# Preliminary Simulations of Sediment Dynamics in the South San Francisco Bay

Prepared for:

The San Francisco Estuary Institute

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# 1. Introduction

The motivation for this study is to develop and apply tools to improve understanding of sediment dynamics in Coyote Creek and Alviso Slough. The preliminary transport studies documented here is intended as a first one year long phase in a five year study of sediment dynamics at Bay margin locations. Improved understanding and modeling tools for sediment dynamics will allow improved understanding of contaminant transport for contaminants associated with sediment at the Bay margin scale.

The SUNTANS application takes advantage of the grid flexibility allowed in an unstructured mesh by incorporating a high resolution grid in the project area, while using lower resolutions farther from the project site. This approach allows for a detailed analysis of local hydrodynamics at the breach sites in Coyote Creek, while still incorporating the overall hydrodynamics of the larger estuary into a single model grid. The model domain extends from the Pacific Ocean west of the Golden Gate through San Francisco Bay and extending into tidal sloughs including Coyote Creek and Alviso Slough.

For the suspended sediment simulations, a particle tracking approach is used in which each particle represents a fixed mass of sediment. The particle transport method of this model is consistent with the transport method of the SUNTANS model. The particle tracking tool predicts transport, settling, deposition, resuspension and consolidation of particles. Several simplifying assumptions are applied to limit the scope of the modeling effort. The effects of wind (and wind-waves) on bottom stress are not considered in calculating shear stress. A single size class of sediment is considered. An advantage of using a particle tracking model instead of a more conventional concentration based sediment transport model is that the entire history of each particle trajectory and status (deposition, resuspension etc.) can be examined. For example, the source location and time of introduction of each particle is known allowing the explicit identification of sources of sediment that deposit/consolidate at any location, whereas this information is generally not available in traditional sediment transport models.

This report is divided into six sections:

- **Section 1. Introduction.** This section presents a summary of the scope and organization of the report.
- **Section 2. Project Approach and Objectives.** This section discusses the objectives of this study, the domain simulated, the modeling approach used, and relevant limitations of the approach.
- **Section 3. Model Formulation.** This section discusses the governing equations of three-dimensional hydrodynamics and particle transport and the numerical method of the FISH-PTM.
- **Section 4. Field Observations.** This section summarizes the field work conducted at Coyote Creek and the relevant observation data used to compare with simulation results.
- **Section 5. Particle Tracking Simulation Results.** This section documents the results of the particle tracking modeling scenarios.
- **Section 6. Summary and Conclusions.** This section summarizes the results of the particle tracking modeling scenarios and conclusions drawn from this investigation.

# 2. Project Approach and Objectives

The objective of this study is to estimate short-term (hours to days) deposition and consolidation patterns of sediment in and around Coyote Creek. Specifically, the suspended sediment dynamics simulated includes sinking, deposition, resuspension and consolidation. The simulation period is March 27 to April 10, corresponding to a spring-neap cycle. Two different simulations have been performed, one in which particles associated with resuspension in the South Bay are introduced at Calaveras Point and a second with particles associated with Guadalupe River flow into Alviso Slough.

The study uses the Stanford Unstructured Nonhydrostatic Terrain-following Adaptive Navier-Stokes Simulator (SUNTANS) (Fringer et al., 2006) applied by Holleman (see companion report) to provide high resolution three-dimensional hydrodynamic information including water levels, velocity, vertical eddy diffusivity and salinity. The three-dimensional Flexible Integration of Staggered-grid Hydrodynamics Particle Tracking Model (FISH-PTM), a particle tracking model which has been coupled with SUNTANS, was applied to simulate sediment dynamics.

# 3. Model Formulation

The application of SUNTANS (Fringer et al., 2006) will be documented by Holleman in a companion report. The Flexible Integration of Staggered-grid Hydrodynamics Particle Tracking Model (FISH-PTM) was developed to appropriately represent particle transport processes for Arakawa C grid (Arakawa and Lamb, 1977) models.

## 3.1 Formulation of Particle Tracking Model

The FISH-PTM solves Equation 3.7 in all three coordinate dimensions in a manner which, as closely as is feasible, retains consistency with the numerical solution of the scalar transport equation in SUNTANS and other staggered (Arakawa C) grid hydrodynamic models.

The numerical solution of particle trajectories follows a commonly used operator-split methodology in which the governing equation is solved in independent steps (e.g., Dunsbergen, 1994). The particle tracking algorithm consists of the following processes:

- Horizontal advection
- Vertical advection
- Horizontal diffusion
- Vertical diffusion
- Sediment dynamics (deposition, resuspension, consolidation)

Computing particle trajectories in multiple steps greatly simplifies the evaluation of particle trajectories and, therefore, improves computational efficiency.

The horizontal particle trajectory in each grid cell is calculated according to

$$dX_i = u_i(\underline{X}, t)dt \qquad (3.1)$$

for the horizontal dimensions ($i$ = 1, 2). Equation 3.1 represents advection in the horizontal dimension. For each FISH-PTM time step, horizontal advection is applied in one or more steps. The particle is transported at the velocity interpolated to the particle location until a cell boundary is encountered. If/when a cell boundary is encountered, the interpolated advection velocity is recalculated using the node velocities of the grid cell entered. Because each substep of the horizontal advection is a linear trajectory, the horizontal advection algorithm is quite simple and computationally efficient.

In order to determine particle trajectories, the velocity field calculated by SUNTANS must be interpolated to each particle location. The velocities calculated by SUNTANS are normal velocities to each cell side (Fringer et al., 2006). Node velocities are calculated for each grid cell from the side-normal velocities following the method of Zhao (2007). The velocity field defined at the nodes is then interpolated to the particle location. The following bilinear interpolation method that applies to both triangles and quadrilaterals is applied (Ketefian, 2004)

$$\phi(x, y) = a + bx + cy + dxy \tag{3.2}$$

where $x$ and $y$ are the coordinates of the particle, $\phi(x, y)$ is the interpolated velocity component, and, $a$, $b$, $c$, and $d$ are interpolation coefficients determined for the grid cell (triangle or quadrilateral). The interpolation coefficients depend only on the geometry of the cell.

The vertical advection is calculated in an analogous manner but is less complex because the vertical velocities are simply interpolated linearly from the top and bottom faces of the cell to the particle location. The settling velocity attributed to particles is added to the hydrodynamic velocity interpolated to the particle position.

The vertical diffusion is calculated using the "backward Ito" integration method documented by LaBolle et al. (2000). The horizontal diffusion is treated similarly. However, unlike the vertical diffusivity, the horizontal diffusivity is not calculated by SUNTANS. Horizontal diffusivity is not required by SUNTANS in typical estuarine simulations because the most important transport processes are explicitly resolved. In addition, some numerical diffusion is present in the scalar (e.g., salt) transport method. For both of these reasons, SUNTANS results are generally insensitive to specified values of horizontal diffusivity and other sub-grid scale mixing of reasonable magnitude. However, since there is no numerical diffusion associated with the particle tracking approach, the FISH-PTM applies a horizontal diffusion coefficient to represent all sub-grid scale processes. In this study a constant horizontal diffusivity value of 1.0 $m^2 s^{-1}$ was used for all simulations.

The probability of deposition is given by Jones (2008) as

$$P = \left(1 - \frac{\tau}{\tau_{cd}}\right) \tag{3.3}$$

where $\tau$ is the shear stress and $\tau_{cd}$ is the critical shear stress of deposition. Resuspension is treated in a simpler manner. When the bed shear stress exceeds the critical shear stress of erosion, a particle is resuspended. If a particle is not resuspended for a specified consolidation time, the particle is considered to be consolidated.

The bed shear stress is calculated following the approach in MacWilliams and Cheng (2008).

$$\tau = \rho C_d {u_b}^2 \tag{3.4}$$

Where $\rho$ is the density of water, $C_d$ is the drag coefficient, and $u_b$ is the near-bed velocity. The coefficient of drag applied was 0.0025 at 1 meter above the bed, as used in MacWilliams and Cheng (2008).

The sediment transport parameters for the simulations are taken from McDonald and Cheng (1997). Specifically, the critical shear stress of deposition was set to 0.15 N/m$^2$, the critical shear stress of erosion was set to 0.40 N/m$^2$, the fall velocity was set to 0.001 m/s and the consolidation time was set to 4 days. Because this phase of work entails "preliminary transport studies" and was intended to only include settling and not resuspension, these parameters were not calibrated in this study.

Several simplifying assumptions are applied to limit the scope of the modeling effort. The effects of wind (and wind-waves) on bottom stress are not considered in calculating shear stress. Only a single size class of sediment is considered. The settling velocity is independent of concentration (flocculation is not considered).

# 4. Field Observations

Field measurements were collected near the Island Ponds by MacVean (2010). For the period between March 8th and April 30th 2006, moored instruments were deployed at three stations, referred to as West, Center, and East (Figure 4-1). Velocity and suspended sediment concentration data were collected at all stations.

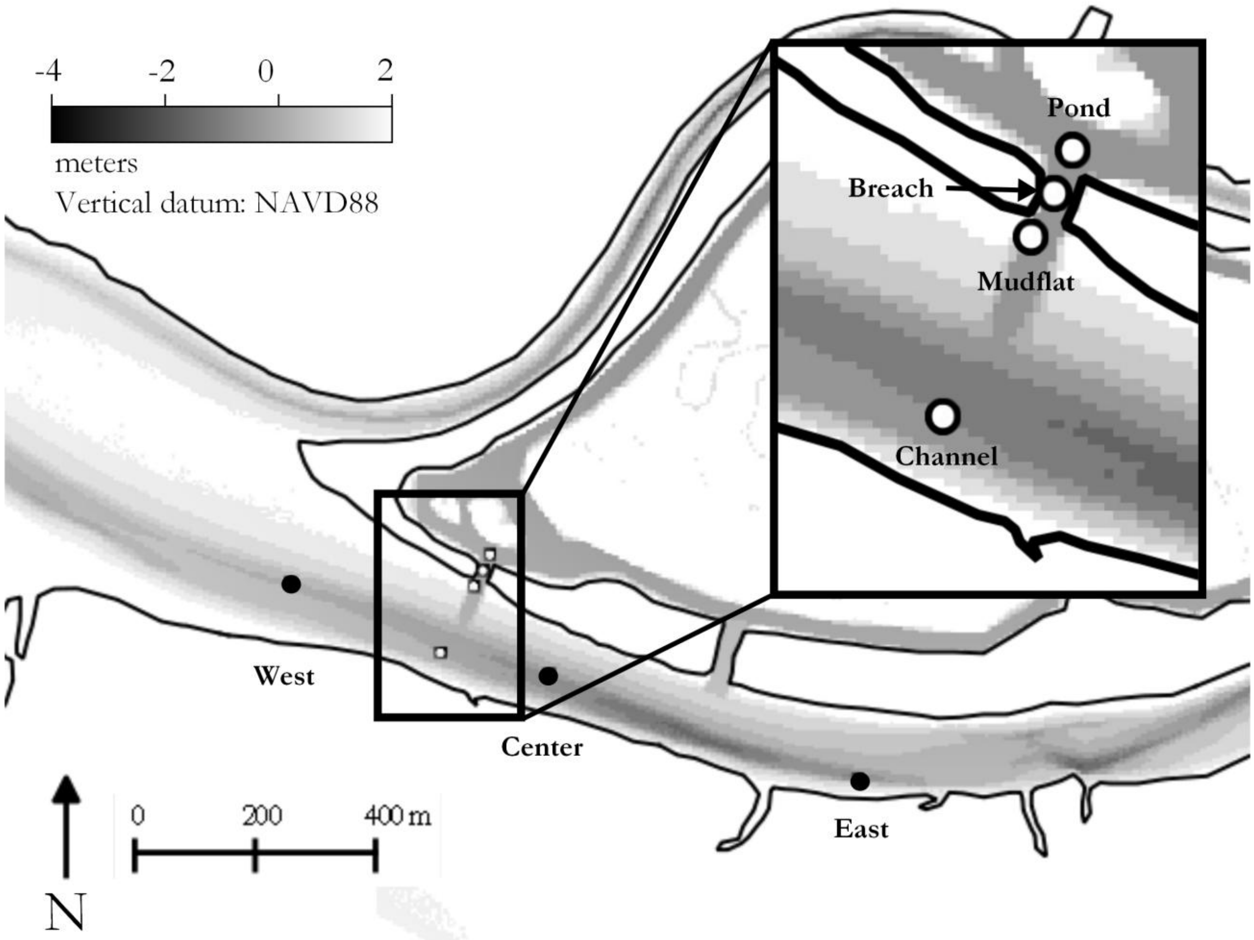


Figure 4-1: Map of Coyote Creek with station locations of MacVean (2010).

