Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2017-5-RC1, 2017

Earth Surface Dynamics Discussions

Interactive comment on "Efficient retention of mud drives land building on the Mississippi Delta plain" *by* Christopher R. Esposito et al.

Anonymous Referee #1

Received and published: 9 March 2017

This manuscript concerns the dynamics of sediment retention in deltaic depositional systems, which is an important area of research within the deltaic community. Restoring drowning deltas, such as the Mississippi River delta, will be a difficult task. One way to accomplish this is using river diversions that nourish areas of drowning with sediment needed to offset sea-level rise. An important part of this ideaâĂŤand the topic of this manuscriptâĂŤis how much sediment will be deposited in a diversion. Afterall, the worst case scenario is that all the sand and mud entering the diversion is suspended and transported far away from the desired deposition location. In this way understanding sediment retention is crucial for land building. Presently sediment retention is an ad-hoc factor in delta land building models, and field data are sorely needed to help constrain that value. In these regards I think this manuscript fits in nicely to an important of the larger topic of delta restoration. I also think this manuscript is technically

sound and clearly written. I think the analysis and presentation of SRE calculation for the studied crevasse splay is well done. Indeed, I find it interesting that such a splay contains only 5% sand. I think the present contribution needs to be placed into an appropriate context. Presently the manuscript's main points are 1) a bit overstated given they only studied one crevasse, and 2) lacking a clear context. If these points can be addressed I think the present contribution would be a valuable addition to the scientific literature.

Deltaic restoration studies (such as the one's the authors cite) are focused on coastal depositional features. These coastal features are the first-line of defense against rising relative sea-levels. Because of their position at the coast the sediment and landform are subject to myriad processes, such as river plume deposition, waves, tides, storm surges, etc. All of these processes can keep fine-grained material suspended, enriching the deposit in sand, and moving the mud offshore. THis is probably why features like Wax Lake have such high mud proportions. The splay studied here is located far upstream of the coast and is NOT subjected to the same processes as features like Wax Lake. So in that context, is it surprising that ACS is composed of so much mud? Without some theory, it is hard to say, but my intuition says no. A crevasse splay that does not grow into a standing body of water (like WLD did) might have higher mud retention because the downstream water surface elevation goes to 0 as flood waters recede which forces mud deposition. Coastal features do not have that degree of freedom. In that context, I think the authors can do a better job of placing their crevasse splay into context EARLY in the manuscript. This splay is on a delta plain, but it is hardly a deltaic feature in the same way Wax lake is, yet there are locations where the authors call this splay a deltaic feature. Only after I read the conclusions was it clear to me how the authors viewed their study in the larger context. The early part of the manuscript suffers from a false tension between researchers who view sand as the important land building constituent and the present work. For instance, on lines 12-5 pg. 3 it is true that most studies focus on sand extraction, but it is also true that most of those studies were focusing on coastal features where sand retention is more critical.

Same thing on 28-31 on pg. 10, the viewpoint that sand builds land need to be placed into context. Too often the authors are treating their crevasse splay as a direct comparison to Wax Lake, which is not appropriate given that Wax formed inot a standing body of water and ACS did not. Afterall on line 31 they say their results 'call into question' using Wax Lake as restoration model. I just don't think creating this false tension is helpful. Instead the splay studied here highlights nicely the variability in retention as a function of location of the splay and processes and suggests that one model of SRE is not appropriate. Said another way, this study highlights the need for general theory of what governs SRE in different settings. The authors seemingly take issue with the 'sand-focused' view of land building that has dominated the literature, but I don't think the present contribution does anything to invalidate that previous work. Instead the present contribution shows how complex and varied the problem isâĂŤdeltas plains consist of shorelines and fluvially dominated zones and SRE at shorelines may apply to other parts of the delta plain.

The title is too grandiose in my opinion. Do the authors really think that efficient retention of mud is what drives land building? They studied only one crevasse splay that was far from the coastline. I would say that the title and some of the primary conclusions need to be revisited and placed in context for the reader. In the same light, I don't see how the present crevasse splay actually is a good model for COASTAL restoration projects. It might be a good model for restoration of the entire delta plain, which consists of coastal and more fluvially dominated zone (like the crevasse studied here). The authors are aware of all these things, given their statements on line 25 pg. 3, but it seems by the end of the paper they forgot that fact. Line 3-5 on pg. 11 seems to suggest that ALL crevasses are created equal. I also find the line on pg. 11 line 15-16 to be odd. Are the authors really suggesting the CPRA focus on emergent settings instead of the coastline? Landloss is MUCH higher near the coast than at the location of this study. Why then focus on emergent settings that are not losing land?

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