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The State of the Art and Science of Coastal Engineering

Eco-System Based Beach Erosion Control By Berm Nourishment Combined With Buried Sand Tube

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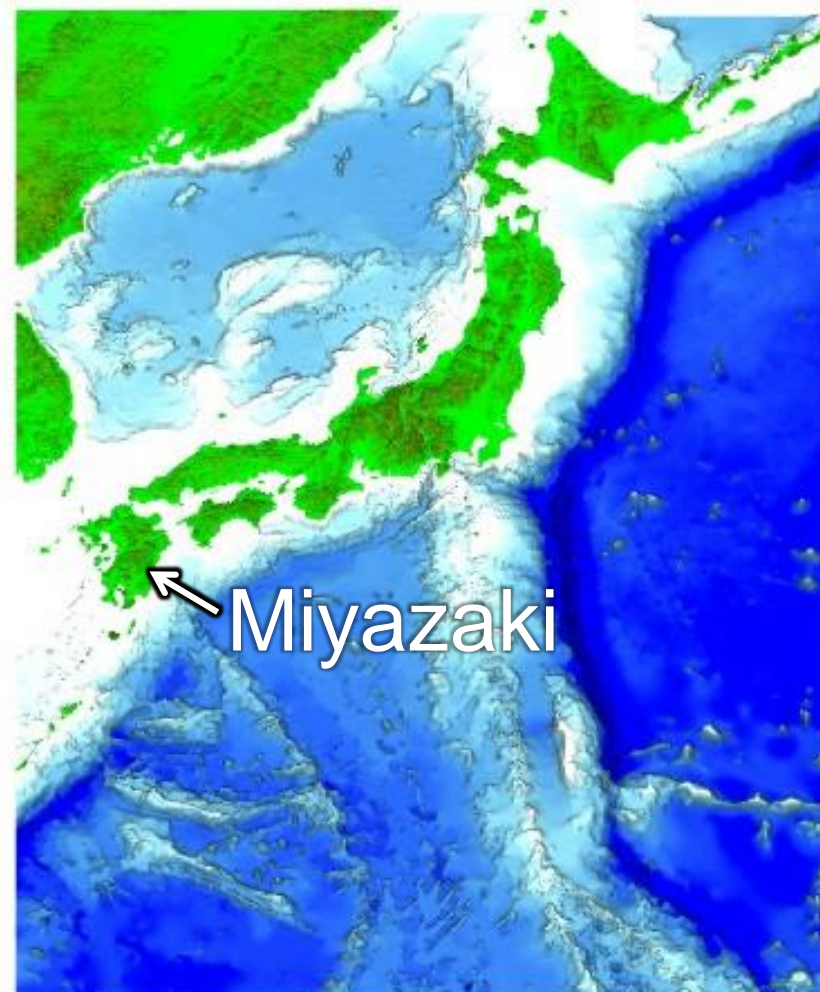
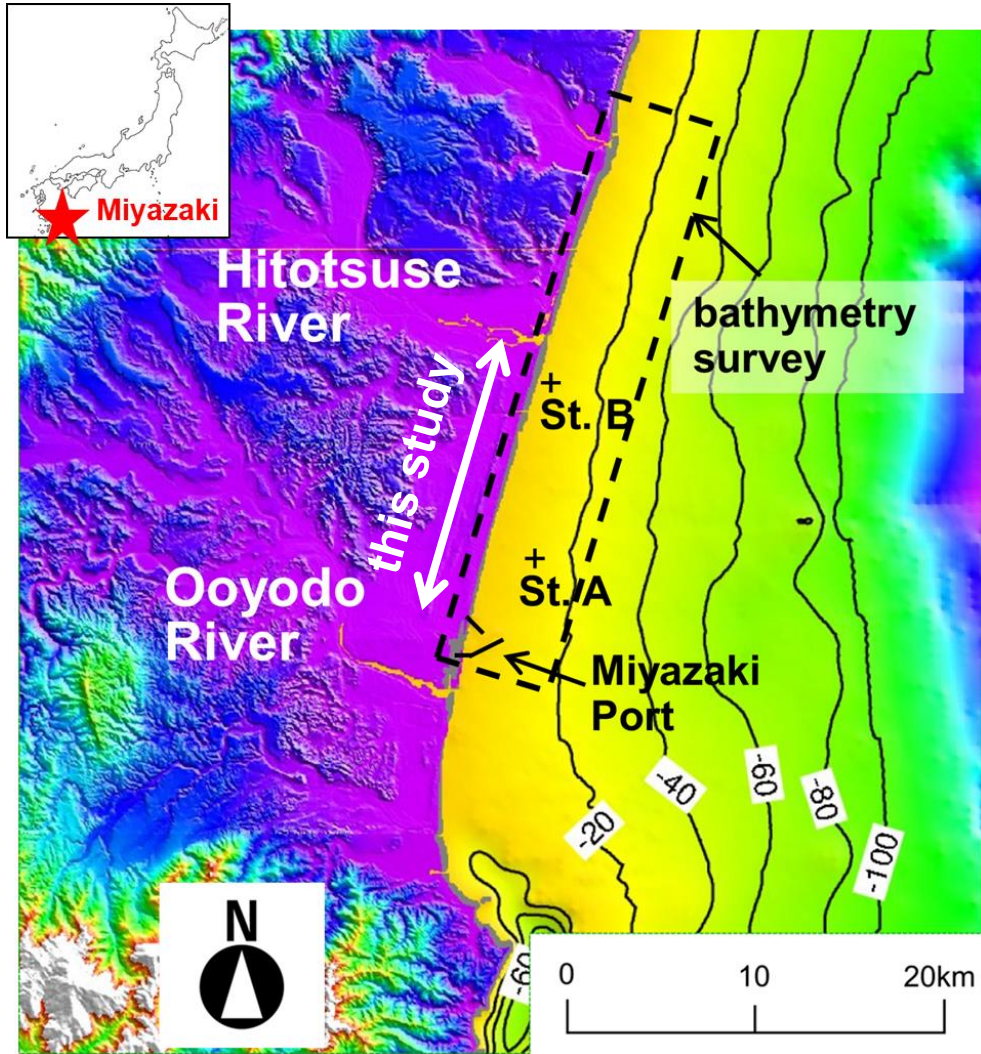
Civil Engineering Department, Miyazaki University

