LONG-TERM BAR DYNAMICS USING SATELLITE IMAGERY: A CASE STUDY AT ANMOK BEACH, SOUTH KOREA

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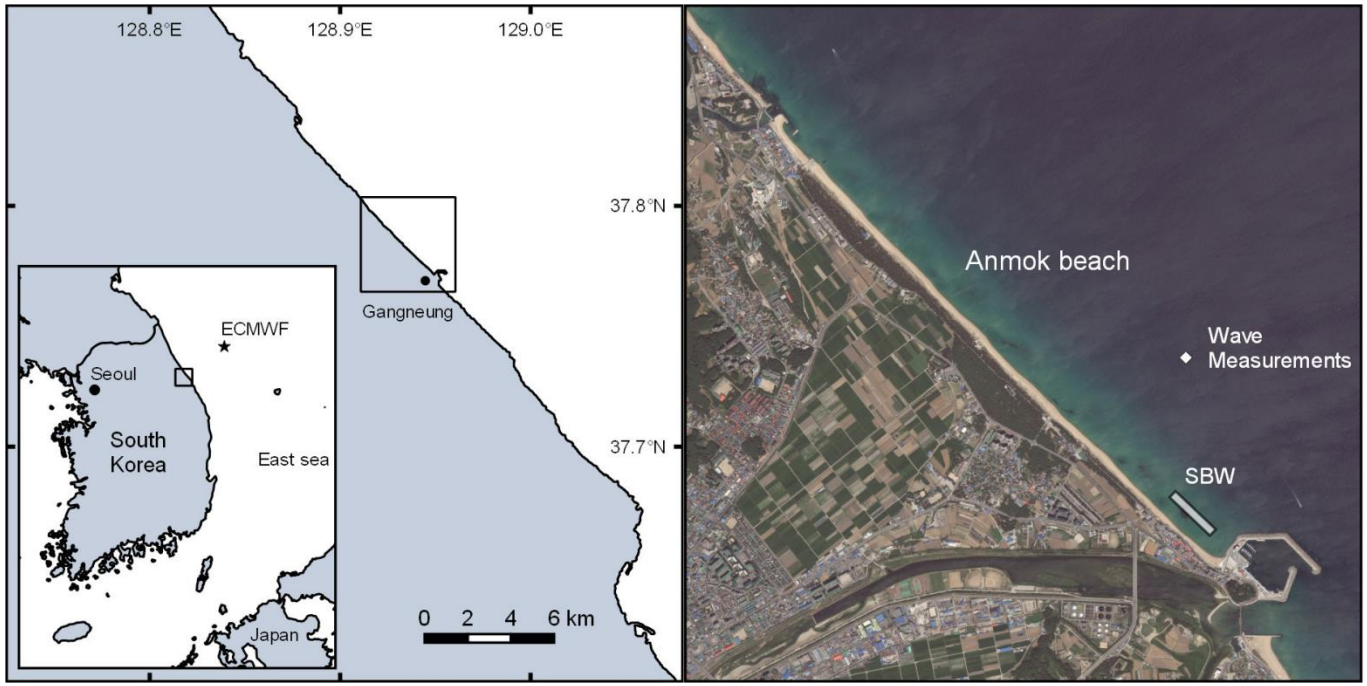
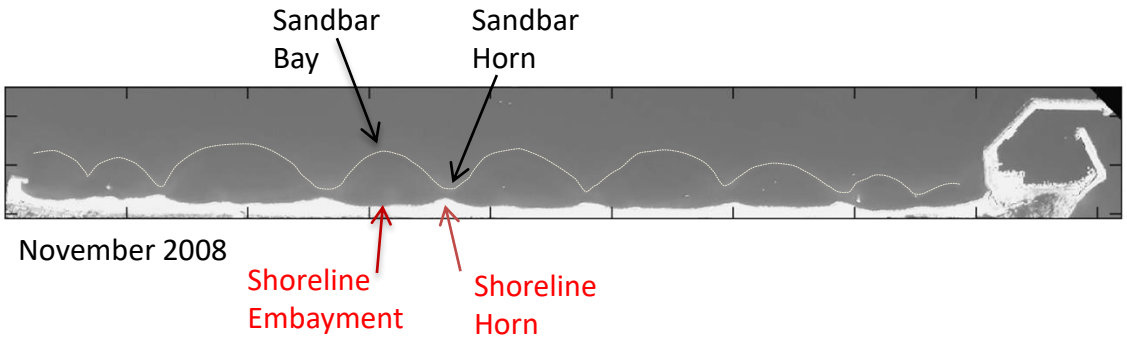
Anmok beach





