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Temporal carbon discharge from coastal erosion and bog burst of tropical coastal peatland in Indonesia

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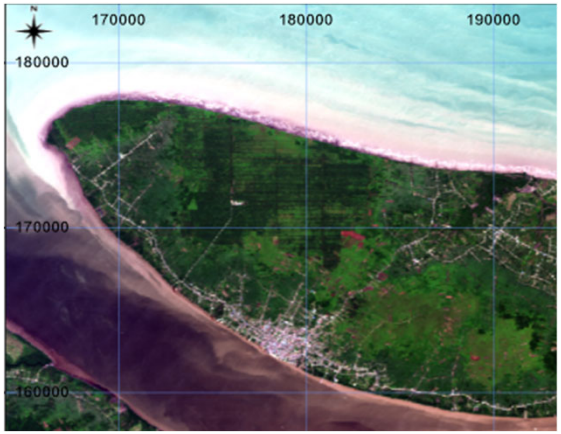
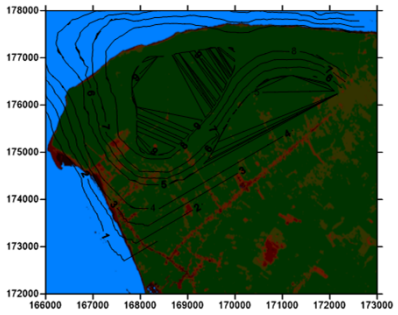
Study site

- Bengkalis Island, Indonesia
- Coastal retreat reaches 40 m per year.
- Coastal peat cliff results peat block as well as suspended peat as Particulate Organic Carbon (POC).
- Peaty organic carbon discharges to the ocean.
- Since 1972, coastal erosion on Bengkalis Island, Riau, Indonesia has lost about 13 km^2 of peatlands.
- Coastal erosion reaches an average speed of 40m per year.



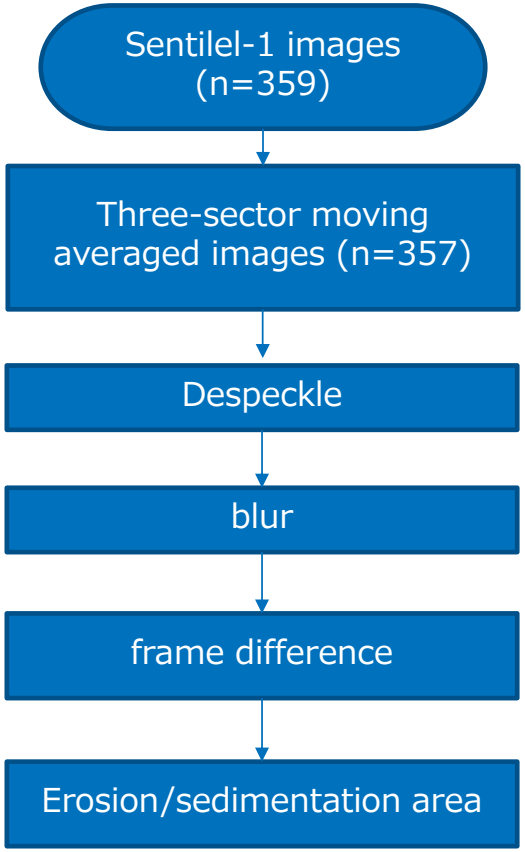
Bengkalis Island

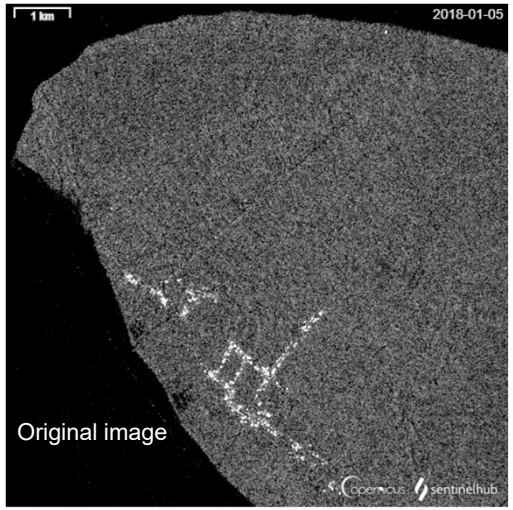
Peat cliff → Peat block → Suspended peat

