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STUDY ON CHARACTERISTICS AND CAUSE OF SAND WAVES IN THE KANMON WATERWAY

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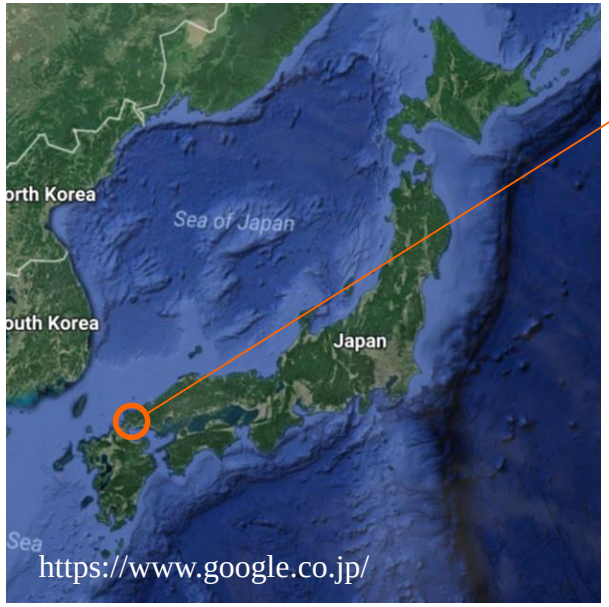
INTRODUCTION

The Kanmon waterway

- ✓ one of the most important international routes in Japan
  50,000 ships per year
- ✓ shallow, narrow and meandering
  minimum water depth: -12m
  width: 500m – 2,000m
- ✓ fast and complicated tidal current
  the fastest current: 10knot

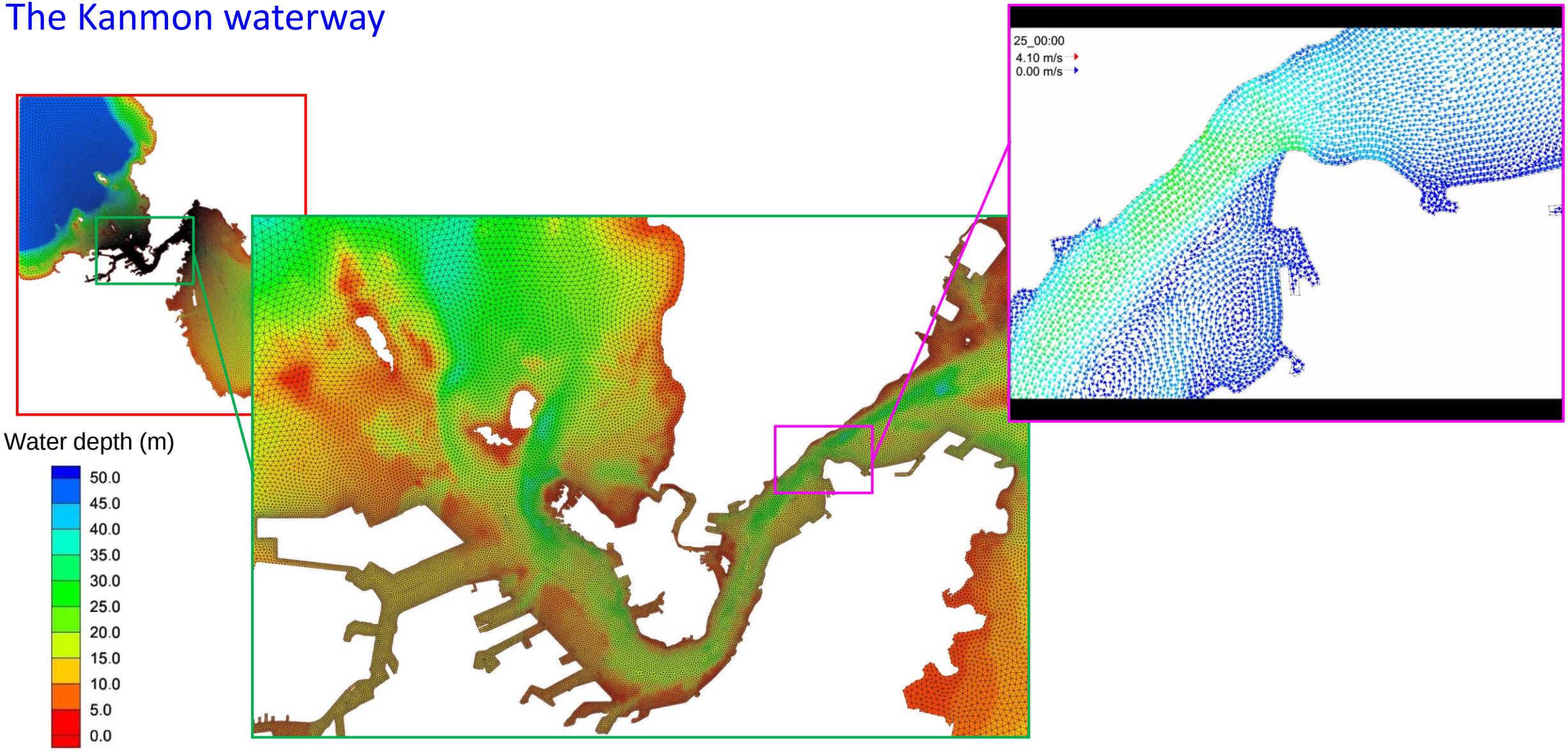


https://www.google.co.jp/

http://www.uchiyama.info/oriori/insho/umi/kanmon

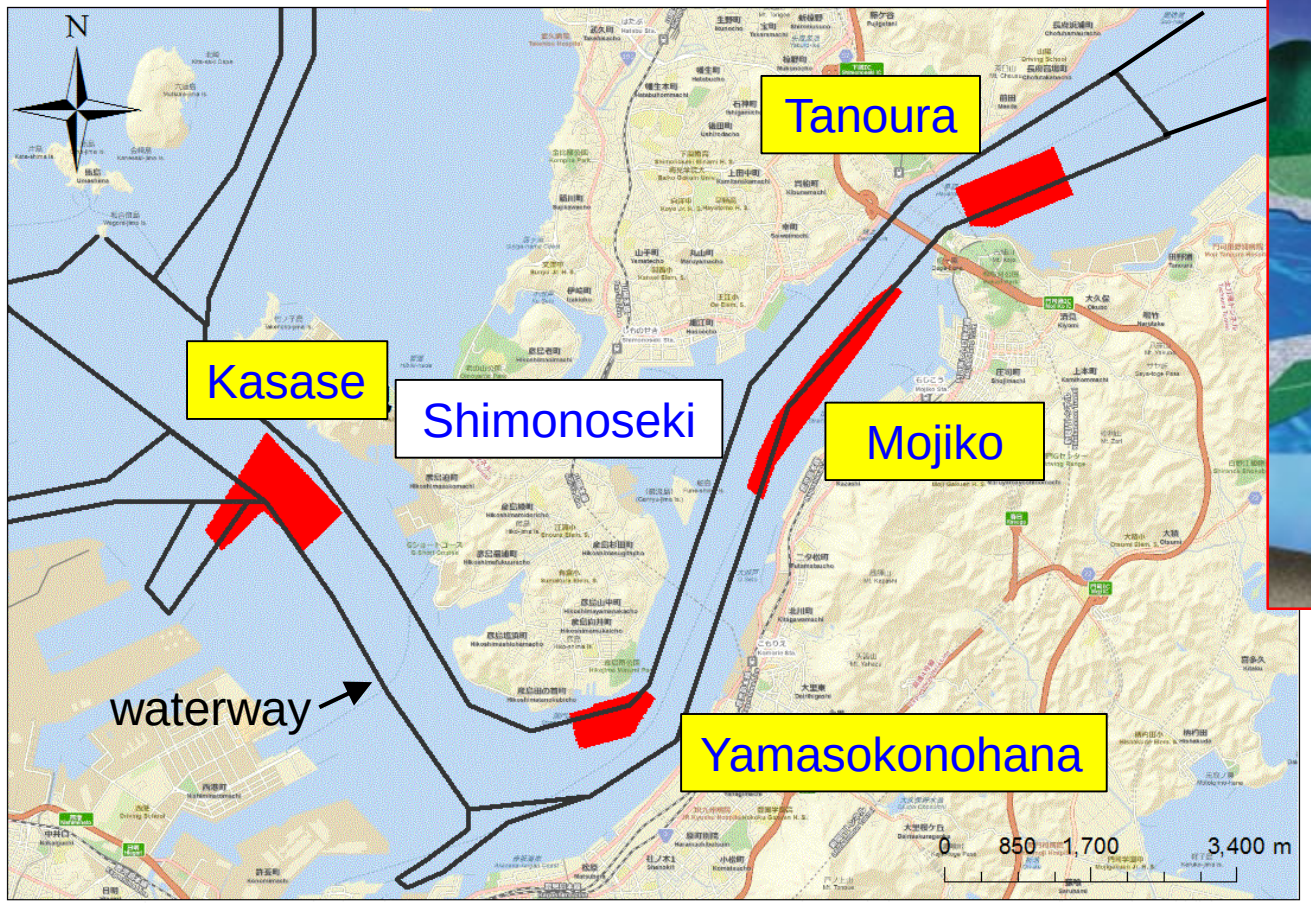
https://map.yahoo.co.jp//

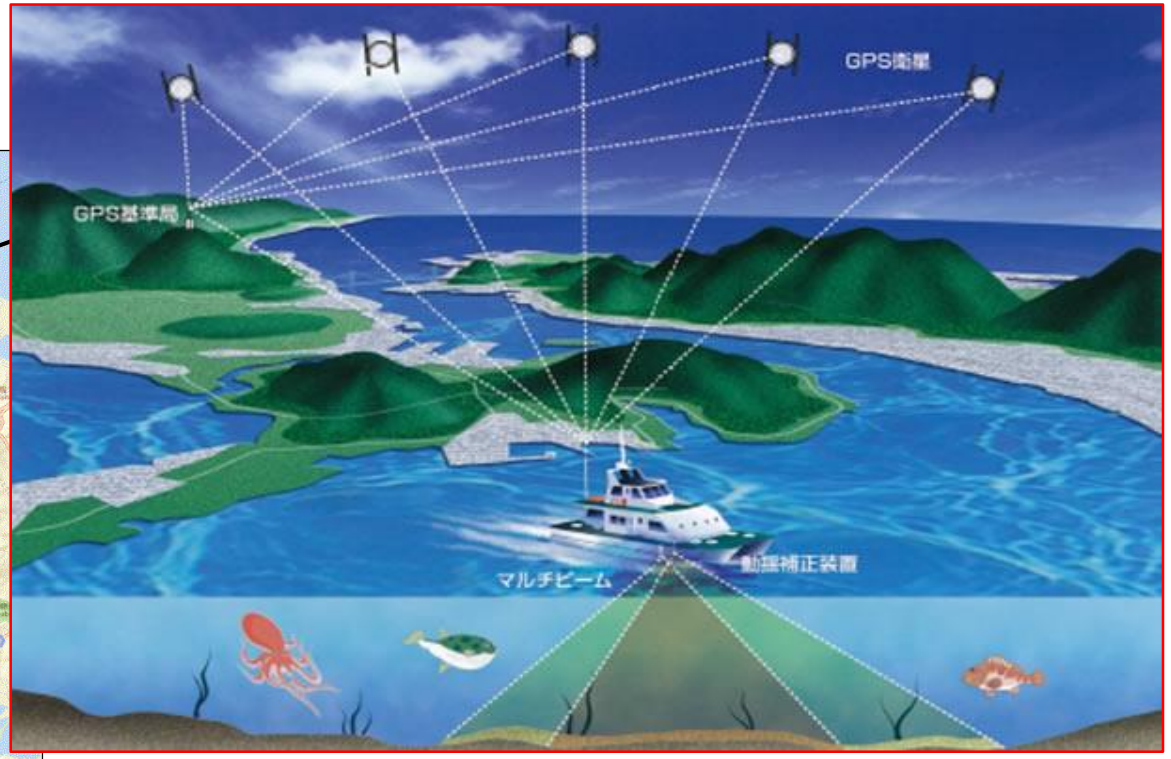
The Kanmon waterway



Sand waves

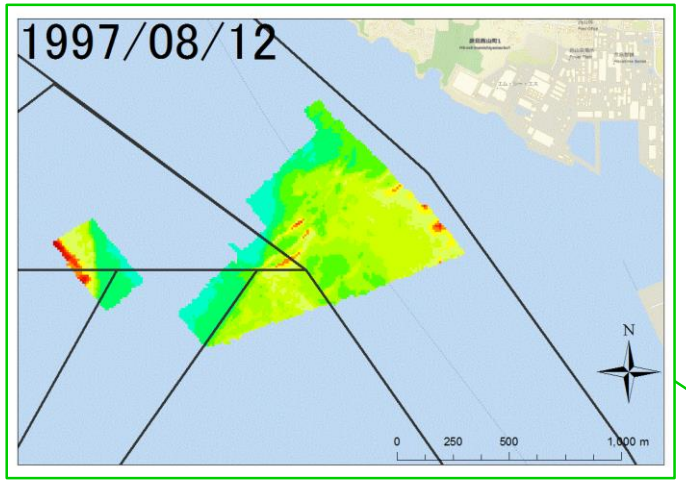
Sand waves, which may hamper the ship navigation, develop on the bottom at some places.



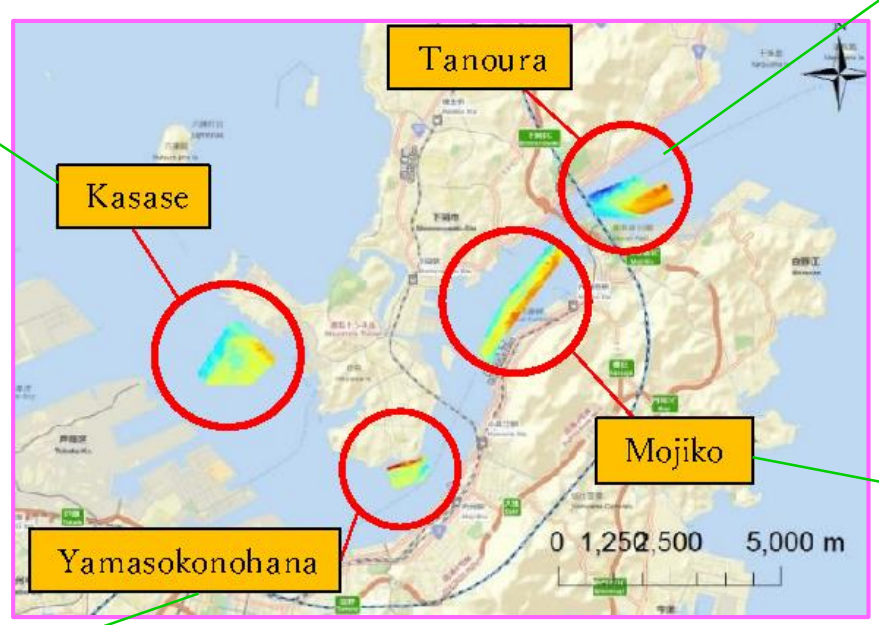


Water depth sounding in the waterway is conducted several times a year by MLIT (Ministry of Land, Infrastructure, Transport and Tourism)

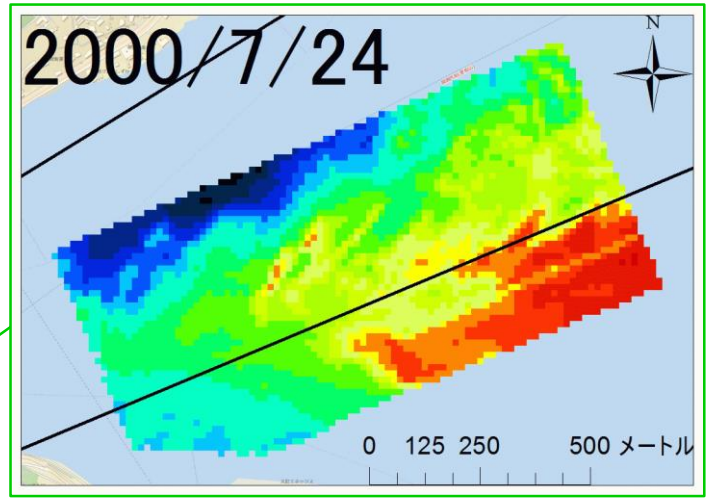
Sand waves



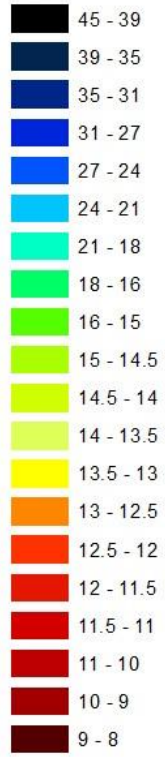
grain size
0.5-1.0mm

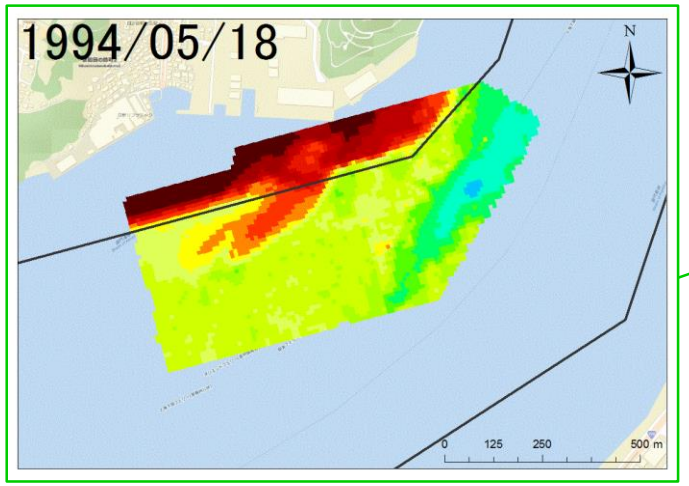


grain size
1.1-1.7mm



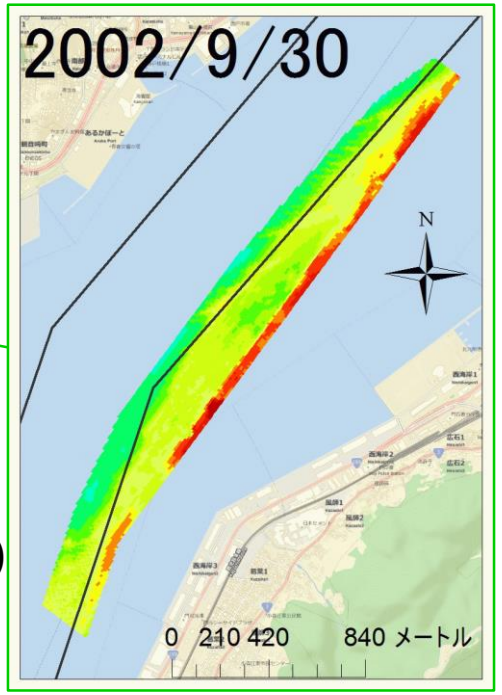
Water depth (m)





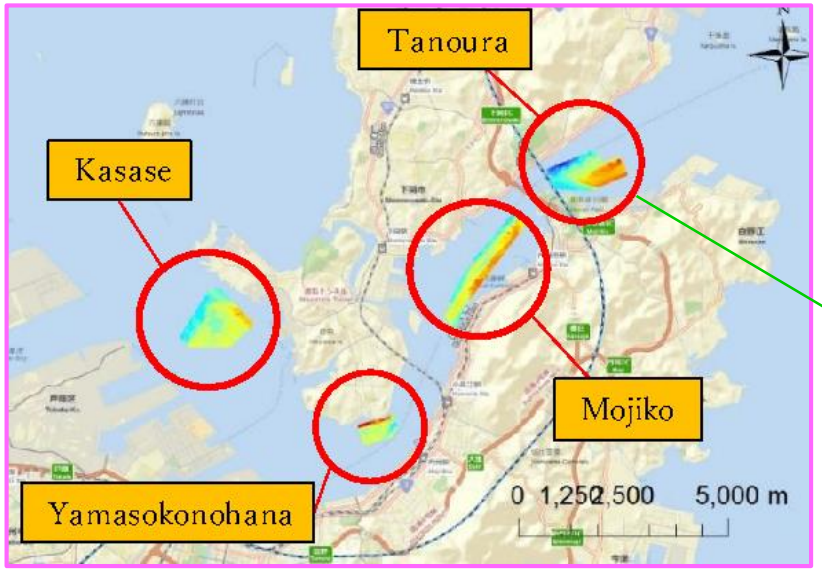
grain size
0.8-2.9mm

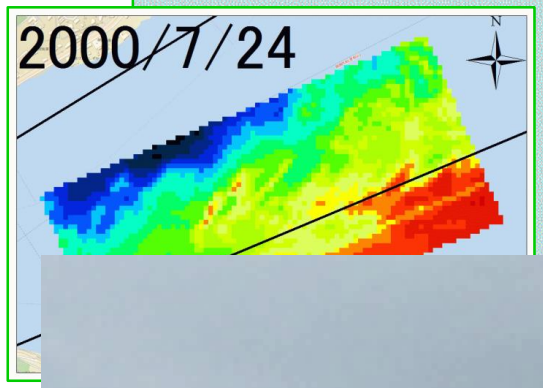
grain size
0.3-31mm(gravel)



Sand waves

Tanoura



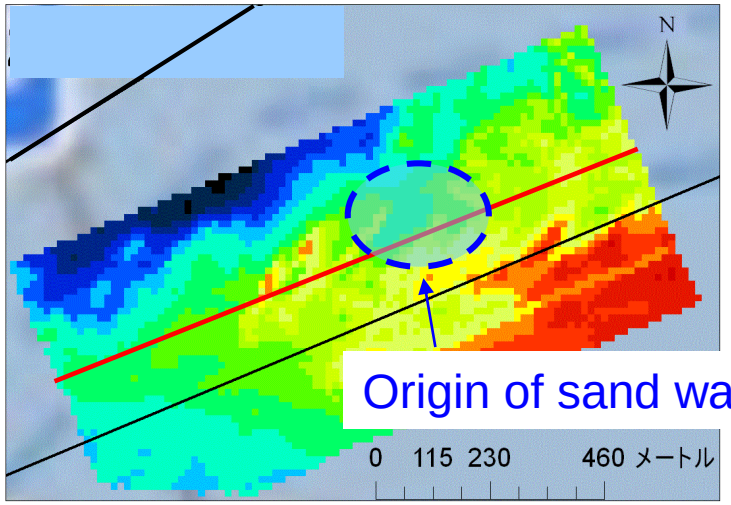


Purpose

To investigate the characteristics and cause of the sand waves in the waterway.

