Open-File Report 94-52

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U.S. Geological Survey National Computer Technology Meeting: Program and Abstracts, New Orleans, Louisiana, April 10-15, 1994

NCTM '94

New Orleans, Louisiana

U.S. Geological Survey

U.S. Geological Survey National Computer Technology Meeting: Program and Abstracts, New Orleans, Louisiana, April 10-15, 1994

Compiled by BARBARA H. BALTHROP *and* EVA G. BAKER

U.S. Geological Survey

Open-File Report 94-52

Nashville, Tennessee

1994

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
ROBERT M. HIRSCH, Acting Director

For additional information write to:

District Chief
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, Tennessee 37203

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FOREWORD

The Distributed Information System-II (DIS-II) is actively in use in the U.S. Geological Survey (USGS) to support the USGS mission of providing the hydrologic information and understanding needed for the optimum use and management of the Nation's water resources. Initial plans are being made for augmenting DIS-II with new procurements for additional hardware and software to maintain state-of-the-art computer technology to support our mission. The 7th National Computer Technology Meeting (NCTM '94), which was held in New Orleans, Louisiana, in April 1994, included presentations on the current use of DIS-II hardware and software to solve scientific, administrative, and management problems. NCTM '94 also provided a forum for identifying additional immediate and future needs for enhancements in hardware and software to continue to meet the USGS mission.

This report contains abstracts of technical papers and demonstrations of newly developed software running in the DIS-II computing environment that were presented at the NCTM '94 meeting. Several panel discussions at the meeting provided an exchange of information on issues concerning the use of Internet for scientific purposes, the administration of a relational data base system in support of the hydrologic and administrative data bases, and the use of a paperless report process.

Training continued to be a major part of the NCTM '94. Short courses in system administration, programming languages, network use and analysis, computer security, application software, and data-base techniques were conducted.

Colleen A. Babcock
Technical Coordinator

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National Computer Technology Meeting 1994

Scientific Visualization Workshop

Clarion Hotel, New Orleans, Louisiana

April 10-15, 1994

Sunday, April 10, 1994

4:00 pm - 8:00 pm Registration - Grand Ballroom Foyer
6:00 pm - 8:00 pm Welcome Hospitality - Mimosa & Azalea Rooms

Monday, April 11, 1994

7:00 am - 5:30 pm Registration - Grand Ballroom Foyer

COMBINED NCTM/SVW OPENING SESSION - Grand Ballroom Salon B

8:30 am - 8:40 am Introduction of the National Computer Technology Meeting (NCTM)
Gloria Stiltner, Water Resources Division, Reston, Va.

8:40 am - 8:50 am Introduction of Scientific Visualization Workshop (SVW)
Richard MacDonald, Information Systems Division, Reston, Va.

8:50 am - 9:30 am Welcome by Water Resources Division/Information Systems Division
Edward H. Martin, District Chief, Louisiana District
Philip Cohen, Chief Hydrologist, Water Resources Division
James E. Biesecker, Assistant Director for Information Systems

9:30 am - 9:40 am Introduction of Invited Speaker - Gary Cobb, Water Resources Division, Reston, Va.

9:40 am - 10:00 am Invited Speaker

10:00 am - 10:30 am BREAK

NCTM Keynote Session - Grand Ballroom Salon B

10:30 am - 10:40 am Introduction of Keynote Speaker - Colleen Babcock, Water Resources Division, Tucson, Ariz.

10:40 am - 11:30 am Keynote Speaker - J. Thomas West, Data General Corporation

SVW - Grand Ballroom Salon A

10:30 am - 11:30 am Paper Presentations for SVW

11:30 am - 1:00 pm LUNCH

NCTM TRAINING

1:00 pm - 3:00 pm Training
3:00 pm - 3:30 pm BREAK
3:30 pm - 5:30 pm Training

SVW - Grand Ballroom Salon A

1:00 pm - 5:30 pm Paper Presentations

VENDOR EXHIBITS (NCTM/SVW) - Grand Ballroom Salon C

1:00 pm - 5:30 pm Vendor Exhibits Open
5:30 pm - 7:30 pm Hospitality Kickoff for Vendor Exhibits - Grand Ballroom Foyer

BIRDS OF A FEATHER - Magnolia Room

8:00 pm - 10:00 pm Data General Software Experts discuss technical issues

Tuesday, April 12, 1994

7:30 am - 5:30 pm Registration - Grand Ballroom Foyer

SOFTWARE TOOLS - Audubon E - Moderator, Edward H. Martin, USGS, WRD, Baton Rouge, La.

8:00 am - 8:10 am Announcements

8:10 am - 8:30 am Developing Graphical Applications Using a Very-High-Level Language
BOUCK, Eric, USGS, WRD, Reston, Va.

8:30 am - 8:50 am Parallel Virtual Machine: Capturing the Cycles
BURGESS, Lisa M., and Johnson, Margaret, USGS, ISD, Reston, Va.; and Pearl Wang, George Mason University, Fairfax, Va.

8:50 am - 9:10 am A Vendor-Independent Fourth-Generation Language for Data Manipulation and Analysis
FULTON, James L., USGS, WRD, Reston, Va.

9:10 am - 9:30 am The Development of Tools for Construction of Interactive Information Systems
JOHNSON, Larry E., USGS, ISD, Denver, Colo.

MODELING APPLICATIONS - Grand Ballroom B
Moderator, Bill Miller, USGS, GD, Reston, Va.

8:00 am - 8:10 am Announcements

8:10 am - 8:30 am Computer-Based, Three-Dimensional Visualization of Observed Solute Distributions during the Cape Cod Tracer Test, Massachusetts
HESS, Kathryn M., Kruger, Mary H., Stock-Alvarez, E. Jessica, and LeBlanc, Dennis R., USGS, WRD, Marlborough, Mass.

8:30 am - 8:50 am Automatic Editing and Graphical Postprocessing of Output from the MODular Finite Element (MODFE) Model
CZARNECKI, John B., USGS, WRD, Denver, Colo.

8:50 am - 9:10 am The Effect of Data Generalization on the Prediction of Hydrologic Response
HALLAM, Cheryl A., USGS, NMD, Reston, Va.

9:10 am - 9:30 am Parallelization of a Coastal Circulation and Transport Computer Model
WANG, Pearl, George Mason University, Fairfax, Va.; and Jenter, Harry L. USGS, WRD, Reston, Va.

PANEL DISCUSSION - Audubon D - Moderator, Terry A. Reinitz, USGS, WRD, Reston, Va.

8:00 am - 9:30 am Overview of the Paperless Report Project of the U.S. Geological Survey
HATHAWAY, R.M., USGS, WRD, Tallahassee, Fla.; and Reinitz, T.A., USGS, WRD, Reston, Va.
Panel members: Andrews, William J., Irwin, George A., Embry, Teresa L., Mixson, Patsy R., Tomberlin, James A., Tallahassee, Fla.; Puente, Celso, Reston, Va.

9:30 am - 10:00 am BREAK

SYSTEM ADMINISTRATION APPROACHES - Grand Ballroom Salon B
Moderator, Janice Ward, USGS, WRD, W. Trenton, N.J.

10:00 am - 10:20 am Interoperability of Computer Systems with Dissimilar Architecture: A Case Study
GRIFFIN, Jess W., USGS, WRD, Oklahoma City, Okla.

10:20 am - 10:40 am Administering Internet Network News (INN), the Netnews Server
BOLDT, D.R., USGS, WRD, Reston, Va.

10:40 am - 11:00 am Automounting Daemon Program
PRICE, Ken C., USGS, WRD, NWQL, Arvada, Colo.; and Townsend, Scott, USGS, WRD, Denver, Colo.

11:00 am - 11:20 am Computer Networking of U.S. Geological Survey Field Offices in the DIS-II Environment as an Alternative to Leased Communication Lines
ROGERS, David W., and Sweat, Michael J., USGS, WRD, Lansing, Mich.