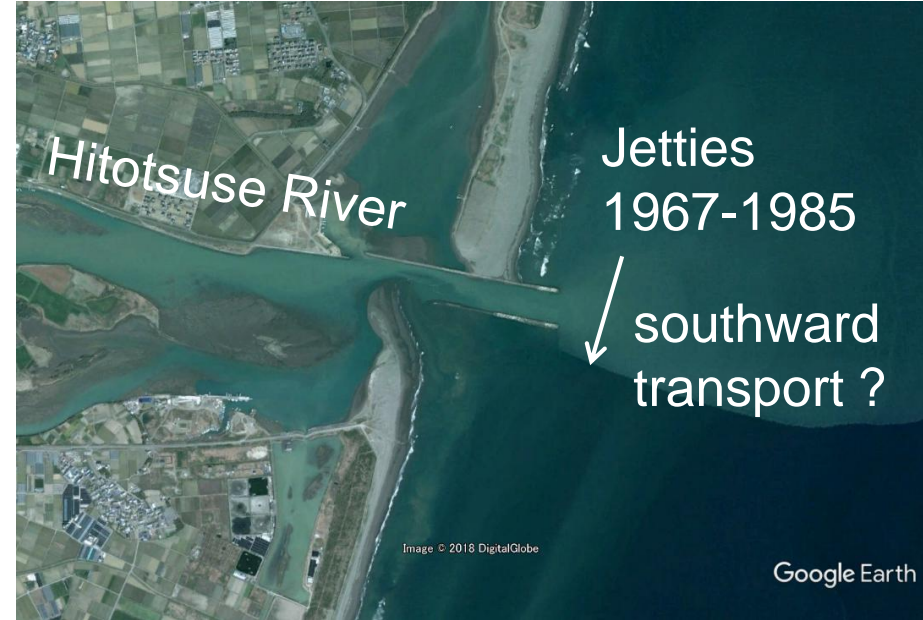
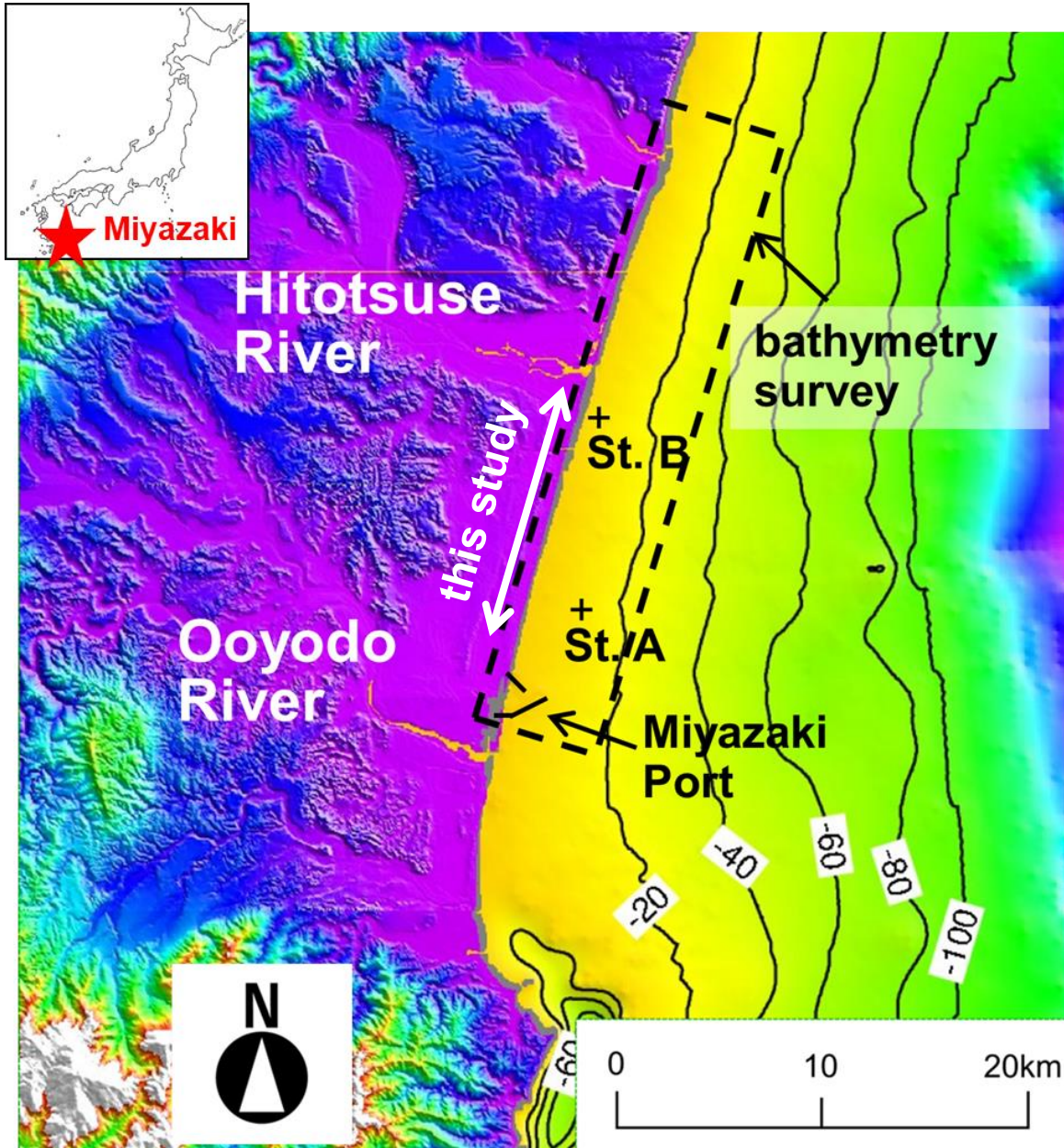
Shin Hashimoto, D.E.

Engineer, Token Consultant, Co. Ltd.

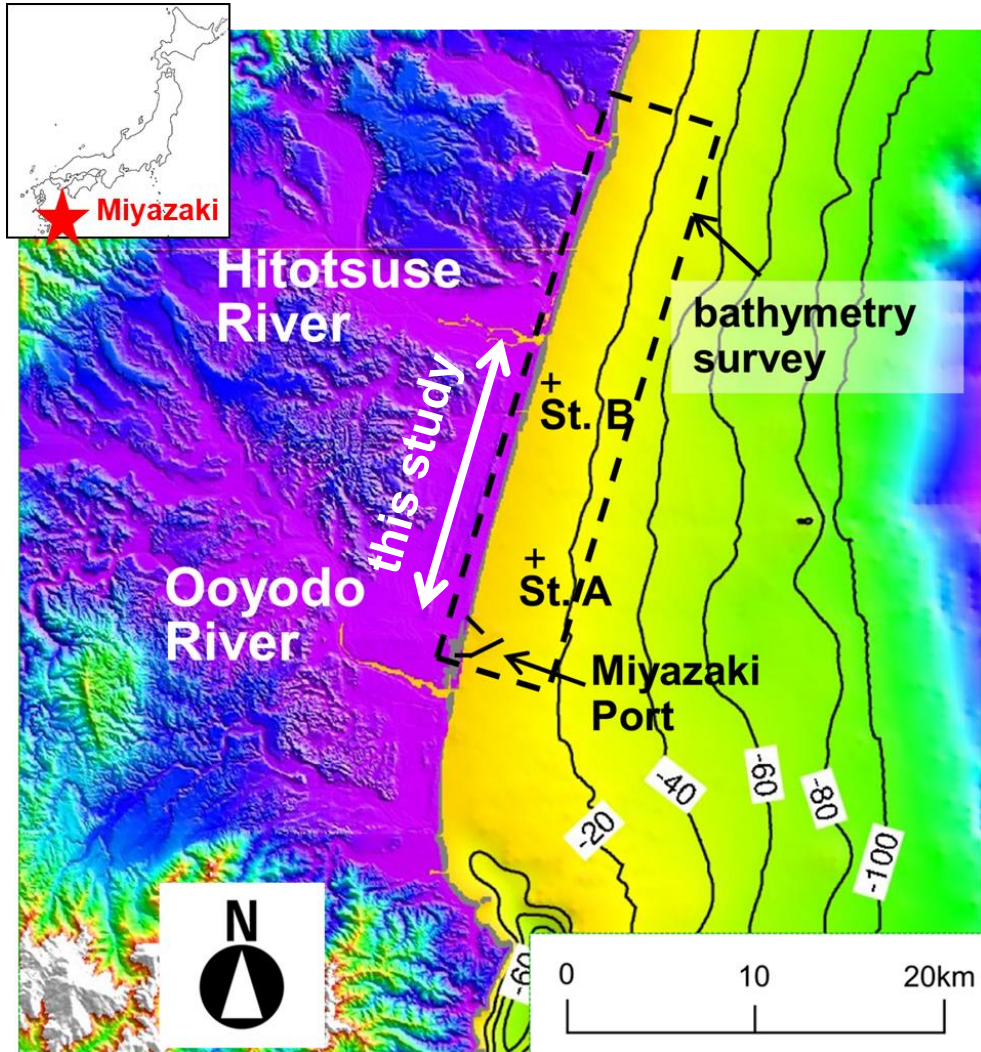


- ✓ 20km beach
- ✓ Ooyodo River and Hitotsuse River
- ✓ severe erosion since 1985





✓ structures alone cannot mitigate erosion



Sumiyoshi

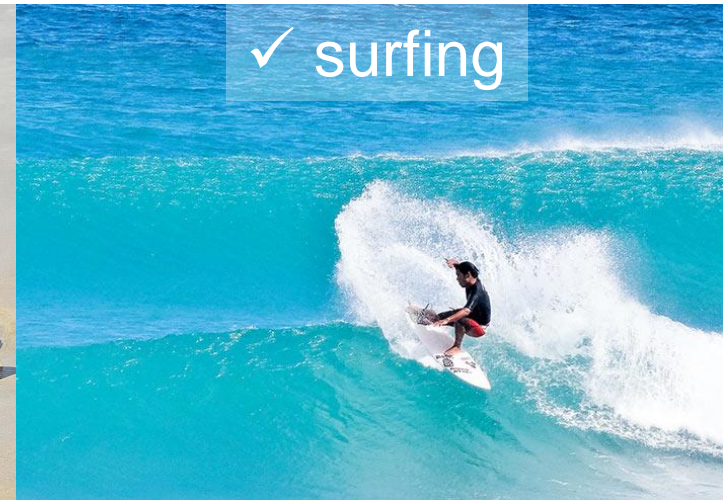
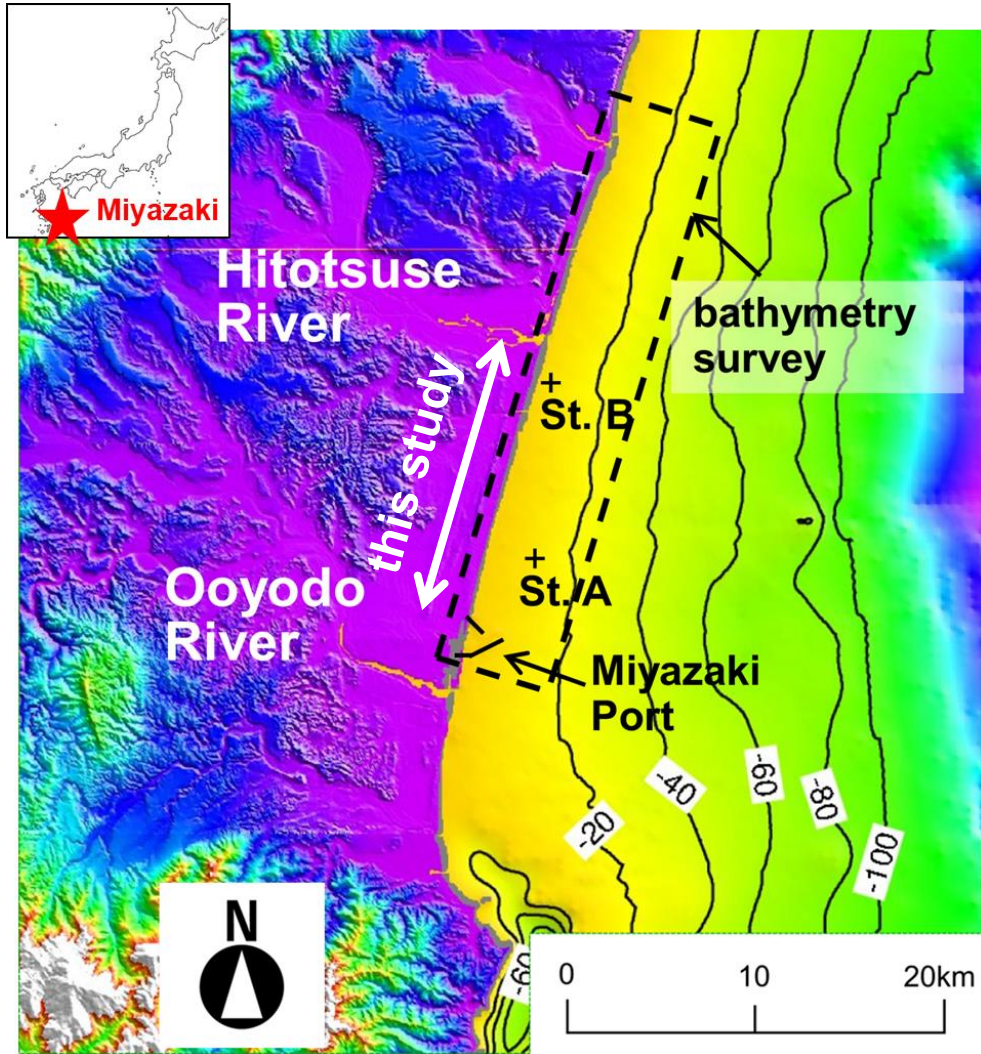