In the simulation of transport of South Bay sediment into Coyote Creek, the incoming suspended sediment concentration was specified based on USGS Dumbarton Bridge SSC observations available at an Upper Sensor and a Lower Sensor. Data at the two sensors was averaged when both were available. Figure 4-2 shows the complete USGS data for the simulation period. During the first week of the simulation period, the observed SSC is higher than during the second week of the simulation period, probably because the first week corresponds to a spring tide period.

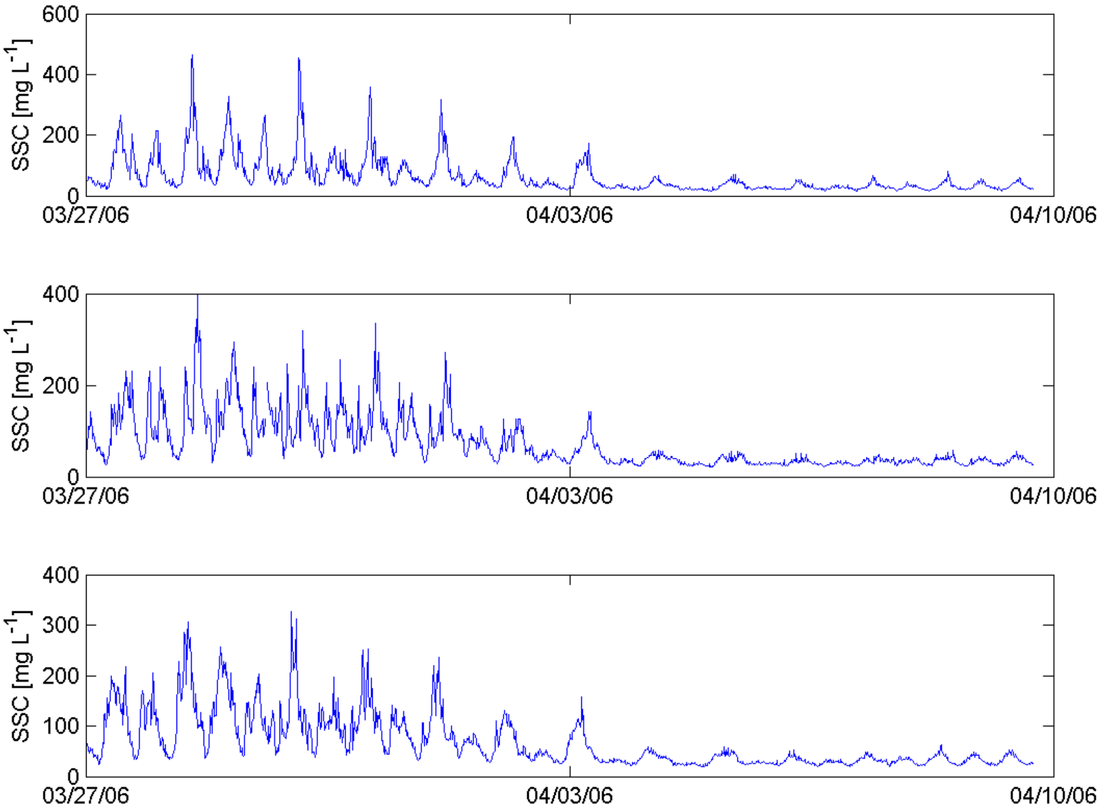


Figure 4-2: USGS SSC measurements at the Dumbarton Bridge. Top panel is the Upper Sensor data, middle panel shows Lower Sensor data, and the bottom panel shows the average of the two sensors.

# 5. Particle Tracking Simulation Results

Simulations were performed for two different sediment sources. In the first simulation, particles were introduced at Calaveras Point to represent sediment resuspended in the South Bay. In the second simulation particles were introduced at the upstream end of Alviso Slough at the 237 freeway to represent sediment introduced from Guadalupe River.

Both simulations extended from March 27, 2010 to April 10, 2010. The water surface elevation predicted by SUNTANS and observed flow in tributaries to Coyote Creek during this period are shown in Figure 5-1. The period included a major flow event with peak flow on April 4, 2006.

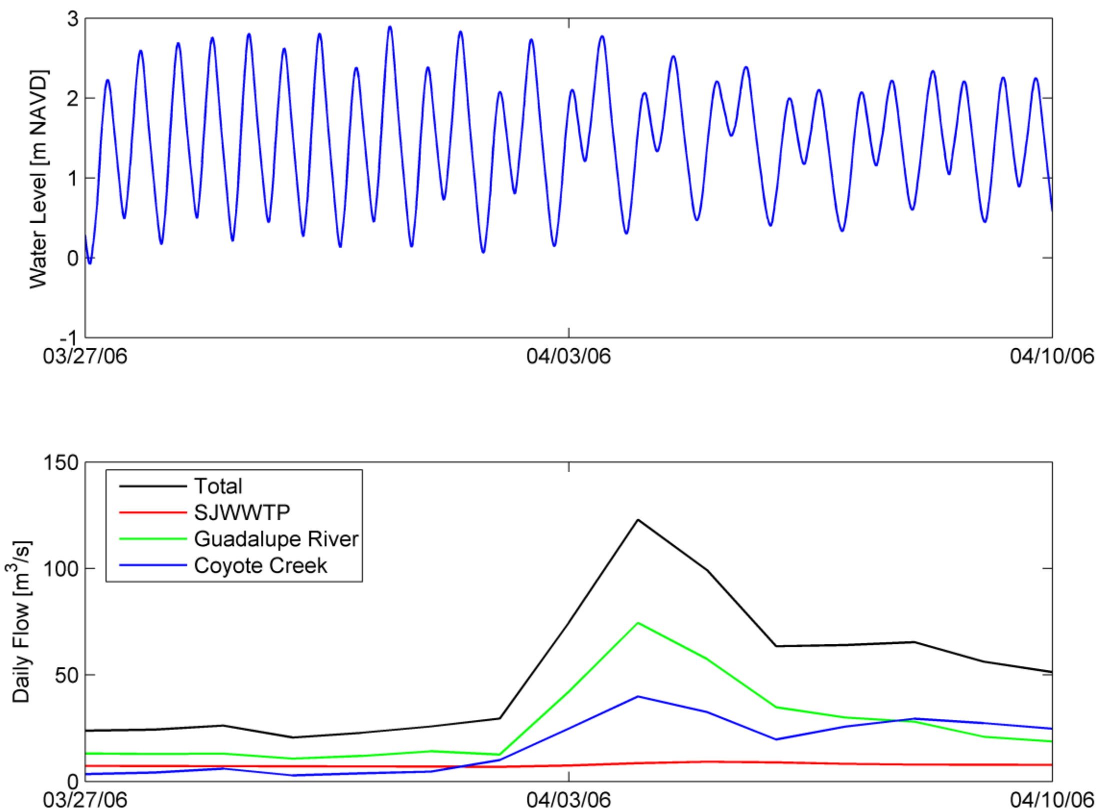


Figure 5-1: Water surface elevation (m NAVD) predicted in Coyote Creek and observed daily flow ($m^3$/s) in tributaries to Coyote Creek.

## 5.1 Simulation of Transport of South Bay Sediment into Coyote Creek

The concentration of incoming SSC (particle mass * number of particles/volume) at Calaveras Point was specified based on USGS Dumbarton Bridge SSC observations (Figure 4-2). Particles were introduced during flood tide at Calaveras Point to represent sediment resuspended in the South Bay. Particles that leave Coyote Creek during ebb tide are deactivated.

The particles are introduced at Calaveras Point and each particle is tracked throughout the simulation until the time of consolidation or exit from Coyote Creek into the South Bay. Figure 5-2 shows the total number of particles in different states throughout the simulation. A large number of particles exit during each tidal cycle because the net flow in Coyote Creek is directed seaward. However, in the initial portion of the simulation a substantial number of particles entering from Calaveras Point deposit in Coyote Creek and associated tidal sloughs. Each particle can deposit and resuspend several times. However, Figure 5-2 suggests limited resuspension of particles each tidal cycle. Over time most of the deposited particles do not resuspend for 4 days and, therefore, consolidate. In the second week of the simulation, the inflows into Coyote Creek from different tributaries increase, leading to flushing of particles from Coyote Creek. In addition, the observed SSC at Dumbarton Bridge, which is applied to set incoming SSC concentration in the simulation, is lower during the second week than during the first week of the simulation (Figure 4-2). Because tidal currents are weaker and concentrations lower during the second week, fewer particles enter Coyote Creek.