11:20 am - 11:40 am Slide Making in a Multiplatform Environment
MIRZAD, S.H., and Danskin, W.R., USGS, WRD, San Diego, Calif.

DATA MANAGEMENT APPLICATIONS - Audubon E

Moderator, Jo Ann Macy, USGS, WRD, Indianapolis, Ind.

10:00 am - 10:20 am The U.S. Geological Survey Data Base for U.S. Department of Defense Environmental Contamination Projects
GERLITZ, Carol N., and Morrell, Eva M., USGS, WRD, NWQL, Arvada, Colo.

10:20 am - 10:40 am Implementation of a UNIX-based Inventory Application at the Rocky Mountain Mapping Center
McKINNEY, Philip, USGS, AD-OSM, Reston, Va.

10:40 am - 11:00 am Software Development for Remote Entry of Water-Use Data
BRYANT, M. Roland, and Holland, Terrance W., USGS, WRD, Little Rock, Ark.

11:00 am - 11:20 am An Information-Request Management and Accounting System
McFADDEN, Keith W., USGS, WRD, Atlanta, Ga.

11:20 am - 11:40 am Real-Time Monitoring of a Hydrologic Sensor Network
WIERDA, Clark B., USGS, WRD, Little Rock, Ark.

SVW - Grand Ballroom Salon A

8:00 am - 5:30 pm Paper Presentations

VENDOR EXHIBITS - Grand Ballroom Salon C

8:00 am - 5:30 pm Exhibits Open
11:40 am - 1:00 pm LUNCH

NCTM TRAINING

1:00 pm - 5:30 pm Ingres for System Administrators Panel Discussion -- Audubon D
Moderator, Colleen Babcock, USGS, WRD, Tucson, Ariz.
Data-Base Logging and Journaling Systems, SCHLESINGER, Mark J., USGS, WRD, Tucson, Ariz.
Ingres Performance Issues Involving the Logging and Locking Systems, SHANK, Gregory L., USGS, WRD, Lemoyne, Pa.
Managing Relational Data Bases Using Ingres, Beeler, David A., and O'CONNOR, Michael J., USGS, WRD, Little Rock, Ark.
Tools for Managing the Administrative Information Systems (AIS), MORRIS, James, USGS, WRD, Lawrence, Kans.
The What, Where, When, and Why's of Checking an Ingres System, BOSTWICK, Candice M., USGS, WRD, Reston, Va.

1:00 pm - 3:00 pm Training
3:00 pm - 3:30 pm BREAK
3:30 pm - 5:30 pm Training

EVENING ACTIVITIES

5:30 pm - 7:30 pm Hospitality Gathering, NCTM T-Shirt Night - Mimosa & Azalea Rooms
8:00 pm - 10:00 pm Southeast Region Computer Specialists Meeting - Audubon D
8:00 pm - 10:00 pm Northeast Region Computer Specialists Meeting - Audubon E

BIRDS OF A FEATHER - Magnolia Room

8:00 pm - 10:00 pm FrameMaker Techniques - Moderator, Terry A. Reinitz, USGS, WRD, Reston, Va.

Wednesday, April 13, 1994

7:30 am - 5:30 pm Registration - Grand Ballroom Foyer

NATIONAL WATER INFORMATION SYSTEMS - Grand Ballroom Salon B

Moderator, Kathy D. Peter, USGS, WRD, Oklahoma City, Okla.

8:00 am - 8:10 am Announcements

8:10 am - 8:30 am The Current Status of the National Water Information Systems - II
YORKE, Thomas H., USGS, WRD, Reston, Va.

8:30 am - 8:50 am Automating Regression and Performance Testing of National Water Information System-II Software
LENFEST, Leslie W., Briggs, John C., and Merk, Charles F., USGS, WRD, Reston, Va.

8:50 am - 9:10 am A User's Map of the Data in the U.S. Geological Survey National Water Information System
LOPP, Lari E., Kirk, James R., and Arroyo, Ileana E., USGS, WRD, Reston, Va.

9:10 am - 9:30 am Use of Conditional Text and Hypertext in the User's Manual for the U.S. Geological Survey National Water Information System-II
MATHEY, Sharon B., and Briggs, John C., USGS, WRD, Reston, Va.

9:30 am - 10:00 am BREAK

10:00 am - 10:20 am Reference Lists for the U.S. Geological Survey National Water Information System-II
THORNBERG, Ruth E., and Sargent, B. Pierre, USGS, WRD, Reston, Va.

10:20 am - 10:40 am Laboratory Analytical Data System
TURNER, Sandra L., Feist, Oliver J., Lewis, James A., and Husband, Richard A., USGS, WRD, NWQL, Arvada, Colo.

10:40 am - 11:10 am Design and Use of the Data Report Subsystem of the U.S. Geological Survey National Water Information System-II
CAULLER, Stephen J., USGS, WRD, Reston, Va., Beeler, David A., USGS, WRD, Little Rock, Ark.; Baxter, Carmen R., and McKallip, Thomas E., USGS, WRD, Reston, Va.

11:10 am - 11:40 am An Application for the Graphical Editing and Analysis of Hydrologic Data
RAEL, Patrick M., USGS, WRD, Little Rock, Ark.; and Trapanese, Susan M., USGS, WRD, Reston, Va.

ADMINISTRATIVE APPLICATIONS IN THE U.S. GEOLOGICAL SURVEY - Audubon E

Moderator, Philip McKinney, USGS, AD-OSM, Reston, Va.

8:00 am - 8:10 am Announcements

8:10 am - 8:30 am Implementation of the Administrative Information System, First Release, in the Water Resources Division, U.S. Geological Survey—Results and Recommendations
BRADY, Steven J., USGS, WRD, Lawrence, Kans.; Clark, Patricia G., USGS, WRD, Austin, Tex.; Kratz, W. James, USGS, WRD, Carson City, Nev.; and Sabatini, Alice A., USGS, WRD, Reston, Va.

8:30 am - 8:50 am Development of a Platform-Independent Paperless Time and Attendance System
HUTTMAN, Greg, USGS, AD-OSM, Reston, Va.

8:50 am - 9:10 am Microlink/FFS (Federal Financial System) for UNIX and U.S. Geological Survey Administrative Information System
McKINNEY, Philip, USGS, AD-OSM, Reston, Va.

9:10 am - 9:30 am Implementation of the U.S. Department of the Interior Electronic Acquisition System (IDEAS)
PALMQUIST, Donald A., USGS, AD-OPC, Reston, Va.

9:30 am - 10:00 am BREAK

MAPPING TECHNIQUES - Audubon E - Moderator, Joel Morrison, USGS, NMD, Reston, Va.

10:00 am - 10:20 am Generation of Digital Base Maps for Preparation of Thematic Maps
FREITAG, Cidney J., USGS, WRD, Madison, Wis.

10:20 am - 10:40 am Digital Mapping of the National Rivers Inventory
MURTAUGH, Peter H., USGS, NMD, Reston, Va.

10:40 am - 11:00 am Development of a 14-Digit Hydrologic Coding Scheme and Boundary Data Set for New Jersey
ELLIS, William H., Jr., and Price, Curtis V., USGS, WRD, W. Trenton, N.J.

11:00 am - 11:20 am Applications of Geographic Information Systems and Statistics Software to a Large Data Base for Producing Publication-Quality Figures
WARNER, Kelly L., Arnold, Terri L., and Nazimek, John, USGS, WRD, Urbana, Ill.

11:20 am - 11:40 am Incorporating Electronic Maps into U.S. Geological Survey Reports
SIWIEC, Steven F., and Southers, Kim L., USGS, WRD, Lemoyne, Pa.

