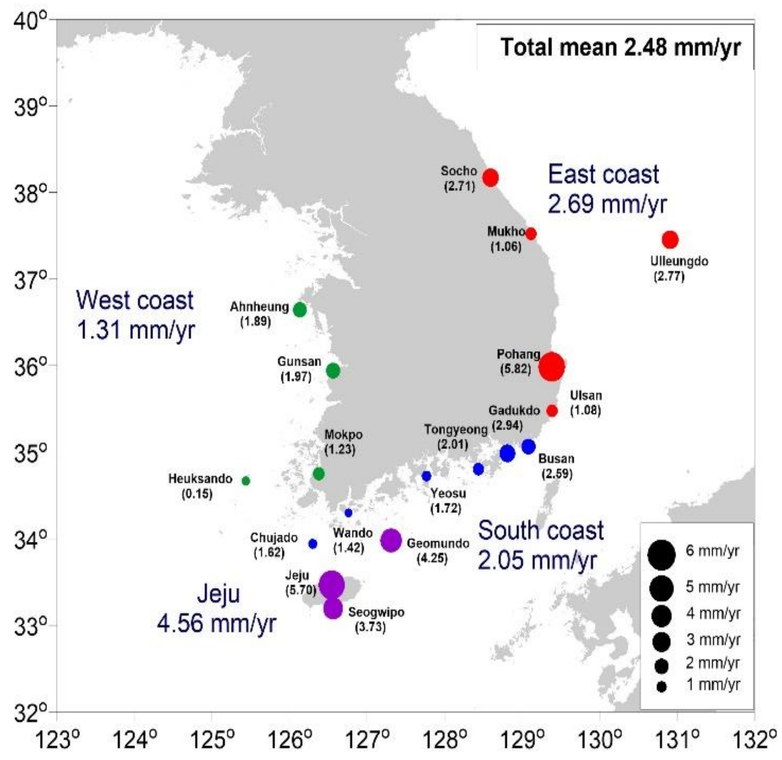
Estimation of coastal sea level rise rate near Korea using satellite and tidal data integration technique

Chaewook Lim[1], Sang-hoonPark[2], Do-Youn Kim[12], Seung-Buhm Woo[1]
Department of Oceanography, Inha Univ.[1], ARA Consulting&Technology[2]

Introduction

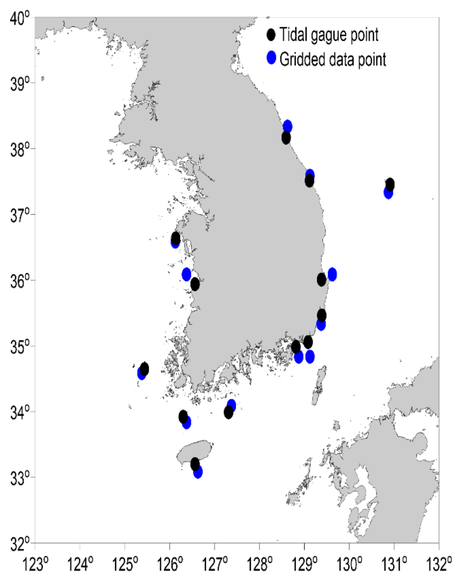
• The rate of sea level rise in Korea is mostly calculated using tide data.
• It is difficult to say that this rate of growth is representative of each sea area.
• In this study, we used tidal data and satellite data to more accurately calculate the rate of increase in open sea.

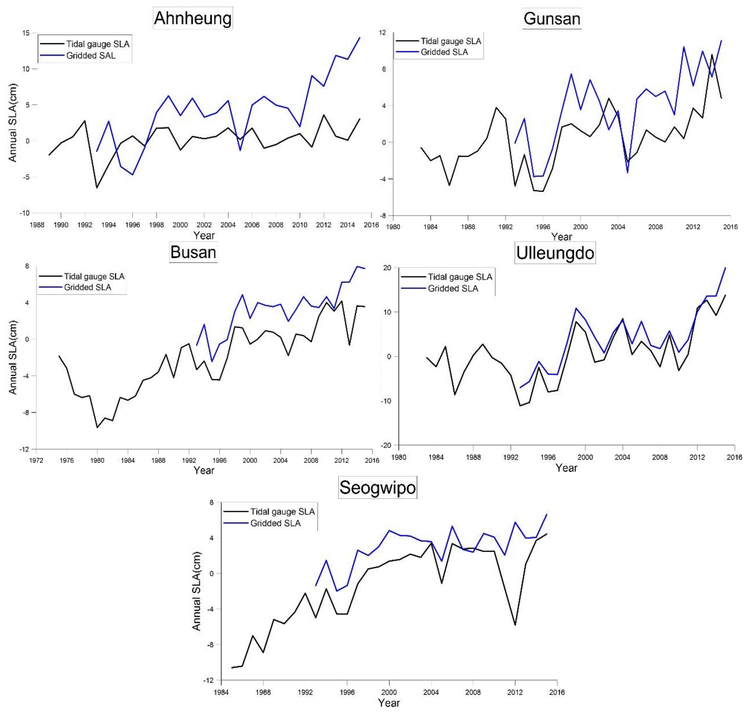
Republic of Korea coastal sea level trend



