after which date 20% of the resources of the Scientific Computing Division (SCD) will be earmarked for use by oceanographers, 10% for NCAR researchers and 10% for scientists from the university community. The research may be in areas that have not previously received NCAR's computing support, including (but not limited to):

- marine chemistry
- marine biology
- marine ecology
- marine physics.

As with all requests for use of SCD's computing resources, applications from oceanographers will be subject to peer review. Allocations of up to five hours of central processor unit time on the CRAY-1A or the CRAY X-MP can be approved at any time by the director of SCD. Larger requests are reviewed by the SCD advisory panel, which meets twice a year, in the spring and the fall. The next meeting will be 29-30 September. The panel has been selected both from the scientific community at large and from within NCAR, and includes a complement of oceanographers who will give special attention to this new focus of resource allocations. The review process is designed to assess the soundness of work proposed, the scientific approaches taken, the techniques proposed, and projects' plans to make efficient use of computing resources.

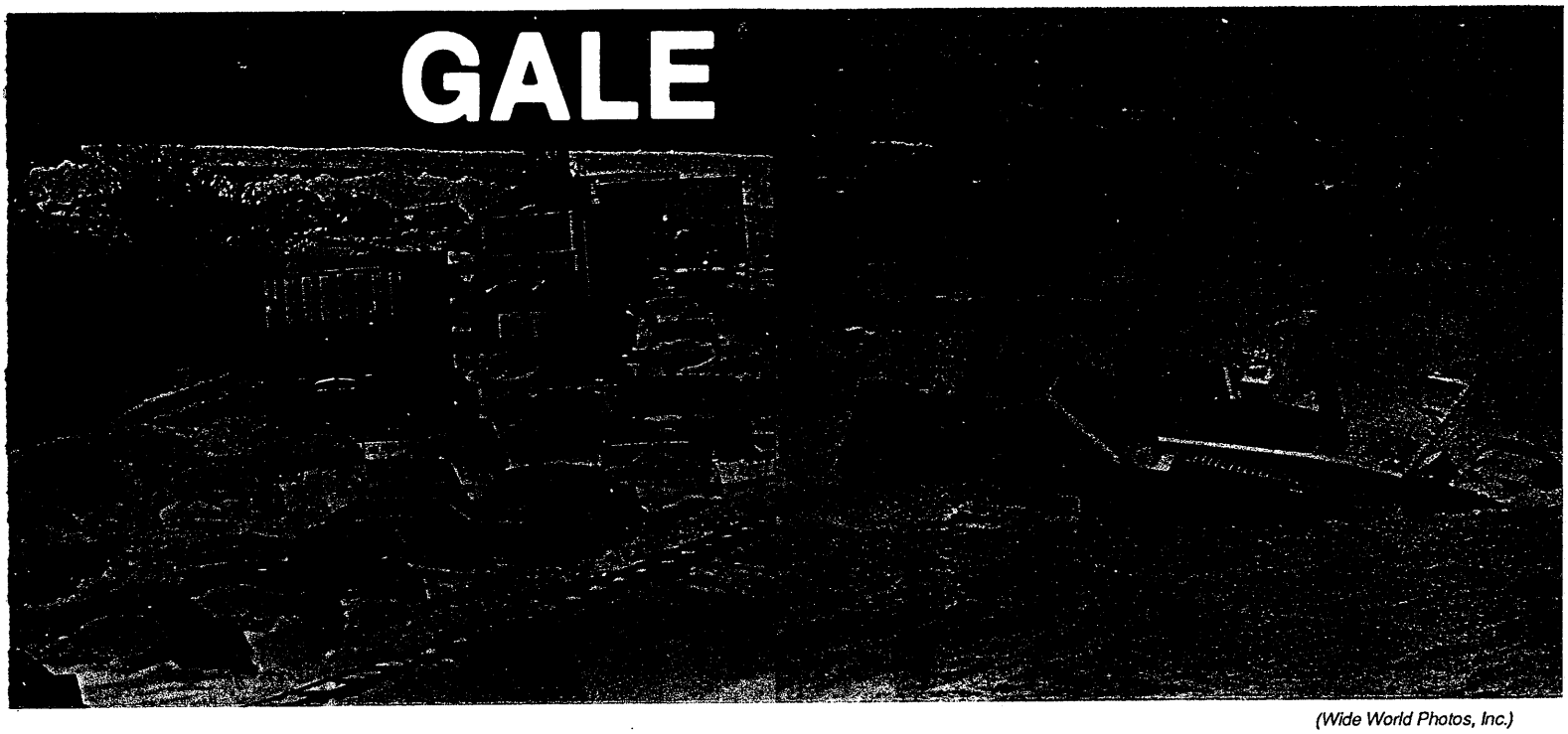
Researchers wishing to be considered at the next SCD advisory panel meeting, both oceanographers and others, should submit their requests by 24 July. Projects sponsored by NSF receive computing resources free of charge. All other projects will be charged according to NSF-approved rates, available from SCD.

For further information, please contact Betty Thompson, Assistant Administrator, Scientific Computing Division, NCAR, P.O. Box 3000, Boulder, CO 80307 (303-497-1208).

Purdue Department Renamed Earth and Atmospheric Sciences

In action by its board of trustees, Purdue University has renamed the Department of Geosciences the Department of Earth and Atmospheric Sciences, effective 1 July. An announcement by Felix Haas, Purdue's executive vice president and provost, states that the renaming is intended to give proper recognition to the nationally renowned atmospheric science program that resides within the department. A new building is also under construction, with a departmental move scheduled for June 1988. Purdue has been a UCAR member university since 1970.

GALE



(Wide World Photos, Inc.)

The Problem

Savage winter storms, often characterized by crippling ice, heavy snow, and damaging gale-force winds, annually batter the East Coast, causing more than a billion dollars in property damage and unfortunate loss of life. These East Coast cyclones, as they are called, generate havoc in one of the largest megalopolis regions of the world, the northeast U.S. coast, and can affect more than 30 million people.

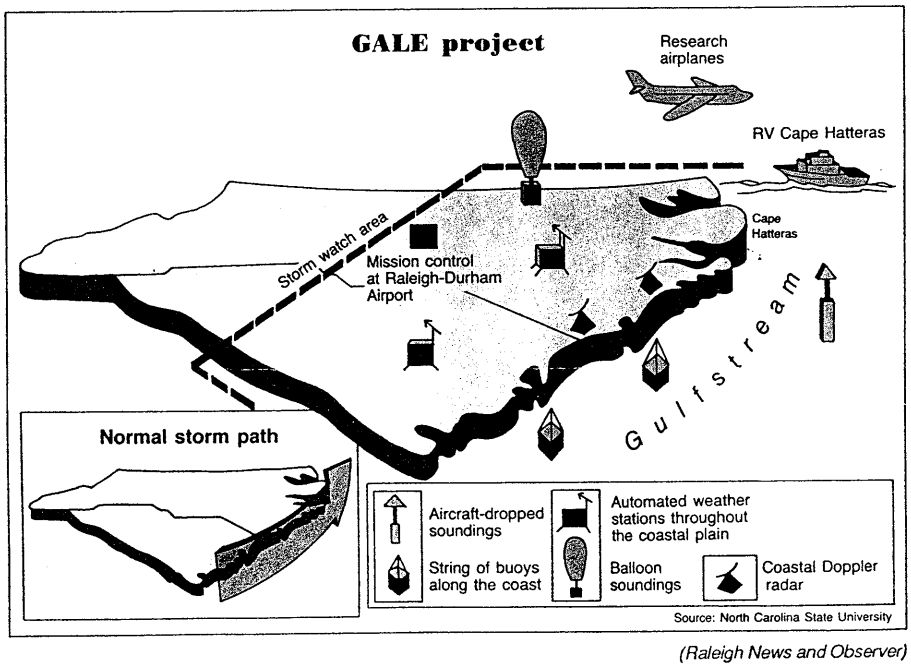
These storms develop very rapidly just off the Carolina coasts and move northward. They are often poorly predicted. Scientists believe that this lack of precise prediction is due, in part at least, to inadequate understanding of regional and air-sea interaction processes within these storms and to a lack of data on space and time scales commensurate with their development.

The Project

To better understand what generates these massive winter storms, federal and university scientists will launch a $10 million research project this winter termed GALE, for Genesis of Atlantic Lows Experiment. Specifically, the researchers hope to improve short-range forecasting of coastal storms and the knowledge of the interaction between these storms and the ocean, and to develop more refined computer models to predict them.

The field experiment, the largest of its kind ever undertaken, will be headquartered at the Raleigh/Durham, North Caorlina, airport for a two-month period between January 15 and March 15, 1986. The National Science Foundation (NSF) is the lead agency for the project.

During the GALE field experiment, approximately 200 scientists, engineers, and technicians from 25 research groups in the United States will collaborate. The researchers hope to determine how the Appalachian Mountains, the coastal landscape, and the Atlantic Ocean, particularly the Gulf Stream, contribute to the formation of winter storms.



(Raleigh News and Observer)

Page 1

Strategy and Objectives

The principal objectives of GALE are:

- To describe the airflow, mass, and moisture fields in East Coast winter storms, with special emphasis on regional-scale and air-sea interaction processes.
- To understand the physical mechanisms controlling the formation and rapid development of these storms.
- To develop and test computerized models for the prediction of the storms.

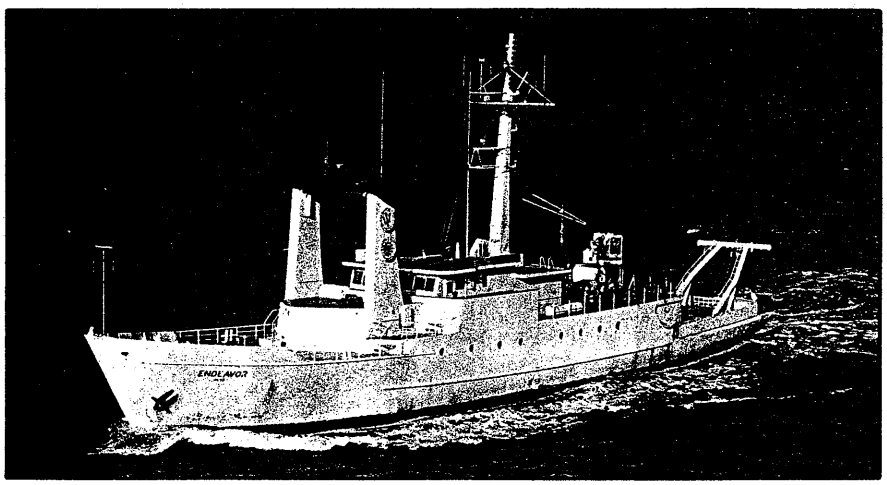
Supporting objectives of GALE are to study:

- Cloud and precipitation processes associated with East Coast cyclones, with emphasis on simultaneous radar and aircraft measurements
- The role of atmospheric gravity waves and other mechanisms in the organization of precipitation bands
- The evolution of stratospheric and tropospheric exchange processes in relation to the rapid birth of winter cyclones
- The influence of cold-air outbreaks over the relatively warm coastal ocean at the onset of fronts and winter cyclones
- The response of the coastal ocean waters to winter storms
- The application of conceptual storm models and enhanced meteorological data to short-range forecasting of significant weather
- The subsequent evolution of major winter cyclones traveling northward from the GALE observational network.

