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# *Interactive comment on* "Sunda Shelf Seas: flushing rates and residence times" *by* B. Mayer et al.

**Anonymous Referee #2**

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Review of the manuscript Manuscript Number: os-2015-28 Sunda Shelf Seas: flushing rates and residence times B. Mayer, T. Stacke, I. Stottmeister, and T. Pohlmann

Recommendation: major revision

General comments: The MS is well written and I found it pleasant to read. The MS tries to compute the flushing times and residence times in the Sunda Shelf Seas and its adjacent marginal seas. The models applied are state of the art, and I cannot really complain about this. However, I found it a little strange that the authors decided not to include tides in the application. I can understand the problems resulting from the use of z-levels. However, transferring all the tidal mixing efficiency to the horizontal diffusion is for me not the solution of the problem. Probably a thicker surface layer would have been a better choice. The above neglect of tides in the model is also the cause of all other problems. When the authors apply the lagrangian model, they neglect turbulent diffusion and only use advective velocities. Unfortunately, the tidal mixing effects have been transferred to the turbulent diffusion, and therefore horizontal velocities used for the lagrangian model do not have any effect of tides included. Authors find this out when comparing flushing times with lagrangian computed residence times: the latter are much higher than the flushing times. Clearly using monthly averaged velocities for the lagrangian simulations does not help with these problems. Using these velocities is like using residual velocities, normally much lower than actual velocities. I think the use of immediate velocities would be a much better choice. Another critic is the fact that they do not use an Eulerian evaluation of the residence times. Since they already have a model it would be easy to this kind of evaluation. See for example Cucco et al. (Ecological Modelling, 2009) for the combined use of lagrangian and Eulerian model applications.

Specific comments: 866, 3-8: this is a very simplistic approach. Normally you use this approach if you only have discharge data, but no numerical model. We know that this kind of computation always produces flushing times which are much lower than realistic renewal times (see for example Umgiesser et al., 2014, JGR). So why do you use this approach? 866 ,11: receive -> obtain 868, 9-15: now this is strange. You say you do not need to account for tides, because you simulate them through higher diffusion in the areas of high tidal mixing. Now, this is already an approach I am not completely satisfied with. However, now, for the lagrangian model, you decide to only use advection and no diffusion (no turbulent mixing). So, for the lagrangian simulations you completely neglect tidal mixing. Therefore, what I would expect is that your lagrangian derived residence or transit times are too high than they would be with tidal mixing included. Neglecting diffusion here is not a secondary effect, as it might be when neglecting non linear effects in the momentum equation, but a first order effect. This is a glitch that has to be resolved. 869, 1-2: you use constant velocities for the computation of the residence times. Now this sounds strange to me, because the averaged velocities are nothing than residual velocities, which normally



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are much lower than real immediate velocities. Again this changes the values of the computed residence times. And when you compute fluxes over the open boundaries, do you still use averaged velocities or velocities coming out directly from the model. In the first case your flushing times will be way too high. 869, 3: with these horizontal velocities... So I was right, you use the averaged values of the velocities. Therefore, your computed Q is wrong. 874, 16: so again my question. What fluxes do you use for the computation of the flushing rates: daily or monthly fluxes? Results are clearly depending on this decision. 875, 15: well, only if the mixing efficiency would be 1. Again this is shown in Umgiesser et al., 2014, JGR. However, here you only consider advection, and for the lagrangian simulation do not consider tidal mixing, I guess that your mixing efficiency would be much lower than 1. 28: well this is not surprising to me. It all depends on the set up of the simulations.

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Interactive comment on Ocean Sci. Discuss., 12, 863, 2015.