

## Supplement:

### 1、 $R_{wj}$ estimation

$R_{wj}$  is the surface reflectance of three deep water areas. The coordinates for the top-left and bottom-right corners of these areas are provided in Figure S1 as follows:

① [114.23825130261295, 13.636935490401187]

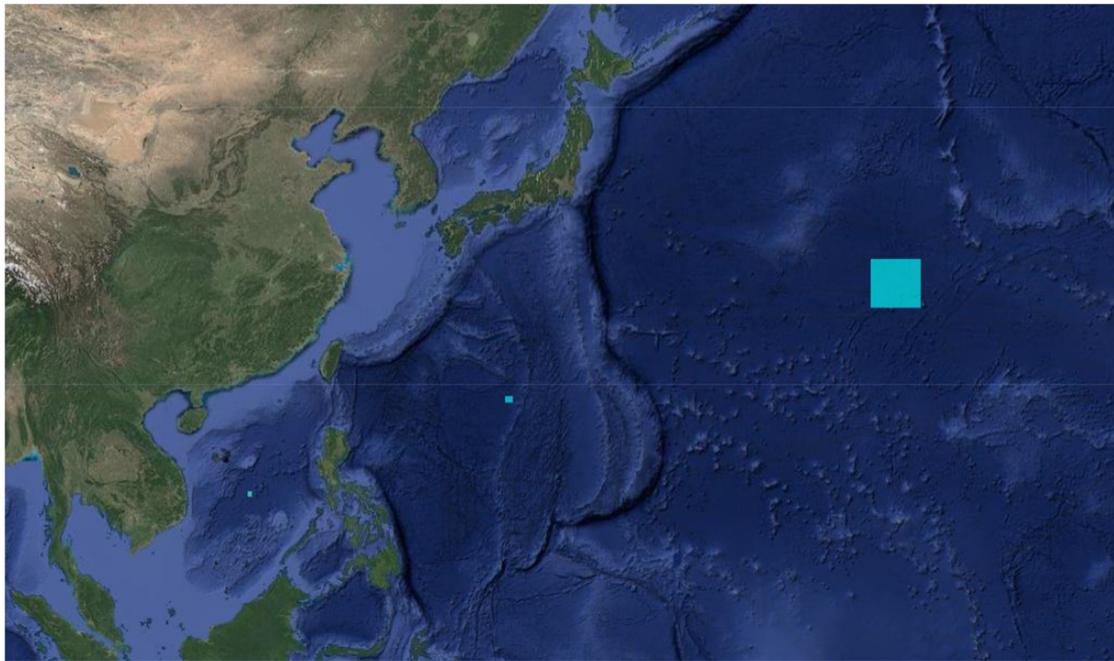
[114.61178645886295, 13.25226730278519]

② [134.96966023951578, 21.048223768929386]

[135.58489461451578, 20.51410391089155]

③ [164.4532277212974, 31.081378316597455]

[168.4522511587974, 27.635093971239797]



