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The State of the Art and Science of Coastal Engineering

Long-Term Settlement of the Caminada Headland Beach Nourishment and Dune Restoration in Coastal Louisiana

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Caminada Beach & Dune Restoration Project

Barrier Island Morphology

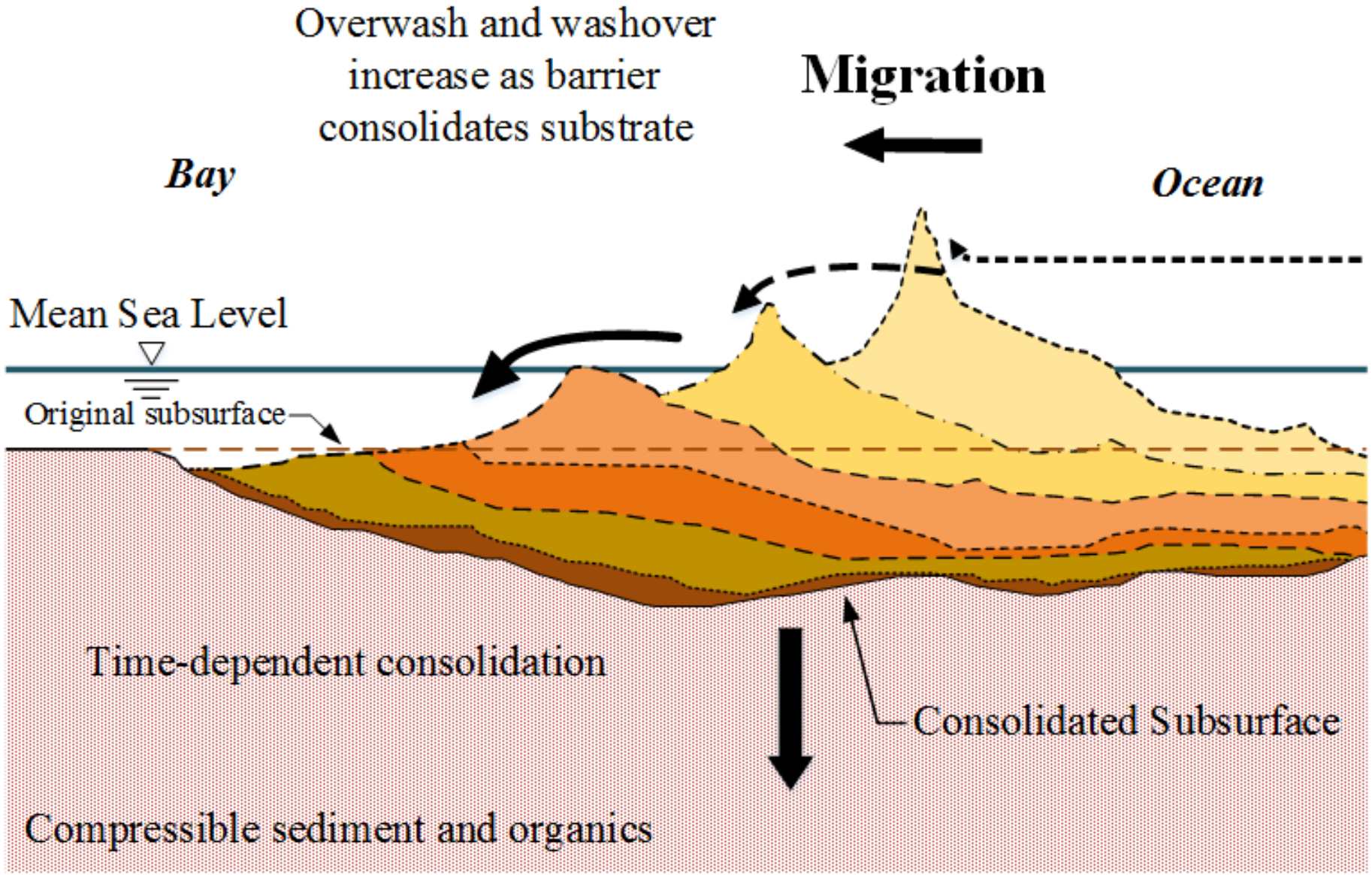
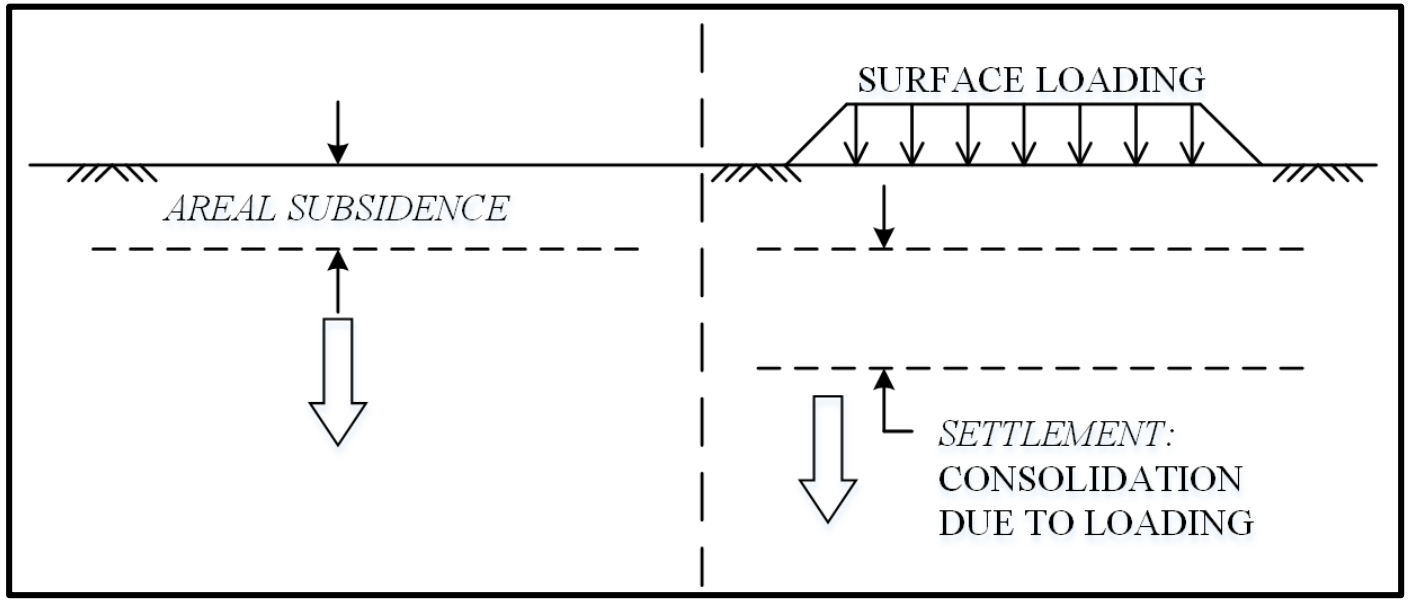
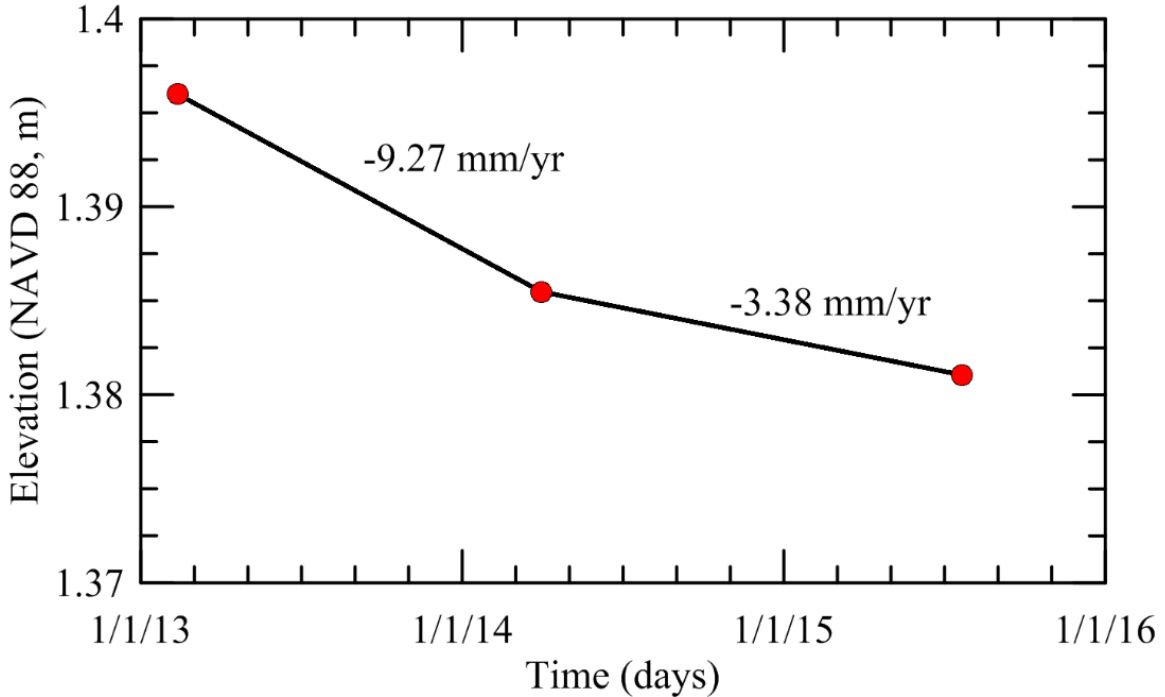