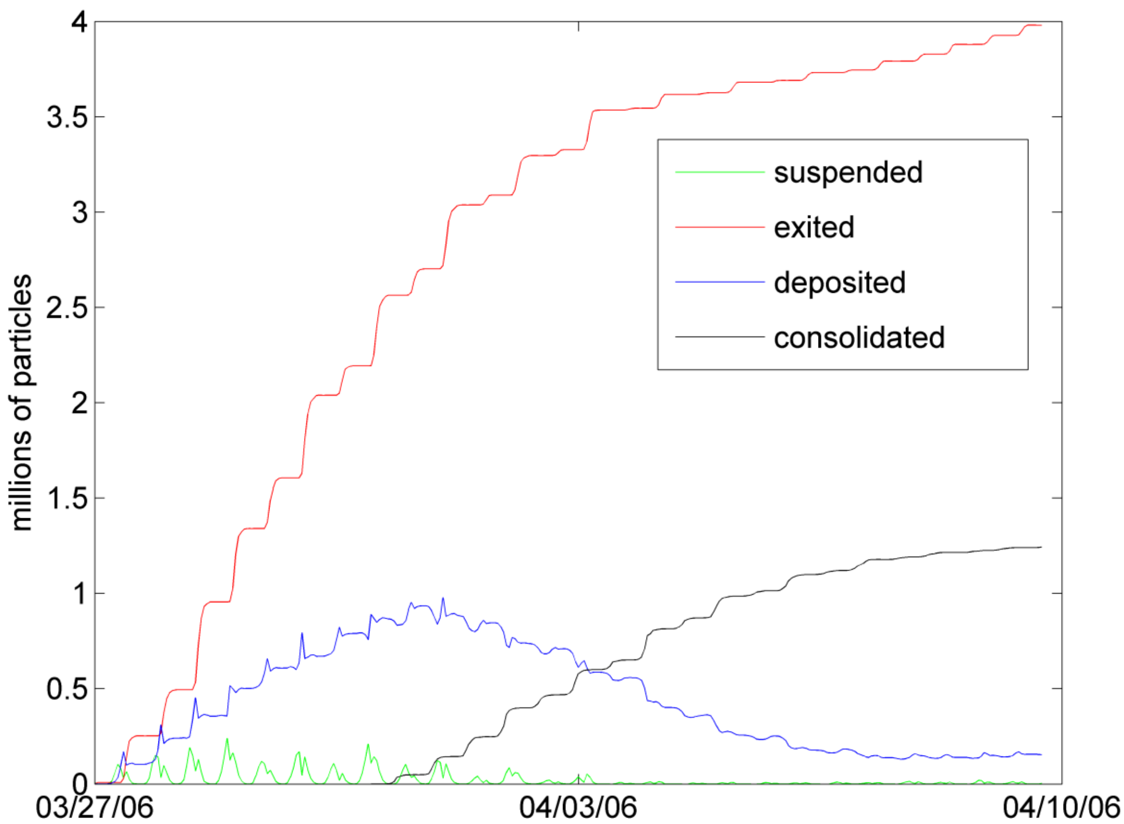


Figure 5-2: Number of particles of different status in the Coyote Creek simulation.

The Coyote Creek sediment dynamics simulation only accounts for sediment arriving in Coyote Creek from the South Bay. Sediment arriving from tributaries or local sources is not accounted for in this simulation. Therefore, the predicted SSC is "South Bay derived sediment" and represents only a fraction of the total suspended sediment that should be present at any given location. Figure 5-3 shows a comparison of the predicted South Bay derived SSC with total observed SSC at the Center station of MacVean (2010). The predicted SSC is made up of particles advected from the boundary and particles resuspended in Coyote Creek. The peak predicted SSC is more than twice the peak SSC at the Dumbarton Bridge during the simulation period, indicating that substantial local resuspension is predicted. However, the predicted SSC is much lower than observed SSC. This suggests that locally resuspended sediment is underestimated and/or tributary derived sediment may comprise a substantial portion of observed suspended sediment concentration at this location. In the second week of the simulation period, the predicted SSC is minimal suggesting that particles entering from the boundary do not arrive at the center station and that predicted local resuspension is small. In contrast, the observed SSC is substantial and is likely in large part comprised of sediment arriving from tributaries.

Figure 5-4 shows that predicted SSC is minimal on ebb tides (negative streamwise velocity) suggesting minimal resuspension of particles near the Center station. This occurs primarily because sediment "particles" from South Bay are predicted to deposit primarily seaward of the Island Ponds. Both local resuspension and tributary sources of sediment are likely to contribute substantially to observed SSC near the Island Ponds, but are not accounted for in this simulation. If all sources were accounted for, including erodible sediment distributed on the bed, remaining differences between predicted SSC and observed SSC could be reduced by calibration of the sediment parameters The parameters of MacDonald and Cheng (1997) were based on calibration to observations in San Pablo Bay and Suisun Bay so may not be representative of conditions in Coyote Creek. Additional improvement might be achieved by accounting for the effect of wind waves results on resuspension in Coyote Creek. If additional phases of this modeling work are pursued, additional sediment sources would be accounted for, sediment parameters can be calibrated to conditions in Coyote Creek, the effects of wind waves would be estimated, and longer simulations would be performed. A more sophisticated representation of sediment dynamics may also be required to achieve good calibration.

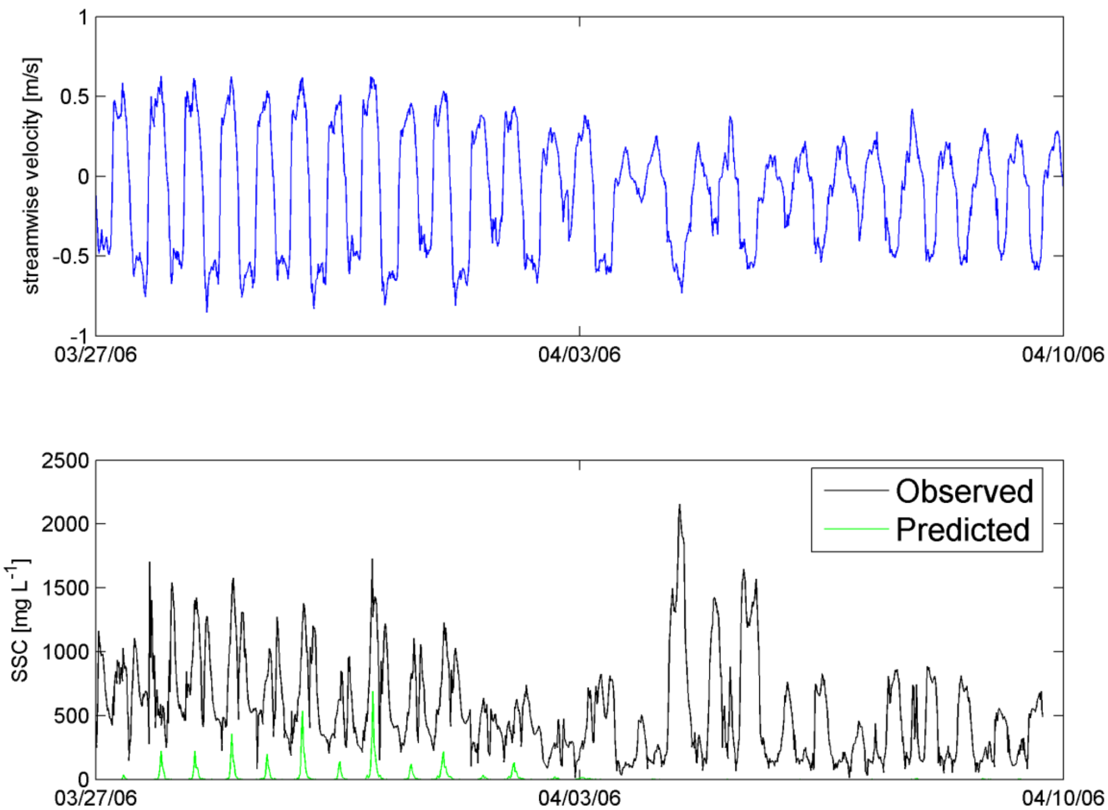


Figure 5-3: Comparison of observed SSC at the Center station of MacVean (2010) and a prediction of SSC associated with South Bay sediment only, at the Center station.

Two periods will be examined in more detail. The first period is a tidal cycle during March 31, 2006 which is during spring tides and roughly corresponds to the period of maximum number of deposited particles and peak predicted SSC in Coyote Creek. Particle status is examined during a flood tide, then at slack water, and then during an ebb tide. The tidal phase was determined based on the observed velocity (MacVean, 2010) during that period, shown in Figure 5-4.

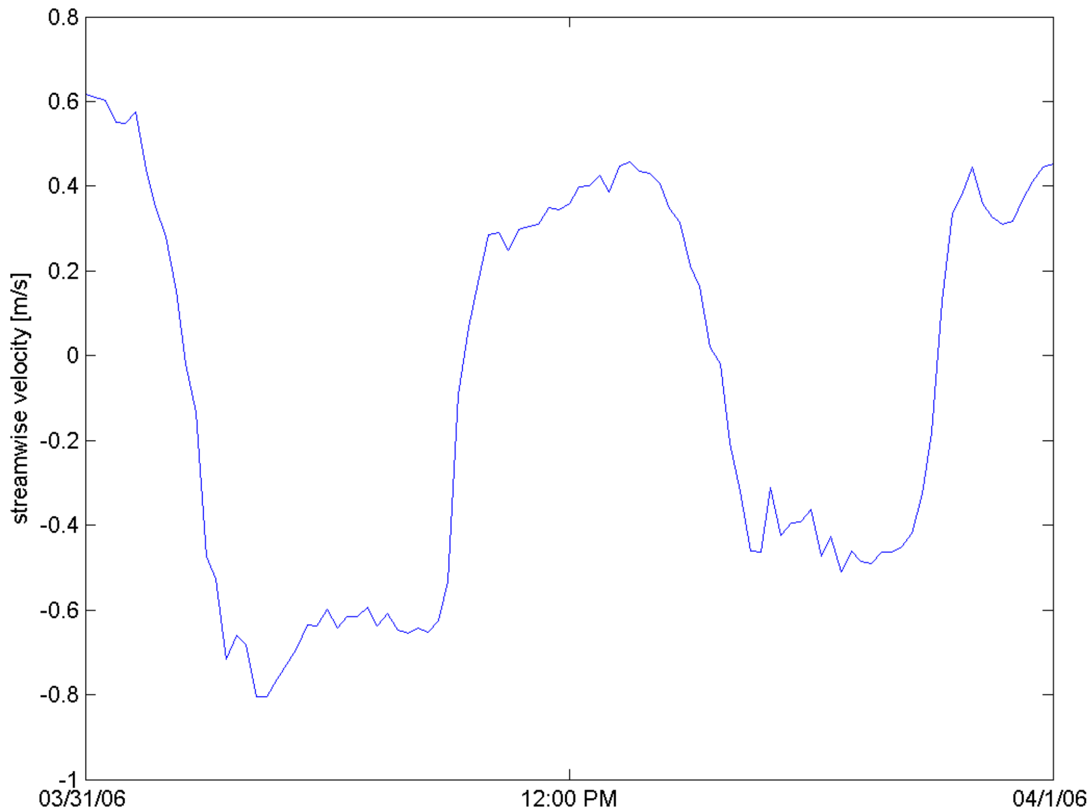


Figure 5-4: Observed velocity at the Coyote Creek East station (MacVean, 2010) on March 31, 2006. Positive streamwise velocity corresponds to flood tide.

During flood tides particles enter Coyote Creek at Calaveras Point resulting in a large number of suspended particles on March 31, 2006 at 1:00 pm. At this time, deposited particles are primarily located in shoals and intertidal regions and extend from Calaveras Point to the Island Ponds. The prediction of deposition in the Island Ponds is an important result, suggesting that sediment suspended from the South Bay can be deposited in the Island Ponds, in addition to sediment derived from local sources. Limited consolidation has occurred at this point in time because consolidation is assumed to occur 4 days after deposition. Therefore, for this simulation that began on March 27, 2006, only particles deposited in the first 13 hours of the simulation can be consolidated on March 31, 2006 at 1:00 pm.

On March 31, 2006 at 4:00 pm, near slack water, many suspended particles are still present. Some particles previously deposited in the channel near Calaveras Point have been resuspended between 1:00 pm and 4:00 pm. The consolidation pattern has not changed noticeably during those 3 hours.

