
NOTE: THIS IS AN EXPERIMENTAL RESEARCH PRODUCT, SUBJECT TO ONGOING FIELD VERIFICATION. NO ASSURANCES ARE EXPRESSED OR IMPLIED REGARDING ACCURACY OF THE TIDAL CURRENT MAPS.

Computer model details. The following maps show predicted surface tidal currents in the Booth Bay region, determined from a hydrodynamic circulation model originally developed by NOAA for application to Chesapeake Bay (Hess, 2000). The date and time of each half-hourly current map is given in the caption. The Booth Bay region (BBR) shown extends from approximately Tumbler Island offshore to Bantam Rock south of Damariscove Island, and from Southport Island to the entrance to the Damariscotta River (aka the ‘BHYC Sailors’ Special’). The sub-region is extracted from a larger model domain that includes the coastal waters, bays and principal rivers from Cape Small to Pemaquid, up to the head of tide. The full model domain covers a region similar to NOAA chart 13293, except for New Meadows River and Merrymeeting Bay.

The model calculates velocity, temperature and salinity on a rectangular grid with 92.7 m resolution in the horizontal and eleven levels in the vertical equally spaced between the sea surface and the bottom (defining ten layers). Bathymetric and coastline data were obtained from NOAA’s National Geophysical Data Center websites. Predicted tidal amplitudes at Portland and relative phases of tidal water level variations were obtained from the NOAA National Ocean Survey and applied at the open boundaries of the full model domain. Annual average river fluxes were specified. For the predictions, wind driving was specified as an artificial seabreeze with a maximum speed of 10 knots from the southwest occurring at 2 in the afternoon.

Downloads. The half-hourly maps are concatenated into one large .pdf that can be downloaded by shift-clicking on the link (option-click on Macs). The full file is quite large, approximately 20 MB, so a high speed link is needed for practical purposes. Note that individual or selected pages (one map per page) can be printed as desired from within your web browser.

Understanding the tidal maps. The local tide is prominently semi-diurnal, with period 12 lunar hours, or about 12 hours and 25 minutes clock time. However, the spring-to-neap cycle and diurnal inequality are clearly evident in the central Maine coastal region, so the range of the tide varies significantly on a fortnightly time scale as well as between successive highs and lows.

The vectors (arrows) on each map show the model-calculated surface current speed and direction at the tail of each arrow, corresponding to the grid point in the model domain. The full-resolution current vectors are “dimmed” in each map. To improve readability, a reduced subset of the full-resolution vectors, decimated by a factor of three in both the east and north directions, are shown in color. The colors indicate speed thresholds as follows: black, 10 cm/s (about 0.2 knot); blue, 25 cm/s (about 0.5 knot); red, 50 cm/s (about 1 knot); green, 100
cm/s (about 2 knots); and magenta, 200 cm/s (about 4 knots). Thus a red arrow indicates a current speed greater than 1 knot but less than 2 knots. The scale arrows shown below the time stamp on each figure can be used to estimate the actual speed of the current vectors between threshold levels. Full detail can be recovered by zooming in on the area of interest.

The light gray contours on the maps show water depths below MLW of 5, 10, 20 and 50 m (16.4, 32.8, 65.5 and 164 ft) respectively; they are unlabelled to reduce clutter.

Remember that the vectors represent the flow speed at the tail of the arrow, not at the head; this can be confusing in regions with strong currents, because the length of each arrow and the size of its head are proportional to the current speed at the corresponding model grid point. The tail of each arrow is marked by a small open or filled circle.

**Using the maps.** Each file is a large .pdf, which can be opened with Adobe Acrobat©. For best results, you will need the full version (currently ‘Acrobat 6.0.6 Professional’), although the figures will open with the more limited Reader version that can be downloaded at no cost. With Acrobat Pro, you can use the handy Loupe tool to slide a magnifying window around on the maps. It is also instructive to compare different maps side-by-side (In Acrobat, choose View>Page Layout>Facing)

The navigational aids shown on each map include lighthouses (stars), nuns (red diamonds), cans (black diamonds), and daymarks (black or green squares). Lighted bell or gong buoys are indicated by filled red circles. Keep in mind that the model grid resolution is about the length of a football field, so narrow channels such as Upper Hell Gate or Townsend Gut are poorly represented in some places. Also recall that the coastline and the water depth information come from different data sets, and they do not always agree in fine detail. As a result of these combined limitations, occasionally you will find shallow depth contours that cross the coast and velocity vectors on the land. In a few cases small islands or drying ledges obvious on charts are not resolved at all in the model bathymetry. The positions of the navigational aids were taken from current NOAA charts, but please note that the tidal maps are not to be used for navigation and no assurance of position accuracy is made.

**Some general observations.** The strongest surface tidal currents in the Booth Bay region, according to the model calculations, occur in the passages between islands or headlands, as one would expect. You will also note intensified currents over shoal ledges or rocks; e.g. south of Damariscove Island near Bantam Rock. Elsewhere in the region shown, the surface currents are quite small. Recall that the maps correspond to the varying tide situation; during spring tides, the speeds may be much higher than during neaps. The largest current speeds in the full model domain occur in Lower Hell Gate and Goose Rock Passage (>4 knots), with somewhat lesser speeds in constricted parts of the Kennebec, Sheepscot and Damariscotta Rivers.

Also remember that the influence of the wind, which can be very important, is only minimally represented here by a mild summer seabreeze. The current speeds and patterns may be quite different under various wind conditions (you can compare with model runs
An important cautionary note. The details and timing of the model-calculated currents sensitively depend on the phase differences of the tidal forcing applied at the model boundaries. As noted above, water level amplitudes and relative phases (i.e., times of high water relative to Portland) are taken from tables available at the NOAA/NOS website, but such data are available at relatively few locations. Thus interpolation of amplitudes and phases is inevitable, and with that comes some uncertainty in the details of the model predictions. These uncertainties can be reduced by direct observations of the tidal currents at controlling locations, such as Fisherman Passage or between Fisherman and Damariscove Islands, because such observations can be used to “tune” the model forcing for the best fit. The most important observations needed are timed records of speed and direction of the tidal flow in narrow passages, especially the times of reversals or maximum flow. The boundary conditions have been adjusted so that the model currents are generally consistent with current observations reported in the US Coast Pilot and elsewhere, but such information is available at only a few sites, almost none of which fall in the subset of the model domain shown by these maps.

And an appeal for data. As noted above, these maps are preliminary research products that require further verification by checking the predictions against observations. Information that may help in this process is much desired. Obviously, local knowledge of the tides is of the greatest utility and will help improve the model predictions in the long run, so any comments or suggestions about the maps will be gratefully appreciated. You can send them to me at dbrooks@ocean.tamu.edu. And thanks.

References: