

# Retrieval of the Wide Swath Significant Wave Height from HY-2C Scatterometer based on Deep Learning

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## Abstract

Ocean waves has great influence in shipping, offshore platform construction, national defense and military affairs. The scatterometer can obtain large-area synchronous sea surface wind data. In order to obtain more ocean wave observation data with large-area synchronous spatial-temporal coverage, the wide swath significant wave height(SWH) from HY-2C scatterometer is retrieved by the deep learning method in this study. The significant wave height data and sea surface wind data of HY-2C are used as the training set. The HY-2C wide swath significant wave height is intelligently extracted by the Convolutional Neural Network(CNN), and the retrieval accuracy of the HY-2C wide swath significant wave height is evaluated.

## Data

**HY-2C SCA data:** longitude, latitude, wind speed, wind direction from December 2020 to December 2022.

**HY-2C ALT data:** SWH from December 2020 to December 2022.

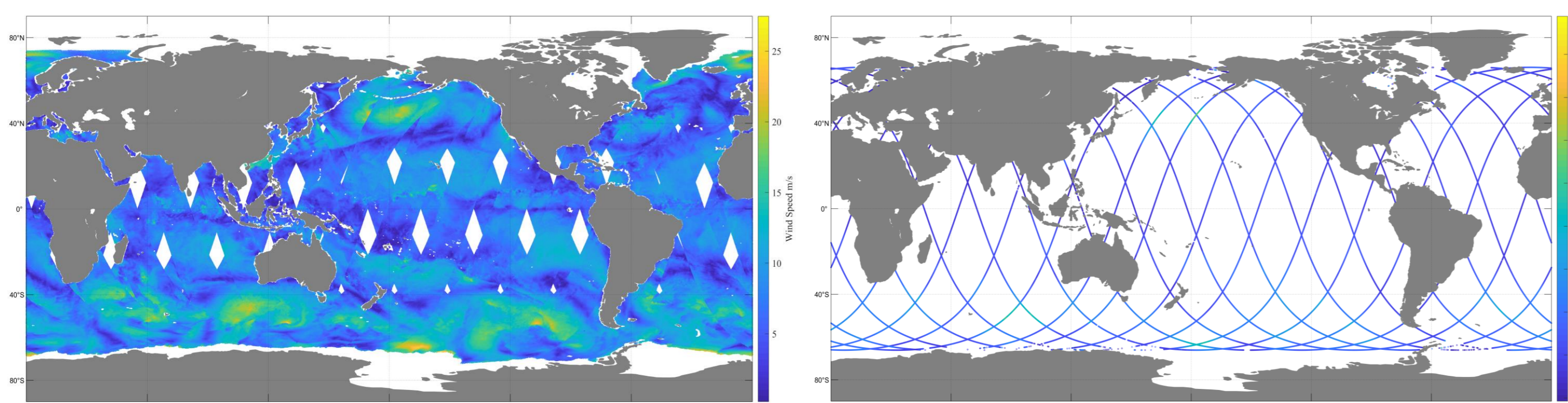


Fig 1. Sea surface wind from HY-2C SCA(left) and SWH from HY-2C ALT(right) on May 1st, 2022

## Method

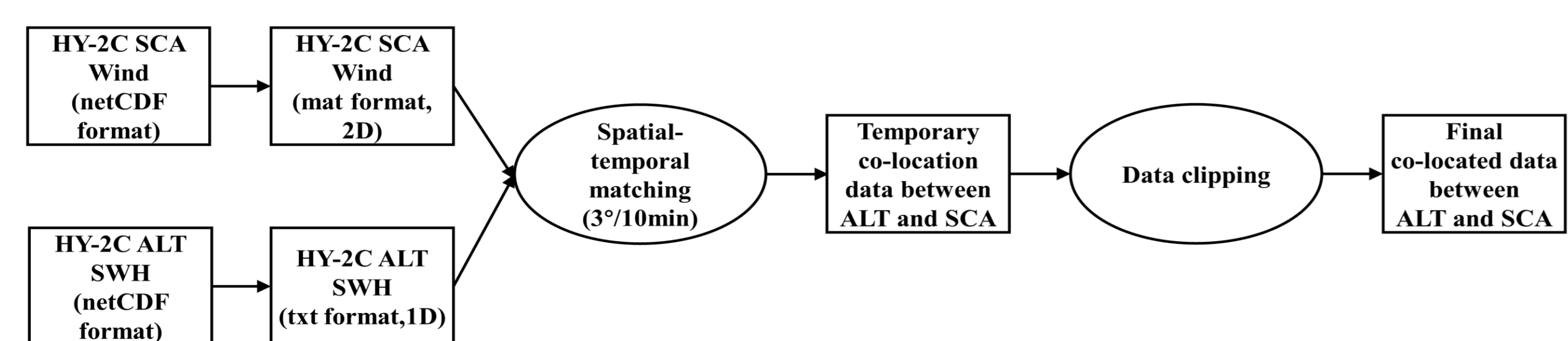


Fig 2. The preprocessing of HY-2C ALT and SCA data. The preliminary SCA training matrix is approximately 25x25. Subsequently, the data is clipped to yield a training dataset of 15x15. The final length of training dataset is 876,713

