Turbidity Tracker 1-pager

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This document gives a brief description of a water quality constituent tracking tool that is based on assimilation of real-time time-series data collected at fixed stations in the Delta.

Because the response of water quality fields to operations is subtle, and, except very near the pumps, occurs at primarily tidally-averaged time scales, care must be taken in how data are collected and presented. In 2015 & 2016, DWR collected turbidity transect data at random phases of the tide. However, depending on timing, data collected in this way can mis-represent the actual spatial distribution in the Old and Middle corridor for two reasons: (1) the tidal excursion can extend for miles and the transects themselves can occur over several hours. The inherent spatial and time constraints in in collecting transect data means the spatial structure in turbidity measured does not represent the peak incursion of turbidity into the South Delta for a given day.. In short, the representation of the turbidity field collected in this way can be misleading (e.g. highly aliased, see https://en.wikipedia.org/wiki/Aliasing).

To overcome the limitations inherent in transect data, we suggest an alternative representation of the turbidity field based on linear interpolation of turbidity data measured at fixed stations taken at a constant point in ***tide***. The point in the tide of most interest to the management agencies charged with protecting delta smelt is at slack water after the largest flood tide of the day because this tidal phase corresponds to the condition where the turbidity field is at its farthest incursion into south Delta on any given day.

Furthermore, if “heat maps” of the turbidity field interpolated at slack after the peak flood tide are strung together in an animation, say over a 3-week period, the resulting animation will show the tidally-averaged movement of the maximum incursion of turbidity into the South Delta. This animation would not only show where the maximum turbidity is on any given day but would show whether turbidity is moving towards or away from the pumps and the extent to which changes in pumping alter these movements.

Additionally, the heat maps generated using this approach are not limited to the Old and Middle River corridor but can provide the Delta-scale context for the distribution and evolution of the turbidity fields within Old and Middle River corridor. For example, most of the turbidity that enters the central and south Delta is primarily supplied by Georgiana Slough (Figure 1, Morgan-Kind and Wright, 2015), so transport between Georgiana Slough through Franks Tract into the South Delta controls the turbidity distributions in the Old and Middle River corridor. Moreover, the so-called “turbidity bridge” between the western and south Delta is also controlled by the flux of suspended sediment that enters the central Delta through Georgiana Slough that is subsequently exchanged into to the south Delta which is mediated by exchanges into and through Franks Tract. The important process of transport of suspended sediment from the north Delta through the central Delta will therefore be observable in the heat maps generated at slack after the peak flood tide.

Finally, turbidity entering the Old and Middle River corridor primarily comes from two different sources/processes: (1) fluvial sources that come directly from the Sacramento, San Joaquin and Mokelumne Rivers, and (2) indirectly from wind-wave resuspension in Franks Tract of recently deposited fluvial suspended sediment. The Delta-scale “heat-maps” generated using this approach will provide managers with a broader/process-based understanding of the sources of the tidally-averaged turbidity distributions and their trajectories into the Central and South Delta.



Figure 1 - Total estimated sediment loads to the central Delta, in thousand metric tons, from each channel during 2013. The sizes of circle are proportional to the magnitude of sediment load and the arrows represent direction of transport. The Georgiana Slough pathway to the Mokelumne, shown in red and black arrow, is the major source of suspended sediment in the Central Delta at 90 thousand metric tons (Courtesy of Tara Morgan).

References

Morgan-King, T. and S.A. Wright, 2015, Sediment Budgets, Transport, and Depositional Trends in a Large Tidal Delta, 2015, in the Proceedings of the 3rd Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, April 19-23, 2015, Reno, Nevada, USA, pages 893- 904, https://acwi.gov/sos/pubs/3rdJFIC/Proceedings.pdf