Aoshima



Akae

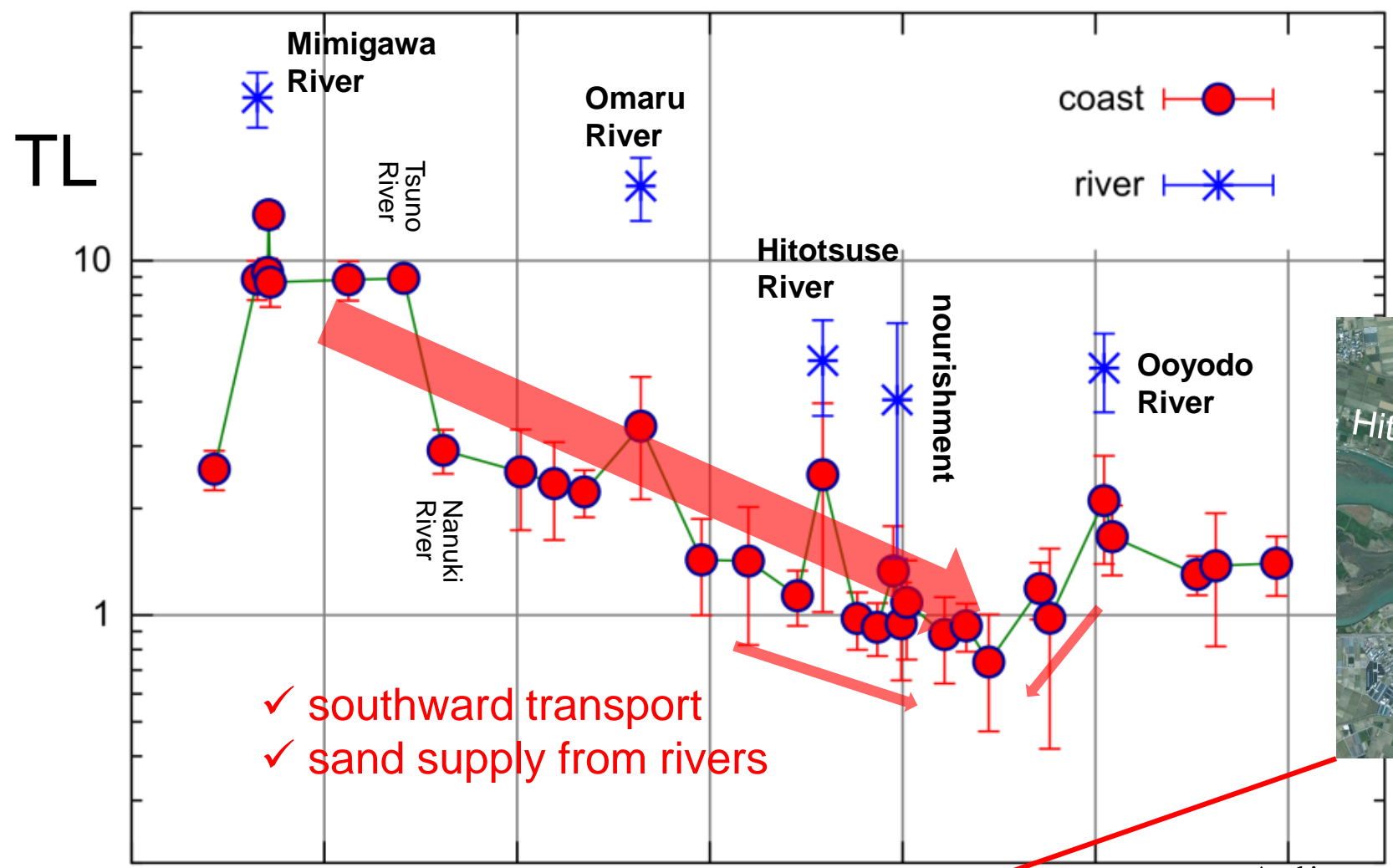




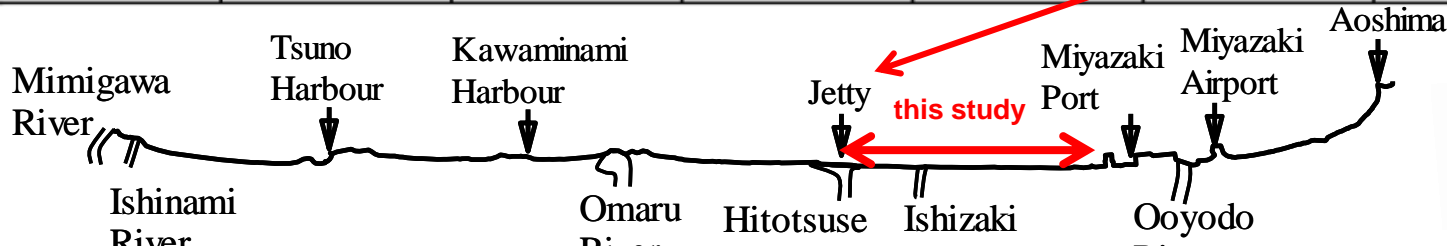
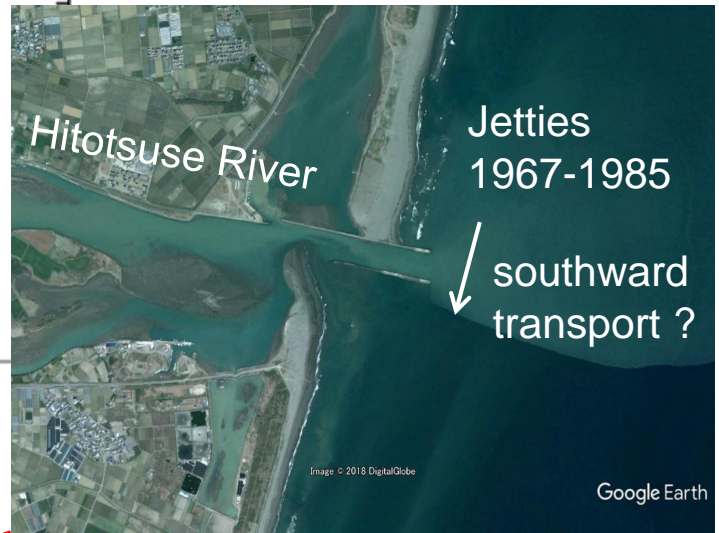
No more concrete!

