The Data Web Pages of the Tides and Inflows in the Mangroves of the Everglades (TIME) Project

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USGS science for a changing world

TIME http://time.er.usgs.gov

What is TIME?

The Tides and Inflows in the Mangroves of the Everglades (TIME) project of the USGS South Florida Place-based Studies Program is a joint research effort to investigate the interacting effects of freshwater inflows and tidal forces in and along the mangrove ecotone of south Florida. This investigation is being accomplished through the use of coupled, numerical, surface-water and groundwater flow models of the region. The primary purposes of the TIME web site are: 1) to provide project scientists ready access to all data required as input to the models; 2) to provide project scientists with an efficient mechanism for sharing data, model output and other information among themselves; and 3) to disseminate project findings to other interested researchers. Toward these goals, the TIME web site (Figure 1) is organized into several sections, including "Time Data" for sharing data (Figure 2), "What's New?" for displaying timely results, and "Scientific Links" for directing users to additional sites of scientific interest in south Florida.

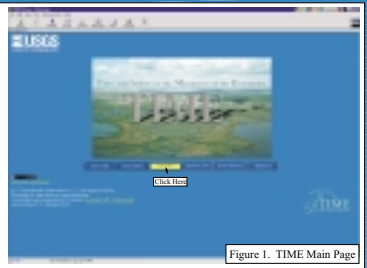

Figure 1. TIME Main Page

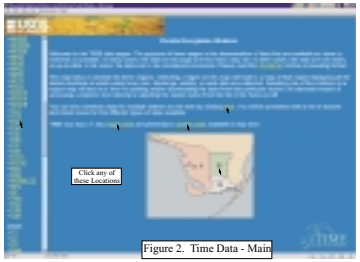

Figure 2. Time Data - Main

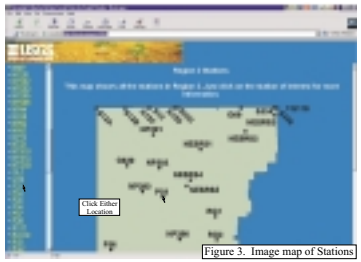

Figure 3. Image map of Stations

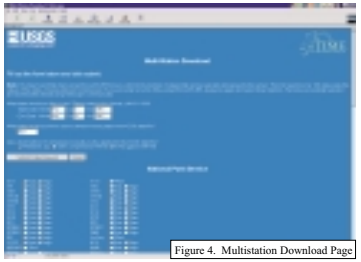

Figure 4. Multistation Download Page

What do the "Time Data" pages contain?

Data from over 100 gaging stations in the TIME modeling domain can be viewed and downloaded from the "Time Data" web pages. The user selects a link to a station of interest from a scrollable list, from a map image of one of three regions, or from the multiple station download page (Figures 3 & 4). Following the links in figure 3 takes the user to the selected "Station Description" web page (Figure 5). By completing and submitting the form on this page, the user can do any combination of the following: 1) view a timeseries plot of either one or two variables collected at the station (Figure 6); 2) download a postscript version of the timeseries plot; 3) download a .gif version of the plot; and 4) download an ASCII data file with or without data compression (Figure 7). By selecting the period of record and the stations of interest on the multistation download page, the user can download as many ASCII data files as needed in one quick step. The TIME data system also shows yesterday's rainfall totals (Figure 8) and a 7 day stage trend (Figure 9) in map form. These products are available from the links on the main TIME data pages (Figure 2).

Figure 5. Station Description Page

```
********************** WARNING **********************
Data available via this website may be provisional data
that have not been reviewed or edited. These data may
be subject to significant change and are not citeable
until reviewed and approved by the agency responsible
for their collection.

Data users are cautioned to consider carefully the
provisional nature of the information before using it
for decisions that concern personal or public safety
or the conduct of business that involves substantial
monetary or operational consequences.

Information concerning the accuracy and appropriate
uses of these data should be obtained from the contact
person listed on each station's web page.

Please refer to the Status code to determine if the
data are provisional or published.

Status Key:
0 = USGS Published    1 = USGS Provisional
2 = NPS Published     3 = NPS Provisional
4 = SFWMD Published   5 = SFWMD Provisional
6 = NOAA Published    7 = NOAA Provisional
8 = USACOE Published  9 = USACOE Provisional
*****************************************************
Station P33
Latitude = 25 degrees 36 minutes 54 seconds
Longitude = 80 degrees 42 minutes 9 seconds
Vertical Datum = NGVD 1929
Horizontal Datum = NAD 27
Units = m

Data Type      Date        Time  Value     Status
-----------------------------------------------------
stage          6- 1-1999   1:00  1.93      3
stage          6- 1-1999   2:00  1.93      3
stage          6- 1-1999   3:00  1.93      3
stage          6- 1-1999   4:00  1.93      3
stage          6- 1-1999   5:00  1.93      3
stage          6- 1-1999   6:00  1.93      3
stage          6- 1-1999   7:00  1.93      3
stage          6- 1-1999   8:00  1.93      3
stage          6- 1-1999   9:00  1.93      3
stage          6- 1-1999  10:00  1.93      3
stage          6- 1-1999  11:00  1.93      3
stage          6- 1-1999  12:00  1.93      3
stage          6- 1-1999  13:00  1.93      3
stage          6- 1-1999  14:00  1.93      3
:
```

