README File for Tide Model Driver (TMD)

Modified: 20 November, 2003 (LP)

Report problems to ***padman@esr.org***.

TMD is a Matlab package for accessing the harmonic constituents for the ESR/OSU family of high-latitude tide models, and for making predictions of tide height and currents. TMD includes two components: (1) a graphical user interface (GUI) for quickly browsing tide fields, zooming in on regions of interest, and selecting points and time ranges for predictions of specific variables; and (2) a set of scripts for accessing tide fields and making predictions. Each component is described below.

TMD was written by Lana Erofeeva (serofeev@coas.oregonstate.edu).

1. TMD GUI

The GUI is accessed in the following manner:

1. Open the Matlab dialog box;
2. Change directory to the location where the GUI code resides;
3. Run "tmd".

The following is the output shown in the dialog box:

```
>> tmd
Welcome to TMD: Tidal Model Driver!

TMD FILE NAME/FORMAT CONVENTION (MUST follow!):
1. Model and grid files should be in OTIS binary format,
   see http://www.oce.orst.edu/po/research/tide/inv_doc.html
2. Elevation file name should start from 'h'.
3. Transport file name should start from 'UV'.
4. Bathymetry grid file name should start from 'g'.
5. If grid is uniform in km string 'km' should be found
   either in model file names or in grid file name.
5. Default model files location is subdir DATA. For each model
   a control file 'DATA/Model_*' should be given. The file
   MUST contain 3 lines:
         <Elevation file name>
         <Transport file name>
         <Bathymetry grid file name>
```

4. You will be asked to select a model from a drop-down menu. If you downloaded the TMD package for a specific model, there will only be one choice available. After you select the model, output similar to the following (here, for the Ross Sea model) will appear:

```
The model is on uniform grid in lat,lon
Loading TMD (Tidal Model Driver)...done
```

```
See button tips for HELP.
Type 'help  extract_HC','help tide_pred', 'help ellipse',
Type 'help  get_coeff','help get_ellipse',
if you wish to use the scripts instead of GUI.
Model and files are in D:\Tide_models\TMD\DATA\h0_Ross.oce
 and D:\Tide_models\TMD\DATA\UV0_Ross.
Bathymetry grid file is in D:\Tide_models\TMD\DATA\grid_Ross.
Input file examples are in: lat_lon, lat_lon_1, lat_lon_2

Programmed by: Lana Erofeeva, 2003
```

5. You can now resize the graphics window so that everything in the screen is clear. Window resizing is monitored, so that for future use of TMD, window dimensions will be the same as the resized window.
6. Hovering the cursor over specific buttons will give you help for that choice. Note that in the "constituent selection" panel (upper right), you can select multiple constituents. To clear-all/select-all, right-click on the blue-gray frame. If you have multiple constituents selected, the plotted constituent is outlined in green. Right-click on the constituent you wish to view. The green frame will highlight the new selection.
7. To select a point, click the "point" button, then use the cross-hairs to choose the point. Or, enter the point coordinates manually. The selected point will be marked on the plot.
8. To select variables, choose from u (E velocity component), v (N velocity component), U or V (transports: Hu and Hv), z (sea surface height (relative to the seabed)), or Ell (current ellipse properties).
9. If "Extract tidal constants" is selected, the tidal harmonic coefficients for the selected variable and selected constituents will be written to a file. You may either "Append" or "Rewrite" the file. The default file name for ASCII data is 'data.out', although you can change this. A Matlab file is also written with the same prefix name but with 'mat' suffix.
10. If "Predict tide" is selected, a tidal prediction of the requested variable (u, v, z, U or V, but not 'Ell') for the specified point will be made, and the output saved in the specified data file. Also, a new graphics window will be opened, showing the plot of the predicted variable. The starting time, and length of predicted record, are specified in the lower left above the "Restart" and "Go" buttons.

If anything in the TMD GUI is unclear from either this RAEDME or the information for specific buttons, please let us know! Email suggestions or comments to Laurie Padman (padman@esr.org).

