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Interactive comment on "Frictional interactions between tidal constituents in tide-dominated estuaries" *by* Huayang Cai et al.

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In this article an analytical solution of the tidal equations is presented to study the interaction of different tidal constituents in the Spanish Guadiana and Guadalquivir estuaries. The solution is based on a method developed by Godin (1999) and Dronkers (1964) for dealing with the non-linear friction term. Different tidal constituents derived from long-term tidal records along both estuaries are compared with amplitudes and phases of these constituents given by the analytical model. Observations and model results are in fair agreement. The article is well written and well organised.

There is probably an error in figure 9; the damping numbers (as defined in table 1) do not match the x-dependence of the amplitudes of figure 8. This is repeated in

the corresponding discussion (lines 320-327). When comparing figures 6 and 8, the damping of M2 tide in the Guadalquivir appears a bit stronger than in the Guadiana, but not an order of magnitude stronger.

The paper can be further improved by adding some clarifications concerning the following points:

1. River discharge is not mentioned at all in the paper. The influence is probably minor in the major part of the estuary, but river discharge could play a role near the sill at the upper end of the estuary, where the tidal velocities go to zero.

2. Close to the sill the tide has the appearance of a standing wave; this gives an almost infinite tidal wave celerity. Tidal wave celerity does not make much sense in this region.

3. The Chebyshev coefficients are the coefficients of the expansion of cos(nx) in powers of cos(x).

4. It should be mentioned that formula Eq. 12 gives a reasonable approximation only if the diurnal tides are much smaller than the semidiurnal tides.

5. The diurnal tides are much less damped than the semidiurnal tides. Apparently, the effects of frictional damping and channel convergence cancel approximately. This might be discussed more clearly in the paper.

6. The sensitivity of the results to the non-linear frictional interaction between the tidal constituents, being the central theme of the paper, should be discussed more explicitly. Figures 6 and 8 show the combined results of friction, channel convergence and tidal wave reflection. A figure might be added, for example, in which results with and without this frictional interaction are compared.

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