SAND WAVES IN THE KANMON WATER WAY

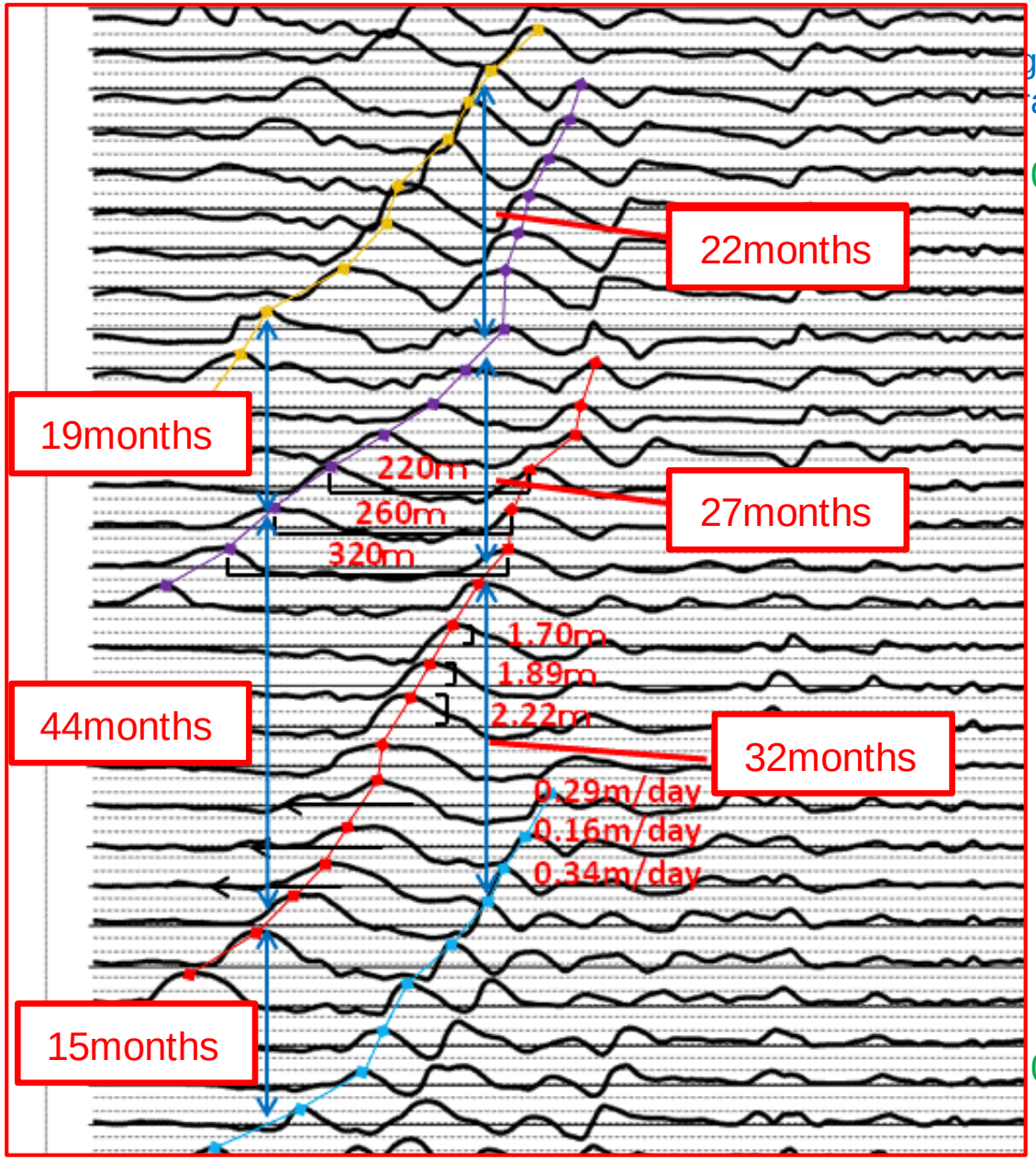
Tanoura



Characteristics

- Height : 2m
- Length : 200-300m
- Migration : 0.2-0.8m/day
- Formation cycle : 15-45months

The sand wave grows as it migrates

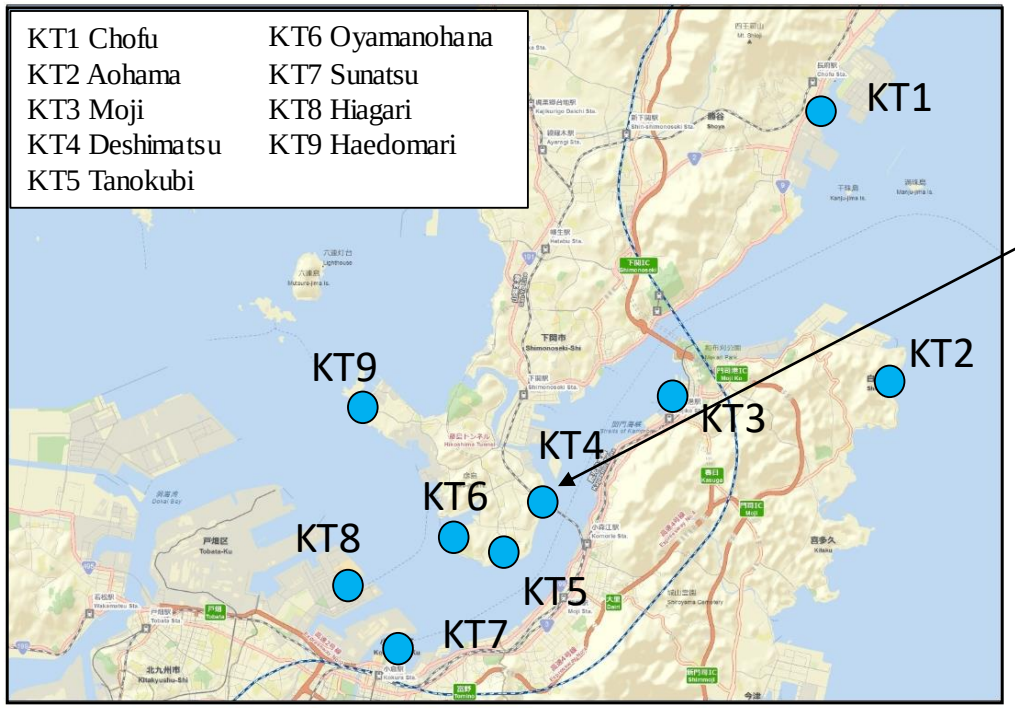


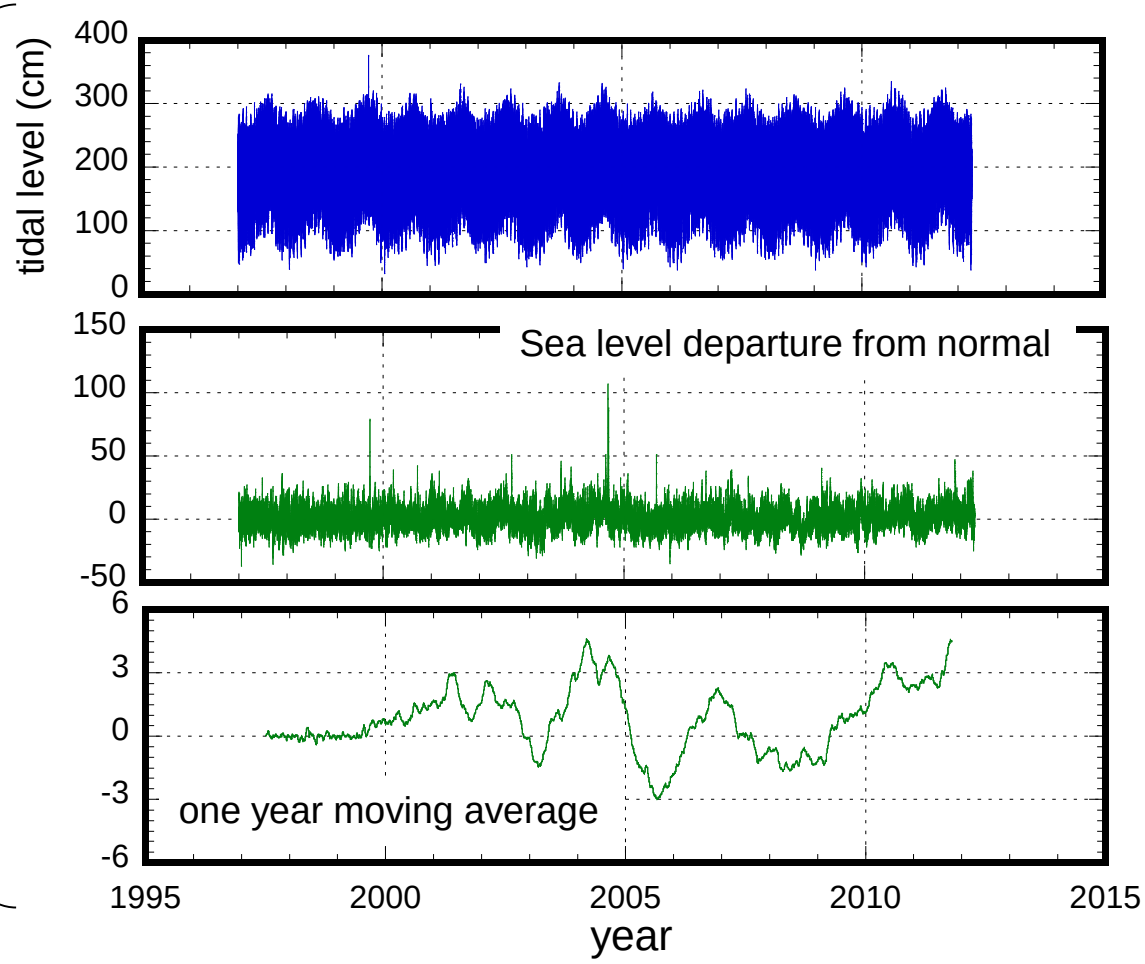
DISCUSSIONS

Main cause of the development of sand waves → Tidal currents — No data

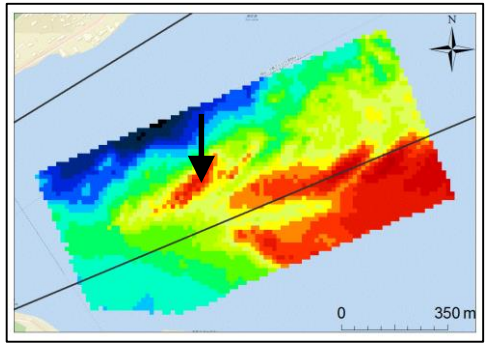
Tidal level change ⟷ Sand waves

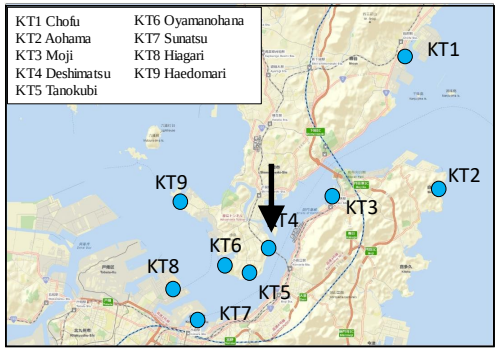
Blondeaux, P. and G. Vittori(2010),
J. M. Damen, et at.(2018) , etc.