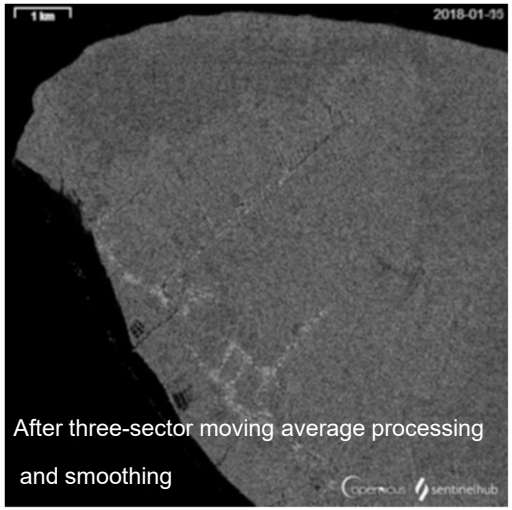


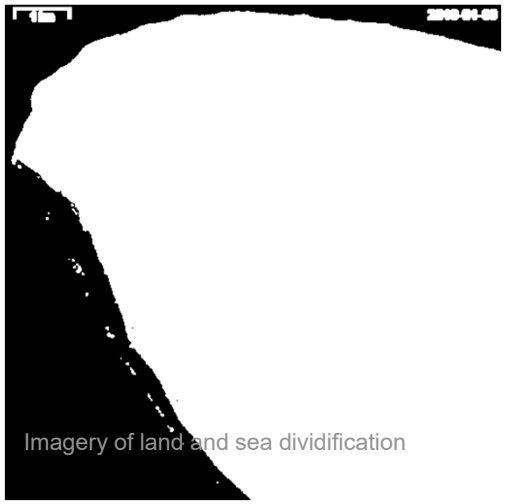
Estimation of coastal retreat using Sentinel-1

