Modeling marsh habitat response to SLR in San Francisco Bay using Wetland Accretion Rate Model of Ecosystem Resilience, WARMER

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Technical note

To facilitate habitat comparisons across sites with differing absolute elevations and tidal ranges the dimensionless elevation, z* is used to evaluate model results.

$$z^* = \frac{Elevation-MSL}{MHHW-MSL}$$
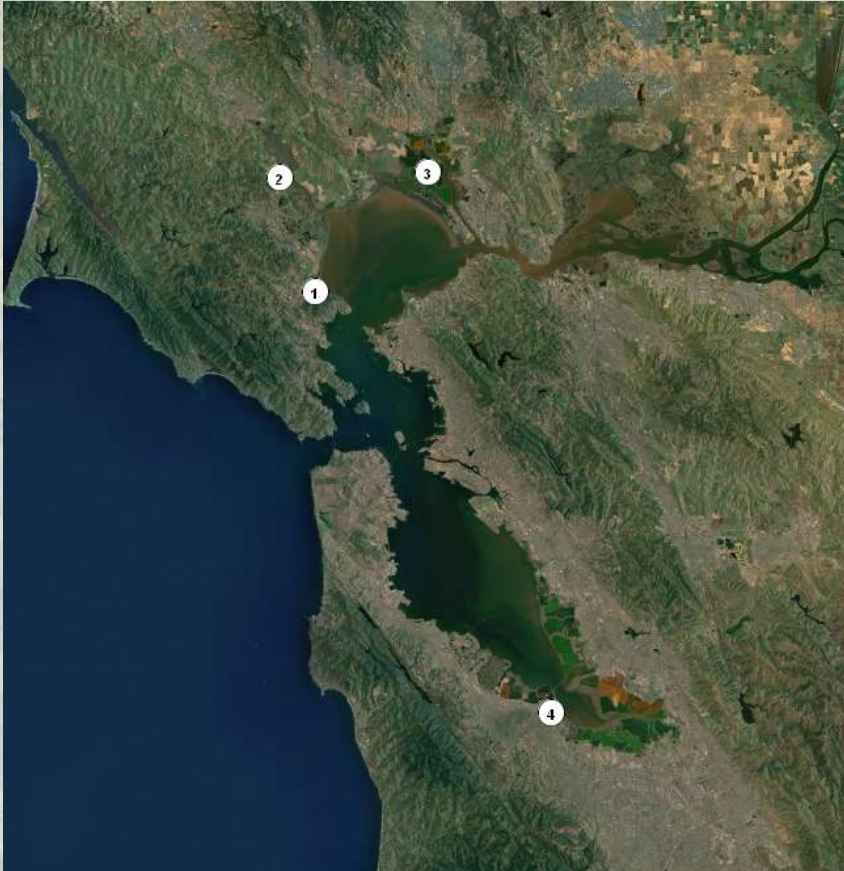
WARMER

Conceptual Model

Relative sea-level rise

Above ground productivity

Sediment input

Root Growth

Compaction

Decay

Cohort based model with an annual timestep

- Adaptation of marsh accretion model developed by Callaway et al. (1996)

