

Lagrangian study of cross-slope transport and its role on phytoplankton bloom in the Northern South China Sea

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(IOCAS)
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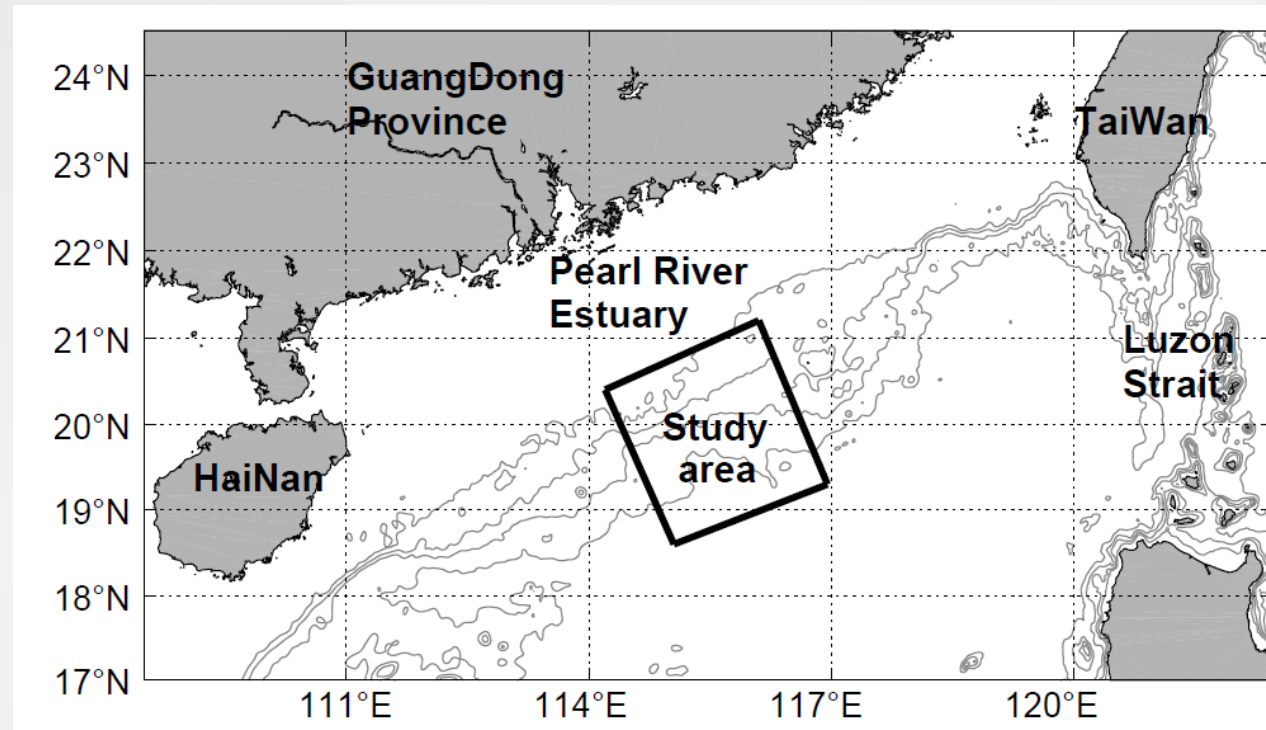
HU ZIYUAN (胡仔园)
YU JIE (于杰)



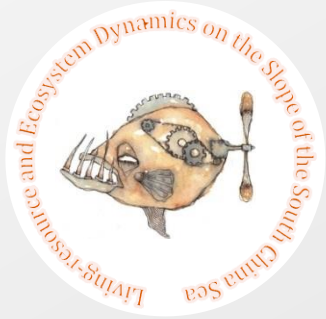
Outline

- Introduction
- Lagrangian FSLE technique
- Horizontal transport patterns of the NSCS slope
- Cross-slope transport in the NSCS (preliminary results)
- Summary

Study Area



Slope of the Northern South China Sea (NSCS)



The **L**iving-resource and **E**cosystem **D**ynamics on the **S**lope of the South China Sea (**LEDS**) project

PI: ZHOU MENG (周朦)