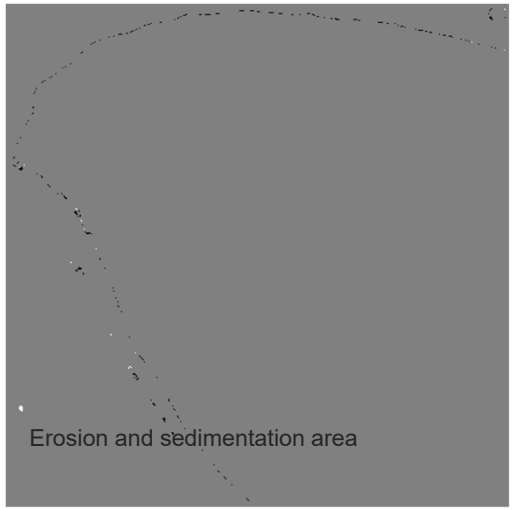
January 2, 2018~January 8, 2022





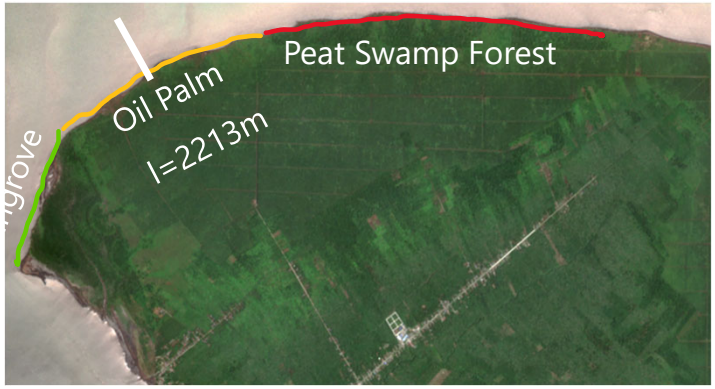




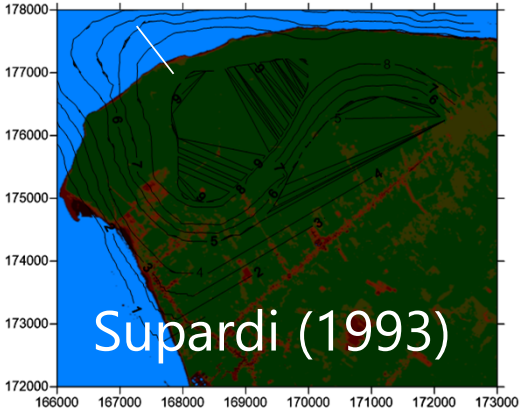


Estimation of carbon discharge

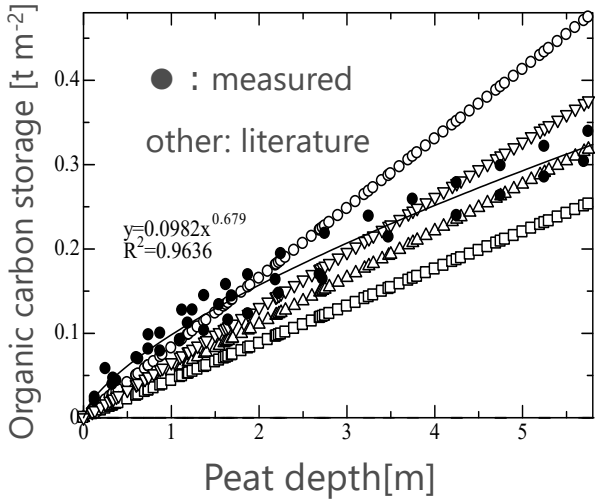
Targeted area

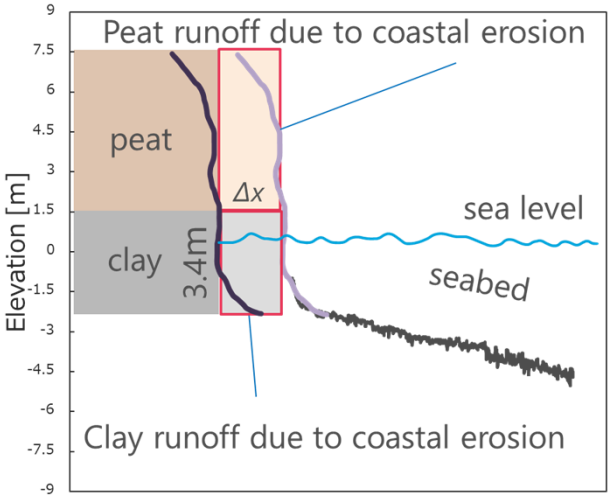


Elevation



Carbon storage





Conceptual view of the longitudinal section of the coast

POC discharged load [tC]