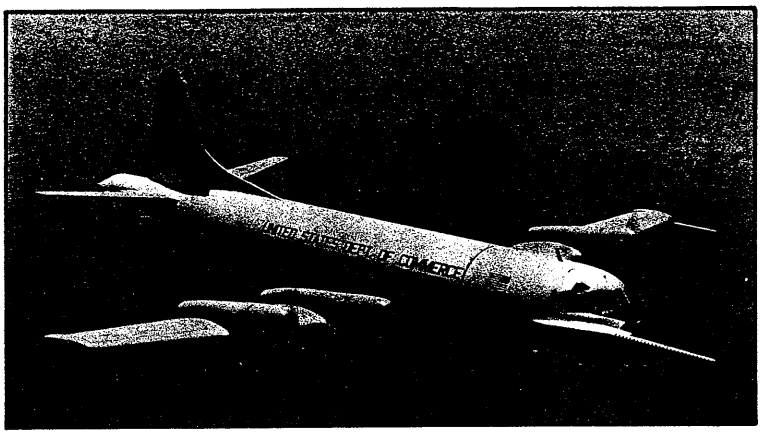
The meteorological observing base of GALE will be used by several companion research projects. Studies in atmospheric chemistry will use available space on GALE aircraft. In addition, researchers from the Department of Energy's acid rain program—Processing of Emissions by Clouds and Precipitation (PRECP)—will deploy and operate a ground precipitation network in the GALE area and coordinate special aircraft flights. Also, a comanion meteorological study of the regional aspects of winter storms will be conducted in the Canadian Maritime Provinces. Entitled the Canadian Atlantic Storms Program (CASP), this study will be carried out concurrently with GALE and will involve coordinated observations when major storms move along the northeast coast from the GALE area into the CASP study region.

Applications

GALE is one of several current national research and development projects devoted to the improvement of short-term weather prediction, detection, and warning. By concentrating high-technology observing systems in a small area, vast improvements in zero-to-six-hour forecasts can be made.



University of Rhode Island "Endeavor" *(U. of Rhode Island photo)*



NOAA P-3 (National Oceanic and Atmospheric Administration photo)

Results of GALE will be used particularly by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service and by Canada's Atmospheric Environment Service to provide refined weather forecasts for commercial vessels and pleasure craft plying the East Coast shipping lanes, as well as for residents of the coastal areas.

Observing Systems

Although regional-scale storm phenomena will form the focus of the core research effort for GALE, there will be adequate measurements on the larger national scale to better diagnose the contributions of scale-interactive processes. Accordingly, the routine National Weather Service (NWS) measurements will be supplemented as follows:

- The frequency of weather balloon launches at 41 existing NWS sites will be increased from once every 12 hours to once every 3 hours during periods of intensive GALE measurements.

- Five of the NWS weather radars located close to the East Coast at Athens, Georgia; Charleston, South Carolina; Hatteras, North Carolina; Volens, Virginia; and Wilmington, North Carolina, will be digitized for GALE. These will provide quantitative radar reflectivity measurements from Georgia to Virginia.

- In additional to routine satellite products, it is expected that special GOES (Geostationary Operational Environmental Satellite) rapid-scan data, as well as NOAA orbiter soundings and high-resolution data will be available.

In support of the intensive regional studies within the primary area designated for the GALE field studies, the following facilities will be deployed:

- Twelve additional land-based sites from which instrumented weather balloons will be launched every 3 hours during intensive GALE studies. Eight of the sites are equipped with Cross-chain Loran Atmospheric Sounding Systems (CLASS), developed by the National Center for Atmospheric Research (NCAR).

- A network of 50 portable automated mesonet (PAM II) solar-powered weather stations, designed by NCAR, will be spaced approximately 60 kilometers (36 miles) apart and extend from South Carolina to Virginia, providing automatic and high-resolution measurements of pressure, temperature, humidity, and wind speed and direction. Four of the stations will be located along a line extending across the Appalachian Mountains.

- Eight new meteorological buoys will be added off the Carolina and Georgia coasts (two from NOAA and six from North Carolina State University).

- Six existing towers for measurements of temperature, humidity, and winds will collect special observations: three are located inland, two on the coast, and one offshore.

- Eight research aircraft: NCAR's North American Sabreliner, Lockheed Electra, and Beechcraft Super King Air: NOAA's Lockheed P-3 and Cessna Citation-II: and NASA's Lockheed Electra and ER-2, and the University of Washington's Convair C-131A.

- Four scanning Doppler radars, including two portable systems from NCAR and one from the Massachusetts Institute of Technology which will be located on the coasts of the Carolinas, and NASA's SPANDAR radar at Wallops Island, Virginia. Also the University of Washington's vertically pointed Dopplerized radar located on the North Carolina coast at Cape Hatteras.

- Duke University's research vessel Cape Hatterras will operate off the North Carolina coast. This will provide an offshore platform for turbulence, energy flux and three-hour instrumented weather balloon measurements. A second research vessel, the University of Rhode Island's Endeavor, will operate part of the research period off the South Carolina coast.

- Dropwindsondes, developed by NCAR to obtain meteorological data over ocean surfaces, will be parachuted from several aircraft at 150-kilometer intervals and six-hour periods. The sondes transmit temperature, pressure, and humidity data as they descend. Wind information is obtained when the sonde receives and retransmits navigational signals.

List of Participants (as of November 1985)

National Center for Atmospheric Research (sponsored by the National Science Foundation)

Universities

Drexel University
Florida State University
University of Illinois
Massachusetts Institute of Technology
North Carolina State University
Old Dominion University
Pennsylvania State University
Skidaway Institute of Oceanography, University of Georgia
State University of New York, Albany
University of Miami
University of North Carolina
University of Texas
University of Washington
Universtiy of Wisconsin
Yale University

Federal Government

National Science Foundation
National Aeronautics and Space Administration
National Oceanic and Atmospheric Administration
Office of Naval Research
Naval Postgraduate School
Naval Research Laboratory
U.S.Army Corps of Engineers

Commercial

Aeronautical Research Associates of Princeton
Bell Laboratories

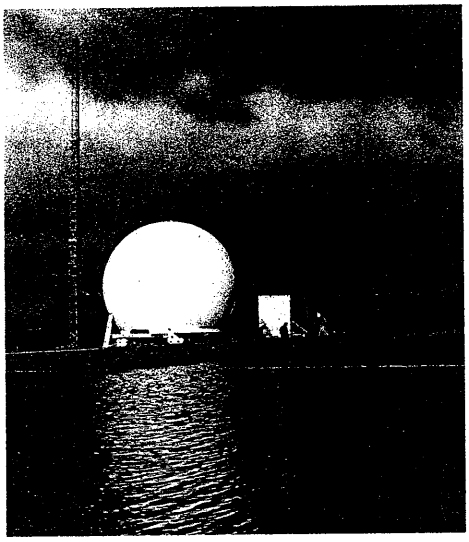
GALE Project Office

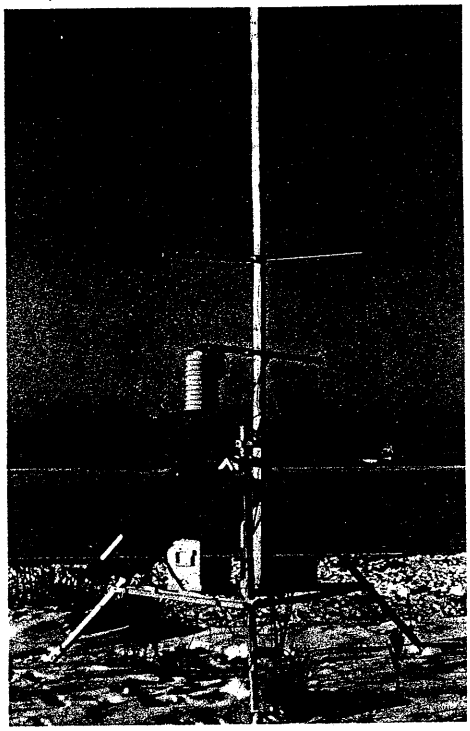
Richard Dirks, Director
National Center for Atmospheric Research
P.O. Box 3000
Boulder, CO 80307
Telephone: (303) 497-8841
(FTS) 320-8841

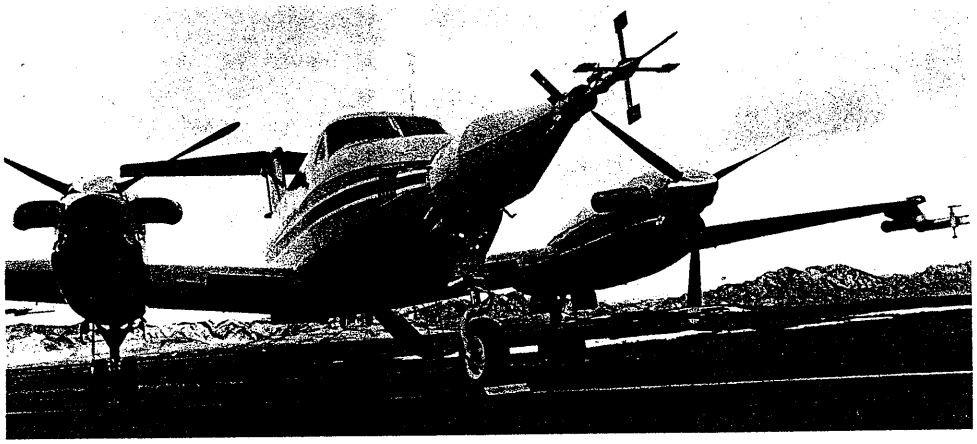
Media Relations

Ralph Kazarian, Public Affairs Office
National Science Foundation
1800 "G" Street N.W.
Washington, D.C. 20550
Telephone: (202) 357-9498
(FTS) 357-9498

Upper left: CP-4 radar, upper right: PAM station, bottom: NCAR Beechcraft Super King Air (National Center for Atmospheric Research/National Science Foundation photos)







NCAR
National Center for Atmospheric Research
P.O. Box 3000 Boulder, CO 80307

NEWS RELEASE

1985-18 EMBARGOED--Hold for Release: Tuesday p.m., December 24, 1985

GALE

Scientists Prepare for Winter Storm Investigation Off Carolina Coasts

RALEIGH --Intense winter storms that often bury the Northeast Coast in snow with little advance warning are the focus of a National Science Foundation (NSF)-sponsored field investigation off the coasts of North and South Carolina beginning January 15 for a two-month period. Major co-sponsors of the $10 million study are NOAA, NASA and the Office of Naval Research.

Researchers from more than a dozen universities will team up with scientists from several federal agencies for the Genesis of Atlantic Lows Experiment (GALE), a research project headquartered in Raleigh, North Carolina.

The principal purpose of GALE is to better understand what generates these massive winter storms. The researchers' goal is to improve short-range forecasting of coastal storms by determining how the Appalachian Mountains, the coastal landscape and the Atlantic Ocean, specifically the Gulf Stream, contribute to the formation of these storms.

Research results of GALE will be of benefit to the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) and by Canada's Atmospheric Environmental Service to provide improved weather forecasts for commercial vessels and pleasure craft plying the East Coast shipping lanes, as well as for residents of the eastern coastal areas.

More than 200 scientists and support personnel will use a fleet of research aircraft from the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, to gather storm data along the Atlantic Coast from Virginia west to the hills of Tennessee and south to Georgia. The NCAR fleet includes a four-engine Lockheed Electra, a twin-jet North American Sabreliner, and a Beechcraft King Air turboprop.

Six additional aircraft, including NASA's Lockheed Electra and ER-2 aircraft, a

-more-

The National Center for Atmospheric Research is operated by the University Corporation for Atmospheric Research under the sponsorship of the National Science Foundation.

