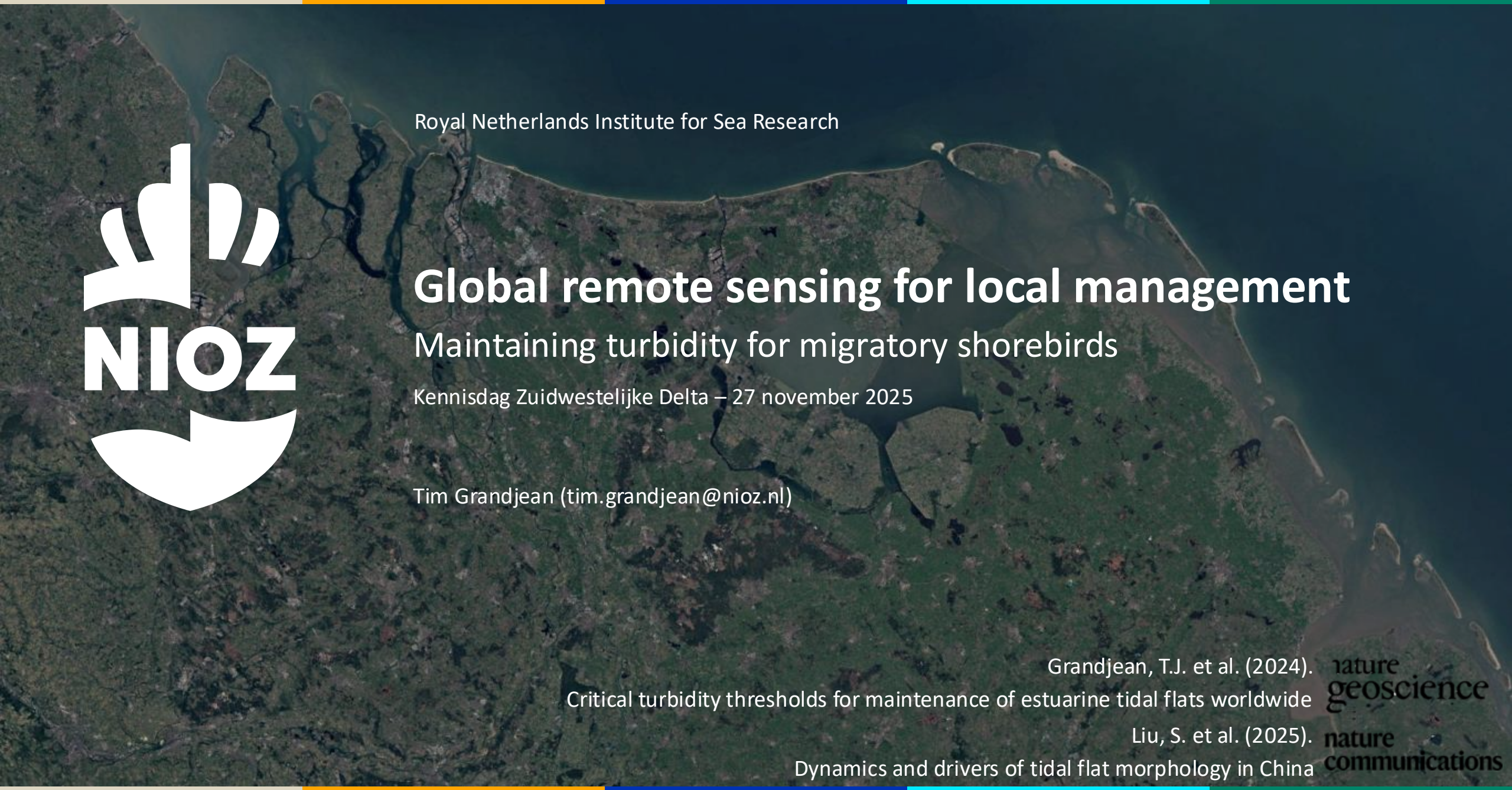

# Sea Research



Royal Netherlands Institute for Sea Research

# Global remote sensing for local management

## Maintaining turbidity for migratory shorebirds

Kennisdag Zuidwestelijke Delta – 27 november 2025

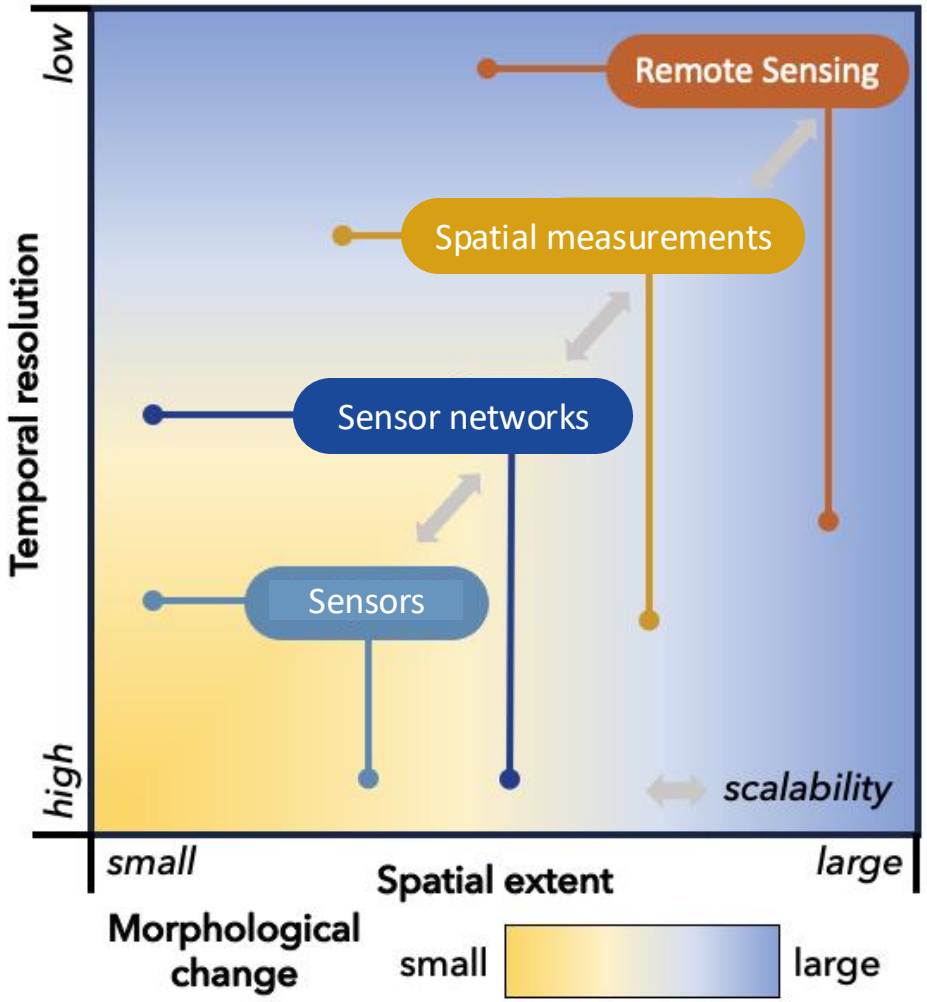
Tim Grandjean (tim.grandjean@nioz.nl)

Grandjean, T.J. et al. (2024).
Critical turbidity thresholds for maintenance of estuarine tidal flats worldwide
*nature geoscience*

Liu, S. et al. (2025).
Dynamics and drivers of tidal flat morphology in China
*nature communications*

“When using global remote-sensing data, it can also provide indicators for local management based on large-scale analyses.”

# Expectations from Remote Sensing



# Typical RS indicators

Turbidity and sediments

Chlorophyll-a (phytoplankton)

Sea Surface Temperature (SST)

Salinity

etc..