*Figure modified from Rosati (2009)

Areal Subsidence vs Consolidation





Settlement Theory

Terzaghi's Small Strain (SETTLE^{3D})

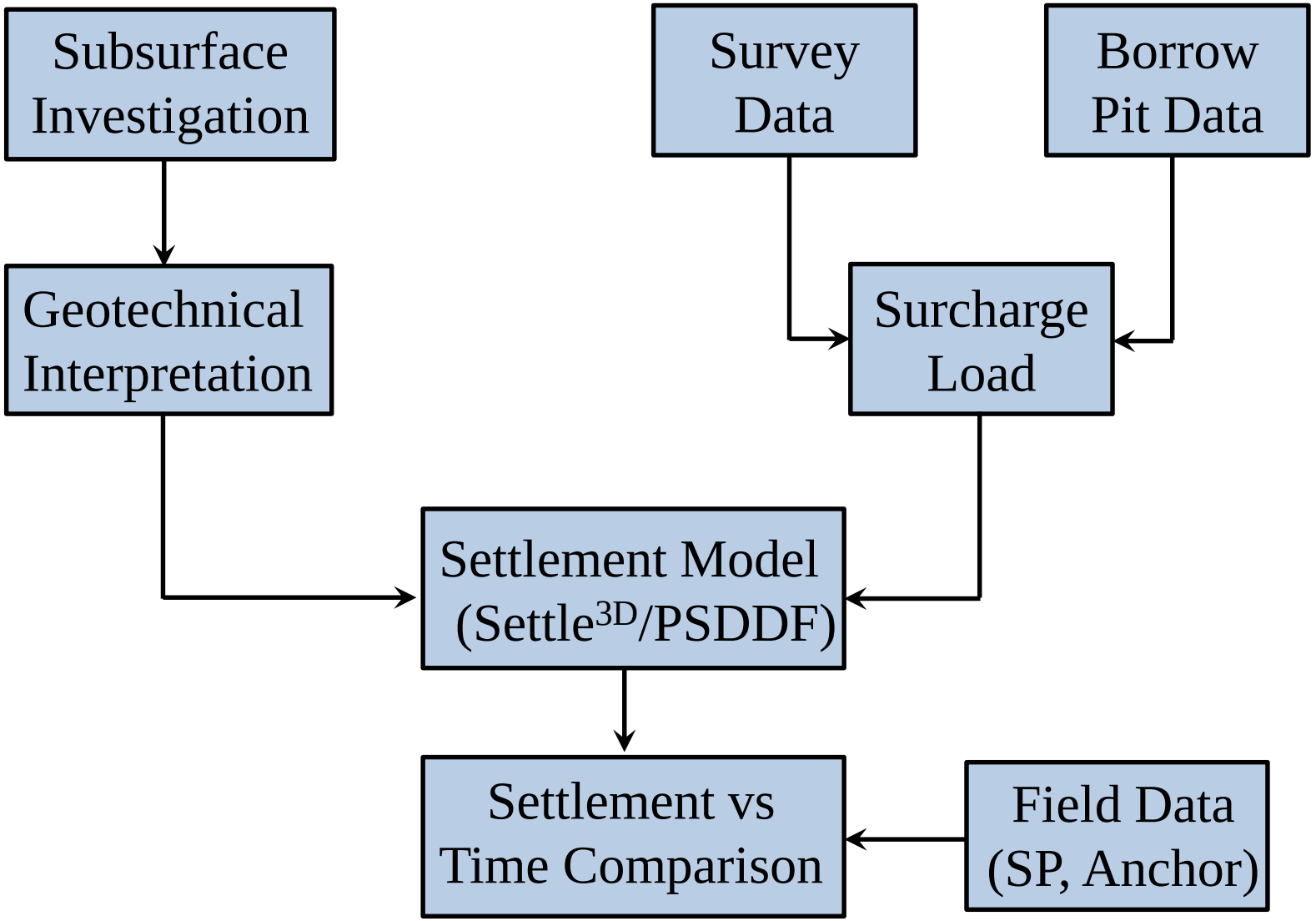
- Small strain physically means the thickness of the compressible layer is significantly greater than the magnitude of compression.
- Constant coefficient of compressibility ($a_v = \Delta e / \Delta \sigma'$).

Finite Strain (PSDDF)

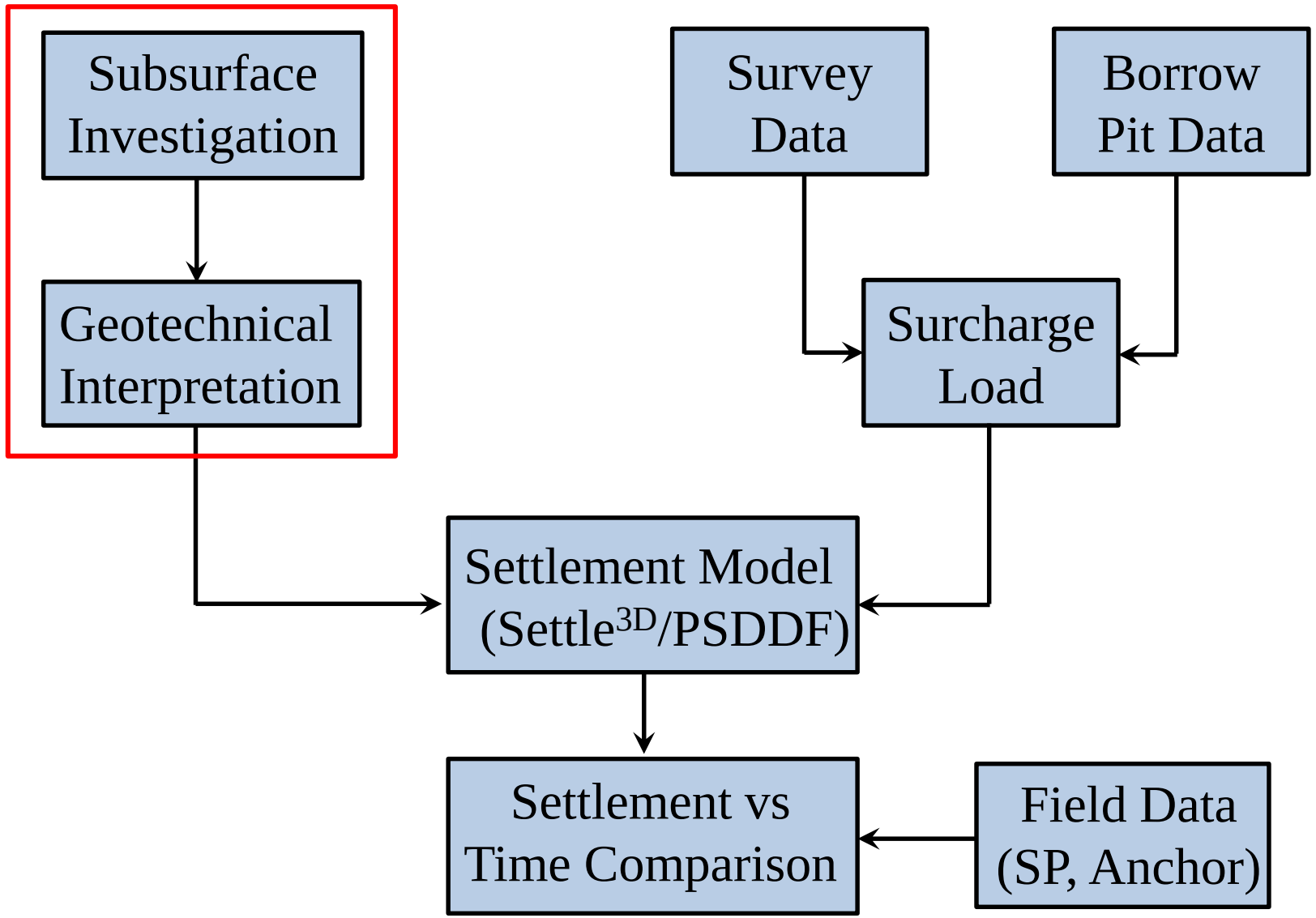
- Non-linear stress-strain relationships (a_v changes with effective stress).
- Large strains are predicted.

Goal: Develop calibrated 1-D model using SETTLE^{3D} and PSDDF based on field measurements and show applicability of both software (theories) in foundation settlement.