- Cohort based 1-D accretion model

- Fortran 77

WARMER –Model adaptations
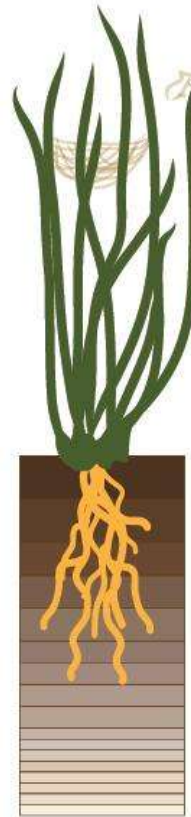

Conceptual Model

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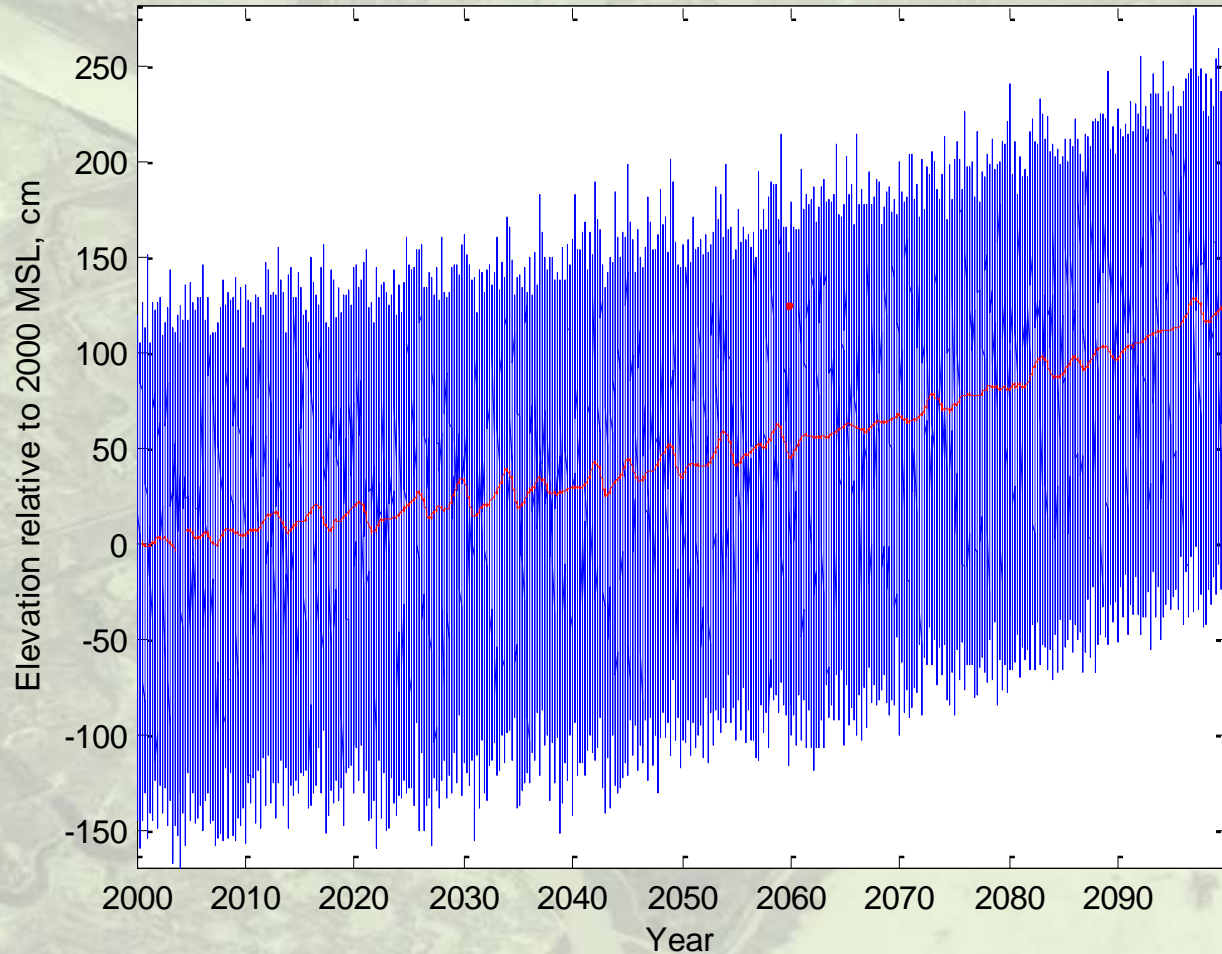
Compaction