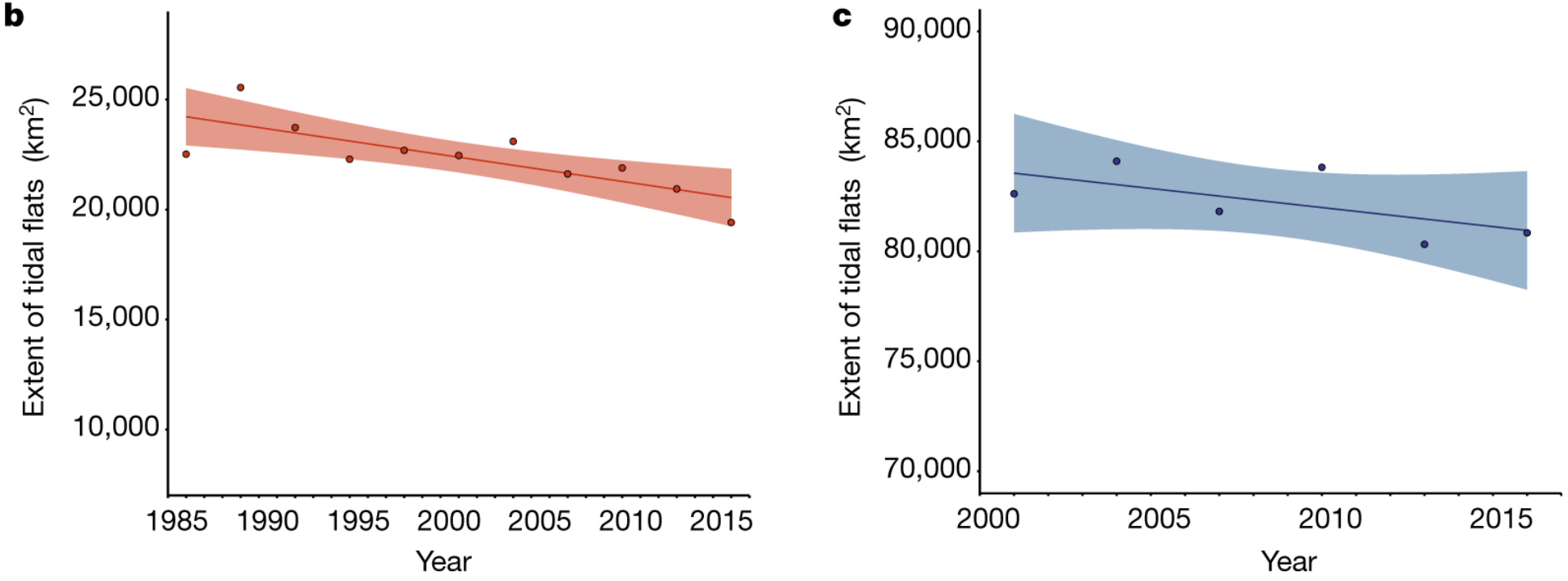
# Worldwide reduction in sediment supply

## Riverine supply


## Marine supply

# Tidal flats are declining worldwide

**–0.15% per year of tidal flat <u>extent</u> is loss**



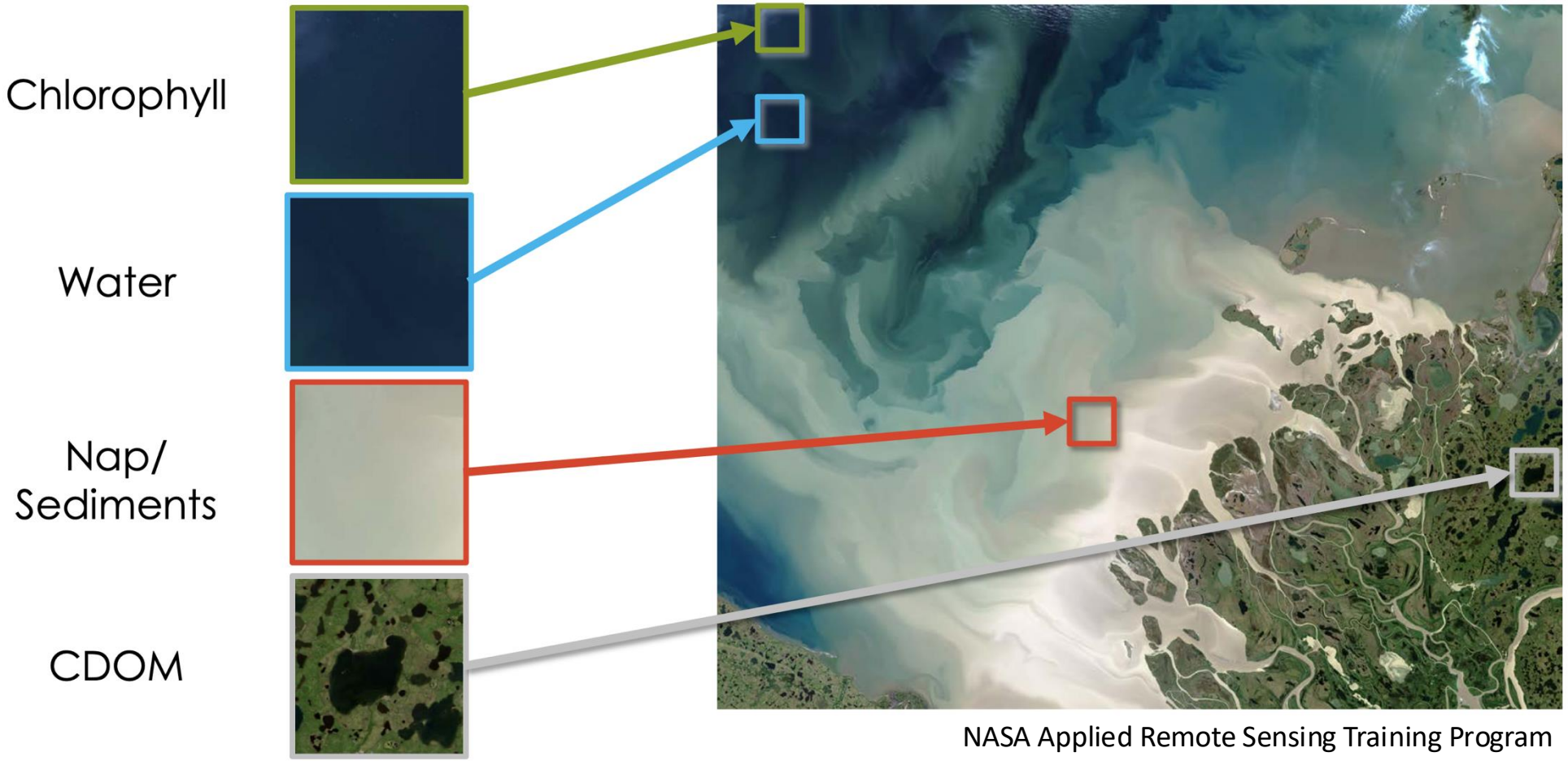

(Murray et al., 2018)

# Sediment as driver of tidal flat morphology

**1. Is there a minimum sediment supply needed for estuarine existence?**

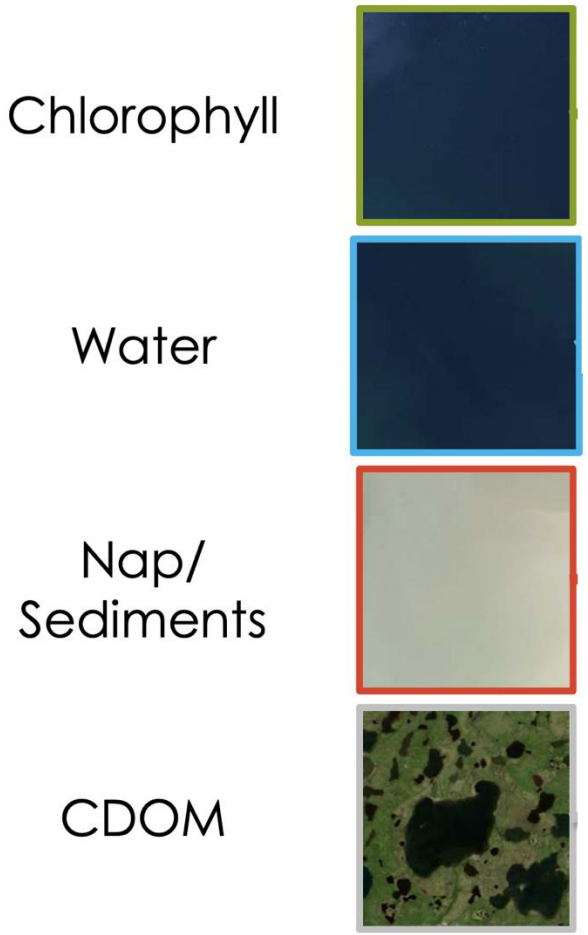
**2. What are the effects of altering sediment supply in estuarine systems?**