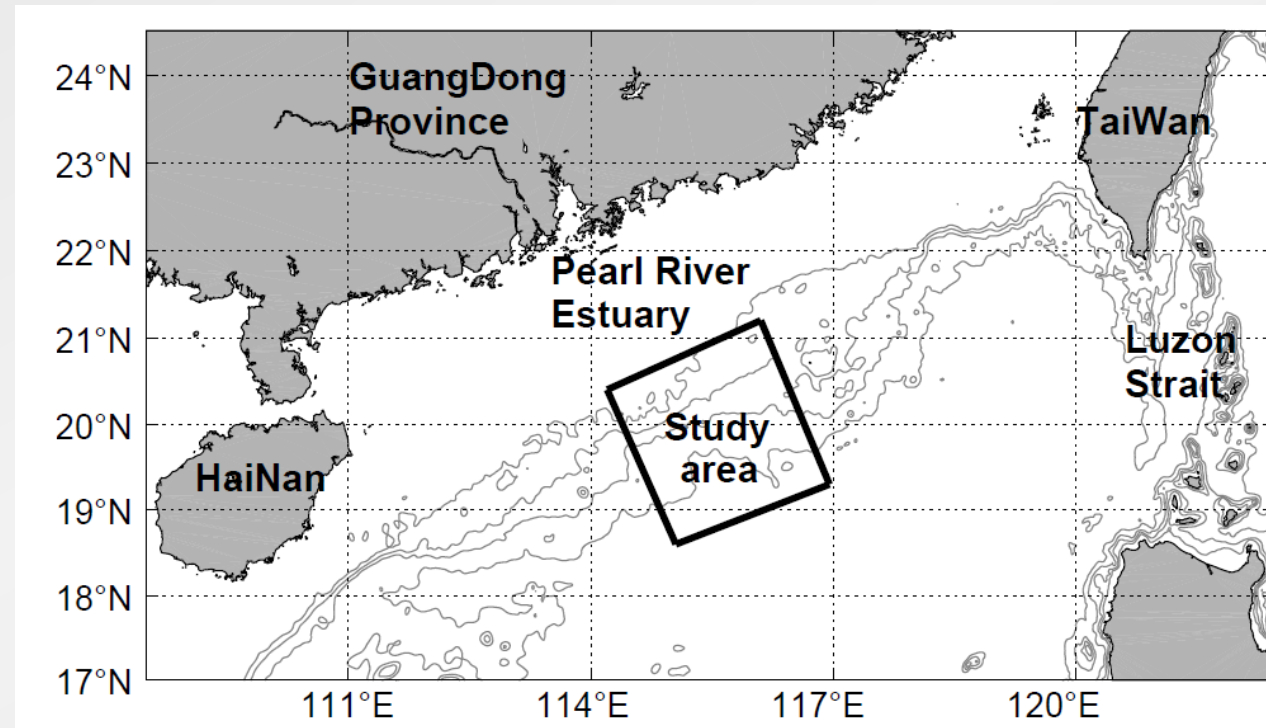
Shanghai Jiao Tong University



Funded by: Chinese Ministry of Science and Technology

Focus: the role of mesopelagic fish in biomass flows between trophic levels of the ecosystem, and horizontal transport and vertical flux of carbon in the northern slope region of the South China Sea (SCS).

Study Area

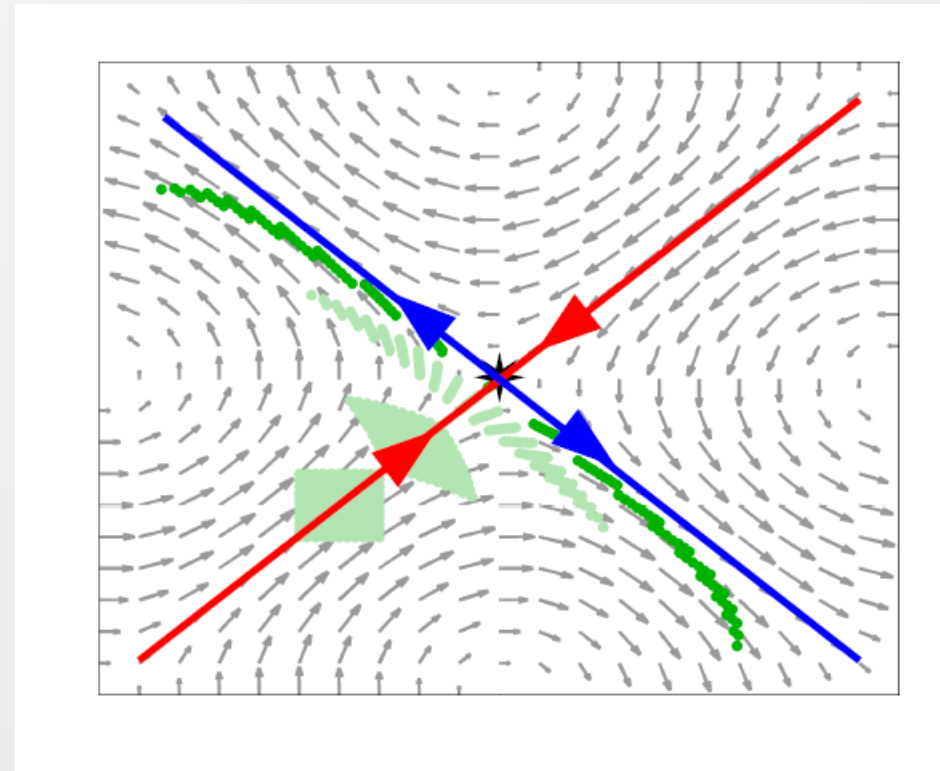
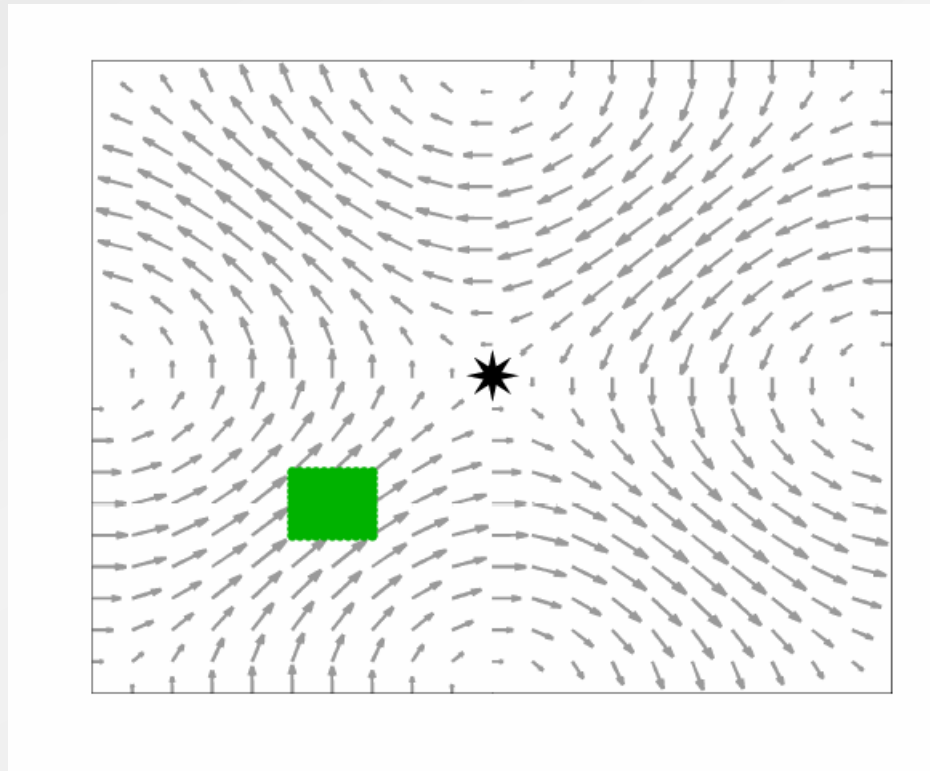