2. TMD Scripts

(See next page)

2. TMD Scripts

The TMD package includes Matlab functions that can be used to access the model directly, for example where the user wishes to run several predictions in batch mode. As with the GUI, please let us know if the explanations of usage are not clear, or another script would be useful (email Laurie Padman at padman@esr.org).

The available functions are as follows. `Courier script refers to print out of "help *.m" commands.`

Extract_hc.m

This function is designed to extract the tidal harmonic constants for a specified location. Usage is explained below:

```
>> help extract_hc

  Function to extract tidal harmonic constants out of a tidal model
  for given locations
  USAGE
  [amp,Gph,Depth,conList]=extract_HC(ModName,GridName,lat,lon,type,km);
  PARAMETERS
  Input:      ModName - model file name, including path;
                        the file format should be "OTIS binary"
              GridName - model Bathymetry file name, including path;
                          the file format should be "OTIS  grid binary"
              lat(L),lon(L) - coordinates in degrees;
              type - char*1 - one of
                     'z' - elvation (m)
                     'u','v' - velocities (cm/s)
                     'U','V' - transports (m^2/s);
              km - 1/0 if the model grid is uniform in km/degrees
                   function xy_ll to convert lat,lon to x,y and
                   back should be provided

  Ouput:     amp(nc,L) - amplitude
             Gph(nc,L) - Greenvich phase (o)
             Depth(L)  - model depth at lat,lon
             conList(nc,4) - constituent list

  Sample call:

[amp,Gph,Depth,conList]=extract_HC('DATA/h_Ross.oce','DADTA/grid_Ross',lat,lo
n,'z',0);

  Dependencies: xy_ll,h_in,u_in,grd_in,XY,rd_con,BLinterp,checkTypeName
```

Tide_pred.m

Tide-pred.m makes predictions of a specified tidal variable (height, u, or v) at a specified location. The user can also specify which tidal harmonics to include. Predictions are made with nodal corrections included.

```
>> help tide_pred

 %%% Predict tidal time series in a given locations at given times
 %%% using tidal model from a file
  USAGE:
  [TS,ConList]=tide_pred(ModName,GridName,SDtime,lat,lon,type,km,Cid);

  PARAMETERS
  Input:      ModName - model file name, including path;
                        the file format should be "OTIS binary"
              GridName - model Bathymetry file name, including path;
                         the file format should be "OTIS  grid binary"

              SDtime(N) - vector of times expressed in serial days
                         see 'help datenum' in matlab

              lat,lon  - coordinates of ONE point in degrees;
              OR
              lat(N),lon(N) - coordinates of N points along the track,
                     in this case SDtime(N) interpreted as times of
                     measuremnts at lat(N) lon(N);
              type - char*1 - one of
                     'z' - elvation (m)
                     'u','v' - velocities (cm/s)
                     'U','V' - transports (m^2/s);
              km - 1/0 if the model grid is uniform in km/degrees
                   function xy_ll to convert lat,lon to x,y and
                   back should be provided
              Cid - indices of consituents to include (<=nc); if given
                    then included constituents are: ConList(Cid,:);
                    if Cid=[] (or not given), ALL model constituents
                    included

  Ouput:     TS(N) - predicted time series
             conListOut(nc,4) - list of ALL model
                                constituents (char*4)

  Dependencies: xy_ll,h_in,u_in,grd_in,XY,rd_con,BLinterp, extract_HC
                harp1,constit,nodal,checkTypeName

  Sample calls:

  SDtime=[floor(datenum(now)):1/24:floor(datenum(now))+14];
  [z,conList]=tide_pred('DATA/h_Ross.oce','DATA/grid_Ross',SDtime,-
73,186,'z',0);
  ConList([5,6])=k1 o1
  [z1,conList]=tide_pred('DATA/h_Ross.oce','DATA/grid_Ross',SDtime,-
73,186,'z',0,[5,6]);
```