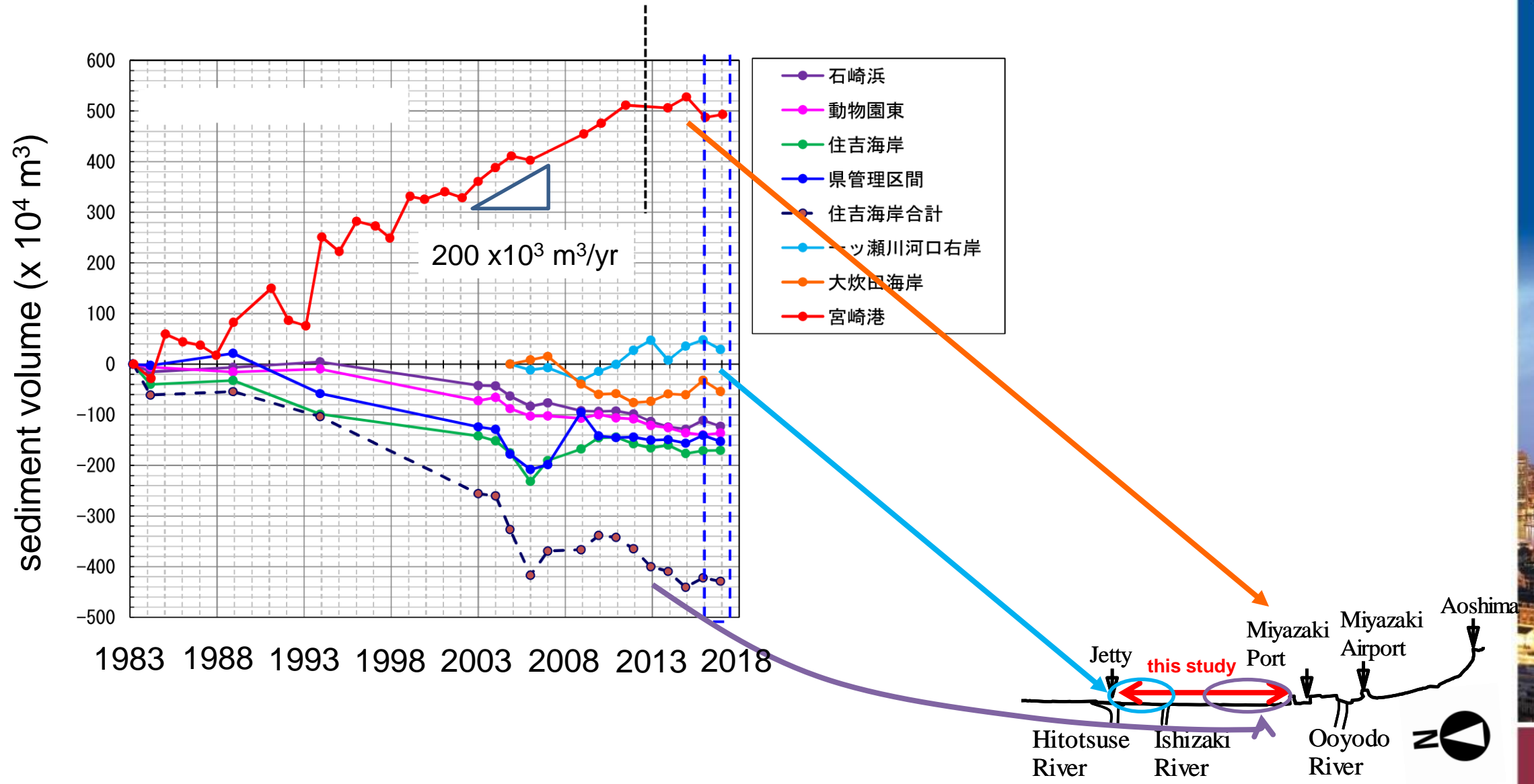


TL intensities of Feldspar particles (Sato et al., ICCE 2010)

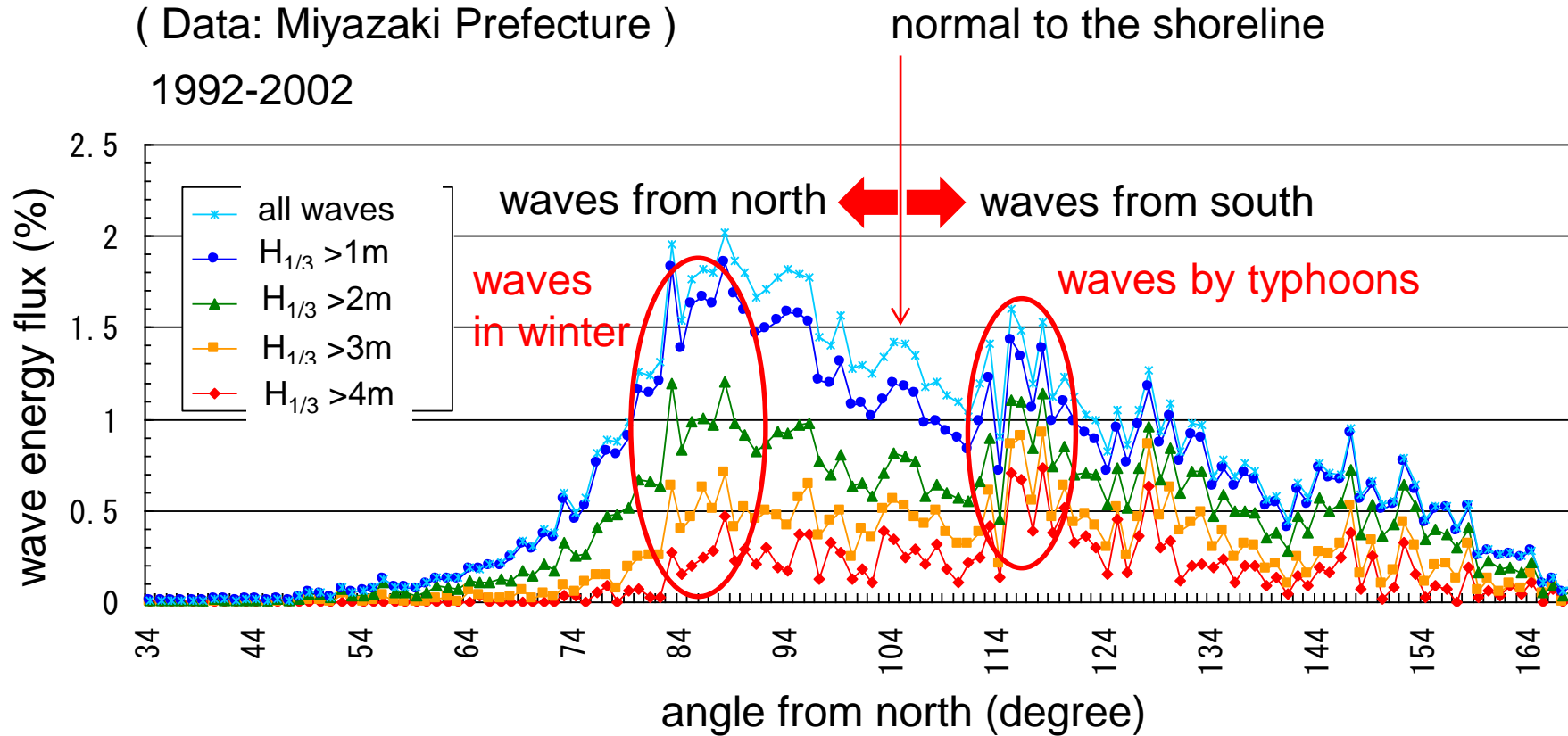


✓ southward transport
 ✓ sand supply from rivers





(Data: Miyazaki Prefecture)
1992-2002



✓ contribution by typhoons ?



