

# Climatologist

## COMPREHENSIVE AEROLOGICAL DATA SET (CARDS)

### Introduction

The goal of the National Climatic Data Center's (NCDC) Comprehensive Aerological Reference Data Set (CARDS) project is to produce a quality global upper air data set based on daily radiosonde observations. The data set will be used in evaluating climate models, detecting climate change, and for mesoscale research. Sounds simple, but this is the first project undertaken to produce such a large scale and complex data set. The CARDS project is funded by the Department of Energy, NOAA's Climate and Global Change program, and the National Climatic Data Center. At NCDC, the Project Manager is Stephen R. Doty and the Project Scientist is Dr. Robert E. Eskridge. The global data base is being assembled from many sources; a quality control system is being designed; comprehensive station histories are being compiled; and research into bias adjustment techniques is being conducted.

Data for over 1,000 global stations are being collected and processed. CARDS will initially build a data base consisting of observations from 1970 to 1990. Somewhat surprising is that even developing countries have been able to maintain reasonably consistent observational programs. These data will be extended back to the 1930s (the beginning of upper air observations using the radiosonde instrument) and they will be updated with more current data on a periodic basis. See picture on back page showing the evolution of the radiosonde.

### Data Base Development Program

The CARDS project will generate three data bases beginning with a "raw" data base consisting of all upper air reports with no corrections applied. Second, there will be a quality controlled data base where duplicate and incomplete (less than three mandatory levels) observations have been deleted. Detected biases

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U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE

NATIONAL CLIMATIC DATA CENTER IN COOPERATION WITH  
AMERICAN ASSOCIATION OF STATE CLIMATOLOGISTS

*"These data bases are expected to contain some 20 million observations amounting to 50GB."*

will either be removed or identified in the third data base. The original or "raw" data base will reside on magnetic tape while the quality controlled and bias checked data bases are being loaded into a Relational Data Base Management System (RDBMS) on a UNIX-based workstation utilizing an 85-Gigabyte read-write optical jukebox.

These data bases are expected to contain some 20 million observations amounting to 50GB. As new data sources are acquired, such as from individual countries, the data will be added. As an example, utilizing bilateral agreements, a visiting scientist from the People's Republic of China may be joining the CARDS team in mid-1993, bringing additional data and expertise to the project.

#### *Quality Control Program*

The Comprehensive Hydrostatic Quality Control (CHQC) system, developed at the National Meteorological Center (NMC), has been modified and implemented to perform the initial quality control. The CHQC uses a hydrostatic check to detect and correct errors in reported temperatures and geopotential heights. It will bring a standard QC level against which all data will be judged.

Dr. Oleg Alduchov of the Russian Research Institute of Hydrometeorological Information is working with the CARDS project team to develop more complex and comprehensive quality control algorithms. His new QC procedures will be applied in later stages of the CARDS project.

*"Systematic errors or biases in the temperature and/or humidity data from radiosondes can hide true climatic trends."*