• According to the IPCC 5th Assessment Report (Stocker *et al.*, 2014), the global mean sea level rise was calculated for each time period and was more than 2.0±0.3 mm/yr from 1971 to 2010
• each coastal region in Korea face a different rate of SLR, i.e., 1.31mm/yr in the west coast, 2.69mm/yr in the east coast and 2.89mm/yr in the South coast of Korea. Especially, the vicinity of Jeju Island showed one of the highest rate of sea level rise, which is 4.56mm/yr
• Due to its geographic characteristics, the island Jeju is much more vulnerable to high rate of sea level rise

Comparative analysis of tidal data and satellite data





Region	Correlation
Ahnheung	0.41
Gunsan	0.68
Hueksando	-0.06
Chujado	0.74
Geomundo	0.73
Seogwipo	0.66
Gadokdo	0.87
Busan	0.84
Ulsan	0.68
Pohang	0.69
Mukho	0.78
Sokcho	0.89
Ulleungdo	0.97

• By analyzing the trends of satellite data and nearby tidal stations, the overall trends are similar. However, Ahnheung and Heuksando were different.

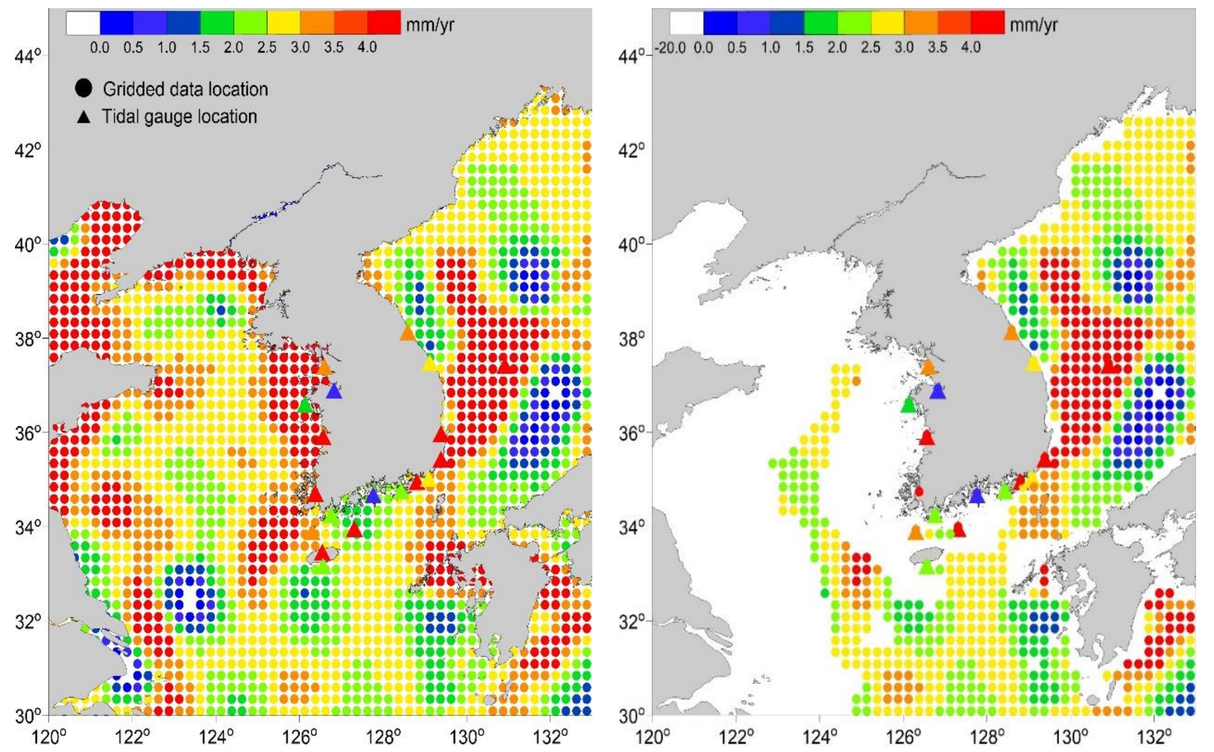
• Correlation analysis shows that correlation between tide data and satellite data is high in regions except Ahnheung and Heuksando

