

Does faulting-induced subsidence drive distributary network reorganization?

Andrew J. Moodie and Paola Passalacqua

amoodie@utexas.edu

Department of Civil, Architectural and Environmental Engineering, University of Texas at Austin



Yes, and

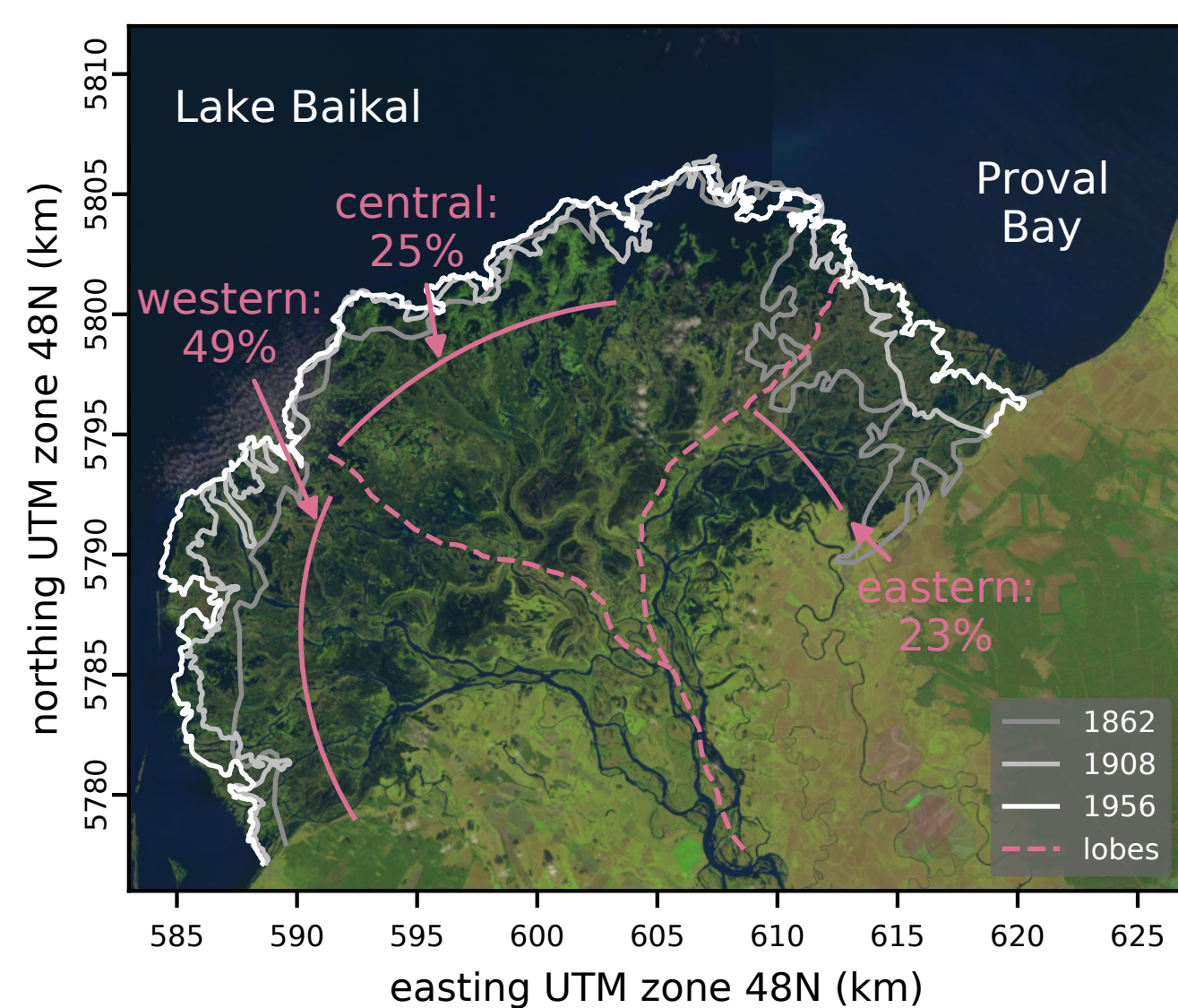
1) channel network change correlates with displacement length