Introduction – Research questions

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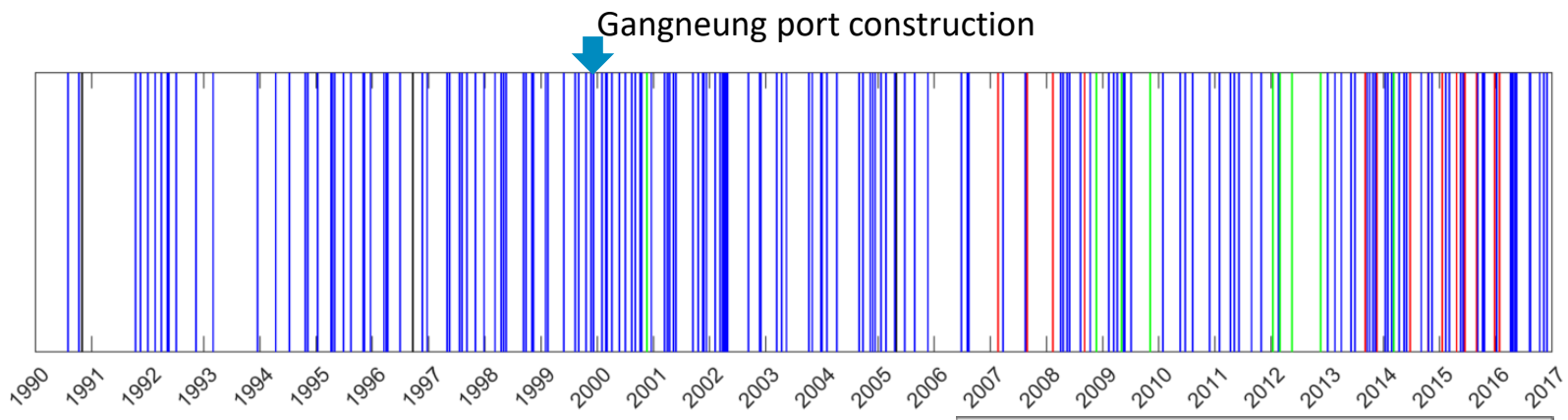
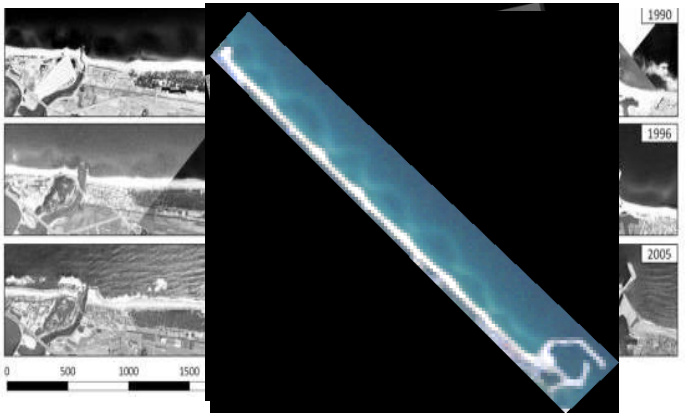
- How to increase the number of sandbar observations at Anmok?
- What are the long-term characteristics of the sandbar patterns?
- What are the long-term dynamics of the sandbar?
- How has the Gangneung port affected the sandbar patterns?
- What is the interaction between the sandbar and shoreline patterns?