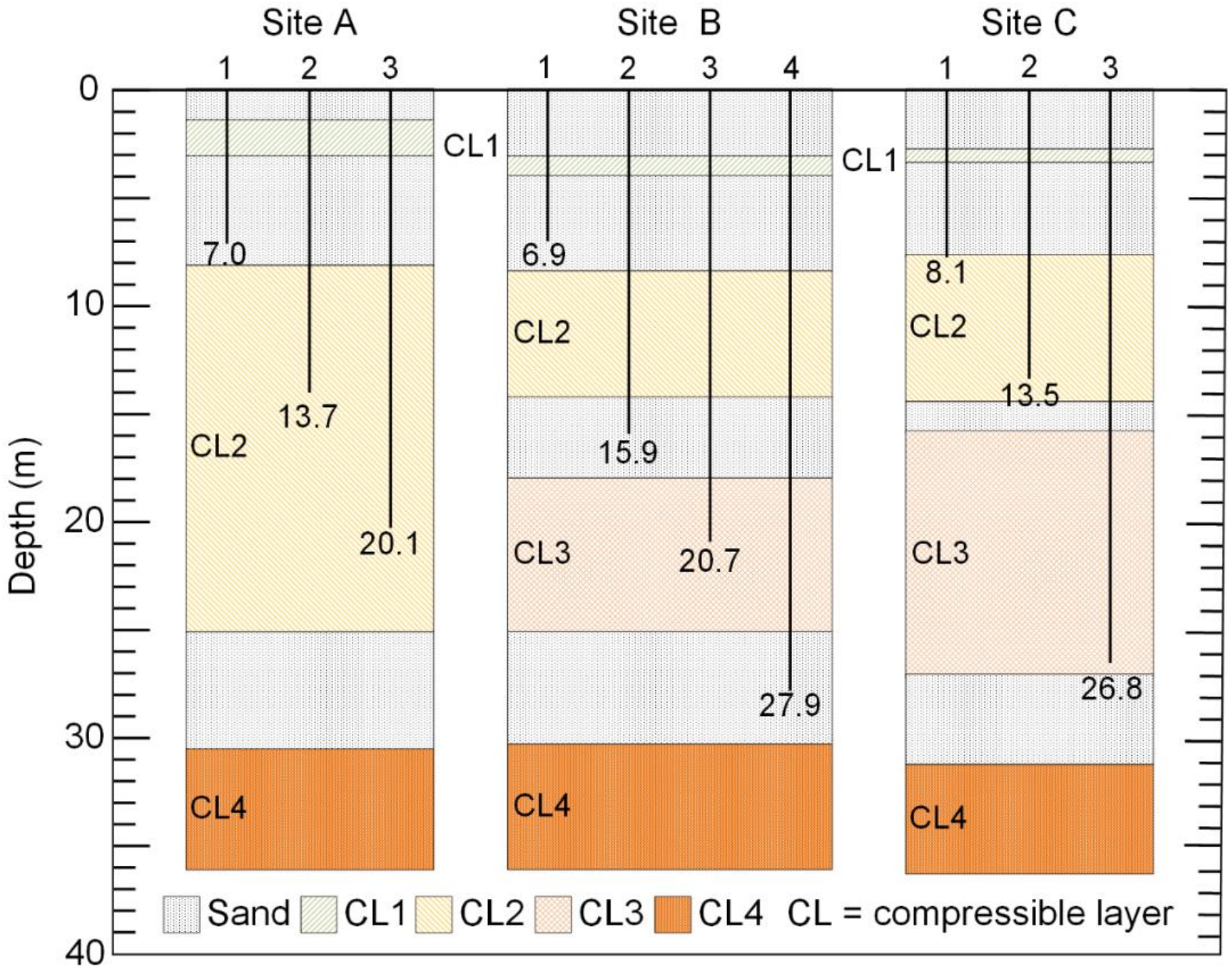
Analysis Methodology



Analysis Methodology

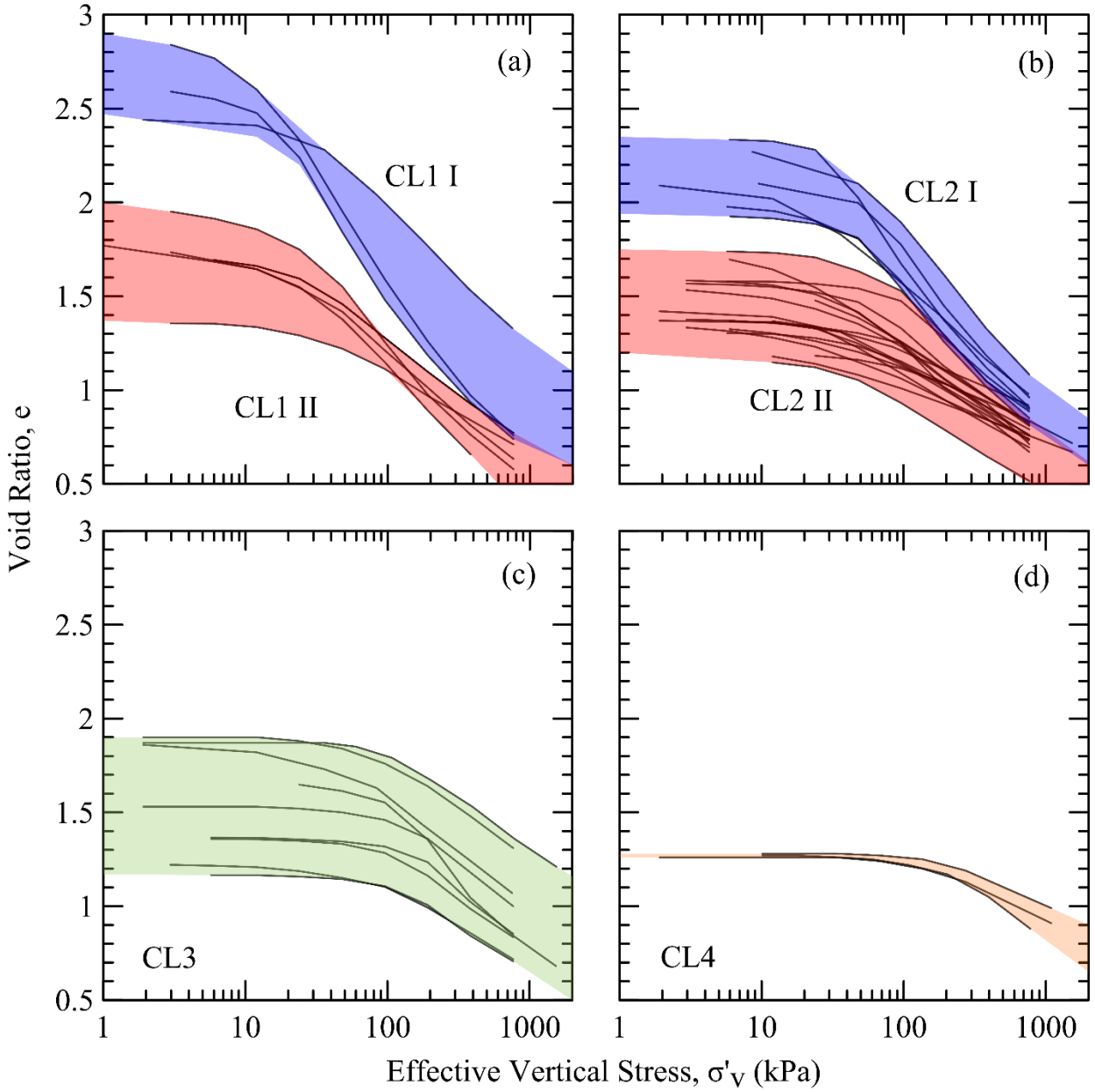


Soil Stratigraphy at Caminada Headlands

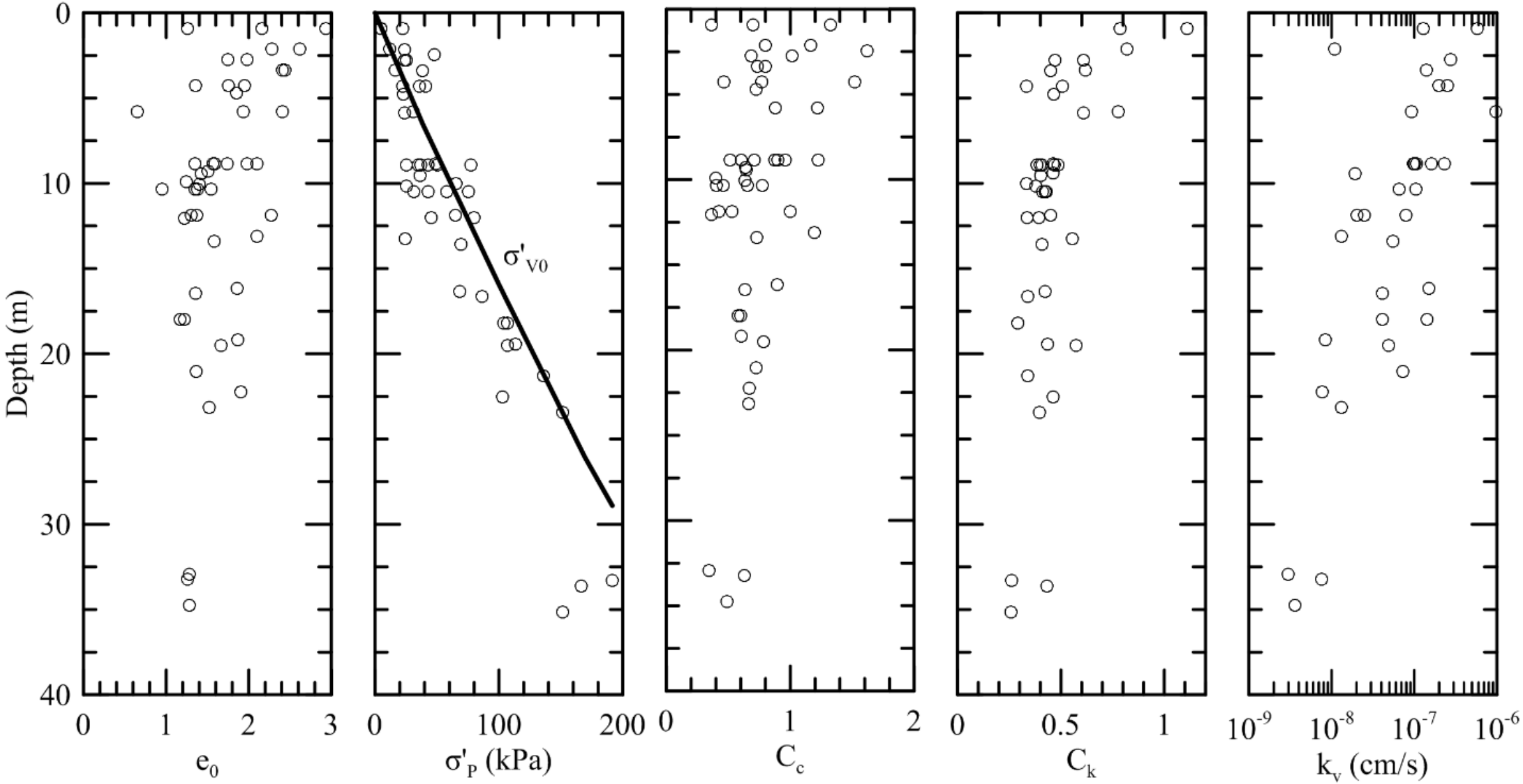


*Pleistocene depth from Heinrich et al. (2015)