but only when

2) channel network is connected to subsided region

Goal: understand how perturbations affect delta network organization

Example: Selenga River delta



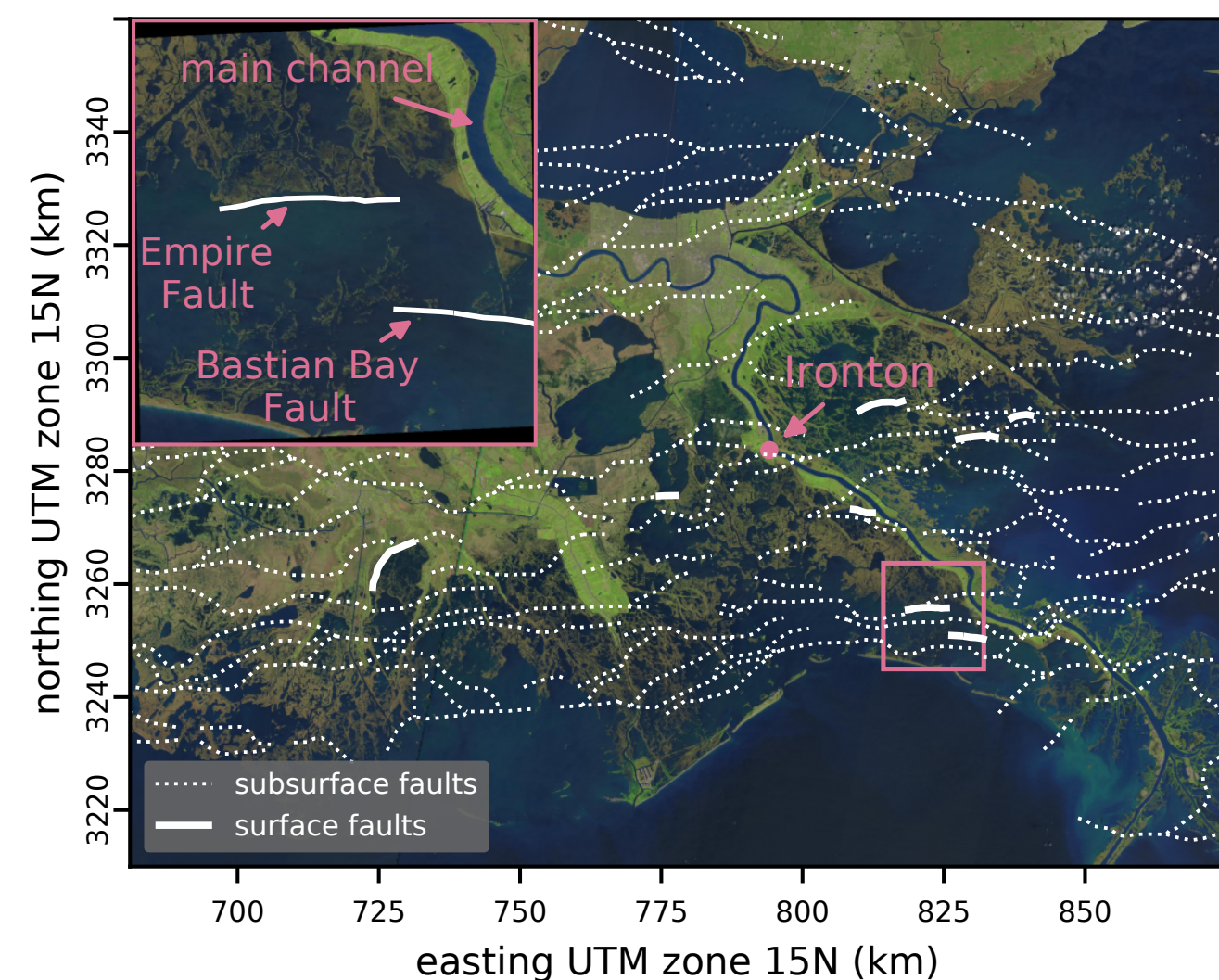
Fault-induced subsidence (earthquake) in 1862 created Proval Bay (1–2 m deep)

Faster shoreline progradation in eastern lobe over last 160 yr, but flux is balanced at present

Mass balance indicates 80–100% of sediment input to delta went to eastern lobe

What events are large enough to make network reorganize?

Case Study: Mississippi River delta



Cumulative subsidence contribution from growth faulting is poorly constrained: infrequent 10^{-1} – 10^0 m

Diversions planned to build land (e.g., Ironton)

Can growth faults make network reorganize?

Will reorganization impact sediment diversion success?