Figure 7. Sample Data

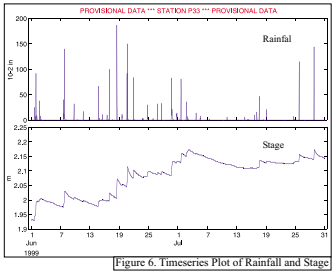

Figure 6. Timeseries Plot of Rainfall and Stage

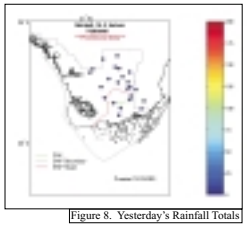

Figure 8. Yesterday's Rainfall Totals

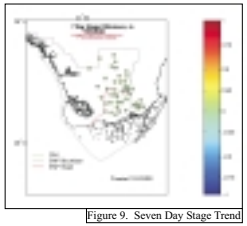

Figure 9. Seven Day Stage Trend

Who collects the data in the TIME data system?

Data in the TIME data system are collected by the U.S. Geological Survey, the National Park Service, the U.S. Army Corps of Engineers, NOAA, and the South Florida Water Management District. Information regarding a data point's source, and any disclaimer provided by the source, is stored with each data point in the system. Much of the data in the system is updated monthly. However, the National Park Service, Everglades National Park, supplies data from many of the stations on a daily basis.

How is the TIME data system implemented?

Data are stored in the TIME data system in NetCDF (Network Common Data Form). They are then accessible via the web interface for plotting and downloading using a Common Gateway Interface (CGI) script written in PERL using the NetCDFPerl modules. When the user fills out one of the short forms on the "Station Description" page or the multistation download page and clicks the "Submit Data Request" button, the CGI script parses the input from the form and either formats the requested data into an ASCII file for download, uses Matlab and Mexcdf to produce a plot of the data, or performs both functions simultaneously depending on the user's request. The server for the TIME web site is the Apache Web Server running on a 733 MHz PC under Redhat Linux 6.1. All the software mentioned above, with the exception of Matlab, is open source and freely available (See the list of URL's at lower right).

Why does the TIME data system use NetCDF?

NetCDF files are binary, direct-access and self-describing. Each contains a header and a data section. The header describes the dimensions, names and attributes of each data array stored in the file. It also contains global attributes describing general information about the dataset (An example ASCII equivalent of a NetCDF file header is shown in Figure 10.).

By including specific variable and global attributes, data sets can be designed to comply with established conventions. TIME data files comply with both the NOAA EPIC and Unidata NetCDF conventions, used for the storage of meteorologic, hydrologic and oceanographic data. These conventions allow TIME data files to be interpreted correctly and without modification by many software packages other than those written specifically for TIME. EPIC convention requires data to be stored in four-dimensional (depth, latitude, longitude, and time) arrays. Data arrays are organized with the time dimension defined as unlimited, allowing data collected in the future to be appended easily to the files.

The time values recorded in the data files are stored as two variables, named time and time2. Time is the True Julian Day on which a data point was collected. Time2 is the number of milliseconds elapsed between the time the data point was collected and 00:00 GMT on the collection day. The combination of the two variables gives the TIME data system millisecond resolution over thousands of years.