Ellipse.m

Ellipse.m calculates the tidal ellipse parameters (major and minor semi-axes, ellipse phase, and ellipse inclination) for a specified tidal harmonic at a specified location. This is useful, for example, for comparing the model to tidal analyses of current meter data.

```
>> help ellipse

  Calculate tidal ellipse parameters at given locations using a model

  USAGE
  [umajor,uminor,uphase,uincl]=ellipse(ModName,GridName,lat,lon,constit,km);

  PARAMETERS

  INPUT
  ModName - model TRANSPORT file name in OTIS binary format
  GridName - grid file name in OTIS grid format
  lat(L),lon(L) - coordinates (degrees)
  constit - constituent name, char length <=4
  km - 1/0 if the model is on uniform grid in km/degrees
           function xy_ll to convert lat,lon to x,y and
           back should be provided

  OUTPUT
  umajor,uminor,uphase,uincl - tidal ellipse parameters (cm/s,o) in
                               lat,lon

  Dependencies: xy_ll,u_in,grd_in,XY,rd_con,BLinterp,TideEl,checkTypeName

  Sample call:
  [umaj,umin,uph,uinc]=ellipse('DATA/UV_Ross','DATA/grid',-73,186,'k1',0);
```

Accessing model bathymetry:

Bathymetry data reside in files named "grid_*", by default located in the DATA subdirectory. As an example of accessing these data, we show below how to access the Arctic Tidal Inverse Model (5-km) grid:

```
[ll_lims, hz, mz, iob] =  grd_in('DATA\grid_Arc5km'); % Reads the file;
[n, m]=size(hz);                                      % z array size;
[x_z, y_z] = XY(ll_lims, n, m);                       % x and z vectors
                                                      %   defining the grid;
```

Note that grids need to be transposed before plotting; e.g., a color-filled bathymetric map (with colorbar) for the Arctic would then be produced by:

```
Pcolor(x_z, y_z, hz'); shading flat; colorbar
```

Functions on the following page access specific tidal harmonic coefficients, either amplitude and phase, or ellipse parameters.

Get_coeff.m

Get_coeff.m extracts amplitude and phase grids from the model, for the specified data type ('h', 'u', or 'v') and specified tidal harmonic. This is useful, for example, for batch files to print out maps of individual harmonics for the entire domain, or a specified limited region of interest.

```
>> help get_coeff

  function to extract amplitude and phase grids from
  a model ModName (OTIS format) calculated on bathymetry grid
  Gridname

  usage:
  [x,y,amp,phase]=get_coeff(ModName,GridName,type,cons);
  type - one of 'z','u','v' (velocities),'U','V' (transports)
  cons - tidal constituent given as char*

  output:
  amp - amplituide (m, m^2/s or cm/s for z, U/V, u/v type)
  phase - phase degrees GMT
  x,y - grid coordinates

  sample call:
  [x,y,amp,phase]=get_coeff('DATA/h_Ross.oce','DATA/grid_Ross','z','k1');
```

Get_ellipse.m

Get_ellipse.m extracts current ellipse parameters major and minor axes, ellipse orientation, and ellipse phase, for the specified harmonic. As with get_coeff.m, this is useful for for batch files to print out maps of individual harmonics (e.g., major axis) for the entire domain, or a specified limited region of interest.

```
>> help get_ellipse

  function to extract tidal ellipse grids from
  a model ModName (OTIS format) calculated on bathymetry grid
  GridName

  usage:
  [x,y,umaj,umin,uphase,uincl]=get_ellipse(ModName,GridName,cons);

  cons - tidal constituent given as char*

  output:
  umaj,umin - major and minor ellipse axis (cm/s)
  uphase, uincl - ellipse phase and inclination degrees GMT
  x,y - grid coordinates

  sample call:

[x,y,umaj,umin,uphase,uincl]=get_ellipse('DATA/UV_Ross','DATA/grid_Ross','k1')
;
```