Open-source methods

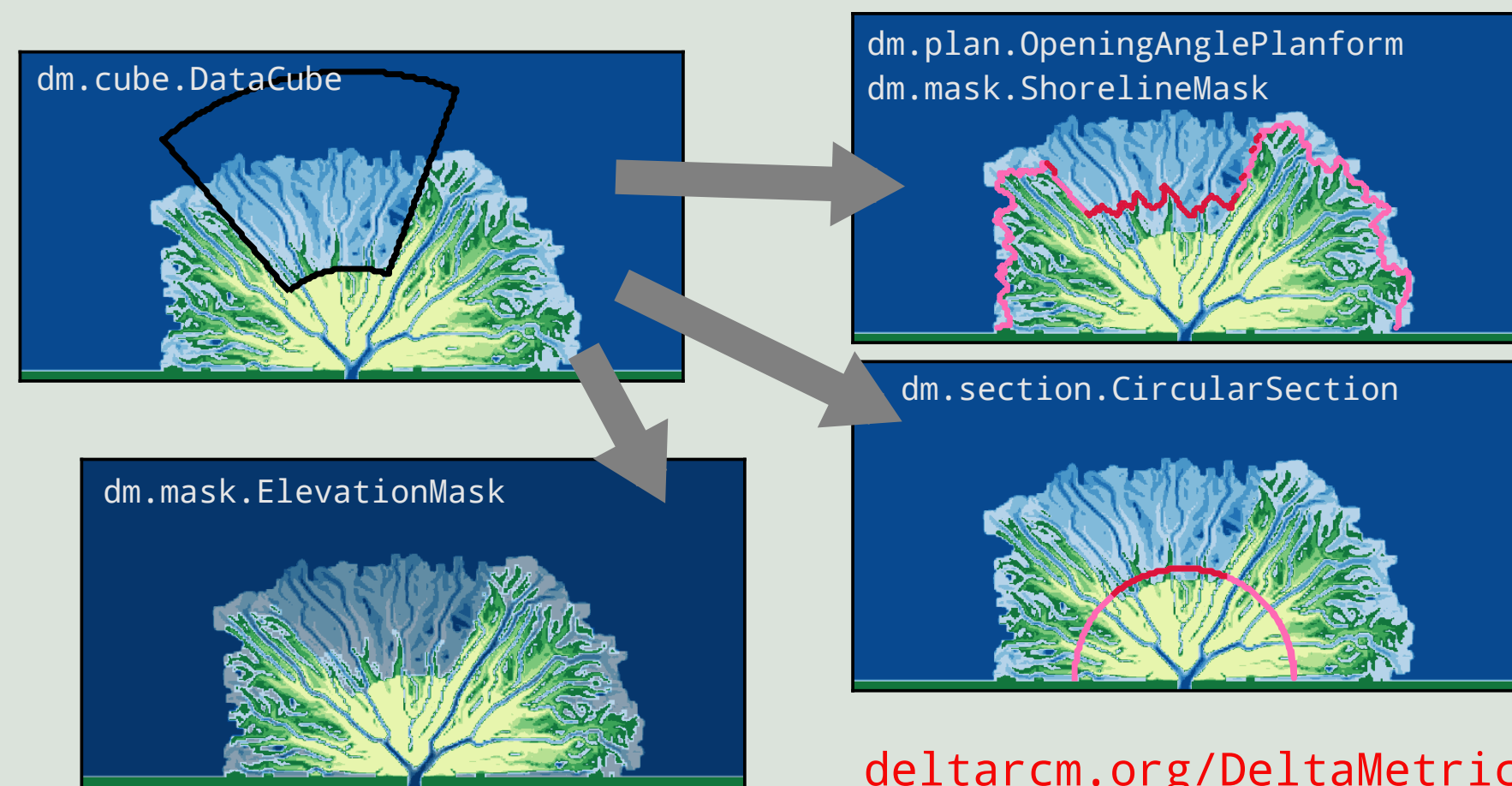
pyDeltaRCM: Python implementation of DeltaRCM

5–10x faster, reproducible, feature-rich, extensible

(JOSS paper in prep.)