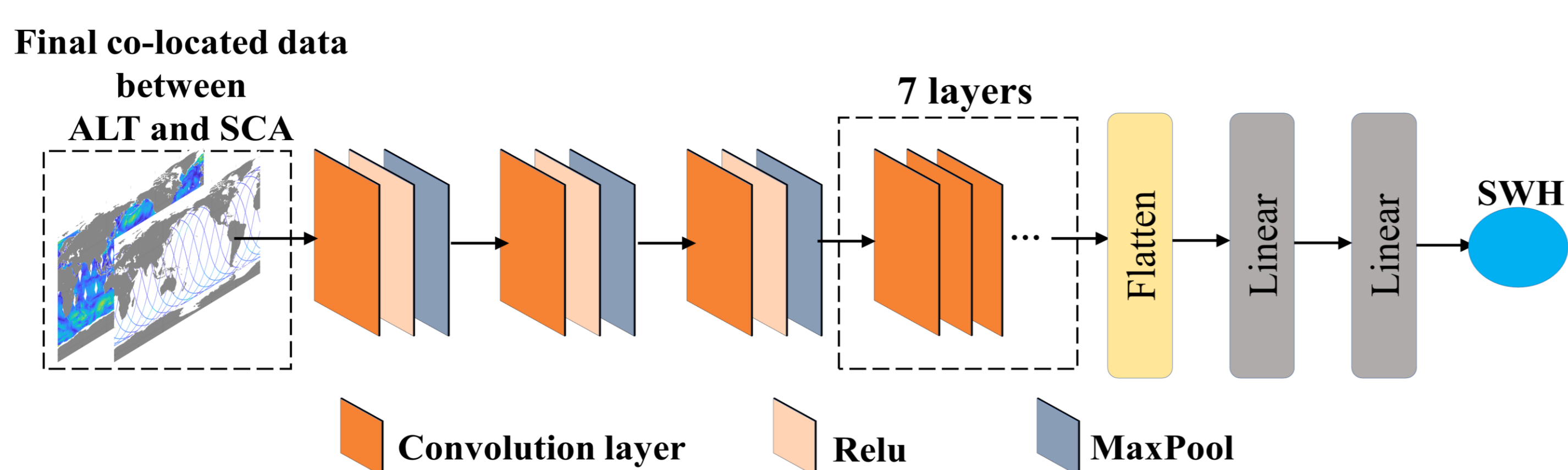


Fig 3. The wide swath SWH retrieving method based on CNN model

## Results

HY-2C SCA and ALT data during January 2023 are used to develop the model and validate the results.

