



The MARSH 98 model assumes that the elevation of a marsh surface increases at a rate that depends on the (1) availability of suspended sediment and (2) depth and period of inundation by high tides. MARSH 98 is based on the mass balance of suspended sediment of the water column using Krone's (1987) mass balance equation:

$$\frac{d\eta}{dt} \geq 0 \quad \frac{d\eta}{dt} < 0$$

$$(\eta - z) \frac{dC}{dt} = -V_s C + (C_o - C) \frac{d\eta}{dt} \quad (\eta - z) \frac{dC}{dt} = -V_s C$$

where:  
 $\eta$  = Water surface elevation,  
 $z$  = Marsh plain elevation,  
 $C$  = Suspended sediment concentration,  
 $t$  = Time,  
 $V_s$  = Settling velocity, and  
 $C_o$  = Ambient suspended sediment concentration of flood laden waters.

**The settling velocity for suspended particles has this relationship:**

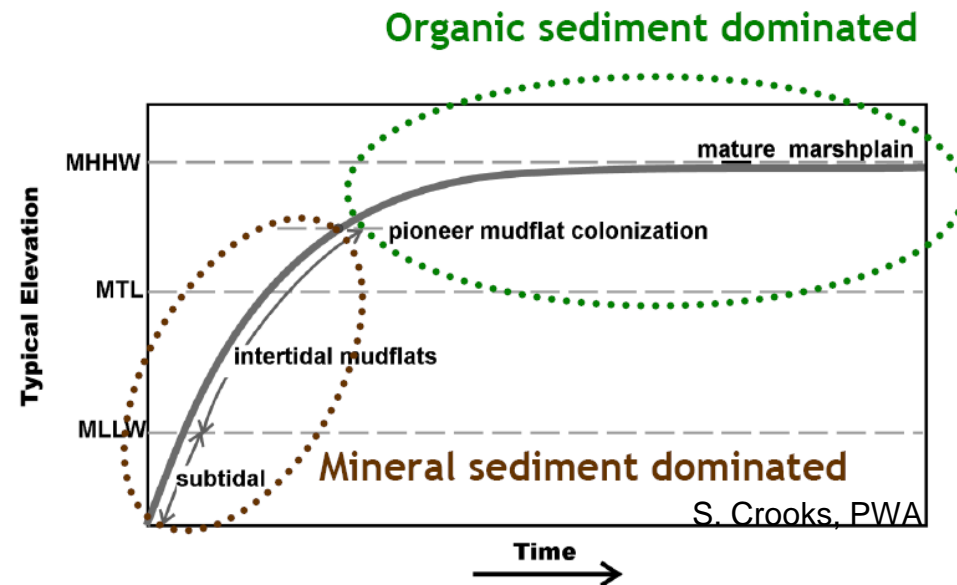
$$V_s = KC^{4/3}$$

$V_s$  = Settling velocity,  
 $K$  = A constant (0.00011 when units are S.I. Metric), and  
 $C$  = Suspended sediment concentration.

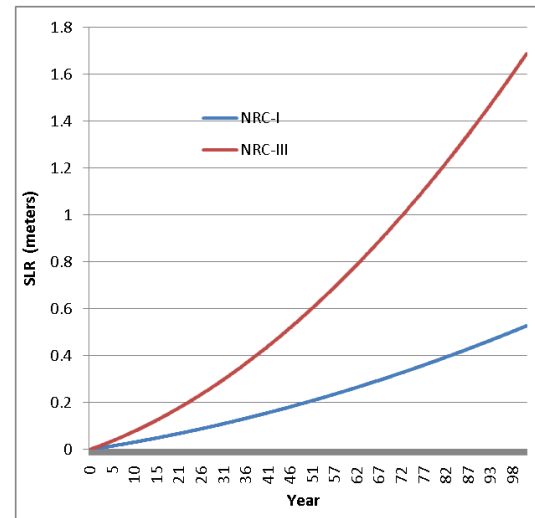
**Accumulation of material on the bed is determined by:**

$$\Delta z = \text{Change in bed elevation,} \quad \Delta z = \frac{\int_t V_s C dt}{C_d}$$

$V_s$  = Settling velocity,  
 $C$  = Suspended sediment concentration, and  
 $C_d$  = Dry density of inorganic material in the deposit.