**Figure S1. The regions for deep water areas.**

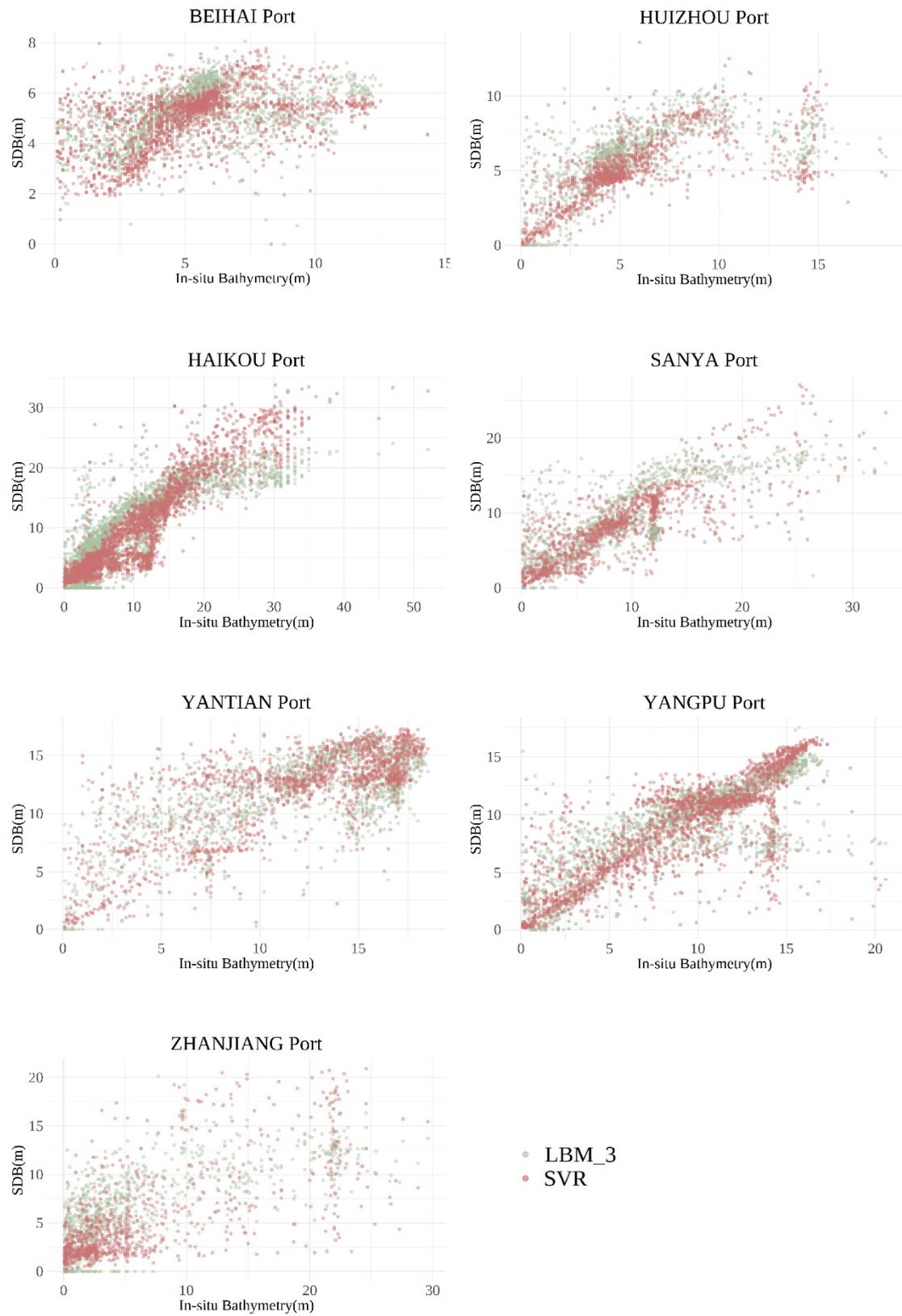
### 2、 The comparison of bathymetry retrieval models

In this study, we have revised the model comparisons by testing different band combinations (e.g., blue+green bands, red+green+blue bands) across various models, including the log-transformed band ratio model (BRM), linear band model (LBM), random forest (RF), and support vector regression (SVR). As shown in Table S1, our results indicate that the  $R^2$  values for Zhanjiang Port range from 0.06 to 0.37, with SVR and LBM performing best overall.