11:40 am - 1:00 pm LUNCH

VENDOR EXHIBITS - Grand Ballroom Salon C

8:00 am - 1:00 pm Exhibits Open

NCTM TRAINING

1:00 pm - 3:00 pm Training
3:00 pm - 3:30 pm BREAK
3:30 pm - 5:30 pm Training

EVENING ACTIVITIES

5:30 pm - 7:30 pm Hospitality Gathering Mimosa & Azalea Rooms

Birds of a Feather - Magnolia Room

8:00 pm - 10:00 pm Toward a Multi-Agency Network for Collection, Transfer, and Display of Real-Time Data, Moderator, Timothy D. Lieberman, USGS, WRD, Carson City, Nev.

Thursday, April 14, 1994

7:30 am - 5:30 pm Registration and Information - Grand Ballroom Foyer

COMPUTER ACTIVITIES IN THE U.S. GEOLOGICAL SURVEY - Grand Ballroom Salon B
Moderator, Wendy Budd, USGS, ISD, Reston, Va.

8:00 am - 8:10 am Announcements

8:10 am - 8:30 am Activities of the U.S. Geological Survey Hydrologic Analysis Support Section
LUMB, Alan M., USGS, WRD, Reston, Va.

8:30 am - 8:50 am Administrative Business Process Re-engineering
McKINNEY, Philip, USGS, AD-OSM, Reston, Va.

8:50 am - 9:10 am Overview of the Global Change Program
KIRTLAND, David, USGS, NMD, Reston, Va.

9:10 am - 9:30 am Scientific Visualization at Flagstaff Image Processing Facility, U.S. Geological Survey: Past, Present, and Future
McMACKEN, Dennis, and Bellisime, Lynda, USGS, ISD, Flagstaff, Ariz.

9:30 am - 10:00 am BREAK
Moderator, Richard MacDonald, USGS, ISD, Reston, Va.

10:00 am - 10:20 am A Collaborative Approach to Electronic Report Processing
WINTERSTEIN, T.A., and Miller, R.A., USGS, WRD, Mounds View, Minn.

10:20 am - 10:40 am NMD Research Lab Overview
MORRISON, Joel, USGS, NMD, Reston, Va.

10:40 am - 11:00 am The Use of Compact Disc-Read Only Memory (CD-ROM) for the Storage of Data and Related Programs for UNIX Computer Operating Systems
NEGRI, Mark, USGS, WRD, Reston, Va.

11:00 am - 11:20 am Telecommunications Infrastructure of the U.S. Geological Survey
BONUGLI, Richard J., USGS, ISD, Reston, Va.

11:20 am - 11:40 am GEONET II Internet Routing
MURPHY, Patrick W., USGS, ISD, Menlo Park, Calif.

GUIDELINES AND STANDARDS - Audubon D -
Moderator, J. Nicholas Van Driel, USGS, NMD, Reston, Va.

8:00 am - 8:10 am Announcements

8:10 am - 8:30 am Comprehensive Approach to Production of Map Illustrations by Computer
LIEBERMANN, Timothy D., Stone, J. Christopher, and Peltz, Lorri A., USGS, WRD, Carson City, Nev.

8:30 am - 8:50 am Guidelines for Creating Software User Documentation in the U.S. Geological Survey
REGAN, R.S., USGS, WRD, Reston, Va.

8:50 am - 9:10 am A Centralized Configuration Management Board in the U.S. Geological Survey
MERK, Charles F., and Flynn, Kathleen M., USGS, WRD, Reston, Va.

9:10 am - 9:30 am Development of Digital Hydrogeologic Map Symbols for the U.S. Geological Survey
TAGGART, Bruce E., and Menoyo, Luis E., USGS, WRD, San Juan, P.R.

9:30 am - 10:00 am BREAK

GEOGRAPHIC INFORMATION SYSTEM APPLICATIONS - Audubon D
Moderator, Douglas Posson, USGS, ISD, Denver, Colo.

10:00 am - 10:20 am Using a Geographic Information System to Derive Urban Land Use from Population Data
HITT, Kerie J., USGS, WRD, Reston, Va.

10:20 am - 10:40 am Statistical and Geographic Information System Analysis of Earth-Science Information for Decisionmaking
SOLLER, David R., and Bernknopf, Richard L., USGS, GD, Reston, Va.

10:40 am - 11:00 am A Site Verification Program Using ARC/INFO Geographic Information System Software
HOFFMAN, Scott A., USGS, WRD, Lemoyne, Pa.

11:00 am - 11:20 am Use of Remotely Sensed Data to Characterize Vegetation in the Red River of the North Basin, Minnesota, North Dakota, and South Dakota
LORENZ, David L., USGS, WRD, Mounds View, Minn.

11:20 am - 11:40 am U.S. Department of the Interior Hazardous-Waste Sites Geographic Information System
WINGARD, Norman E., USGS, WRD, Reston, Va.

11:40 am - 1:00 pm LUNCH

SPECIAL MEETINGS

1:00 pm - 3:30 pm Information Systems Council Meeting - Magnolia Room

1:00 pm - 3:00 pm DIS Technical Support Meeting - Cypress Room

NCTM TRAINING

1:00 pm - 4:30 pm Panel Discussion Internet Usage - Audubon D
Moderator Doug D. Nebert, USGS, WRD, Reston, Va.
Use of Wide-Area Information Server Software to Support the National Geospatial Data Clearinghouse, NEBERT, Douglas D., USGS, WRD, Reston, Va.
The Hydrologic Models Summary (HYMS): Making Software Information Accessible through the Wide Area Information Servers (WAIS) Software, GOZÉ, Michèle Y., USGS, WRD, Reston, Va.
Selected Water Resources Abstracts in WAIS, KNAPP, George, USGS, WRD, Reston, Va.

Mosaic as an Internet Browsing Tool, TOWNSEND, Scott, USGS, WRD, Denver, Colo.
USGS-Wide Information Clearinghouse, MILLER, Bill, USGS, GD, Reston, Va.

1:00 pm - 3:00 pm Training
3:00 pm - 3:30 pm BREAK
3:30 pm - 5:30 pm Training

EVENING ACTIVITIES

8:00 pm - 1:00 am The NCTM Lagniappe Party - Audubon DE

Friday, April 15, 1994

FUTURES SESSION - Grand Ballroom Salon B -

Moderator, David E. Click, USGS, WRD, Lemoyne, Pa.

8:30 am - 8:50 am Regional GIS Labs, Van Driel, James Nicholas, USGS, NMD, Reston, Va.
8:50 am - 9:00 am Introduction of Guest Speaker - Thomas C. Wood, USGS, WRD, Reston, Va.
9:00 am - 9:30 am Guest Speaker, James Fulton, NCD, "The Future of X"
9:30 am - 10:00 am BREAK
10:00 am - 10:45 am A Report on Technology Trends and Developments 1994-2000
Richard Hollway, USGS, WRD, Portland, Oreg.; and Douglas Posson, USGS, ISD, Denver, Colo.
10:45 am - 11:30 am The Status of DIS-II+
Gloria Stiltner, USGS, WRD, Reston, Va.; and Richard Hollway, USGS, WRD, Portland, Oreg.
11:30 am - 12:00 m Close of Meeting - James Daniel

Demonstrations

Computer-Science Guest-Lecture Series at Langston University Sponsored by the U.S. Geological Survey, STEELE, Karen S., USGS, WRD, Oklahoma City, Okla. (located in the Registration area)

A Microcomputer-based Personnel System Demonstration Using TouchScreen Technology, MATTHEWS, R. William, USGS, ISD, Reston, VA (located in the Vendor exhibit area)

Demonstration of a Digital Compact Disc Containing Navajo and Hopi Indian Reservation Data for Use in Schools to Teach Remote Sensing, ACOSTA, Alex V., USGS, ISD, Flagstaff, Ariz. (located in the Vendor exhibit area)

The DIS Program Office sponsored "Nerds R Us" demonstrations on software tools and techniques (located in the Vendor exhibit area)

Abbreviations

AD-OPC	Administrative Division-Office of Procurement and Contracts
AD-OSM	Administrative Division-Office of Systems Management
GD	Geologic Division
ISD	Information Systems Division
NCTM	National Computer Technology Meeting
NMD	National Mapping Division
NWQL	National Water Quality Laboratory
SVW	Scientific Visualization Workshop
USGS	U.S. Geological Survey
WRD	Water Resources Division

DEMONSTRATION OF A DIGITAL COMPACT DISC CONTAINING NAVAJO AND HOPI INDIAN RESERVATION DATA FOR USE IN SCHOOLS TO TEACH REMOTE SENSING

ACOSTA, Alex V., USGS, ISD, 2255 N. Gemini Drive, Flagstaff, Arizona 86001

A digital compact disc with read-only memory (CD-ROM) containing remotely sensed data, introductory material on image processing, and multimedia presentations was developed in a multiagency/division effort between the Information System Division, Bureau of Indian Affairs, Geologic Division's Office of Scientific Publications, and Northern Arizona University. The development of this information on CD-ROM was part of an outreach activity aimed at the pre-college educational community.

