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Hydrodata: water resources information for the United States and Canada

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An wide range of water resources data for the United States and Canada is available through the Hydrodata family of compact discs. Hydrodata is produced by EarthInfo Inc., who market non-bibliographic environmental information on compact disc. For the United States, Hydrodata discs provides access to daily and peak streamflow values and surface and ground water quality data from the WATSTORE database of the United States Geological Survey (USGS). WATSTORE is an acronym for the National WATER Data STOrage and REtrieval System and was established by the USGS to handle water data and to facilitate release of the data to the public. WATSTORE is operated by the USGS at its National Center in Reston, Virginia which, for a fee, provides a range of products from simple tables to complex statistical analyses. In WATSTORE and on the Hydrodata discs, more than 600,000 station years of daily values, more than 25,000 stations of flood peak values, and over three million surface and ground water quality observations for 3,000 water quality parameters from 200,000 locations are available. These WATSTORE records are published annually in numerous volumes of the USGS Water-Data Report series; earlier volumes were published in the USGS Water-Supply Papers series. For Canadian surface waters, a Hydrodata disc provides access to daily and peak stream flow and lake levels from the Hydat files (surface water and Hydex) of the Water Resources Branch of Environment Canada. On disc are more than 200,000 station years of Canadian surface water observations.

Hydrodata is a family of five CD-ROM titles with some available as a national disc and others as regional discs. Hydrodata discs are non-bibliographic and present data to the informed researcher for subsequent analysis. Familiarity with water data is mandatory for using and understanding the vast information resources of Hydrodata. This review looks at four titles in the Hydrodata family: USGS Daily Values; USGS Peak Values; Environment Canada Canadian Surface Water Data; and, USGS Quality of Water Surface Water. The first three share a similar software interface; USGS Quality of Water Surface Water has a totally different software interface. Unreviewed is the USGS Quality of Water Ground Water title which shares its software interface with the Quality of Water Surface Water CD-ROM under review. In addition to the Hydrodata series of discs, EarthInfo produces the Climatedata series of discs accessing the United States National Climatic Data Center's archives of daily weather observations, hourly and 15 minute

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precipitation, and thirty-year weather averages.

USGS DAILY VALUES

USGS Daily Values (volume 3, version 2.3) presents daily data related to stream flow or lake volume and also some physical data. USGS Daily Values is produced as four regional discs (figure 1). Most of the USGS Daily Values data is related to stream flow and represents daily observations of parameters like stream flow (volume), temperature, height above datum (stage), and suspended sediment concentration and discharge. Other parameters on disc are lake levels, reservoir storage, and physical observations like pH and conductivity. Occasionally stray data like rainfall shows up.

Start by selecting a state (figure 2); a specific state can be configured as the startup default. View each state's daily values for observing stations through five menu-based ways: index, summary, daily, extremes, and remarks. The index view (figure 3) displays that state's list of stations and the available parameters of water data. Each index listing covers one parameter per station; one station (eg San Diego River Near Fashion Valley) with three parameters (eg stream flow, temperature, suspended sediment concentration) has three listings. Each listing contains the station's name, parameter being measured, the type of statistic being reported (eg minimum, maximum, mean), the first year and the number of years on record. The list of stations can be re-designed for specific needs and saved lists can be loaded upon startup or at any time. Stations can be screened to select those having certain parameters of data. The summary view (figure 4) displays general information on the station and a monthly summary of data (including mean, minimum, and maximum) for all years on record for the parameter under review. The station information covers location, elevation, drainage area, latitude and longitude. A bar graph at the bottom of the screen graphically represents the number of years on record. The daily view (figure 5) displays daily observations for each year on record for each stations's parameters. The extreme view (figure 6) displays the daily mean and extremes (minimum and maximum values and years in which they occurred) for all years on record for each station's parameters. The remarks view displays a textual information file (if available) relating to each station's history and period of record.

USGS PEAK VALUES

USGS Peak Values (volume 3, version 2.3) presents annual and partial flood peak values for stream flow. All US peak values are available on one national disc (no regionals). The annual flood peak is the highest discharge or flow recorded during a year; a partial peak is the flow recorded during each hydrologic event with several events possible

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during a year. The USGS Peak Values disc is accessed by a software very similar to that used for the USGS Daily Values discs. After selecting a state, view each state's flood peaks through six menu-based ways: index, summary, annual, partial, rank, and remarks. These views are similar to views for the Daily Values discs. The index view displays the station name, the starting and last year of record, and the number of annual and partial peaks. The summary view (figure 7) displays the history of flood peaks for a station including station location and minimum and maximum flood peaks and maximum stage for years on record. A bar graph at the bottom of the screen graphically represents the number of years on record. The annual view (figure 8) displays a station's yearly flood peaks in chronological order while the partial view displays multiple observations of high flow for each year. The rank view (figure 9) displays a station's annual and multiply-observed or partial peaks ranked from highest discharge to lowest. The remarks view (figure 10) displays a textual information file (if available) relating to each station's history and period of record.