$$L_{POC} = 0.0982(h-1.5)^{0.679} l\Delta x$$

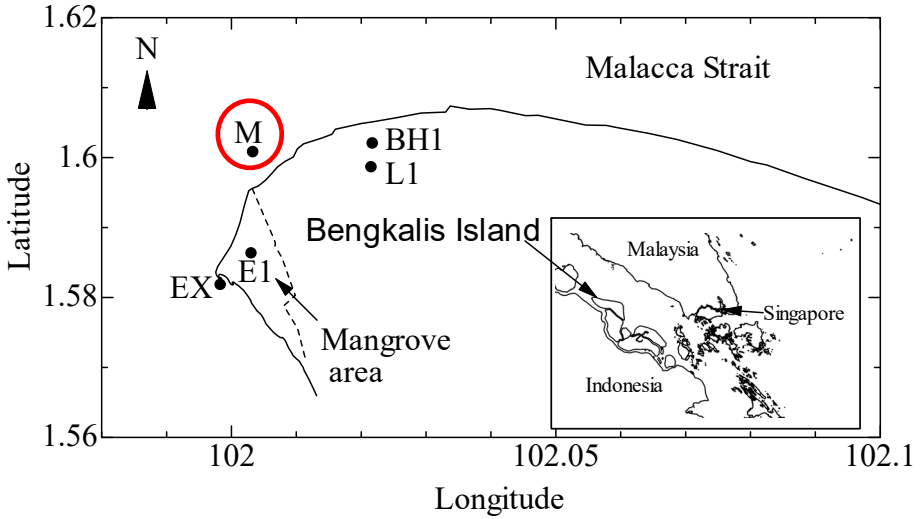
L_{POC} :POC discharged load [m]

l: coastal line length [m]

