

EPIC

By Donald W. Denbo and Nancy N. Soreide

WHAT IS EPIC? EPIC is many things all designed to work with *in situ* data sets. For the researcher, EPIC provides a large selection of high quality analysis tools for many different types of data (time series, CTD, ADCP, XBT, bottle, etc.). For the programmer, it provides a single application program interface (C, Fortran, and MATLAB) to multiple data formats (netCDF, Classic EPIC, and hpf format). For the database manager, it provides tools for the loading of meta data into a database and formatting the results from a researchers query into a format that can be directly used by the EPIC analysis tools. For the webmaster, EPIC provides a set of tools to access and display data in real time.

EPIC was developed at NOAA's Pacific Marine Environmental Laboratory to manage the large numbers of hydrographic and time series oceanographic *in situ* data sets collected as part of the NOAA climate study programs, such as EPOCS and TOGA in earlier years, WOCE, CLIVAR and others more recently. At present, PMEL maintains approximately 100,000 individual data sets in the EPIC data base. These data are available on-line to researchers inside PMEL on the desktop and can be provided on PMEL's intranet utilizing EPIC Web utilities.

The Researcher

Typically the researcher will use EPIC tools to select a data set, refine the initial data selection, analyze the data, and dis-

play the results with publication quality graphics (the Plot Plus Graphics program, available at "[HTTP://www.halcyon.com/www2/dwd](http://www.halcyon.com/www2/dwd)") at no cost, is used at PMEL and many other oceanographic institutions).

EPIC analysis and display tools are available for both UNIX and VMS environments. Tools are available to calculate a wide range of oceanographic parameters, such as dynamic height, geostrophic velocity, and potential density. Programs to compute statistics, auto and cross spectra, correlations, and empirical orthogonal functions and to display sections, time series, multivariable CTD casts, and temperature-salinity lines graphically are available. Since the EPIC tools are individual programs, it is easy for a researcher to add a new analysis technique or use his favorite graphics program.

EPIC is capable of working with profile (CTD casts, XBT, bottle), time series from moored instruments, shipboard ADCP, and drifting buoy data. Presently, EPIC can read files in netCDF, classic EPIC, and hpf data formats. Documentation that describe the netCDF format is available at "http://www.pmel.noaa.gov/epic/General_Conv.html".

A new generation of X/Motif tools (Fig. 1) are being developed to provide easy access to the EPIC data files and make it convenient for researchers to display, analyze, and edit the EPIC *in situ* data from desktop UNIX computers. These tools include **XEpic**, EPIC meta data selection, **4dEdit**, graphical 4-dimensional view and edit selected meta data, **EpicEdit**, text view and edit selected meta data, and **HdrEdit**, text edit header information of an individual EPIC data file. More information is available at "<http://www.pmel.noaa.gov/epic/gui.html>".

Documentation for EPIC includes on-line help for all routines. User manuals

and on-line examples document all system elements for the researcher and the data-base manager.

The Programmer

Access to the EPIC data files is provided via the EPIC system library "epslib." Epslib was developed to give a single consistent application program interface to multiple file formats (Fig. 2). Programs that use epslib consist of four layers: (I) the application specific code, (II) the language interface layer, (III) the file independent layer, and (IV) the file dependent layer. Epslib currently supports the C language, Fortran, and MATLAB with plans to include C++ and Java. The layered approach allows epslib to protect the large investment in software development by providing a path to easily support new data formats.

New file formats are implemented by writing only the code needed to read the new format from disk and load the required information into the internal epslib data structures. Additional information about epslib is available at "<http://www.pmel.noaa.gov/epic/eps-overview.html>".

The DataBase Manager

The EPIC system provides several tools to help the database manager import meta information from data files into the database tables. Command line, X/Motif, and Web tools are provided to query to the database. Presently the INGRES database software is fully supported and support for the msql software is under development.

The WebMaster

A set of EPIC Web utilities have been developed to access data and generate graphics. Utilities for creating Web pages include **AnyURL**, which uses forms to point to static URLs (such as GIF graphics, MPEG animations, or other Web