Traditional methods used to teach science and mathematics to Indian Reservation students can be augmented through the use of a visual and nontraditional environment of remotely sensed data that can be inexpensively distributed through CD-ROM media. Data from Landsat sensors or other imaging systems can be used in a visual environment to expose students to the concept of the electromagnetic spectrum. Different algorithms for contrast enhancement or digital filtering can be applied to the data to demonstrate the effects of mathematical processes. The images and visual representations presented can provide the impetus to interest and challenge students in the fields of science and mathematics. The introductory material provided is used to make the transition from the visual to the traditional methods of teaching.

Multimedia presentations pertaining to culture, and history are included to perpetuate tradi-tions and instill pride to manage Reservation resources for the benefit of present and future generations.

MANAGING RELATIONAL DATA BASES USING INGRES

BEELER, David A., and ***O'CONNOR***, Michael J., 700 West Capitol Avenue, Little Rock, AR 72201

Many of the traditional data bases that are maintained by the U.S. Geological Survey are being redesigned to use relational data base technology available as a result of the implementation of the Distributed Information System-II. The Arkansas District has been involved in the development of software for the National Water Information System-II (NWIS-II) and has maintained as many as three relational Ingres data bases for software development. The District also has installed and maintains the Administrative Information System, a separate relational Ingres data base, in conjunction with the NWIS-II software development data bases.

A variety of tools is required to efficiently maintain the integrity and security of multiple data bases in a District computing environment. These tools include utility programs to provide data checkpoints, backups, and verification, as well as utility programs for reviewing data in tables, granting permissions, and routine cleanup of data base tables. The Arkansas District experience in maintaining multiple relational data bases may be useful to other District that are beginning to deal with these issues.

ADMINISTERING INTERNET NETWORK NEWS (INN), THE NETNEWS SERVER

BOLDT, D.R., USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092

Internet Network News (INN) has replaced the Continuum, an electronic bulletin board used by the Water Resources Division, on its Prime minicomputers. Having a local netnews-server can boost responsiveness, and allows the creation of local newsgroups, but presents a host of management issues. This talk provides an overview of how the news-server software works, and how it can be customized for local use. Management of an INN news-server includes obtaining news articles from other news-servers, providing news articles to other sites, expiring (deleting) and archiving old articles, monitoring disk space and inode usage, and maintaining data bases providing information on newsgroups, distribution codes, and connection permissions.

TELECOMMUNICATIONS INFRASTRUCTURE OF THE U.S. GEOLOGICAL SURVEY

BONUGLI, Richard J., USGS, ISD, 12201 Sunrise Valley Drive, Reston, VA 22092

An information services division within the U.S. Geological Survey (USGS) provides the telecommunications infrastructure and support necessary to meet the scientific mission of the bureau and its associated administrative support facilities. In addition, the USGS provides telecommunications services to support the varied missions of several other Federal government agencies. This telecommunications infrastructure, called GEONET, is based on a transmission technology known as cell-relay technology and on a transmission protocol known as the Asynchronous Transfer Mode (ATM).

GEONET is a proprietary-based ATM network made up of cell (ATM) switches. Recently, GEONET expanded from 3 to 11 cell switches located throughout the country at major USGS sites. These cell switches are connected by high-speed telecommunications lines known as T1 that transmit information at a rate of 1.5 million bits per second (Mbps). The cell switches are capable of multiplexing data, voice, and video information in small fixed-sized 24-byte cells. While the international ATM standards stipulate 53-byte cells at T3 (44.736 Mbps) and higher rates, the cell switches employed use 24-byte cells for higher efficiency and performance at T1 rates. This technology provides the USGS with an efficient, high-performance, multimedia national telecommunications network.

At each cell switch, a mulitprotocol router collects and routes data from one or more Local Area Networks (LAN's). Data from these LAN's destined for a site on the wide-area network passes to the cell switch through the frame-relay packet mode service, and is then switched to another cell switch on GEONET.

All 11 major USGS sites have the need for data transmission. In addition, some sites can also appropriately support voice and video transmission. Voice is interfaced to the cell switch from digital voice switches, and video in interfaced to the cell switch from video equipment.

The ATM benefits of bandwidth on demand, bandwidth pooling, multimedia format, and scalability provide the USGS and other Federal agencies using GEONET with high-performance LAN-to-LAN and LAN-to-wide area traffic, interactive graphics, and videoconferencing. In the future, ATM benefits are expected to provide video email, distance learning, hypermedia documents, and desktop videoconferencing.

The USGS has a contract with a vendor to provide the hardware and software for the cell switches and multiprotocol routers necessary for GEONET. In addition, the USGS is provided an integrated network management system. The system consists of a combination of hardware and software for managing cell switches and multiprotocol routers. In the near future, the USGS will also be provided an overall network management system to integrate the management of all telecommunications elements. The USGS maintains a duplicate, read-only version of this network management setup to assist in trouble-shooting telecommunications problems.

Future plans call for the ATM-based network to be fully compliant with the ATM international standards. USGS plans to deploy the ATM technology to operate on LAN's. GEONET has the potential to become the telecommunications infrastructure for the entire U.S. Department of the Interior.

DEVELOPING GRAPHICAL APPLICATIONS USING A VERY-HIGH-LEVEL LANGUAGE

BOUCK, Eric, USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092

Scientific applications benefit from graphical user interfaces. The time required to create graphical user interfaces with low level development tools can be exorbitant. High level tools to speed development are available, but these tools require costly licensing arrangements with vendors and do not guarantee portability to future platforms.

The freely available Tool Command Language (Tcl) is a very-high-level interpreted language designed to be used as a common command language for many different applications. Tcl has a very simple syntax and command structure that serves to reduce development time at the expense of some computational performance and error detection. Tcl can be embedded and extended through the use of its C language library, allowing for the implementation of certain routines through C function calls. Tk is a Tcl extension that facilitates the construction of graphical user interfaces. A feature of Tk is the ability to send commands between Tk based applications. The strength of the combination of Tcl and Tk lies both in the ability to create graphical applications rapidly and in the connectivity that results from multiple applications sharing the same command language. Through new and existing extensions, Tcl/Tk can provide a powerful development environment.

IMPLEMENTATION OF THE ADMINISTRATIVE INFORMATION SYSTEM, FIRST RELEASE, IN THE WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY—RESULTS AND RECOMMENDATIONS

BRADY, Steven J., USGS, WRD, 4821 Quail Crest Place, Lawrence, KS 66049; *CLARK*, Patricia G., 8011 Cameron Road, Building 1, Austin, TX 78754-3898; *KRATZ*, W. James, 333 West Nye Lane, Room 203, Carson City, NV 89706; and *SABATINI*, Alice A.,USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092

The Administrative information System(AIS), designed and developed by the U.S. Geological Survey (USGS), was released as scheduled in January 1993, and 88 sites throughout the country began immediate installation, data transfer, and use. The AIS includes many new features not present in previous systems: simultaneous access by many users; graphical user interface in a UNIX-based windowed environment; and a distributed data base that facilitates use and reporting at single and multiple cost center sites, area, region, and division levels. The first release included capabilities to handle funding, expenditure tracking, and selected parts of project management. All cost centers will use the software to close accounts for fiscal year 1993.

