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Interactive comment on "Can the growth of deltaic shorelines be unstable?" *by* Meng Zhao et al.

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Review of Zhao et al. "Can Growth of Deltaic Shorelines be Unstable" By John Shaw, University of Arkansas (shaw84@uark.edu)

This study considers the possibility of a deltaic shoreline (or topset-foreset rollover) that grows unstably over an adversely sloping basement. Using a geometric modeling approach and linear stability analysis, it is found that for certain conditions, a linearly advancing delta shoreline will have perturbations grow. It is also found that the most unstable wavelength is infinitely long, meaning that any unstable growth will likely be the size of the container. In it also interesting that once a delta enters the unstable region, perturbations will keep growing more unstable for the simple geometries discussed here.

While intentionally abstract, this mathematical approach allows for the growth of instabilities to be investigated in a very pure and clear manner. I have found the mathematics to be sound. The paper is also very well written and the figures are sufficient.

The main point of improvement is that the applications chosen to illustrate the theory are somewhat cursory compared to the theory. I find the application to Atchafalaya Bay in particular to be too simplified. The 6 km long transects showing gradual shallowing are very focused in a small part of the bay, and might not be characteristic of the slopes that a delta progrades over. Then, the prediction of the stable wavelength is given for x = 10 and 16 km, which is far longer than the adverse bedslope measurements. Also, the S_F is roughly -0.00024 for the Wax Lake Delta, as reported by Shaw et al. (2016) and cannot be reasonably estimated as S_F=-1. This would increase the neutral wavelength and instability as described in Eq. 17 and 14.

Ultimately, I would consider trying to find more or better examples of deltas prograding across adversely sloping beds. Leva Lopez et al. (2014) provide a good discussion that might yield another geological case study. Deltas forming near or underneath glaciers are a potentially great place to look (Carlson et al., 1999; Dowdeswell and Vásquez, 2013; Lønne and Nemec, 2011. . . these are not perfect but show potential). This effort might really broaden the appeal of this paper beyond theoreticians (like me).

P4L16: I initially thought that this equation was incorrect because l_dot was on both sides of the equation. I am now sure that it is correct, but it may be good to show this equation solved for l_dot.

P7L13: I do not understand how a wavenumber k = 1 is chosen from the XES10 conditons.

P9L11: shouldn't S_B always be positive? This looks like S_B must be negative.

Works Cited in this Review Carlson, P. R., Cowan, E. A., Powell, R. D. and Cai, J.: Growth of a post-Little Ice Age submarine fan, Glacier Bay, Alaska, Geo-Mar. Lett., 19(4), 227–236, doi:10.1007/s003670050113, 1999. Dowdeswell, J. A. and Vásquez, M.: Submarine landforms in the fjords of southern Chile: implications for glacimarine processes and sedimentation in a mild glacier-influenced environment, Quat. Sci. Rev., 64, 1–19, doi:10.1016/j.quascirev.2012.12.003, 2013. Leva Lopez, J., Kim, W. and Steel, R. J.: Autoacceleration of clinoform progradation in foreland basins: theory and experiments, Basin Res., 26(4), 489–504, doi:10.1111/bre.12048, 2014. Lønne, I. and Nemec, W.: Modes of sediment delivery to the grounding line of a fast-flowing tidewater glacier: implications for ice-margin conditions and glacier dynamics, Geol. Soc. Lond. Spec. Publ., 354(1), 33–56, doi:10.1144/SP354.3, 2011. Shaw, J. B., Mohrig, D. and Wagner, R. W.: Flow patterns and morphology of a prograding river delta, J. Geophys. Res. Earth Surf., 2015JF003570, doi:10.1002/2015JF003570, 2016.

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