DeltaRCM
deltarc.org/pyDeltaRCM

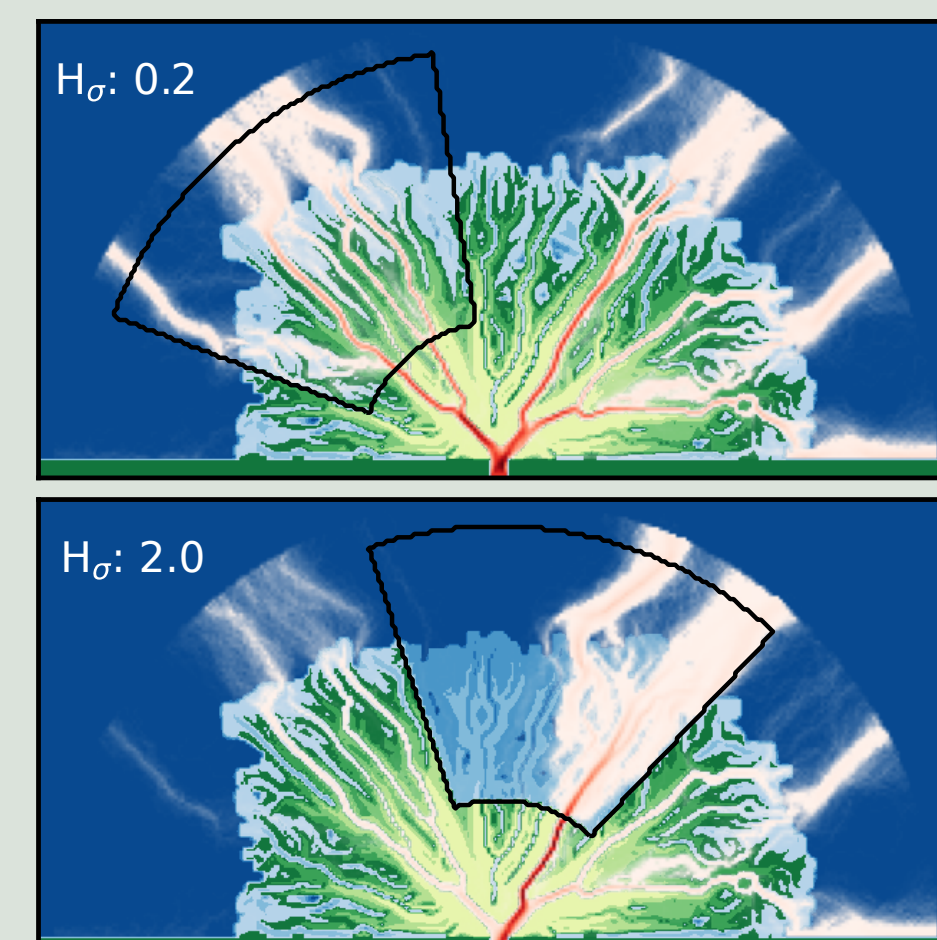
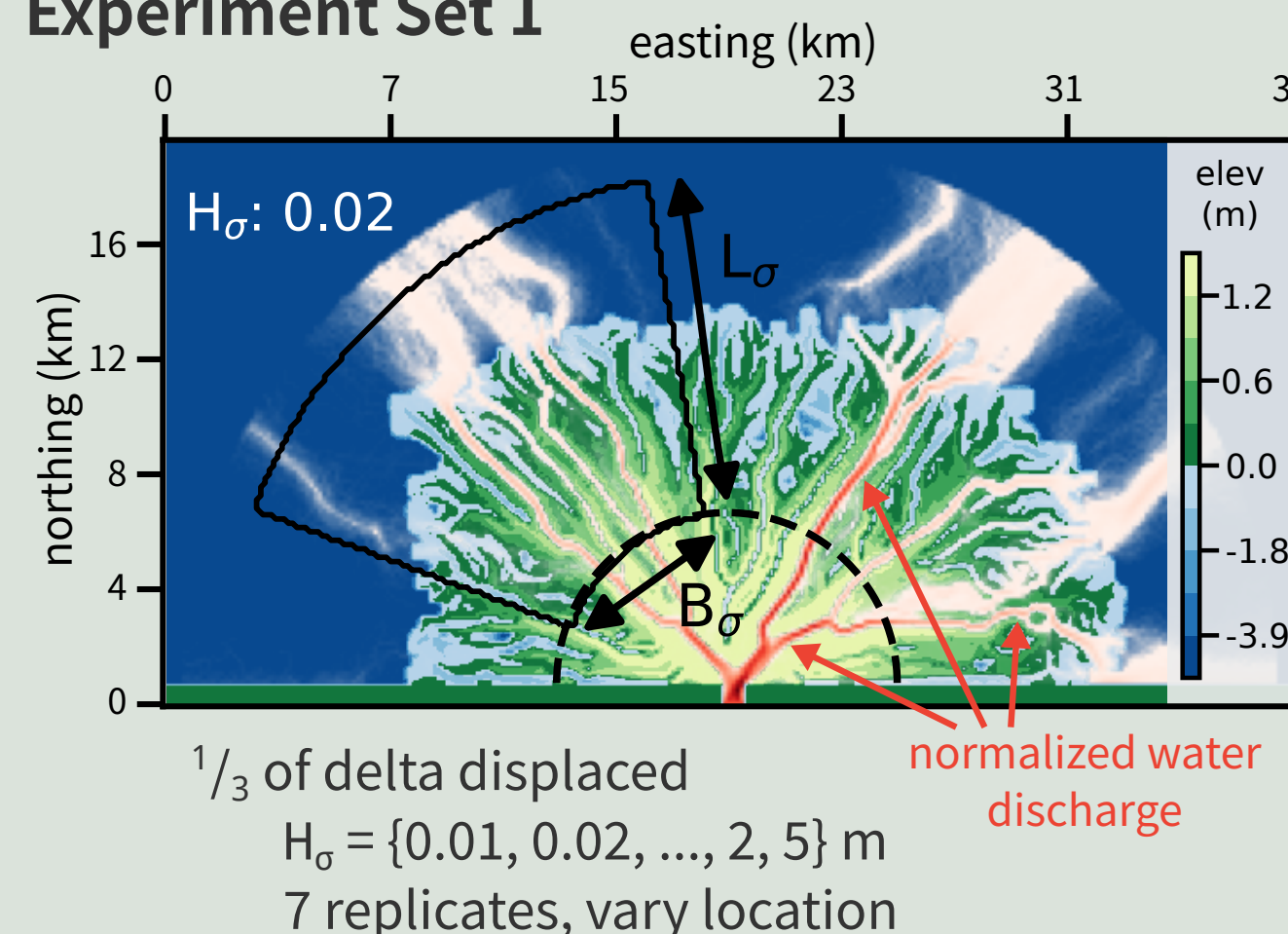
DeltaMetrics: data-cube analysis for deltas
object-oriented API, data agnostic



