

Study on Wet Tropospheric Correction of HY-2C Altimeter based on Multi-source Data

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Abstract

Satellite Radar Altimetry missions are essential for global ocean observation and monitoring sea level changes. Wet Tropospheric Correction (WTC) is one of the errors in satellite altimetry. The HY-2C satellite is the third China's marine dynamic environment monitoring satellite, and Calibration Microwave Radiometers (CMR) can provide WTC data for the correction of sea surface height. However, due to the pollution of coastal land, sea ice, rainfall and anomalies of instrument, CMR WTC sometimes has large errors or even is missing, especially in the coastal area. To solve this issue, a new WTC method of HY-2C altimeter based on spatial-temporal objective analysis (OA) by combining GNSS WTC, ERA5 WTC and valid HY-2C CMR WTC data is proposed.

Data

- HY-2C altimeter GDR data from January 2021 to December 2021.
- GNSS data of 113 stations (shown as red dots in fig5) within the distance to the HY-2C nadir less than 200km in 2021.
- ERA5 data: The mean sea level pressure, the total column water vapour and the atmospheric temperature at the height of two meters from sea level.

HY-2C CMR WTC evaluation

GNSS data and ERA5 data are used to evaluate the HY-2C CMR WTC data of 2021.

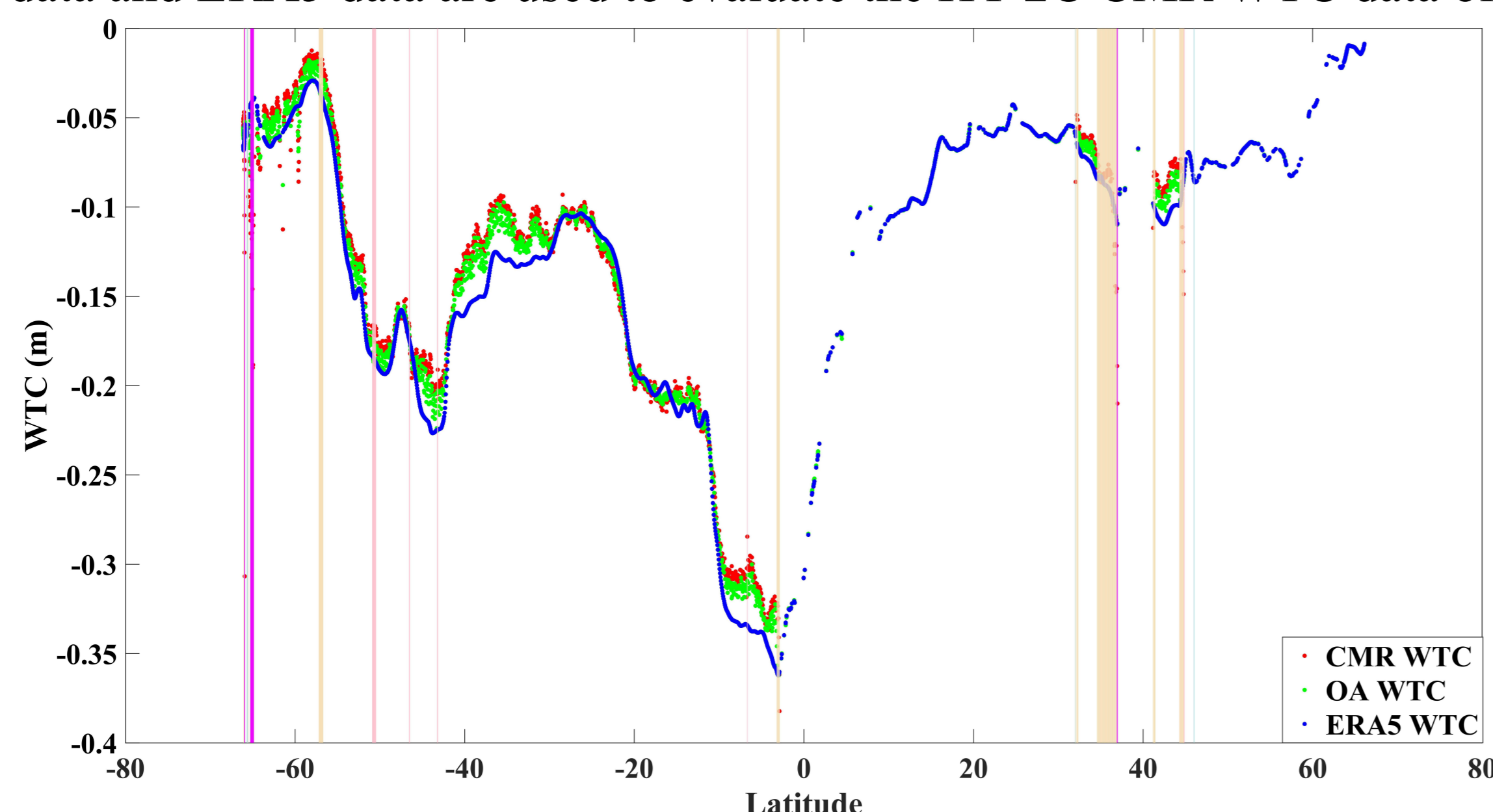


Figure 1. Comparison of different WTCs in cycle 0010 pass 0247 of HY-2C (The shaded area represents invalid CMR WTC data affected by rainfall (pink), ice (light blue), land (light orange), nearshore (light yellow), strong wind (light green), instrument anomalies (purple))

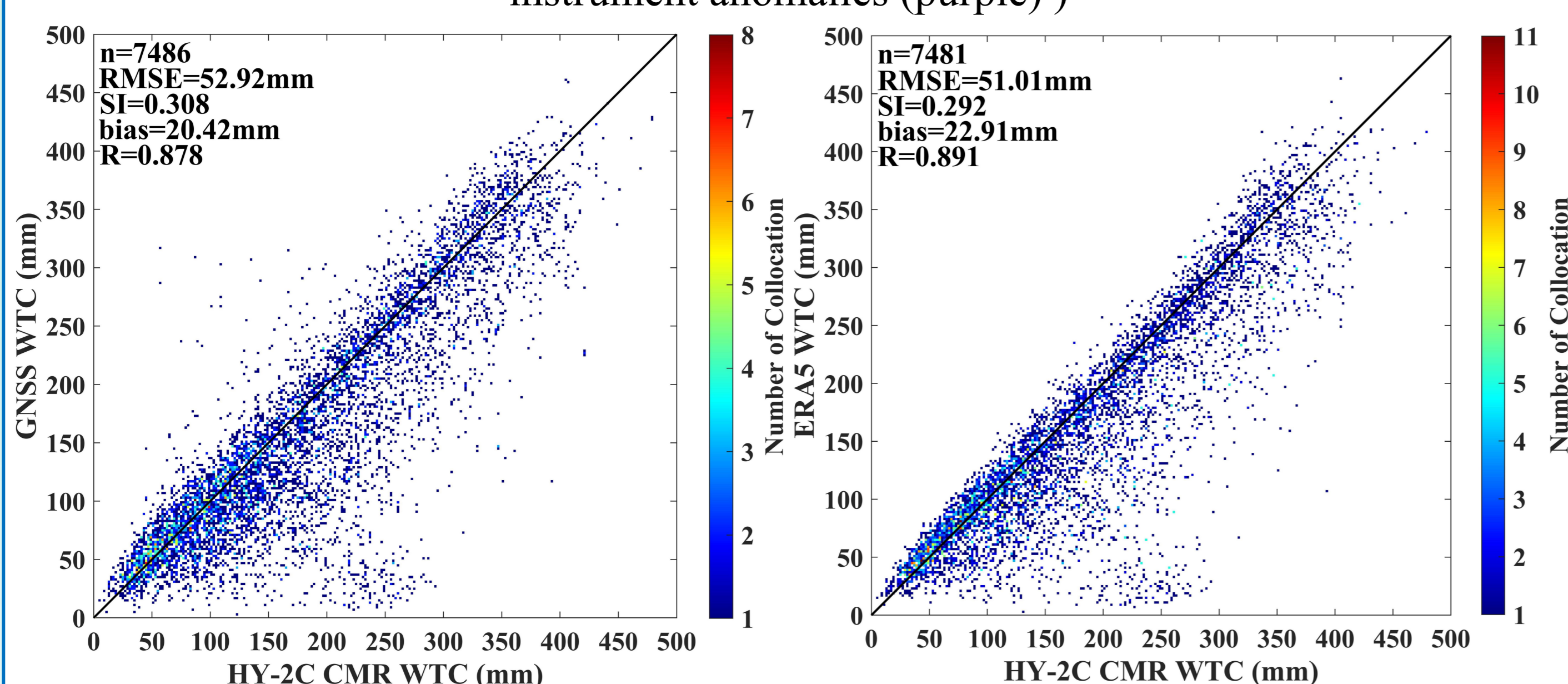


Figure 2. The comparisons between HY-2C CMR WTC and GNSS/ERA5 WTC over the coastal ocean

Methods

Taking the ERA5 WTC as the background field, and combining the effective CMR WTC, the GNSS WTC, ERA5 WTC and the effective CMR WTC, the new HY-2C WTC data are obtained by multi-source data fusion using spatiotemporal matching and objective analysis (OA) methods.