On March 31, 2006 at 7:00 pm, during ebb tide, few suspended particles are present because most particles have been advected out of Coyote Creek by the ebb currents. A few suspended particles remain in Coyote Creek, presumably from local resuspension. Substantial additional deposition has occurred between 3:00 pm and 7:00 pm. The predicted consolidation pattern does not changed noticeably during those 4 hours.

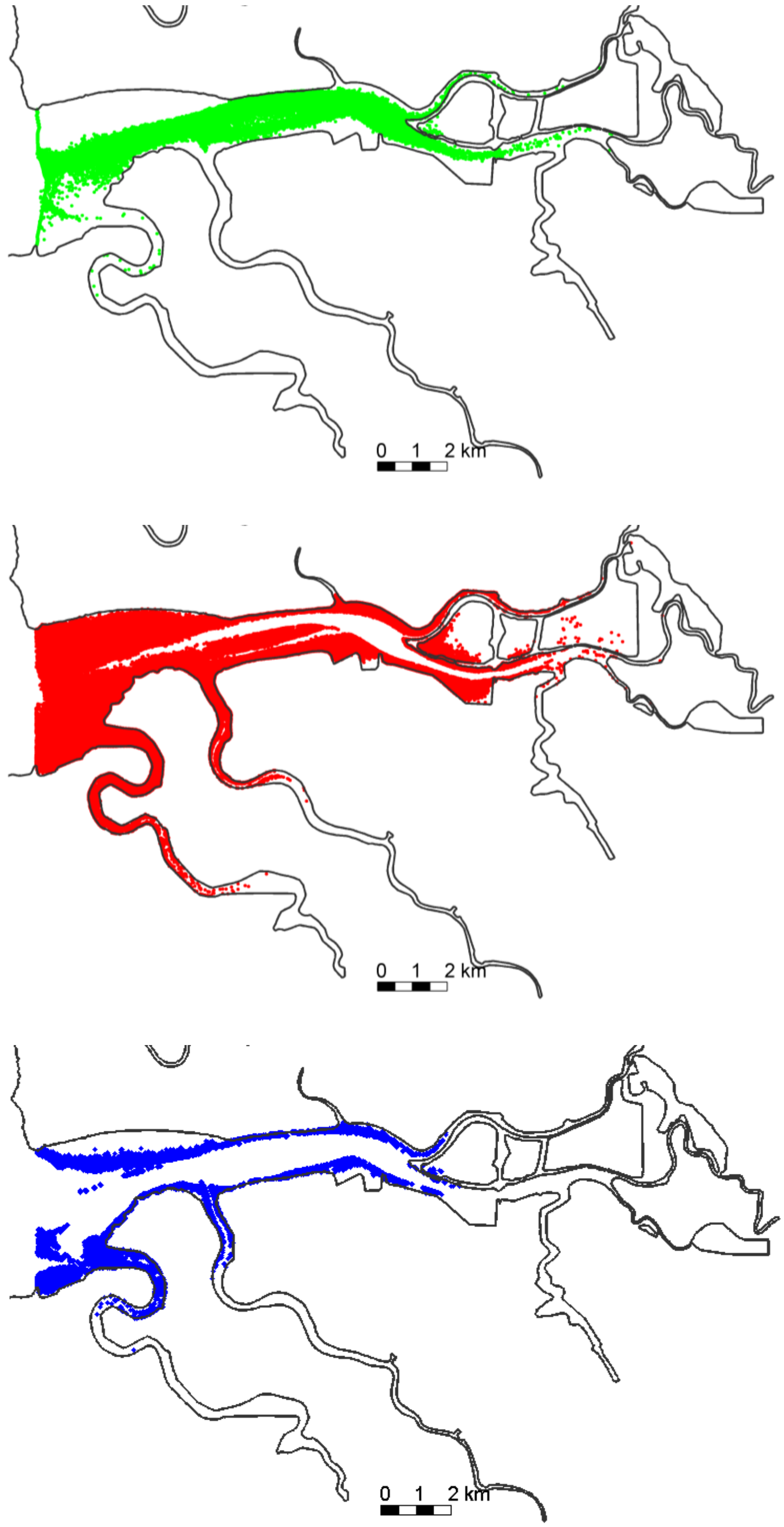


Figure 5-5: Particle status on March 31, 2006 at 1:00 pm during a flood tide. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

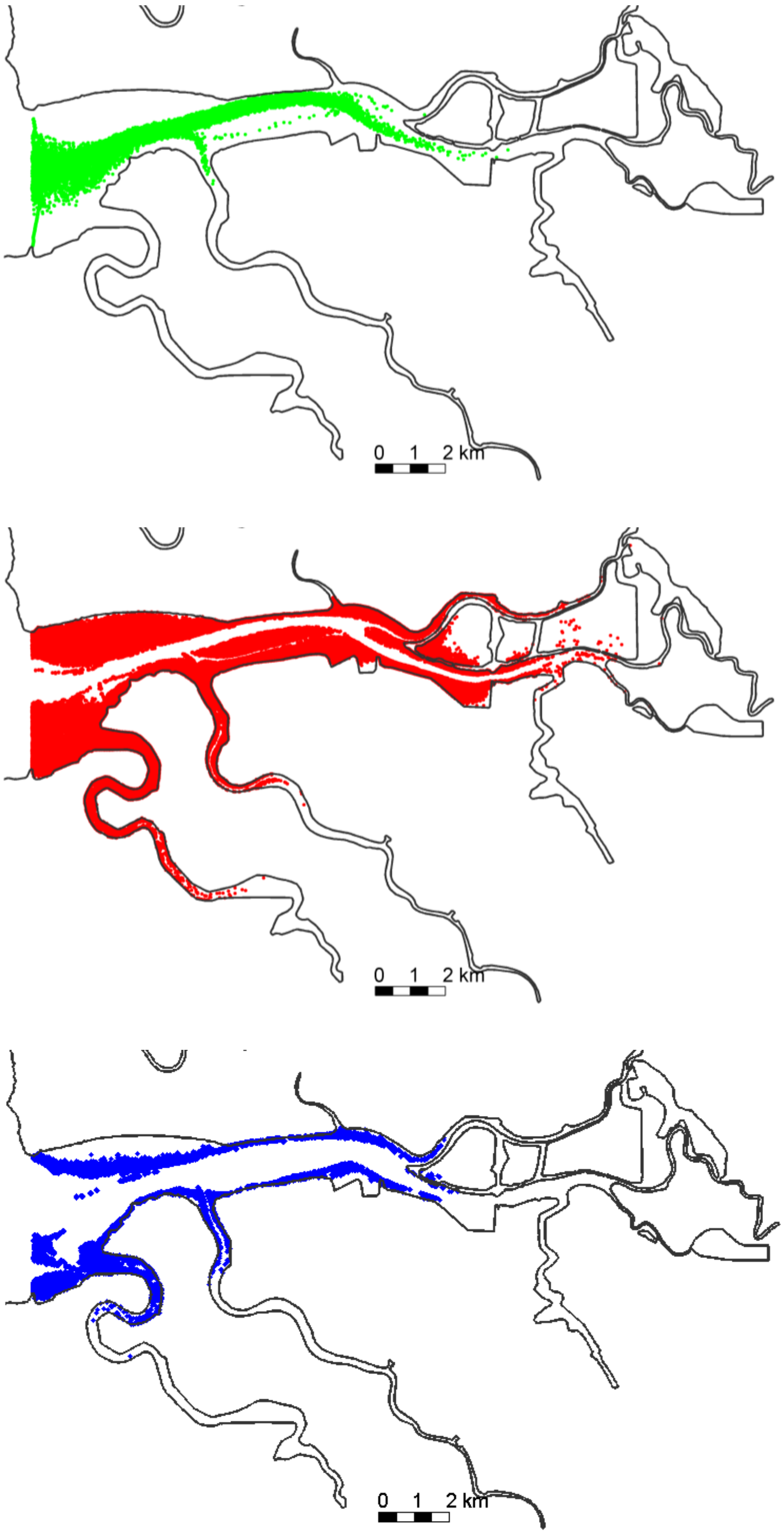


Figure 5-6: Particle status on March 31, 2006 at 4:00 pm near slack water. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

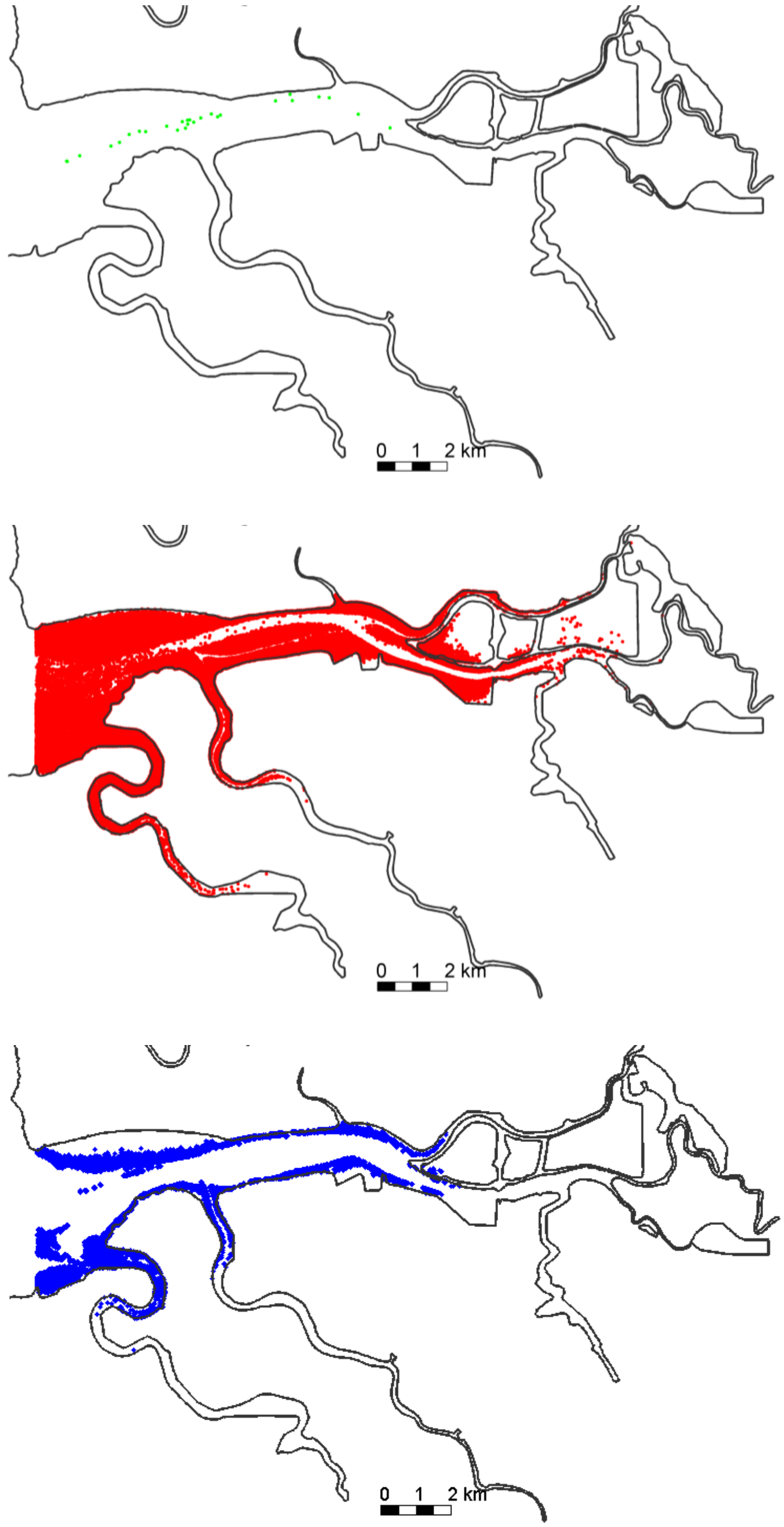


Figure 5-7: Particle status on March 31, 2006 at 7:00 pm during an ebb tide. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

The second period is a tidal cycle during April 9, 2006 which is during neap tides and a period of high tributary inflows to Coyote Creek. Particle status is examined during a flood tide, then at slack water and then during an ebb tide. The tidal phase was determined based on the observed velocity during that period (MacVean, 2010), shown in Figure 5-8.