- surface transport structures
- cross-slope exchange
- Role on the phytoplankton bloom
- interpretation of the field measurements

Slope of the Northern South China Sea (NSCS)

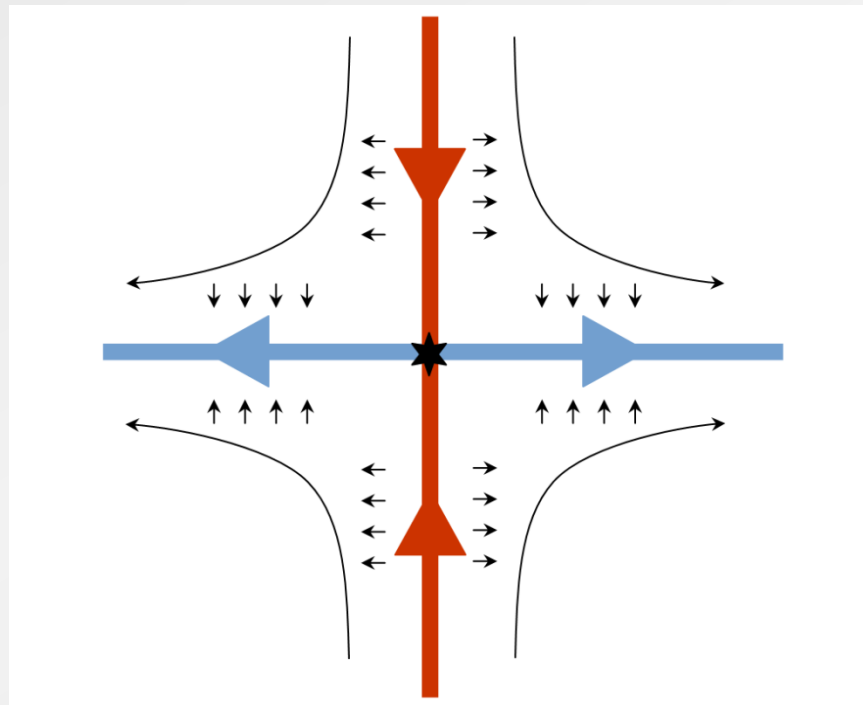
LCSs

Lagrangian Coherent Structures



LCSs

Lagrangian Coherent Structures



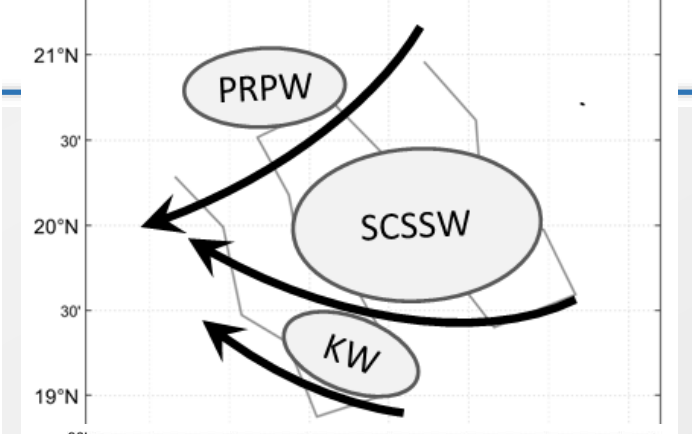
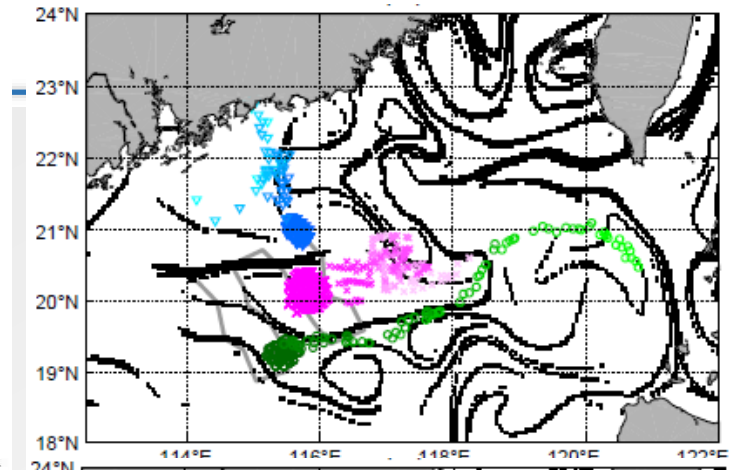
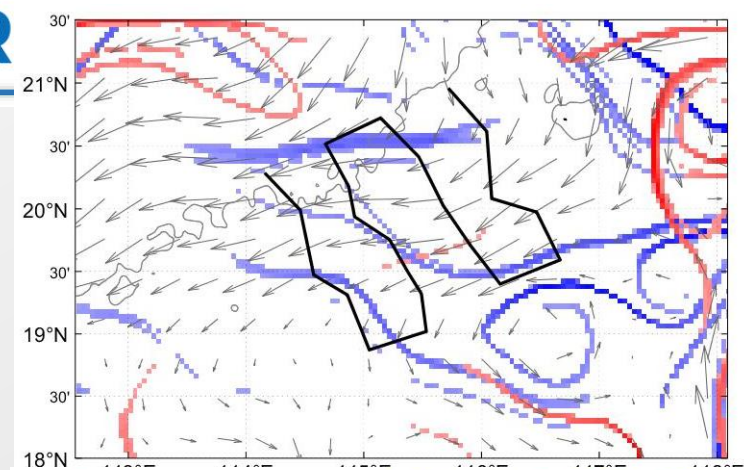