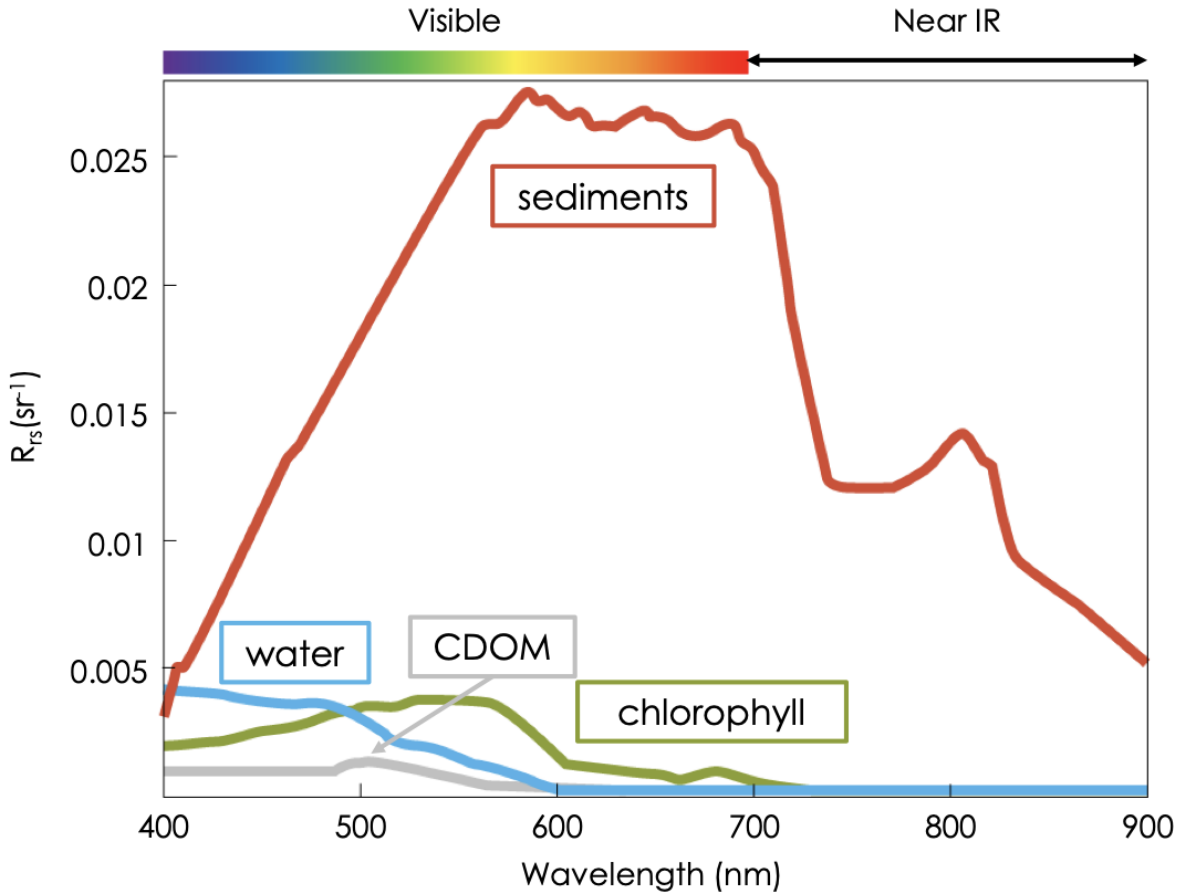
# The color of the water




NASA Applied Remote Sensing Training Program

# The color of the water

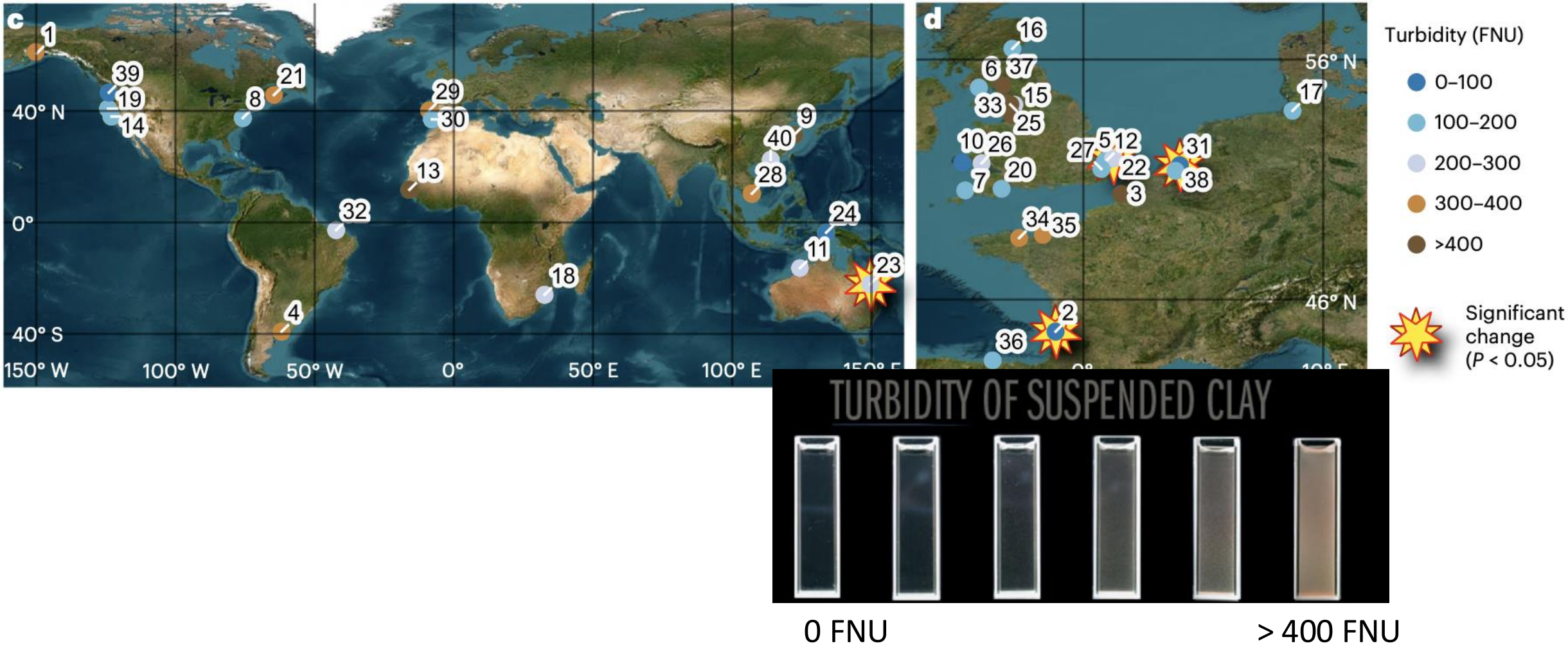



NASA Applied Remote Sensing Training Program

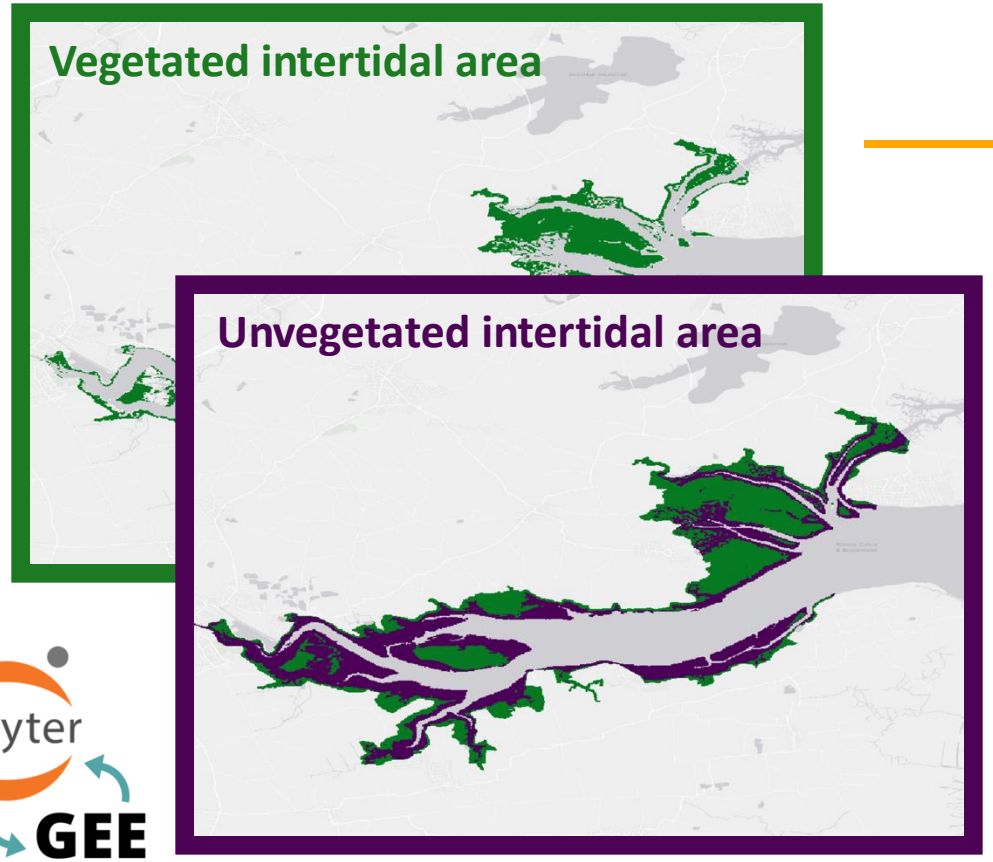
*Grandjean et al., Nature Geoscience (2024)*

