Turbidity Tracker 1-pager

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Water Quality variability in the Delta is, at its core, governed by the movement of water quality fields that move at timescales that vary from the rapid twice daily movements driven by the tides (which can be on the order of 8 miles in the western Delta) to longer-term movements that respond to changes in river flows, the spring/neap (14 day) cycle and pumping. Compared to the tides and river flows, the response of water quality fields to water project operations is comparatively small, with response times that are correspondingly slow, on the order days to weeks.

This paper describes a water quality constituent tracking tool, based on assimilation of real-time time-series data collected at fixed stations in the Delta, that explicitly recognizes that changes in water quality variability due to water project operations is a slow, subtle overlay on the movements of water quality fields that are primarily governed by other larger-scale processes.

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. For example, turbidity transect data collected by DWR (Figure xx) at random phases of the tide can mis-represent the actual spatial distribution in the Old and Middle corridor for two reasons: (1) the tidal excursion in these reaches is on the order of xx miles, (xx percent of the length of these channels), and (2) the transects take time (on the order of 6 hours??? Is this true?) which means the spatial structure in turbidity measured in this way (a) does not represent the peak incursion of turbidity into the South Delta on a given day and (b) is evolving as the transect is taken, respectively. 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) and is therefore not the most useful snapshot of the turbidity field for management decisions.

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 interested in 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 supplied by Georgiana Slough (Figure xx, Ref Morgan, et.al. 20xx), 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 mediated by exchanges with 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 of recently deposited fluvial suspended sediment. The capability of generating Delta-scale “heat-maps” using this approach will provide managers with a broader/process-based understanding of the sources of the tidally-averaged turbidity distributions and their trajectories.