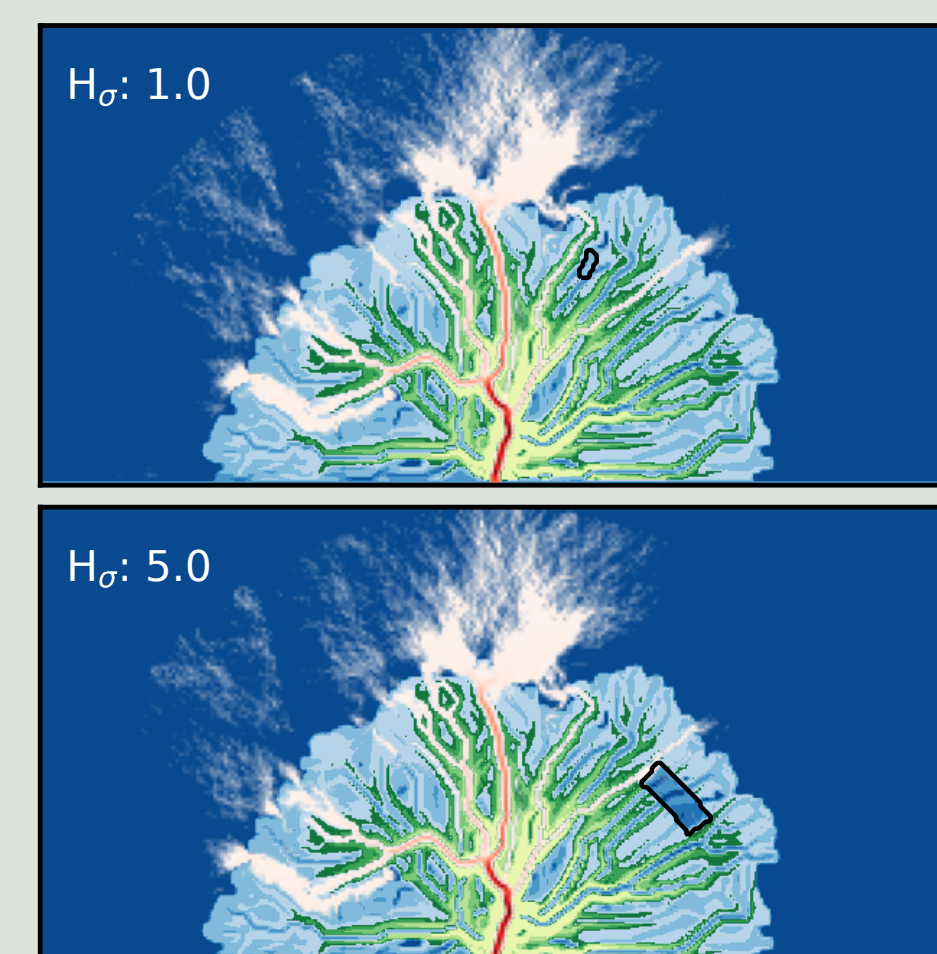
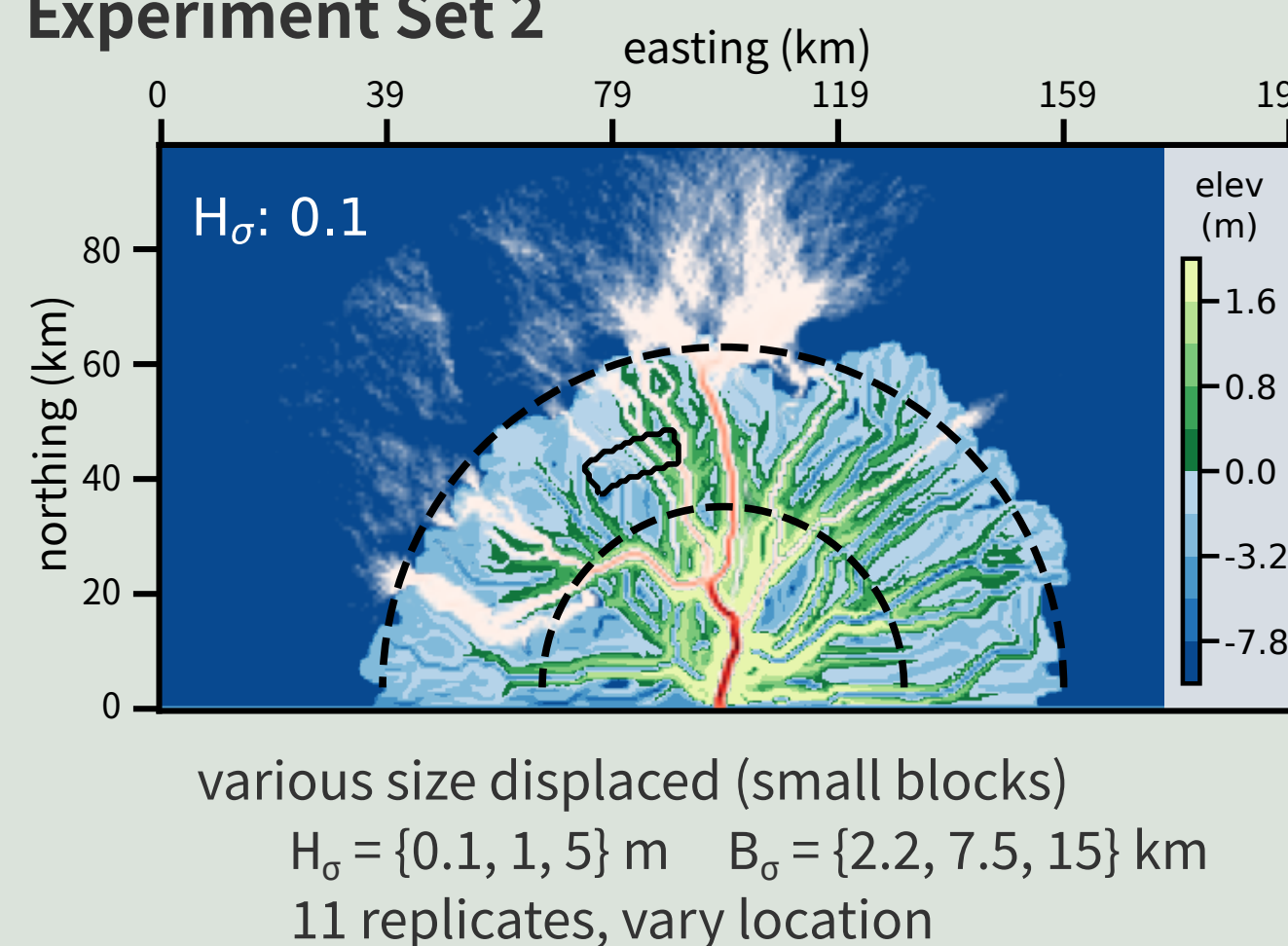
deltarc.org/DeltaMetrics