ENVIRONMENT CANADA CANADIAN SURFACE WATER DATA

Environment Canada Canadian Surface Water Data (volume 2, version 2.0) presents daily and annual peak stream flow and lake levels for all Canadian provinces and territories on one disc. The Environment Canada disc is accessed by a software very similar to that used for the USGS Daily Values discs. After selecting a province, view each province's daily flows, peak flows and lake levels through six menu-based ways: index, summary, daily, peak, Hydex, and mean. These views are similar to the views for the USGS Daily Values discs. The index view displays the station name, the parameter being measured (flow or water level), the first year of record, and the number of years of record. The summary view displays station location information and the station's history of flows or levels including daily minimum, maximum and average values and monthly maximum and minimum means. A bar graph at the bottom of the screen graphically represents the number of years on record. The daily view displays a station's daily flow or level readings a year at a time. The peak view displays a station's daily maximum and minimum mean stream flow or lake level and the annual maximum stream flow discharge or lake level for the years on record. The Hydex view displays a station gage information including location, type of gage, datum, operations schedule, and history. The Mean view displays monthly and annual means for each year on record.

USGS QUALITY OF WATER

USGS Quality of Water Surface Water (volume 1, version 1.21) presents three million analyses of 3,500 surface water quality parameters from 200,000 stations. The unreviewed companion product covering ground

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water quality provides similar data and shares the same menu structure and software features. Both USGS Quality of Water titles are produced as four regional discs with the same geographical divisions as the USGS Daily Values discs. Surface water quality parameters on disc include the expected (water temperature, turbidity, alkalinity, metals, coliform, pesticides, organics, inorganics, solvents, radioisotopes) and the unexpected (precipitation, evaporation, humidity, dead fish). "Water quality" can be very broadly defined as browsing through the list of water quality parameters reveals. This product's interface software is substantially different from that used by the other Hydrodata CD-ROMs yet does have similarities facilitating cross-over usage. A main menu of seven options (file, station, analysis, parameter, locate, mark, display, help) appears along the top of the screen with each option having a pull-down menu. The File menu starts new search queries/results, saves existing queries/results, and recalls previously saved search queries/results. The File menu also exits to DOS, prints retrieved data, and exports water quality data to a file. The Station menu (figure 11) creates a search query through selection of water quality observing stations. Stations can be searched by name, identification number, state, or county; stations can also be browsed through a list. Stations are selected for a search query in order to retrieve information. A selected group of stations can be limited or range searched by latitude, longitude, elevation, drainage and contributing areas, and other criteria. Groups of stations can be permanently saved and reused in future queries. The Analysis menu (figure 12) further defines the search query through definition of analytic attributes pertaining to the observing stations with the default being to take all analyses. Analytic attributes include date, time, geologic time unit of the formation from which the data was taken (eg Pleistocene), hydrologic conditions and events (eg whether a river was rising or falling), and the type and medium of the sample from which the data was taken (eg animal tissue). Analytic attributes like date and time can be range searched.

The Parameter menu further defines a search query through definition of the desired water quality parameter(s) with the default being to take all parameters. Browsing the long list of water quality parameters (figure 13) is enlightening once but tedious with regular use; text searching via function key F4 for the names of water quality parameters is recommended. After searching through the water quality parameter list for a particular type eg selenium, all selenium parameters can be permanently saved and reused in future queries. Code numbers for the water quality parameters can be searched but users have to browse or search a long non-hierarchical onscreen list to learn codes for desired parameters. Water quality parameters can be range searched to locate high concentrations of a substance. The Locate menu begins, continues, and stops search queries and also finds stations, analyses, and parameters by text word or codes. The Mark menu duplicates the ability

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of function keys to select specific stations, analyses, and parameters for search queries. The Display menu switches between long and short displays of water quality data. The long display unfolds the information retrieved from a search query: each observing station and their analyses and water quality parameters. Each station and its analysis and parameter information is displayed onscreen in three windows (figure 14); each window is entered through the Tab key to page through all retrieved information. The retrieved stations can be looked at one-by-one, one station's analyses can be looked at one-by-one, and one station's water quality parameters can be looked at one-by-one. The short display arrays each station's analyses and parameters like a spreadsheet.