Lockheed P-3 and Cessna Citation-II operated by NOAA, an Airborne Research Associates' Beechcraft Baron, and the University of Washington's Convair C-131A, will also join the fleet of research aircraft.

Three sophisticated scanning Doppler radars, including two systems from NCAR and one from MIT, will be located on the coasts of the Carolinas. In addition, NASA's SPANDAR radar will operate from its site at Wallops Island, Virginia.

Participating in the project will be NCAR, NOAA, NASA, the Naval Research Laboratory, the Naval Postgraduate School, and 16 universities listed in the enclosed brochure.

A network of 50 portable solar-powered weather stations, designed by NCAR, will be spaced approximately 60 kilometers (36 miles) apart and will extend from South Carolina to Virginia, providing automatic and high-resolution measurements of pressure, temperature, humidity, wind speed and wind direction. Four of the stations will be located along a line extending across the Appalachian Mountains from the Tennessee border to the Atlantic Ocean.

The frequency of weather balloon launches at 41 existing NWS sites will be increased from once every 12 hours to once every 3 hours during periods of intensive GALE measurements. Eight of NCAR's new CLASS weather balloon sounding systems will be operating for the first time in the field. Three Air Force/Air Weather Service rawinsonde teams will also support GALE. In addition to routine satellite products, it is expected that NOAA's special GOES (Geostationary Operational Environmental Satellite) rapid-scan data, as well as NOAA orbiter soundings and high-resolution data, will be available. Eight new meteorological buoys will be added off the Carolina and Georgia coasts (two from NOAA and six from North Carolina State University).

From these special scientific networks the federal and university researchers will try to get information about the various stages of a storm, what causes storms to develop very rapidly in coastal areas, what factors influence their growth rate and the paths they take. Such information will help solve one of the biggest problems for a forecaster: determining whether precipitation will be in the form of rain, freezing rain, snow, or sleet.

-The End-

Note to Editors: There will be some space on the larger aircraft, including NCAR's Electra and NOAA's P-3, for press on a first-come, first-serve basis by advance reservation. For further information about making arrangements to visit the GALE project between January 15 and March 15, 1986, or to tour the facilities during an open house and press conference on January 29, please contact:

Joan Vandiver Frisch, Manager
Media Relations and Information Services
National Center for Atmospheric Research
P.O. Box 3000, Boulder, Colorado 80307
Phone:(303) 497-8721 or (303) 443-5011

Genesis of Atlantic Lows Experiment

GALE

Data Users Guide

124 pages

- only samples here.

9 pages here

prepared by

Thomas J. Mercer

March 1987

GALE Data Center
Department of Physics and
Atmospheric Science
Drexel University
Philadelphia, PA 19104

Preface

This document represents a critical step in the GALE Data Center's (GDC) effort to ensure the maintenance and extensive use of the GALE data base. This will be the last major document released by GDC. As such, it provides an opportunity to review the progress in GALE data management to date and to identify the tasks which remain.

The primary data management objectives, as identified in the GALE Data Management Plan, were as follows:

- Organizing collection of all data of interest to GALE, including data collected by special observing platforms as well as the subset of conventional meteorological data pertinent to GALE.
- Supporting the operations and forecast teams with data.
- Timely preparation of preliminary data sets and analyses, so that information is available while interest is high and the details of an event are fresh in the minds of GALE participants.
- Identification of validation procedures in the preparation of research data sets by the various groups processing GALE data.
- Insuring the long-term availability of GALE data through the establishment and documentation of the GALE data archive.
- Preparation and maintenance of a catalog of the GALE data base.

Since April 1986, an extensive set of the data available for GALE has been compiled. With the assistance of the Data Management Committee, in its various manifestations, and the entire GALE community GDC has sought to identify and collect the many discrete pieces of data of interest to our users. These discrete pieces are a large focus of this guide. The data sets of primary value to GALE, as described in the Data Management Plan, are identified in this document. Many of these have been collected at GDC; others are held at other GALE affiliated institutions.

Over the period from July 1, 1986 through March 1, 1987, the GALE Data Center distributed approximately 140 digital tapes to representatives of 20 affiliate institutions. Extensive effort has been expended on production of a comprehensive in-situ sounding data set and a quality-controlled surface data set, versions of which are currently available. The data GDC is distributing which has had the highest quality-control is from NCDC's TD-3280 Surface Hourly Airways file and TD-6201 Upper Air file, for which we are most appreciative.

While much data have gone out the door of GDC, it has been preliminary in an important sense. Individual observations have been checked for internal consistency, but the need for extensive inter- and cross-comparison of data from different sources remains. These are the activities in which GDC will be absorbed over the next few months. We know that many of our users will be comparing various data sets. Such

validation of GALE data needs to be incorporated in information provided to the whole GALE community by GDC.

Validation of data has been a sticking point since the planning stages of GALE. GDC has striven to closely review and validate the sounding data, and is beginning this process on the surface data. Other archives such as NCAR and CIMSS have expended considerable effort in post-processing of GALE data. Still more investigators have compared data sets and provided valuable calibration information. Efforts will continue at GDC to foster exchange of information on data errors and quality.

The best method of validating GALE data is very simple: encourage scientists to use it. It takes considerable time and special effort to evaluate the accuracy and quality of data from diverse sources. As scientists use the data from various sources, they will learn how the data can be further synthesized for the benefit of other data users.

Archival of the data for GALE is a responsibility of GDC which is shared to a great extent among the user community. GDC's library now contains 600+ magnetic tapes provided by many institutions and generated at GDC, in addition to almost 200 videotapes, 150 rolls of microfilm, and reams of paper. Yet this includes very little radar and satellite data, and represents only a portion of the data of potential interest to GALE investigators. NCAR, CIMSS/University of Wisconsin, NASA, NCDC, MIT, University of Washington, and North Carolina State University are among the institutions extensively involved in archiving and processing GALE data. Contributions of many groups have enabled the storage of the extensive GALE data base.

The final objective outlined in the GALE Data Management Plan was the preparation and maintenance of a catalog of the data base. The GALE Data Users Guide carries the weight of this task. To the greatest extent possible, we have pinned down the components of the data base, frozen them in time, and described them in this catalog. Any catalog describing a collection as fluid as the GALE data base is bound to become outdated. The looseleaf format of the guide will allow us to accomodate the further development of the data base. This guide should be a living document, which continues to be current and useful as the real work in GALE progresses.

This guide is not a catalog of *observations*, but a catalog of *products*. The GALE Field Program Summary serves as a preliminary catalog of observations. Publishing a comprehensive set of indexes of observations from all GALE systems would result in a massive, expensive document which would be of little utility to many readers. GDC has taken another approach: indexes of the observations made during GALE are available as data products. Frequently, these indexes are built into or distributed with the data products themselves. This approach allows targeted distribution of this information to the individuals who need it most.

GDC is intended to serve as GALE's information clearinghouse. This catalog captures only some of the information that GDC handles. Much more information lies in the documentation of the various data sets and, of course, in the data themselves. GDC is GALE's library: we have many volumes of GALE data on our shelves, and if we don't have it, we can direct you to the groups which will accomodate you. We look forward to continuing our support of our users, expanding the base of GALE data users, and supporting the attempts of investigators to gain understanding through the application of GALE data.

Acknowledgements

Preparing this document has been less an exercise in writing than compilation. The information which is found in this document was provided by a large number of individuals and organizations whose contributions have been invaluable. I gratefully acknowledge the assistance of all those who have contributed thus far, particularly the members of the GALE Data Management Committee. I welcome further feedback and input from any and all members of the GALE community.

Among all of the contributions which have been made to handling GALE data, the efforts a few individuals deserve special recognition. Chris Velden of the University of Wisconsin coordinates the satellite data processing efforts and is a dependable source of information on satellite data. Woody Roberts of NCAR ably manages the extensive GALE radar program. The expertise and committment of these two individuals has greatly benefitted myself and all GALE data users. Al Riordan of North Carolina State University has worked diligently to produce a high quality set of surface marine data, which will be of great utility to many GALE participants. James Franklin of NOAA-HRD provided GALE with an excellent set of dropwindsonde data. As part of his coordination of the entire GALE program, Richard Dirks, the GALE Project Director, has provided GDC with thoughtful criticisms of our efforts. Dick has chaired the GALE Data Management Committee, which helped to clarify the objectives of GALE data management and to ensure that GDC's efforts would meet the needs of the community.

Closer to home, the many individuals at Drexel University who form the nebulous staff of the GALE Data Center are the true foundation of this document. Without the talents and hard work of Bob Cohen, Shing Yoh, Ed Hartnett, Pieter Kreyns, Alice Presley, Tom Kreitzberg, and Harry Buhl, this document would be considerably thinner, for there would be no data products to speak of. Don Perkey has consistently contributed with feedback, support, and, most importantly, patience. Finally, Carl Kreitzberg has labored through numerous versions of this text with an eye toward including information which is accurate, succinct, and of greatest potential utility to the meteorological community.

Thomas J. Mercer
GALE Data Manager
March, 1987

Genesis of Atlantic Lows Experiment

GALE

Data Users Guide

Version 2.0: March 1988

The rest of the manual exists - not here - at NCAR

Genesis of Atlantic Lows Experiment

GALE

Field Program Summary

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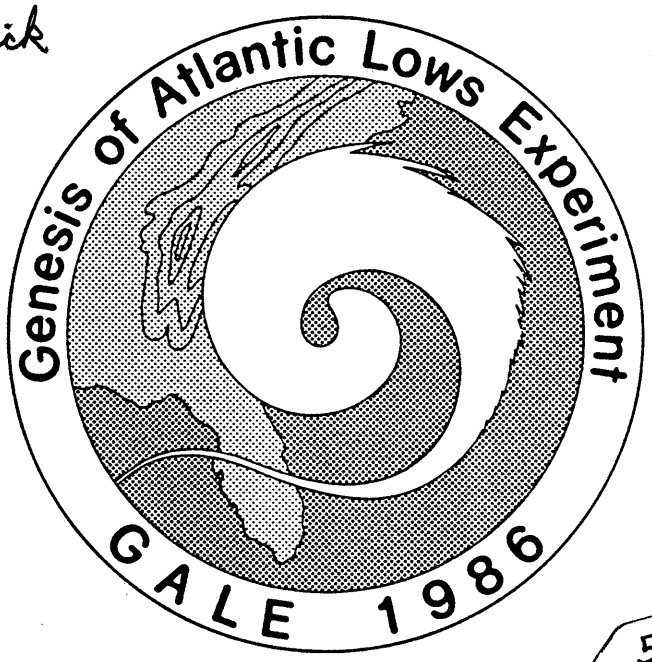

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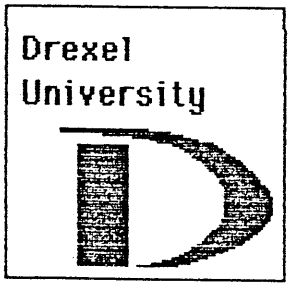
prepared by
Thomas J. Mercer and
Carl W. Kreitzberg