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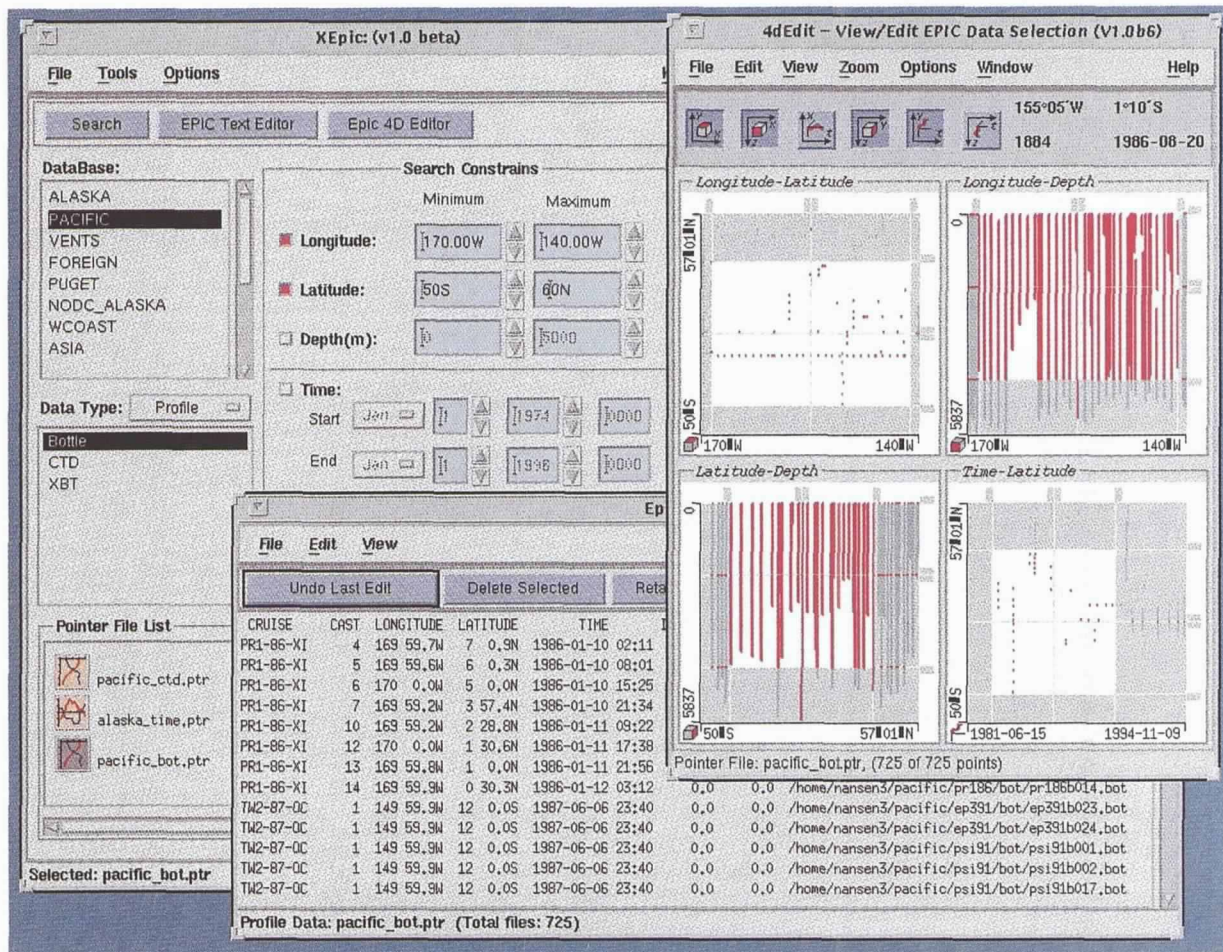


Fig. 1: The EPIC X/Motif tools.

pages) with HTML and **cover**, which can be used for dynamic generation of graphics or listings on the Web by running existing utilities from a Web page. Utilities for graphics and data access include **m2gif**, which converts Plot Plus meta-code files into GIF files, and EPIC/IN-

EPS Library

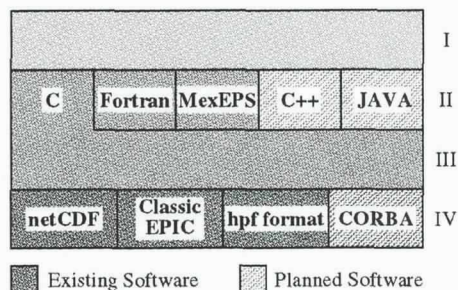


Fig. 2: Epslib layer structure.

GRES communications. The **EPIC Web Browser** is a utility for viewing *in situ* data on the Web by creating graphics and listings "on the fly."

A more complete description of the utilities with examples is available at "<http://www.pmel.noaa.gov/epic/doc/web-utilities.html>" and examples of Web access to oceanographic data using the EPIC utilities can be found at "<http://www.epic.noaa.gov/epic/>".

Java provides a flexible and platform independent environment for data access, delivery, and graphics. Demonstration projects using the EPIC software development tool kits with Java are available for viewing at "<http://www.epic.noaa.gov/epic/java/java-info.html>".

Obtaining EPIC

EPIC is freely available for UNIX and for VAX/VMS. Elements of EPIC are in use at many oceanographic insti-

tutes, and the PMEL team welcomes collaboration and software exchange with others using any of the system elements. More information on how to obtain EPIC can be found at "<http://www.pmel.noaa.gov/epic/epic-toolkits.html>". The tools are available at "<ftp://ftp.pmel.noaa.gov/epic/>". The EPIC Home Page is "<http://www.pmel.noaa.gov/epic/>" and you can contact the EPIC team via e-mail at "epic@epic.noaa.gov".

The EPIC Team

Programmers and consultants who have contributed to EPIC system development include Robert Deloura, Donald Denbo, Dave Kachel, Jean Lynch, Linda Mangum, Laura McCarty, Margie McCarty, Dai McClurg, Kristy McTaggart, Nazila Merati, Nancy Soreide, Mark Renton, Sigrid Salo, Marie Schall, Mick Spillane, Tiffany Vance, Willa Zhu, and Stefan Zube. □