# Turbidity as proxy for sediment supply

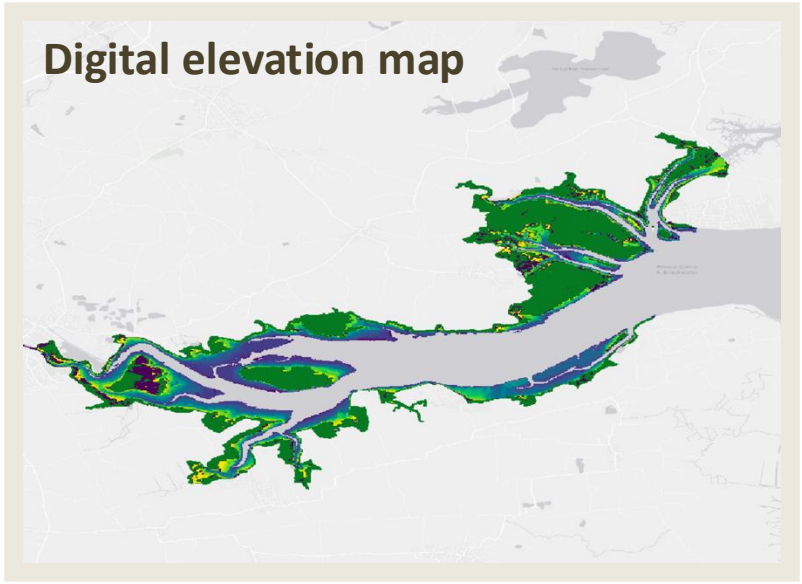


# Monitoring lateral vs vertical development

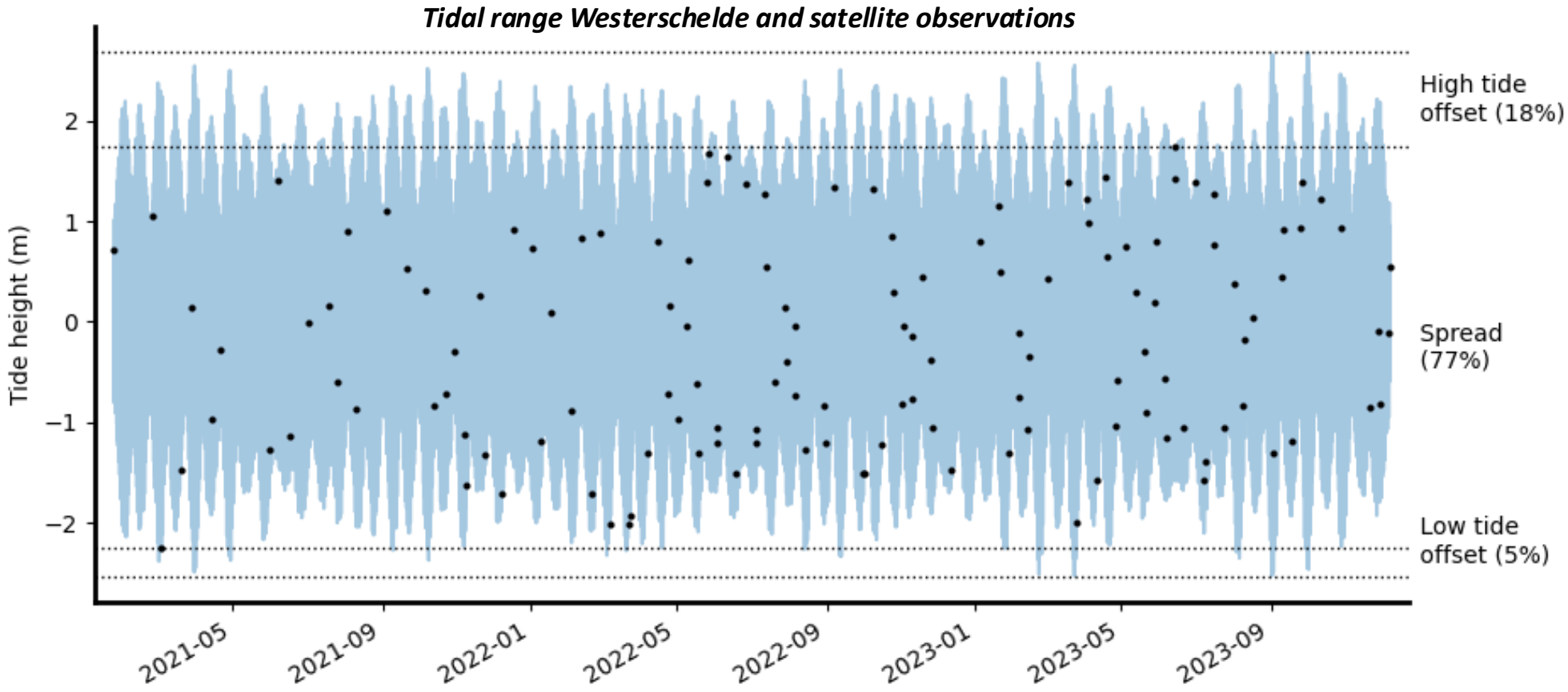
Previous studies




This study



# Satellites provide snapshots of emerged intertidal areas

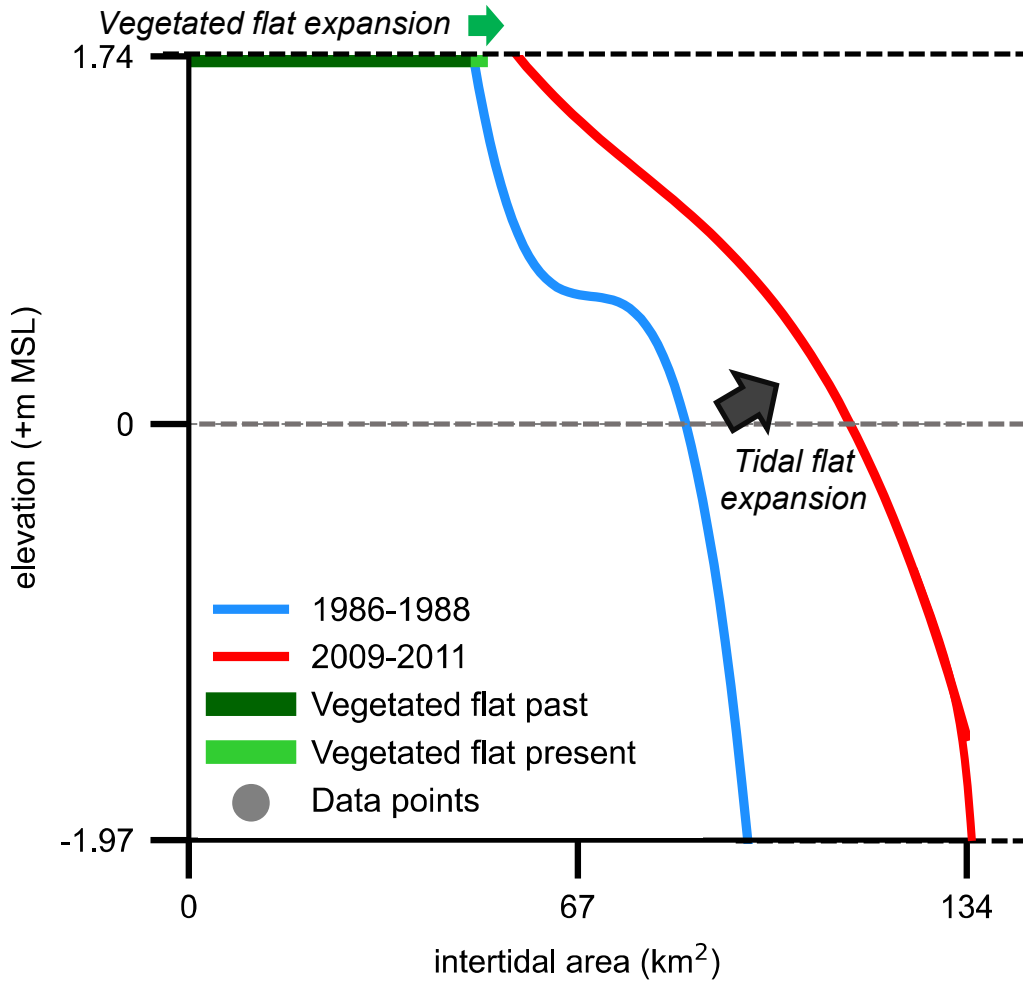


# Inundation frequency maps

- 30 m resolution
  *(Landsat 5 / 8 / 9 and Sentinel-2)*