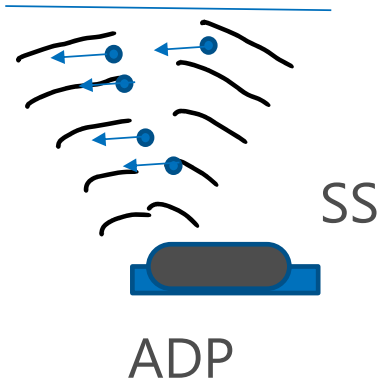
h: elevation [m]

Δx: retreat distance [m]

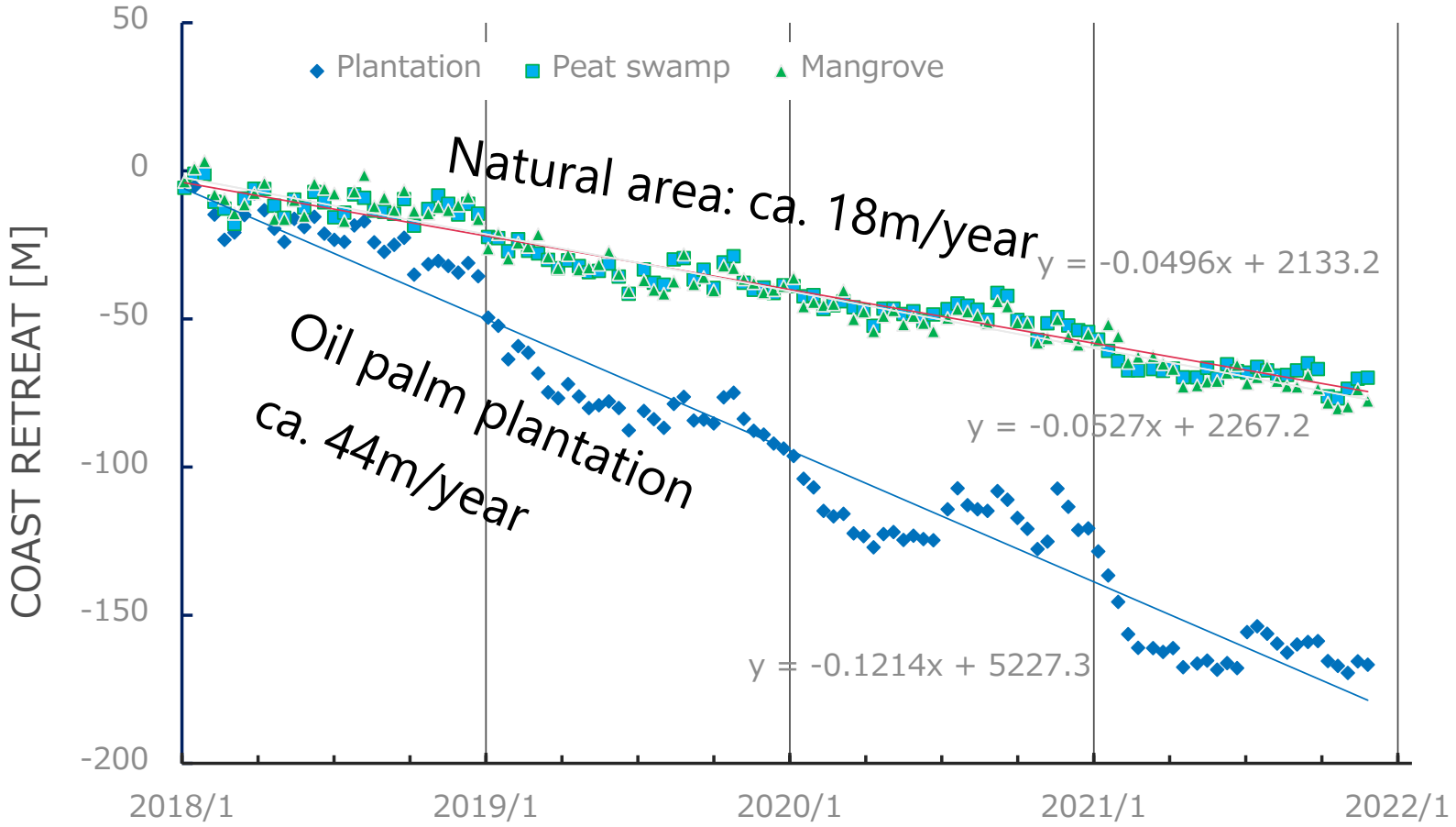
Suspended particle matter flux measurement