Hyperbolic LCS structure

LCSs: Structures which separate **dynamically distinct regions** in time-varying systems
 attractors, saddles, manifolds...
 → Avenues and barriers to transport, vortex boundaries, high mixing activities...

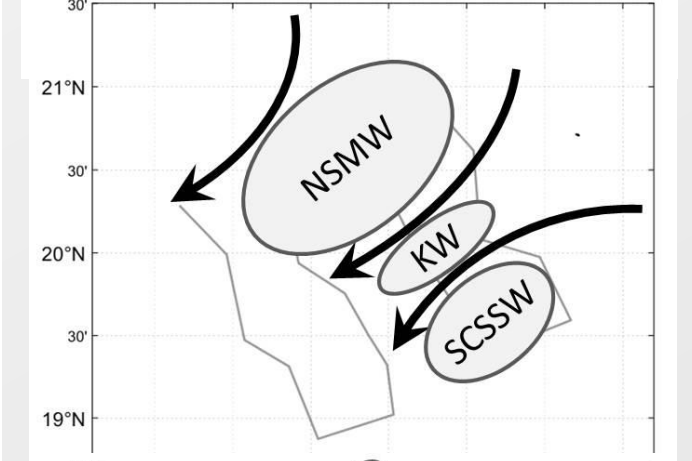
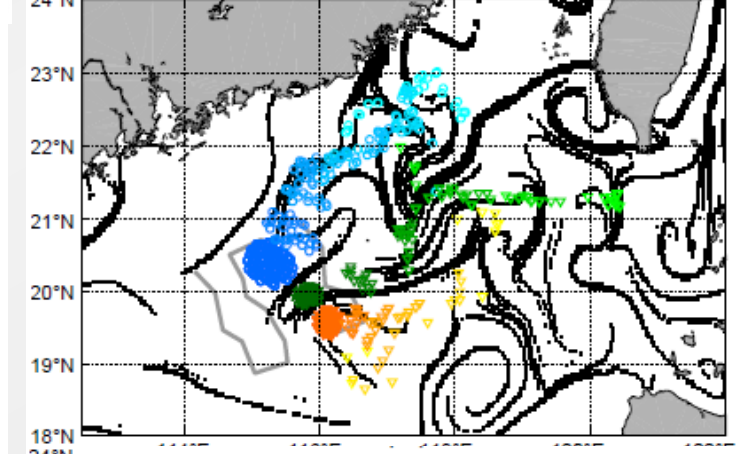
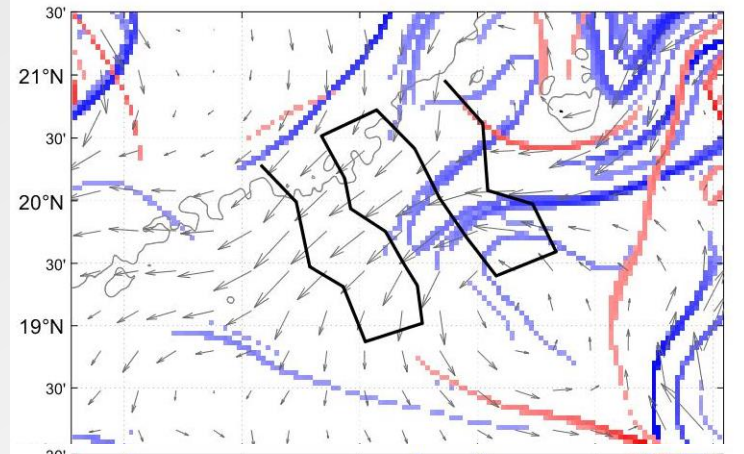
Attractive LCSs → diverging (backward)