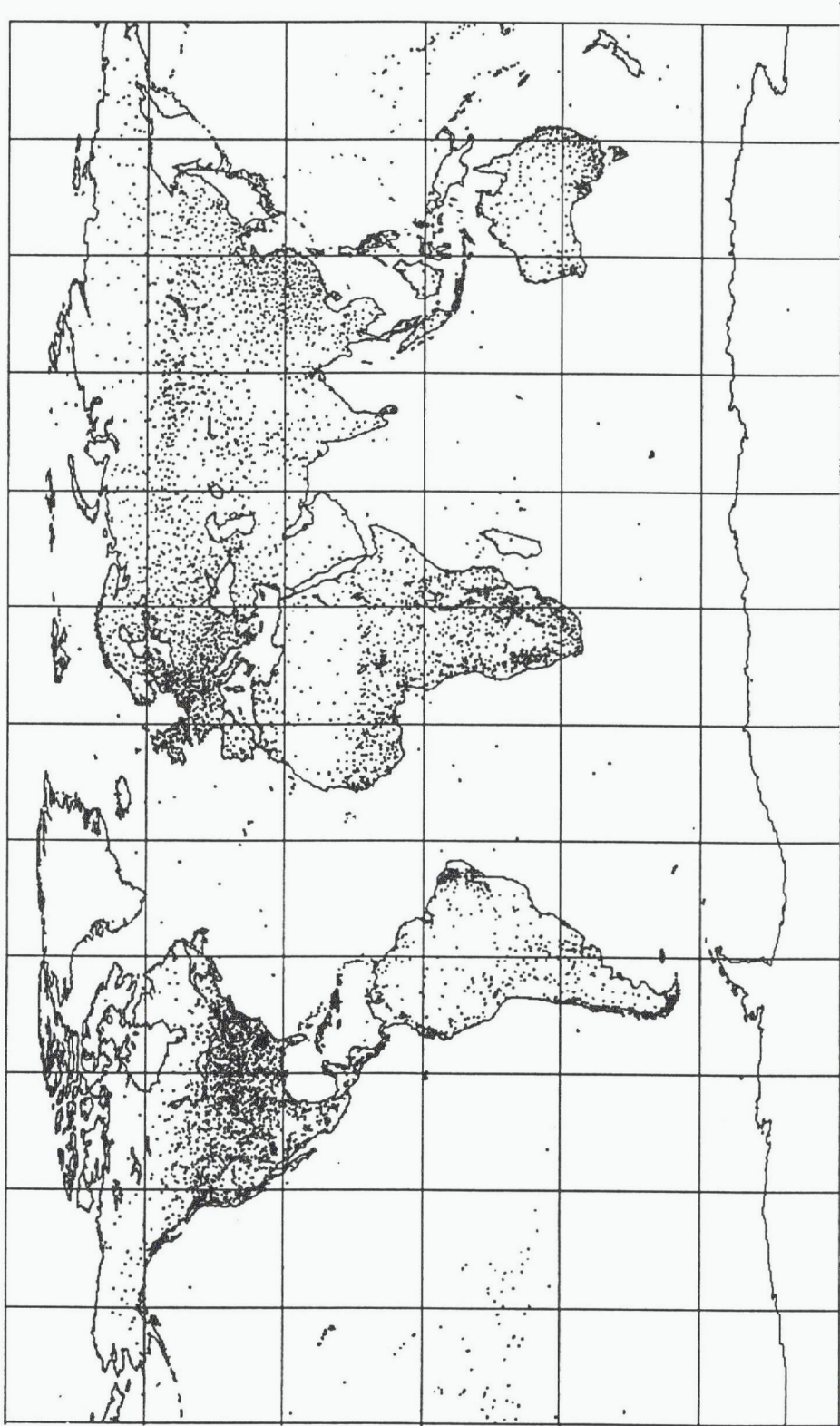
#### *Station History Program*

The CARDS station history has been designed to supplement the "official" NCDC station history files. Information is being compiled not only on changes in station location over time, but on instrumentation and processing histories. The current data base is being supplemented through the use of questionnaires which have been sent to all U.S. National Weather Service upper air stations. The World Meteorological Organization also has been helpful in arranging for the CARDS project to receive supplemental information from their member countries. Through personal contacts, additional information has begun to arrive such as the preliminary station history for the 205 Russian stations.

#### *Bias Removal and Identification Program*

Systematic errors or biases in the temperature and/or humidity data from radiosondes can hide true climatic trends. Steps are being taken to detect and correct these biases. Complicating the effort is that every radiosonde instrument design has its own response to environmental conditions. Throughout history, over 100 different instrument designs have been used around the world.

Dr. Eskridge, NCDC's Project Scientist, is leading the effort to develop techniques for modifying humidity data taken with VIZ radiosondes during the period 1961 to 1973. Other efforts include developing algorithms to correct temperature errors induced by various thermistor designs and studying statistical methods to



Locations of the more than 7,500 stations worldwide that gather meteorological data for the Global Historical Climatology Network.

detect biases in time series data or in spatial data when station histories are lacking.

*Conclusion*

This joint NCDC-NOAA-DOE project will make available the most comprehensive upper air data set yet developed. By mid-1993, individual observations for over 1,000 sites worldwide, from the 1930s to 1990, will give the climate change research community the reference quality data set required for detailed upper air studies. The station history files being compiled will be the most complete and accurate metadata ever collected for the global upper air network.

