Long-term variability of eddy activities in the South China Sea

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1. Introduction

- The long-term variability of eddy activities in the South China Sea (SCS) is still not documented.
- This study aims to present the variability in different temporal scales and the feature distribution of the eddies in the SCS.
- The relationship of between the variability and the large scale phenomena (like the intensity of monsoon, the Kuroshio and El Niño) will be investigated later.

2. Data and methodology

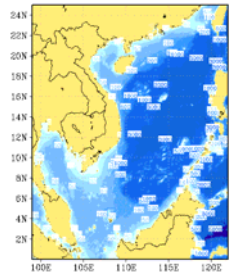

Fig.1 The tophograghy in the SCS

STORM global simulation(MPI-OM , J. von Storch et al., 2012):

- Tripolar curvilinear Arakawa-C grid;
- Forced by 6-hourly NCEP1;
- Time period: 1950-2010; daily data;
- Horizontal resolution: about10 km;

Identification of eddy

- Along one eddy track, each SSHA extremum (eddy center) with relative intensity (RI) over 3mm and the strongest extremum over 6mm;
- Size over 5 pixels;
- Travel length longer than 100km;
- 90% of lifespan in deep water (deeper than 200m).

3. Evaluation of the model dataset

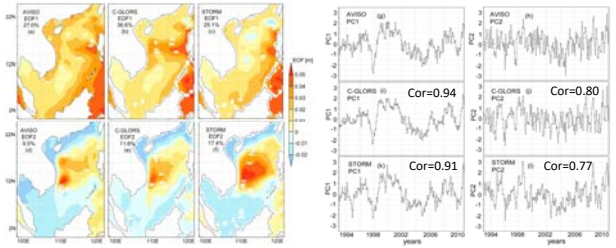

Fig.2 The first two EOFs [m] of 1993-2010 (the joint period) deseasonalized and detrended monthly SSHA from AVISO, CGLORS and STORM

- STORM simulation proves to reproduce the SCS ocean dynamics reliably, comparable with the C-GLORS reanalysis data. More details can be found in Zhang and H. von Storch (2017).

4. Statistics and variability of eddies in the SCS

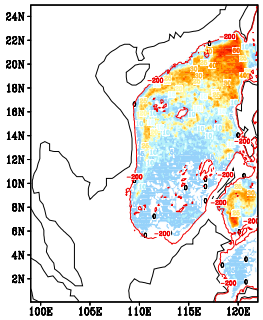

Fig. 3 the frequency of eddy occurrence

- A total of 1871 anti-cyclonic eddy (AE) tracks and 4219 cyclonic eddy (CE) tracks have been detected from STORM daily data based on the set of parameters.
- More CEs occurs in the SCS than AEs.
- In the SCS, eddy occurs most frequently near Luzon Strait and Vietnam coast.

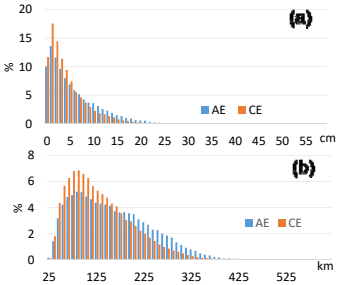

Fig.4 the distribution of eddy intensity (a) and eddy diameter (b)

- The maximum eddy intensity (EI) is less than 40 cm, and the maximum eddy diameter (ED) is over 500 km.
- Compared with CEs, AEs have a higher percentage of eddies with an intensity over 6 cm and diameter over 175 km.

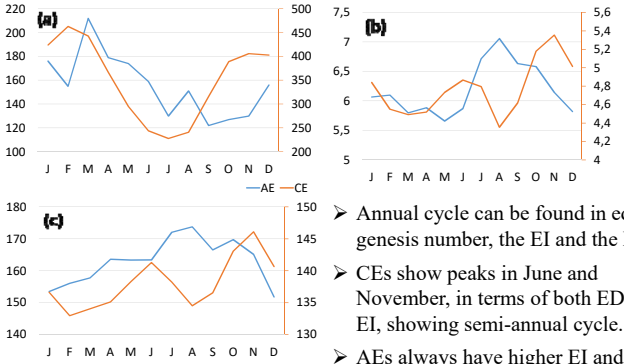

Figure 5 The annual cycle of eddy number (a), mean EI (b; cm) and mean ED (c; km).

- Annual cycle can be found in eddy genesis number, the EI and the ED.
- CEs show peaks in June and November, in terms of both ED and EI, showing semi-annual cycle.
- AEs always have higher EI and larger ED.

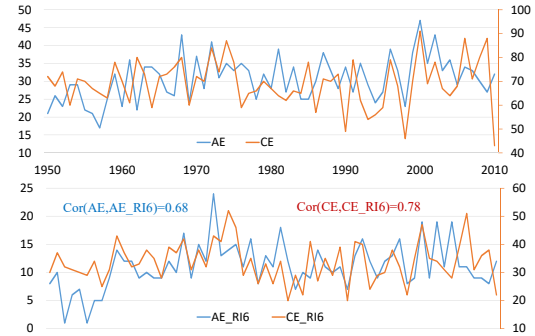

Fig. 6 the annual generated eddy number. (b) has used different parameter set of RI=6mm and RImax=10mm

- Inter-annual variability dominates the annual eddy genesis.
- Different sets of parameters don't change the interannual variability.

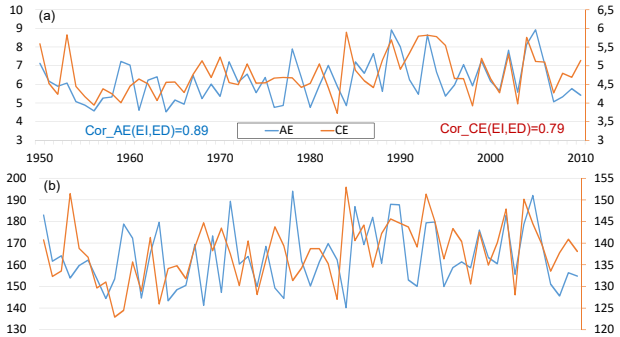

Fig.7 the annual time series of EI (a; unit: cm) and ED (b; unit: km);

- The annual series also presents predominant interannual variability.
- ED reveals strong positive correlation with EI, in terms of both AEs and CEs.

5. Summary

- Strong interannual variability dominates in the annual series of eddy genesis, eddy intensity and eddy size. And EI and ED have high correlation, in terms both AEs and CEs.
- Eddy genesis number and the EI and ED of AEs present annual cycle. However, the EI and ED of CEs show more semi-annual cycle.
- CEs are much more active in the SCS than AEs. However, more percentage of AEs have higher intensity and larger size.

References

- von Storch, J.-S. et al., 2012. An estimate of the Lorenz energy cycle for the world ocean based on the 1/ 10° STORM/NCEP simulation. J. Phys. Oceanogr. 42 (12), 2185-2205, http://dx.doi.org/10.1175/JPO-D-12-079.1
- Zhang, M., von Storch, H., 2017. Toward downscaling oceanic hydrodynamics - suitability of a high-resolution OGCM for describing regional ocean variability in the South China Sea. Oceanologia. 59 (2), 166-176, DOI 10.1016/j.oceano.2017.01.001