TWLWG3 - Agenda Item 4.1: Standard Constituent List

The following e-mail was received from an enquirer with regards to comments and questions on the IHO Standard List of Tidal Harmonic Constituents, as available on the IHO TWLWG website at http://www.iho-ohi.net/mtg_docs/com_wg/IHOTC/IHOTC_Misc/TWLWG_Constituent_list.pdf.

A draft response covering most of the issues has already been constructed, and is given below following the original e-mail. TWLWG is invited to consider the above information and below draft response and provide any assistance to UK and FR in order to complete the response accordingly.

As part of an old job I wrote a tidal analysis package which I continue to work on now and again as a hobby. I called it Tidal Analysis Package in Python (TAPPy) and have set up a site at http://tappy.sf.net

The analysis in TAPPy is based on Schureman's "Harmonic Analysis and Prediction of Tides." I wanted to modernize and extend the analysis using the work of the IHO and have some comments, questions, and feature requests.

Duplicate Entries:
I would encourage elimination of all duplicates. Very confusing. The way I handled this within my database of IHO constituents is to have a "Also Known As" column. I took as duplicate all entries that had the same XDO and nodal correction.

Derivation of speeds and values of u and f from Constituent Names:
There are some situations that aren't clearly defined so more examples would be very helpful. My main issue is that the name doesn't have enough information to define, for example, whether to use 'K2' or 'K1' when 'K' is in the name. 'L', 'O', and 'S' also have the same problem.

MKS2 -> M2 + K2 - S2
but...
KP2   -> K1 + P1

In the second example above, it has to be 'K1' since that is the only way to add up to 2. Sometimes though, the equation could be established in two ways...

3NKS6 -> 3N2 + K2 - S2
or...
3NKS6 -> 3N2 + K1 - S1

S2 and S1 fall out of the actual u and f equations, but it isn't clearly defined whether to use K1 or K2.

Source:
Where did the analysis, nodal corrections, ...etc. come from? I have not been able to find any references.

Schureman Nodal Corrections:
I would expect there to be differences between Schureman and the IHO constituents and nodal correction factors, but I cannot figure out any coherent pattern or analogy with Schureman. For example u for 'M2' from Schureman is '2*zeta - 2nu' and u for 'MSf' is 0. The IHO u for MSf is -u of M2. Except for the shallow water constituents (which follow the analysis used for code 'x'), I haven't been able to find one corroborating relationship.

Simplification of Nodal Correction Factors for Sx:
I would suggest that all of the Sx ('S2', 'S3, 'S4', ...etc.) be coded with 'z' rather than 'x'. I also coded all 'MAx' and 'MBx' with 'f' rather than 'x'.

Equilibrium Tidal Potential:
One complaint that I get about TAPPy is that it is slow. Painful at times actually. Part of the issue is that my initial guess for the least squares for all amplitudes is set equal to 1.0. I want the initial guess to be approximated by the equilibrium tide potential. I have associated in my database the equilibrium tidal potential values that I have been able to find with the IHO constituents, but the equilibrium tide for most constituents is not represented anywhere. If at all possible the equilibrium tidal potential would be very useful to establish the general strength of the constituent.

Length of time series:
Foreman with IOS has established a clever way to get at the length of time series required to differentiate from adjacent constituents using a hierarchy based on the equilibrium tidal potential and the difference in speed. This is another very value piece of information that would be nice to have for all of the IOS tidal constituents.

Schureman's book is available at
http://www.archive.org/stream/manualofharmonic00schu and his table of constituents is Table 2 on page 164.

DRAFT RESPONSE

Duplicate Entries
There are instances where the XDO and Nodal Correction are the same, but the name of the constituent differs (see 2MK2 and O2 as an example). I don't think that we should eliminate the duplicates from the list (as the whole point here is to recognise the different constituent name), but maybe there is some merit in somehow showing them as 'also known as'. Perhaps some kind of colour coding might be applicable?

Derivation of speeds and values of u and f from Constituent Names:
More examples? I hadn't really thought about this. But I'm not sure about his second proposed method of obtaining 3NKS6, as shown below:-

N2 = 28.439730
K2 = 30.082137
S2 = 30.000000

K1 = 15.041069
S1 = 15.000000

So by my calculations:-

3NKS6 = 3N2 + K2 – S2 = 85.401326 (which agrees with the listed value in the table)

but

3NKS6 = 3N2 + K1 – S1 = 85.360259, which is not correct.

Source
The main work on this list was undertaken by a previous employee within the UKHO tides section (Lt. Cdr. Tony Merriman). He has indicated the sources of the nodal corrections in anecdotal papers written within the section, but it would be quite a task to go through this documentation in order to provide specific references.

Schureman Nodal Corrections:
?

Simplification of Nodal Correction Factors for Sx
Sx:
Changing the nodal correction reference from 'x' [indicting that the corrections should be derived from the name of the constituent using the principles set out in] to 'z' [indicating that u = 0 and f = 1].

MAx
Changing the nodal correction reference from 'x' [indicting that the corrections should be derived from the name of the constituent using the principles set out in] to 'f' [the theoretical reasons why u and f should be the same as M2, but no significant error introduced if u and f are set to 0 and 1 respectively].

I think this is acceptable

Equilibrium Tidal Potential and Length of time series
Is a list of the equilibrium tidal potential for each constituent something readily available, which could perhaps be published as a separate list? I will have to delve a bit with our IT gurus to see if we have anything which may help. Similarly with the length of time series?