On April 9, 2006 at 7:00 am, during a flood tide, particles enter Coyote Creek at Calaveras Point resulting in a large number of suspended particles. However, the location of the suspended particles does not extend as far landward during this neap tide period relative to the Figure 5-5 for the flood tide during spring tides. On April 9, 2006 at 7:00 am deposited particles are primarily located in shoals and lower intertidal regions and extend from Calaveras Point to the Island Ponds. In high marsh areas many consolidated particles are present but deposited particles are not present. This is expected because April 9, 2006 is during neap tides so high water does not always inundate high marsh areas. For this reason, no recent deposition has occurred in the high marsh and particles previously deposited in those locations have consolidated. The prediction of deposition in the Island Ponds is an important result, suggesting that sediment suspended from the South Bay can be deposited in the Island Ponds, in addition to sediment derived from local sources. Much more consolidation has occurred by April 9, 2006 relative to the consolidation predicted on March 31, 2006.

On April 9, 2006 at 12:00 pm, near slack water, few suspended particles are present because many of the particles have been deposited or advected out of Coyote Creek by this time. The maps of deposited and consolidated particles are similar to the corresponding maps on April 9, 2006 at 7:00 am during flood tides.

On April 9, 2006 at 12:00 pm, during an ebb tide, very few suspended particles are present because most of the particles have been advected out of Coyote Creek by this time. The maps of deposited and consolidated particles are similar to the corresponding maps on April 9, 2006 at 7:00 am, during flood tides, and April 9, 2006 at 12:00 pm, near slack water.

The consolidation pattern at the end of the two week long simulation period is shown on Figure 5-12. The predicted consolidation is primarily located in intertidal regions. Tidal currents are strong enough in the channel to limit deposition and allow resuspension of particles. In contrast, in many intertidal regions the predicted shear stress does not exceed the specified critical shear stress of erosion, allowing consolidation of particles. However, it should be noted that the shear stress resulting from wind waves is not estimated in these simulations. The additional shear stress from wind waves would result in additional resuspension. The map suggests that, to the extent that the sediment parameters applied are appropriate, that sediment from the South Bay can deposit and consolidate in intertidal areas of Coyote Creek including the island ponds during periods of moderate tributary inflows. As indicated by Figure 5-3, suspended particles derived from the South Bay are predicted to be flushed out of Coyote Creek during high tributary inflow periods.

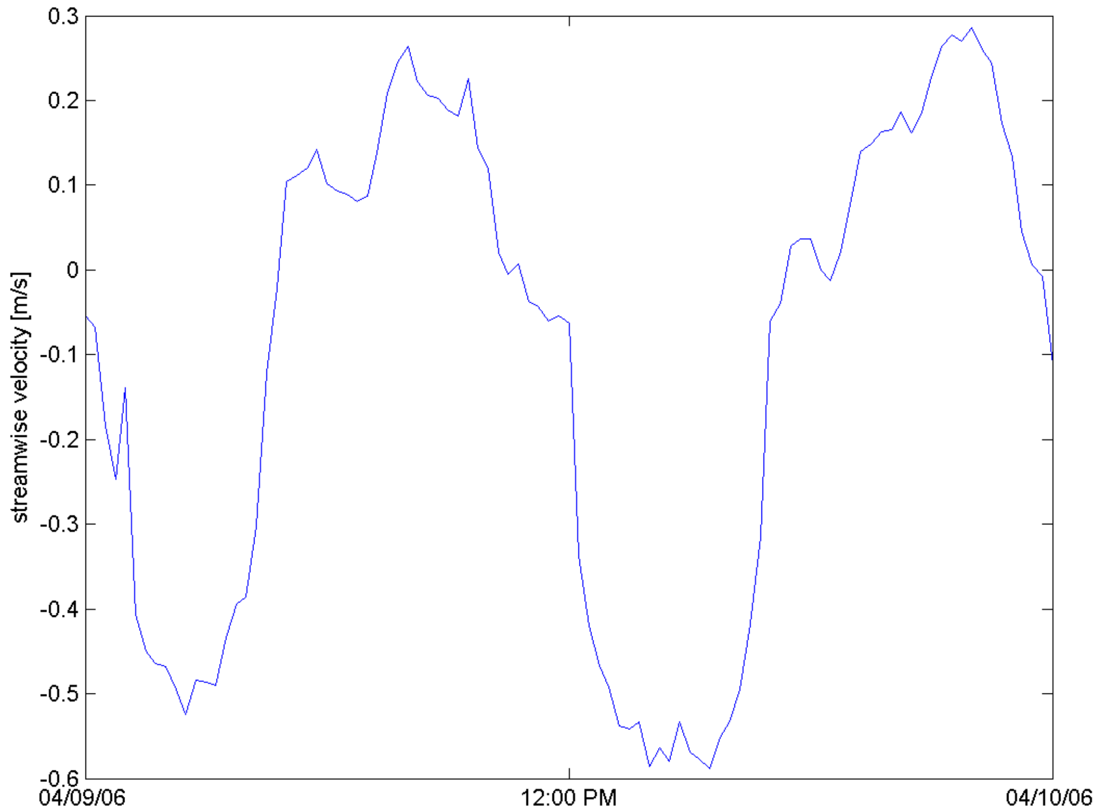


Figure 5-8: Observed velocity at the Coyote Creek East station (MacVean 2010) on April 9, 2006. Positive streamwise velocity corresponds to flood tide.

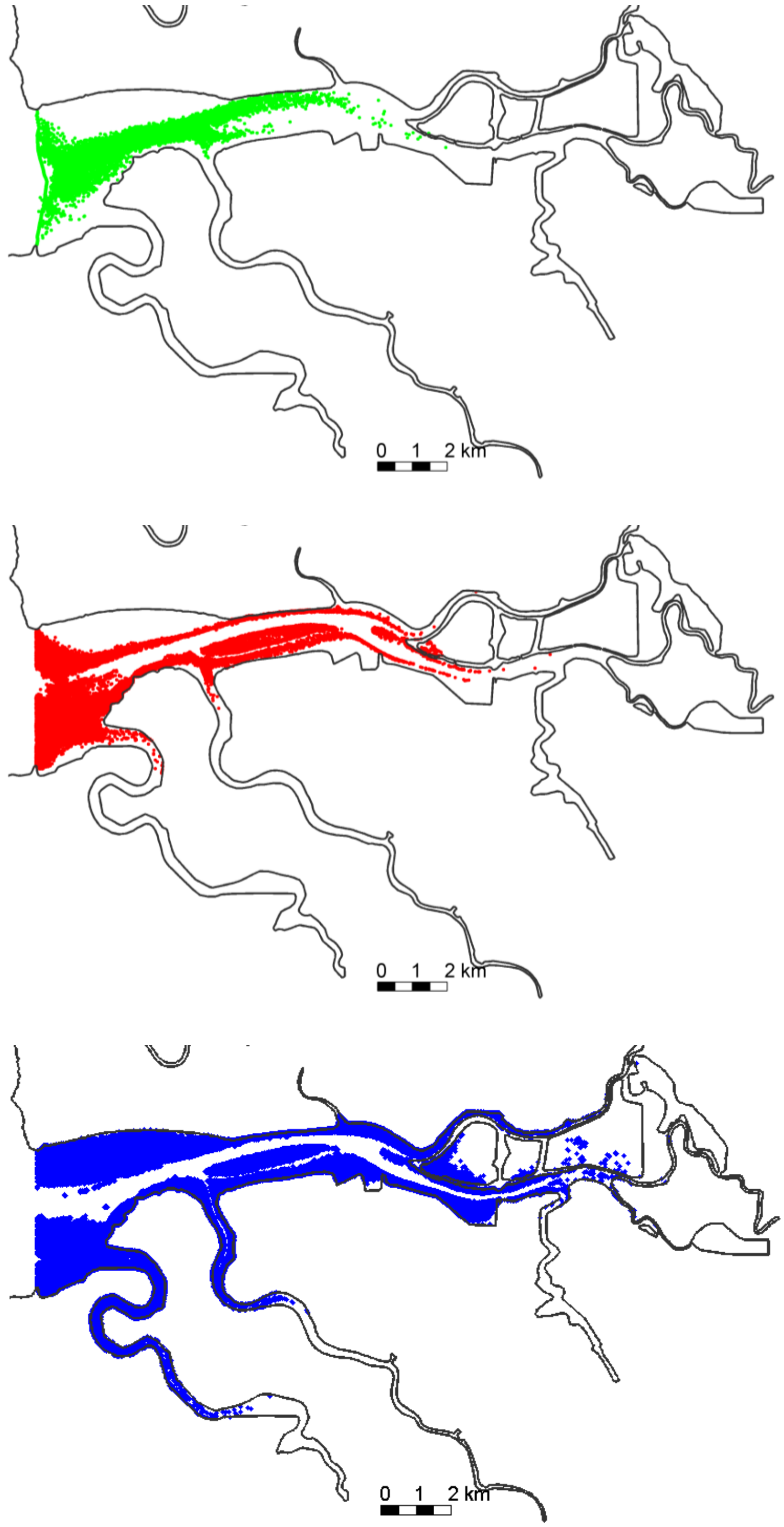


Figure 5-9: Particle status on April 9, 2006 at 7:00 am during a flood tide. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