Modeling fault-induced subsidence

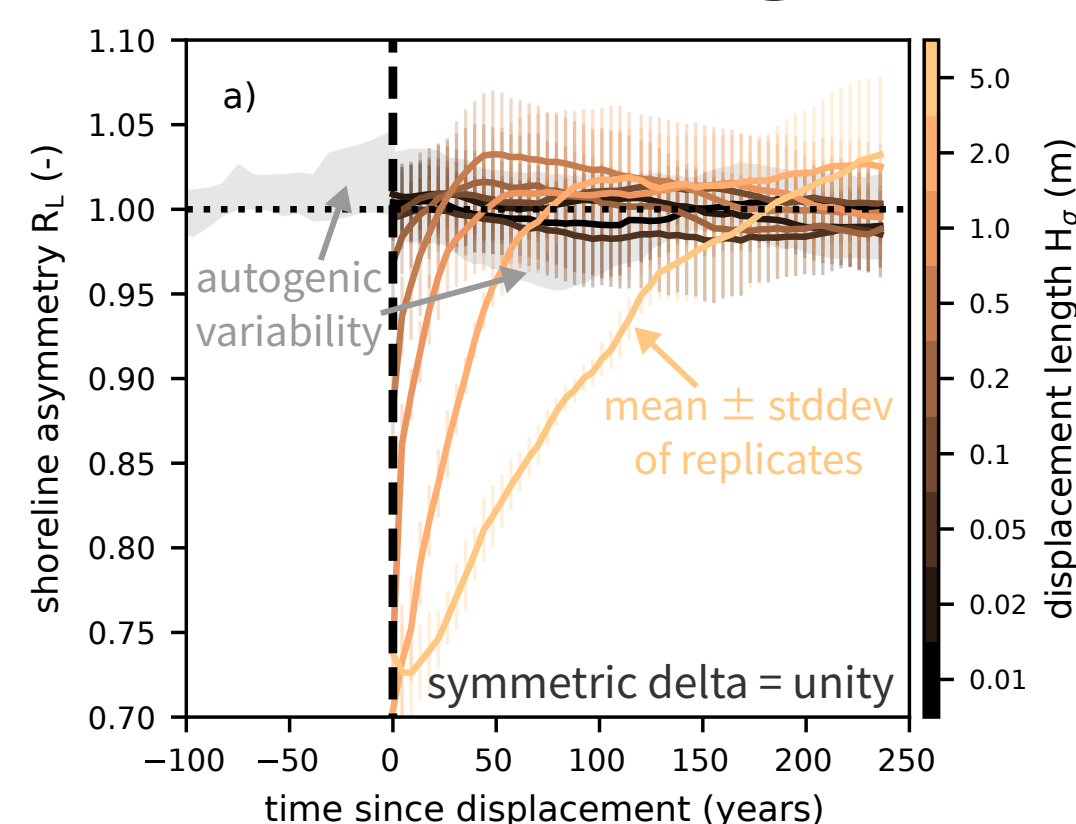
Experiment Set 1



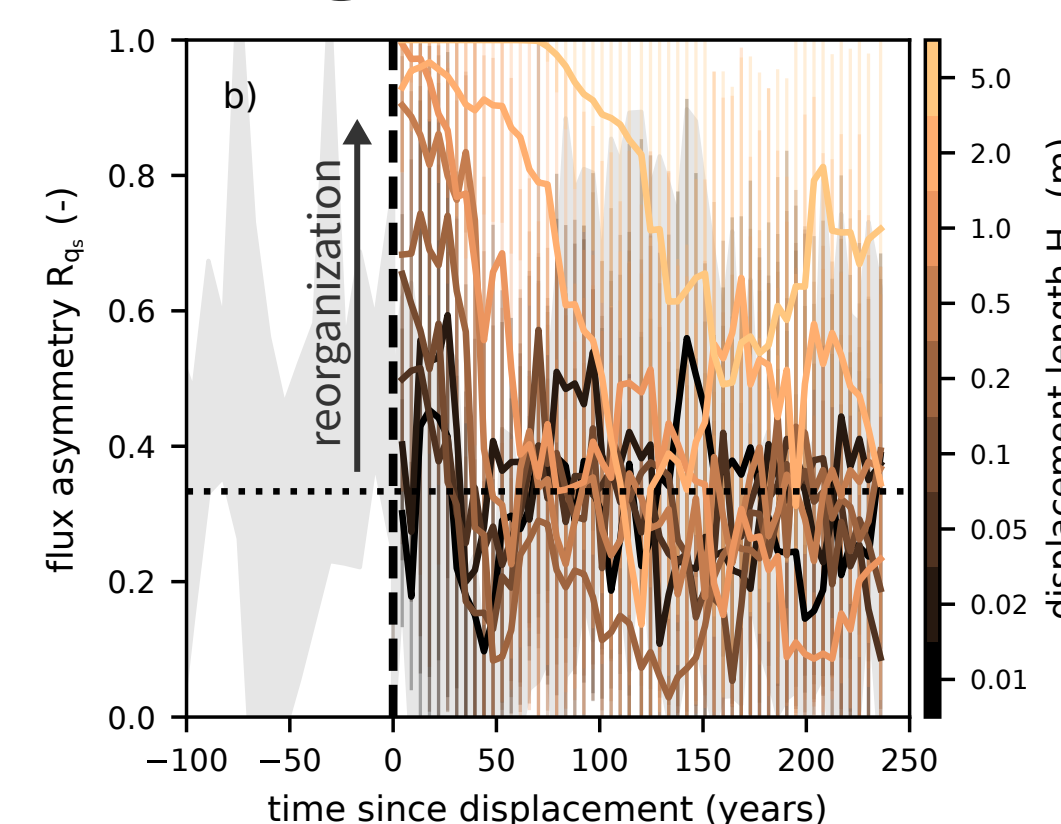
Experiment Set 2



Displacement length dictates reorganization

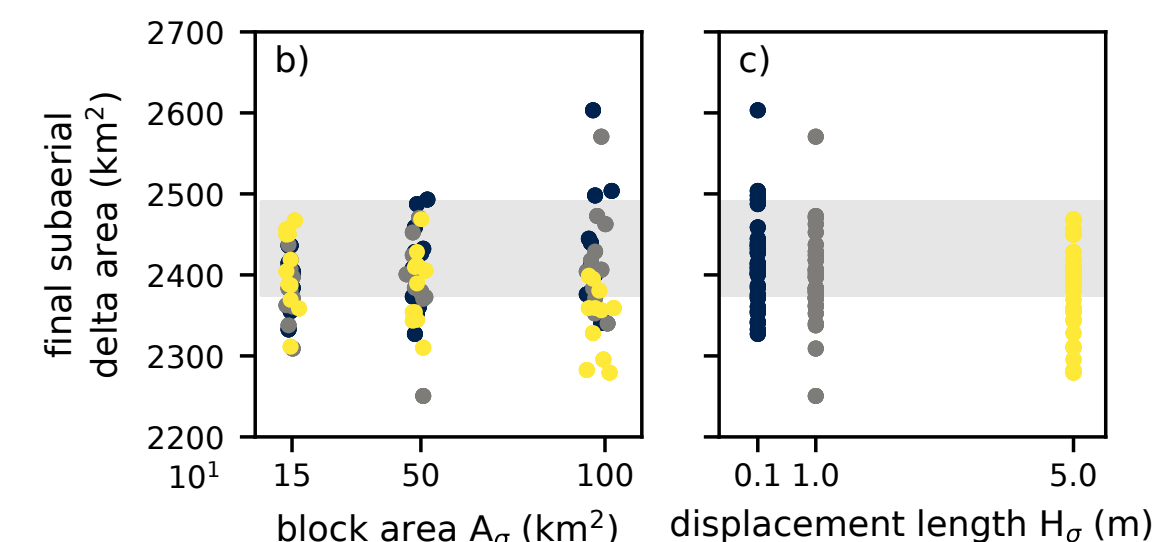
