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TCARI Goes Operational: Improvements for Field Use and the Development of an Error Model

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Abstract: The Tidal Constituent and Residual Interpolation (TCARI) method was developed in NOAA's Coast Survey Development Lab in 1995 by Dr. Kurt Hess. TCARI interpolates the tidal constituents, datum offsets, and residual water level values from multiple historic and operational water level stations to a given point of interest. Once the interpolated values are computed for that point of interest, they are used to compute an estimated water level value. TCARI offers a significant improvement over the traditional method of discrete tide zoning which NOAA currently uses to reduce its hydrographic soundings to the chart datum. Discrete tide zones introduce an obvious step in the bathymetry between adjacent discrete zones, are unable to incorporate multiple gauges into the water level solution, and do not capture changes in the shape of the tide curve across a geographic region.

Since TCARI's inception, it has been used primarily for research and development at the Marine Modeling and Analysis Program (MMAP) to develop the Vertical Datum Transformation Tool (VDatum). However, the increasing resolution of the multibeam echosounders used for hydrographic surveys has begun to highlight discrete tide zoning's shortcomings and has hastened the transition to the TCARI method. As a part of this transition, the Hydrographic Systems and Technology Program (HSTP) has upgraded Dr. Hess' original program from FORTRAN to Python, established links to the Caris data structure, enhanced the interpolation algorithm, and added a graphical user interface to support both office and field processing.

In addition, an error model was developed to support the computation of Total Propagated Error for each sounding. This error model quantifies uncertainties in the water level measurement, station datum, and tidal constituents for all contributing water level stations, as well as the interpolation from the water level station to the point of interest. Using the rules of propagation of error, a water level uncertainty estimate is then computed for each grid node of the model. This paper will discuss the general processing steps for using this latest version of TCARI, present some preliminary results for its uncertainty model, and layout the plan for its implementation into the NOAA hydrographic fleet.