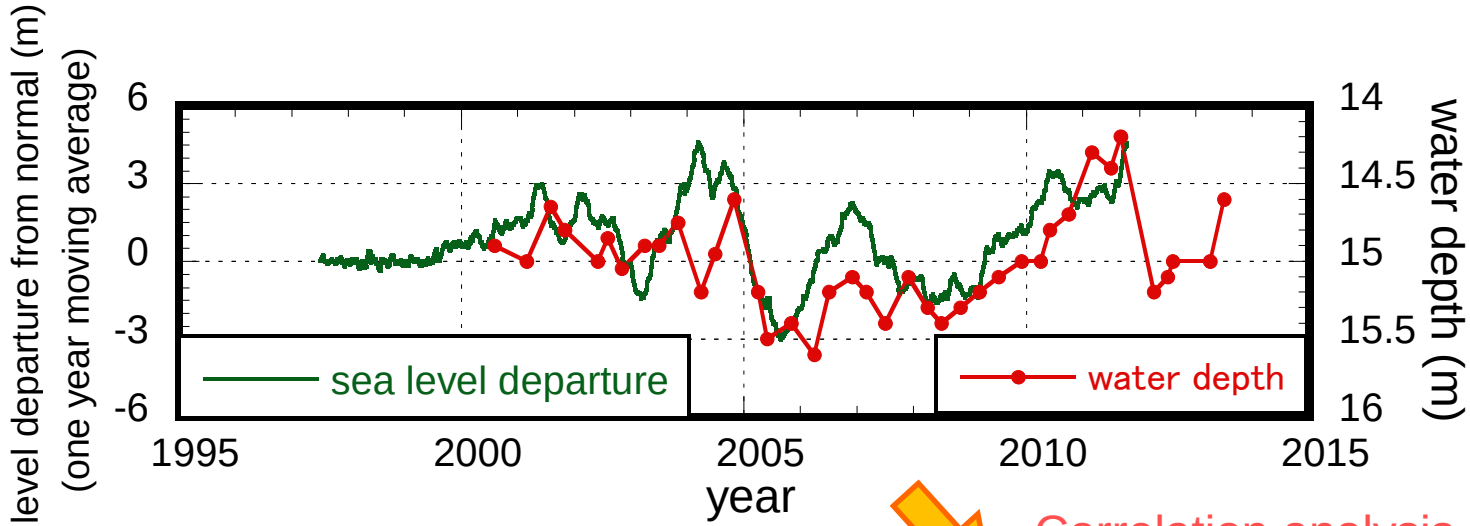




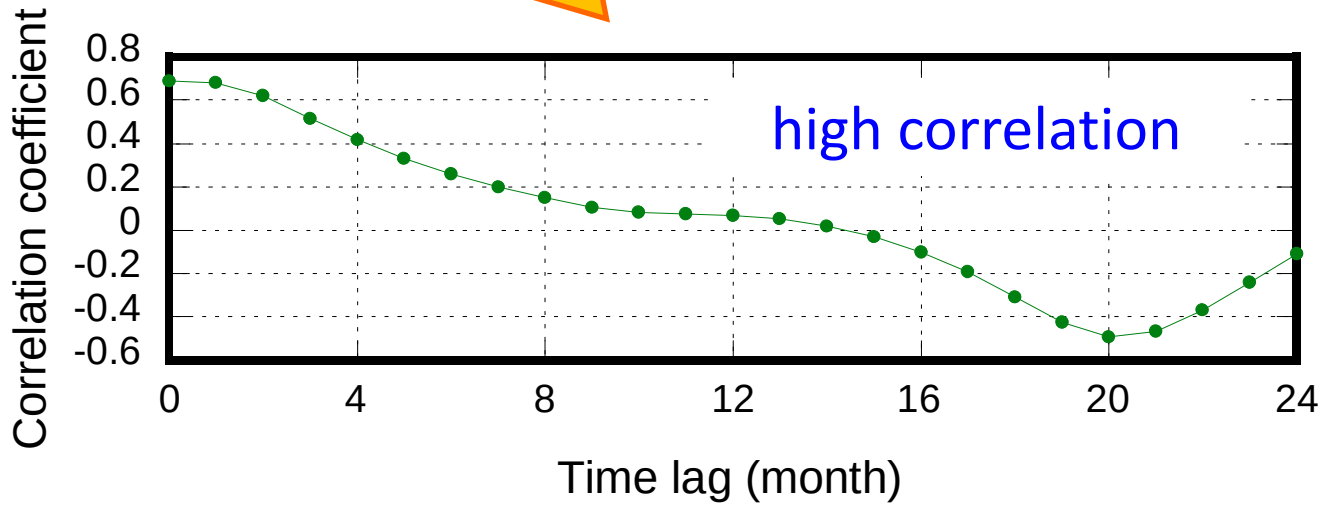
Relationship between sand waves and sea level departure