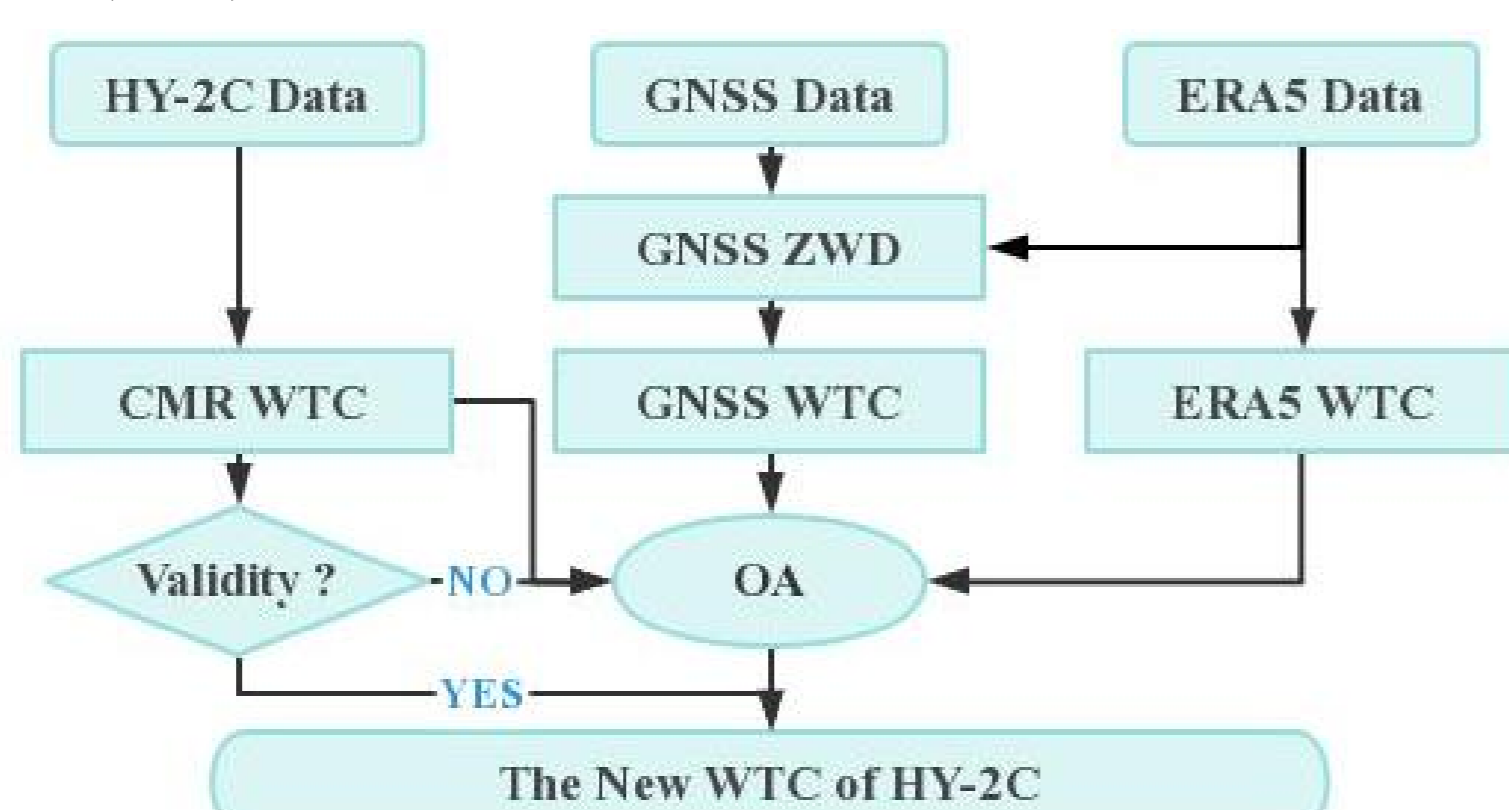


Figure 3. Technical flow of the new WTC method of HY-2C altimeter

Results

- The availability rate of HY-2C WTC data increased by 86.05%.
- The RMSE of the difference between OA WTC and GNSS WTC decreases significantly.
- The number of the available HY-2C WTC data after using OA WTC increases over the open ocean.
- The SLA variances corresponding to OA WTC are significantly smaller than that of the original HY-2C CMR WTC.