From National Research Council, adopted by ACOE



### Weaknesses of the model

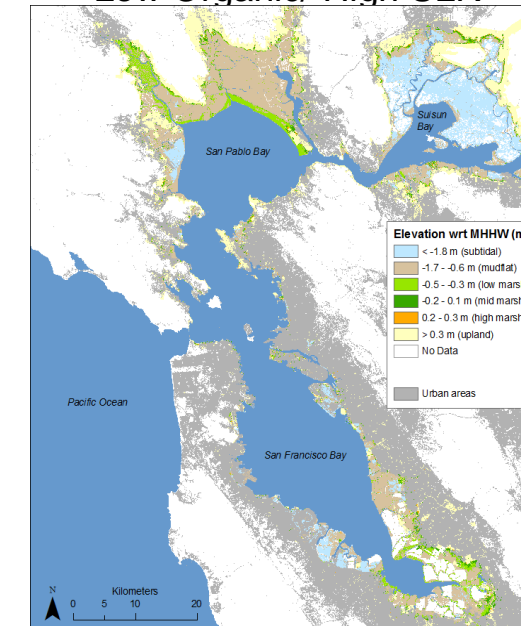
One dimensional, no sediment transport, erosion scouring underestimated, sediment accumulation from extreme tides underestimated

### Strengths of the Model

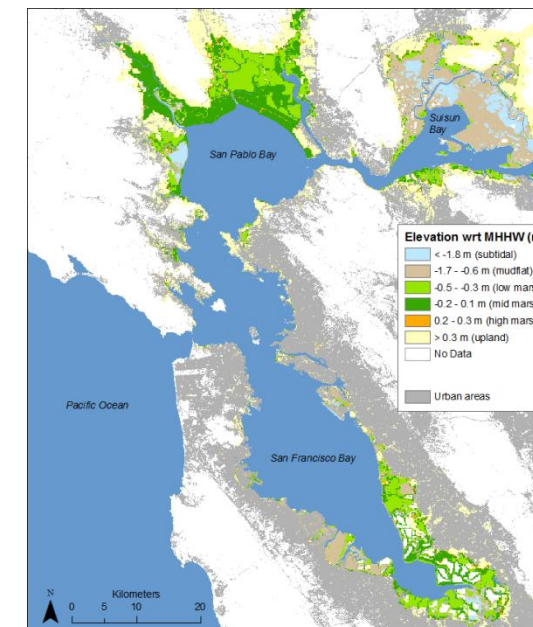
Applied throughout the San Francisco Estuary and accurately reproduces observed accretion. Computationally efficient.

### Where has the model been applied?

Year 2110: Low sediment/ Low Organic/ High SLR

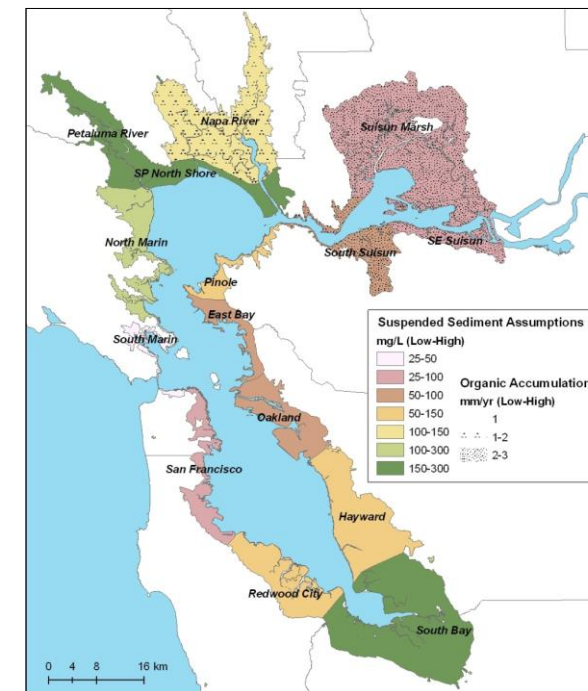


Year 2110: Low sediment/ Low Organic/LowSLR



### Sensitivity analysis

ESA PWA and PRBO have applied the MARSH 98 model throughout the San Francisco Bay estuary using different scenarios for sea-level rise, suspended sediment concentrations and organic accumulation rates.



### Decision support tool

Results are available as a mapping tool and data will be soon be made available for download at: [www.prbo.org/sfbayslr](http://www.prbo.org/sfbayslr)

### References

Krone, R. B. A method for simulating historic marsh elevations. *Coastal Sediments '87. Proceedings of the Specialty Conference on Quantitative Approaches to Coastal Sediment Processes. New Orleans, LA May 12- 14. 1987. 316-323*