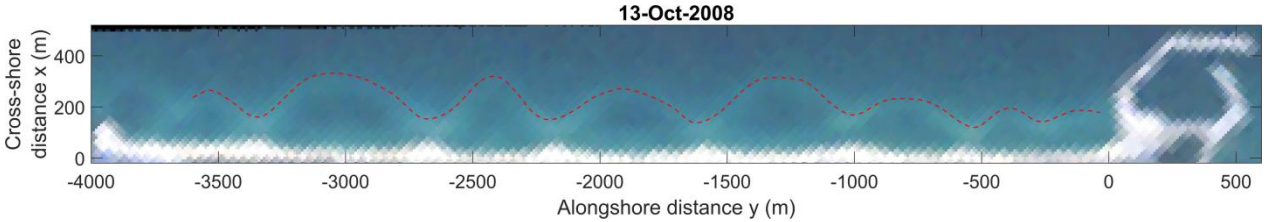
Methods – Sandbar observations



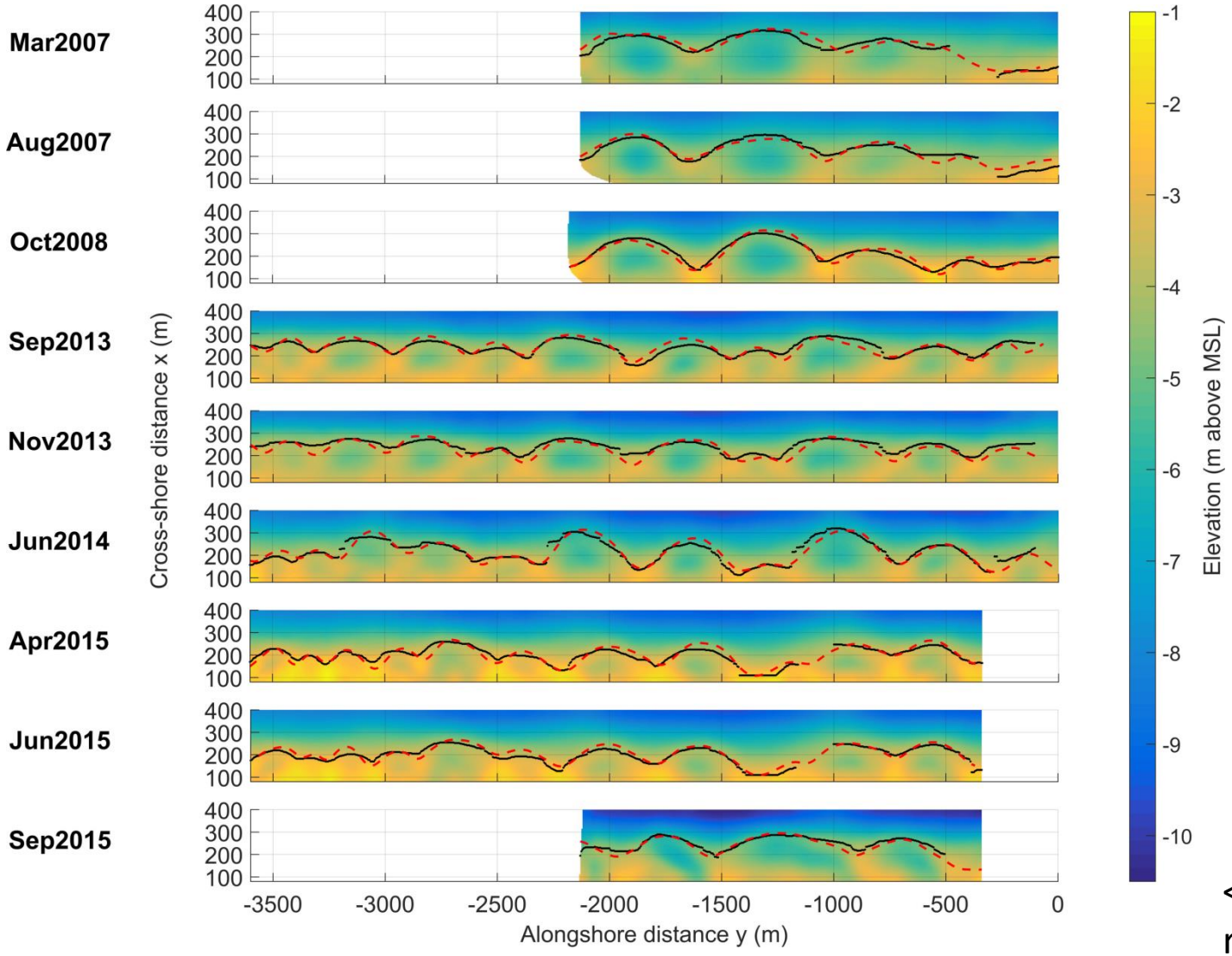
- 14 available surveys
- 3 aerial images
- 9 Arirang Satellite images
- 175 Landsat and Sentinel freely available satellite images



Visually derived sandbar crest line:



Methods - Accuracy of satellite derived sandbar crest lines



$RMSE$: 14.6 – 21.3 m

$\overline{RMSE} = 17.6\,m$

< 30 m Landsat image resolution

Methods – Sandbar characteristics and dynamics

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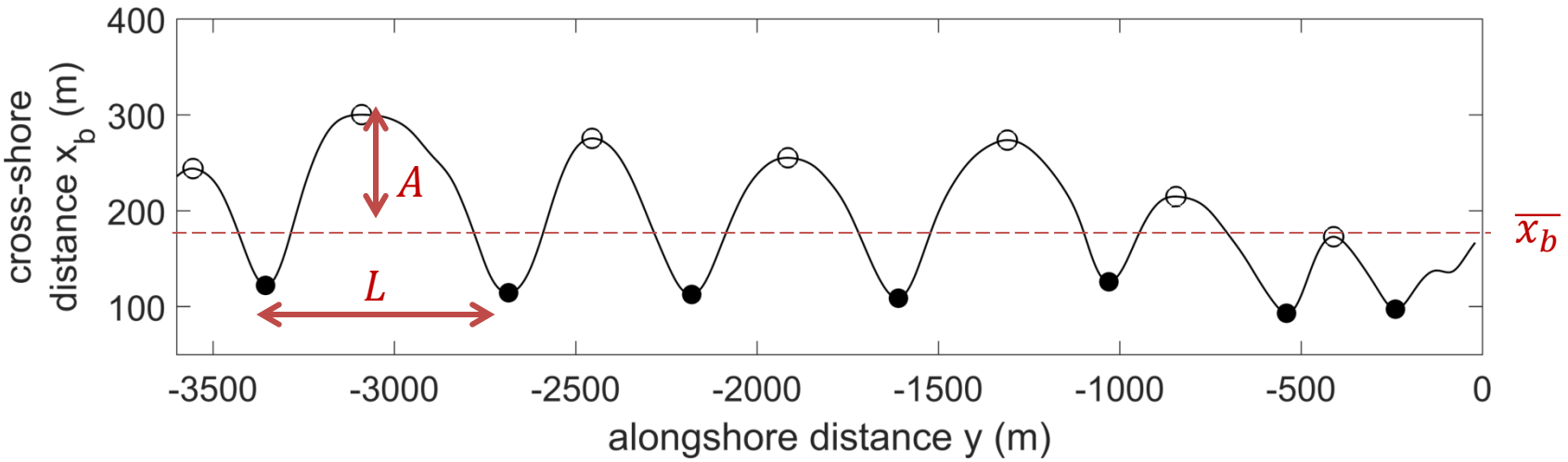
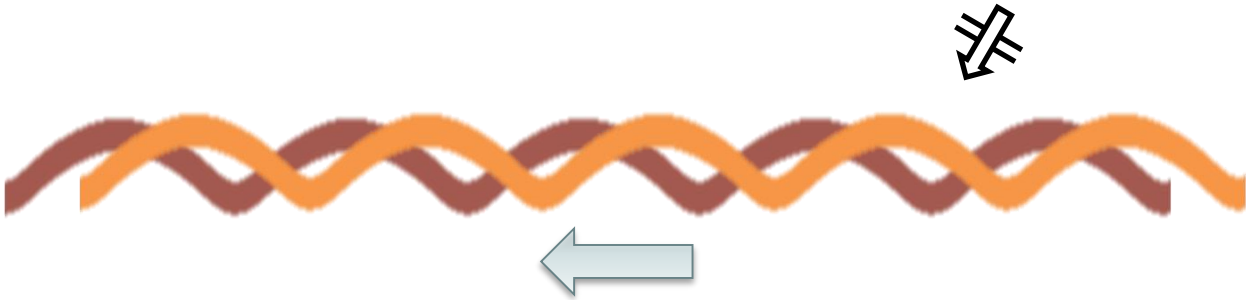
Sandbar characteristics:



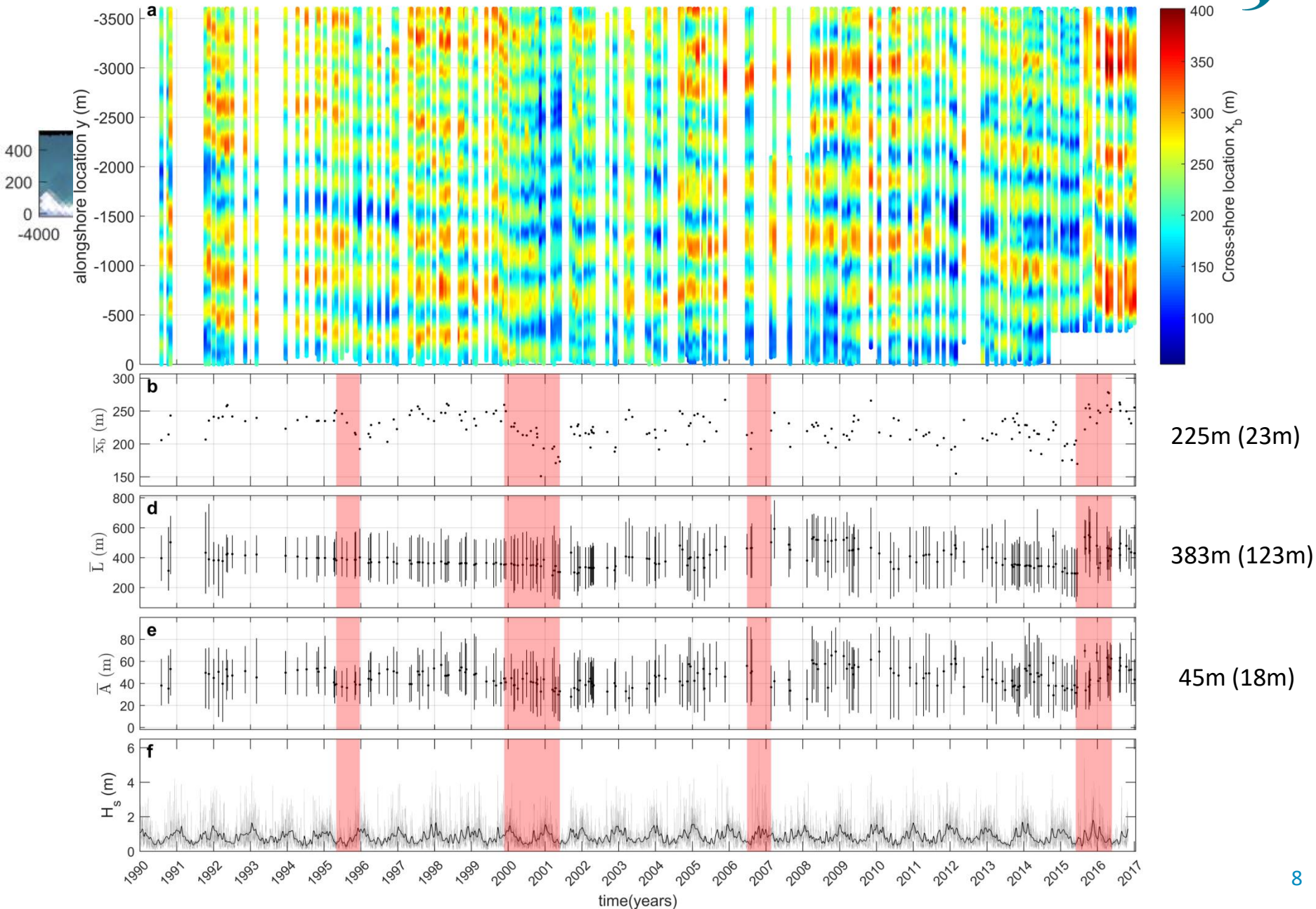
Alongshore migration:



- Migration → Lag with the highest cross-correlation between consecutive observations.

van Enckevort, I.M.J.J., Ruessink, B.G., Coco, G., Suzuki, K., Turner, I.L., Plant, N.G., Holman, R.A., 2004. Observations of nearshore crescentic sandbars. J. Geophys.