- Two periods
  *(1985-1987 vs 2021-2023)*

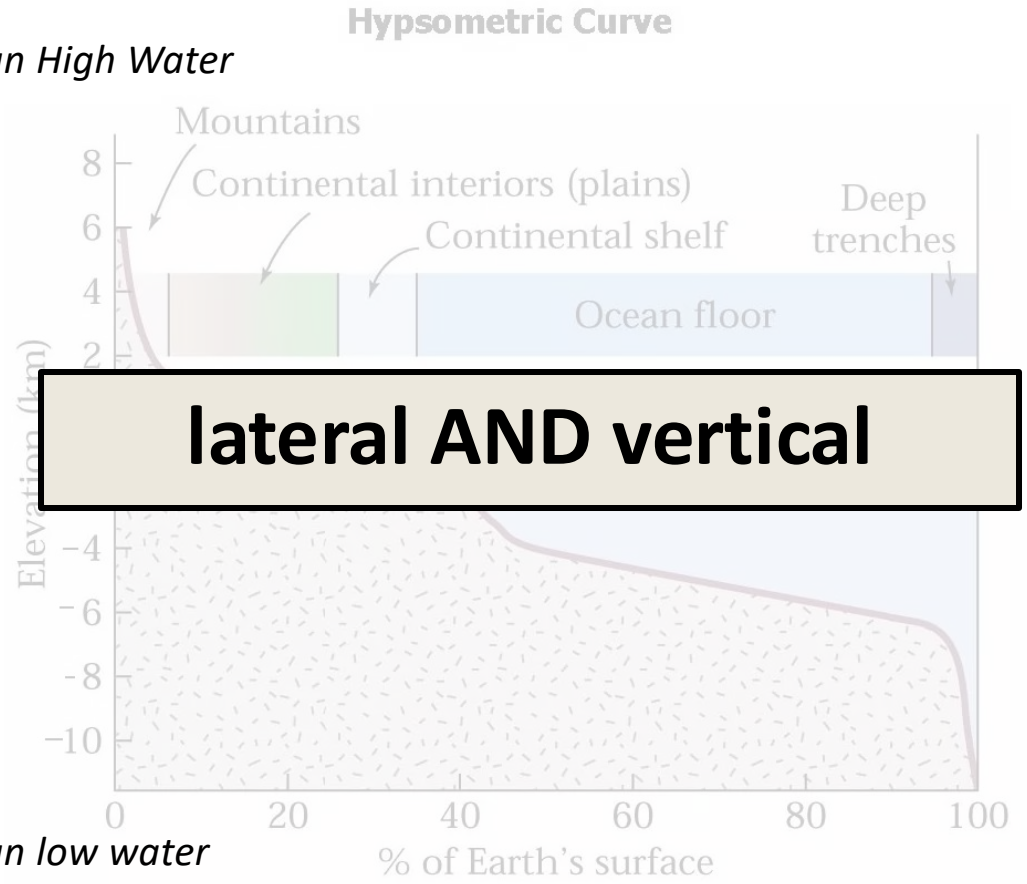
# Distribution of intertidal area




Mean High Water

MSL

Mean low water

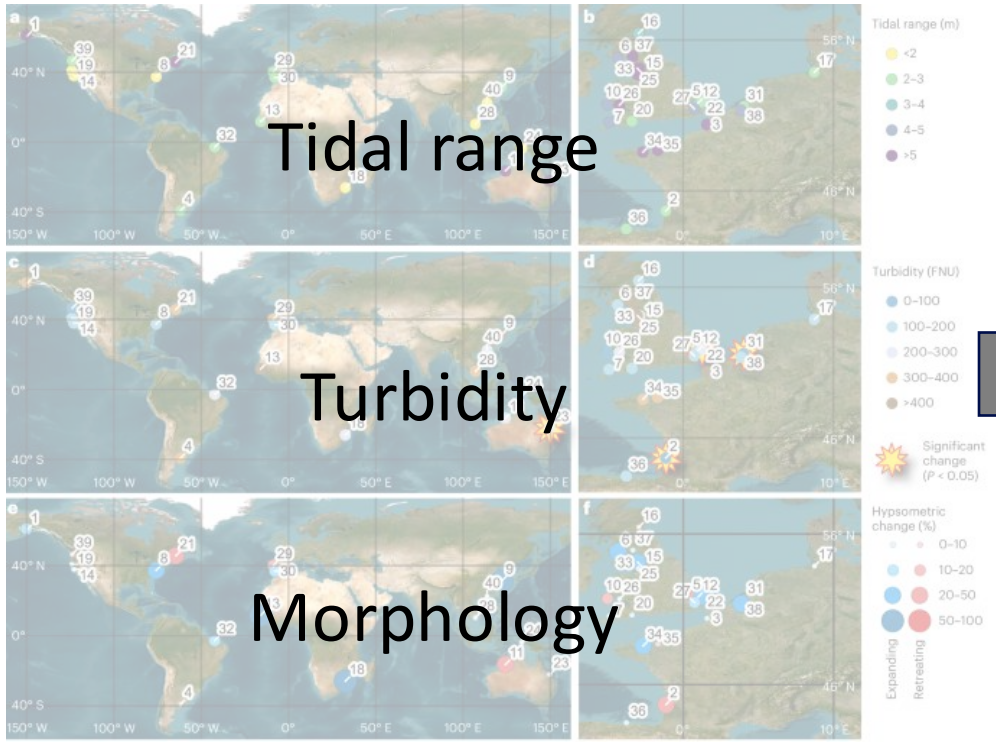


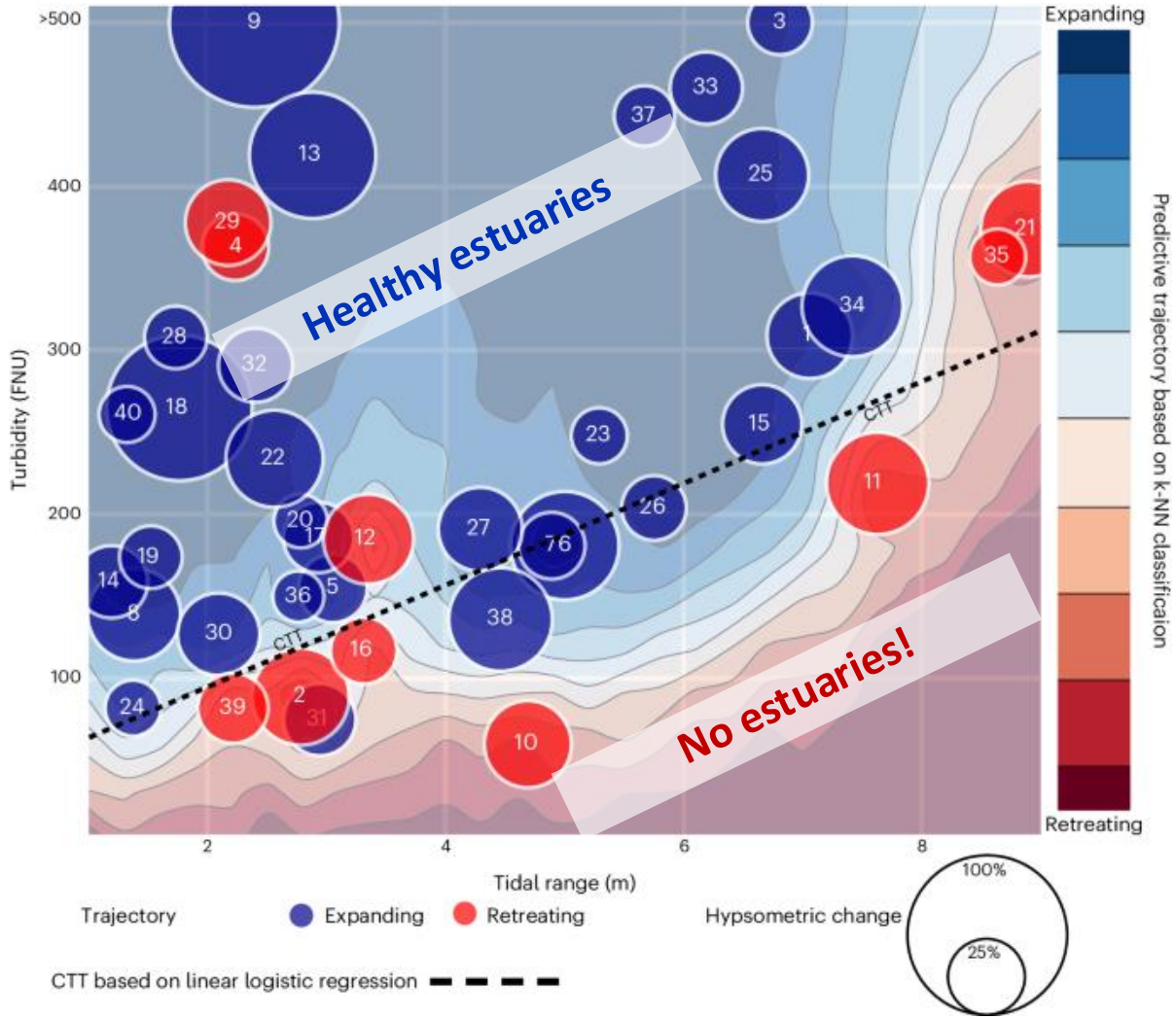

**lateral AND vertical**

(Baer and Wenner, n.d.)

*Grandjean et al., Nature Geoscience (2024)*