Stephen R. Doty  
National Climatic Data Center

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**The Global Historical Climatology Network**

The National Climatic Data Center and the Carbon Dioxide Information and Analysis Center, Oak Ridge National Laboratory, have compiled a new global baseline climate data set called the Global Historical Climatology Network (GHCN), Version 1.0. This data set contains historical time series of four surface climatological parameters; temperature (6,039 stations), precipitation (7,533 stations), sea level pressure (1,873 stations). All values are monthly and the spatial coverage is of global land areas. In comparison to other major climatological data sets, coverage over Africa, Asia, and South America has been

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*"The NSRDB is a serially complete data base of measured and modeled hourly solar radiation and meteorological data for 239 locations in the United States and its possessions for the period 1961-1990."*

The data base was compiled from numerous pre-existing digital archives. These include well known data sets such as the temperature data base compiled by Jones et al., the World Weather Records, and the World Monthly Surface Station Climatology, as well as previously unpublished archives for nations such as Russia, China, and Mexico.

Several data quality checks were performed, including the elimination of duplicate stations and the visual inspection of each time series for gross data processing errors and discontinuities. When possible, all station metadata parameters such as WMO number, latitude, longitude, elevation, and station name were also verified for accuracy.

The GHCN data base is available from both the Carbon Dioxide Information Analysis Center and the National Climatic Data Center.

Robert G. Quayle  
National Climatic Data Center

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**New Solar Data Base Available !!!!!**

The National Renewable Energy Laboratory (NREL) recently completed development of a new National Solar Radiation Data Base (NSRDB) in cooperation with the NCDC. The NSRDB is a serially complete data base of measured and modeled hourly solar radiation and meteorological data for 239 locations in the United States and its possessions for the

period 1961-1990. The NSRDB replaces the SOLMET data base dramatically improved

*"Statistical summaries generated from the 30 years of hourly observations can be obtained on tape or diskette."*

*"The NSRDB data base should be available on a three-volume CD-ROM from NCDC in the Spring of 1993."*

veloped in the late 1970s that covered the period 1952-1975. The NSRDB is a much improved data set due to improved models for estimating solar radiation, better instrumentation, and more rigorous quality control procedures. All three common measures of solar radiation (global horizontal, direct normal, and diffuse horizontal) are available. Statistical summaries generated from the 30 years of hourly observations can be obtained on tape or diskette. Users can request a complete NSRDB manual and order any products from NCDC's Climate Services Division. A price list is available on request. The manual contains detailed information on how the data base was produced, quality control procedures and known limitations. The NSRDB data base should be available on a three-volume CD-ROM from NCDC in the Spring of 1993.

Address:

National Climatic Data Center  
37 Battery Park Avenue  
Federal Building  
Asheville, NC 28801-2733

Customer Service Telephone:  
704-259-0682  
**(After 5/1/93 704-271-4682)**  
Customer Service Fax:  
704-259-0876  
**(After 5/1/93 704-271-4876)**

Users can request a manual and price list electronically by contacting the following addresses:

OMNET Bulletin Board Mailbox:  
NCDC.SERVICE  
INTERNET MAILBOX:  
tross@ncdc.noaa.gov or  
nlott@ncdc.noaa.gov

If contacting NCDC electronically, please give mailing address for sending the manual.

Thomas F. Ross  
National Climatic Data Center

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### Climate Viewing for User Enjoyment

Every once in awhile a project comes along that piques your interest, presents a challenge, and has the potential for high satisfaction. This opportunity recently presented itself to NOAA's National Climatic Data Center (NCDC) and its System Development Staff. The Association of Science-Technology Centers (ASTC) had requested that NOAA donate the development of a "Birthday Weather" interactive, PC-based, graphics system for use in a "Greenhouse Earth" exhibit which will eventually be seen by an estimated two million science museum visitors. NCDC's Steve Doty and ASTC's Sheila Grinell developed the concept whereby NCDC would create the software and data base, while ASTC would purchase the hardware and aid in the overall design. Tom Reek and Tim Owen had just completed the development of NCDC's interactive graphics operational quality control system, so the occasion and the resources came together quickly. As with any project an appropriate name was paramount; thus, Climate Viewing for User Enjoyment (CLIVUE) was born.

Tim, working with the Franklin Science Institute, and under the direction of Tom, a senior systems analyst with a bent for computer graphics,

*"The user can then zoom in on a particular city of interest."*

was assigned the task of creating the data displays. Using a track ball and a slot machine-like approach, the user can select a date and area of the United States. The data base is queried for stations within the specified domain having data for the given day. The user can then zoom in on a particular city of interest. Once the date and a specific location have been selected, the system will display the daily maximum and minimum temperatures, precipitation, and snowfall for the area. Graphs showing 7 years, 21 years, and the full period of record (up to 100 years) for the station(s) are then available. These displays allow the user to view trends, variability, and extremes in the climate parameters. A final graph allows the user to ask "What if there were a warming and what would be the affect on the temperature records?"