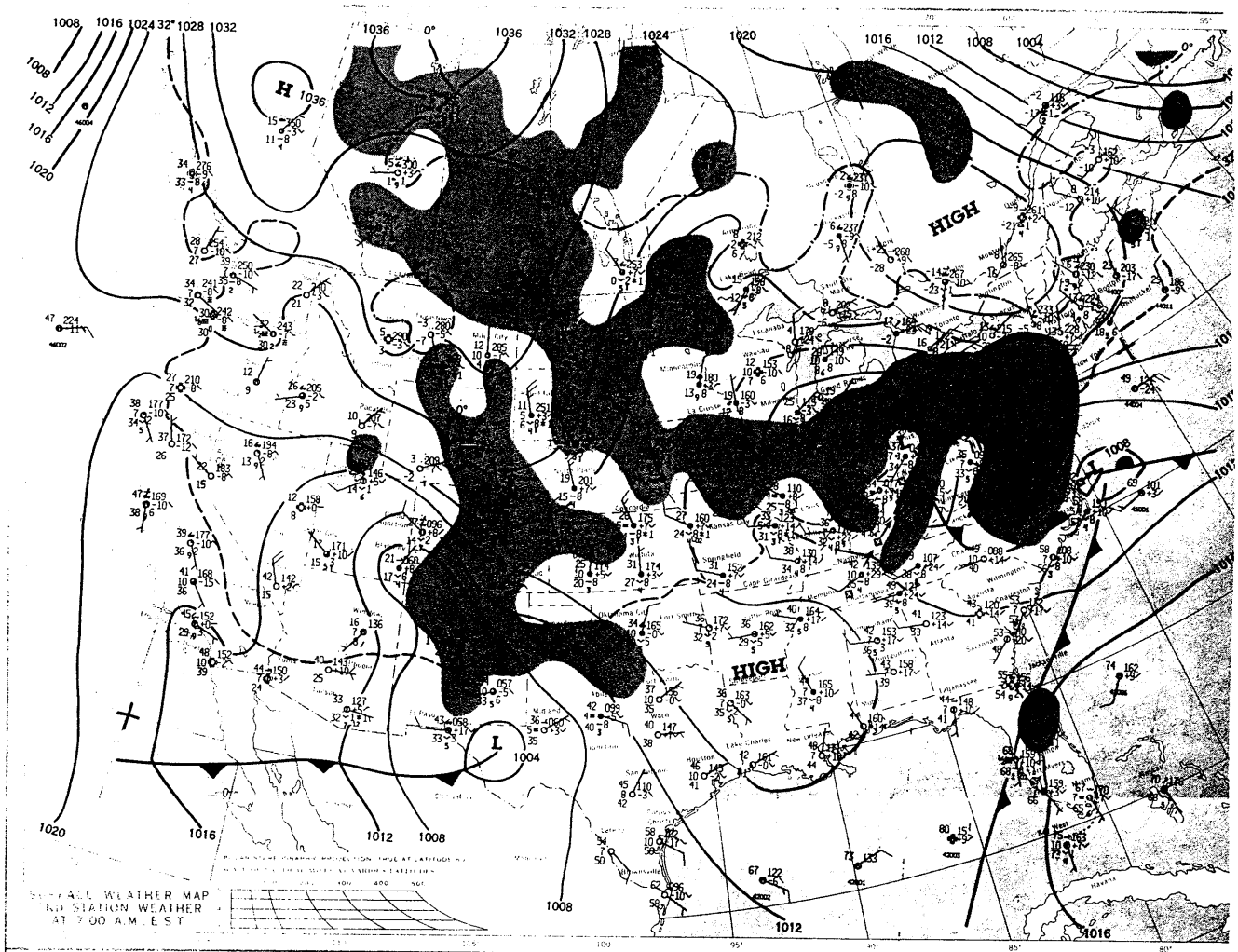
May 1986

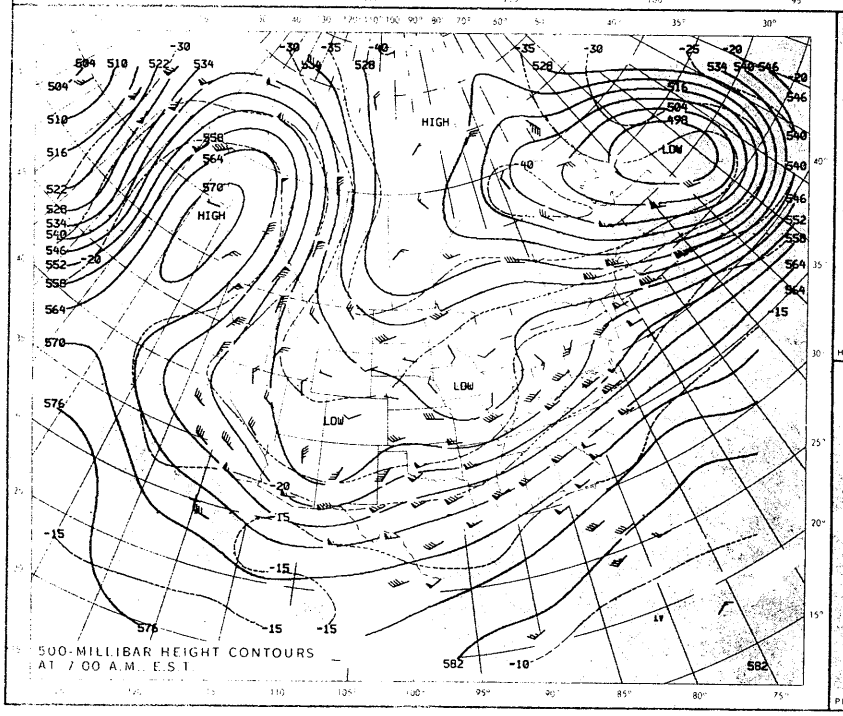


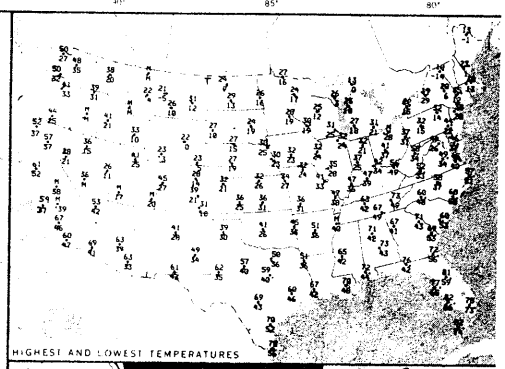
GALE Data Center
Drexel University
Department of Physics &
Atmospheric Science
Philadelphia, PA 19104

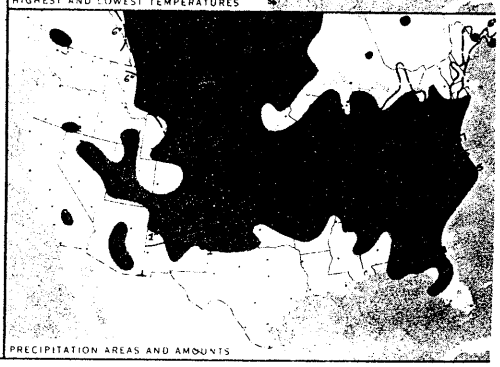
Genesis of Atlantic Lows Experiment
GALE

Field Program Summary
May, 1986









GOES IMAGERY FOR THE GENESIS OF ATLANTIC LOWS EXPERIMENT

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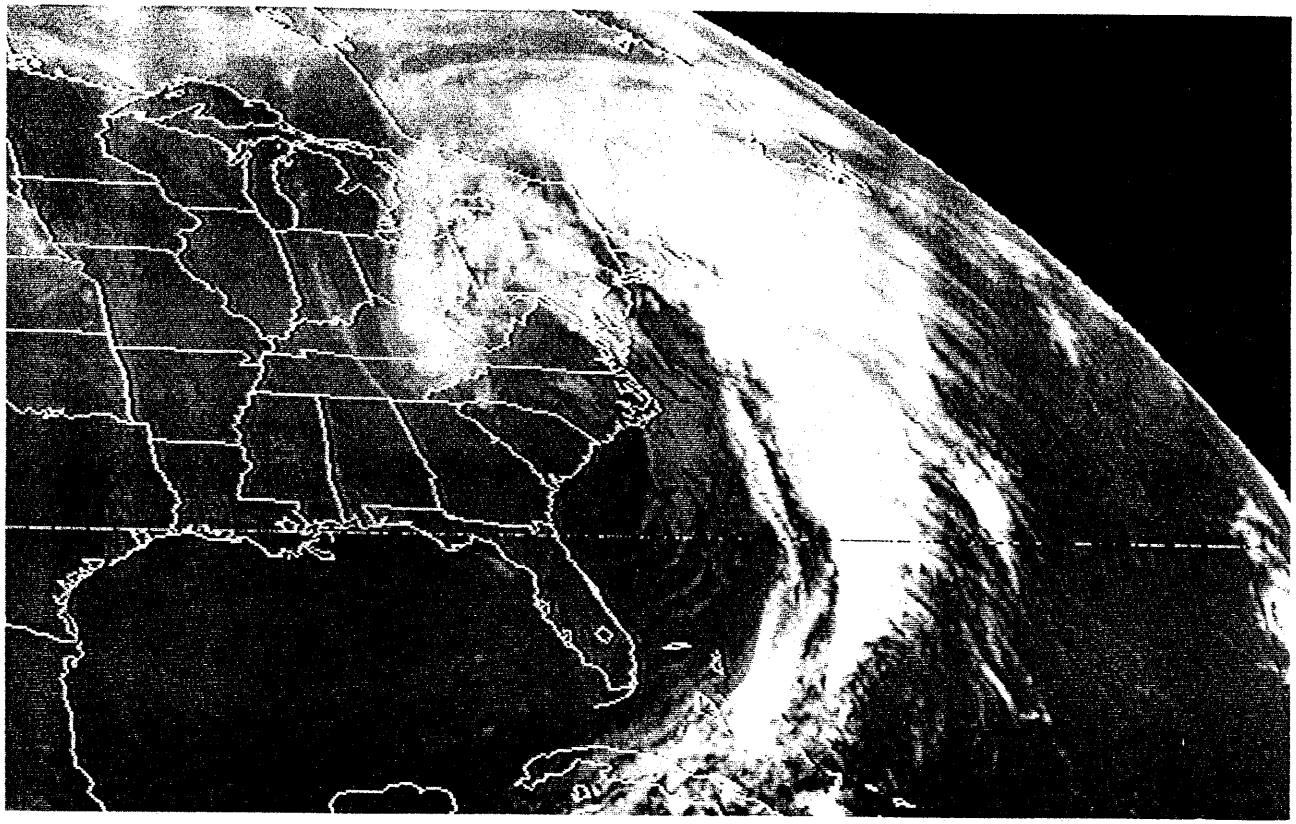
GALE PERIOD: JANUARY 15 - MARCH 15, 1986