In February 1990, the USGS began to design the replacement of existing administrative management systems from the current system housed on PR1ME minicomputers to a UNIX-based distributed environment. Twelve user work groups were established to identify functional user requirements and process flow diagrams. Work-group reports were used to develop a system specification design document. A development team was organized in Lawrence, Kansas, to write the program code using the design document. The development of the AIS and its installation is scheduled for release in four parts: Financial Management, Project and Reports Management, Human Resources Management, and Organization Management. Releases will extend through 1995.

A training plan that is effective, timely, cost efficient, and reaches the largest possible number of users was designed for AIS implementation. A 6-member group of instructors with a broad range of experience and expertise provided instruction to a national team of 32 trainers in December 1992 at the U.S. Geological Survey National Training Center in Denver, Colorado. The 32 trainers then were given the responsibility for providing hands-on instruction to other users within their respective geographic areas. A questionnaire, completed by most attendees at the end of the national training session, rated the training as positive in method and content. The replies to a second questionnaire to evaluate the instruction provided by the national trainers were less than positive and indicated that problems were encountered using the AIS and training others in its use.

Three major problems found using AIS were as follows: (1) some sites did not have the equipment necessary to run the software when it was released; (2) Data General hardware, the UNIX environment, and Ingres software were new to USGS personnel and knowledge of those capabilities was limited; and (3) the transfer of data from existing administrative management systems was more complicated than had been anticipated. Other problems included: (1) communication between the development and implementation teams and the users was insufficient; (2) training was held too early during implementation, allowing information to be forgotten before it could be applied; (3) training provided to field users had inconsistent results; and (4) software was inadequately tested prior to release.

Recommendations for software implementation and related training in its use include the following: (1) ensure that installation sites have adequate equipment and that data-base administrators and users have received instruction in basic operational techniques: (2) expand software testing to detect programming and functional problems; (3) improve the communication between programmers and users to share information and problem resolution; (4) adhere to selection criteria for choosing individuals to serve as trainers; and (5) provide training immediately before application to increase retention of the material.

SOFTWARE DEVELOPMENT FOR REMOTE ENTRY OF WATER-USE DATA

BRYANT, M. Roland, and *HOLLAND*, Terrance W., 700 West Capitol Avenue, Little Rock, AR 72201

The Arkansas Soil and Water Conservation Commission (ASWCC) and the U.S. Geological Survey (USGS) are working cooperatively to collect and store water-sue data for the State. Approximately 53,000 reporting forms for ground- and surface-water withdrawals for agriculture and irrigation are submitted to ASWCC annually through the Conservation District Offices in 26 eastern Arkansas counties. Also, about 2,000 water-use registration forms are processed annually. Completion of these registration forms usually involves an interview between the water user and Conservation District personnel.

The current process requires a great deal of paper handling by Conservation District office, ASWCC, and USGS personnel. This reporting process includes the grouping of water-use registration forms (one form per well or surface-water diversion) by landowner or diverter, conducting interviews with farmers, computing irrigation and agricultural water use by crop type, determining monthly and annual water-use totals, and collecting a registration fee and filling out a receipt of payment for every well or diversion reported by the water use.

Completed water-use reporting forms are received and logged in by the ASWCC, and forwarded to the USGS for entry of the water-use data into the National Water Information System (NWIS) Site-Specific Water-Use Data System (SSWUDS) during an 8-month period (March-September). The USGS produces preprinted forms for the next reporting period, certificates documenting surface-water diversions, and cards reminding users of the start of a new reporting period. These documents are provided to ASWCC for mailing to registered water users.

To streamline the reporting process and minimize the large amount of paper forms, the USGS is designing a local data base and writing supporting computer software, that will reside and be maintained on the Conservation District Office computer. With this software, the Conservation District Office personnel will be able to enter water-use registration information into the office computer during the interview with the water user. In addition, they will be able to maintain a local county data base that can be used to answer local questions about water use. Other functions of the water-use reporting system include: performing mathematical computations to ensure irrigation and agricultural data are summed correctly, providing a table for crop application rates by crop type for those users that must estimate the amount of water that was withdrawn, computing the number of wells or surface-water diversions for each owner and the amount of money owed for water-use reporting fees, and enabling the Conservation District personnel to print receipts for water-use fees. In order to keep the SSWUDS (and eventually NWIS-II) updated properly, the local Conservation District Office personnel will be able to copy new data to a file that can be written to a diskette, mailed to the ASWCC and forwarded to the USGS, and loaded into the NWIS data base. This will eliminate the handling of thousands of paper forms.

PARALLEL VIRTUAL MACHINE: CAPTURING THE CYCLES

BURGESS, Lisa M., and *JOHNSON*, Margaret, USGS, ISD, 804 National Center, Reston, VA 22092; *WANG*, Pearl, George Mason University, Computer Sciences Department, Fairfax, VA 22030

As scientists begin to push the limits of single-processor desktop computers, the advantages of parallel processing are becoming critical. The use of parallel processing techniques to increase numeric computation capability, however, comes with unexpected costs of time and money: converting programs, acquiring software oriented to programming in the parallel processing environment, attending training courses, and possibly buying new hardware. Although scientists could readily make use of more Central Processing Unit (CPU) power, they are frequently unable to obtain the funding for the software conversion of programs to take advantage of this CPU power. Becoming productive in the parallel processing environment is often not advantageous to the scientists due to the costs of time and money.

Parallel Virtual Machine (PVM) may be the answer to the problem of these costs. As a public domain programming environment, PVM can take advantage of unused CPU cycles available on a network of UNIX-based computers. In the PVM environment, several computers can be connected into a virtual machine thus creating a "parallel virtual machine." One advantage that PVM has to offer is that it allows a heterogeneous collection of computers to cooperate in completing a task. Because the U.S. Geological Survey (USGS) maintains a computing environment that is heterogeneous in nature, this is an important feature. The time needed to learn to program in the PVM environment is reduced by the fact that PVM programs are written in either FORTRAN or C with embedded PVM routines to handle such tasks as message passing and synchronization. Thus, an entirely new language does not need to be learned.

The USGS has installed PVM on several computers and has begun experimenting with the capabilities of parallel processing. Currently, two prototypes are under development: one using a geochemical model for aqueous solutions and the other using an image processing application. These exiting applications are being ported into the PVM environment and studies will be done to quantify the processing of these data sets and compare results to traditional computing methods. Numeric studies will be performed based on the test results obtained from sample computations to determine if the increase in performance, if any at all, outweighs the hours used in converting these applications. These and future prototypes will serve as a basis for evaluating the effectiveness of PVM in Earth science computing environments.

DESIGN AND USE OF THE DATA REPORT SUBSYSTEM OF THE U.S. GEOLOGICAL SURVEY NATIONAL WATER INFORMATION SYSTEM-II

CAULLER, Stephen J., USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092; ***BEELER***, David A., USGS, WRD, 700 West Capitol Avenue, Little Rock, AR 72201; ***BAXTER***, Carmen R., and ***McKALLIP***, Thomas E., 12201 Sunrise Valley Drive, Reston, VA 22092

The National Water Information System-II (NWIS-II) is being developed by the U.S. Geological Survey (USGS) to replace several disparate water data-base systems with a single multidiscipline data-base system. The NWIS-II application software is written in a fourth-generation language, Ingres Windows4GL, which provides a graphical interface to the NWIS-II Ingres relational data base. Application software that interacts with the NWIS-II data base consists of several integrated subsystems, each with distinct functionality and purpose. The Data Report Subsystem (DRS) of the NWIS-II is described in this paper.