What type data base would support this detailed examination? NCDC holds a digital file of daily climate observations for some 25,000 stations, some dating back to the turn of

destroying legitimate values, while at the same time building a data base designed for fast retrieval. Tom quickly developed solutions for both problems. His methodology is thoroughly described in the *Bulletin of the American Meteorological Society*, Volume 73 No. 6, pages 753-772. After many hours of work, including weekends (when no one else was on the Local Area Network), the new data base emerged.

The resulting CLIVUE system has turned out to be a real winner. It's fun to play with, efficient, accurate, informative, and educational. NCDC will undoubtedly adapt portions of CLIVUE to other uses in the operational life of the Center. CLIVUE is now available on a CD-ROM. The grand opening of the exhibit was on January 16, 1992, at the Franklin Institute. The exhibit will visit 11 other science museums in America. The CD may be purchased from NCDC for \$50.00 plus \$11.00 service and handling charge.

However, the data base over 100 reels of magnetic tape, a big job for even today's PC technology. Thus, a data base of observations for a representative set of 1,000 stations across the country was extracted from NCDC's 9000 Day Tape Deck (TD-9000). Next problems encountered were the data quality was not good enough to support the development of an efficient mechanism for retrieval needed to be developed. An intensive effort was made to develop an approach for removing or correcting errors in the data without

### System Requirements

- IBM-PC or compatible
- EGA/VGA graphics card for extended color graphics with memory
- Minimum 470K of system memory (RAM)
- MS-DOS version 3.21, or higher
- A hard drive for temporary files
- CD-ROM drive
- Mouse (optional)

Stephen R. Doty  
National Climatic Data Center

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*"CLIVUE is now available on a CD-ROM."*

the century. He is archived on optical tape, a big job for even today's PC technology. Thus, a data base of observations for a representative set of 1,000 stations across the U.S. was extracted from NCDC's 9000 Day Tape Deck (TD-9000). Next problems encountered were the data quality was not quite good enough to support the development of an efficient mechanism for retrieval needed to be developed. An intensive effort was made to develop an approach for removing or correcting errors in the data without

### Notes from the AASC President

Since the Bowling Green meeting I have been involved with a few routine matters for the Association. I've sent information about the AASC to prospective members, fielded questions about advertising products through the AASC, and tried to coerce a few of you to do some chores or represent the AASC at specific functions. I also need to remind you all that we approved amendments to the AASC Constitution at the last meeting, and discussed changes to the Association's By-laws which must be voted on for approval at our next meeting.

*"...changes to the Associations's By-laws which must be voted on for approval at our next meeting."*

Kelly Redmond and Nolan Doesken and their committee members, with help and cooperation from John Hughes at NCDC, did a great job of getting the AASC position statements on NWS modernization and ASOS out for our review in the summer 1992 edition of the State Climatologist. I hope you all availed yourselves of the opportunity to make comments to them. The next step is to get the statements submitted for publication.

Pam Naber Knox has agreed to represent the AASC on the USGS Advisory Committee on Water Data for Public Use. The Association will pay her expenses to attend the meeting of that group, and she will report to us at our next meeting.

*"Myron Molnau has made initial plans for us to meet in Coeur d'Alene, Idaho, on July 21-23, 1993."*

Speaking of our next meeting, Myron Molnau has made initial plans for us to meet in Coeur d'Alene, Idaho, on July 21-23, 1993. He has booked 50 rooms at the Shiloh Inn at the rate of \$61 per night plus \$6 per additional person. Phone numbers are 800-222-2244 or 208-664-2300. He is thinking of holding the meetings at North Idaho College with a bus to transport