Caminada Beach & Dune Restoration Project

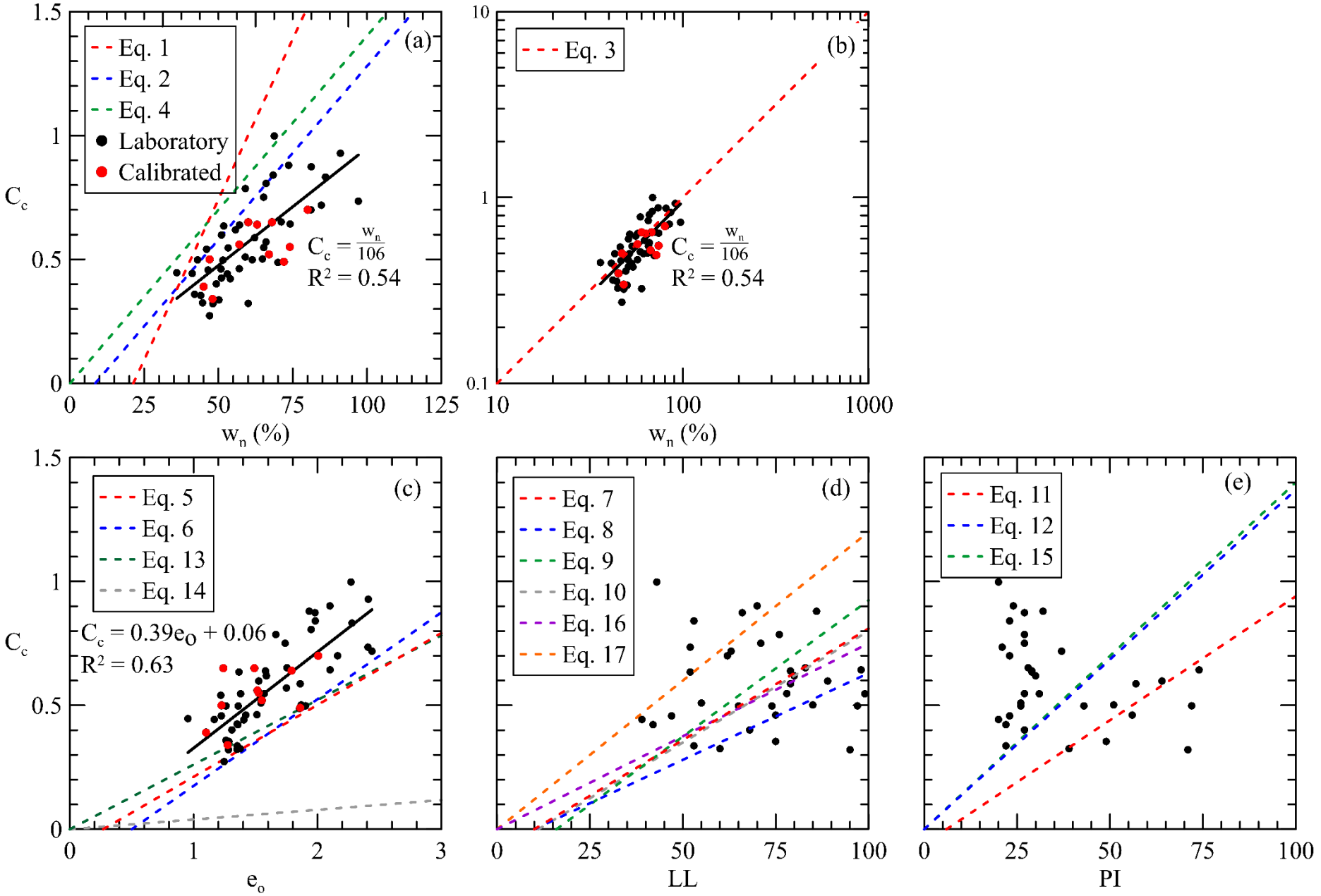


Sediment Layer Profiles

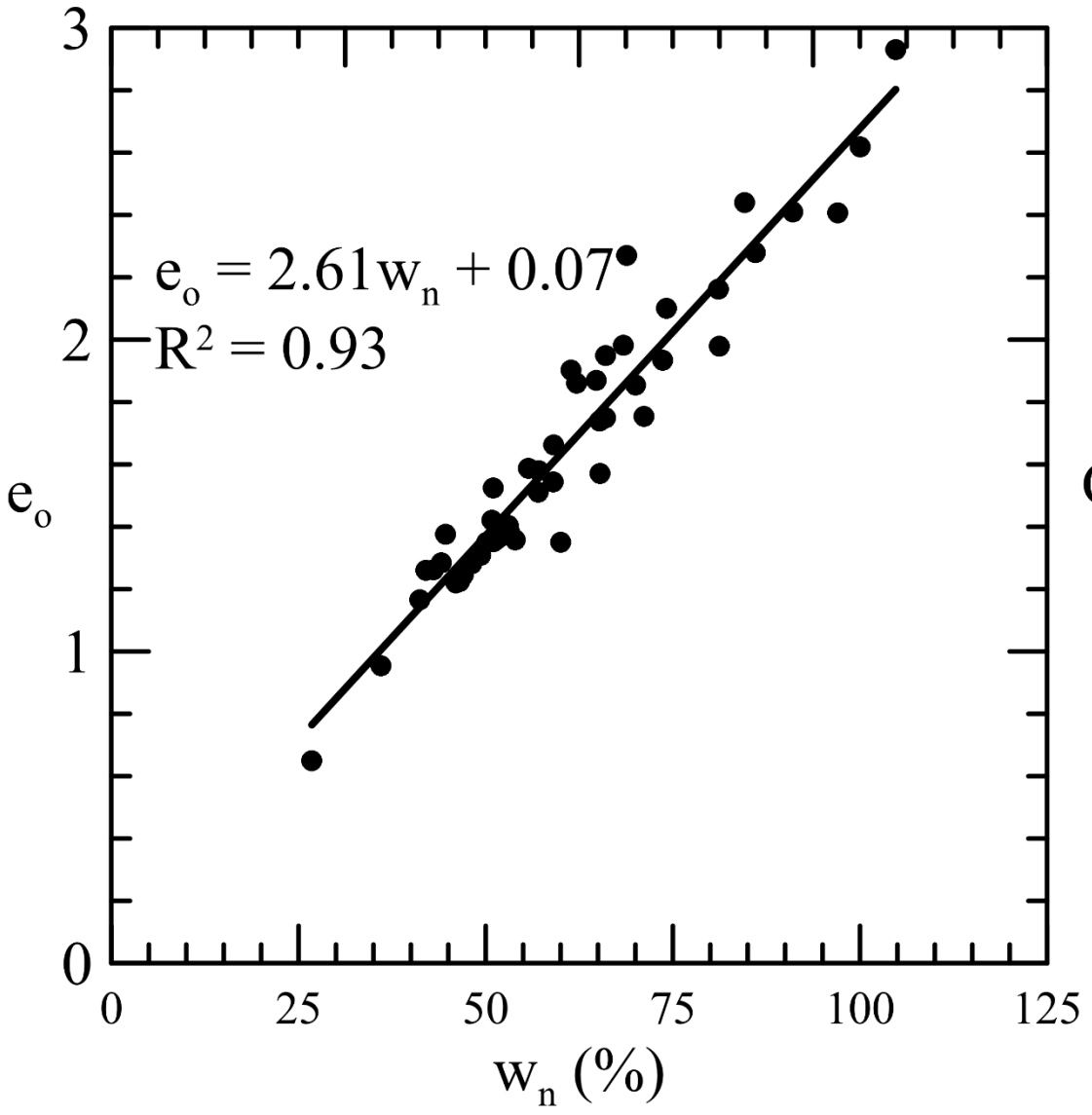


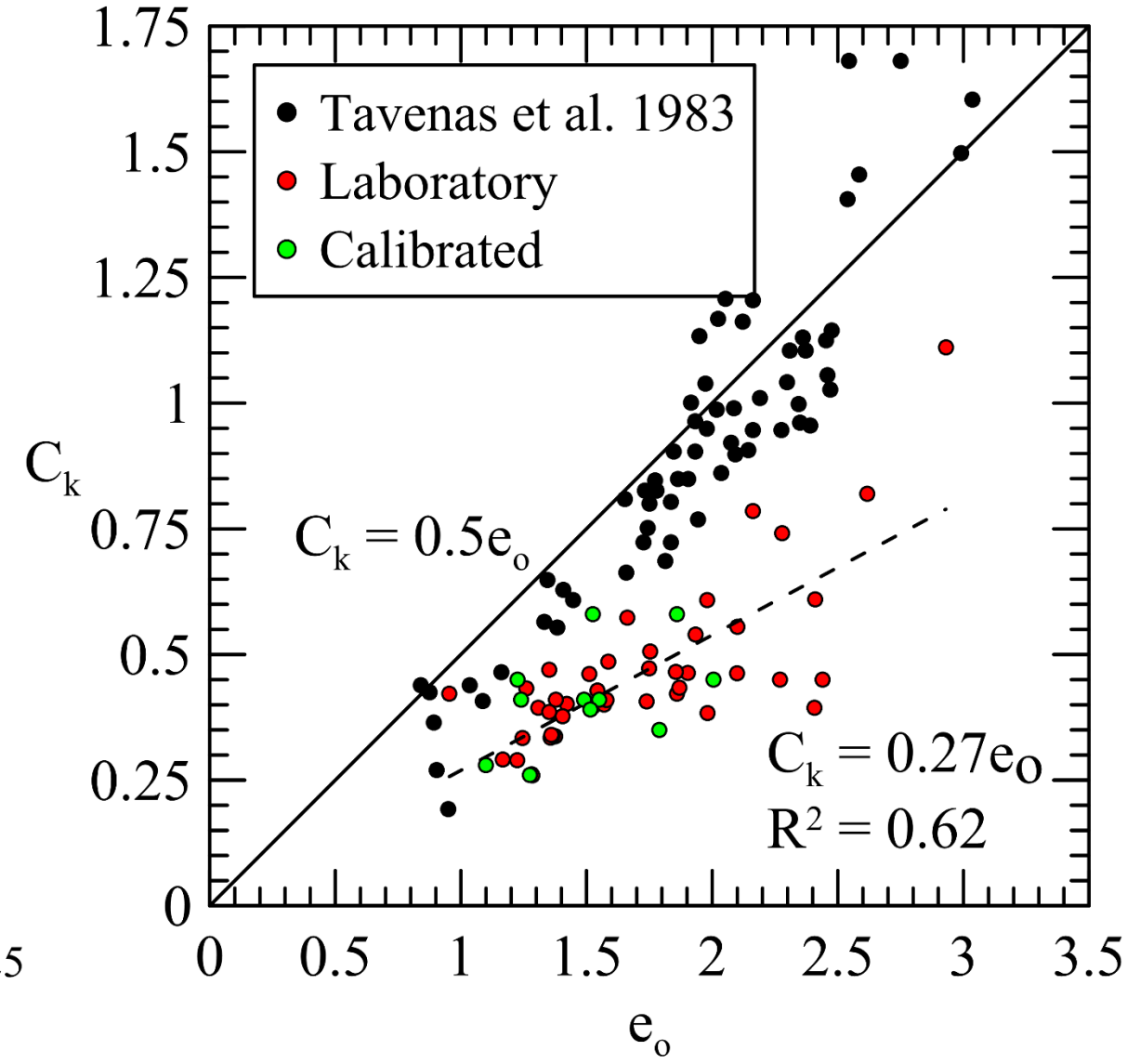