Results – Sandbar characteristics and dynamics

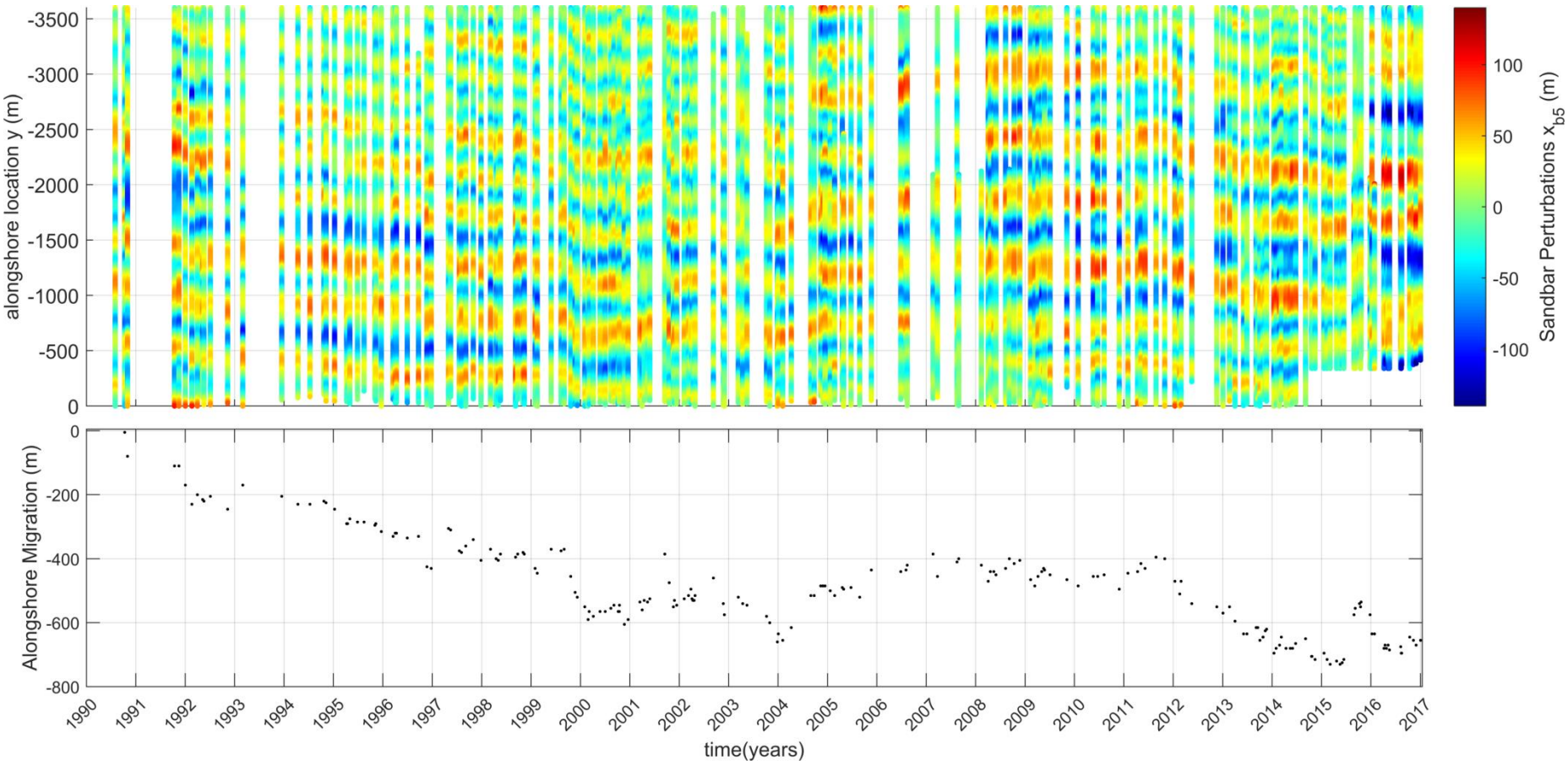


225m (23m)

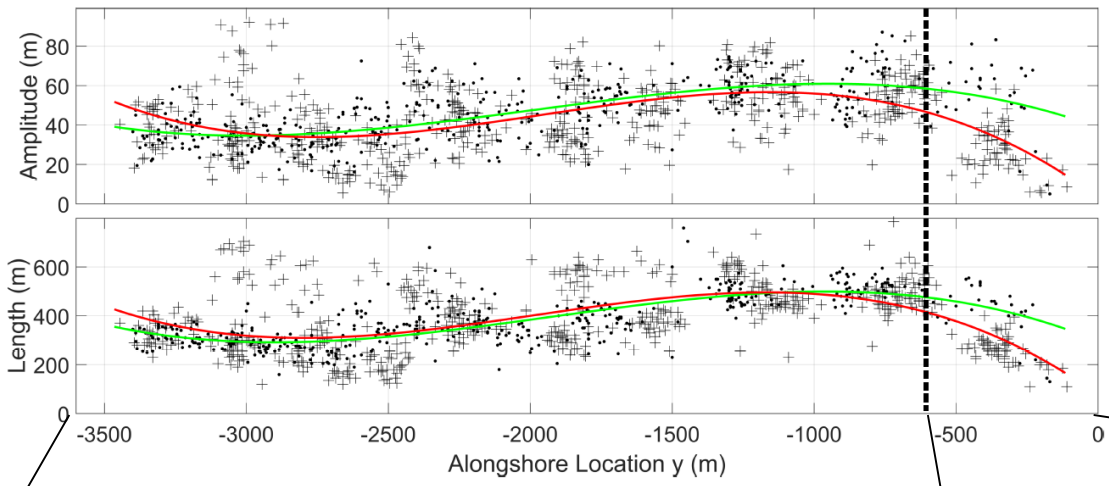
383m (123m)