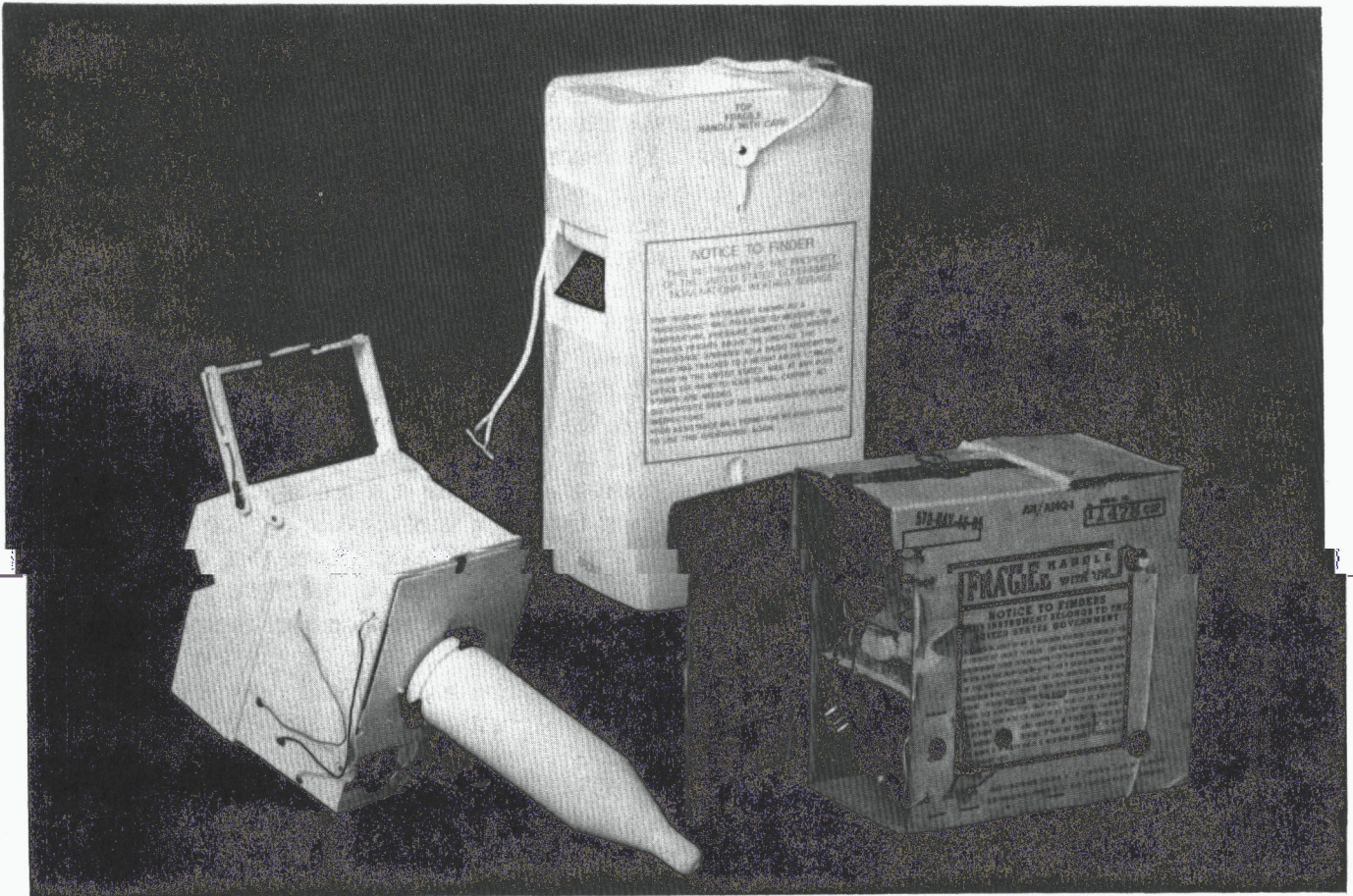
us to the campus from the motel. He plans to mail the information to us all by the end of the April, since this is a resort area and requires a minimum of one month for reservations. He is working on some tours and other extras to make us love Idaho!

Jim Zandlo has begun to work on the agenda and program for the July meeting. Please contact either Jim or me to express any ideas or suggestions you may have. We have discussed moving the business meeting to an earlier place on the agenda, possibly avoiding some of the last-minute confusion that seems to reign over that part of the program. I will plan to preside over the program with true southern hospitality--translated, that means I will wave a Confederate battle flag in the face of speakers who go over their allotted time! I understand Alabama has such a flag I can borrow.....

On a sad note, I'm sorry to report that Bob Muller's wife, Jean, passed away very suddenly last November. I know many of you already know this tragic news, and I'm sure you all joint me in expressing sincere and heartfelt condolences to Bob from the AASC and all our members. American climatologists have lost a supporting contributor of many years, and we will especially miss the adventures she joined in and helped create at all our annual meetings.

Before this gets any longer, let me conclude by again asking you to make your plans to attend the next meeting. Please convey any thoughts about the program to me or Jim. I'm looking forward to going to Idaho.

Charlie Wax  
AASC President 1992-93



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