$$k_v = c_v m_v \gamma_w$$

Caminada Headlands Compressibility Correlations



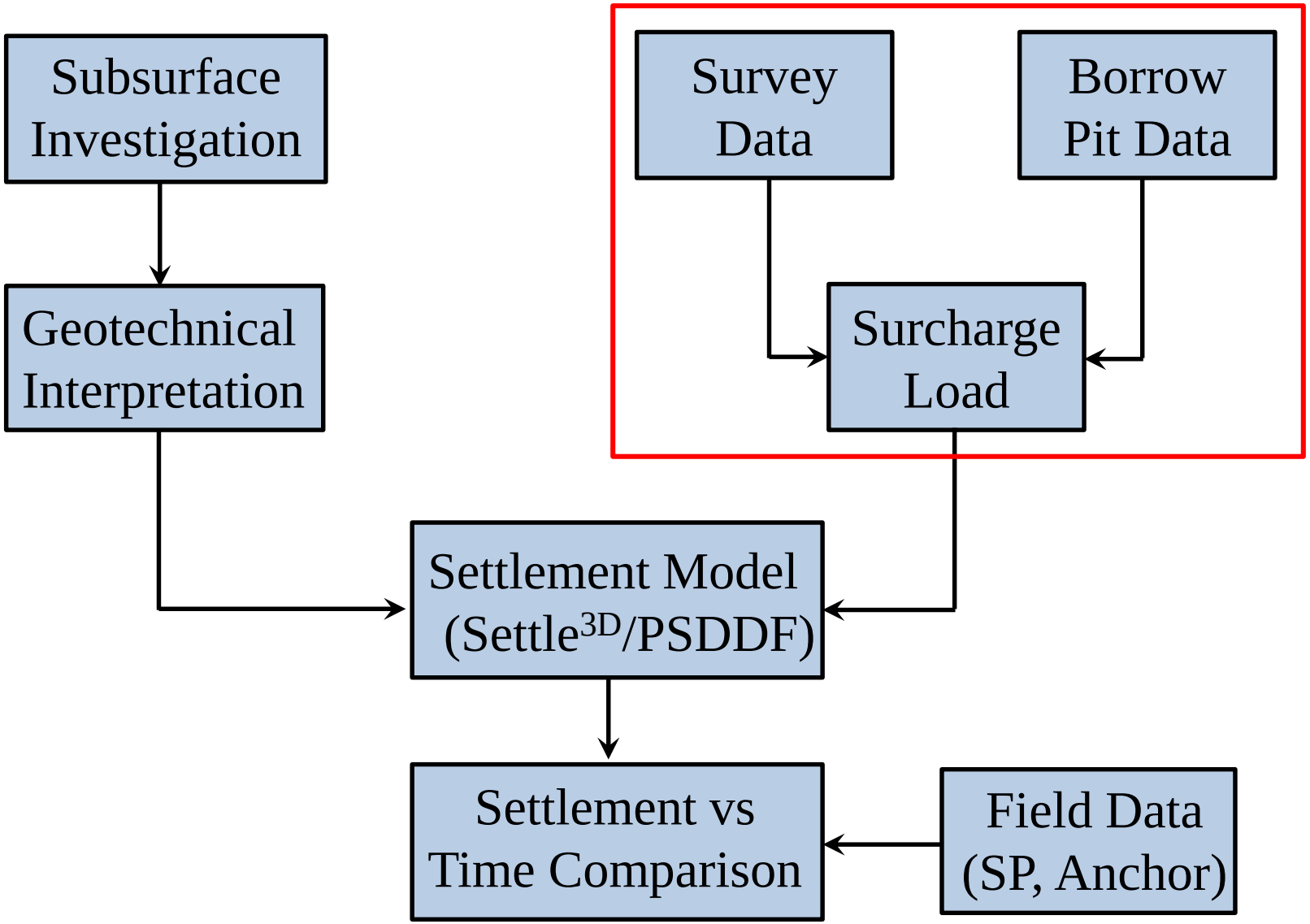
Caminada Headlands Compressibility Correlations