The TIME data system is designed to store timeseries of scalar variables. At present, these include stage, rainfall, discharge, salinity, conductivity, wind speed, and wind direction. However, there is no practical limit to the number of different types of timeseries data that the data system can accomodate.

```
netcdf P33_stage {
dimensions:
    depth = 1 ;
    latitude = 1 ;
    longitude = 1 ;
    time = UNLIMITED ; // (19752 currently)
variables:
    float depth(depth) ;
        depth:FORTRAN_format = "f10.1" ;
        depth:units = "m" ;
        depth:type = "" ;
        depth:epic_code = 3 ;
    float latitude(latitude) ;
        latitude:FORTRAN_format = "f10.4" ;
        latitude:units = "degrees" ;
        latitude:type = "" ;
        latitude:epic_code = 500 ;
        latitude:valid_min = -90 ;
        latitude:valid_max = 90 ;
        latitude:horizontal_datum = "NGVD 1929" ;
    float longitude(longitude) ;
        longitude:FORTRAN_format = "f10.4" ;
        longitude:units = "degrees" ;
        longitude:type = "" ;
        longitude:epic_code = 501 ;
        longitude:valid_min = -180 ;
        longitude:valid_max = 180 ;
    int time(time) ;
        time:FORTRAN_format = "f10.0" ;
        time:units = "True Julian Day" ;
        time:type = "EVEN" ;
        time:epic_code = 624 ;
    int time2(time) ;
        time2:FORTRAN_format = "f10.0" ;
        time2:units = "msec since 0:00 GMT" ;
        time2:type = "EVEN" ;
        time2:epic_code = 624 ;
        time2:valid_min = 0 ;
        time2:valid_max = 86400000 ;
    double height(time, depth, latitude, longitude) ;
        height:name = "hght" ;
        height:long_name = "height (m)" ;
        height:generic_name = "height" ;
        height:FORTRAN_format = "f10.2" ;
        height:units = "m" ;
        height:epic_code = 18 ;
        height:scale_factor = 1. ;
        height:add_offset = 0. ;
        height:missing_value = 1.e+35 ;
        height:vertical_datum = "NGVD 1929" ;
        height:axis_name = "Stage" ;
    byte height_status(time, depth, latitude, longitude) ;
        height_status:FORTRAN_format = "i4" ;
        height_status:units = "none" ;
        height_status:valid_min = -128b ;
        height_status:valid_max = 127b ;
        height_status:missing_value = -128b ;
        height_status:status_key = "0=USGS published; 1=USGS
provisional; 2=NPS published; 3=NPS provisional; 4=SFWMD published;
5=SFWMD provisional; 6=NOAA published; 7=NOAA provisional; 8=USACOE
published; 9=USACOE provisional;" ;

// global attributes:
        :title = "                    " ;
        :CREATION_DATE = "Tue May  4 16:13:00 1999" ;
        :Conventions = "DMEL-EPIC/Time_Series" ;
        :INST_TYPE = "                    " ;
        :DATA_TYPE = "TIME" ;
        :DATA_SUB_TYPE = "Obs required with DATA_TYPE=TIME" ;
        :DATA_ORIGIN = "UNKNOWN                    " ;
        :COORD_SYSTEM = "GEOGRAPHICAL" ;
        :WATER_MASS = " " ;
        :MOORING = "      " ;
        :PROJECT = "                    " ;
        :DELTA_T = "      " ;
        :EXPERIMENT = "      " ;
        :VAR_DESC = "                                        " ;
        :COMPOSITE = "0" ;
        :POS_CONST = 0 ;
        :DEPTH_CONST = 0 ;
        :FILL_FLAG = 1 ;
        :VAR_FILL = "1e+35                    " ;
        :DRIFTER = 0 ;
        :WATER_DEPTH = 0 ;
        :DESCRIPT = "                                        " ;
        :DATA_UNIT = "
" ;
        :PROG_CMNT1 = "                                                  " ;
        :PROG_CMNT2 = "                                                  " ;
        :PROG_CMNT3 = "                                                  " ;
        :PROG_CMNT4 = "                                                  " ;
        :start_yr = 1998 ;
        :start_mo = 10 ;
        :start_da = 1 ;
        :start_jd = 2451088 ;
        :timestep = 3600000 ;
        :timestep_units = "msec" ;
        :end_yr = 2000 ;
        :end_mo = 12 ;
        :end_da = 31 ;
        :end_jd = 2451910 ;
        :missing_value = 1.e+35 ;
        :official_USGS_name = "" ;
        :official_NPS_name = "P33" ;
        :official_SFWMD_name = "" ;
        :official_NOAA_name = "" ;
        :official_USACOE_name = "" ;
        :description_name = "P33" ;
        :SFWMD_dbkey = "      " ;
}
```

Figure 10. NetCDF Header Information

Where can I learn more about the software packages used in the TIME data system?

PERL
http://www.perl.com

Redhat Linux
http://www.redhat.com

NetCDF, NetCDF Conventions, and NetCDFPerl
http://www.unidata.ucar.edu/packages/netcdf/

Matlab
http://www.mathworks.com

Mexcdf
http://crusty.er.usgs.gov/mexcdf.html

EPIC Conventions
http://www.pmel.noaa.gov/epic/

Apache Web Server
http://www.apache.org

http://time.er.usgs.gov