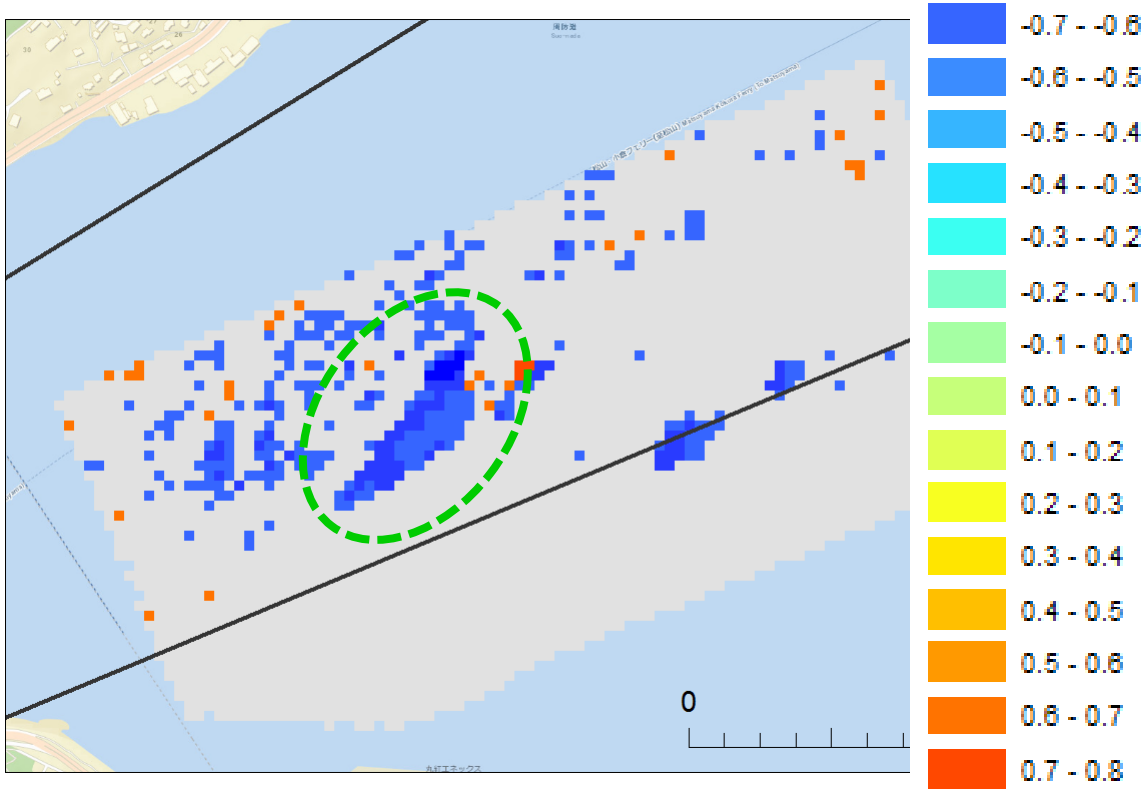




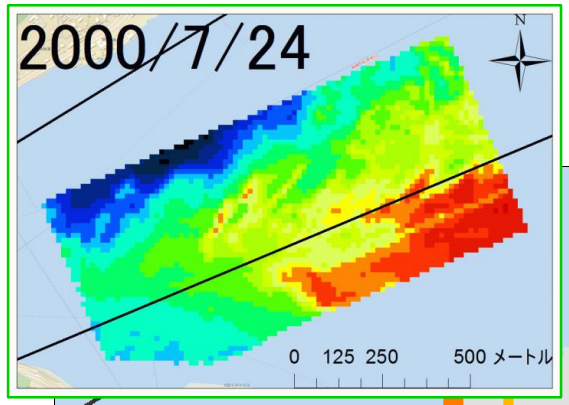
Correlation analysis

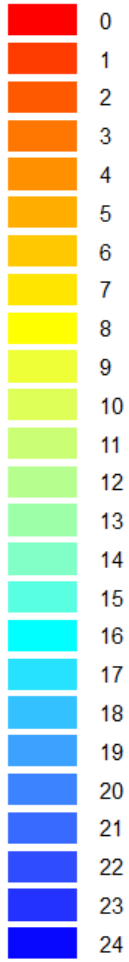


Relationship between sand waves and sea level departure



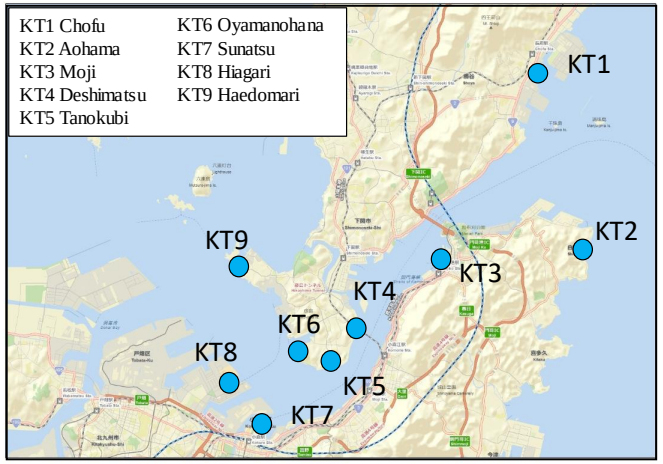
correlation coefficient

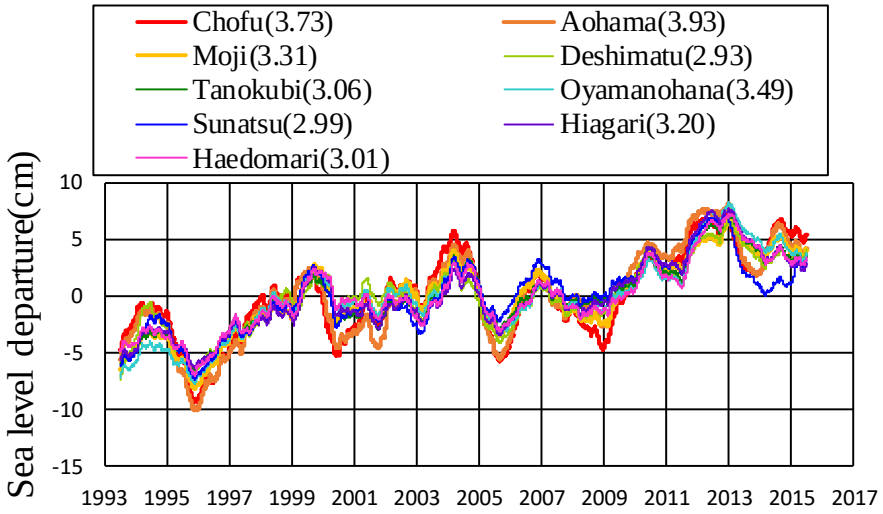




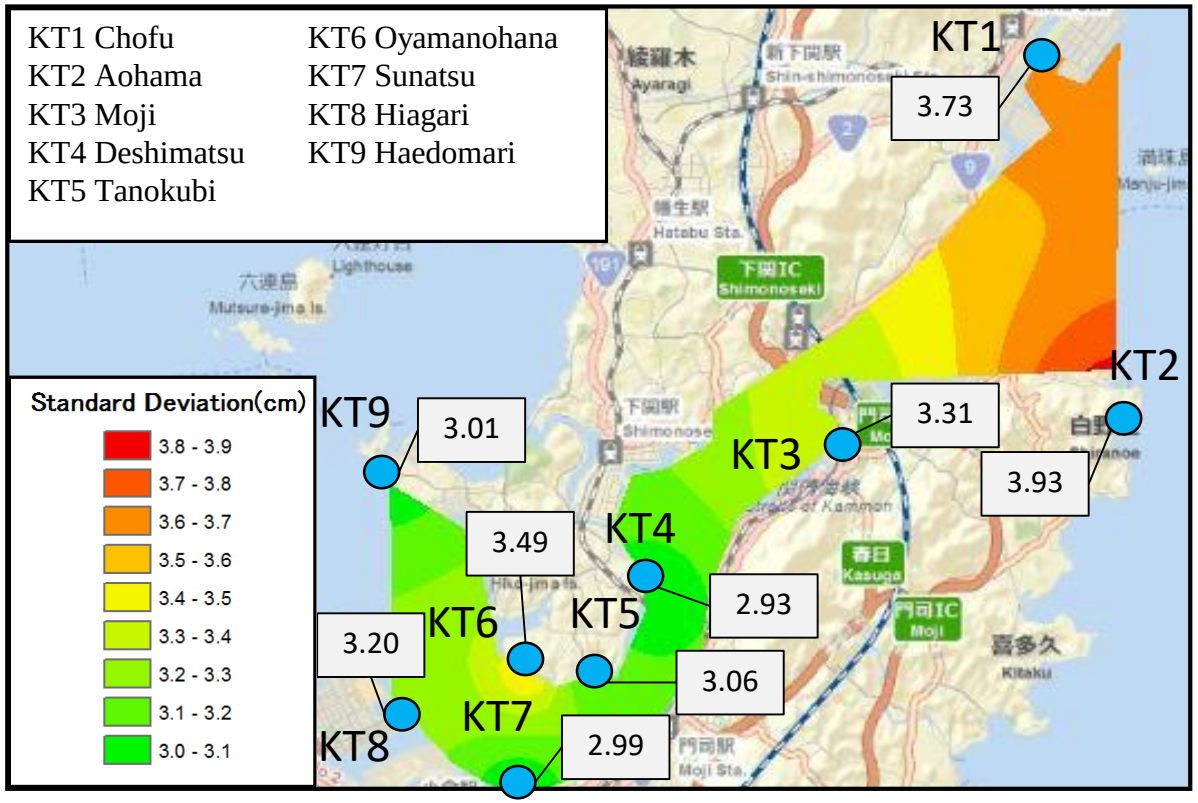
time lag

The cause of long-term fluctuations of sea level departure



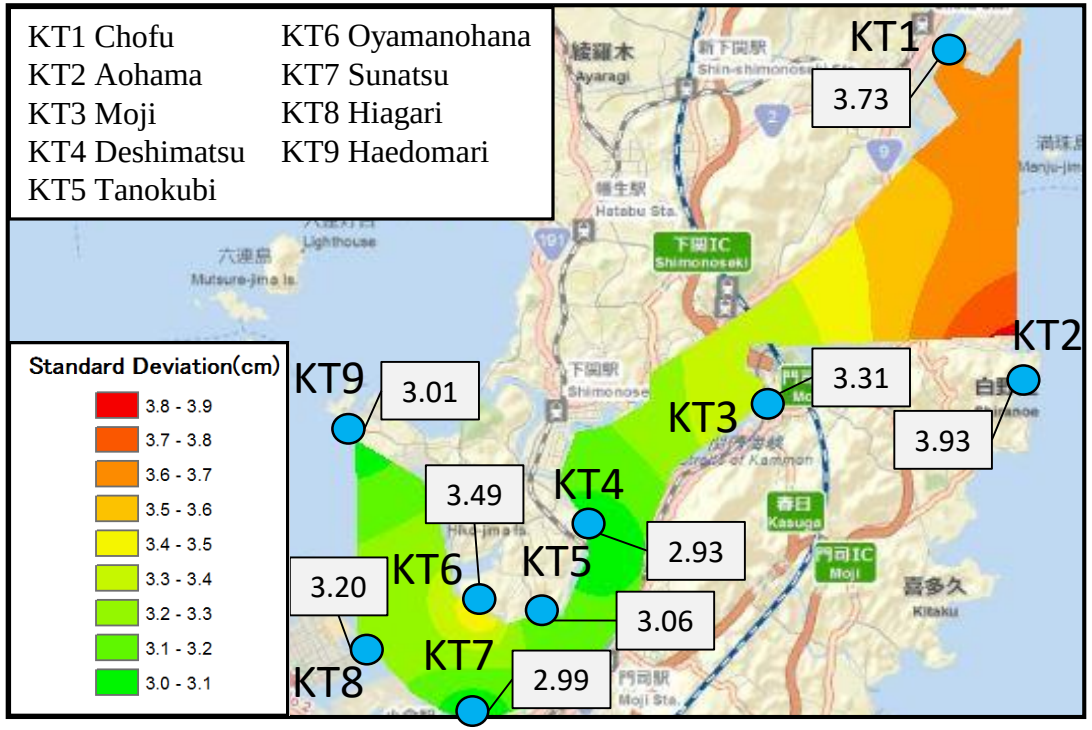