Repelling LCSs → converging (forward)

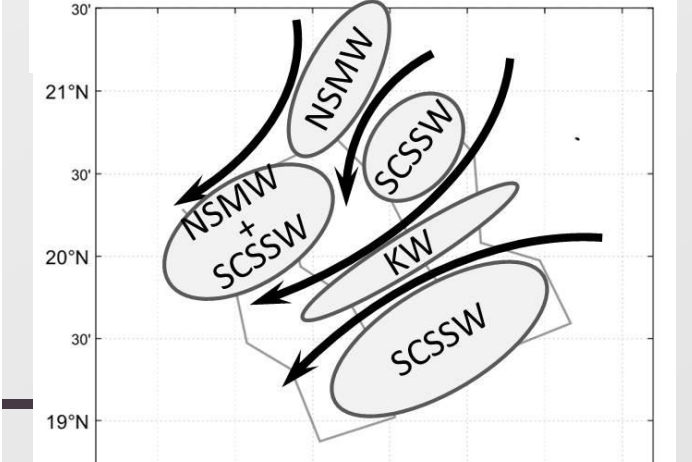
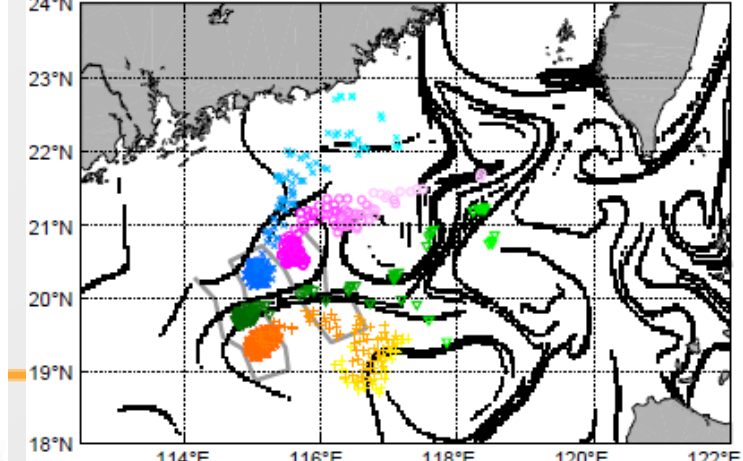
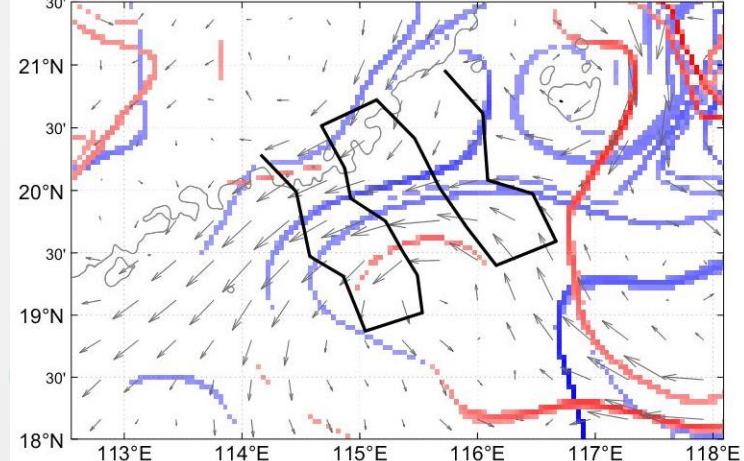
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