Consensus building

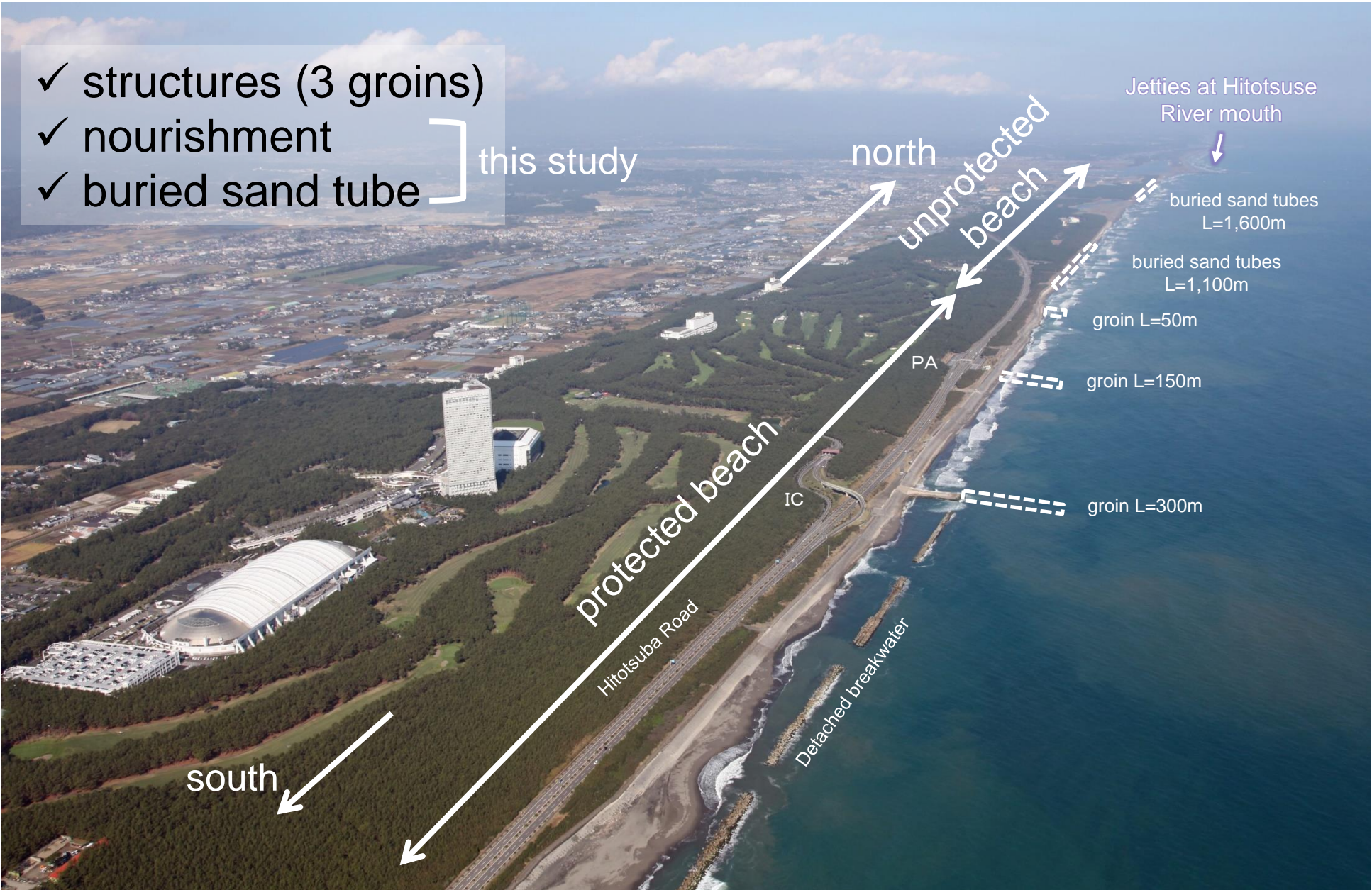
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Erosion control plan (2011)

- ✓ structures (3 groins)
- ✓ nourishment
- ✓ buried sand tube

this study



Erosion on unprotected beach

Oct 11, 2014



Oct 13, 2014

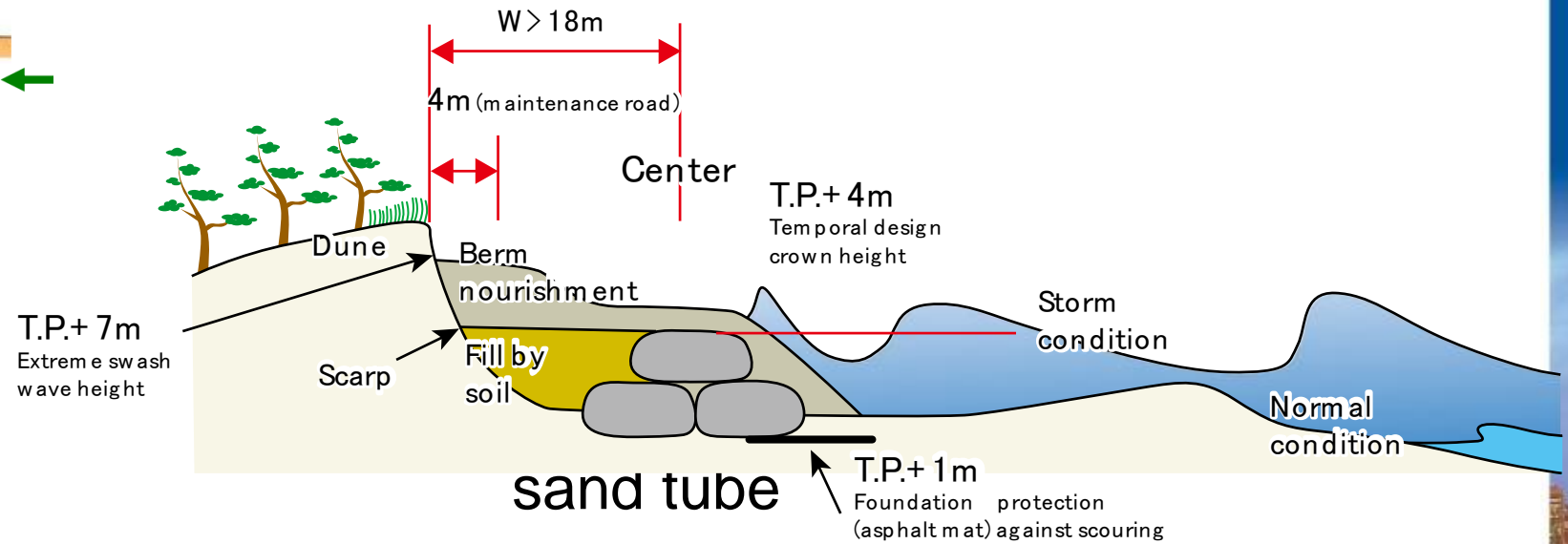
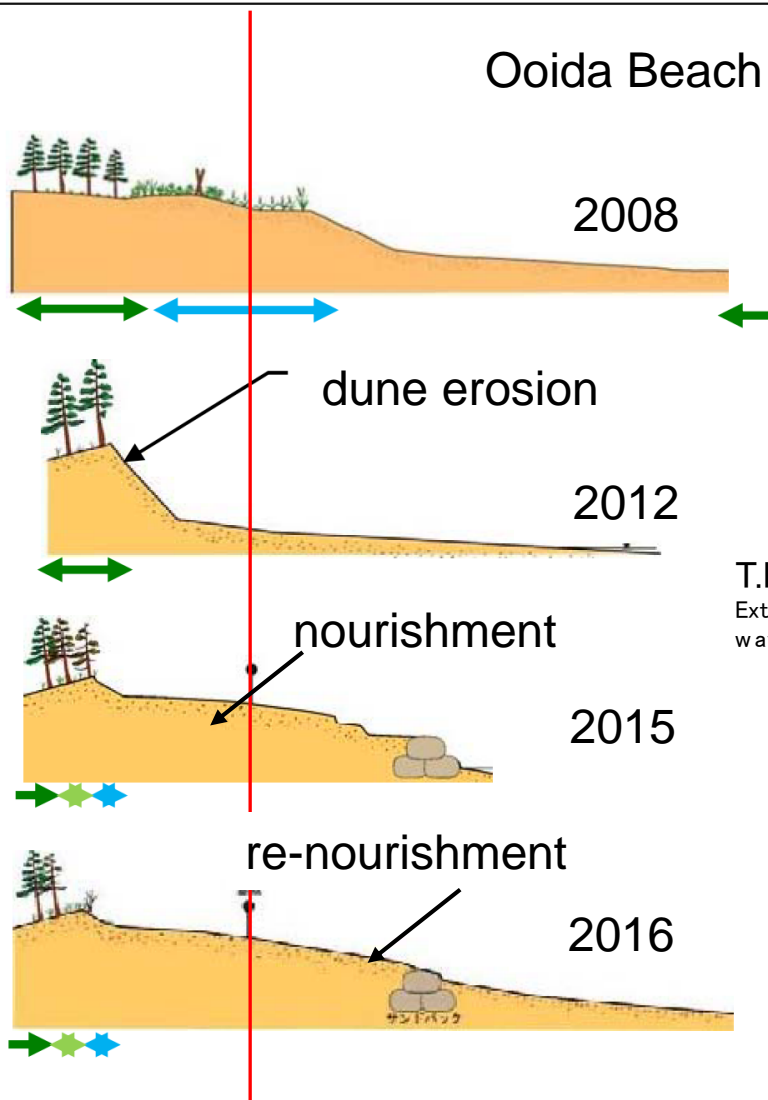


Impact of typhoon waves on long-term erosion ?