45m (18m)

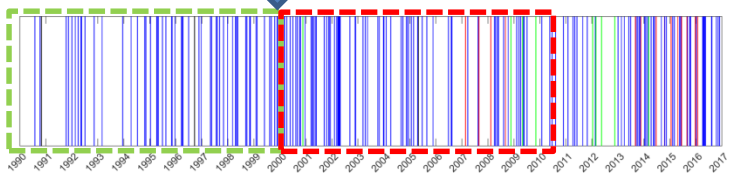
Results - Alongshore sandbar migration

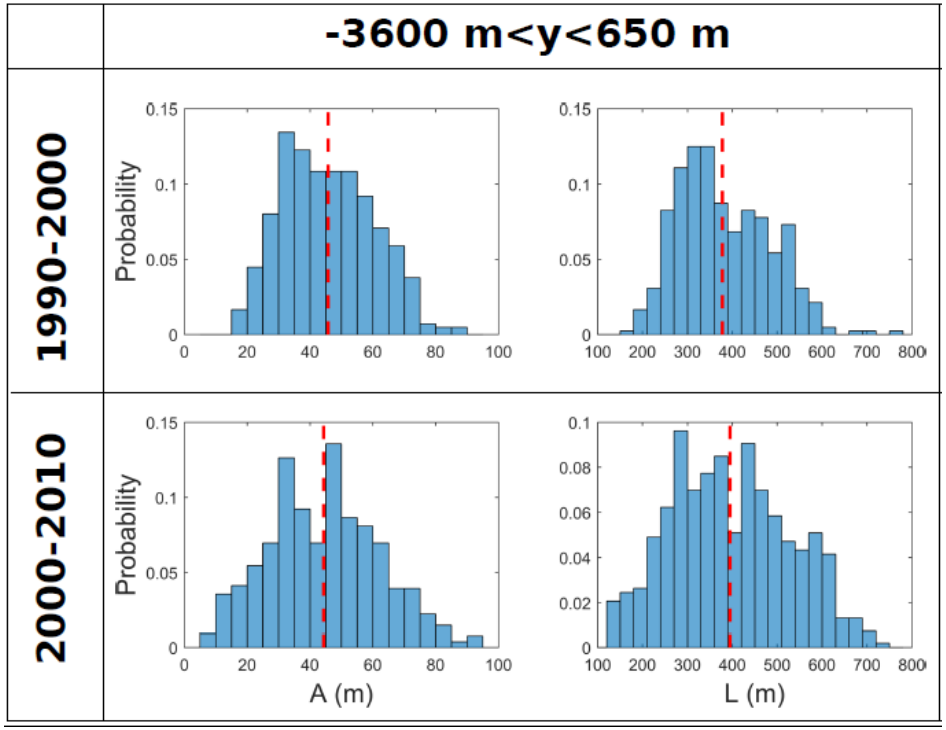


Results - Structural impacts on sandbar characteristics



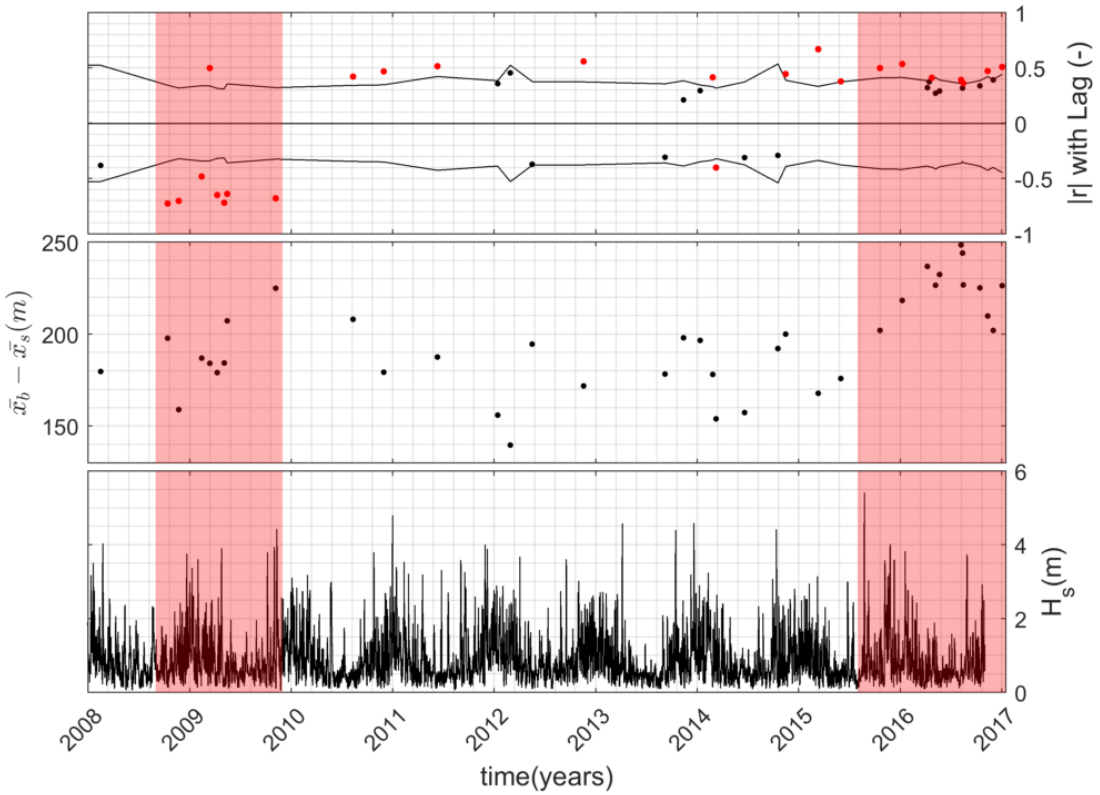
Gangneung port construction





Results - Sandbar and shoreline coupling

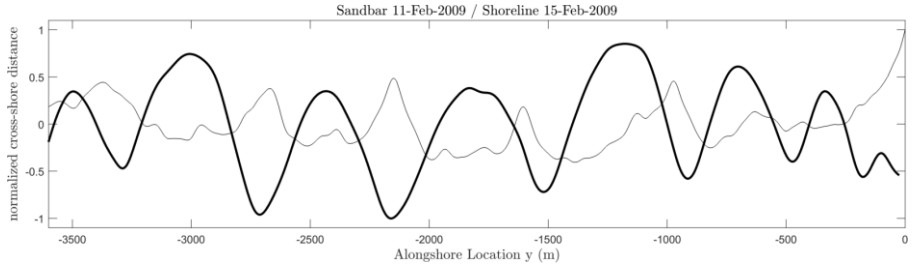
Compare available sandbar and shoreline observations:

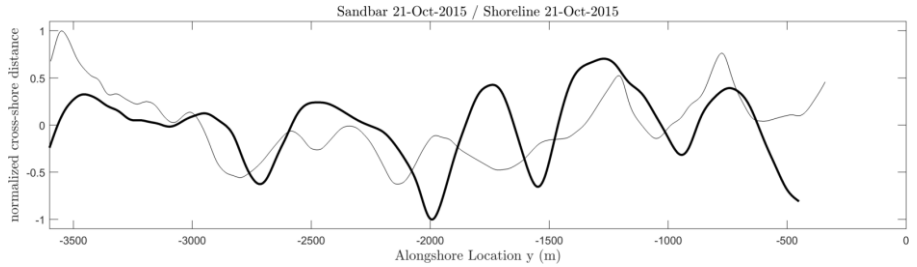


Cross-correlation at different alongshore spatial lags[1]

2008-2010:
Average r= - 0.65
Out of phase coupling

2015-2017:
Average r= 0.46
In phase coupling





[1]Ruessink, B.G., Coco, G., Ranasinghe, R., Turner, I.L., 2007. Coupled and noncoupled behavior of three-dimensional morphological patterns in a double sandbar system. J. Geophys. Res. Ocean.

Conclusions

- Increased number of sandbar observations from 26 without to 201 with the freely available satellite imagery data
- Persistent crescentic patterns only changed by extreme storm conditions
- Alongshore migration in the order of hundreds of meters during the study period 1990-2017
- Port reduced both cross-shore and alongshore length scales of sandbar at the adjacent area
- Frequent significant coupling between the sandbar and the shoreline patterns

Outlook

Satellite derived sandbar crest lines:

- global availability
- (growing) temporal coverage of several decades
- use in data scarce locations
- accuracy less than satellite image pixel resolution

Applicability of technique:

1. cross-shore crescentic length scales being larger than the image resolution
2. absence of frequent wave breaking or clouds and
3. water clarity.

THANK YOU FOR YOUR ATTENTION

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Paper submitted in Marine Geology journal:

Athanasiou et al. 2018 “Analysing decadal-scale crescentic bar dynamics using satellite imagery: A case study at Anmok beach, South Korea”

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