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Earth Surface Dynamics Discussions

Interactive comment on "Measuring Subaqueous Progradation of the Wax Lake Delta with a Model of Flow Direction Divergence" *by* John B. Shaw et al.

Anonymous Referee #2

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This article presents and validates a technique for estimating the location of subaqueous channel tips based on the divergence of the flow field on the foreset of river deltas. The technique is referred to as the "Flow Divergence to Channel Tip" (FD2C) model. It builds on the previous work of Shaw et al(2016, JGR-ES) in which the authors first presented the method of mapping "streak lines" to estimate flow direction offshore of the Wax Lake Delta. Here the use of streak lines is used to provide input data (divergence field) for the FD2C model.

The authors claim that flow patterns near subaqueous channel tips follow a specific pattern: that horizontal flow vectors are away from the channel in between the shore-

line and the channel tip, where flow is lost to the overbank (positive divergence); and that horizontal flow vectors are towards the water's flow path downstream of the tip (negative divergence). The channel tip is therefore indicated by regions of zero flow divergence.

If the proposed model of flow pattern is widespread, and if streaklines are faithful indicators of flow direction, then this method is a remote sensing technique that can be used to obtain bathymetric information on the foresets of prograding deltas. This region is quite turbid in most deltas, so remote sensing of bathymetry is usually difficult or impossible. The streakline technique combined with the FD2C framework could be useful if the proper conditions are met.

The article is well written, well sourced, and the mathematics are clearly presented. There are valid questions about the universality of the technique, including:

Steaklines might not be good flow indicators everywhere, and subject to wind and tide forcing.

Flow convergance offshore of channel tips may not be universal.

Applying the model requires making some measurements or assumptions to justify the choice of delta-l.

However, the authors mostly address these limitations head on, and provide potential users of the method with the tools to decide whether it might be applicable in their own setting. Given the clarity of the presentation here, other scientists should find it straightforward to apply this technique to their own work. Whether those studies will confirm that the assumptions are valid across many locales remains to be seen, but I expect this paper to be read and the technique to be used by other workers.

I support publication in ESurf with only minor revisions, listed below.

P5L11: Dhat_cr is location where Dhat is zero? unclear

P3L27: It would be good to specify that these are spatial accelerations, to avoid confusion

P6L11: Here you fit a regression line to time vs. delta-l. The slope was small, but the t-test showed that you couldn't reject the null hypothesis of no trend (i.e. zero slope). So doesn't that mean that there might indeed be a trend, and therefore that you cannot say for sure that stationarity exists? My suggestion would be to show the regression line in figure 6 along with error bounds. That should be pretty clear that whatever trend exists is small, and confirm the visualization.

P7L10: I don't see what distribution on delta-l is being assumed for the Monte Carlo simulation. Is it simply uniform over the grey boxes in Figure 5?

Figure 3: If I'm understanding this correctly, the method shown is to estimate the paths of the channels, then extend the channel line beyond the last known channel tip location, then calculate divergence based on streak lines, then use the divergence field to locate the channel tips. So the method shows the distance that the channel tip is along a known or assumed flow path, but doesn't necessarily identify the lateral location of the tip. That means that some information about the channel's path in the subaqueous reach beyond the shoreline is necessary. I think that should be mentioned in the text.

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