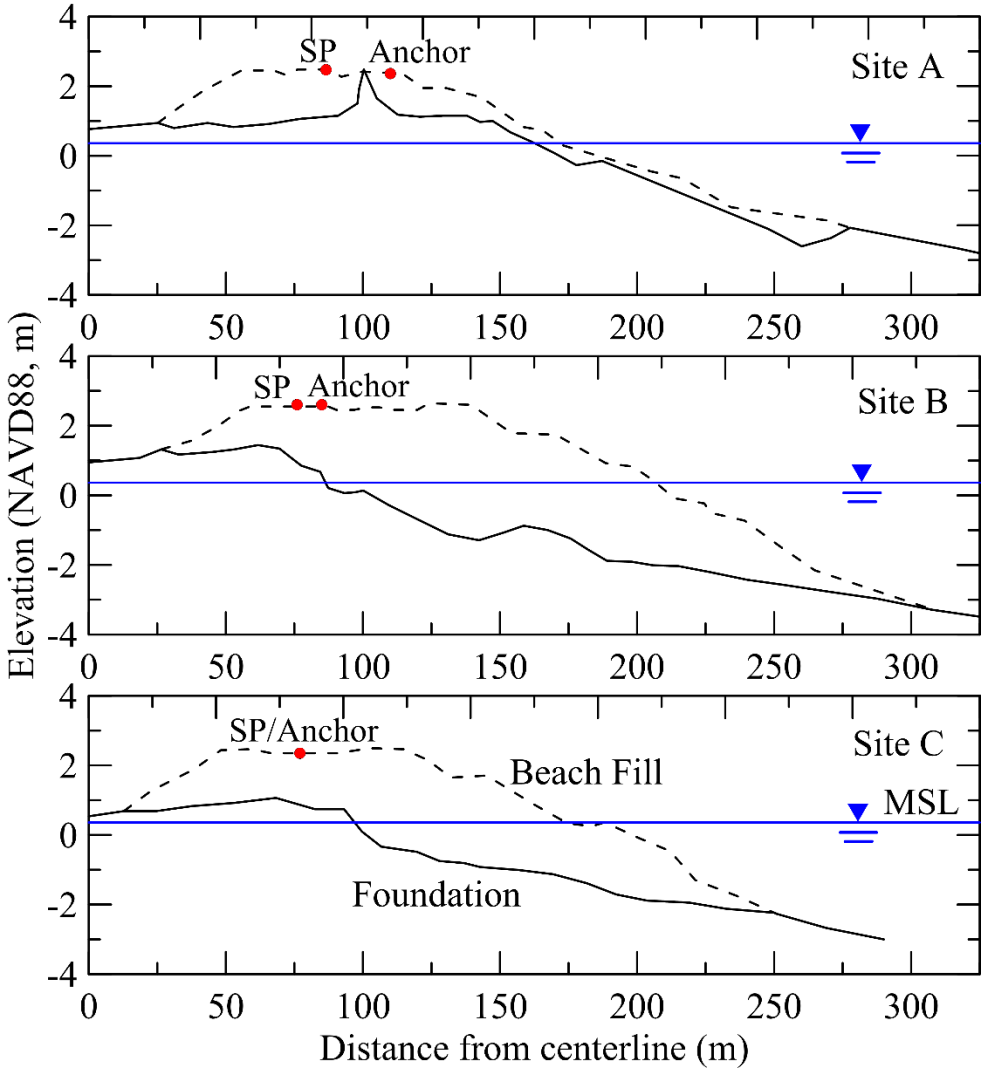


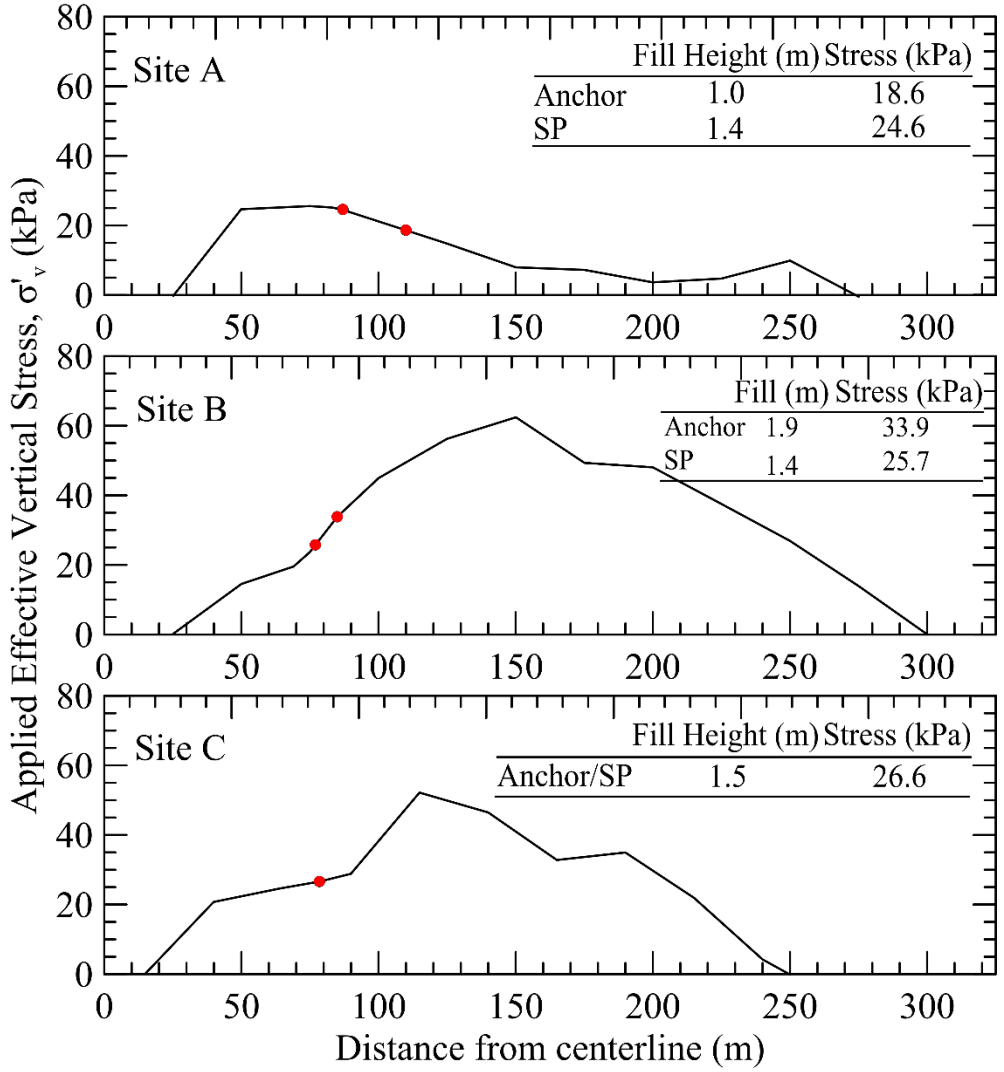
$$Se = wG_s$$

Analysis Methodology



Surcharge Stress Prediction

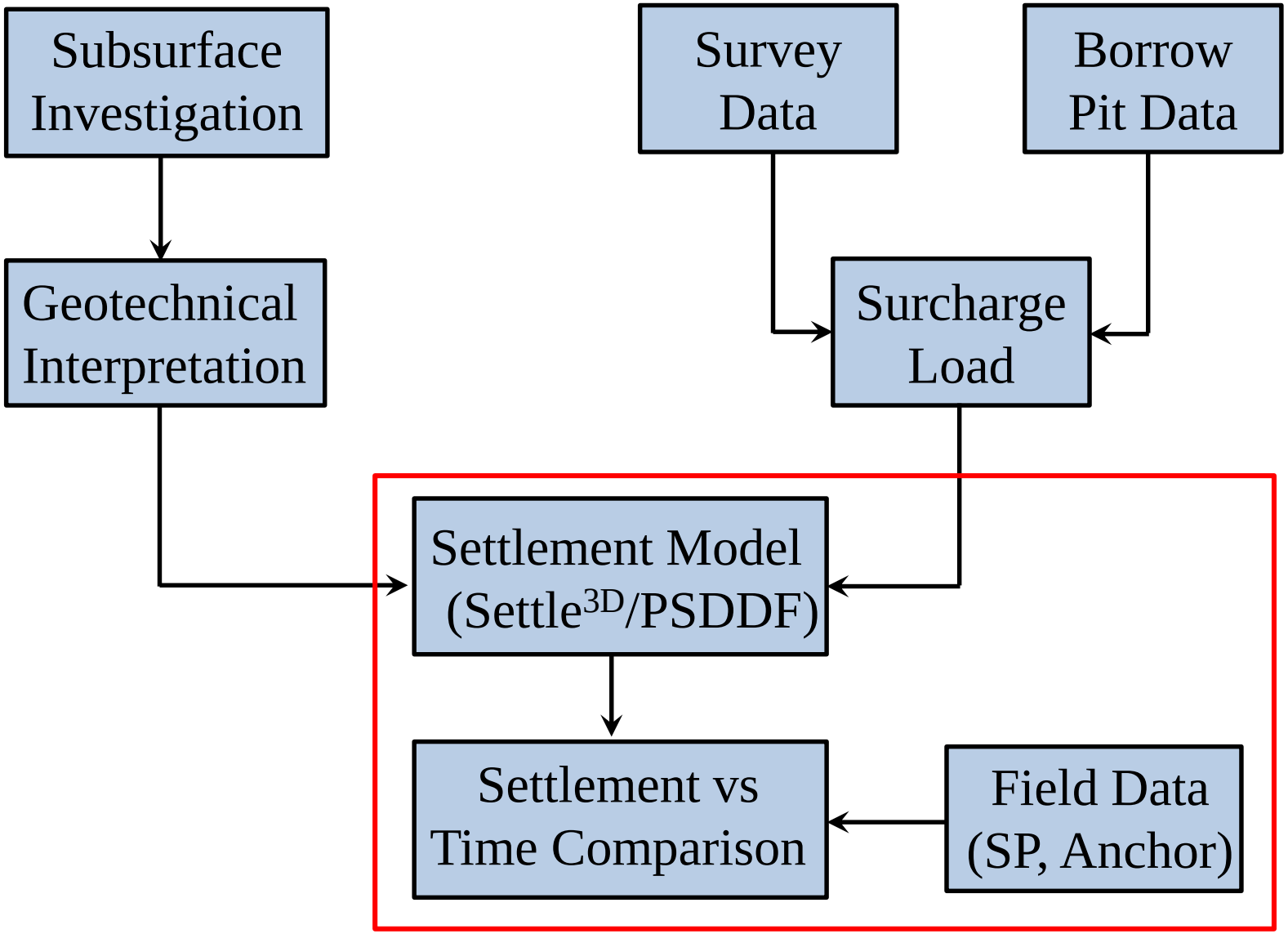




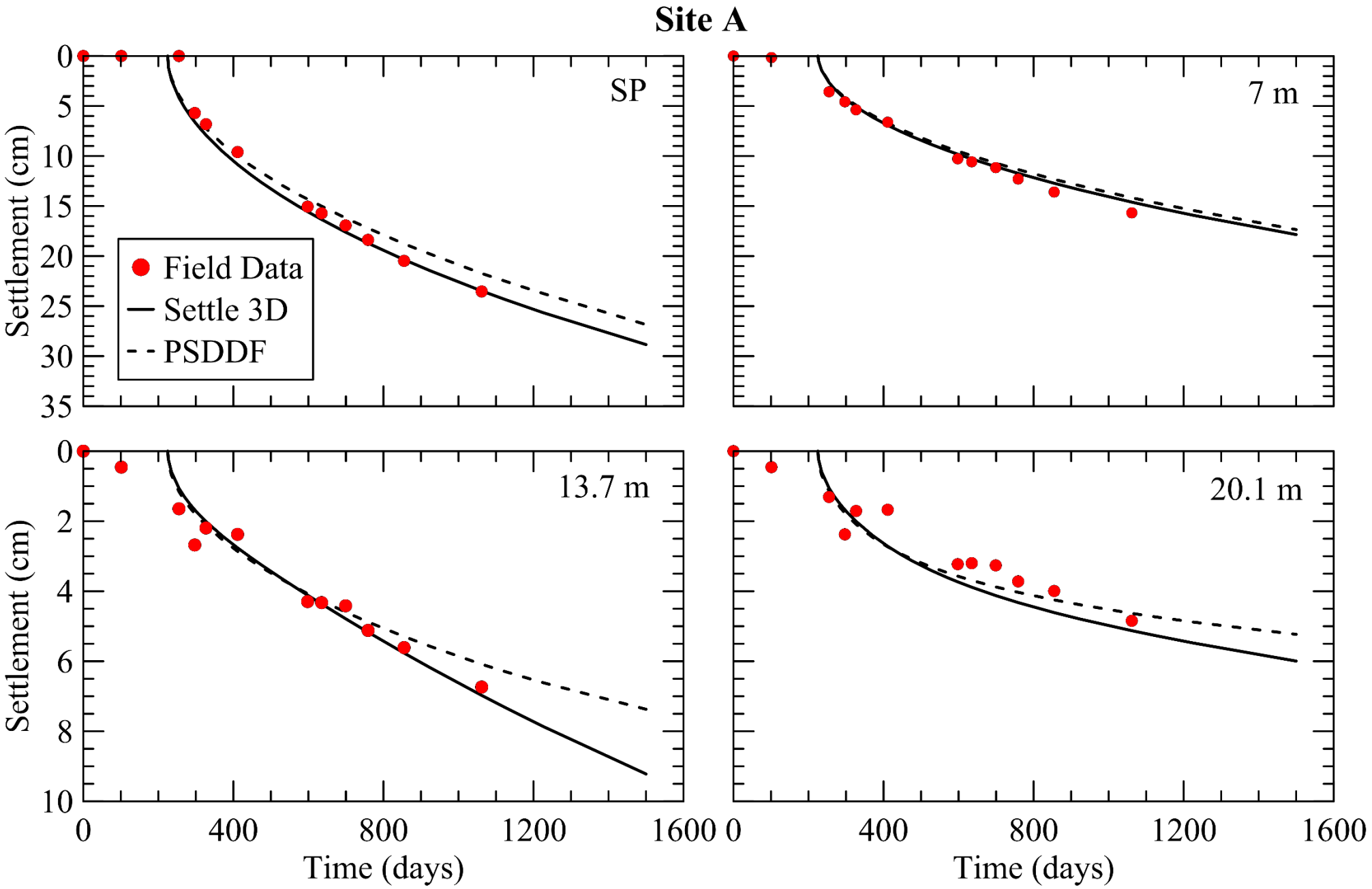
- Dredged sand moisture unit weight ~ 18.2 kN/m^3 based on particle size gradation (Cu=4.06 and Cc=1.95).