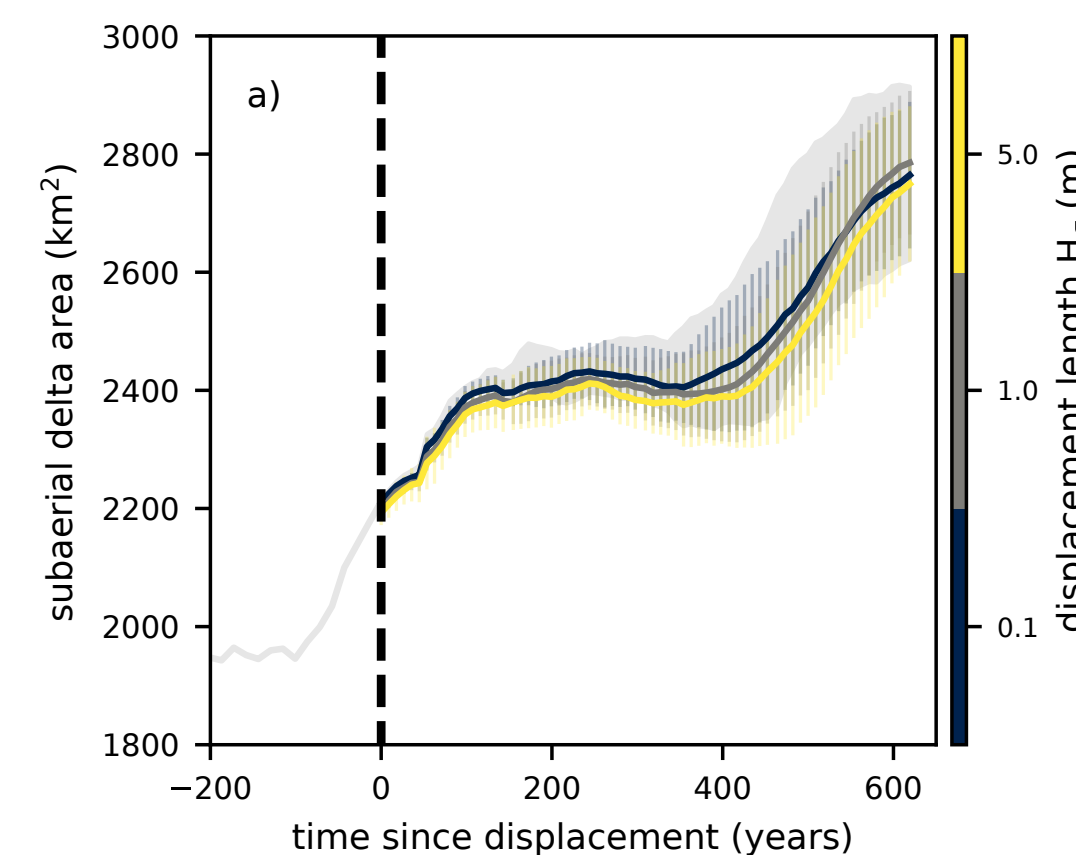


Shoreline asymmetry and recovery time depend on displacement length



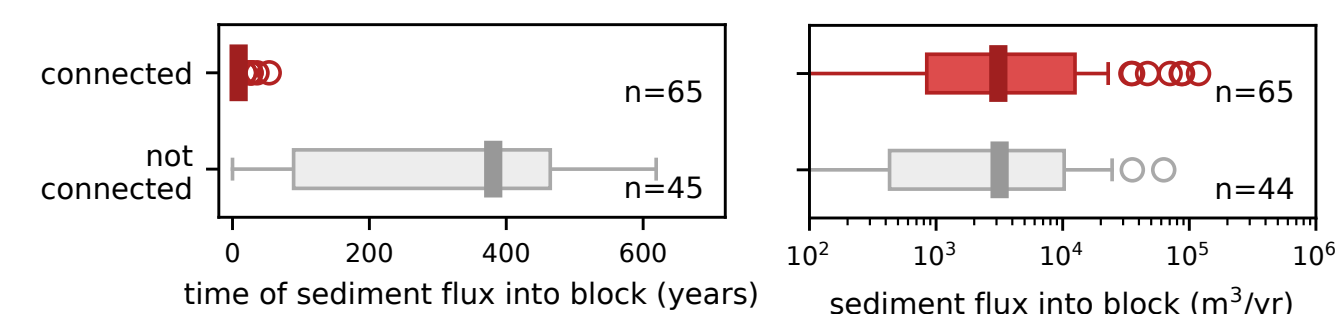
Sediment flux asymmetry following displacement depends on displacement length

Connection to inlet dictates reorganization



No correlation with subaerial delta area

Connectedness determined by > 5% of normalized discharge before displacement event



Connectedness impacts when sediment reaches block, but flux at this time is not affected