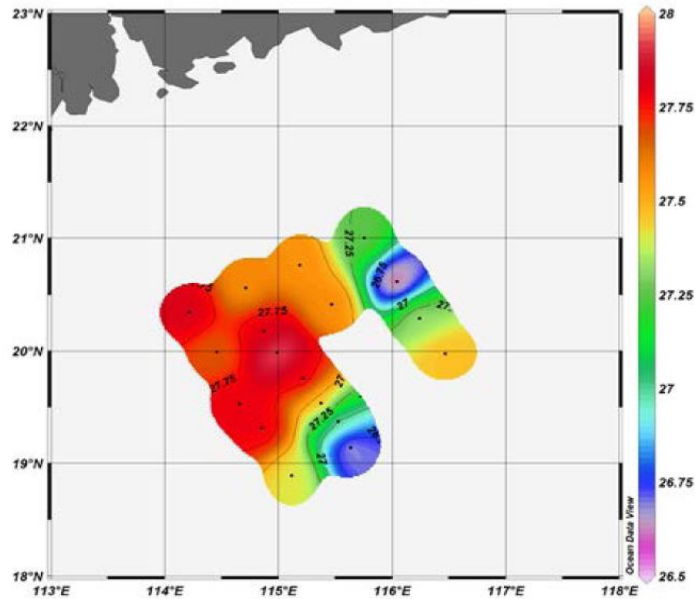
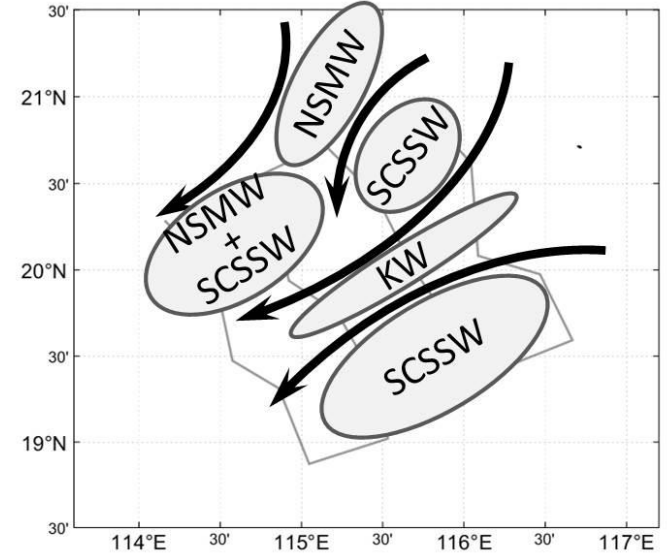
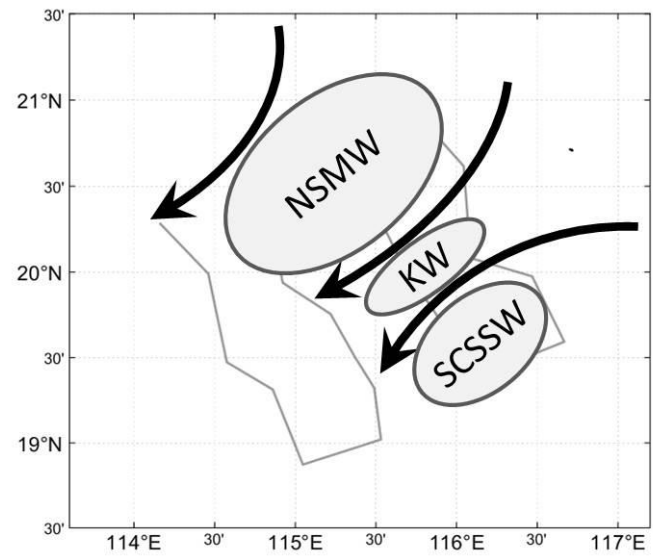
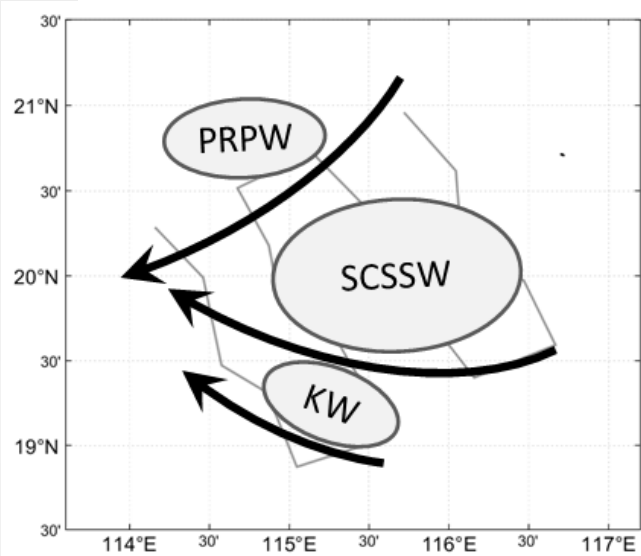
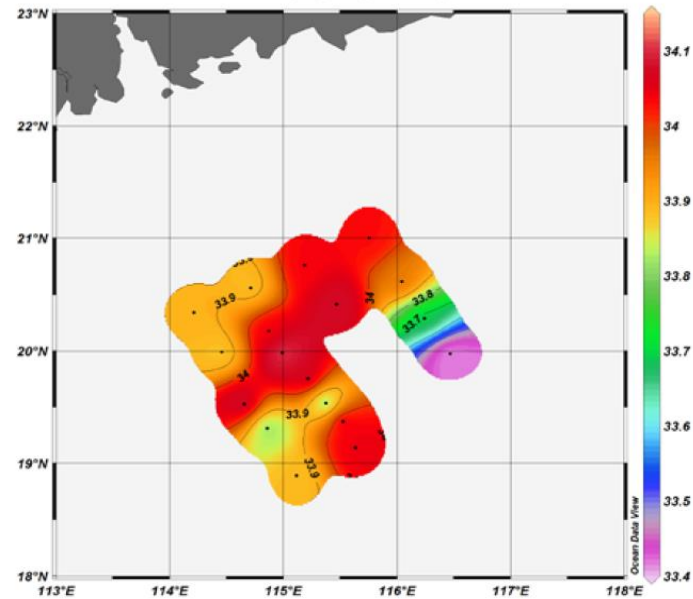


