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Interactive comment on "Morphological and sedimentological response of a mixed-energy barrier island tidal inlet to storm and fair-weather conditions" *by* G. Herrling and C. Winter

Anonymous Referee #2

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The paper submitted by Herrling and Winter presents the application of a 3D morphodynamic modeling system (DELFT3D) to the Otzumer Balje tidal inlet. This study aims at describing the sediment pathways and surface grain size evolution at this mixed-energy inlet under both fair weather and storm conditions. The manuscript is reasonably written, the figures are clear and this study appears suitable for the journal. However, several points would need to be improved and clarified, which I believe would require moderate to major revisions before the paper can be accepted. In particular, the modeling system description is not detailed enough and the analysis of the relevant physical processes is limited and ignores recently published studies. This review is split into two parts: (A) important issues, impacting the whole manuscript and (B)

along the text minor problems. (A) Important issues:

- Insufficient description of the modeling system. The setting of Delft3D is not sufficiently described to allow the reader interpreting the numerical results presented in this study and referring to Lesser et al. (2004) is not always helpful. For instance, it is not clear what "bidirectional coupling" means (P6, L10): is that two-way coupling? Is the current feedback on the wave field taken into account? Then it is not clear if suspension sand fluxes are computed using an empirical transport formula or solving an advection-diffusion equation. Figure 5 and 6 show strong onshore directed bedload transport: is that related to wave asymmetry? If yes, how is wave asymmetry computed? It is surprising that under storm conditions, both bedload and suspended load do not display any offshore component caused by undertows: is this processes adequately represented? What is the theory used to compute wave-current interactions in 3D? Is that really through radiation stress or through the dissipation model of Walstra et al. (2000) etc. A general figure with the extensions of the various nested grid would also help, including all the geographic names mentioned in the text for non-European readers (e.g. Denmark, Wadden Sea, East Frisian Barrier Island, Ems, etc.)

- Lack of model validation. This study concludes that short wave contribution is very important in the sediment dynamics of this inlet. However, no model/data comparison is presented for the waves while wave measurements are apparently available both inside and outside the lagoon (section 4.1). A figure showing how waves are reproduced by the model should be included. In particular, the overestimation of wave height inside the backbarrier is interesting: if this problem occurs mostly during the ebb, this could be related to enhanced wave dissipation by counter currents. The importance of this process, that is probably not accounted for in the simulations, was demonstrated at a nearby tidal inlet by van der WestHuysen (2012) and at a shallow inlet by Dodet et al. (2013). In the same manner, the sediment concentrations are said to be "satisfactorily reproduced" by the model (P. 12, L19): this agreement should at least be quantified and possibly shown on a figure.

- Organization of the discussion and lack of physical interpretation. Although it contains valuable information, the discussion is very long and suffers a lack of organization. Re-organizing the discussion with sub-sections (e.g. 6.1 Tide-induced transport; 6.2 Short wave processes; etc) would help future readers. Then, the discussion refers mostly to classical studies on tidal inlets that were published about 30 years ago (e.g. FitzGerald, Hubbard et al.). Although very valuable to a certain extent, these studies are very descriptive and sometimes outdated regarding physical processes. For instance, several authors explained the shoreward migration of ebb-ebb delta sandbars by a so-called wave-induced "bulldozer effect", that has nothing to do with swash. Thereby, it does not seem reasonable to keep calling these sand bars "swash bars". I suggest also referring to more recent studies carried out at wave-dominated and mixed energy tidal inlets (e.g. Olabarrieta et al., 2011; Van der Westhuysen, 2012; Dodet et al., 2013, etc.). Would it be possible to compute a sediment balance across the inlet for both fair weather and storm conditions? As in other comparable systems, is the inlet ebb-dominated under fair weather conditions and flood dominated under storm conditions? What is the impact of tidal asymmetry (if asymmetric).

(B) Along the text minor problems: -P4, L19: Son et al. (2010) postulated. -P6, L17 : Âń the here applied Âż should be changed to Âń the sediment transport applied here". -P7, L23: depending on the beach slope, a 20 m spatial resolution may be too coarse to properly represent wave-induced currents under faire-weather conditions. As a rough guideline, there should be at least 5 nodes accros the breaking zone. -P8, L.10: "the here reproduced" is not a correct English construction. -P10, L8 and all along the text: is that the storm surge that is relevant or the storm and associated waves? I believe this is the second option; therefore storm surge should be changed to storm. -P11, L5: referring to Cayocca here is ambiguous since this author didn't use Delft3D but a preliminary version of the MARS model from IFREMER. -P13, L16-19 if the model/data comparison is really obvious, it should be shown on a figure. If not, try to moderate and avoid "obvious". -Whole discussion: avoid "the here applied"… -P21, L. 25: "several such zones" is not correct in terms of English. P24, L26: "wave attack" is not very

accurate/scientific.

References: Dodet, G., Bertin, X., Bruneau, N., Fortunato, A.B., Nahon, A., Roland, A., 2013. Wave-current interactions in a wave-dominated tidal inlet. Journal of Geophysical Research C: Oceans 118 (3), 1587-1605. Olabarrieta, M., Warner, J.C., Kumar, N., 2011. Wave-current interaction in Willapa Bay. Journal of Geophysical Research C: Oceans, 116 (12), C12014. Van der Westhuysen, A.J., 2012. Spectral modeling of wave dissipation on negative current gradients. Coastal Engineering 68, pp. 17-30. Walstra, D.J., Roelvink, J.A. and Groeneweg, J., 2000. Calculation of wave-driven currents in a 3D mean flow model. Proceedings of the 27th International Conference on Coastal Engineering, ASCE, Sydney (Australia), 1050–1063

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