- Observation:2019/3/8- 2020/1/11
- ADCP and turbidity meter moored on the seabed at Point M
- The calculated cross section was a cross-section connecting the coast and point M.



Estimated results of peat coast retreat in Bengkalis Island, Indonesia



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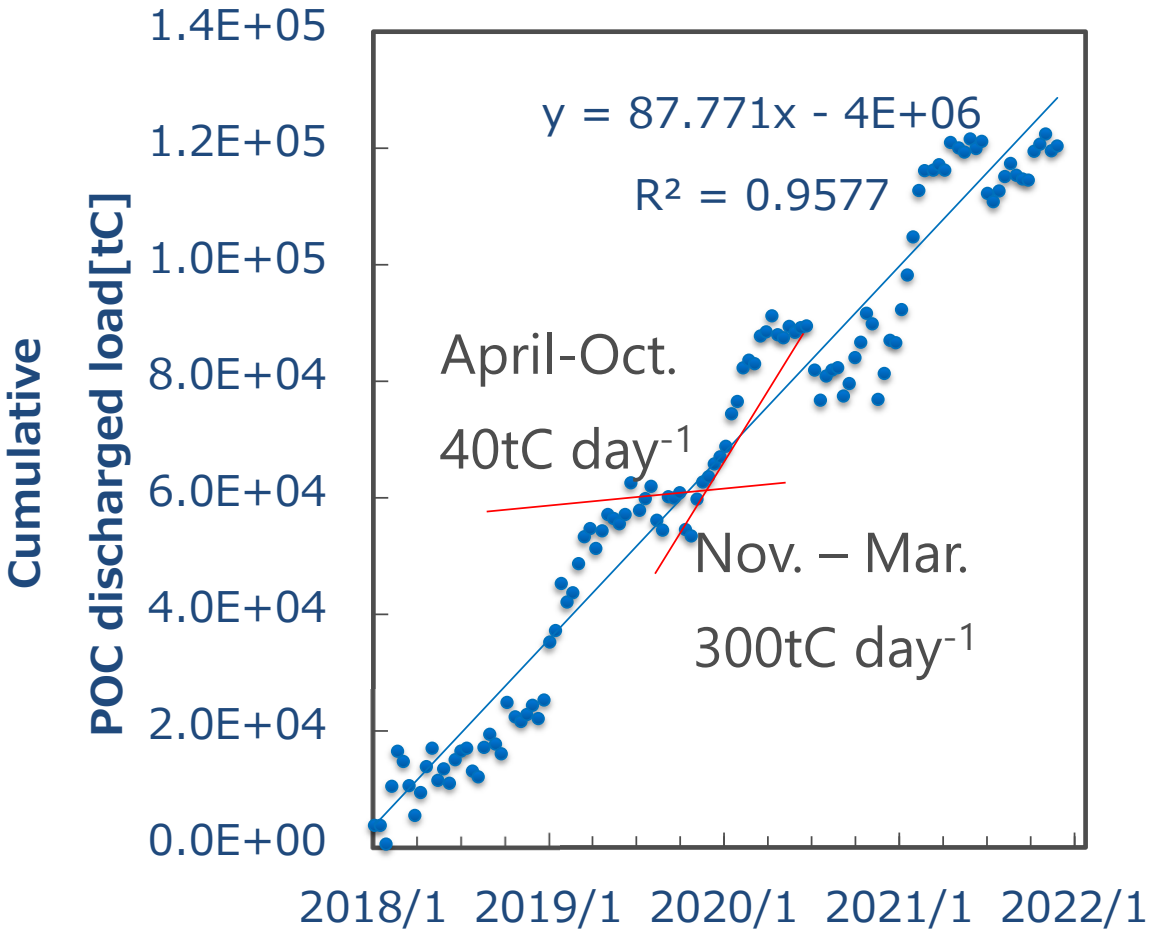
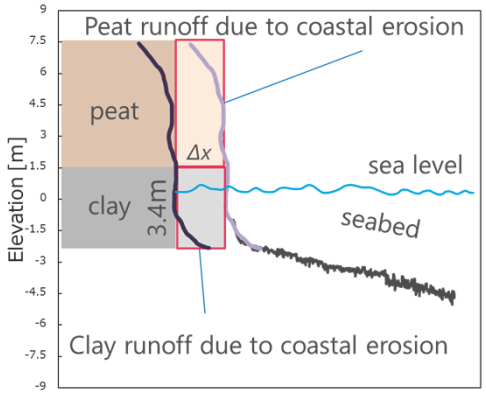
Estimated particulate organic carbon discharge by coastal erosion of oil palm plantation in peatland of Bengkalis Island