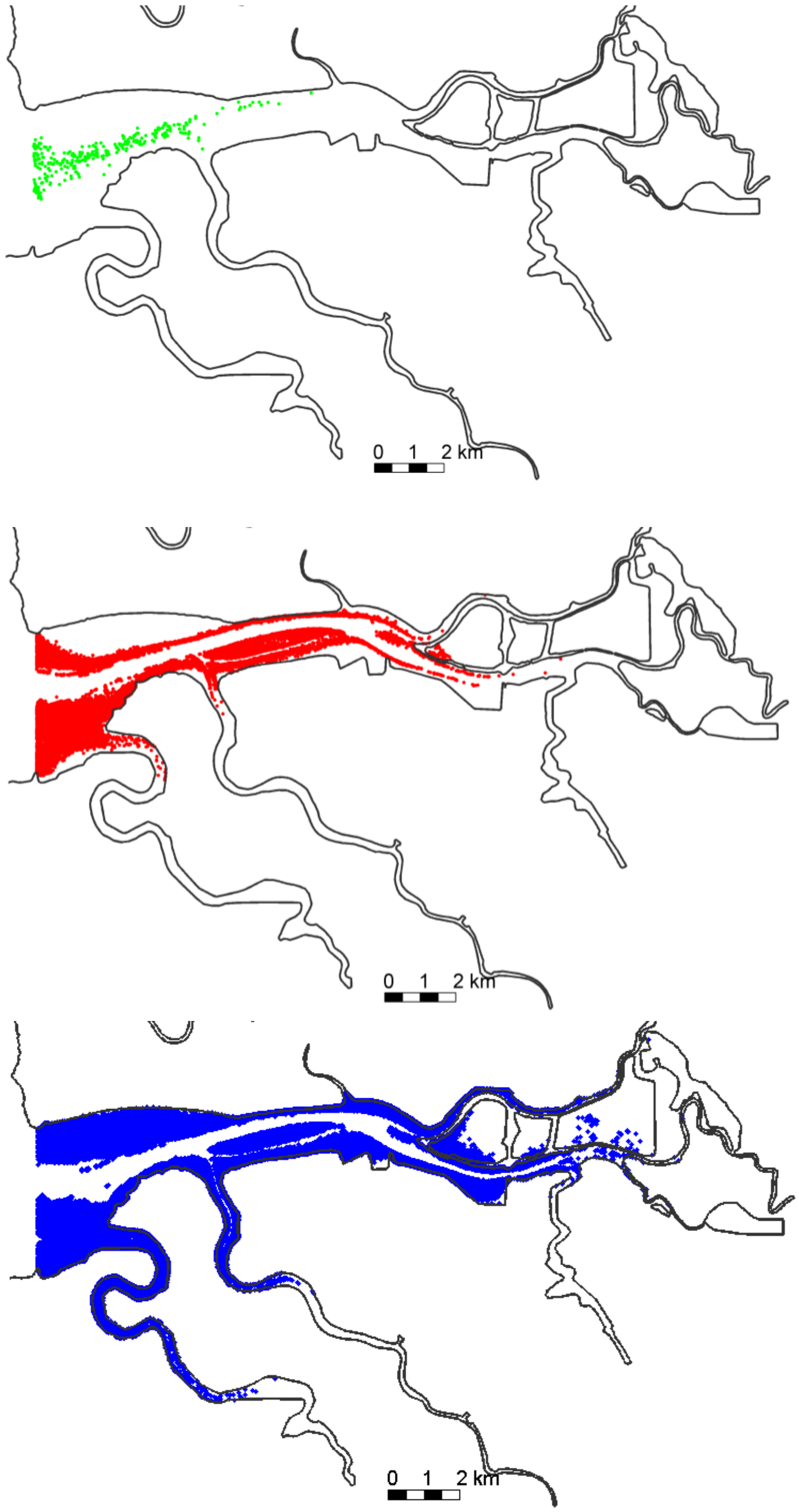


Figure 5-10: Particle status on April 9, 2006 at 12:00 pm near slack water. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

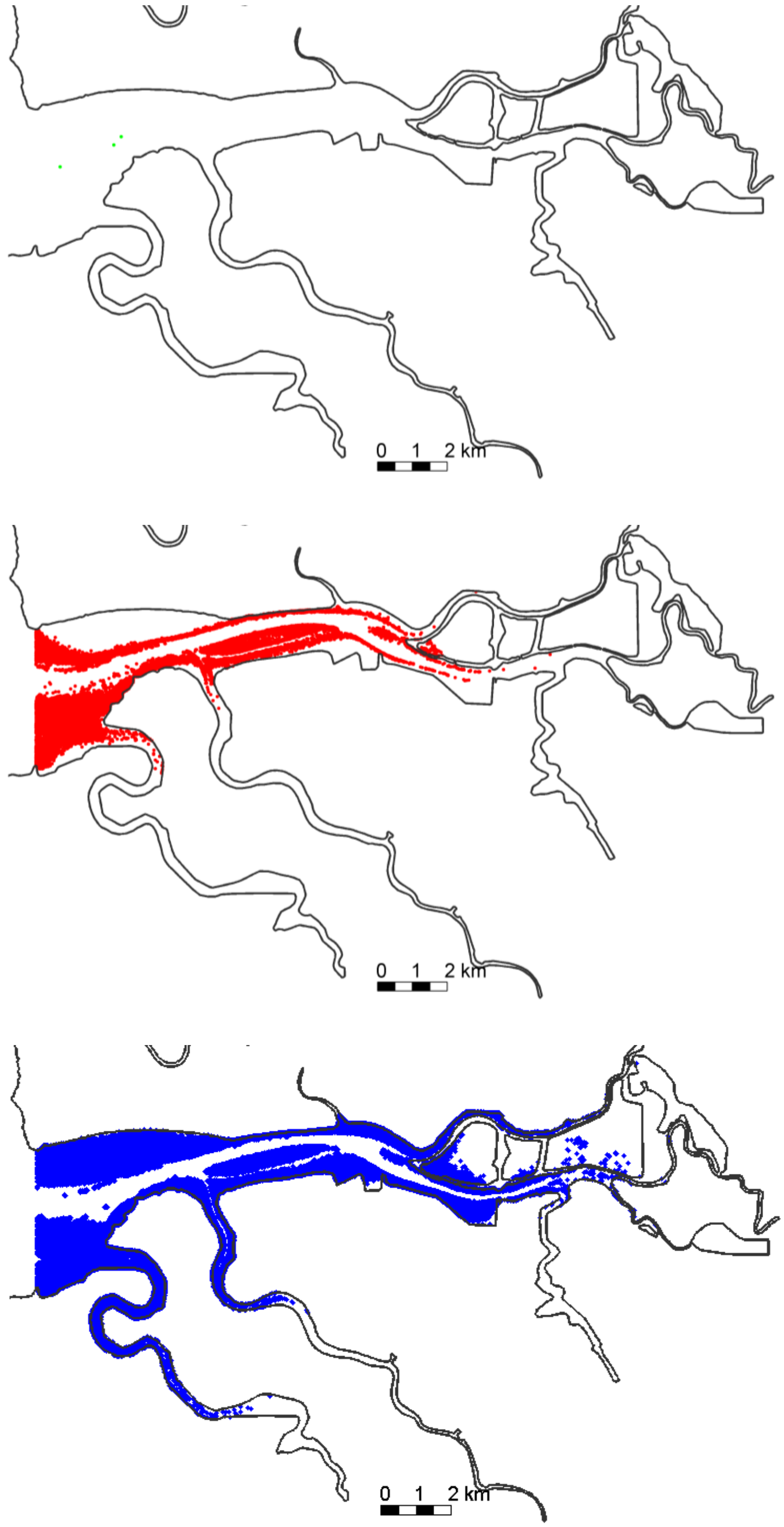


Figure 5-11: Particle status on April 9, 2006 at 3:00 pm during an ebb tide. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

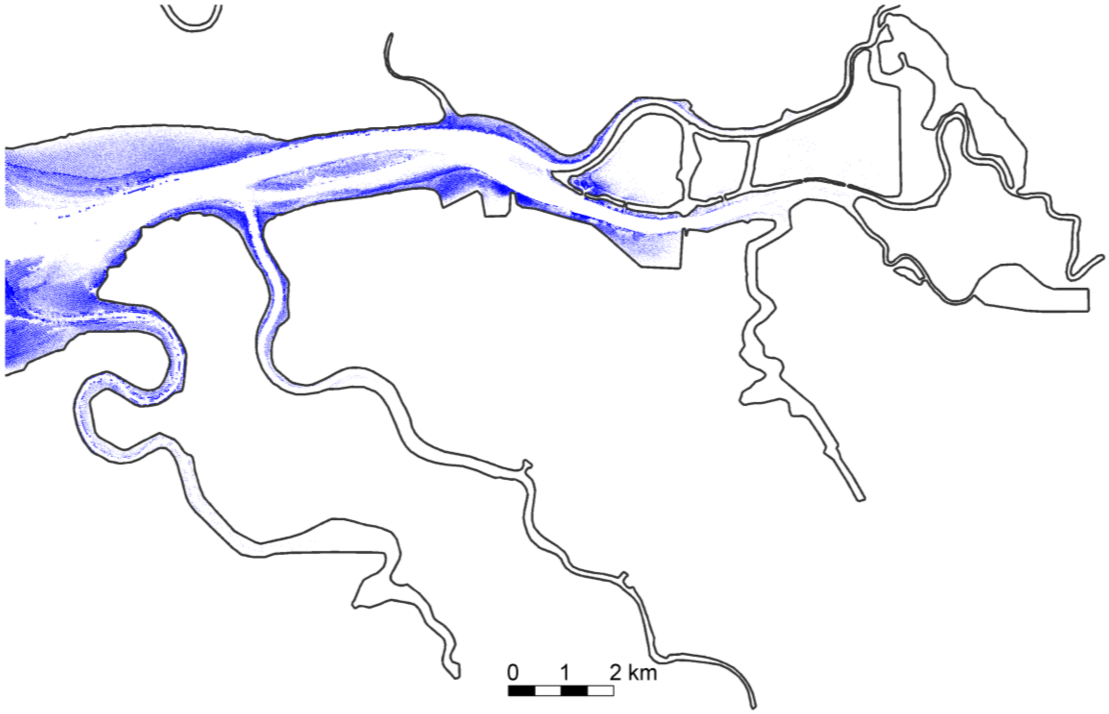


Figure 5-12: Locations of consolidation of South Bay derived sediment during simulation period.

An advantage of a particle tracking approach over a traditional concentration based sediment transport model is that the full history of each particle can be examined and multiple sources of sediment can be tracked individually. As an example, Figure 5-13 shows the trajectories and locations of deposition and consolidation of two different particles released at approximately the same time.