# Critical Turbidity Threshold (CTT) to maintain tidal flats



# Sediment as driver of tidal flat morphology

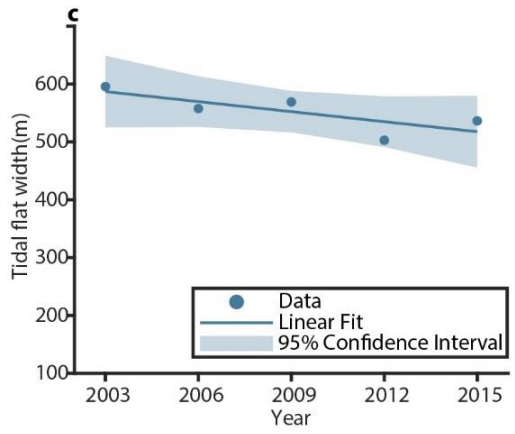
1. Is there a minimum sediment supply needed for estuarine existence?

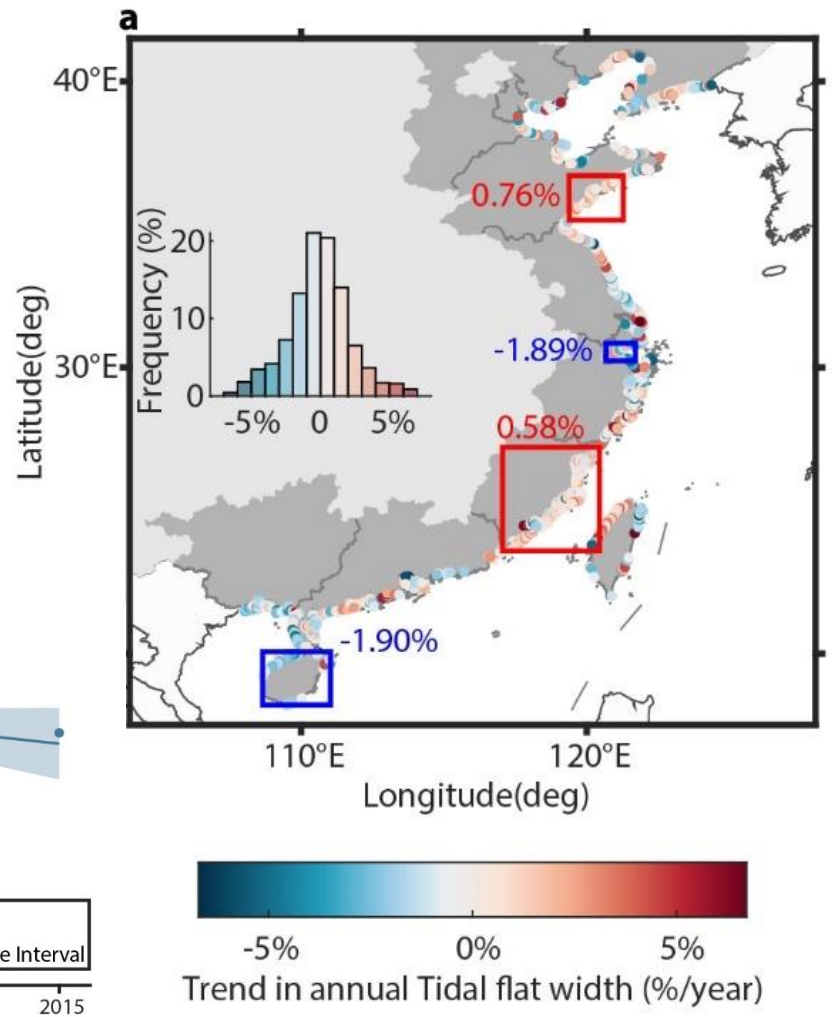
    Yes, estuaries have a tidal amplitude dependent turbidity threshold

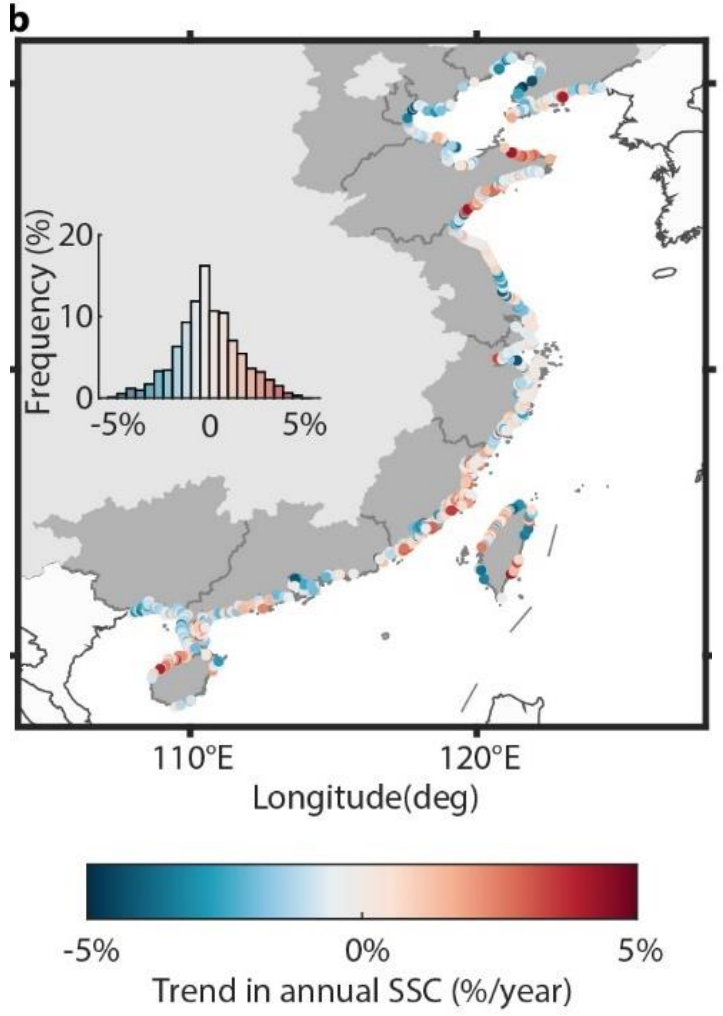
2. What are the effects of altering sediment supply in estuarine systems?

