Enhanced Eddy-induced Ocean-to-Atmosphere Turbulent Heat Transfers in the Global Western Boundary Current Regions

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Introduction

Significant ocean-atmosphere interaction from basin to frontal scale occurred in the global subtropical Western Boundary Current (WBC) regions where are characterized by high eddy kinetic energy and strong SST gradient. Here, we focus on the interannual variation of eddy induced turbulent heat flux anomalies (ETHFA) in the global five WBC regions respectively based on the composite method. We present that the ETHFA exhibits a upward trend during the period from 1993 to 2011 over the all WBC regions, suggestive of the role of mesoscale ocean-atmosphere interaction is much more significant. this upward trend results from the enhancing background SST gradient associated with increasing air sea temperature difference inside the eddies over the five WBC regions.

Data and Method

- eddies dataset by Chelton
- WHOI OA Air-Sea Fluxes(OAFlux)
- AVHRR SST
- composite method to isolate eddy-induced THF anomalies

Five WBC Regions

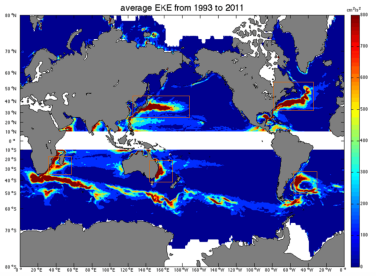

Fig.1 spatial distribution of sea surface eddy kinetic energy(EKE) averaged from 1993 to 2011. red boxes denote the 5 WBC regions: the Kuroshio Extension(KE),the Gulf Stream(GS), the Brazil-Malvinas confluence(BM), the Eastern Australian current(EA) and the Agulhas Current(AC).

KE , GS Regions

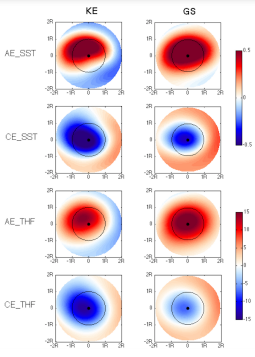

Fig.2 top two rows shows the composite of the SST anomalies associated with AEs versus CEs in the KE and GS regions,respectively; lower two rows shows the composited eddy-induced THF anomalies in the KE and GS regions.

the maximum (minimum) value of SST anomalies and THF anomalies concentrate in the radius of AE (CE),which is represents the AE (CE) induced SST anomalies and THF anomalies.

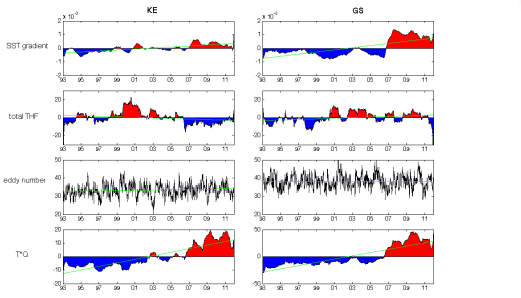

Fig.3 the first row shows the variability of meridional SST gradient; the second row shows the averaged THF ;the third row shows the eddy number ; the last row shows the SST and eddy induced THF anomalies .

AC,EA and BM Regions

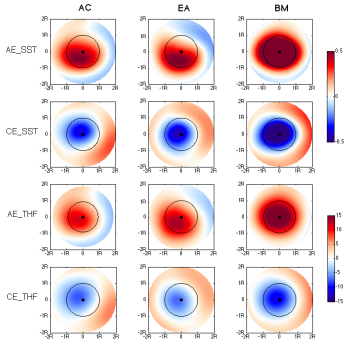

Fig.4 the composite of SST anomalies associated with AEs versus CEs and eddy-induced THF anomalies like Fig.2 but in AC,EA and BM regions.

We can see that the eddy-induced THF patterns are similar with SST patterns , unveiling CE (AE) associated with negative (positive) turbulent heat flux anomalies.

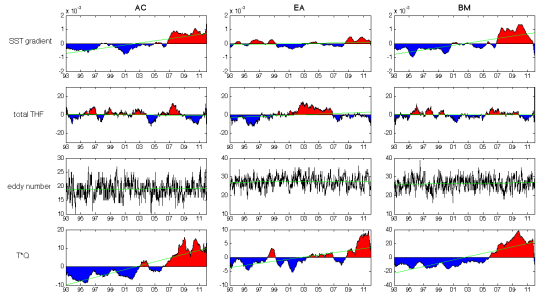

Fig.5 the variation of same elements as Fig,3 but in the AC,EA and BM regions.

Conclusion

- the eddy- induced THF anomalies is enhanced from 1993 to 2011 in the five WBC regions.
- this upward trend results from the enhancing background SST gradient associated with mesoscale eddies.
- this result suggests that mesoscale ocean-to-atmosphere interaction is much more significant.