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Buried sand tubes (2013-)



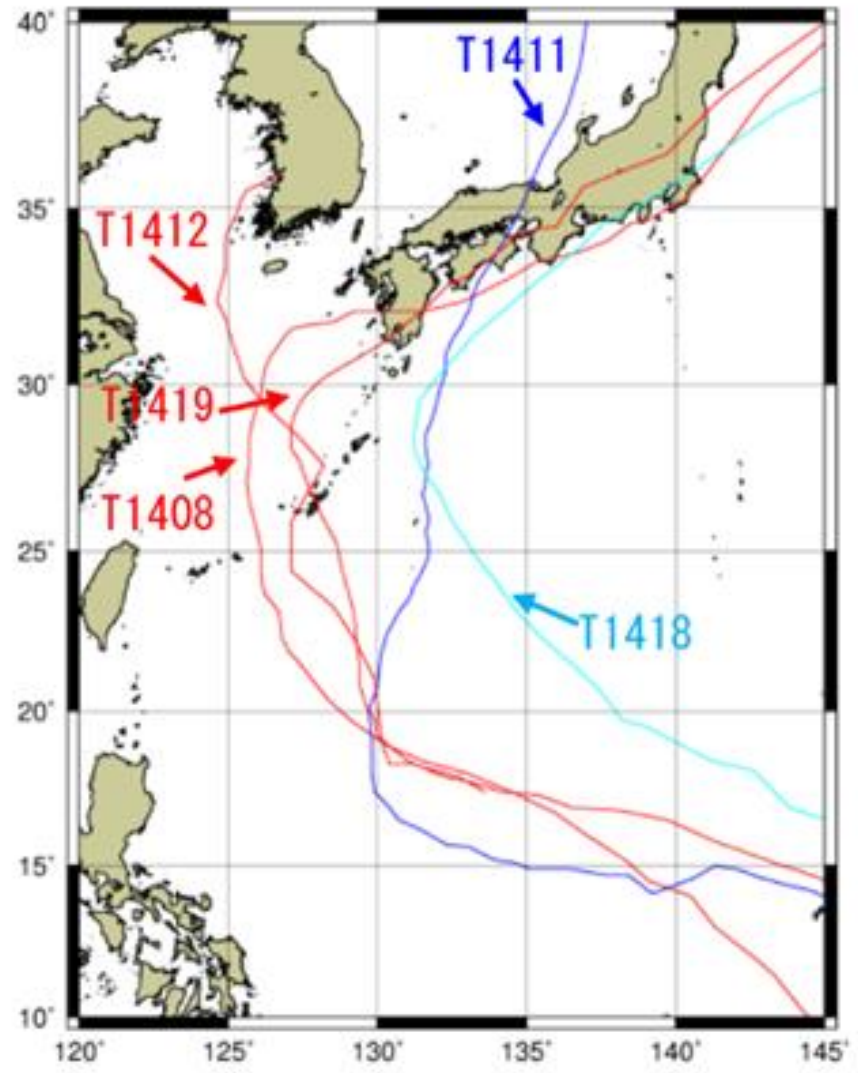


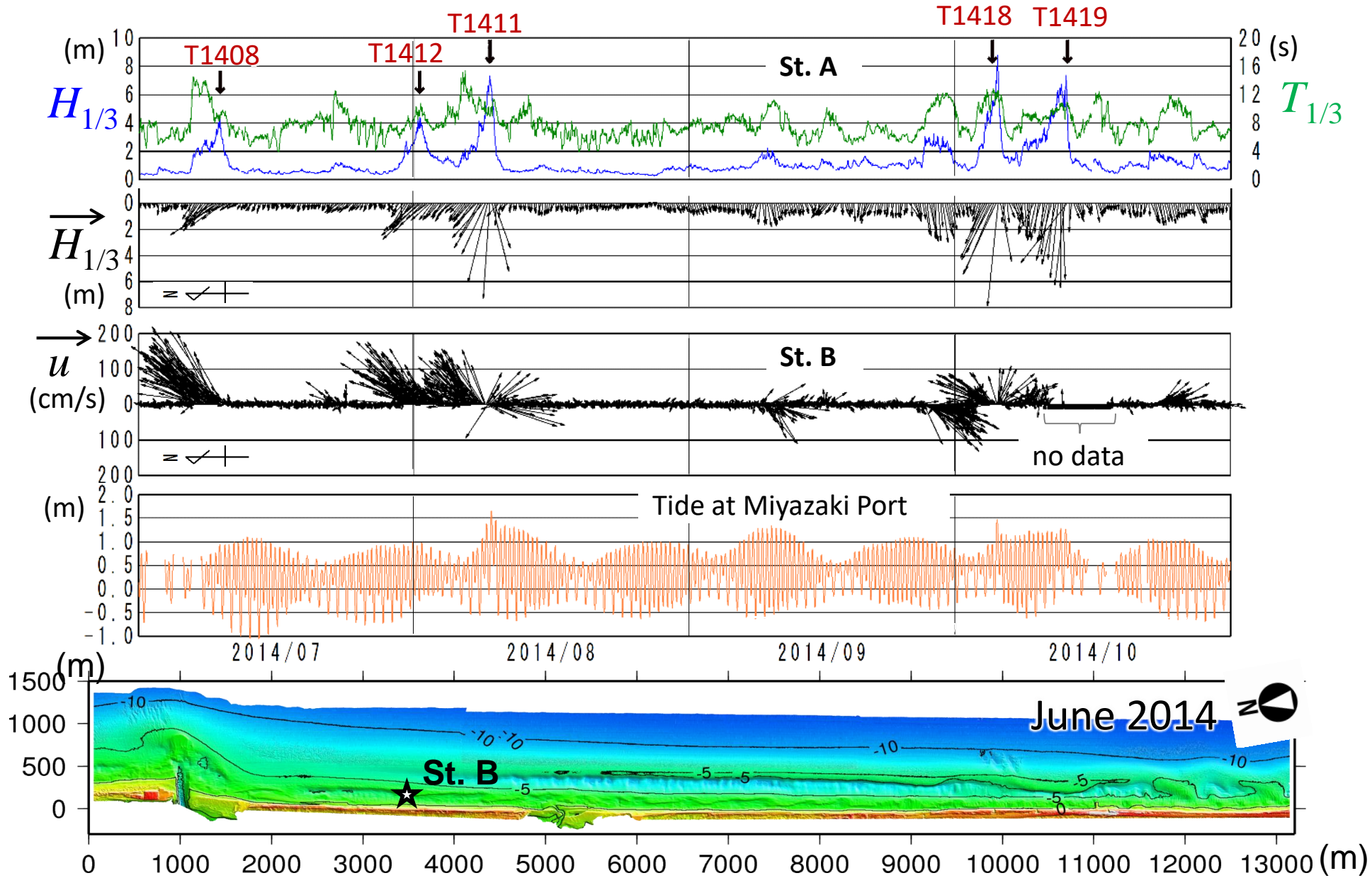
Sand tubes buried by nourishment

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Five typhoons affected Miyazaki in July-October 2014





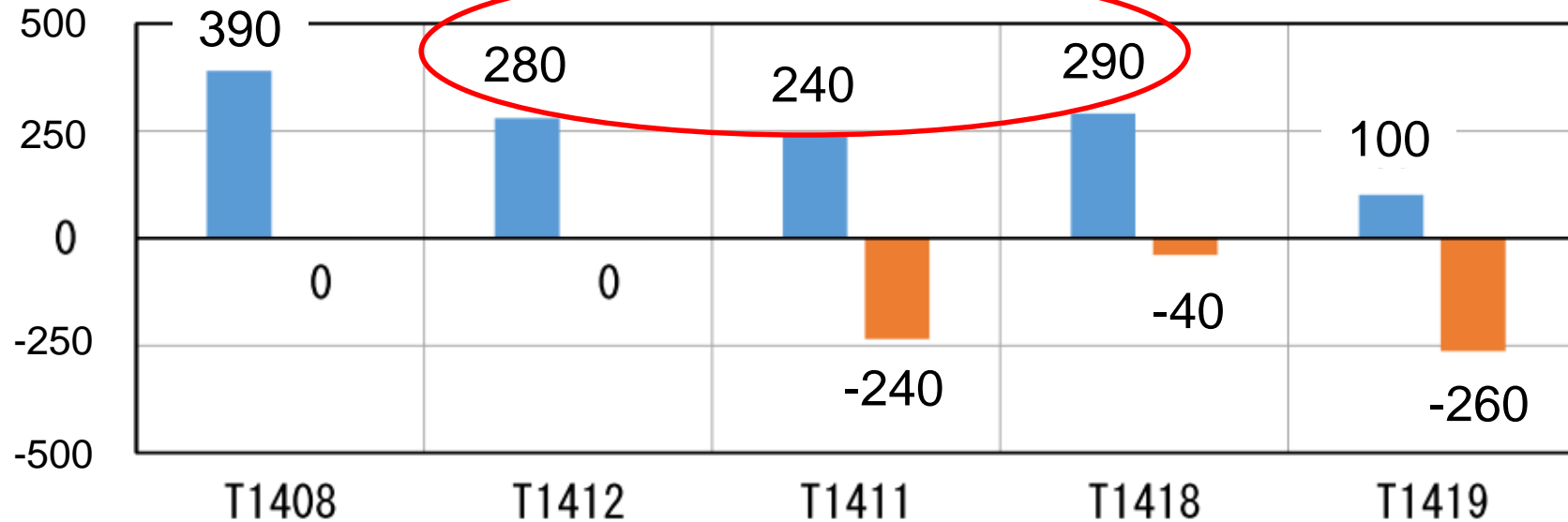
Kraus et al. (1982, ICCE)

$$Q = \frac{3.8 \times 10^4}{\gamma \tan \beta} H_b^2 \cdot V$$

as large as long-term annual southward transport $\sim -200 \times 10^3 \text{ m}^3$