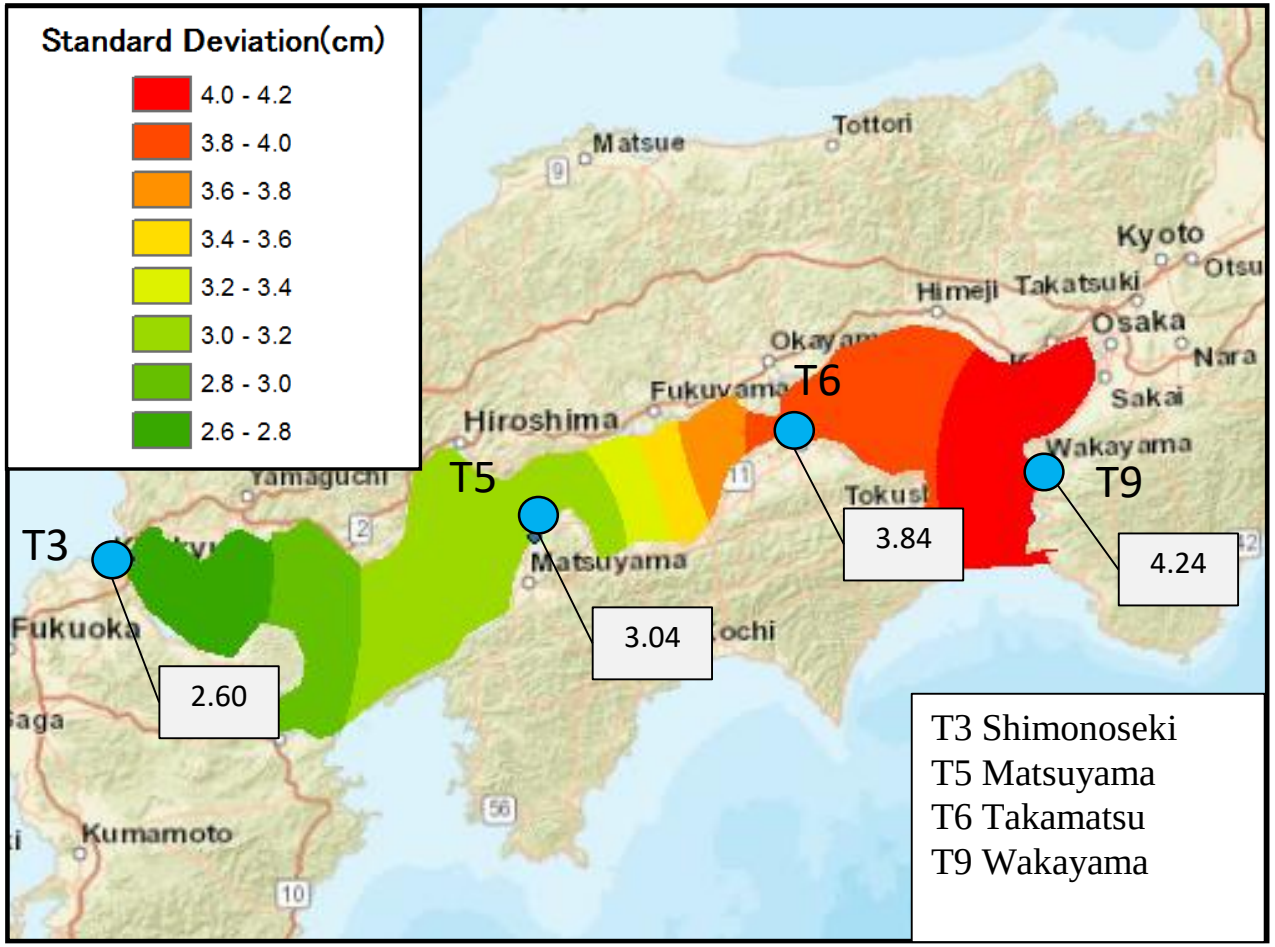
Long-term fluctuations of sea level departure from normal



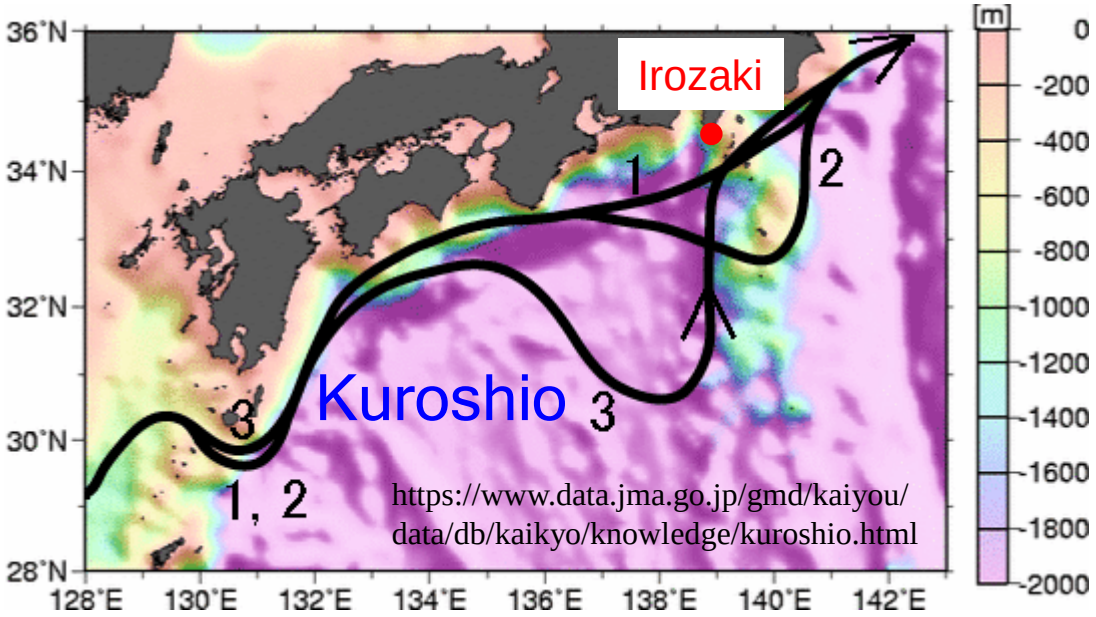
Spatial distribution of standard deviation of long-term fluctuation of sea level departure

The cause of long-term fluctuations of sea level departure

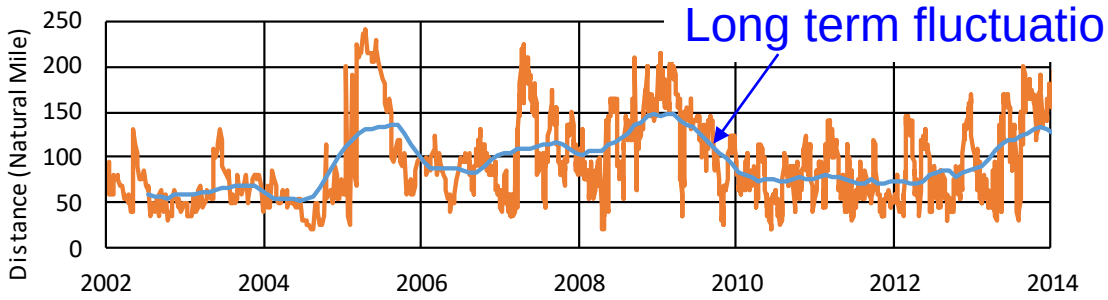




Spatial distribution of standard deviation of long-term fluctuation of sea level departure in the Seto Inland Sea