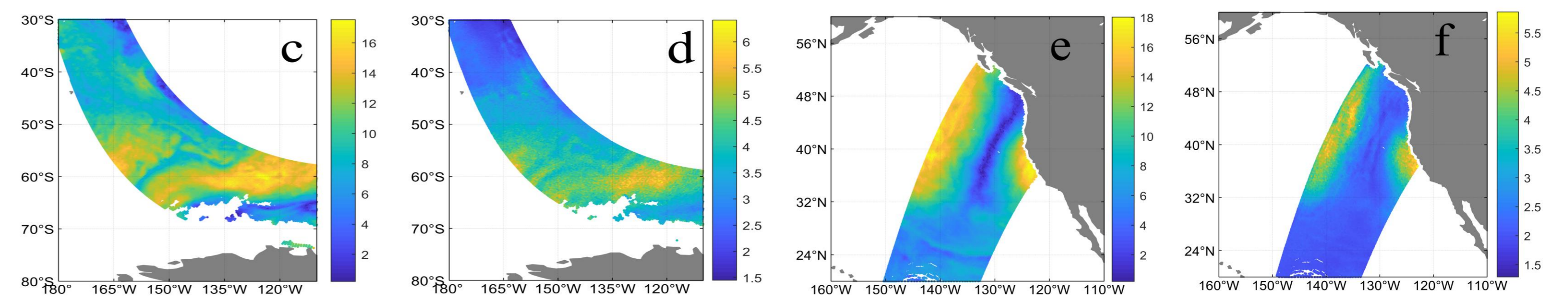
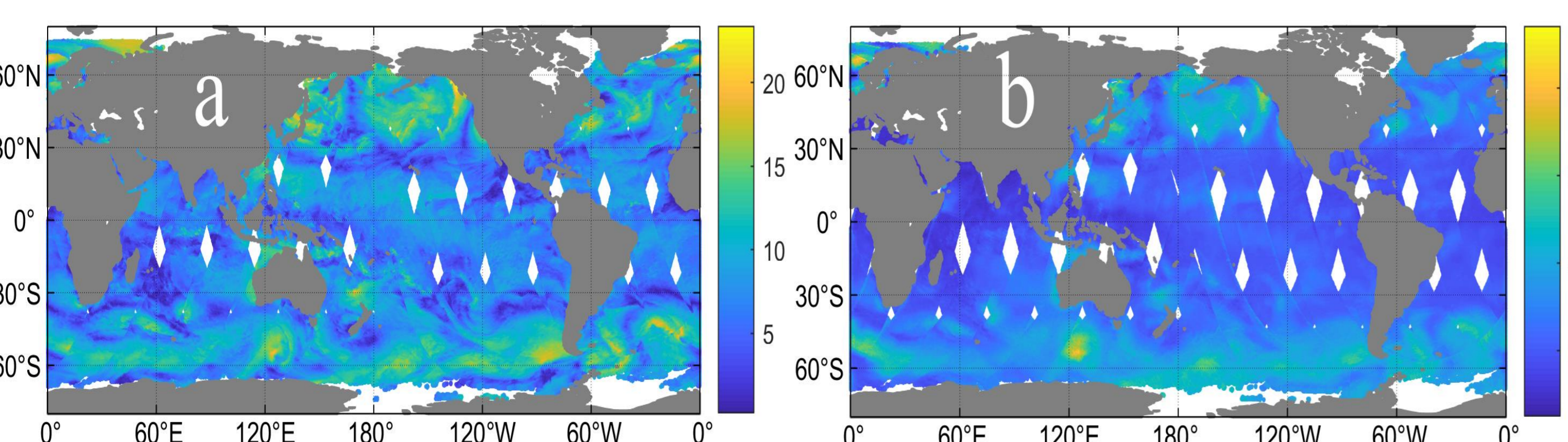


Fig 4. The original SCA wind speed (a, c, e) and the corresponding retrieved wide swath SWH respectively(b, d, f) on January 1st, 2023