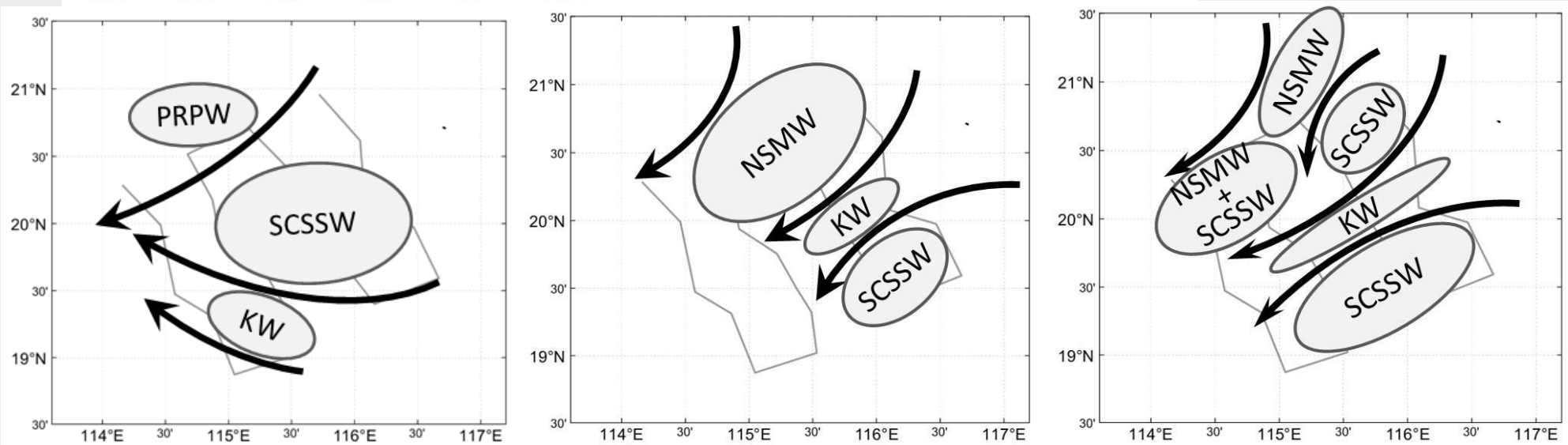
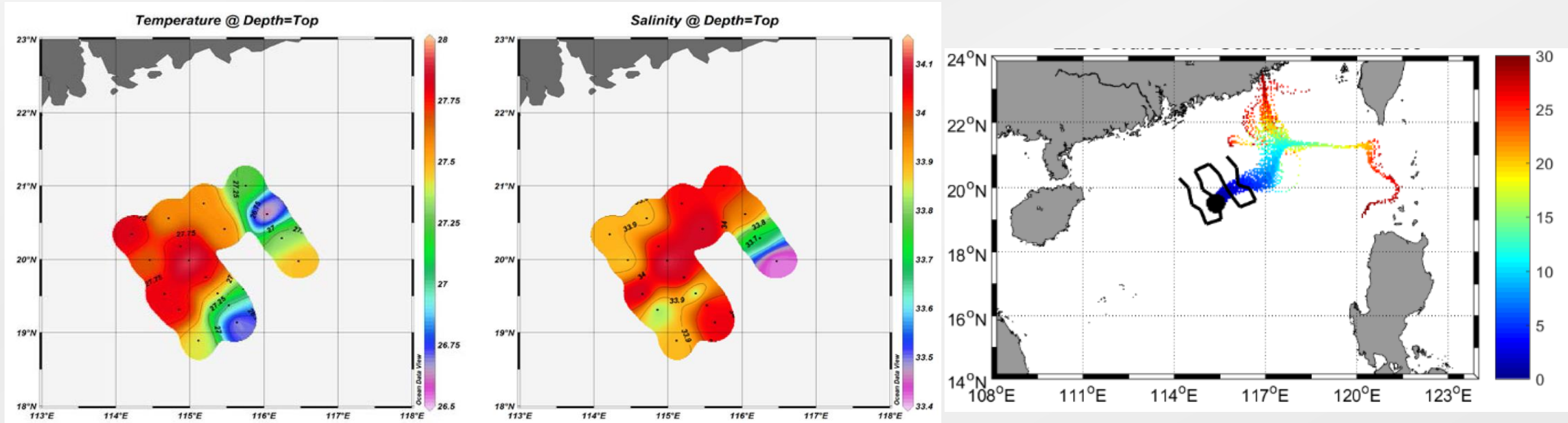
Middle