262 pages

BY CHRISTOPHER VELDEN AND JANET PYEATT

SPACE SCIENCE AND ENGINEERING CENTER
UNIVERSITY OF WISCONSIN-MADISON

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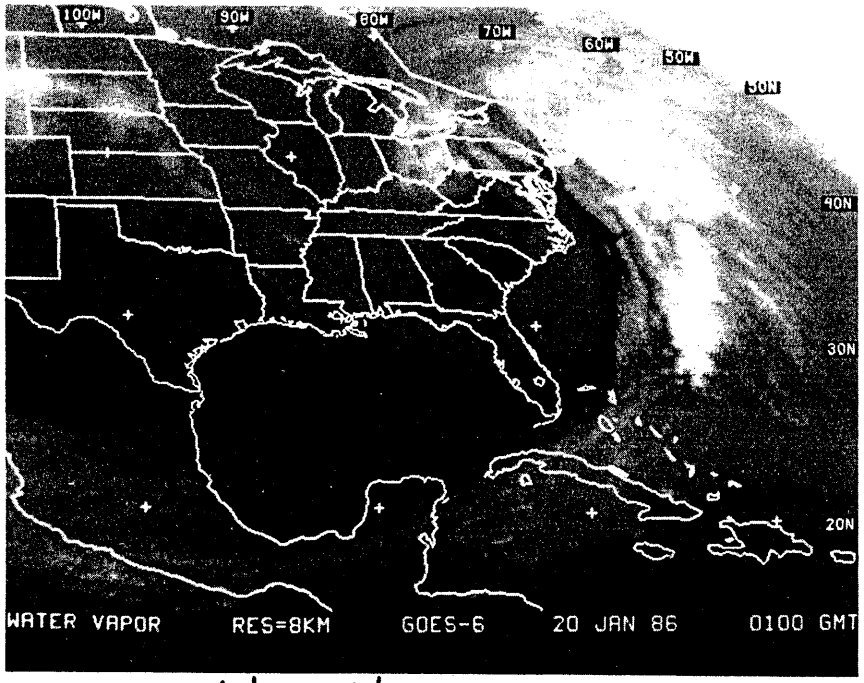
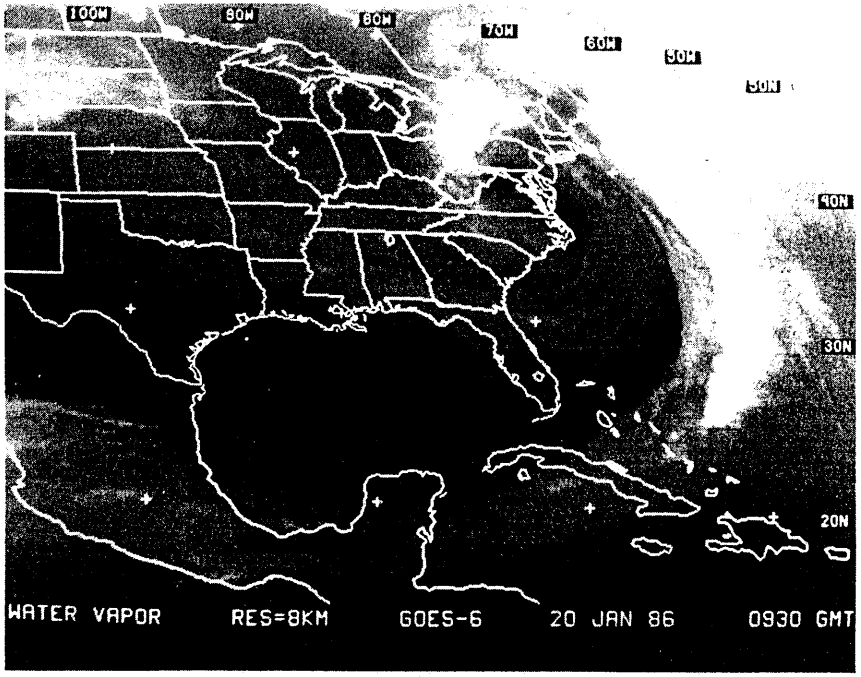
National Aeronautics and Space Administration Under Grant NAG 5-742

JULY 1987





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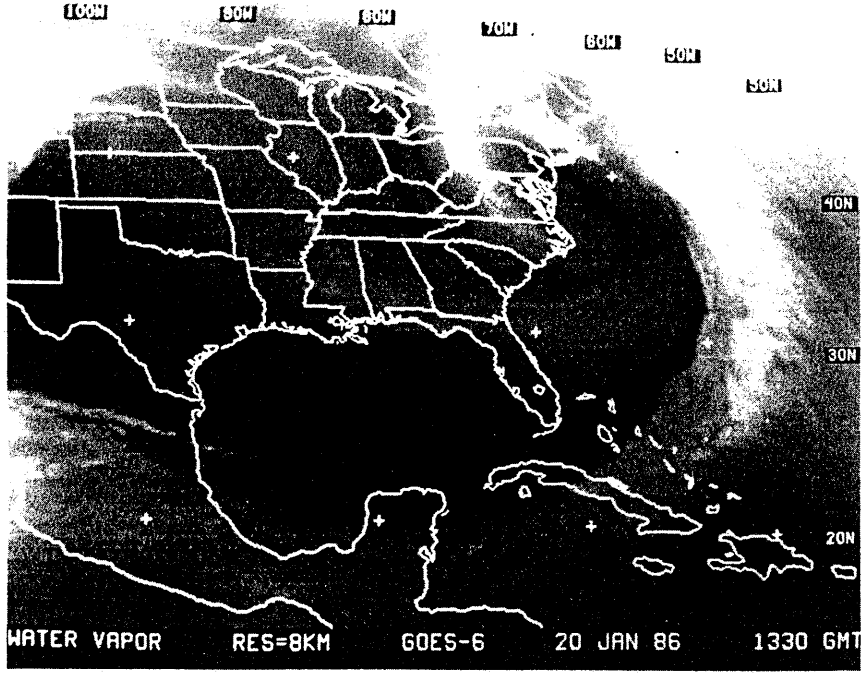

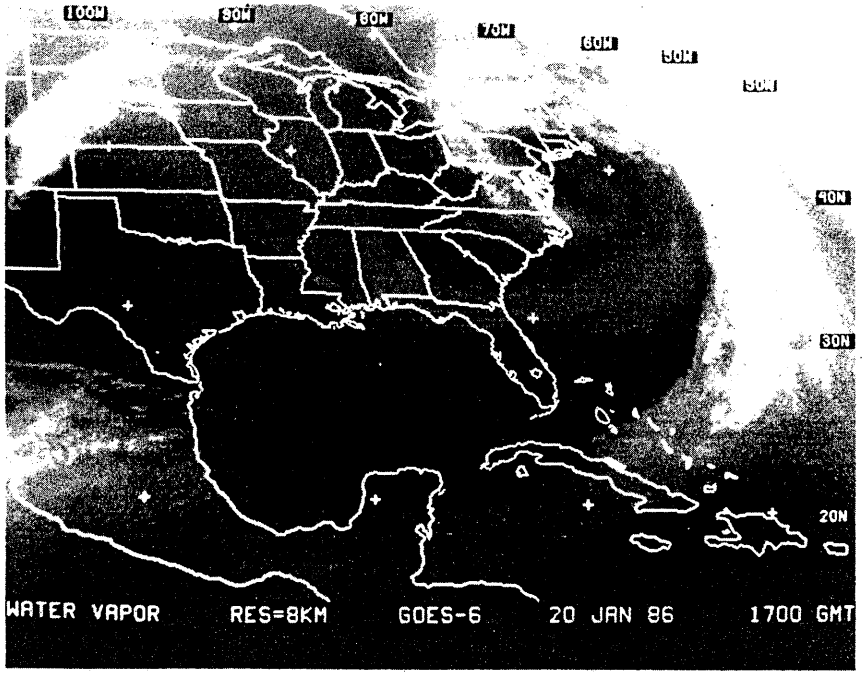

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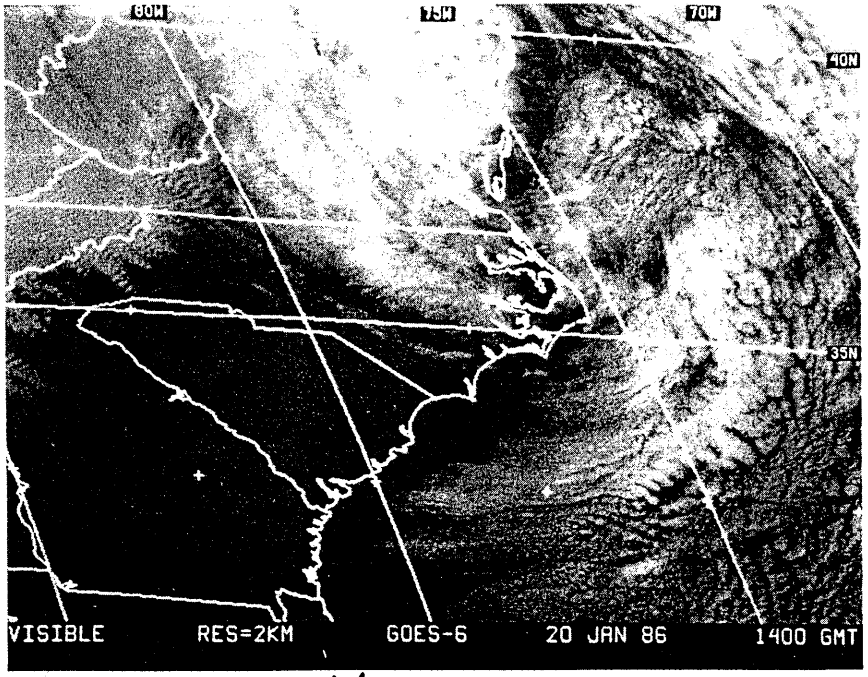

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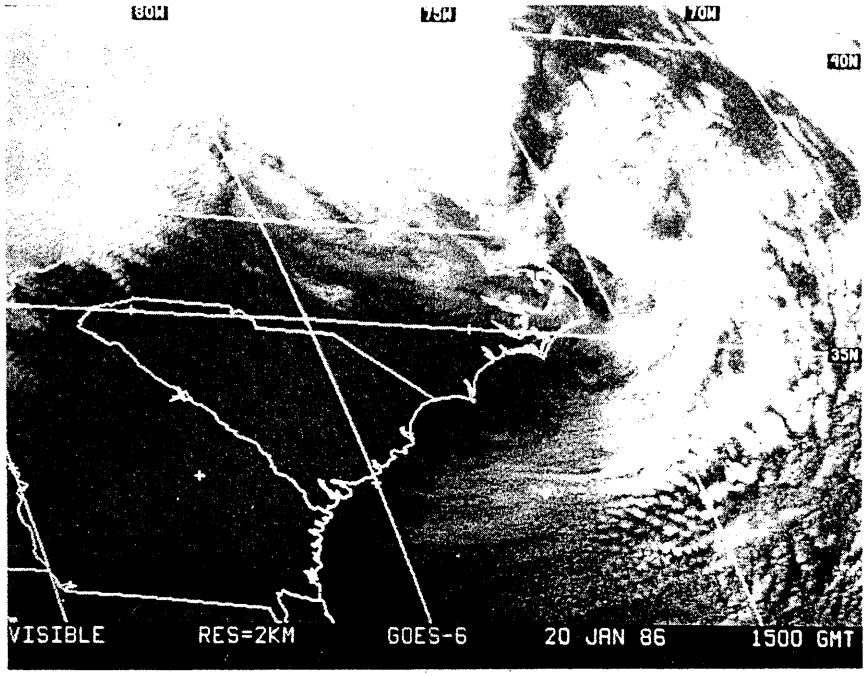

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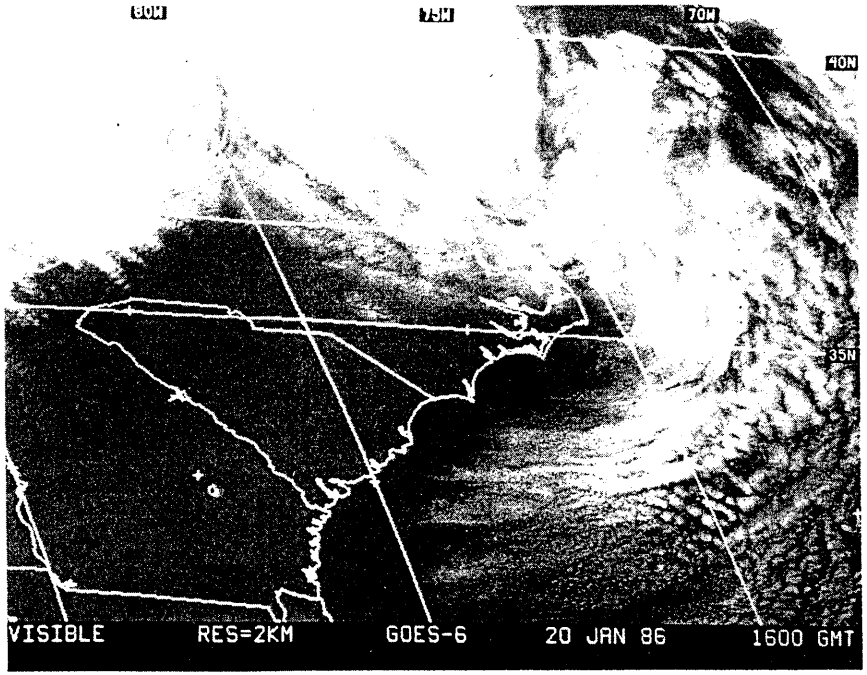