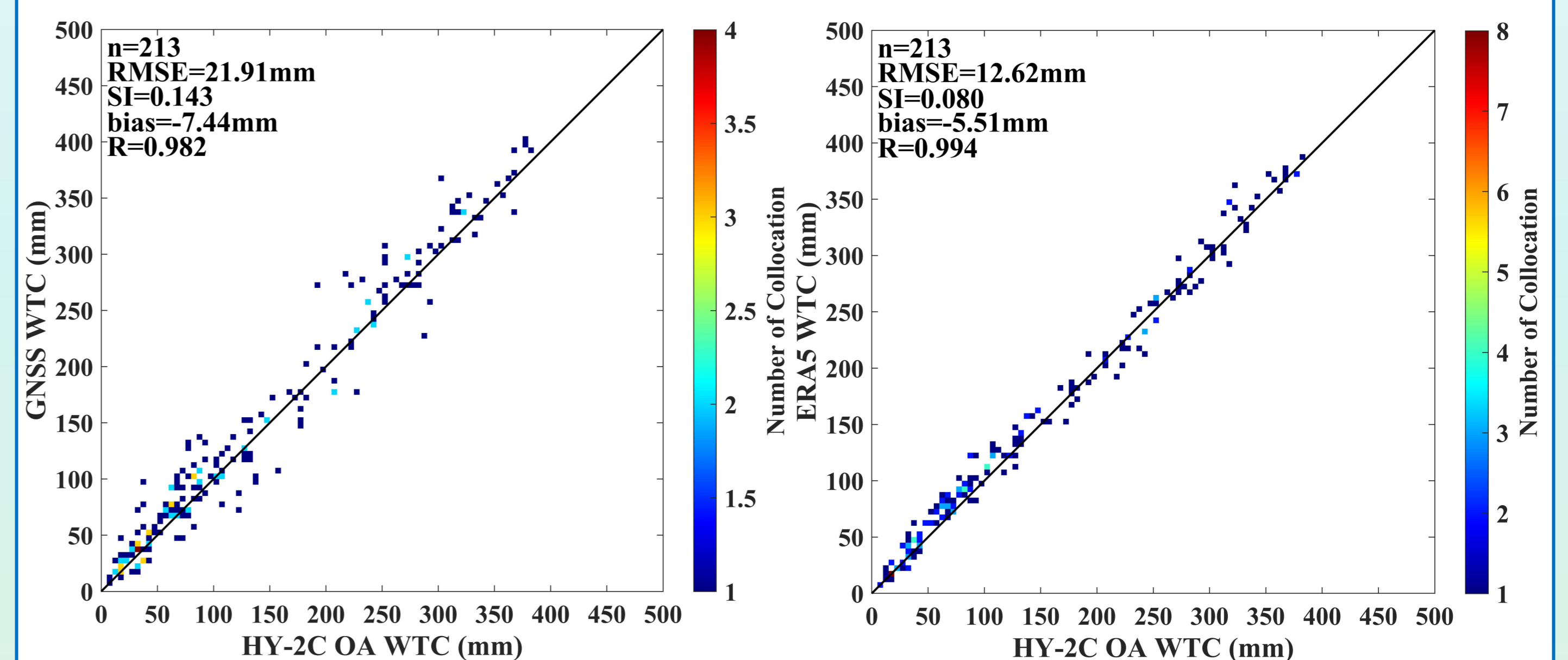


Figure 4. The comparisons between HY-2C OA WTC and GNSS/ERA5 WTC for cycle 0020 of HY-2C altimeter