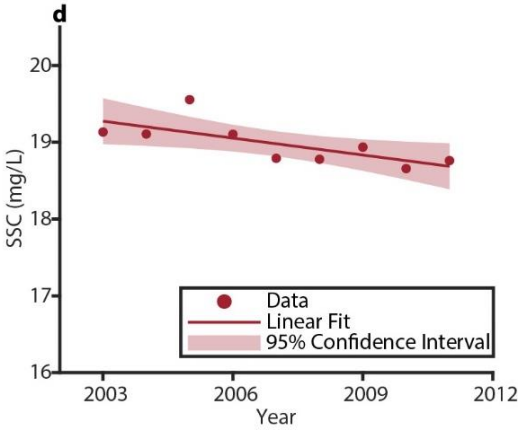
*Liu et al., Nature Communications (2025)*

# Declining tidal flat width and SSC



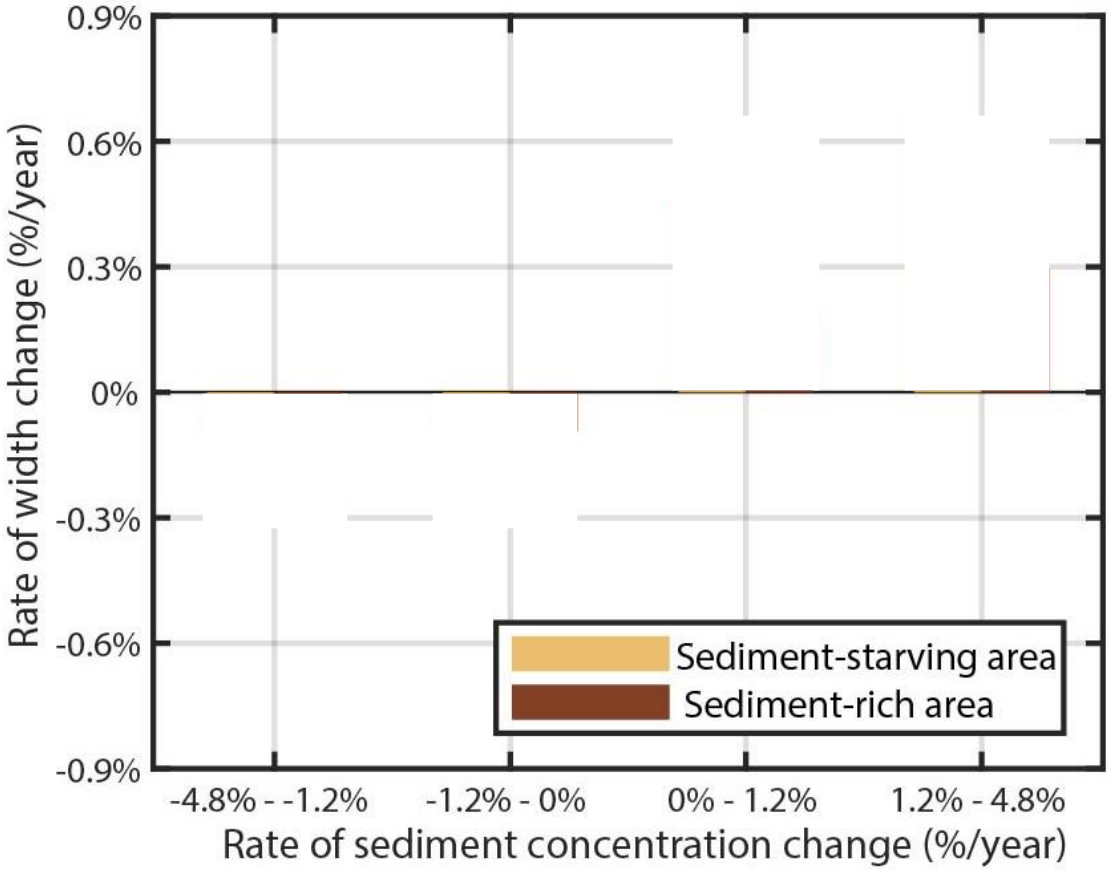



*Liu et al., Nature Communications (2025)*

# Tidal flat width VS changing SSC



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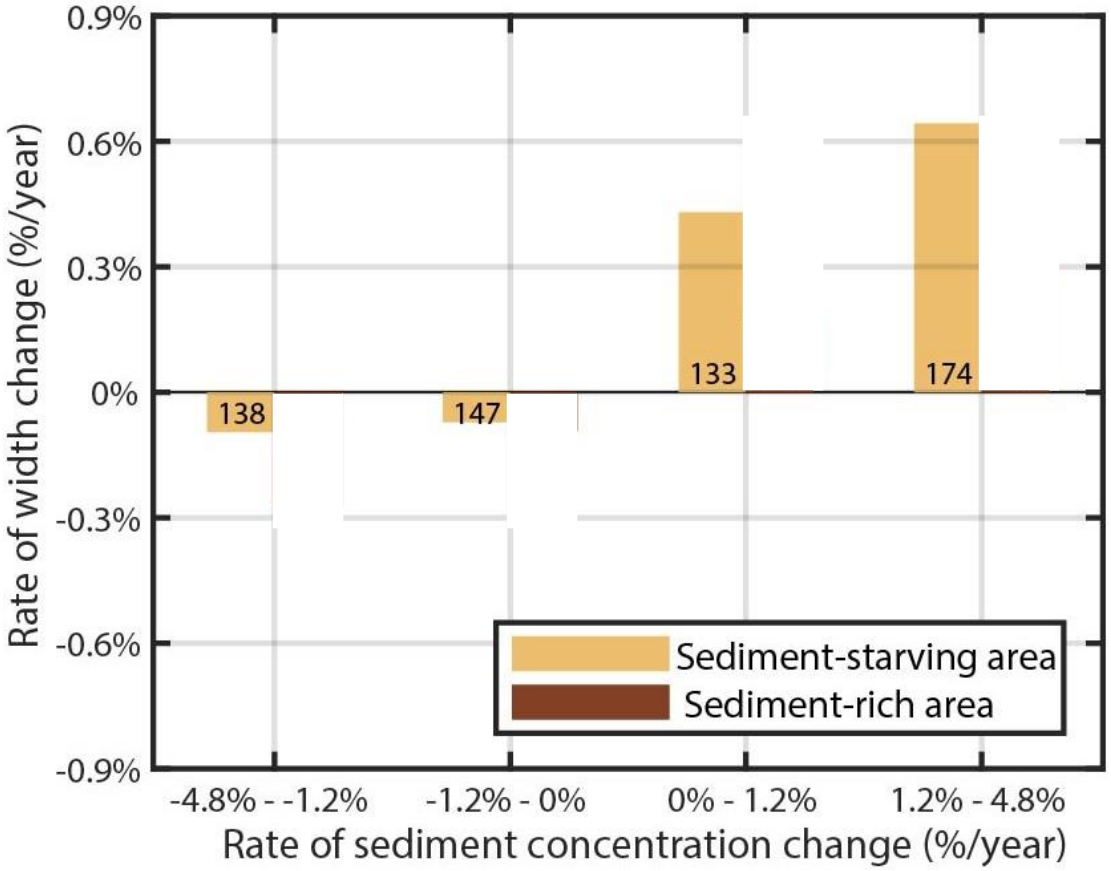