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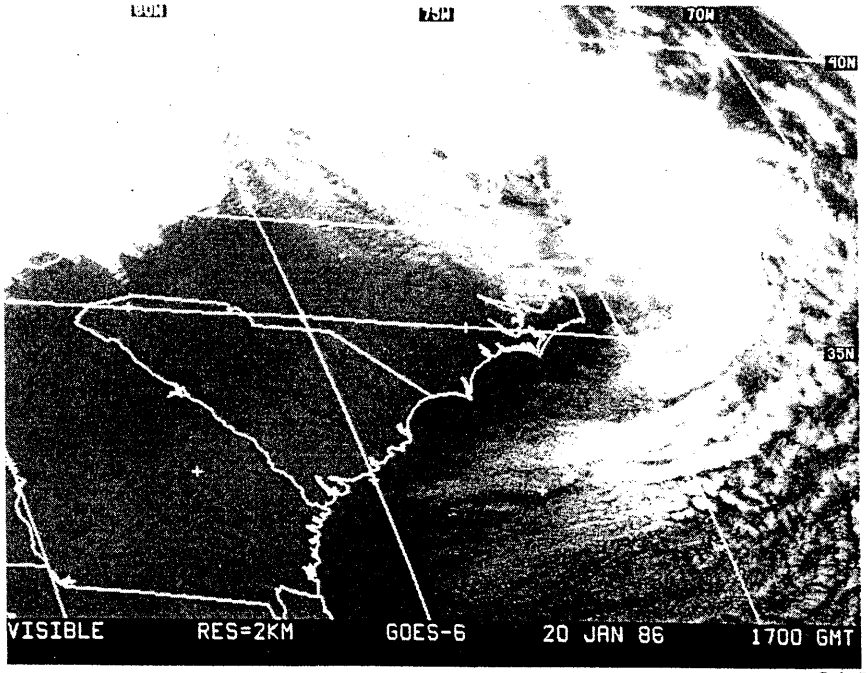

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GALE

A Final Report to

National Aeronautics and Space Administration

for

Rain Maps

Atlantic Ocean Satellite Rain Maps for GALE

Contract #NAG5-742

University of Wisconsin Account #144X701

This report is 1.1 cm thick

for the period of

1 October 1985 through 14 April 1988

submitted by

David W. Martin
Brian Auvine
Barry Hinton

Space Science and Engineering Center
at the University of Wisconsin-Madison
1225 West Dayton Street
Madison, Wisconsin 53706
(608)262-0544

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April 1988

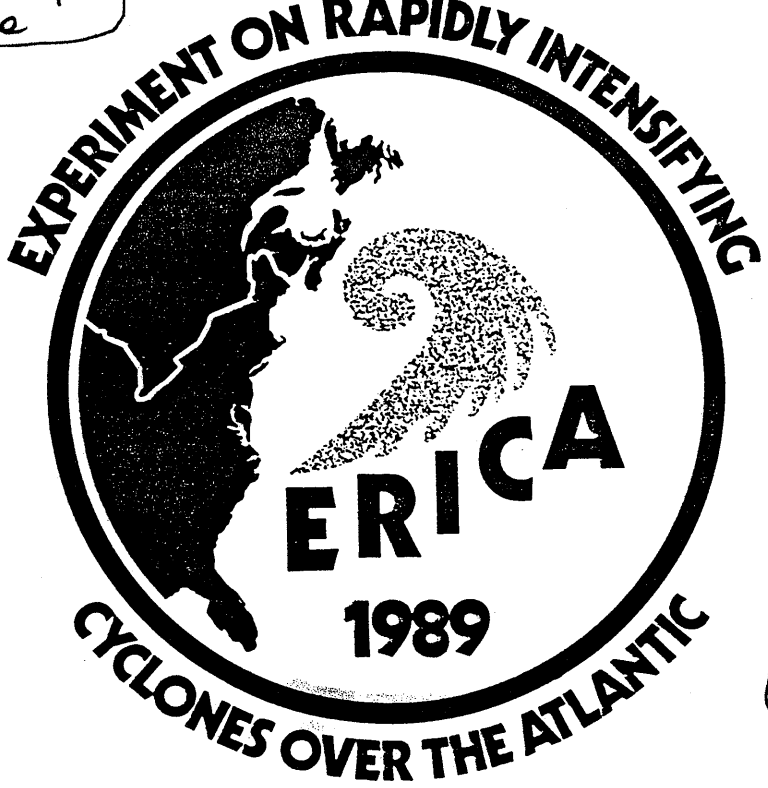
ERICA

Experiment on Rapidly Intensifying Cyclones over the Atlantic

Data Users' Guide

March, 1990

This report has 117 pages
- R Jenne



6 pages are here

Edward Hartnett
ERICA Data Manager

Dr. Carl W. Kreitzberg
Principal Investigator

ERICA Data Center
Department of Physics and
Atmospheric Science
Drexel University,
Philadelphia, PA 19104
(215) 895-2786

Preface

The ERICA Data Users Guide is expected to help researchers select products of most use. In most cases they will discuss their order with the Data Manager before making a final decision.

The goal of the ERICA Data Center is to allow more researchers to efficiently study more storms with more types of data. Clearly these data will be unique for five to ten years. It is our intention to distribute as much data as widely as possible as soon as possible such that it will be available from NCDC, NCAR and other data centers in the future.

The role of a project data center evolves from planning for the field study to collection of all the data to combining like data from different platforms to allowing ready access to data of diverse types along with necessary documentation. The CD ROM should make it possible for a large number of scientists to work with good data.

This role falls short of making the data readily visible to the researchers. The problem is that the user community does not yet have a common base of computer workstations and software. Most scientists have their own methodology and computer environment tailored to what was practical, not to the ideal that can be achieved in the near future.

Since practical hardware and software for displaying different data types, including digital satellite data, radar data, research aircraft data and numerical analyses and predictions, is only now becoming available, the most we can hope for is that the GALE and ERICA data sets can be used as examples that can be integrated into research workstations in the future. The most advanced workstations now deal with data in the real-time data stream, rather than data assembled, completed and corrected over periods of months after the event.

This Center will assist exchange of information on the data set problems among investigators. Our experience has been that few researchers report problems they find in the data sets to the Data Center. The reason for this breakdown in communications is the time it might take to document and transmit problem reports. The need to publish takes precedence over the need to advise others in general of problems in data sets. We all must recognize that deficiencies most certainly exist that will only be uncovered by researchers and this information must be provided to the Center if others are to be spared from the difficulties these cause. A simple call, E-mail, or note by regular mail would be appreciated!

Carl W. Kreitzberg
March 14, 1990

ERICA Data Users' Guide

March, 1990

Table of Contents

ERICA

Experiment on Rapidly Intensifying Cyclones over the Atlantic

Satellite Atlas

This report has 235 pages

4 pages are here -R Jenne

Edward Hartnett
ERICA Data Manager

Charles Browne
Assistant Data Manager

Department of Physics and Atmospheric Science
Drexel University
Philadelphia, PA 19104
(215) 895-2786

June, 1989

Introduction

The Experiment on Rapidly Intensifying Cyclones over the Atlantic (ERICA) seeks to develop new scientific understanding of the rapid intensification of storms at sea. The field phase of ERICA began on December 1, 1988, and ended on February 26, 1989; the ERICA Field Phase Summary (FPS) provides a quick reference to the weather studied and the data collected during the field phase. This Atlas is intended to supplement the FPS by providing a three hour sampling of the satellite imagery in an easily distributable form.

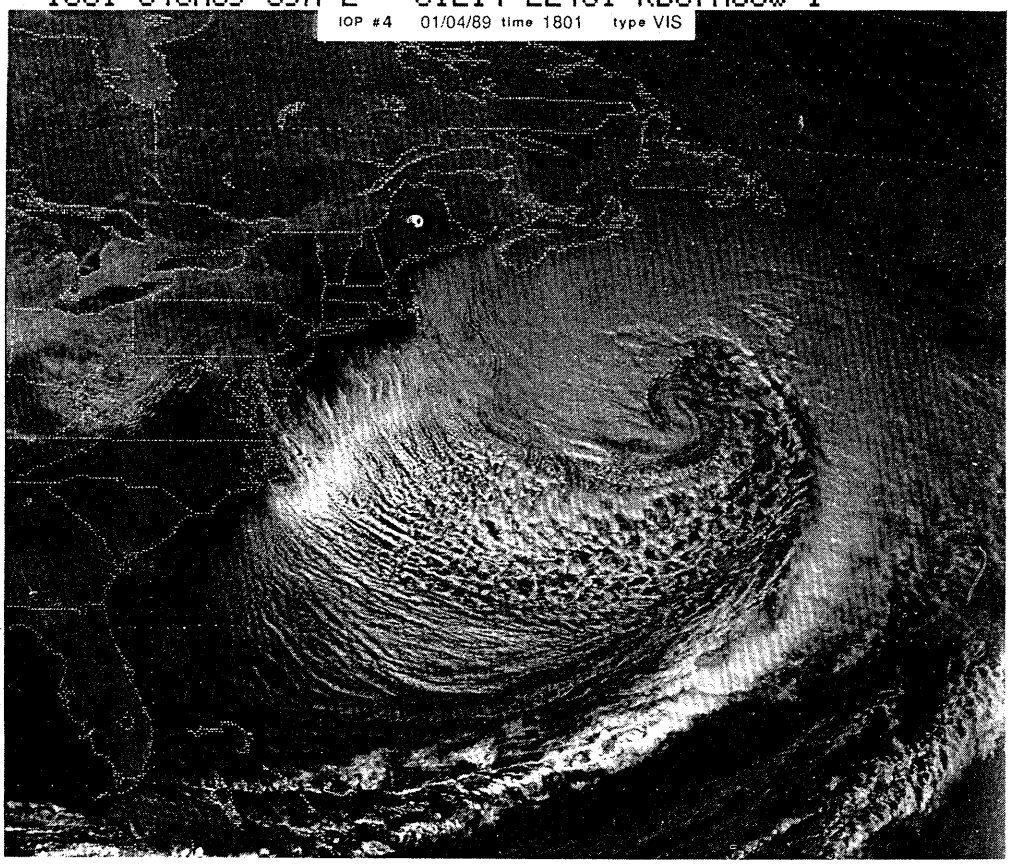
The ERICA operational forecasters and Airborne Mission Scientists relied heavily upon the many different satellite data products available at the National Environmental Satellite Data and Information Service (NESDIS), in the World Weather Building near Washington, D.C. The GOES (Geostationary Operational Environmental Satellite) imagery sampled in this Atlas is only one of these products. There are over 1500 GOES images from the ERICA field phase; visible, infrared, and water vapor. The imagery included in this Atlas are listed in Appendix A. A complete list of the ERICA GOES imagery can be found in Appendix E of the FPS. Other satellite data products are described in the ERICA Field Operations Plan, and will be further described the the ERICA Data Users Guide, which will be released in March, 1990.