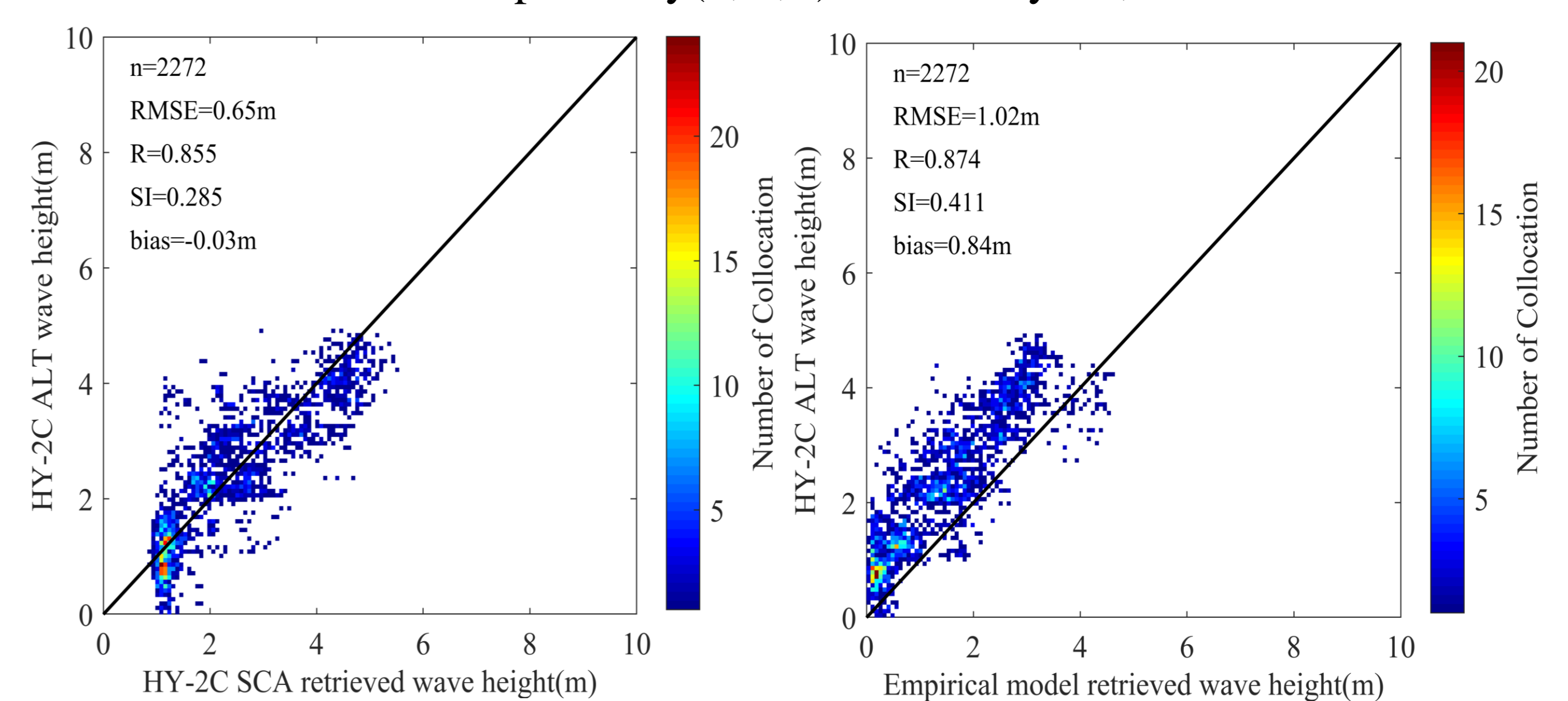


Fig 5. Validation of wide swath SWH(left) retrieved by SCAT data by comparing with retrieved SWH of empirical model (right) to ALT SWH in South China Sea during January 2023

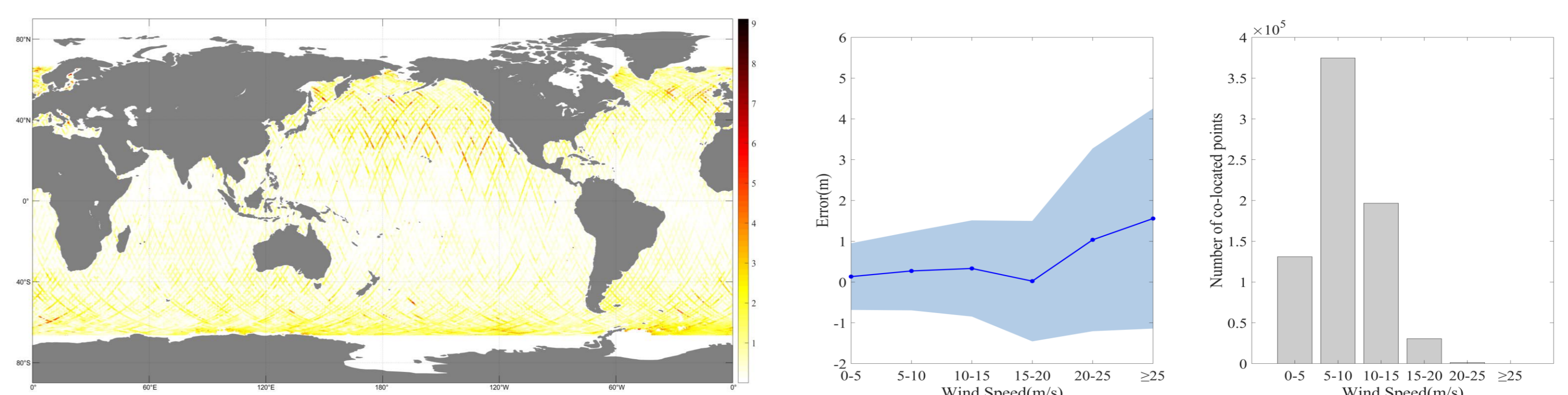


Fig 6. The difference distribution between SCA retrieved SWH and ALT SWH(left) and the errors in the bin of 5m/s(right) during January 2023

- The large errors are distributed in mid and high latitude areas with strong winds.
- The errors gradually increase in general with the wind speed increasing.

## Conclusions

- A new wide swath SWH retrieving method based on CNN model using HY-2C SCA data is proposed.
- The retrieved wide swath SWH has a better spatial coverage and spatial-temporal resolution.
- The retrieved wide swath SWH has a better accuracy than that of the empirical model.

## Acknowledgements

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## Major references

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