Developing Best Practices in Tidal Analysis

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The tide is generally the dominant component of a sea level record in many parts of the world and its analysis has therefore been a central part of oceanography for hundreds of years. Methods to predict the tide have changed over time, but have largely converged on the classical harmonic method, which is based on the principle that a series of tidal observations may be decomposed into a finite number of sinusoidal functions, known as tidal constituents, with angular speeds related to known astronomical frequencies.

Classical harmonic analysis is usually carried out using one of a number of software packages made available by scientists and oceanographic institutions. These are exceptionally useful, but within them they encode a series of assumptions and decisions that need to be made in order to carry out an analysis, including:

- What is an appropriate set of constituents to use in a location, given the data available and the hydrodynamics of the area?
- How does the analysis account for variations of the tidal constituents over time, for example over the nodal cycle?
- How will our results be affected by non-tidal influences?

Furthermore, other approaches will be more successful in particular environments, for example in shallow waters when the tidal curve can be highly non-symmetric.

Non-experts in tidal science are often unaware of the options available, and the consequence of making the wrong decision. Furthermore, this knowledge is developed as rules-of-thumb within organisations based on many years of experience, so is not readily accessible. As a result, there is a need for some internationally agreed recommendations.

We recently held a tidal analysis workshop to discuss these matters, funded by the International Association for the Physical Sciences of the Oceans (IAPSO) as one of their Best Practice Study Groups. Here we present some illustrations of the issues mentioned above, along with some of our suggested approaches.

The best practice document is currently being drafted based on discussions held at the workshop, and when completed will be submitted to the International Oceanographic Commission's best

practice system (https://www.oceanbestpractices.org/).