This Atlas also contains satellite imagery received by the Mark IV system at MacDill Air Force Base. All of the 153 images from the Defense Meteorological Satellite Program (DMSP) which were collected for ERICA are included in this Atlas. A complete list of the DMSP imagery can be found in Appendix B.

IMAGERY INDEX

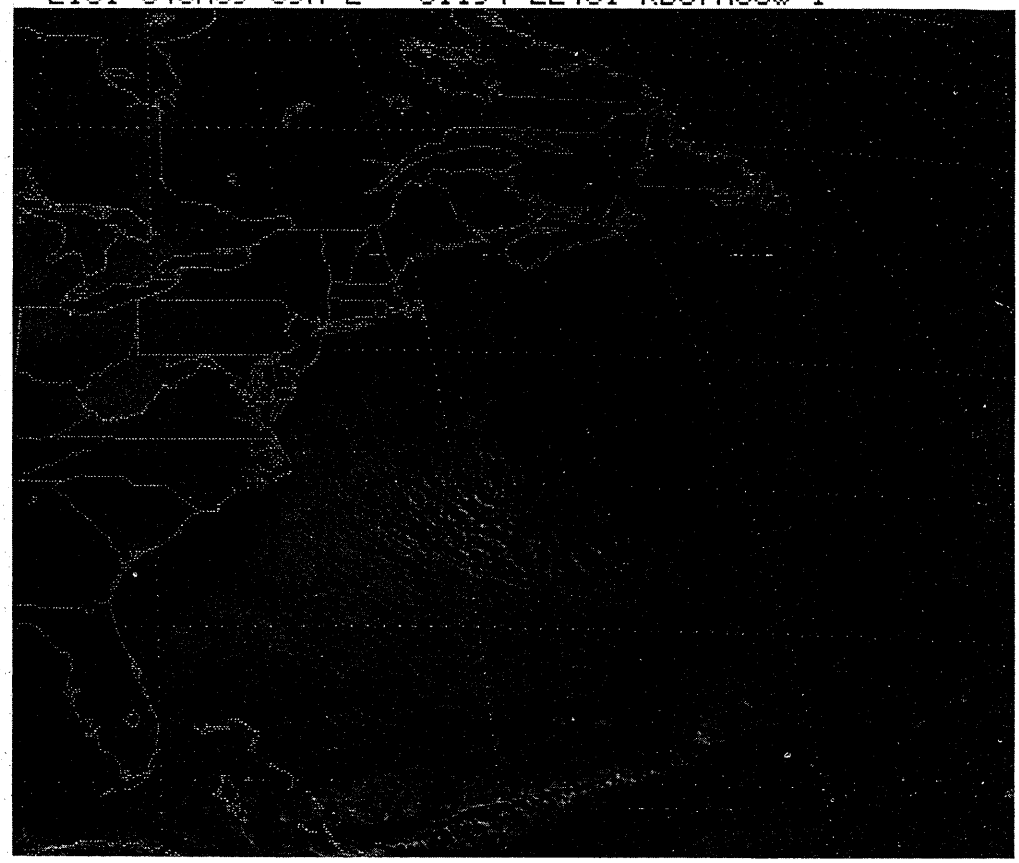
Erica

1801 04JA89 39A-2 01214 22481 RB37N68W-1



Erica

2101 04JA89 39A-2 01194 22481 RB37N68W-1



8/24/90

Edward J. Hartnett
Carl W. Kreitzberg

ERICA CD ROM 1
-or-
ERICA's Greatest Hits

Welcome to the first ERICA CD ROM. We have endeavored to provide the highest quality data sets on this CD, but there may be problems and errors. If you find any, please report them to the Data Center immediately. Periodically, or upon request, we will notify researchers of any reported problems in the data, or any changes in the software. If you have not received this CD directly from that Data Center, you might want to drop us a note with your name and address so that we can put you on our CD mailing list. We anticipate that news letters will be sent out around January and July of 1991. You can reach us at:

The ERICA Data Center
Department of Physics and Atmospheric Science
Drexel University
32 and Chestnut Streets
Philadelphia, PA, 19104
(215) 895-2786
OMNET: ERICA.DATA.CENTER
internet: edc@convex.drexel.edu

This is from the ERICA CD-Rom

Acknowledgements

Preparing the data sets for this CD took substantial work. It would not have been possible without the help of many people. Dr. Ron Hadlock, the ERICA Field Director, provided invaluable help with the ship and buoy data; Dr. Norman Donaldson of AES supplied a lot of data, and provided complete information on Canadian data sets. Mr. Sam McCown of NCDC provided most of the U.S. surface, upper air, and SST data. We also owe our thanks to Vin Lally and Claude Morel of NCAR, Gerry Crescenti of WHOI, and the staff of NCAR/RAF and NOAA/OAO. The ACARS commercial aircraft reports were provided by NOAA/PROFS; the geographic data were obtained from Dennis Josephs, NCAR Data Support Section.

Robert Cohen, Dr. Jing Guo, and Chuck Browne all worked on the data sets at the Data Center.

ERICA is funded under Office of Naval Research contract N00014-85-C-0518.

Data Distribution Policy

Over 100 copies of this CD are being distributed to ERICA scientists at no charge. Additional copies are available for $35 each. Data are also available on EXAbyte tapes (each holds 2.3 gigabytes), magnetic tapes (40 or 130 megabytes/tape for 1600 and 6250 bpi, respectively), floppy disks (IBM or Macintosh), and paper. Prices, effective 9/1/90, are listed below. We anticipate that data will be available on DAT tapes by mid-1991. The satellite and aircraft digital data will be distributed in large quantities only on EXAbyte and DAT tapes.

CD ROM:	$35
EXAbyte tapes:	$35/Gbyte
magnetic tapes	

for sets on the CD:	$75
for other sets:	$50
floppy disks:	$10
paper	$.10/page

The CD Data Sets

Each data set comes completely equipped with its own documentation and sample program. The sample program is not intended to access all of the data (usually), but only what can easily be displayed on a computer screen. To access other parameters you must add variables and change the format statements. The programs usually request a file name to read from. You must also provide the path to the file (i.e. if the data file is in a different directory or folder you must supply that information in the filename). The ways to do that vary from computer to computer - see your own FORTRAN documentation for details. You must compile the programs yourself.

Our goal has been to provide data sets which are convenient and simple. Almost all of the data sets are in ASCII; record lengths are relatively short, and, since each data set is divided into daily files, the file sizes are usually small. Units have been changed to decimal degrees for latitude and longitude (instead of degrees and minutes). All temperatures have been converted to Celsius and wind speeds have been converted to meters per second. Relative humidity is with respect to water regardless of the temperature. We would be happy to hear any suggestions or criticism.

The data on this CD is divided into 14 directories, which are listed below. The numbers appearing next to the data set name are the sections in the ERICA Data Users Guide that describe the set. In some cases there is no section in the DUG describing the set, since the set was developed after the Guide was released.

P3FLD - Compressed P3 Flight Level Data, version 2 (2.1.1)

NCARFLD - Compressed NCAR Flight Level Data, version 2 (2.2.1)

OTHERAC - PIREPS from PROFS, ACARS, version 2 (2.3.2)
WC-130 Flight Level Data, version 2 (2.3.1)

SND2 - Master Sounding Files, version 2 (3.1.1)
(Including balloon sonde, drop sonde, and research aircraft soundings.)

SST14 - 14 km ASCII SST files, version 2 (5.8.1)

SST50 - 50 km ASCII SST files, version 2 (5.8.1)

EDC3280 - EDC Reformatted NCDC Surface Hourly Airways (TD-3280), version 4 (6.3.1)

DATSAV - EDC Reformatted DATSAV Surface Data, version 2 (6.3.4)

CANHLY - EDC Reformatted Canadian Surface Hourly, version 1

MESONET - EDC Refomatted Nova Scotia Mesonet Data, version 1

SHIP - EDC Combined TD-1129 Format Ship Data, version 5 (6.5.3)
(Including NCDC, Canadian, and U.S. Navy data)

BUOY - EDC Combined Buoy and C-MAN Data, version 1 (6.5.8)
(Including drifting buoys, AES and WHOI moored buoys, NWS buoys, and C-MAN sites.)

DOC - CD ROM Docmuentation
(Including this file and the text of the ERICA Data Users' Guide, version 1.)

GEOG - North American Detailed Elevation and Land Use Data Sets,
(Including global elevation, percent water, and surface characteristic data.)

Documentation

Documentation for these data sets can be found in the data's directory. Since much of the documentation that we received has been hardcopy, there is a considerable volume of hardcopy that is distributed with each CD on microfiche. We have tried to include enough (digital) documentation with each data set so that if the hardcopy is lost, the CD does not become useless. If you cannot arrange access to a microfiche machine, contact the data center for paper copies of whatever documents you are interested in.

For data sets which are EDC reformatted or compacted version of the data sets, the documentation on the CD supercedes the hardcopy documentation, which describes the original (unreformatted) data sets.

PLEASE NOTE: The text copy of the ERICA Data Users' Guide which is included in the DOC directory on the CD is no longer fully accurate. In all cases where it disagrees with a data set's documentation, believe the documentation that goes with the data set. The ERICA DUG needs to be, and will be, updated. Please contact the ERICA Data Manager if you have any questions.

Other ERICA Data Sets

This CD contains only a fraction of the volume of ERICA data. Radar data (from ground stations and aircraft), satellite data, and NMC gridded data are examples of ERICA data sets that are not on this CD. In the coming months these sets will be worked on at the ERICA Data Center. Contact the ERICA Data Manager for more details on any data set.

Julian Calendar

The Julian Calendar for the ERICA Field Study is reproduced below for convenience, as Julian day appears frequently in the data set names.

November 1988

Calendar Day							Julian Day of the Year						
Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5			306	307	308	309	310
6	7	8	9	10	11	12	311	312	313	314	315	316	317
13	14	15	16	17	18	19	318	319	320	321	322	323	324
20	21	22	23	24	25	26	325	326	327	328	329	330	331
27	28	29	30				332	333	334	335			

December 1988

Calendar Day							Julian Day of the Year						
Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa
				1	2	3					336	337	338
4	5	6	7	8	9	10	339	340	341	342	343	344	345
11	12	13	14	15	16	17	346	347	348	349	350	351	352
18	19	20	21	22	23	24	353	354	355	356	357	358	359
25	26	27	28	29	30	31	360	361	362	363	364	365	366

January 1989

Calendar Day							Julian Day of the Year						
Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31					29	30	31				

February 1989

Calendar Day							Julian Day of the Year						
Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa
			1	2	3	4				32	33	34	35
5	6	7	8	9	10	11	36	37	38	39	40	41	42
12	13	14	15	16	17	18	43	44	45	46	47	48	49
19	20	21	22	23	24	25	50	51	52	53	54	55	56
26	27	28					57	58	59				

March 1989

Calendar Day							Julian Day of the Year						
Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa
			1	2	3	4				60	61	62	63
5	6	7	8	9	10	11	64	65	66	67	68	69	70
12	13	14	15	16	17	18	71	72	73	74	75	76	77
19	20	21	22	23	24	25	78	79	80	81	82	83	84
26	27	28	29	30	31		85	86	87	88	89	90	

ERICA Intensive Observation Periods

For reference to ERICA IOPs, the list below includes Julian days.

```
IOP 1.   (344) 1209/1200Z -  (345) 1210/1930Z
IOP 2.   (347) 1212/1500Z -  (350) 1215/0000Z
IOP 3.   (352) 1217/0000Z -  (354) 1219/0000Z
IOP 4.   (003) 0103/1200Z -  (006) 0106/1200Z
LOP 4A.  (011) 0111/1200Z -  (014) 0114/0000Z
IOP 5.   (018) 0118/1800Z -  (020) 0120/1200Z
LOP 5A.  (020) 0120/1200Z -  (021) 0121/1800Z
LOP 6P.  (026) 0126/1500Z -  (028) 0128/0600Z
IOP 6.   (039) 0208/0800Z -  (040) 0209/0100Z
IOP 7.   (043) 0212/0600Z -  (044) 0213/1200Z
IOP 8.   (055) 0224/0600Z -  (056) 0226/1200Z
```

Line Feeds, Carriage Returns, and You

A problem that came up with this CD was the problem of record delimiters. In text files (such as this one) a special character is stored at the end of each record (i.e. at the end of each line of text). In UNIX systems the line feed is used (a.k.a. LF, ^J, or ascii character 0A). On the Macintosh the carriage return is used (a.k.a. CR, ^M, or ascii character 0D). IBM PC compatables use both CR and LF (in that order) on their text files. Note that this is software dependent in that word processing software may be able to read files with different record delimiters than those described here.