Decay

Cohort based model with an annual timestep

- SLR defined as temporally variable
- Productivity a function of elevation
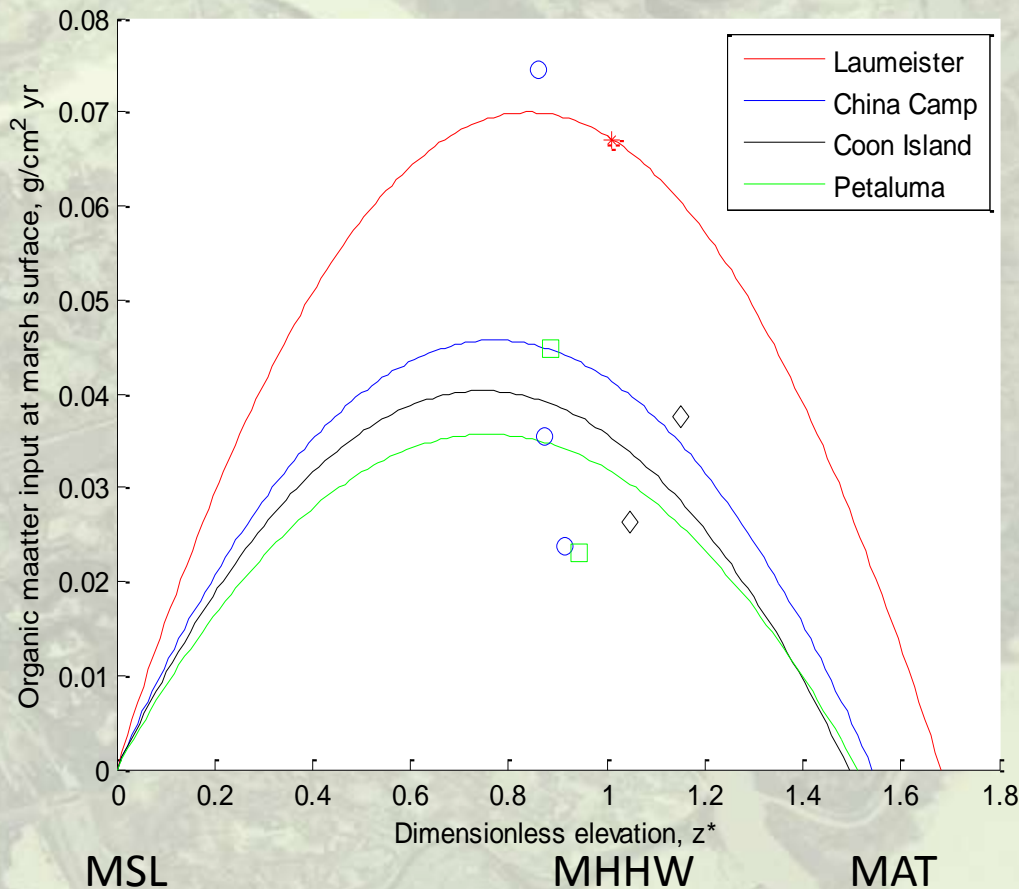- Sediment input calculation from water level, SSC, and sediment core data

WARMER –Model adaptations

SLR defined as temporally variable

WARMER –Model adaptation

Productivity function updated based on Morris et al. (2002) and vegetation characteristics of SF Bay

- Parabola defined from MSL-MAT
- Calibrated to organic matter accumulation in mars cores
- Split between above and below ground inputs by shoot:root ratio for pickleweed from literature

WARMER –Model adaptation

Mass deposition rate calculated from SSC and water level time series
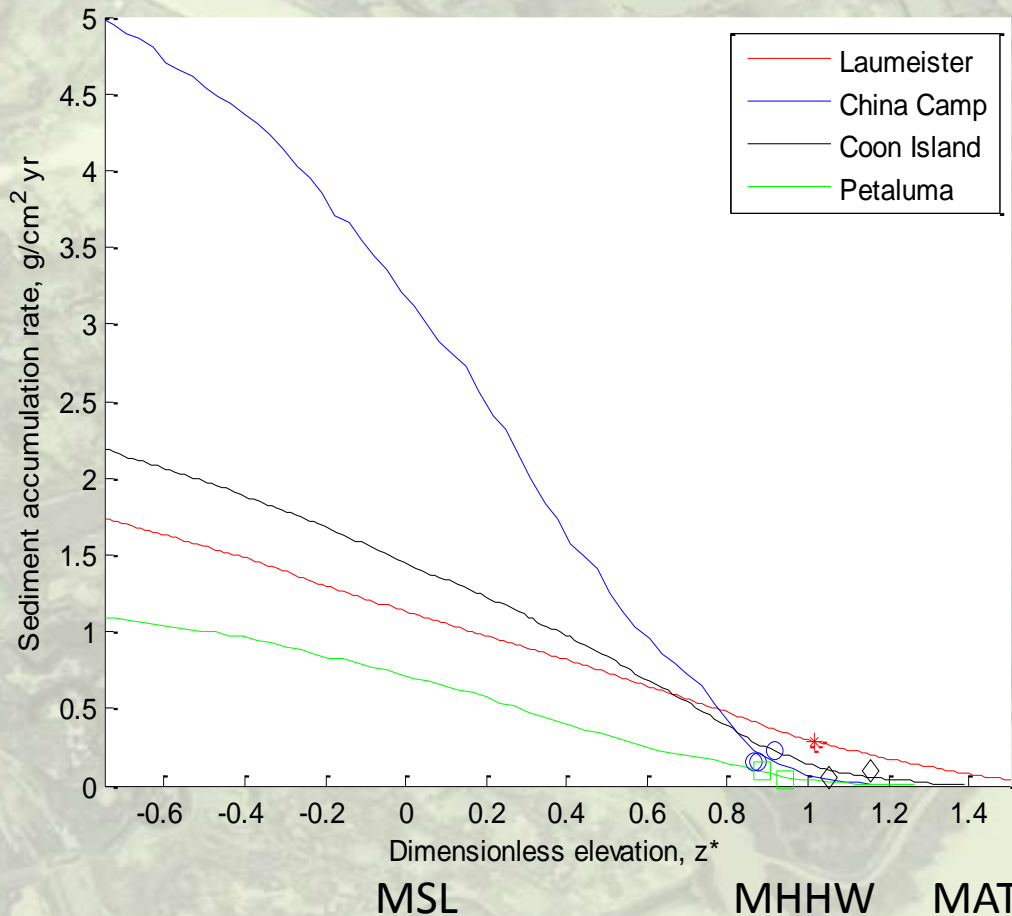
- Temporally variable SSC and mixed tides
- Assumes a constant settling velocity
- Settling velocity calibrated to match 210Pb calculated sediment accumulation rate