Satellite data and Tidal data

*Satellite data
• AVISO+ (Archiving, Validation and Interpretation of Satellite Oceanographic Data, CNES)
CMEMS(Copernicus Marine Environment Monitoring Service, EU)
• Delayed Along track ADT (Absoulte Dynamic Topography)
Reprocessed SLA (Sea Level Anomaly) : Gridded (0.25° X 0.25° , 1day)

*Tide data
• Using data: observation period 18 years or more 18 tidal stations (~ 2015)
• Observational history survey, data retention period, data quality review
• Missing data interpolation: Computation of harmonic constant before and after missing value
• Interpolation of missing data using TASK-2000's MERIE tool

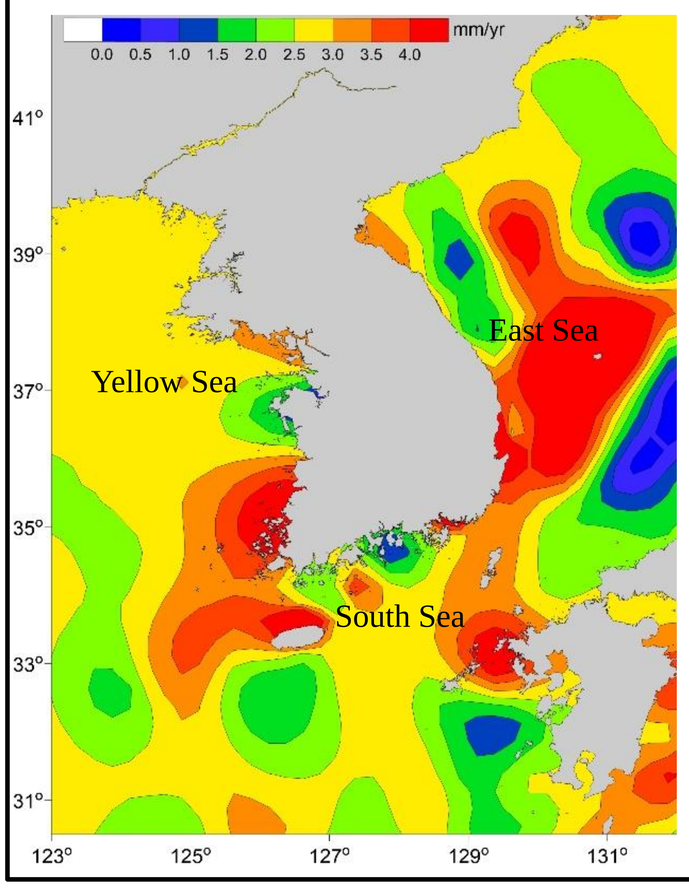
Sea level rise integration technique



• The sea level rise rate of tidal data (triangle) and vertex satellite data (circle)
• Excluding Hueksando, Jeju, and Pohang from tide data (the rate of sea level rise is different from nearby tide stations). Incheon, Pyeongtaek added

• Satellite altimeter lattice data provides SLA (Sea Level Anomaly) data and ERR data: Global average OE error range (4-5 cm)
• Satellite altimetry data with an error value of 5cm and within 20km from the coast were removed

• Right figure: before removing the error,
• Left figre: remove the location corresponding to the error



• Weighted mean interpolation with error elimination

Region	Sea level rise rate(mm/yr)
Y/S	2.8
S/S	2.7
E/S	3.5

• The rate of increase was higher in all regions than when using only tide data
• The rising rate of the Y/S is low and the rate of E/S is high was the same as when using only the tide data

• If there is more tidal data available at more locations, more reliable research will be done
• In addition, tidal removal of satellite data was conducted with global tidal data. Therefore, further study on accurate tidal removal is needed considering the high tidal range in Korea

Conclusion

• tidal data and satellite data to more accurately calculate the rate of increase in open sea
• each coastal region in Korea face a different rate of SLR, i.e., 1.31mm/yr in the west coast, 2.69mm/yr in the east coast and 2.89mm/yr in the South coast of Korea(using only tidal data)
• Comparison with tide data for verification of satellite data -> High correlation
• Using the weighted average interpolation, the sea level rise rate was calculated
• Future study is needed on accurate tide removal considering the high tidal range in Korea