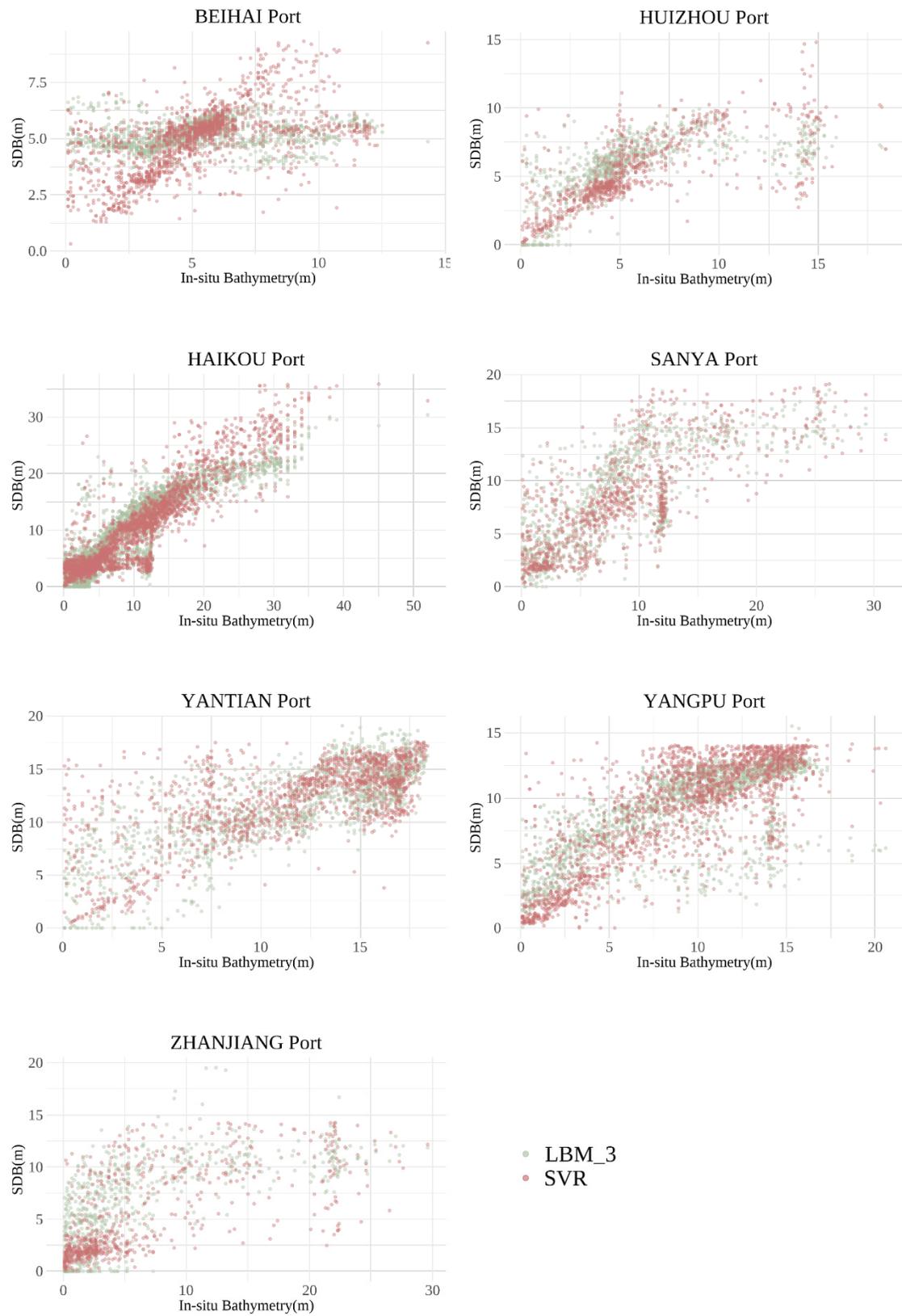
**Table S1. The bathymetry retrieval model tested in Zhangjiang Port**

2019.09-2022.09 Sentinel-2 Zhanjiang		SampleAll
Model	Bands	R2
BRM	B + G	0.366
	B+R+ G	0.360
LBM	B + G	0.175
	B+R+ G	0.306
SVR	B + G	0.19
	B+R+ G	0.306
RFR	B + G	0.06
	B+R+ G	0.26