Sand volume
($\times 10^3 \text{ m}^3$)

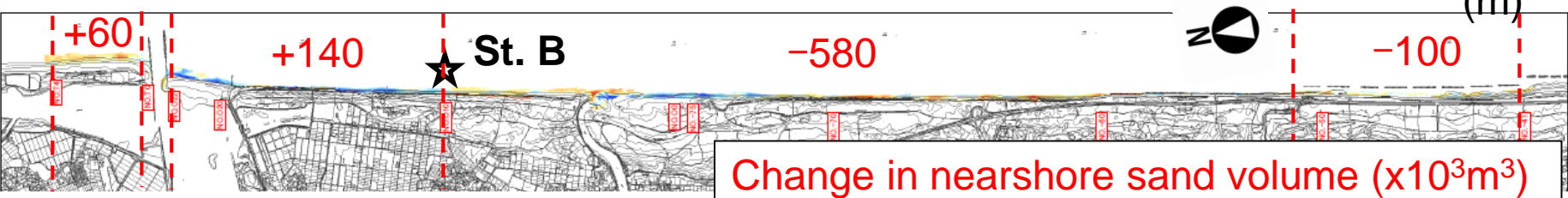
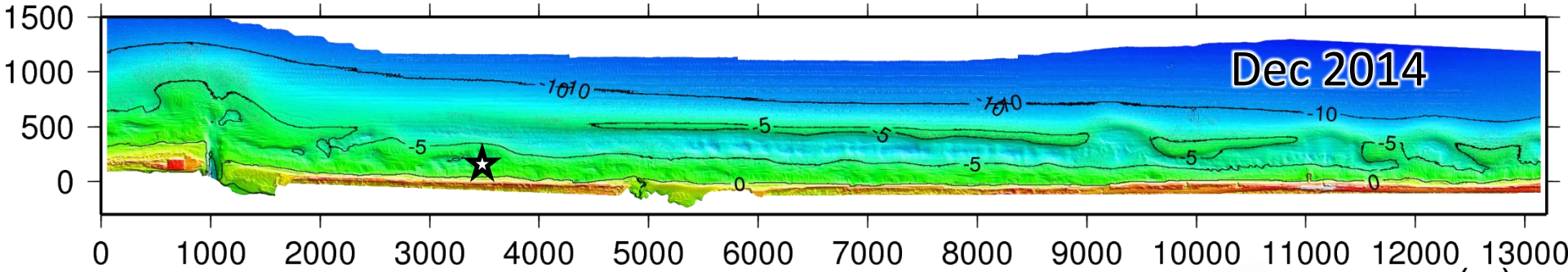
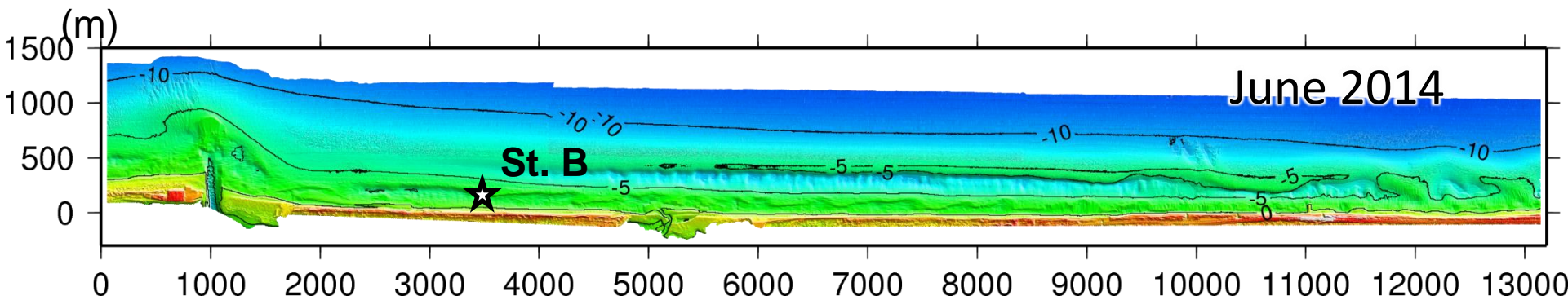
north
↑
↓
south



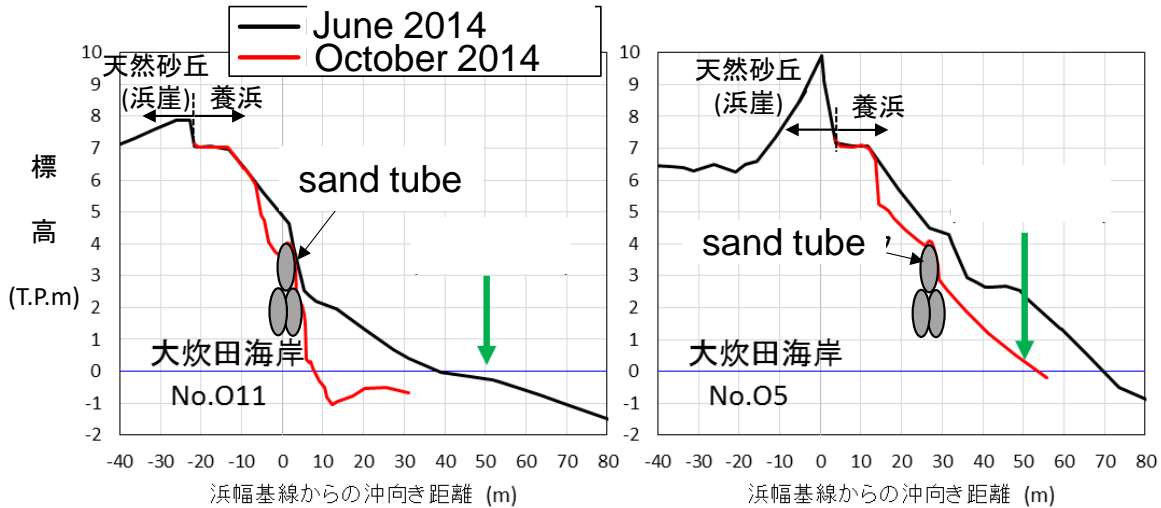
Northward sand transport by five typhoons
 $\sim 760 \times 10^3 \text{ m}^3$



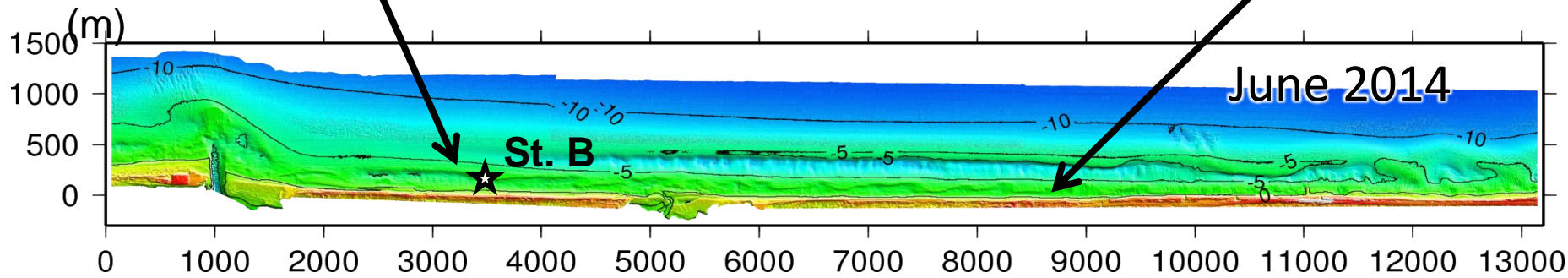
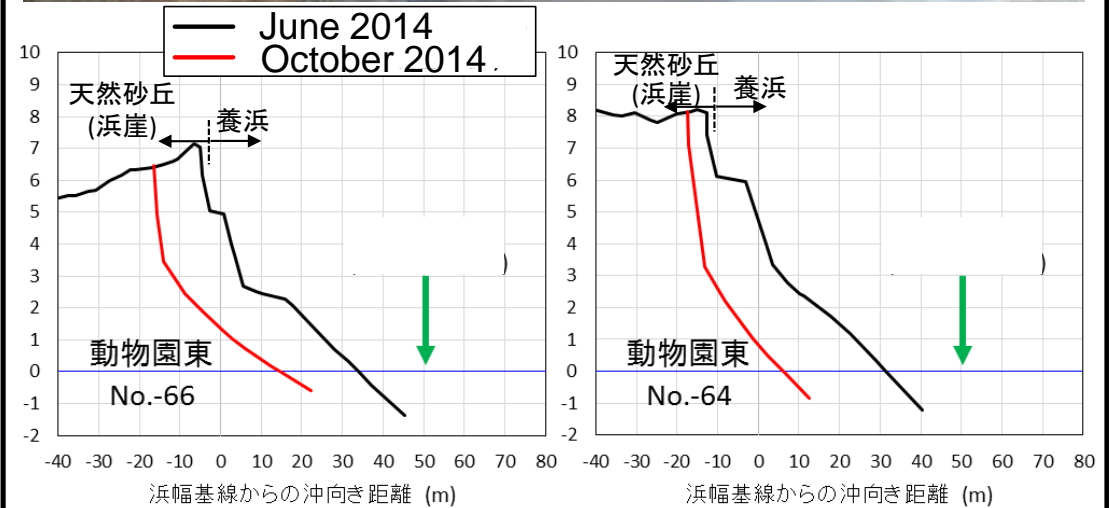
Northward sand transport $>10^5\text{m}^3$ by five typhoons