The DRS was designed to accommodate USGS users' need to generate flexible, near-publication-ready data reports and general-purpose data summaries. It allows users to select specific report types, each consisting of a distinct layout and format. Report formats are divided into fixed-format postscript, flexible-format postscript, and American Standard Code for Information Interchange (ASCII) text output. The intended use of the report, and whether it is published or not, governs the category in which it is included. Upon selecting a particular report format and specifying a period of record to be included in the report, the user is led through one or more data-selection screens. Each selection screen consists of a theme or logical subdivision of water-data attributes, such as sites (where data are collected), samples (type of environmental sample and date/time of collection), and/or parameter sets (the physical or chemical constituents measured on the sample). The specifications entered in each selection screen are used to define the final data elements selected from the data base to be included in the report. Results from each selection screen can be saved to a file to be reused for future report generation.

Postscript reports are created by retrieving the specified data and writing the data stream, commingled with Maker Interchange Format (MIF) strings, to an MIF file. The MIF file is imported into a blank FrameMaker template, creating a word-processor-formatted document that can be printed on a postscript-compatible printer. ASCII reports are created by retrieving the specified data and generating the report layout using Ingres Report-Writer.

AUTOMATIC EDITING AND GRAPHICAL POSTPROCESSING OF OUTPUT FROM THE MODULAR FINITE ELEMENT (MODFE) MODEL

CZARNECKI, John B., USGS, WRD, Building 53, Box 25046, Denver Federal Center, Denver, CO 80225

Transient simulations of ground-water flow in the vicinity of Yucca Mountain, Nevada (the potential site of a repository for high-level nuclear waste), were made using the U.S. Geological Survey MODular Finite Element (MODFE) Model. These simulations were used to predict possible changes in water-table altitude and ground-water flow as a result of a potential increase in recharge and a change in local transmissivity over a period of 20,000 years. The resulting computer output represented hundreds of time steps, prohibiting hand processing of each time step. Because of the need to graphically examine these simulation results, hydraulic-head values from each reported time step were processed using a variety of automatic editing routines and nested script files on UNIX-based computers.

To extract hydraulic-head values for each time step, a script file, which invokes the vi editor, is used to search for the occurrence of a specific string of text written at the start of each time step in the MODFE output file and to copy the heads for those time steps to separate files. These files use the time step value, in seconds (for example, 0.53003E+07), as part of the file name for easy identification. By modifying saved directory listings of only these files, additional script files are invoked to run programs to calculate the change in hydraulic head from initial head conditions, edit control files for use with a contouring program, run the program, and print contour plots. A similar procedure is available for ground-water flow vector processing and plotting. The use of script files in postprocessing MODFE output greatly increases the efficiency of visualization and analysis of model results.

DEVELOPMENT OF A 14-DIGIT HYDROLOGIC CODING SCHEME AND BOUNDARY DATA SET FOR NEW JERSEY

ELLIS, William H., Jr., and *PRICE*, Curtis V., USGS, WRD, 810 Bear Tavern Road, Suite 206, W. Trenton, NJ 08628

An interagency effort to define and delineate 14-digit hydrologic cataloging units in the State of New Jersey is underway. Agencies involved include the U.S. Geological Survey (USGS); the New Jersey Department of Environmental Protection and Energy (NJDEPE); and the U.S. Department of Agriculture, Soil Conservation Service (SCS). The 14-digit units are needed for use in water-quality-management programs that will include watershed monitoring, study, and regulation. Standards and guidelines for the development of the 14-digit units were established by an interagency committee. The final 14-digit basin data base will be in digital-line-graph format on floppy disk.

An 11-digit coding scheme was devised by the NJDEPE and SCS for water-planning purposes in the early 1980's. This delineation scheme was decked for accuracy and updated where necessary and will be used as the basis of the 14-digit basin delineation. Updates include the addition of 11-digit divides in the intercoastal waterways of New Jersey based on areas of limited tidal mixing.

Most of a polygon data set of drainage basins that were digitized and updated by the USGS in the late 1980's will be incorporated into the 14-digit basin data base. This data set consists of more than 3,000 drainage-basin delineations prepared for flow estimates and drainage-area determinations. This existing 14-digit data set is currently being checked and edited to ensure its accuracy. The availability of these previously developed data sets has greatly facilitated the development of the new 14-digit hydrologic cataloging units.

GENERATION OF DIGITAL BASE MAPS FOR PREPARATION OF THEMATIC MAPS

FREITAG, Cidney J., USGS, WRD, 505 Science Drive, Madison, WI 53711

The Cartographic and Publication Program of the Water Resources Division, Northeastern Region has implemented procedures using a geographic information system (GIS) or a combination of a GIS and a vector-based drawing program to produce publication-quality base maps. Thematic overlays can be added by digital or analog methods. Use of a base map derived from the same data base used for scientific work allows smooth transition from analysis to publication stages of a project.

The base map generation process begins with the acquisition of digital data and ends with prepress film products. Steps in the process include (1) analytical data processing to combine and register layers of data into a continuous dataset useful for scientific work; (2) cartographic processing to add annotation and generalize the data for small map scales; and (3) cartographic refinement to assign symbology and choose base information appropriate for project publications.

Thematic-data overlays may be generated digitally as part of the analytical process and included as part of the data base. Projects not using GIS can still enjoy some of the benefits of digital-map production by importing a GIS-derived base map into a drawing program where thematic data can be incorporated.

A VENDOR-INDEPENDENT FOURTH-GENERATION LANGUAGE FOR DATA MANIPULATION AND ANALYSIS

FULTON, James L., USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092

Fourth-generation languages (4GL's) are very high-level programming languages that include facilities for data management and analysis. Examples of commercial 4GL's that have been widely used within the U.S. Geological Survey include INFO, ARC/INFO, SAS, P-Stat, Ingres SQL, and Ingres Windows 4GL. The use of these languages provides many advantages over the use of low-level programming languages, such as Fortran or C, including reduced training requirements, shorter development times, and fewer lines of code to be maintained. Unfortunately, there are few standards for 4GL's and each vendor's 4GL differs from other vendors' 4GL's in significant ways. Programs written using commercial 4GL's are typically non-portable and commercial 4GL's can not readily work with other vendor's software. A disadvantage of commercial 4GL's is that although less training is required to master a 4GL than is required for a low-level language, retraining and reprogramming are required every time the 4GL vendor changes.

The UNIX operating system provides a vendor-independent 4GL alternative. The UNIX shells, such as the Bourne or Korn shells, in combination with specialized programs provide a very high-level programming environment that is highly portable and flexible, and that provides functionality equalling or exceeding that of commercial 4GL's. A key feature of the UNIX environment and operating philosophy is that many different programs can be integrated through UNIX inter-process communication to perform a variety of tasks. The UNIX shells control the execution of application programs and the flow of data between them. If existing programs don't exist to solve a particular task, it is easy to build one or more small programs that supply the missing functionality and to integrate them with the rest of the environment.

A useful set of programs for data manipulation and analysis is the Relational Database System (RDB). The RDB system is available at no cost and provides a simple, flexible, self-documenting data format and a set of small programs for data-base management, data selection and transformation, data restructuring, quality assurance, and simple statistical analysis. RDB was designed to be flexible and it is easy to move RDB data between different computer hardware systems and software applications, and to develop new RDB programs. The simple format of RDB files provides a basis for application integration because simple translation software is provided for converting between various specialized application formats and the RDB format and the conversion software can be applied directly to the stream of data passing between applications. The various RDB programs in combination with the UNIX shells provide the data management and analysis facilities normally associated with a 4GL.