FEATURES IN COMMON

Function keys have equal or similar assignments in the software used by the Hydrodata discs. Thus a user can cross over from one disc to another and not be totally lost. Function key F1 accesses an online help manual. Help is not context-specific but is arranged under broad headings. Help information is useful and refers users to the manual when more detail is needed. The printed manual is well-written in a friendly style with a useful table of contents and index; comprehension is enhanced with figures of the screen displays. For USGS Daily and Peak Values and Environment Canada, function key F2 toggles station listings between their names and their identification numbers. Function key F2 is unused in USGS Quality of Water. For USGS Daily and Peak Values and Environment Canada, function key F3 searches stations by their names or identification numbers. For USGS Quality of Water, function key F3 searches for stations, parameters or analyses by code number. For USGS Daily Values and Environment Canada, function key F4 pulls out a station's daily data for a specified year. For USGS Quality of Water, function key F4 searches stations, parameters or analyses by text words. Text word searches can be left-truncated and are truncated automatically on the right. Function key F5, F6, and F7 are used to mark and unmark individual stations or groups of stations for subsequent examination/manipulation of data. For USGS Quality of Water, function key F8 is used to mark and unmark all stations or items in a list. Function key F10 (figure 15) translates into full text the data codes used in USGS Peak Values and USGS Quality of Water.

The Hydrodata software supports printing of exact screen images with lines and boxes on graphics-capable printers (see the figures for this review). DOS, wordprocessing, or spreadsheet software can be temporarily accessed without leaving the Hydrodata software. With this feature for those microcomputers with sufficient memory resources, data can be exported and imported directly into a written report. Data on Hydrodata discs can be exported in several formats usable by many other software. Output formats for data are ASCII table, Lotus WKS

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spreadsheet, dBase DBF file (only USGS Daily Values and USGS Quality of Water), USGS Binary file (all discs including Environment Canada), Canadian Binary (only Environment Canada), and, card record (only USGS Daily Values, USGS Quality of Water, and Environment Canada).

EarthInfo recommends a fast microcomputer for using the Hydrodata CD-ROMs. Take this advice to heart and consider at least a 80386 microcomputer and the latest models of CD-ROM players offering fast access times. Expect that users will engage in long searches; many types of Hydrodata searches will consume considerable time and the printed documentation warns of this. Offering Hydrodata discs in an environment serving many active users will require a workstation dedicated to the Hydrodata discs. If expected usage will be regular, consider carefully the ramifications of putting Hydrodata on a CD-ROM workstation offering access to several other CD-ROMs. Searching for all analyses of 20 strontium water quality parameters for all San Diego County stations consumed six minutes on a 10 megahertz 80286 microcomputer attached to a vintage Philips CM100 CD-ROM player. Six minutes was just the search time. Pre-search and post-search activities consume substantial additional time. Pre-search activities for this six minute search were global marking of all San Diego County stations and textword-search and marking of all strontium water quality parameters. Post-search activities would be onscreen reviewing, printing, or exporting all retrieved data. Experienced users will become speedy on the Hydrodata discs while inexperienced users will take considerable time and ask for assistance. The Hydrodata discs and software are powerful in their retrieval capability and the data is very interesting to review onscreen; expect extended search sessions.

To facilitate further manipulation of Hydrodata's data, EarthInfo sells a wide range of supplemental software. Statistical programs analyze data (e.g. flood recurrence, log-Pearson frequency-duration, moving averages, graphing tools for Lotus, R:Base, and dBase). A Hybridata software brings a suite of Hydrodata-like functions to locally-collected data. On the microcomputer's hard disk, Hybridata will edit or import, store and manipulate non-CD-ROM data collected locally. Subsets of data both local and derived from CD-ROM can be created and distributed for Hybridata viewing and manipulation. For maximum flexibility in using the information on Hydrodata's compact discs, a Programmer's Toolkit is available which is a library of C programming language routines to directly access data from the Hydrodata discs. Individualized programs can be written in the C language incorporating these routines.

Hydrodata subscriptions are \$495 per disc for the first year with annual updates at \$295 per disc. A four-disc Hydrodata subscription to all regional discs in a series (eg USGS Daily Values) is discounted to \$1595 for the first year with annual updates for \$995. For those wary

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of CD-ROM subscriptions, disc purchases are available at \$1095 per disc and \$3495 for a four-disc series. A site license is required when Hydrodata discs are used at multiple sites, or are used by multiple users via network access, or when exported data is distributed to multiple sites. The site license fee is per-user and per-disc and is added to the subscription or purchase price. EarthInfo will also download the data for any USGS station to floppy disk(s) starting at \$200.

Equipment/software required: IBM PC or compatible, 512K RAM, CD-ROM player, Microsoft Extensions or Reference Technology Standard File Manager, DOS 2.0 or higher, 2 floppy drives

Equipment/software recommended by EarthInfo: 640K RAM and additional memory, 20 megabyte hard drive, color monitor, DOS 3.0 or higher, 80386 or higher microcomputer, math coprocessor chip.

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