**3. The scatter plot between SDB and in situ bathymetry based on L8 and S2**



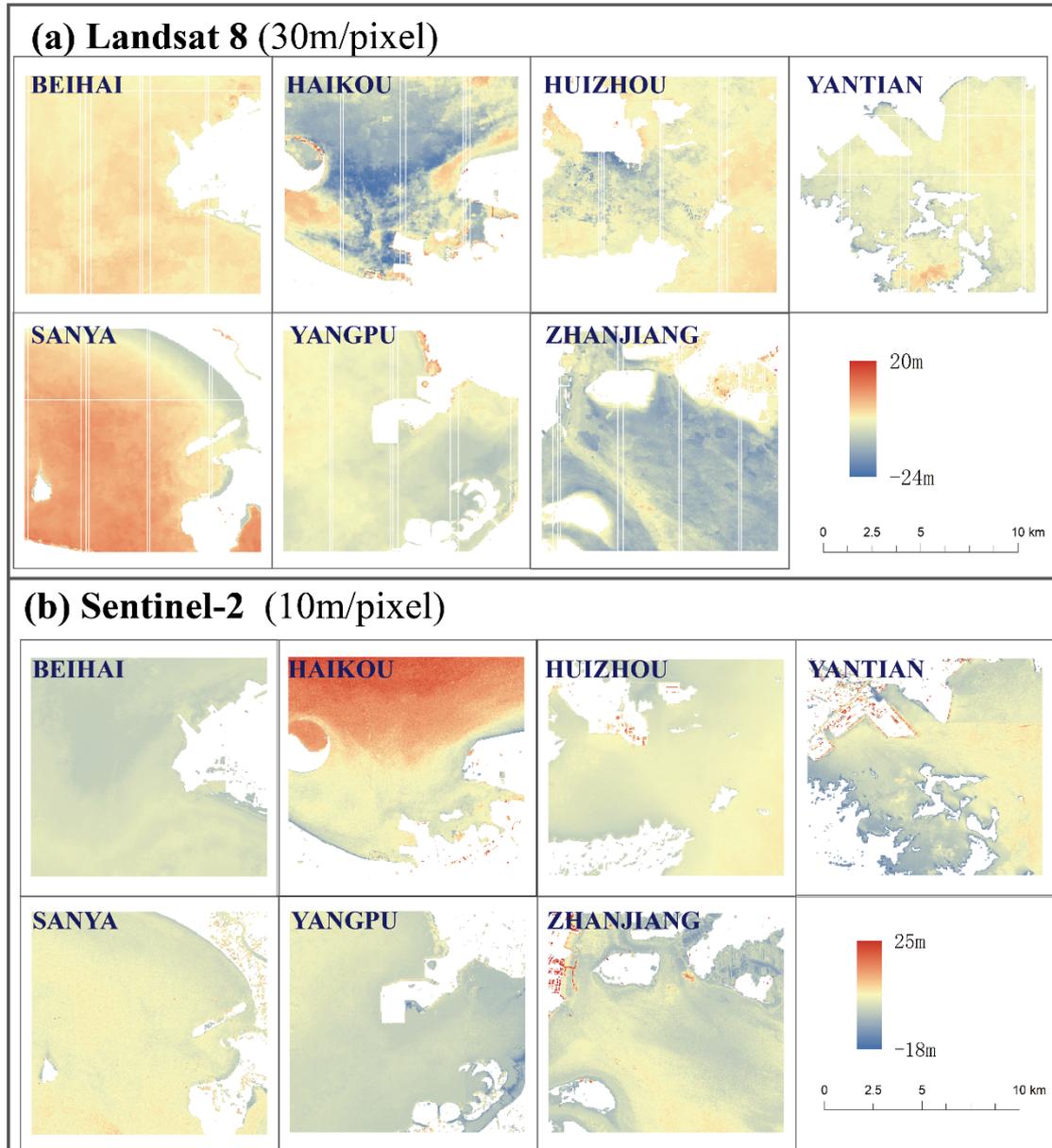
**Figure S2. The correlation between SDB and in situ bathymetry based on Landsat8**