Other Parameters

- Compaction is modeled as the rate of decrease in porosity of a given cohort is a function of the density of all of the material above that cohort, and is a calibration constant.

- Decay decreases exponentially with depth and decreases with age for organic matter 1,2 and 3 years or older.
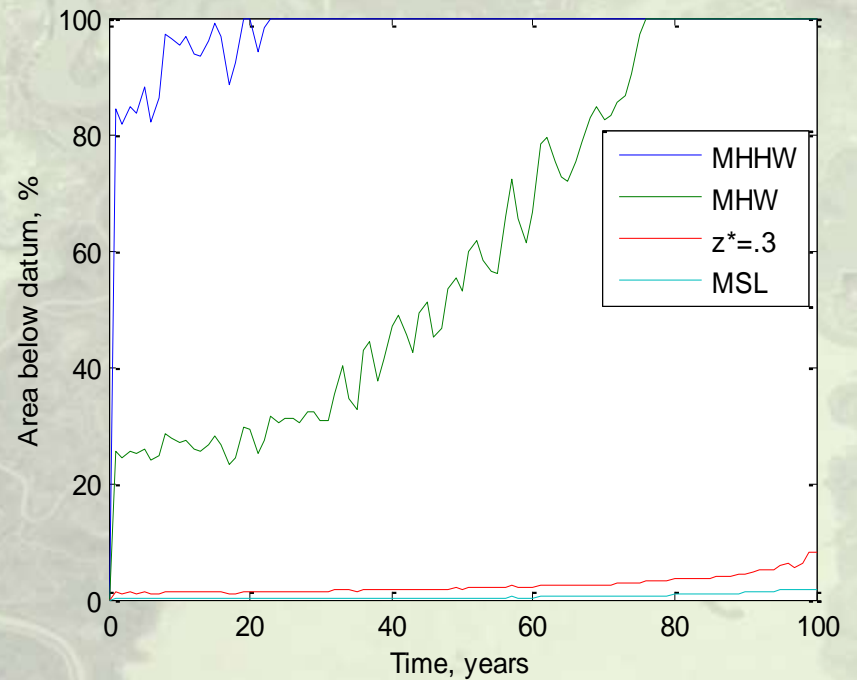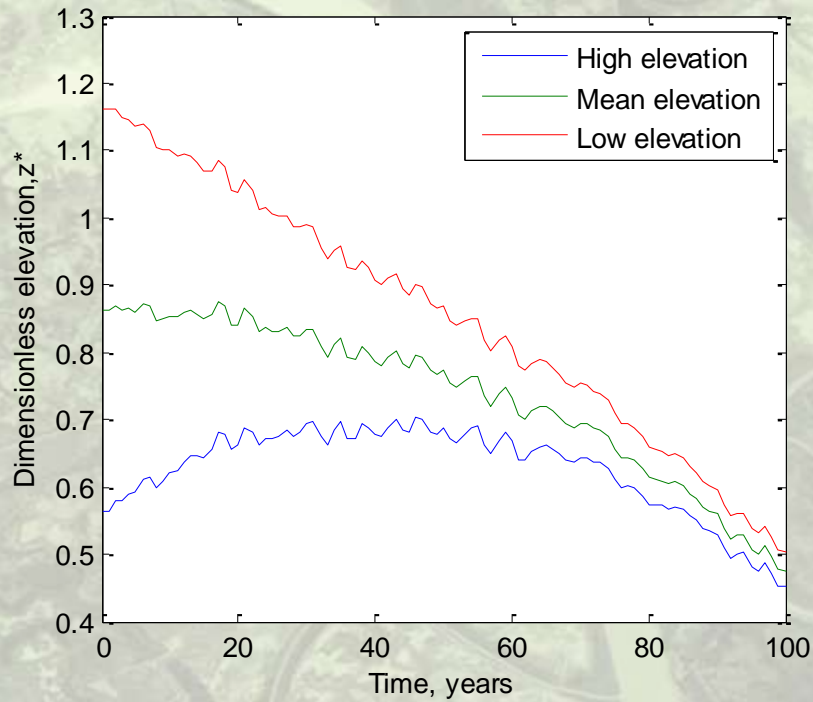
Other Parameters