Since we want this CD to be accessible on all of these computers, each record of the text files has a CR and a LF (in that order). When these files are displayed with a UNIX-based word processor each line has a ^M at the end of it. On the Mac each line has a little square at the beginning (which is the Mac way of displaying non-printable characters, such as LF).

The additional characters should not bother your compiler, but if it does, use some kind of global change feature in your editor to

remove the extra characters.

Although we were originally planning to add CRs to data files, so that they too could be examined with a word processor, we decided not to when we realized that the introduction of an extra byte at the end of each record might cause programming complications. Instead we have included a program in the DOC directory which will add CRs to the end of each line of a text file. The program, addcr.f, can easily be modified to add LFs, remove CRs, or whatever other weird requirement your computer and software might be more comfortable with.

When running a FORTRAN program which does formatted reads, the record delimiter is used by the program to find the start of the next record. This is reflected in the fact that a formatted FORTRAN read will always advance the file position pointer one entire record, no matter how many bytes have been read. On our computers the FORTRAN read recognized either CRs or LFs as record delimiters. The data files on this CD have LFs.

The only data files to which CRs have been added are the aircraft one-minute data files and the sounding data comment files.

Overview of the specific files on the ERICA CD-ROM #1

This is a directory of the contents of the ERICA CD-ROM #1. For each directory, the total size including documentation (in megabytes - 1 Mb = 1024*1024 = 1,048,576 bytes) is given below the directory name. This total size is either exact or a close approximation of the space used.

Next to the directory name is a brief listing of the files contained within that directory. Most data files on the CD have a similar format: name[jjj].dat, where name is a data-set-specific name and [jjj] stands for the Julian date of the data contained within that file. In the comments column the range of days (represented by the Julian date -> 291 to 366 from 1988, 001 to 075 from 1989) are given for each set so named this way.

Exact sizes in bytes of specific files are given in the Size column to give an idea of the filesizes in each set, and to also compare with the filesize on the CD.

Directory	File(s)	Size	Comments
DOC 80 kilobytes	CDROM.DOC, intro.dug, chap2, chap3, chap4, chap5, chap6, chap7, addcr.f		These files contain the text of the ERICA Data Users' Guide, as well as this file which you are now reading, and the program addcr.f
P3FLD 119.7 Mb	p3fld.doc, rdedcp3.f, rd1min.f, rdp3t.f, minute2.f, E101041E.DAT, E*.DAT, e101041e.1mn, e*.1mn	 5046400 bytes 118.5 Mb total 46937 bytes 1.1 Mb total	There are 26 sets of P3 data (DAT, 1mn files). The DAT files are approximately 5 Mb in size, while the 1mn files run about 45k.
NCARFLD 43.8 Mb	ncarfld.doc, rdncar.f, ELcoarse.f, SLcoarse.f,		There are 19 sets of Electra data (hdr, bin, and 1mn). The bin data are the largest and range in size from 12k to

	el011611.bin,	2805920 bytes	3 Mb, averaging 1.5 Mb.
	el*.bin,	20.2 Mb total	There are 24 sets of Sabre-
	sl012411.bin,	738760 bytes	liner data.
	sl*.bin,	17.9 Mb total	The Sabreliner bin data
	el011611.1mn,	37822 bytes	range from 0.5 Mb to 1 Mb.
	el*.1mn,	254.5k total, average 40k	
	sl012411.1mn,	10551 bytes	
	sl*.1mn,	288.2k total, average 11k	
	el01161.hdr,	40663 bytes	
	el*.hdr,	754.5k total (all el*.hdr files are same size)	
	sl012411.hdr,	41915 bytes	
	sl*.hdr,	982.4k total	
OTHERAC	acars.doc,		There are 39 data files -
3.9 Mb	rdacars.f,		of these, 12 are roughly
	acars002.dat,	7281 bytes	6k, and 26 are about 100-150k.
	acars[jjj].dat		Day 355 is about 57k.
			The days included are:
	wc130.doc,		343-353, 002-006, 010-013,
	wc130.dat	54629 bytes	017-019, 025-028, 038-040,
			042-044, 054-057, and
			pre-ERICA 025-026.
SND2	psnd2ecd.doc,		The daily files ('.com' for
100 Mb	readpsnd.f,		comment, '.snd' for sounding)
	es2sites.doc,		run from 12/01/88 (1201)
	e2update.doc,		to 2/28/89 (0228). There
	e1notes.doc,		are 90 com files and 90
	e2com.doc,		snd files total.
	e2count.doc,		
	e2format.doc,		
	e2notes.doc,		
	e2table.doc,		
	sample.doc,		
	pes20101.com,	10933 bytes	
	pes2*.com,	1.3 Mb total, 11k average	
	pes20101.snd,	1127952 bytes	
	pes2*.snd,	98 Mb total, 1.1 Mb average	
SST14	sstascii.doc,		All data files are the same
5.0 Mb	rdsst14.f,		size. The days included are:
	ssta14.001,	139468 bytes	001, 004, 008, 011, 015, 018,
	ssta14.[jjj]		022, 024, 025, 029, 032, 036,
			039, 043, 046, 050, 053, 057,
			060, 064, 065, 067, 071, 074,
			078, 328, 332, 335, 339, 342,
			346, 349, 353, 354, 356, 360,
			363
quality	scdist.f,		This is a subdirectory
	scomp.buoy,	98410 bytes	within SST14.
	scomp.doc,		
	scomp.f,		
	scomp.res,	98343 bytes	
	scomp.sdif,	98343 bytes	
	sread.f,		
	srel.f,		
	srel.res,	45621 bytes	
	sstsoft.doc,		
	swrite.f		
SST50	sstascii.doc,		All data files are the same
2.1 Mb	rdsst50.f,		size. The days included are:
	ssta50.003,	58028 bytes	003, 007, 010, 014, 017, 021,
	ssta50.[jjj]		024, 028, 031, 035, 038, 042,
			045, 049, 052, 056, 059, 063,
			066, 070, 073, 077, 080, 084,

			320, 326, 327, 331, 334, 338, 341, 345, 348, 352, 355, 359, 362, 366
EDC3280 106.9 Mb	edc3280.doc, rdtd3280.f, edc3280.sit, src001.dat, src[jjj].dat, xtra.dec, xtra.jan, xtra.feb, xtrapw.obs	 921536 bytes 365390 bytes 472140 bytes 551440 bytes 107490 bytes	There are data for days 336-366, and 001-059.
DATSAV 32.5 Mb	datsav2.doc, datsav2.stn, rddatsav.f, datmiss, ds001.dat, ds[jjj].dat	 379134 bytes	The data files are roughly of similar size to ds001.dat. jjj varies between 002 - 059 and between 336 - 366.
CANHLY 31 Mb	canhly.doc, rdcan28.f, can001.dat, can[jjj].dat	 333147 bytes	There are data for days 336 - 366, and 001 - 060.
MESONET 12.0 Mb	mesonet.doc, rdmeso.f, meso.001, meso.[jjj],	 147836 bytes	The daily data range in size from 75k to 165k. The data go from 330 - 366, and from 001 - 060.
SHIP 9.8 Mb	ship.doc, rdship.f, exact.dec, exact.jan, exact.feb, inexact.dec, inexact.jan, inexact.feb, ship001.dat, ship[jjj].dat	 48000 bytes	The daily files range from 336 - 366 and from 001 - 059.
BUOY 6.6 Mb	edcbuoy.doc, rdbuoy.f, buoy001.dat, buoy[jjj].dat	 48328 bytes	There are 151 data files, from 291-366, and 001-075. The data file sizes vary from as low as 1.5k (outside of the ERICA timeframe) to 90k, with the average at roughly 50-60k.
GEOG 26.6 Mb			
	geog.doc,	6857 bytes	
ten_min	navygeog.doc readnav.f, rdedcxxx.f, edcelv10.dat, edcwat10.dat, edcchr10.dat, edcnav10.dat, direct.nav	18467 bytes 7751 bytes 4221 bytes 2374272 bytes 2374272 bytes 2374272 bytes 3816720 bytes 82671 bytes	There are three subdirectories within GEOG - ten_min, thrty_sc, and landuse.
thrty_sc	terr30.doc, unfold30.f, check30.f, read30.f,	10607 bytes 3670 bytes 2279 bytes 3662 bytes	

	fold30.f,	3158 bytes
	terr30.dat,	16206000 bytes
	direct.30	84315 bytes
landuse	landuse.doc,	5514 bytes
	rdedcuse.f,	5966 bytes
	edcuse.dat,	429030 bytes
	direct.use	33390 bytes

ERICA CD-ROM #1 Microfiche directory

This is a directory of the documentation on the six pages of microfiche that accompany the ERICA CD-ROM #1. This documentation is also sent along with the disc in hardcopy form; the fiche serves as a backup copy. Each microfiche holds 98 pages of text.

Fiche No. 1: NCAR documentation

Doc #	Documentation Name	Page #
	NCAR cover page	1
1	6/20/90 Error Memorandum	2
2	NCAR Bulletin No. 9	10
3	NCAR Bulletin No. 23 (pg 1-24)	74

Fiche No. 2: More NCAR Documentation

Doc #	Documentation Name	Page #
1	NCAR Bulletin No. 23 (pg 25-49)	1
2	NCAR Bulletin No. 24	26
3	NCAR Bulletin No. 25	61
4	Sabreliner Data Quality Report	68
5	Technical Field Support Report	81

Fiche No. 3: Son of NCAR Documentation

Doc #	Documentation Name	Page #
1	Sabreliner Research Flt. Repts.	1
2	CONCNC Error Memorandum	50
3	Electra Data Quality Report	52
4	Electra Project Tech. Report	68

Fiche No. 4: NCAR, CANHLY, DATSAV, SHIP Documentation

Doc #	Documentation Name	Page #
1	Electra Research Flt. Repts.	1
	CANHLY cover page	19
2	CANHLY documentation	20
	DATSAV cover page	39
3	DATSAV documentation	40
	SHIP cover page	48
4	SHIP documentation	49

Fiche No. 5: P3FLD, EDC3280 Documentation

Doc #	Documentation Name	Page #
	P3 cover page	1
1	P3 documentation	2
	EDC3280 cover page	57
2	EDC3280 documentation (pg 1-42)	58

Fiche No. 6: EDC3280, Mesonet, SST Documentation