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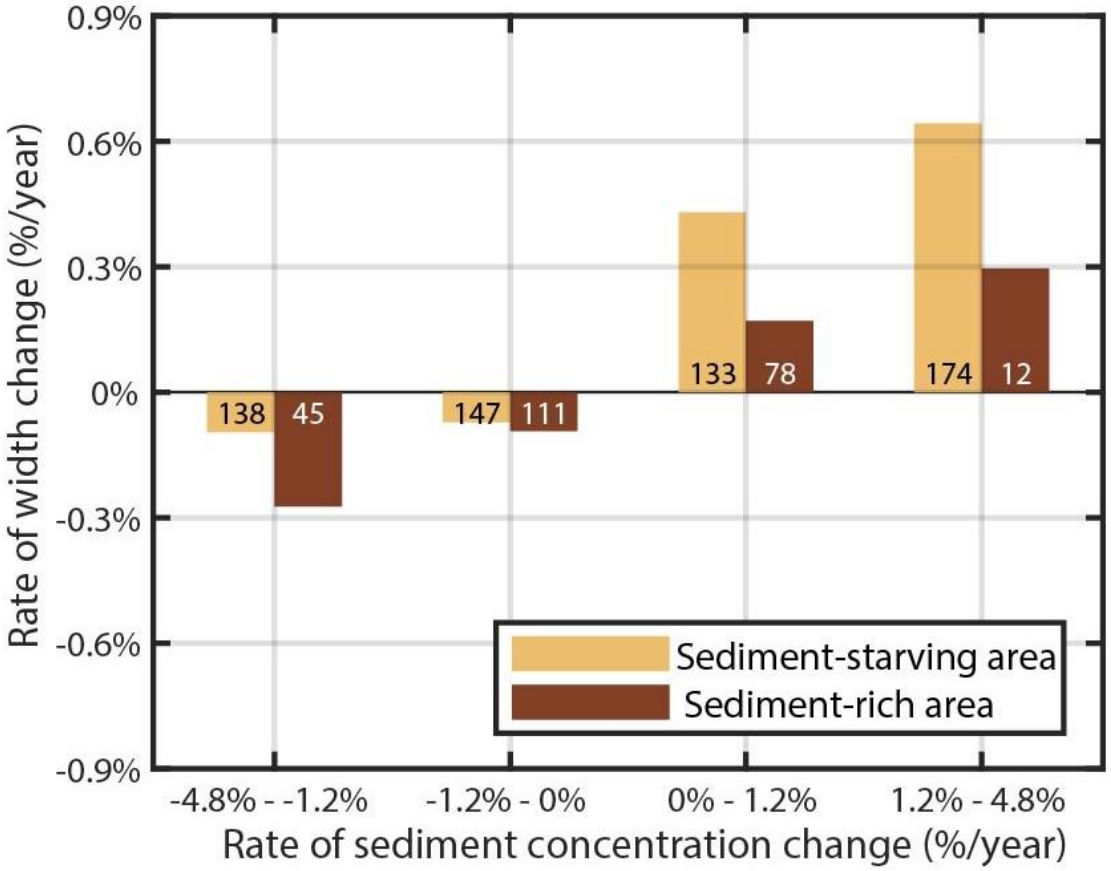

# Sediment as driver of tidal flat morphology

1. Is there a minimum sediment supply needed for estuarine existence?

Yes, estuaries have a tidal amplitude dependent turbidity threshold

**2. What are the effects of altering sediment supply in estuarine systems?**

Response rate depends on SSC concentration

# Sediment as driver of tidal flat morphology

1. Is there a minimum sediment supply needed for estuarine existence?

   Yes, estuaries have a tidal amplitude dependent turbidity threshold

2. What are the effects of altering sediment supply in estuarine systems?

   Declining SSC → Declining tidal flat widt

**RS or BIG DATA provides indicators important to understand the mechanisms of estuaries**

Grandjean, T.J. et al. (2024). Critical turbidity thresholds for maintenance of estuarine tidal flats worldwide — nature geoscience

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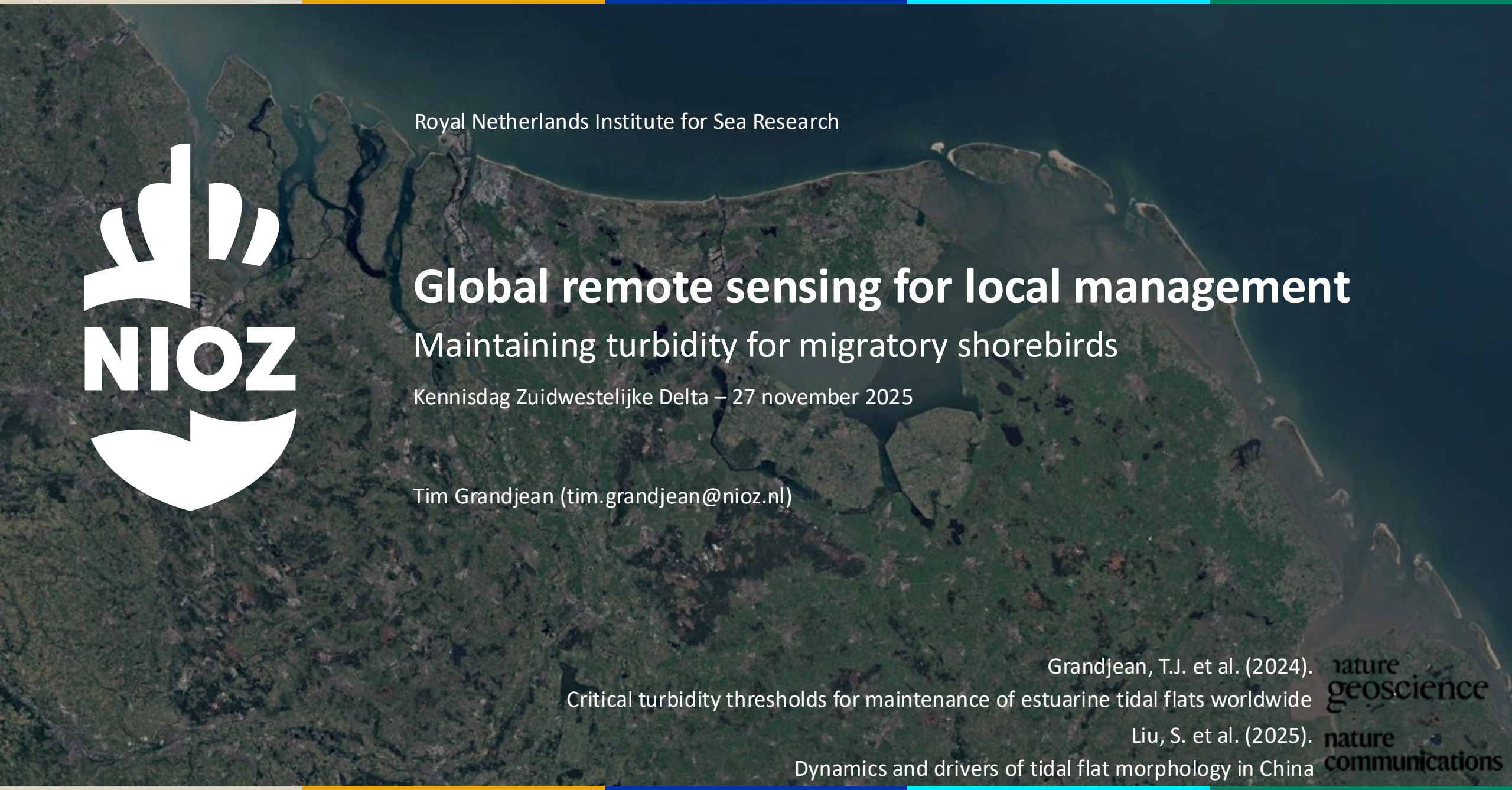
Take home message

# Sediment supply key to maintain intertidal areas

Barriers to sediment supply

Declining foraging areas

Nature-based coastal safety



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