THE U.S. GEOLOGICAL SURVEY DATA BASE FOR U.S. DEPARTMENT OF DEFENSE ENVIRONMENTAL CONTAMINATION PROJECTS

GERLITZ, Carol N., and *MORRELL*, Eva M., USGS, WRD, National Water Quality Laboratory, 5293 Ward Road, Arvada, CO 80002

Large and variable data sets generated by the U.S. Geological Survey's Department of Defense Environmental Contamination (DODEC) projects will not fit into the current (1993) National Water Information System (NWIS). To provide data-handling capability for these DODEC projects until NWIS-II is available, an interim DODEC relational data base has been developed using Ingres on Data General workstations.

The DODEC data base consists of tables for storing site descriptions, well information, and results of chemical analyses of soil, water, and plant- and animal-tissue samples. Data-base users can enter data into site and well tables by means of a menu-driven interface. Chemical data—received from the laboratory in digital format—can be automatically loaded into the data base using embedded Structured Query Language (SQL) C programs. The chemical data can be related to information about specific sampling locations stored in the site and well tables.

Advantages of the DODEC data base, in addition to providing space for the variable data, include assistance with quality assurance and quality control of data, ease of compiling summary tables for various reports, and direct access from other software (for example, ARC/INFO, SAS, G2, and Statit). In addition, U.S. Air Force DODEC projects can retrieve data tables in the format required by the Air Force Installation Restoration Program Information Management System (IRPIMS).

Successful operation of the DODEC data base depends on careful preparation of equipment and personnel by following a specific list of hardware, software, and training requirements prior to installation. The list of requirements is available to prospective users.

THE HYDROLOGIC MODELS SUMMARY (HYMS): MAKING SOFTWARE INFORMATION ACCESSIBLE THROUGH THE WIDE AREA INFORMATION SERVERS (WAIS) SOFTWARE

GOZÉ, Michèle Y., USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092

Providing software support for the U.S. Geological Survey (USGS) includes making known what software is available and what computing needs can be met by that software. The Wide Area Information Servers (WAIS) software has been employed by the Hydrologic Analysis Support Section of the USGS Office of Program Coordination and Technical Support to provide an easily accessible text data base of software descriptions called the Hydrologic Models Summary (HYMS).

Well-defined categories of information describe each of the programs in HYMS. These categories include: an abstract describing what the program does, the theory behind the computational scheme, the input and output options and/or requirements, references to any published documentation, the computer platforms on which the program is available, descriptions of where and how the program has been successfully or unsuccessfully applied, and contacts for computer and technical support.

HYMS is stored on-line in Reston, Virginia, for immediate query by users of WAIS client software. Use of HYMS at a given site involves a few simple steps that the system administrator can perform to make HYMS directly available to all the users at that site. Once local access to HYMS has been established, obtaining information from the data base is accomplished by entering one or more words that are used to search the text for information on the program of interest.

Creation of the HYMS data base, or any other text data base, involves relatively simple modification to the public domain C source code. Three basic functions are called in a predetermined order to process a text file and index its contents for WAIS query and retrieval. The WAIS software on the workstation that serves the data base can also be modified to fine tune what will be retrieved from the data base for each query.

INTEROPERABILITY OF COMPUTER SYSTEMS WITH DISSIMILAR ARCHITECTURE: A CASE STUDY

GRIFFIN, Jess W., USGS, WRD, 202 N.W. 66 Street, Oklahoma City, OK 73116

The Oklahoma District of the U.S. Geological Survey is conducting a study using a Local Area Network (LAN) and the X Window System (X) to provide a Microsoft Disk Operating System (MS-DOS) server. X, a standard open network graphics windowing system, allows different operating systems to use a consistent user interface. An MS-DOS server is a personal computer (PC) providing MS-DOS services to the LAN.

Quarterdeck's DESQview/X and Sun's PCNFS software were evaluated. DESQview/X uses X to display UNIX-based programs on the PC. It also allows the workstation to run PC-based software and display output. PCNFS makes available UNIX-based file systems to the PC.

Installation and setup of software on the PC was time-consuming. The software provided automatic installation, but configuration files required editing to account for specific hardware devices. Most of the X-window software displayed on the PC performed well; however, DESQview/X could not produce a 1280 x 1024 pixel display. Multiple users accessing a PC file created problems such as corrupting program data and in some instances caused the PC to lock up. Additionally, integration of UNIX file systems required either mounting each workstation's logical disk as a logical drive on the PC, or creating a common user disk space.

Costs and benefits of providing an MS-DOS server must be weighed by each office. System administration of the MS-DOS server is complicated, yet may ease operations if the MS-DOS server can replace multiple PC's.

THE EFFECT OF DATA GENERALIZATION ON THE PREDICTION OF HYDROLOGIC RESPONSE

HALLAM, Cheryl A., USGS, NMD, 12201 Sunrise Valley Drive, Reston, VA 22092

As more land-based process information is included in the predominantly atmospheric general circulation models (GCM), the generalization of descriptions of the Earth's surface contained in digital elevation models (DEM) and other land characterization data sets is becoming more important. Many lower resolution data bases used in global models are being assembled from groups of higher resolution regional data bases.

As the regional effects of global change are studied, and the information generated by continental and global models provides data sources for the regional hydrologic models, the validity of those regional models' predictions may come into question. Although efforts are being made to minimize the amount of information lost in the generalization process, some loss is inevitable. It is important to understand the effect that such an information loss will have on the models in which these data are used.

This research project examined the sensitivity of a widely used precipitation-runoff model to data generalization. A controlled experiment was conducted to determine how runoff predictions were affected by changes in the spatial resolution of elevation-based input parameters.

Preliminary results suggest that, for the 17 years tested, the elevation data resolution had a significant effect on the prediction of monthly runoff totals, but the annual runoff totals were unaffected by generalization of the elevation data from 100 to 1,000 meters. In addition, the changes in predicted monthly runoff showed a seasonal pattern. If such runoff differences hold up under statistical tests, they could suggest serious seasonal prediction errors when input data are generalized.

OVERVIEW OF THE PAPERLESS REPORT PROJECT OF THE U.S. GEOLOGICAL SURVEY

HATHAWAY, R.M., USGS, WRD, 227 N. Bronough St., Suite 3015, Tallahassee, FL 32301; and
REINITZ, T.A., USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22902

The Paperless Report Project is a cooperative effort of the U.S. Geological Survey (USGS), Office of the Assistant Chief Hydrologist for Scientific Information Management, and the Florida District of the USGS to develop, evaluate, and test procedures for producing publications in a fully electronic environment. A Water-Resources Investigations Report "Effects of Selected Dairy Farms on Ground-Water Quality in North Florida" by William A. Andrews is being prepared from draft to camera-ready stages using Data General workstations and software packages that include FrameMaker, CorelDRAW, USGS-G2, Statit, and Statistical Analysis Software (SAS), and local and wide-area networks. The techniques used at each stage are documented in an electronic journal and recommendations for the production of paperless reports will be published in an Open-File Report.

Training for the various software packages, including CorelDRAW and FrameMaker, has been provided to project participants. FrameMaker training covered both basic and advanced features, such as creating complex equations and tables. Refinements have been made to FrameMaker templates, and USGS-G2 software has been revised to resolve difficulties experienced in importing ASCII data files.

The author completed the draft report in April 1993 and the report has undergone precolleague reviews by the Supervisor, Discipline Specialist, and Editor. All text, charts, maps, photographs, and other illustrations were reviewed electronically using the Distributed Information System-II (DIS-II) and Data General workstations. Reviewer comments were added in color as an overlay using the graphics text tools.

Overall, the early electronic reviews and author revisions of text and illustrations were completed without experiencing any problems that delayed the scheduled progress of the report. The use of multiple screens to review test, illustrations, and tables is efficient; however, some enlargement features need to be utilized for smaller graphics and type fonts that are not easily visible onscreen.

The paperless report will be transferred electronically to colleague reviewers in September 1993 using the DIS-II wide-area network. Region and Headquarters reviews and Director's approval of the report are scheduled from October 1993 through January 1994. Camera-ready production and printing is scheduled to be completed by June 1994. An Open-File Report containing the documentation from this project will be compiled by the project participants.

