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Big Data-driven geomorphic analysis of the world's river deltas: a need for caution and rigour

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There is increasing recourse to Big Data in the geosciences as in all other spheres of research. This is an important development in the pursuit of global statistics or unifying rules on environmental change. However, the finality can only be justified if such data are rigorous and checks equally rigorous, because the objective is to derive and eventually propose reliable quantified trends or functional laws.

River deltas, a hot topic because of their exposure to hazards, increasing vulnerability and assumed loss of resilience caused by climate change and human intervention, are witnessing an upsurge of analysis based on available satellite and model data. A recent database (Nienhuis et al., 2020) comprises ~11000 identified 'deltas' along with surface area changes for each delta based on Aqua Monitor (Aqua) and Global Surface Water Explorer (GSW) datasets derived from Landsat images, alongside with fluvial, wave and tidal sediment fluxes from global models and estimations. The authors claim that deltas globally have gained an area of 54 ±11.8 km^2/yr over the last 30 years due partially to human interventions in drainage basins, and they attributed land loss in about 1000 deltas to recent reductions in sediment supply. However, these findings are, unfortunately, beset with flaws.

Prompted by the inventory of numerous 'river deltas' in regions such as the British Isles and Britanny, France, where a Web-of-Science bibliographic check yielded no modern river deltas, we randomly selected 108 deltas from the dataset (n = 1%), checking for delta presence and obtaining change rates from manually-drawn buffers. We obtained no agreement with the original data of Nienhuis et al. (2020), and found the same disagreement when we tested the data against an already published dataset. We consider that the database of Nienhuis et al. (2020) is replete with errors that render the derived delta area changes unreliable. We raise fundamental concerns about their methodology and the criteria they use to define river mouths as deltas.

Our caveat here is that while Big Data certainly provide a way forward for the global analysis of river deltas (and other landforms), there is a need for awareness of current pitfalls in datasets and their handling. Nienhuis et al. (2020) proposed their definition of river deltas. There is indeed a need for community consensus on delta definition, but this could be a hard task. Considering just deltaic coastal change, some guidelines for rigorous analysis of data are: (i) better and more

robust buffers that delineate only such change. Is this even achievable by automatic means?; and (ii) better filtering of anthropogenic modifications which, in many deltas, are dominating area change, so that new coastal reclamation projects can be more robustly detected in improved landcover databases. There is also a need for accurate datasets on water surface change. Do these exist? A comparison, for instance, of Aqua and GSW datasets on deltaic coastal change shows significant discrepancies between the two.