- Analysis showed minimal stress distribution occurred, i.e. near constant increase in applied stress with depth through entire substratum.

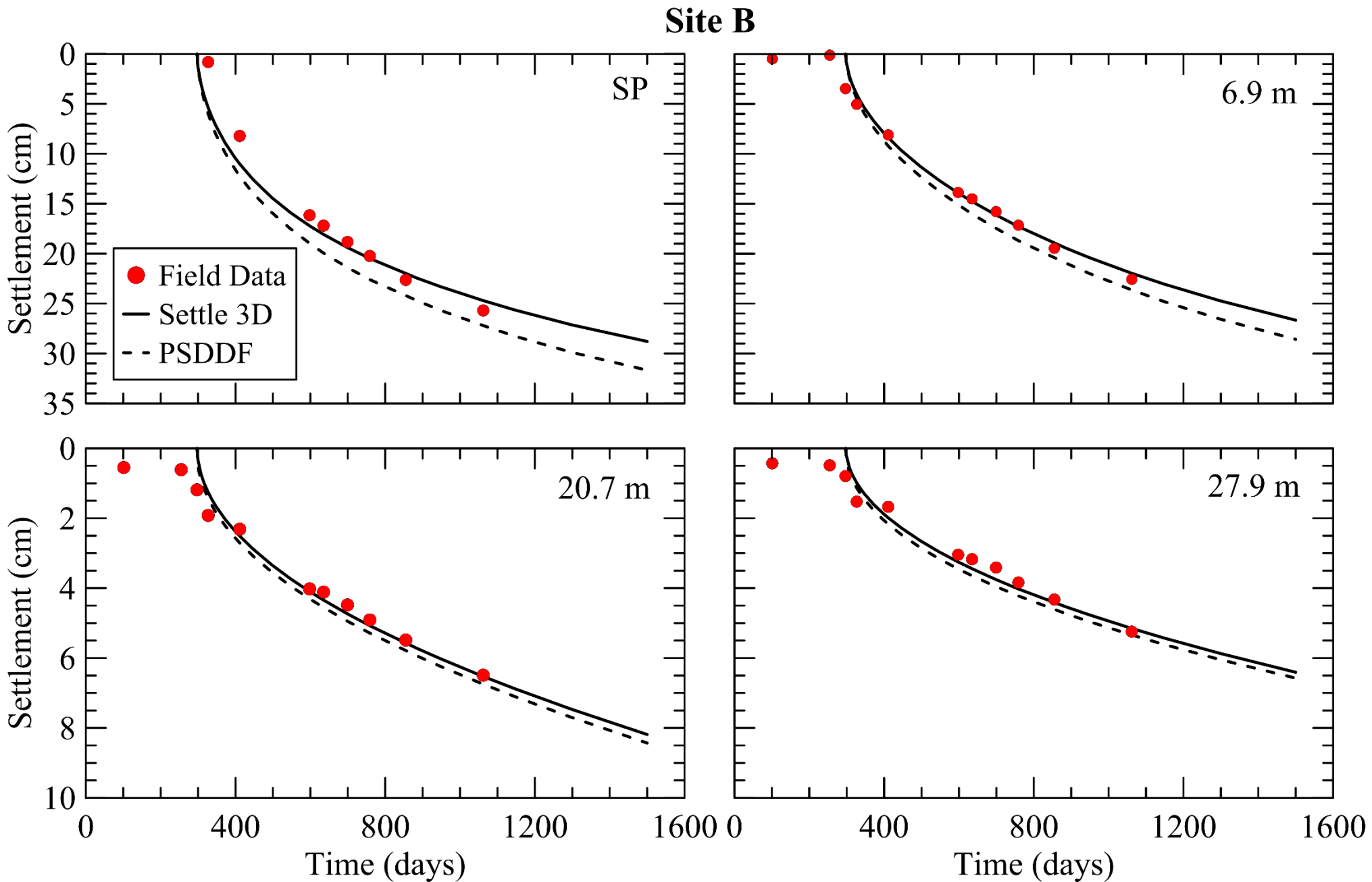
Analysis Methodology



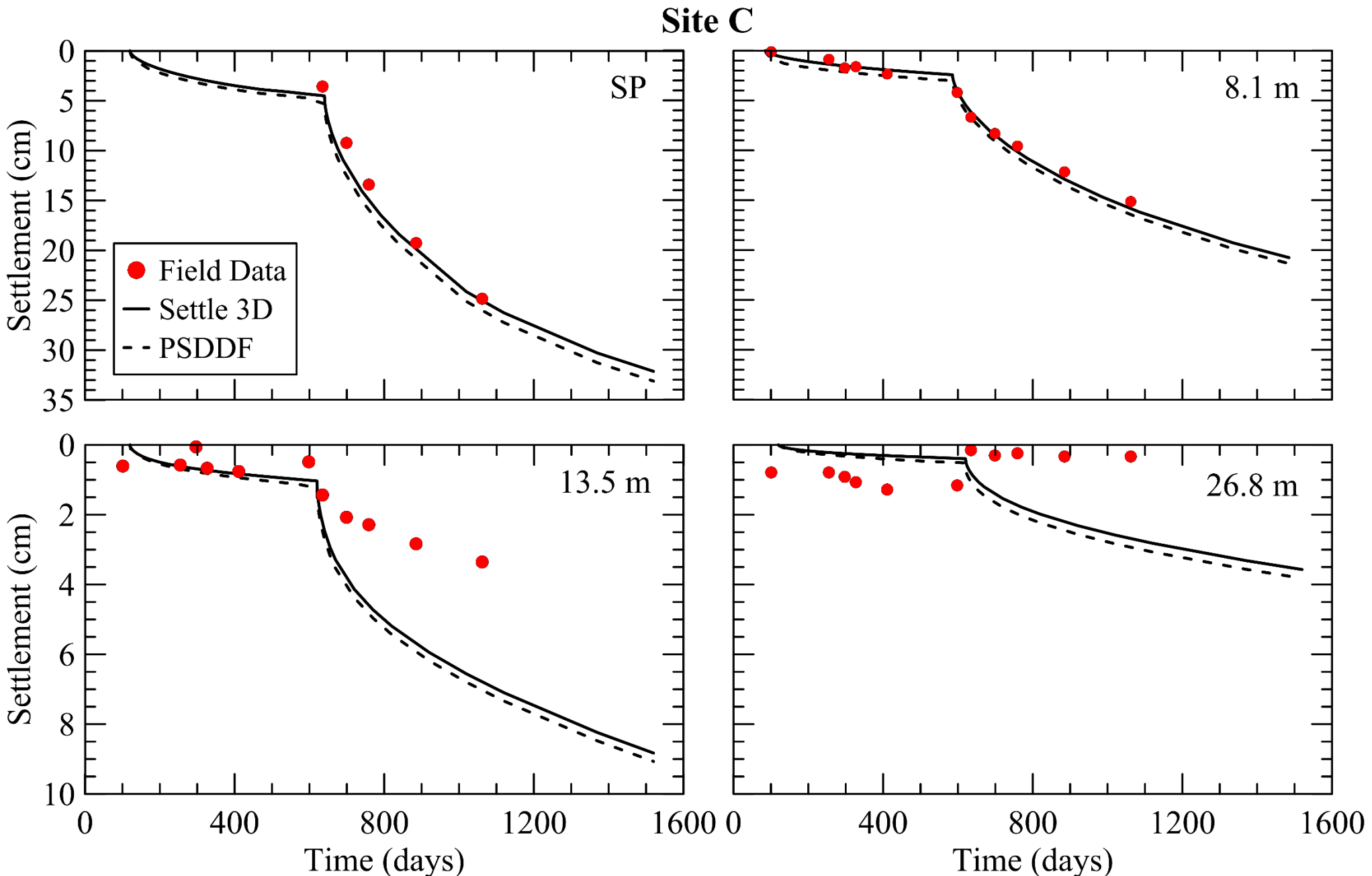
Settlement vs Time Relationships (Site A)