COMPUTER-BASED, THREE-DIMENSIONAL VISUALIZATION OF OBSERVED SOLUTE DISTRIBUTIONS DURING THE CAPE COD TRACER TEST, MASSACHUSETTS

HESS, Kathryn M., *KRUGER*, Mary H., *STOCK-ALVAREZ*, E. Jessica, and *LeBLANC*, Denis R., USGS, WRD, 28 Lord Road, Suite 280, Marlborough, MA 01752

The high spatial and temporal densities of the tracer-concentration data collected during the large-scale tracer test in a sand and gravel aquifer at the U.S. Geological Survey Toxic Substances Research Site on Cape Cod, Massachusetts, make this data set ideal for testing the application of computer-based visualization to ground-water studies. Two thousand gallons of water containing the nonreactive tracer, bromide, and the reactive tracers, lithium and molybdenum (as molybdate), were injected into three closely spaced wells on July 18-19, 1985. An array of 656 multilevel samplers was installed downgradient of the injection wells. Each multilevel sampler was constructed with 15 sampling ports in the vertical direction, thus providing almost 10,000 sampling points. Approximately 57,300 samples were collected from the multilevel samplers during 19 comprehensive sampling sessions conducted during July 1985-June 1988.

The software used in this exercise is Advanced Visual Systems (AVS), which is one of the few visualization packages that run on the Data General platform. AVS creates images of spatially scattered data that can be used to explore the data in ways which would be difficult using conventional graphical techniques. For example, images can be rotated so that all sides can be viewed, isosurfaces can be peeled away to reveal the complex interior of a solute distribution, and discrete measurements of solute concentration can be spatially displayed as spheres, with the size and color of each sphere varying based on the concentration. In AVS, three-dimensional isosurfaces are constructed by interpolating between irregularly spaced data points using tetrahedrons. This algorithm results in isosurfaces that lack smoothness, but that accurately reflect the measured data. AVS also can be used to create two-dimensional slices through a three-dimensional distribution, resulting in improved versions of standard two-dimensional contour plots.

The images created by AVS visually confirm our previous understanding of the tracer-test results. Dispersion of the tracers occurred mostly in the direction of transport; dispersion transverse to flow was limited. Movement of the reactive tracers, molybdenum and lithium, was retarded and they progressively lagged behind the nonreactive bromide. Early in the test, the reactive and nonreactive tracer clouds overlapped. By making one of the images transparent in AVS, both overlapping tracer clouds can be displayed without losing the three-dimensional aspects of either one. Through this type of visualization, we gained new insight into the complexity of the tracer distributions and into the spatial and temporal relations among the three tracers.

USING A GEOGRAPHIC INFORMATION SYSTEM TO DERIVE URBAN LAND USE FROM POPULATION DATA

HITT, Kerie J., USGS, WRD, 12201 Sunrise Valley Drive, Reston, VA 22092

The National Water-Quality Assessment (NAWQA) program has developed a geographic information system (GIS) procedure to define urban land use by overlaying U.S. Bureau of the Census 1990 population density at the block group level on 1970's digital land-use data from 1:250,000- and 1:100,000-scale maps. First, the population density of the census block groups is calculated, and then the block group boundaries are overlaid on the 1970's land-use information. Any area having a population density of 1,000 or more people per square mile is re-classified as "urban" land use in the derivative map.

To evaluate the procedure, the GIS technique was applied to four NAWQA study areas. Local scientists have verified that the results give reasonable indications of urbanization that has occurred since the 1970's land-use data were compiled. The NAWQA program intends to relate water quality to urban land use in all 20 NAWQA study units. Other projects requiring up-to-date urban land use could use this technique to estimate the extent of urban land until a more current national land-use data base is compiled.

A SITE VERIFICATION PROGRAM USING ARC/INFO GEOGRAPHIC INFORMATION SYSTEM SOFTWARE

HOFFMAN, Scott A., USGS, WRD, 840 Market St., Lemoyne, PA 17043-1586

Locational errors of data points can limit their use within site-specific data bases. In particular, with the forthcoming implementation of the National Water Information System-II (NWIS-II) of the U.S. Geological Survey (USGS), verification of site-specific locations for the USGS data bases ADAPS, Ground Water Site Inventory (GWSI), WUDS, and QWDATA is a significant element. A geographic information system (GIS) can be a valuable tool for detecting latitude and longitude errors for streamflow-gaging stations, wells, water-use facilities, and water-quality data-collection sites within these data bases. A computer program has been developed in the Pennsylvania District that uses the cartographic capabilities in the Arcplot module of ARC/INFO to simplify the detection of erroneous site locations. Users may select background and foreground colors by a series of pop-up windows. Information on site-specific locations is retrieved by county or hydrologic unit by using the data-retrieval method of the particular data-base system. This information (in an ASCII file) is combined with existing USGS programs, GIS digital data sets, and on-screen display and query, to produce a file of sites with possible locational (latitude/longitude) errors. This program also could be adapted to attribute verified locations with county and hydrologic-unit data.

DEVELOPMENT OF A PLATFORM-INDEPENDENT PAPERLESS TIME AND ATTENDANCE SYSTEM

HUTTMAN, Greg, USGS, AD-OSM, 12201 Sunrise Valley Drive, Reston, VA 22092

The Administrative Division is leading a multidivision effort to develop a new Paperless Time and Attendance (T&A) system. Building on an existing system, the aim of this project is to jointly design an application capable of operating on a variety of dissimilar computers throughout the USGS—PC's, UNIX workstations, and Macs. The new system will be designed with input from all Divisions in the USGS using the Joint Application Design (JAD) approach with tools that facilitate rapid prototyping. The new system is designed to interface with the Water Resources Division Administrative Information System (AIS) and National Mapping Division's work assignment system being developed for its regional mapping centers. Elimination of the paper T&A reporting form, greatly reduced error rates, electronic routing and approval of T&A information, and more timely data entry (no need to project leave use ahead of time to meet the processing cut-off) are all achievable benefits.

Because of the use of the cross-platform application development tool, the T&A system is the first application capable of running on virtually every type of hardware, network, operating system, and database management system now in use at the USGS. A phased implementation will begin in the Administrative and Water Resources Divisions early in the summer of 1994.

THE DEVELOPMENT OF TOOLS FOR CONSTRUCTION OF INTERACTIVE INFORMATION SYSTEMS

JOHNSON, Larry E., USGS, ISD, Denver Federal Center, Box 25046, Denver, CO 80225-0046

This presentation describes the process of developing some of the necessary tools to build an interactive information system. An interactive information system is a hierarchical menu-driven system that contains and displays information in the form of hypertext documents containing pictures, graphs, sound, animation, data and meta-data. The main advantage of an interactive information system is that a user can browse through the information and skip areas that are not of interest.

This research project provides an integrated set of tools for building an interactive information system. The type of interactive information system that will be built as a result of this work is for the distribution of scientific data and information related to that data. These tools will help in the production of data sets for the sharing of data with researchers and other people who wish to gain information in a research area. The tools will make the process of producing interactive data sets on digital compact disc easier and will reduce the cost of putting the information in a usable and convenient form.

There are three major groups of end users of an Interactive Information System. The first are scientists and researchers, who will be mostly interested in the data and how to retrieve it from the digital compact disc. The second group will be decisionmakers (in industry and government), who will be interested in the results of a research project and how it will affect them. The third group will be educators, who will use the interactive information system in teaching new areas of research.

The following is a list of the tools that are being developed.

1. Tools within the interface builder
    a. Templates for a hierarchical menu system.
    b. Template windows to contain hypertext
    c. Page turning facilities for large papers
    d. Interface window for graphic files
2. Full Text Searches to find information within text fields quickly
3. Conversions for most graphic formats and resizing of graphic files

With these tools, interactive information systems can be constructed more rapidly and at a lower cost.