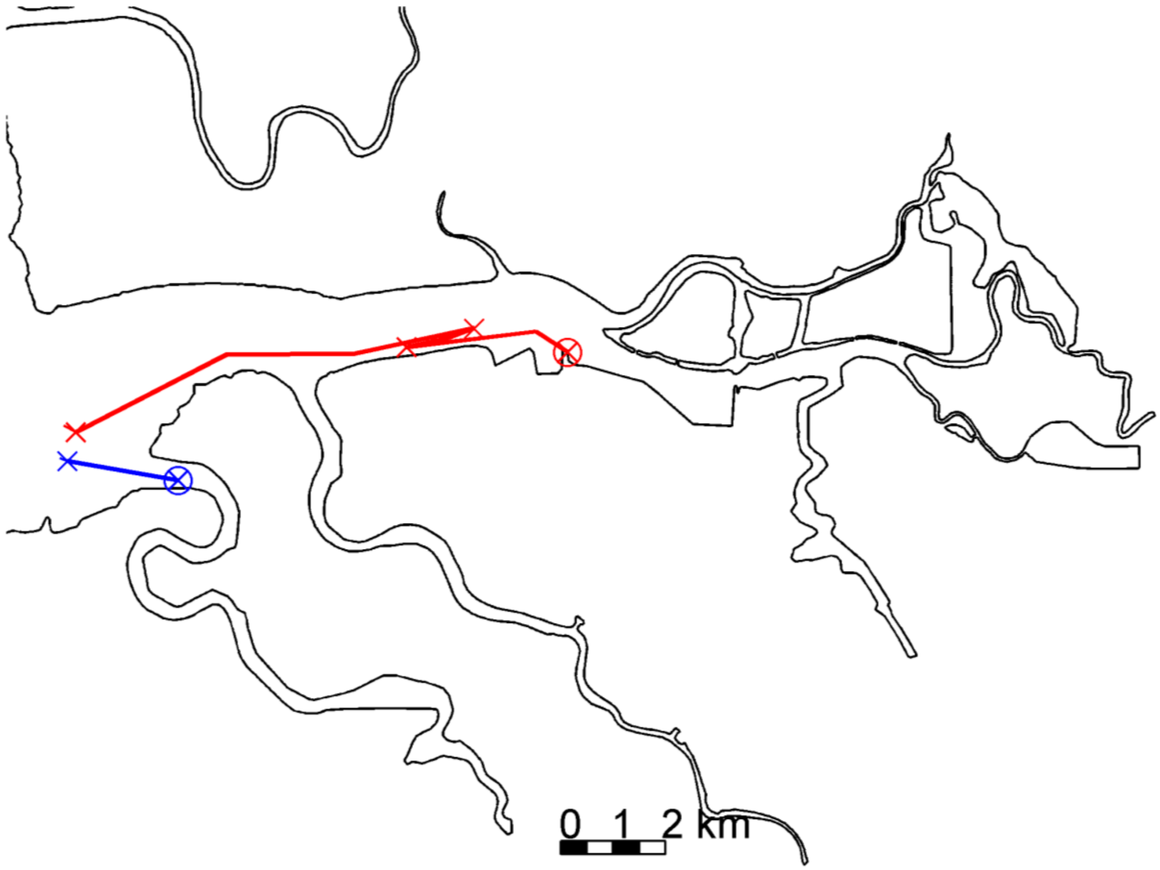


Figure 5-13: Trajectories of two different particles released on March 27, 2006. Each "x" marks a location of deposition and the circle represents the location of consolidation, which corresponds to the final location of deposition. The trajectories appear to be straight lines because they are based on hourly output of predicted position.

## 5.2 Simulation of Transport of Guadalupe River Sediment through Alviso Slough

Particles were introduced to Alviso Slough at the 237 Freeway in this simulation to represent Guadalupe Slough sediment. The concentration of incoming SSC was set to a constant value of 1 particle per 100 $m^3$ of water. During the second week of the simulation, Guadalupe River flows are relatively high (Figure 5-14). Therefore, more particles were introduced in high flow periods than during low flow periods. Any particles that leave Alviso Slough are deactivated ("killed").

Each particle is tracked throughout the simulation until the time of consolidation or exit from Alviso Slough. Figure 5-15 shows the total number of particles in different states throughout the simulation. Very few particles are predicted to resuspend after depositing initially. Therefore, the majority of the particles released consolidate in Alviso Slough during the simulation period and relatively few particles exit. In the second week of the simulation, the Gualdalupe River flow increases resulting in more particles being released and an increase in the number of deposited particles.

The status of each of the particles is examined at different tidal phases on the last day of the simulation (Figure 5-16 through Figure 5-18). On April 9, 2006 at 7:00 am, during flood tide, relatively few suspended particles are present, all located in the upper portion of Alviso Slough (Figure 5-16). Noticeably more particles are present in the subsequent snapshots for April 9, 2006 at 12:00 pm, near slack water (Figure 5-17), and April 9, 2006 at 3 pm, during an ebb tide (Figure 5-18). However, during all three tidal phases, few suspended particles are present and most particles have consolidated throughout Alviso Slough. Deposition is predicted mostly in the upper half of the slough at all tidal phases on April 9, 2006.

Figure 5-19 shows the time from particle release to consolidation at the locations of predicted consolidation in Alviso Slough. This map indicates that most particles deposit soon after release, with consolidation occurring 4 days later. However, at downstream locations, a wide range of time from release to consolidation is predicted. This occurs because particles are transported rapidly downstream during the high Guadalupe River flow period around April 4, 2006.

The very limited number of particles that are predicted to remain suspended or resuspend and exit Alviso Slough seems unrealistic and suggests inaccuracy in the sediment parameters selected for this preliminary transport simulation. For example, the selected critical shear stress of deposition (0.15 $N/m^2$) selected for the simulation may be too low or the settling speed (0.001 m/s) may be too high.

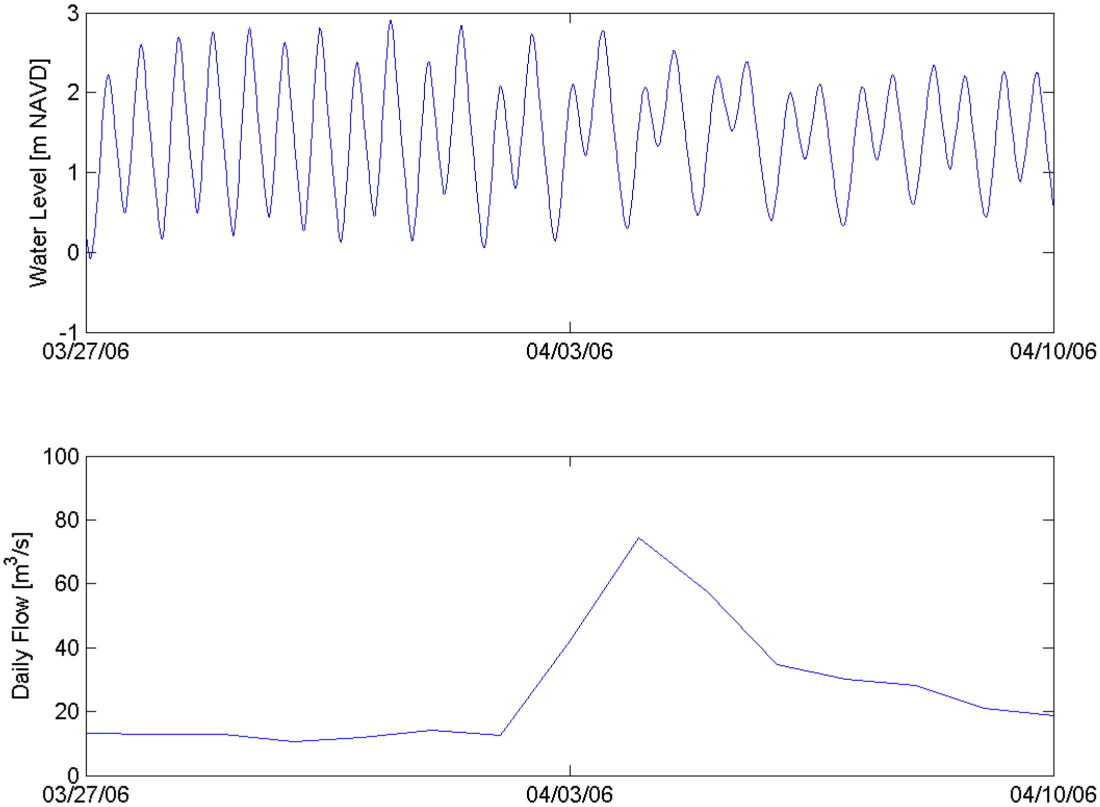


Figure 5-14: Water surface elevation (m NAVD) predicted in Coyote Creek and observed daily flow ($m^3/s$) in the Guadalupe River.

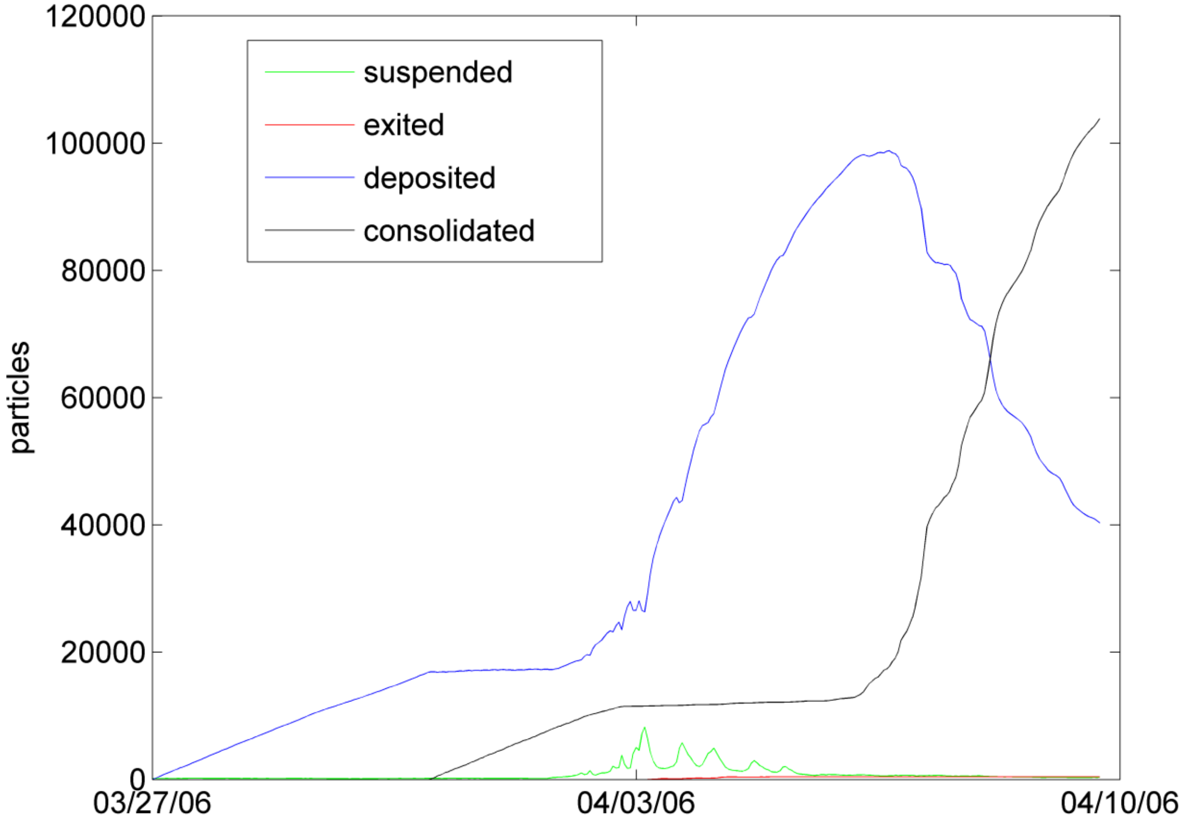


Figure 5-15: Number of particles of different status in the Alviso Slough simulation.