**Figure S3. The correlation between SDB and in situ bathymetry based on Sentinel-2**

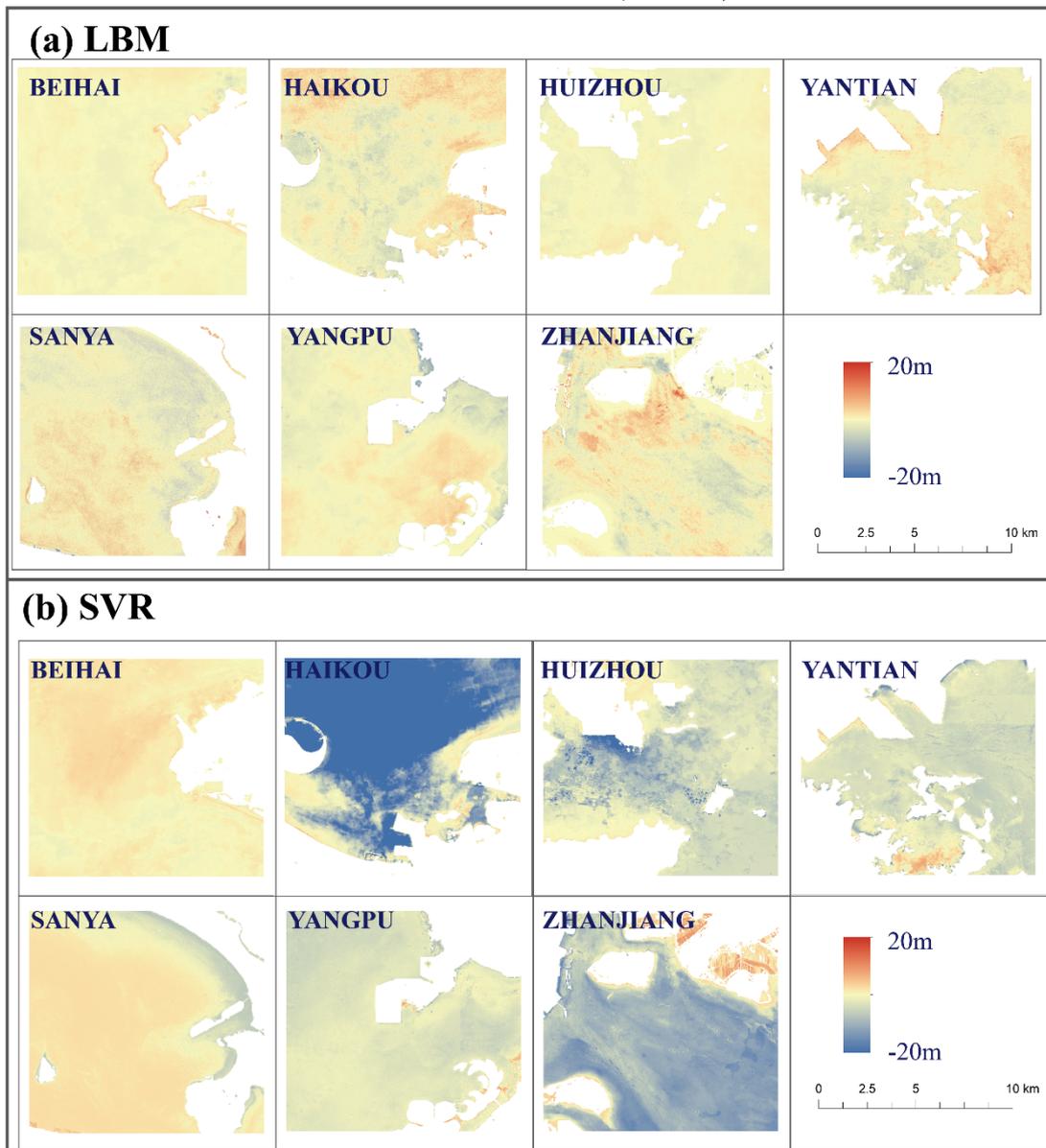
**4、 The difference of retrieval bathymetry based on L8 and S2**

### SDB Difference (LBM-SVR)



**Figure S4. Bathymetry differences between LBM and SVR models across seven ports.**

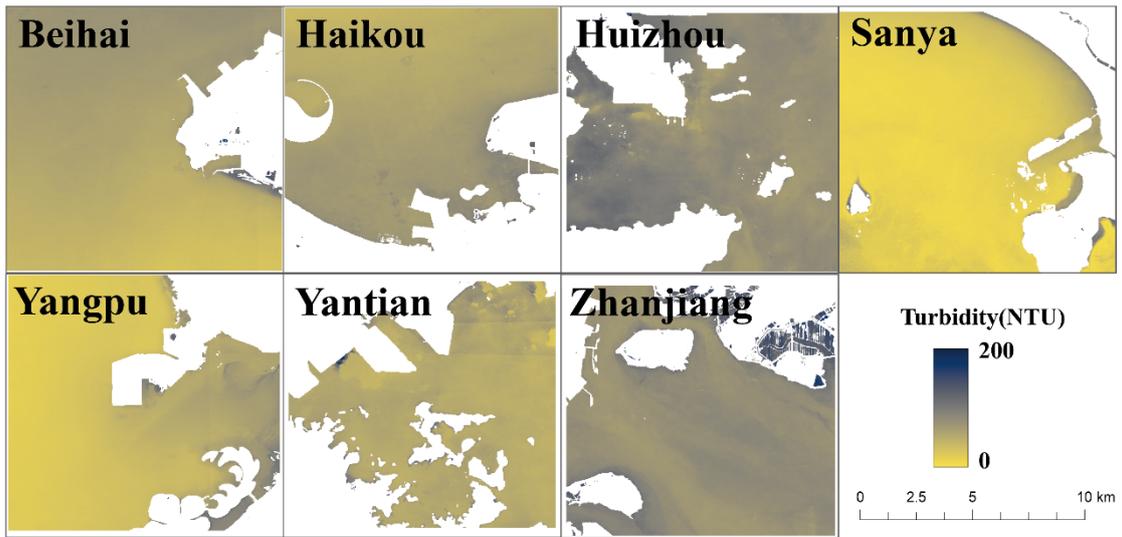
### SDB Difference (S2-L8)