- Porosity – measured in top 5 cm and bottom 5 cm of each core

- Elevation - DEM of each site developed using RTK-GPS

- Vegetation information – survey % cover and height be species at each site
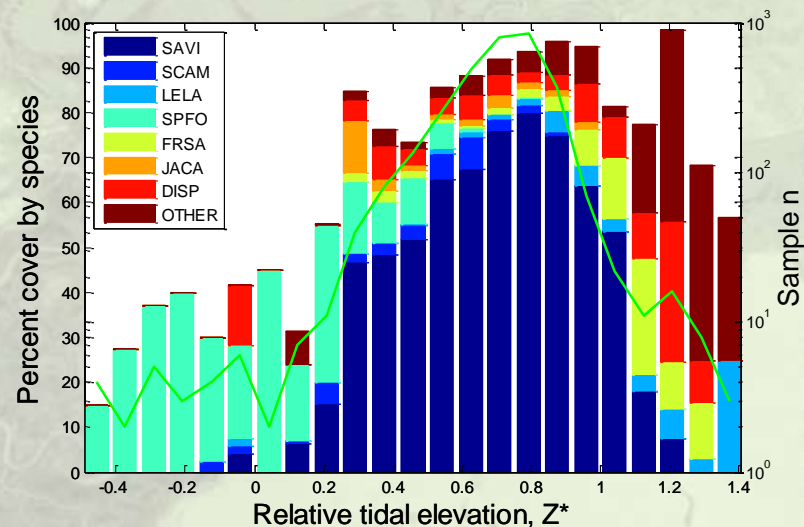
Model Evaluation

Elevation projections and comparison to key habitat metrics

Model Strengths

- Model can be used to identify the time scales of response to SLR when making long-term management decisions
- Flexibility for temporal and elevation dependent input functions
- Adaptation of organic matter input function for SF Bay marshes
- Runs 100 years in less than 1 minute
- Can be used to evaluate response of individual marshes based on site specific forcings
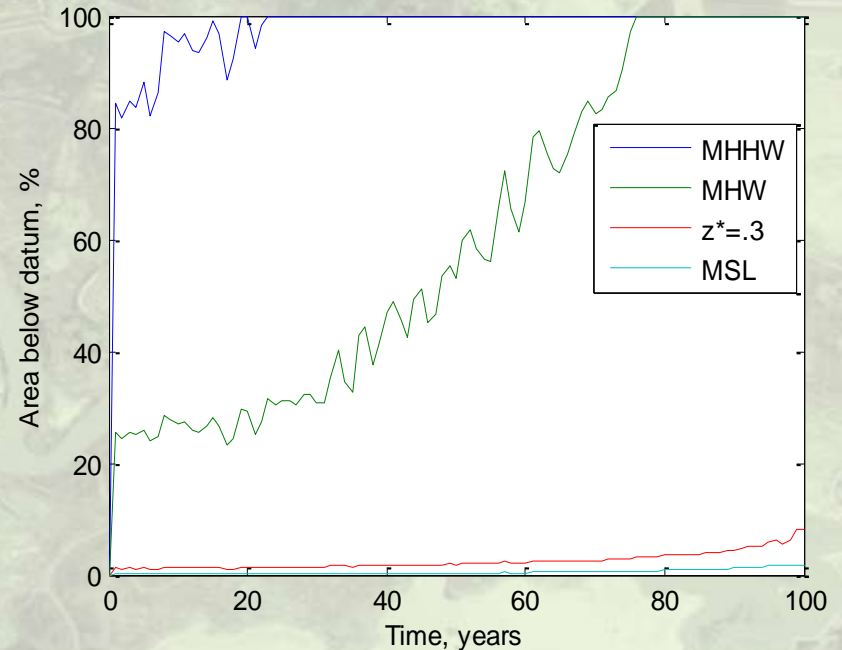
Room for improvement

- Better parameterization of spatial and elevation dependent sediment accumulation function
- Predictions of changes in sediment supply and tide range
- Compensation for increased storminess?
- Only applicable to current footprint of a marsh