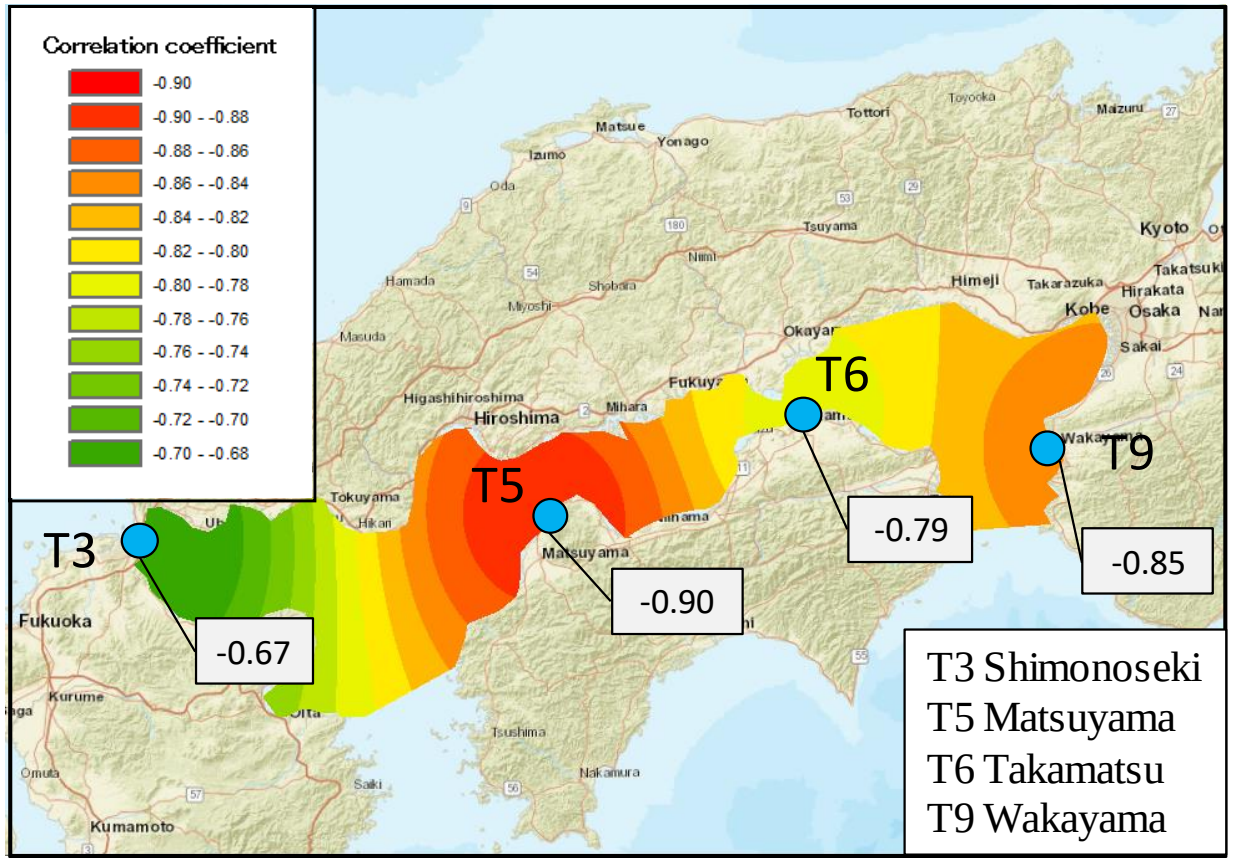


Kuroshio affects the se level in the Seto Inland Sea (Nitani 1973)



Offshore distance of the Kuroshio at Irozaki

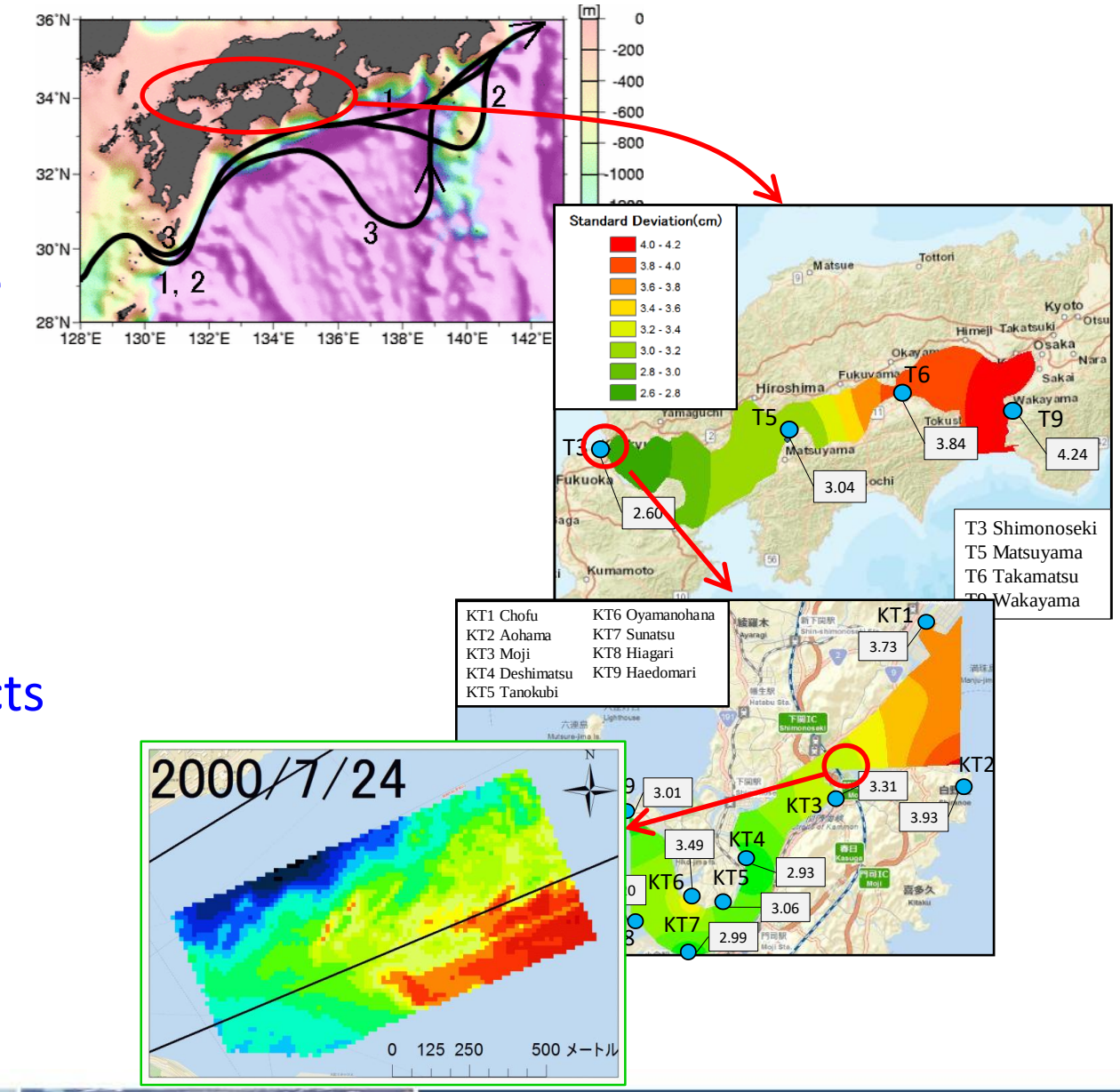
Japan Coast Gurd http://www1.kaiho.mlit.go.jp/KANKYO/KAIYO/qboc/



Spatial distribution of correlation coefficient between offshore distance of the Kuroshio at Irozaki and sea level departure in Kii Channel, Seto-Lland sea and Kanmon Straits

CONCLUSIONS

- The Kuroshio path variation causes the long-term fluctuation of sea level departure in the Kanmon waterway.
- The results imply that the long-term fluctuation of tidal currents accompanied by the long-term fluctuation of sea level departure affects the development of sand waves.







Thank you for your kind attention.