**Figure S5. Bathymetry differences between S2 and L8 satellites at a 10-meter resolution across seven ports.**

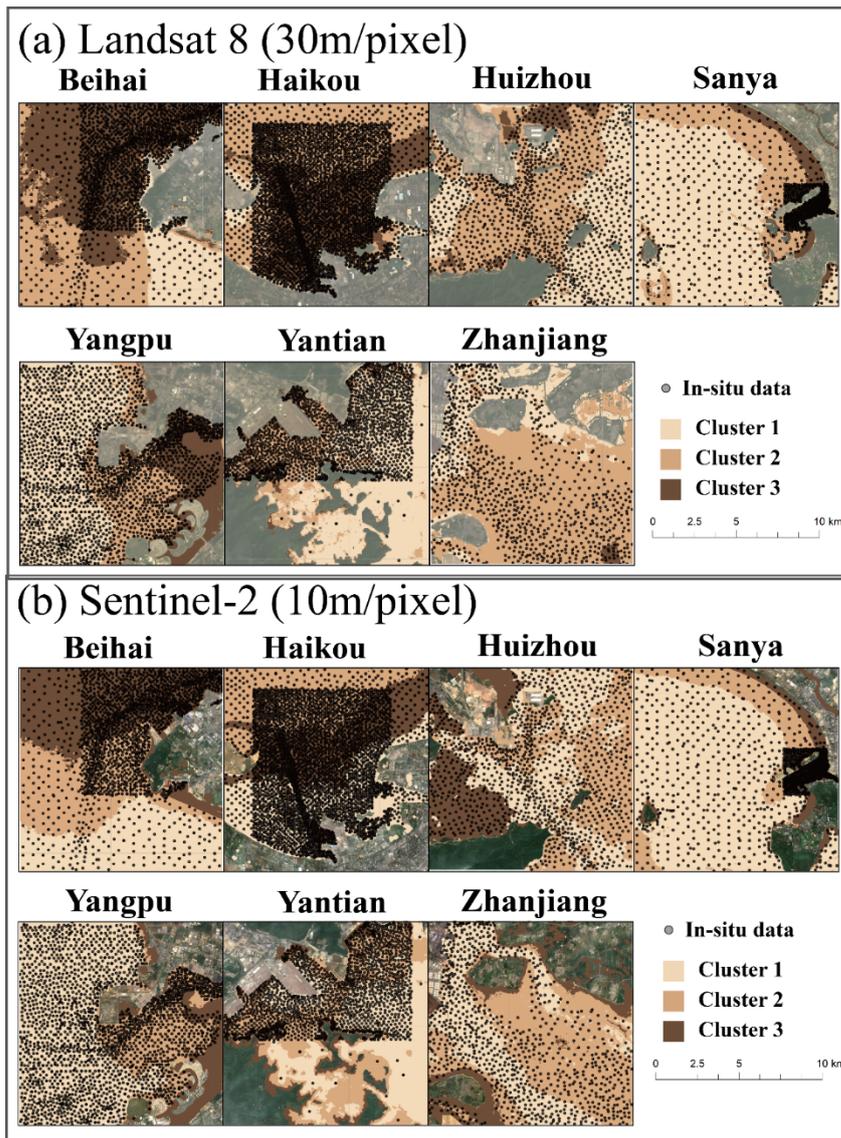
#### **5. The differences in retrieval turbidity based on L8 and S2**

### Turbidity Difference (NTU) (S2-L8)



**Figure S6. Turbidity differences between S2 and L8 satellites at a 10-meter resolution across seven ports.**

#### 6、 The clustering results based on turbidity



**Figure S7. The cluster results based on water turbidity across seven ports**