Oil palm field section: 2213m

Daily discharged POC load: 88tC day^{-1}

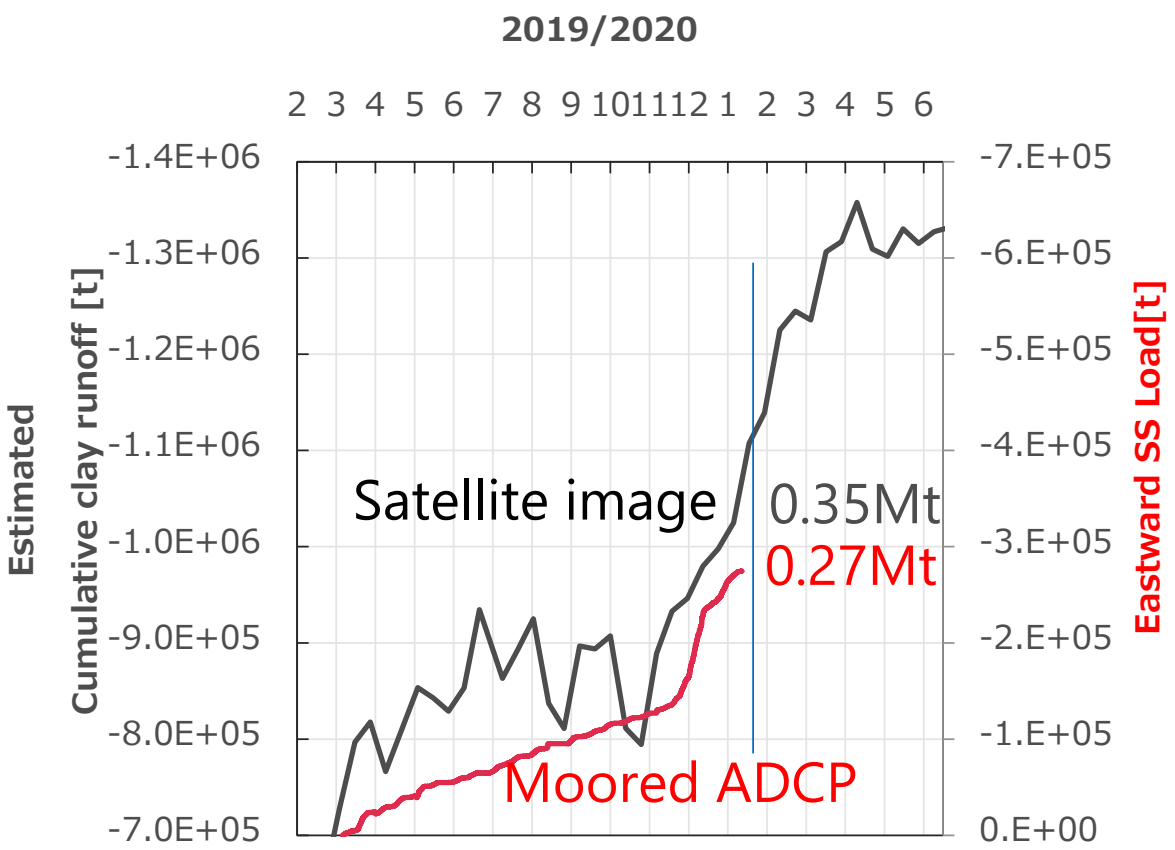
Annual POC runoff per coastal line: 15tC m^{-1} y^{-1}

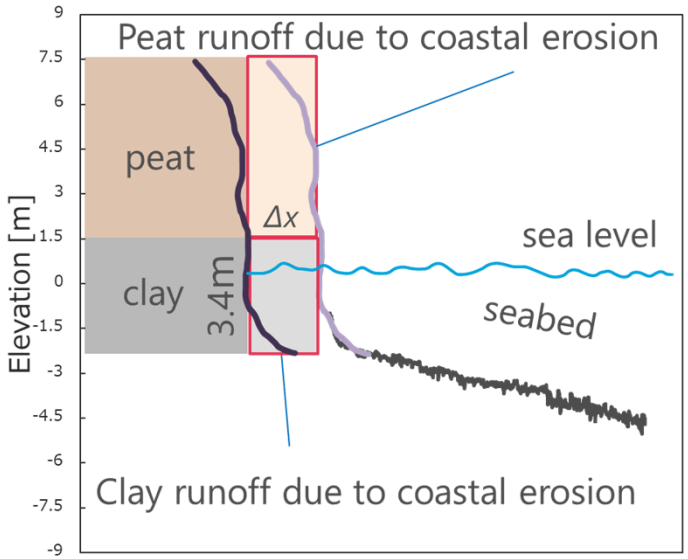


Conceptual view of the longitudinal section of the coast

Results: Comparison between satellite based estimated clay runoff and Eastward SS load measured by moored ADCP

$$L_{clay} = 3.4\rho_s l \Delta x$$





Conceptual view of the longitudinal section of the coast

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Conclusions

- Suspended organic carbon runoff loads were estimated in active tropical peatlands of coastal erosion.
- In winter, coastal erosion intensified and the runoff load tended to increase.
- The erosion rate of oil palm fields was about twice that of the natural area.
- Annual organic carbon runoff load associated with erosion of oil palm fields on Bengkalis Island reached 15 tC per 1m of coastline and 33 ktC per year on the entire oil palm coast.

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