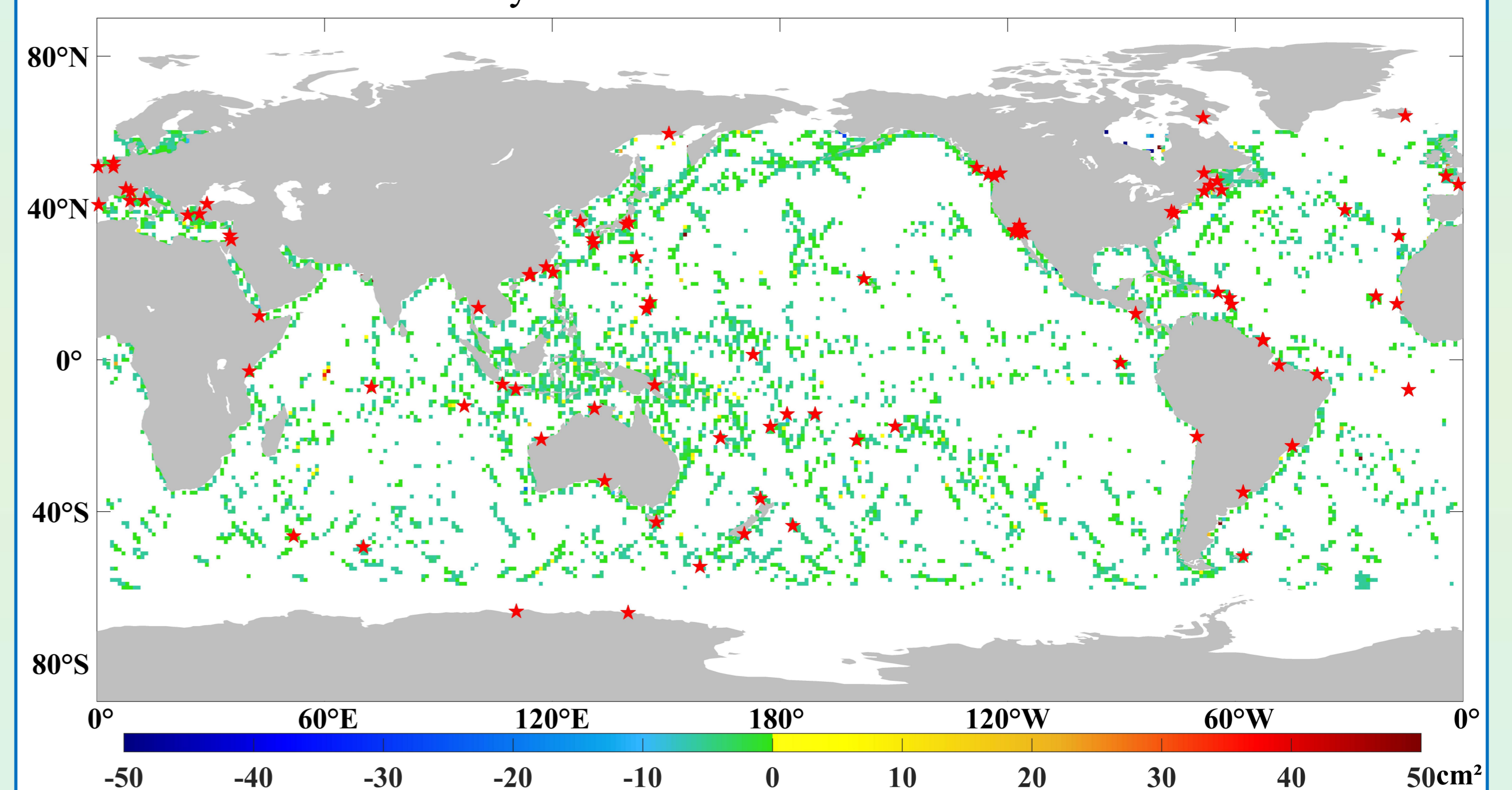


Figure 5. The differences of SLA variance according to OA WTC and CMR WTC for cycle 0020 of HY-2C altimeter

Conclusions

- The HY-2C CMR WTC are obviously abnormal or invalid over the coastal ocean for the influence of land and other environmental or instrumental conditions.
- A new WTC method of HY-2C based on OA by combining Multi-source Data is developed in this study.
- The availability and accuracy of HY-2C altimeter data are improved largely when WTC of HY-2C altimeter are calculated by the OA method.

Acknowledgements

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- The HY-2C altimeter products is produced by National Satellite Ocean Application Service (<http://www.nsoas.org.cn/>).
- The GNSS data is provided by NASA and IGS Data Center of Wuhan University (<https://cddis.nasa.gov/archive/gnss/data/>, <ftp://igs.gnsswhu.cn/pub/>).
- The ERA5 data is provided by ECMWF (<https://cds.climate.copernicus.eu/>).

References

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