Nourishment + Buried sand tube



Nourishment only



Buried sand tubes exposed by typhoon storms



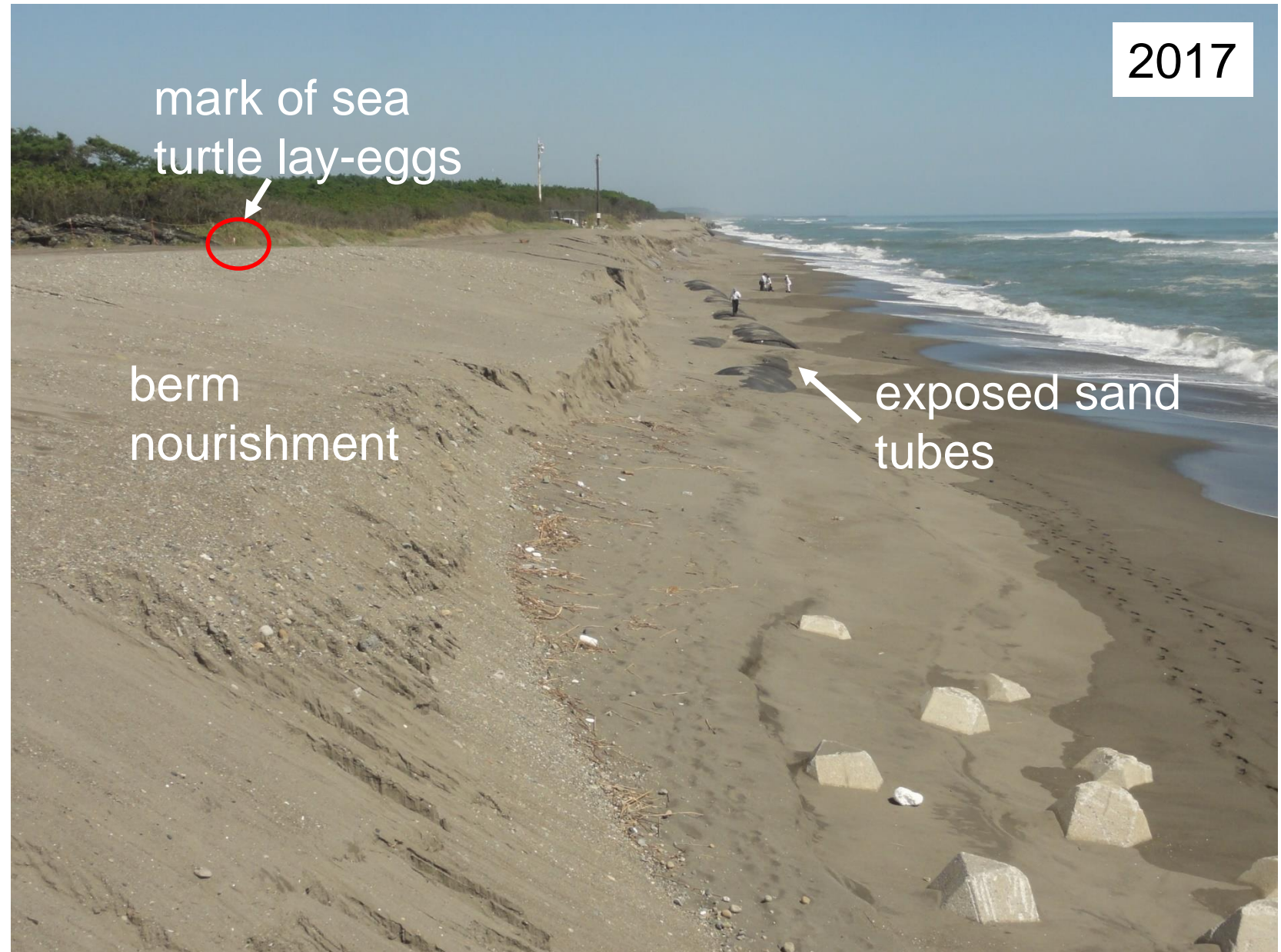
Buried sand tubes exposed by typhoon storms

Oct 11, 2014



Oct 13, 2014

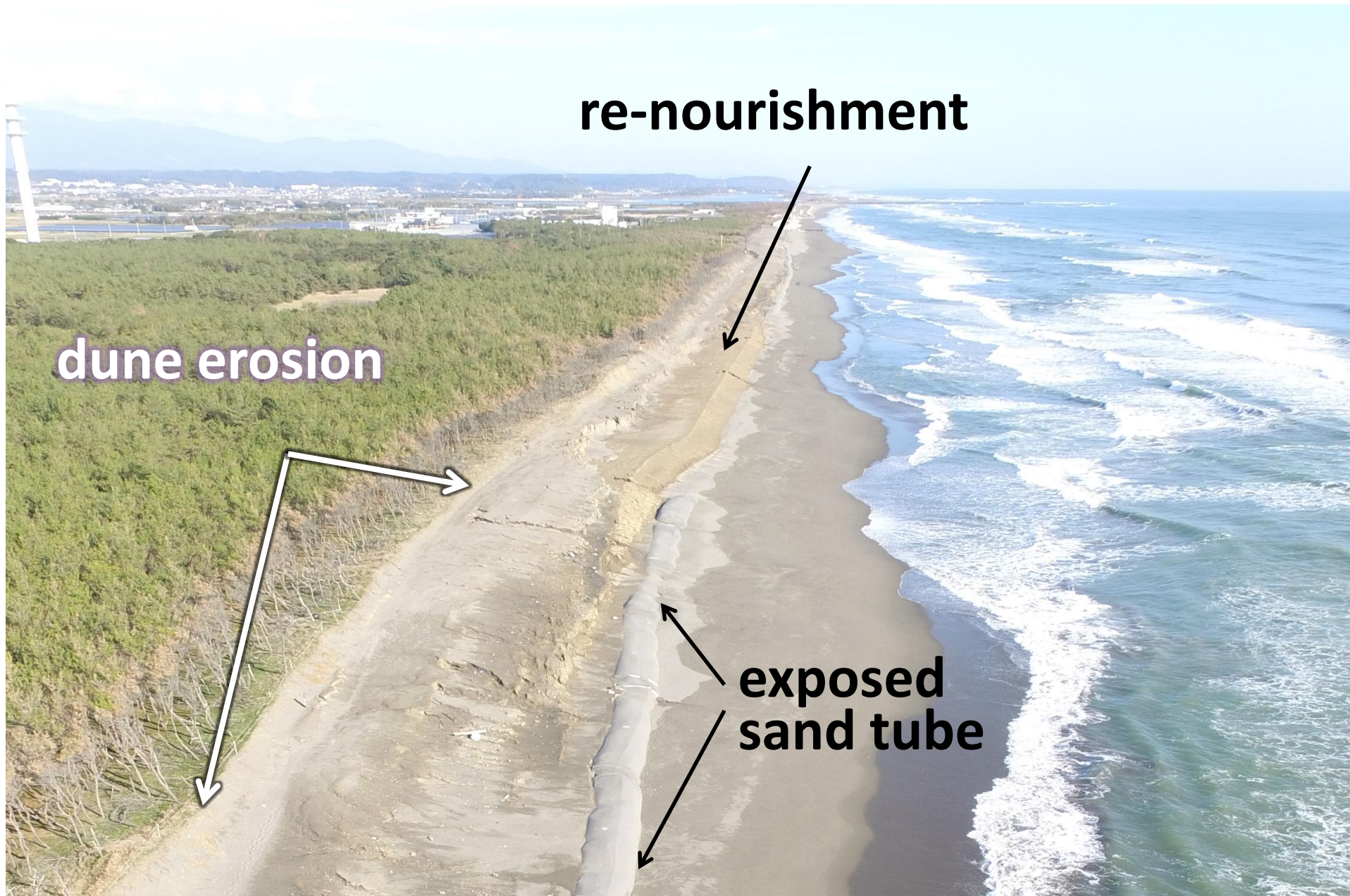




Sea turtle laying eggs on nourished berm

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Eco-System Based Beach Erosion Control By Berm Nourishment Combined With Buried Sand Tube

1. The northward longshore sand transport due to a single typhoon storm was found to be as large as the annual southward longshore sand transport, thus causing rapid dune erosion.
2. Eco-system based control works, berm nourishment with buried sand tubes, appeared effective to mitigate dune erosion with minimum impact on eco-systems.