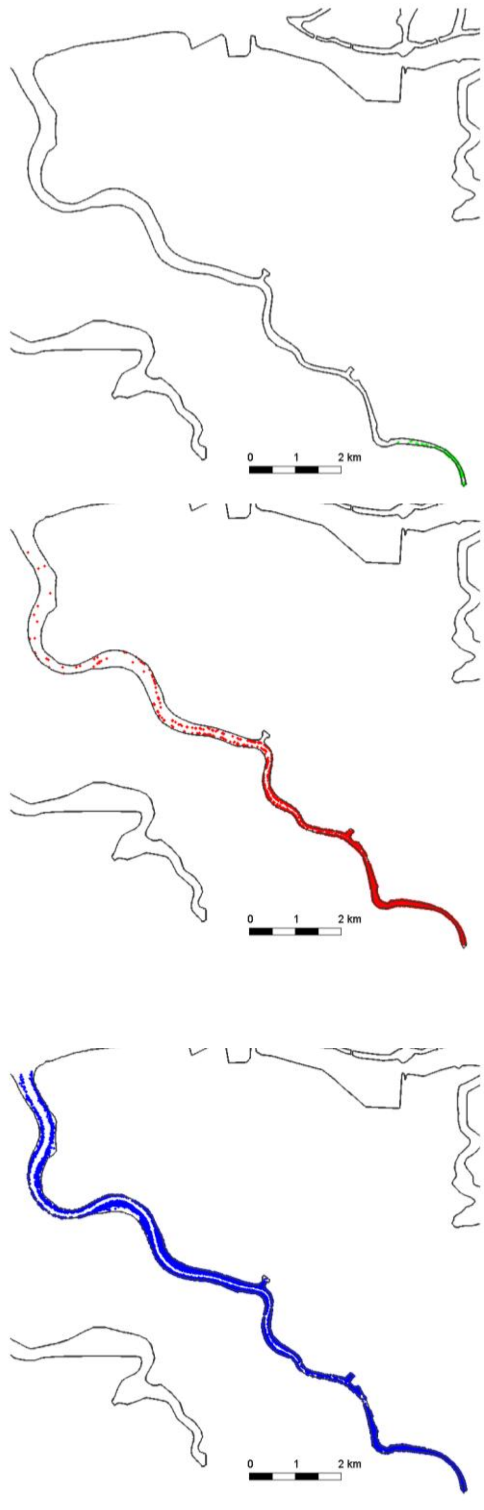


Figure 5-16: Particle status in Alviso Slough on April 9, 2006 at 7:00 am during a flood tide. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

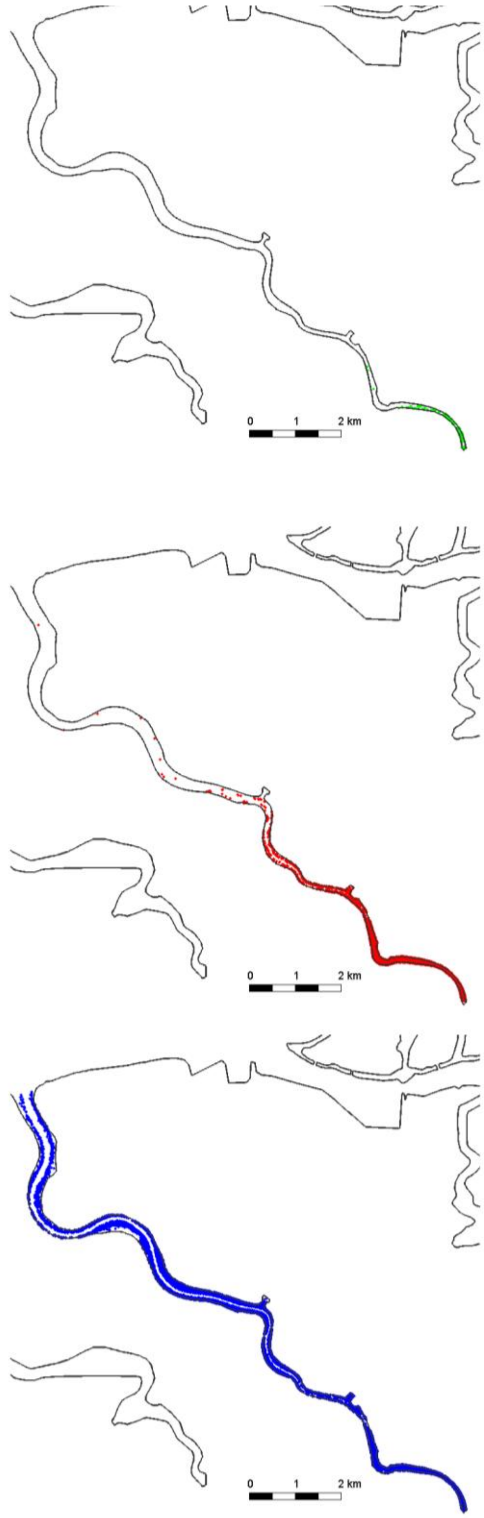


Figure 5-17: Particle status in Alviso Slough on April 9, 2006 at 12:00 pm near slack water. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

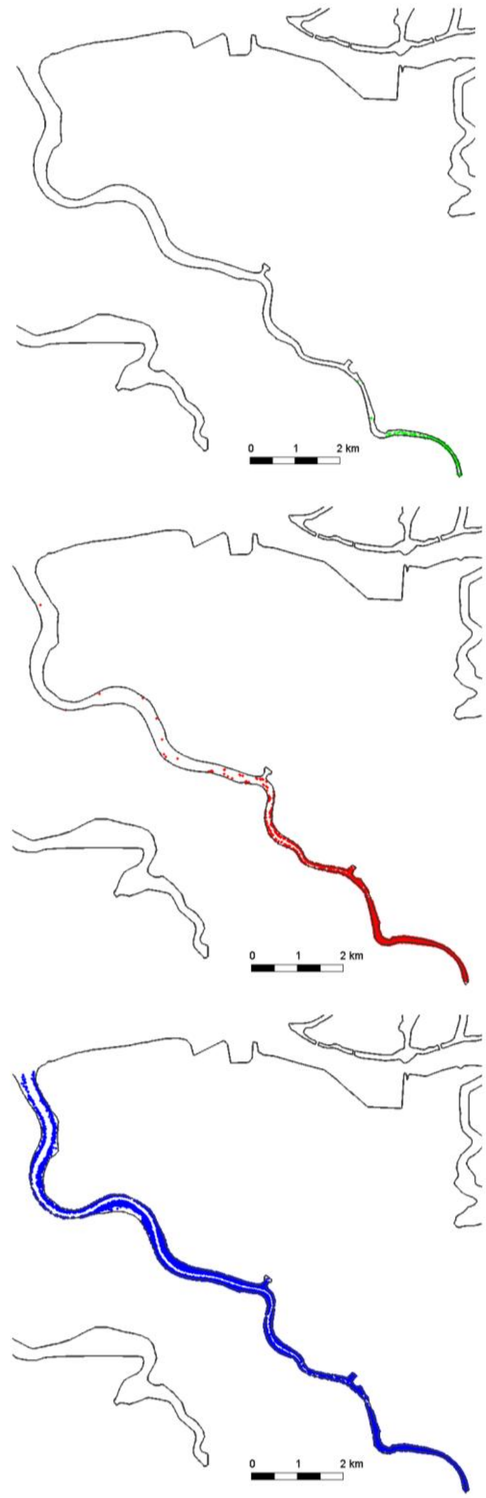


Figure 5-18: Particle status in Alviso Slough on April 9, 2006 at 3:00 pm near slack water. The top panel shows the locations of suspended particles, the middle panel shows the locations of deposited particles and the bottom panel shows locations of consolidated particles.

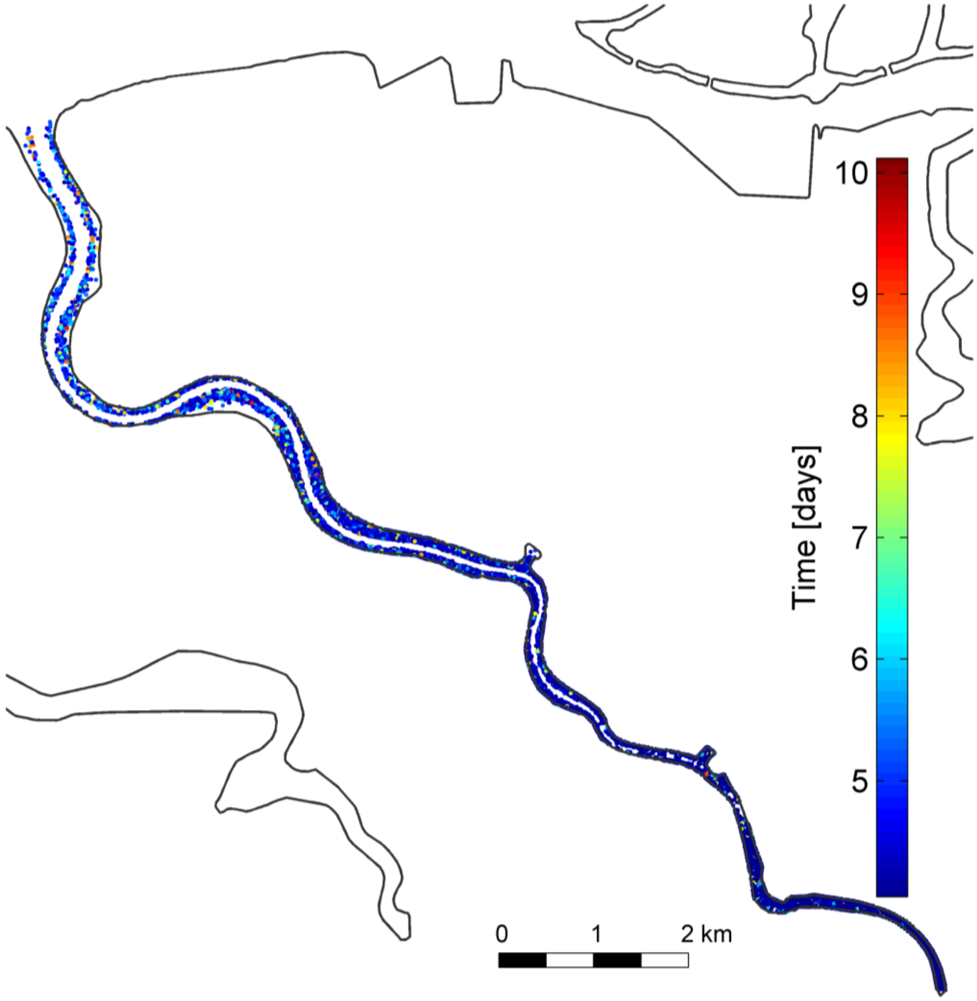


Figure 5-19: Time from particle release to consolidation for Alviso Slough simulation. Each particle is shown at the location at which it consolidates.

# 6. Summary and Conclusions

Two different particle tracking scenarios have been performed to examine sediment dynamics at the “Bay Margin” scale in South San Francisco Bay. The study locations selected were Coyote Creek and Alviso Slough.

The Coyote Creek simulation suggests that South Bay derived sediment can be transported and consolidate in the Island Ponds, suggesting a substantial spatial extent of “reworking” of sediment in this region. During periods of significant tributary inflows, South Bay sediment enters Coyote Creek to a much smaller extent. In addition, during neap tides, SSC is lower in South Bay, so the conditions likely to result in sediment transport from the South Bay to the Island Ponds are low to moderate tributary flow periods during spring tides.

The Alviso Slough simulation suggests that Alviso Slough is a strongly depositional environment. However, these results are likely to depend strongly on the sediment parameters chosen, which have not been calibrated to local conditions.

One clear potential application of the tool developed in this study is a fingerprinting study to determine provenance of bed sediment present in various “Bay Margin” locations. However, in order to provide quantitative results all major tributary sources of sediment must be considered and the tool must be calibrated by comparison against local SSC measurements. Accurate calibration may require that the modeling is extended to account for additional processes, such as the effect of wind waves on bottom stress.

Once the fingerprinting approach is proven to be realistic for sediment simulations, it could be extended to represent contaminant sources associated with sediment.

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