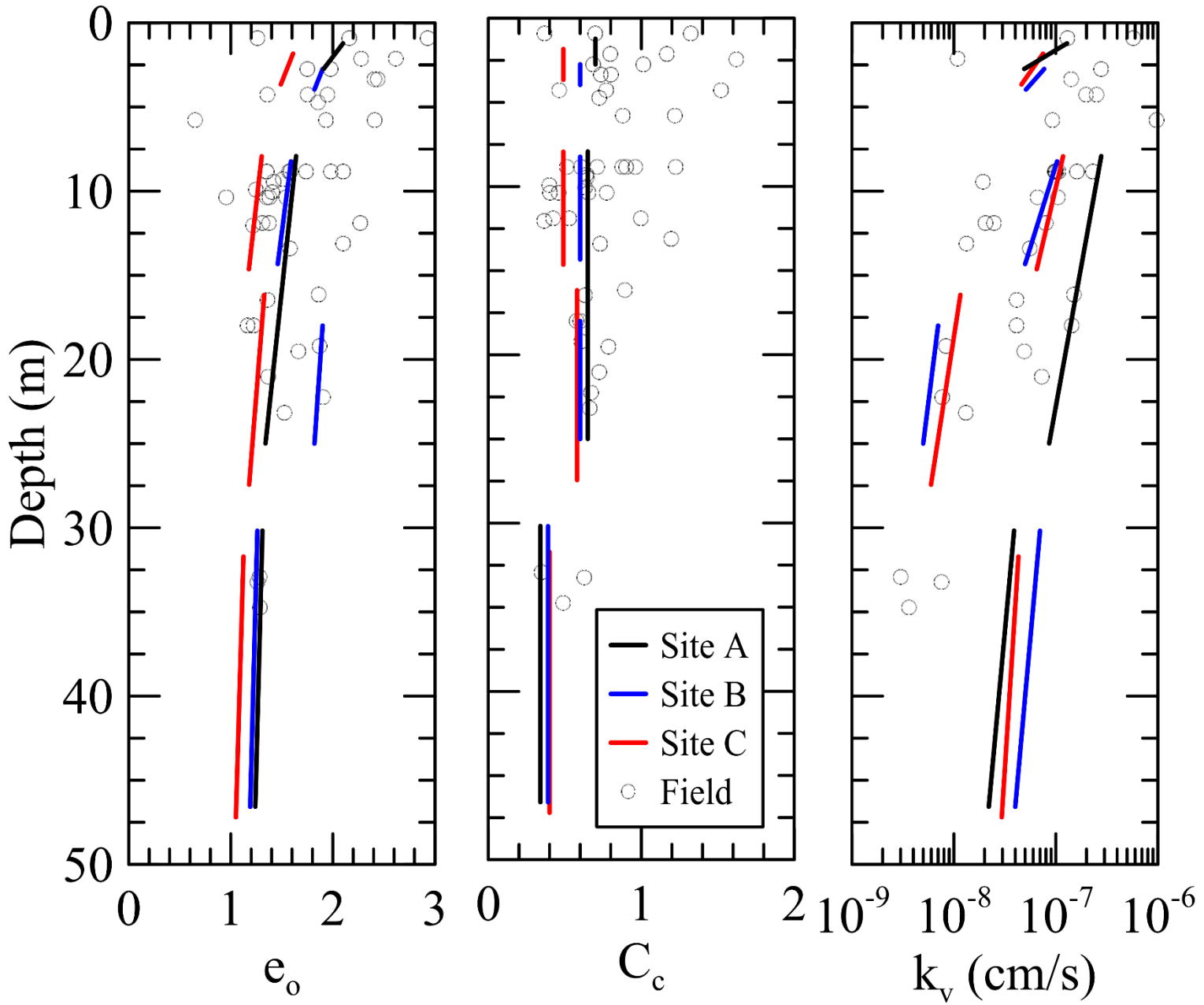
Settlement vs Time Relationships (Site B)



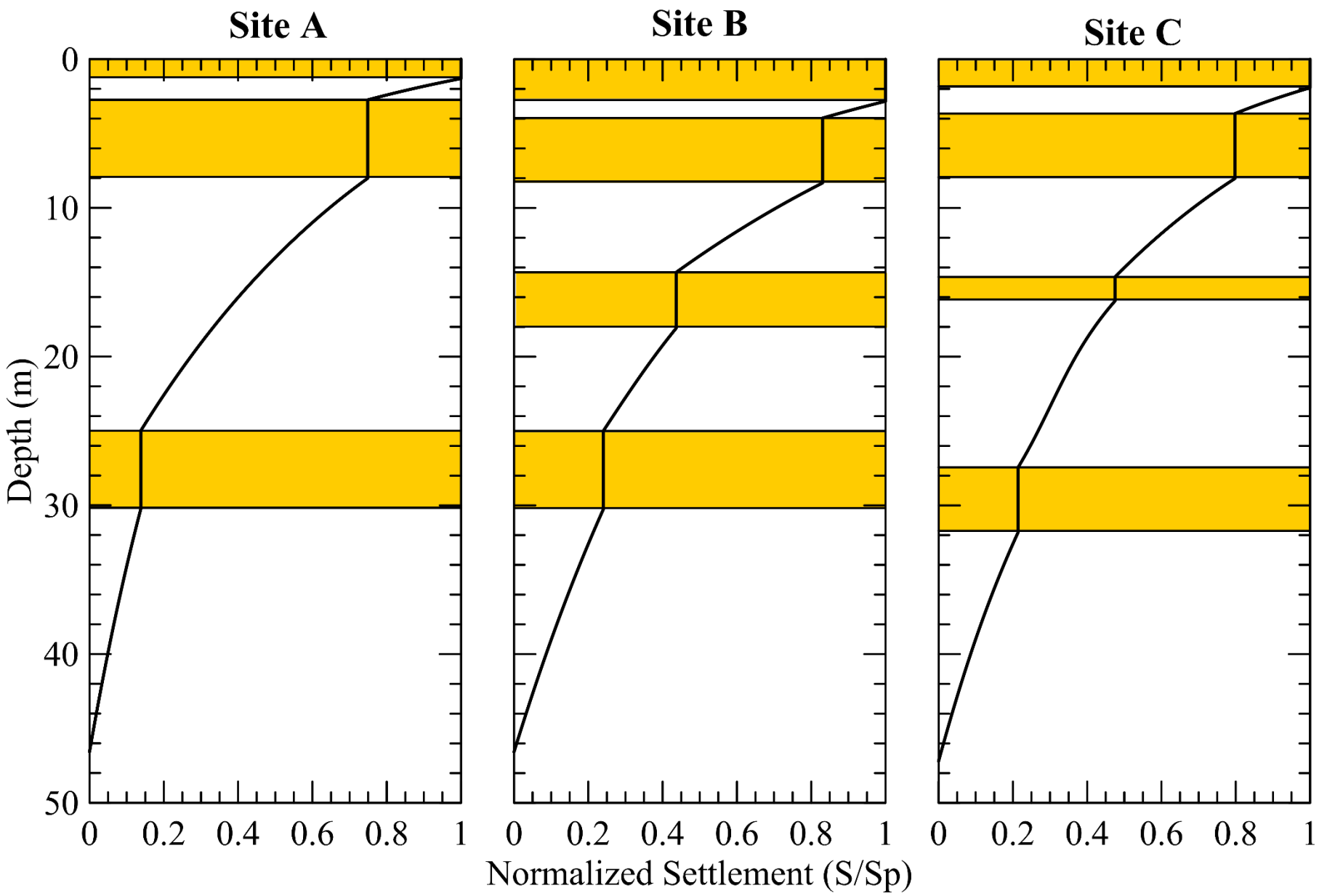
Settlement vs Time Relationships (Site C)



Comparison of Laboratory Data to Calibrated Model



Contribution of Settlement from Compressible Layers



Summary & Conclusions

- 1-D analyses using Settle^{3D} and PSDDF were used to predict the field observed settlement at three instrumented sites. Both are applicable for foundation sediment.
- Provide guidelines for using both software packages (input parameters, loading, boundary conditions, and post processing).
- PSDDF can be applied in fine-grained dredged sediment (self-weight consolidation) in marsh creation projects.

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Thank you!
Questions?

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