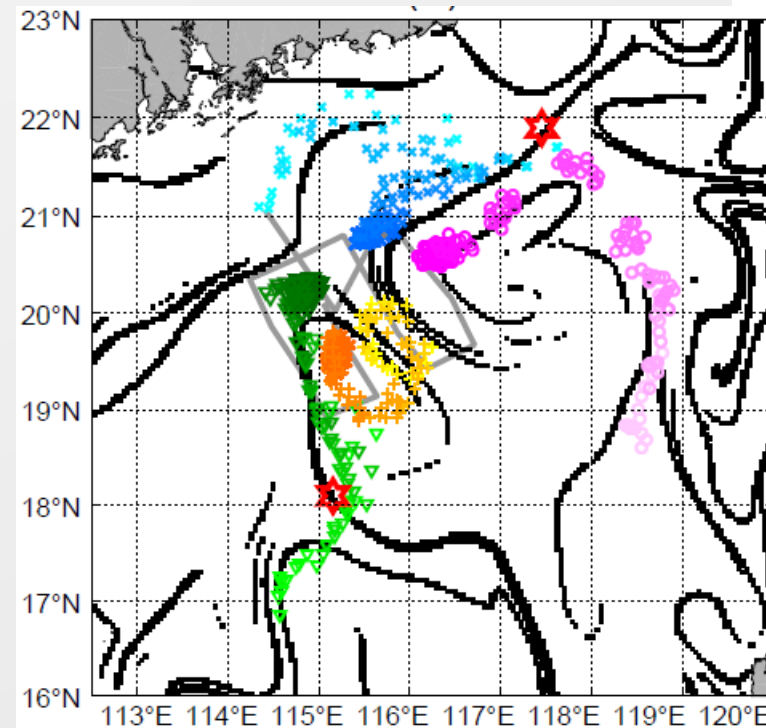
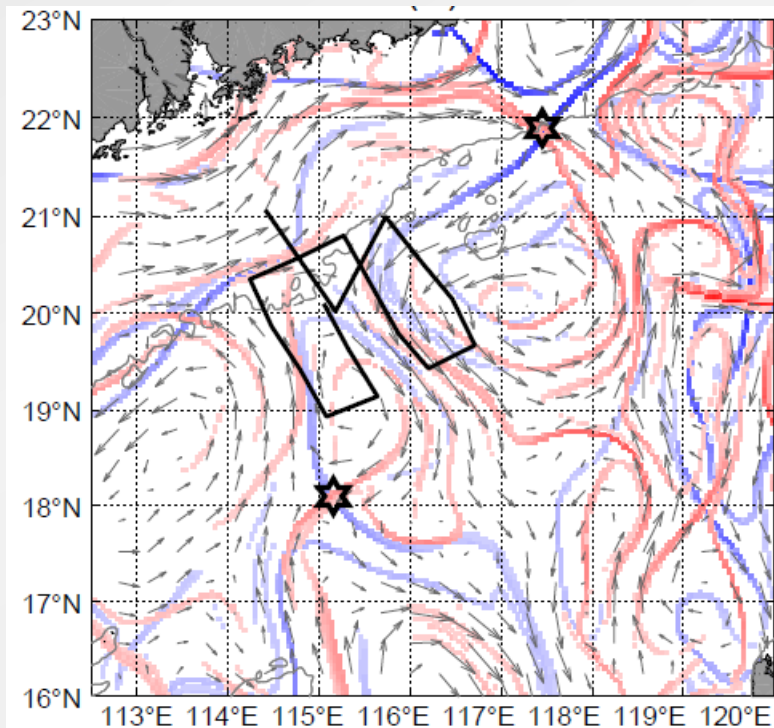
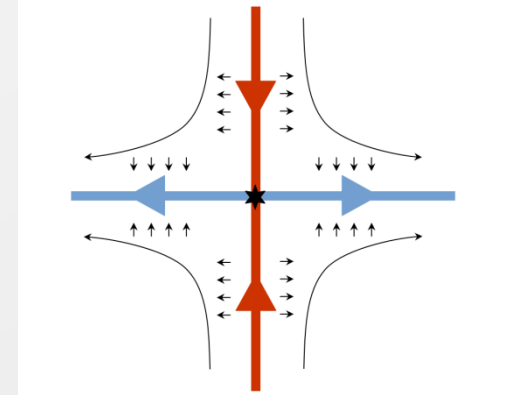
End



LEDS 2014
Temperature @ Depth=Top

Salinity @ Depth=Top


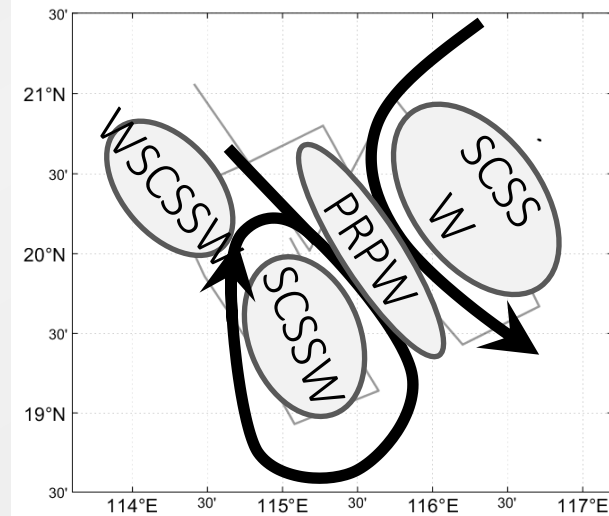
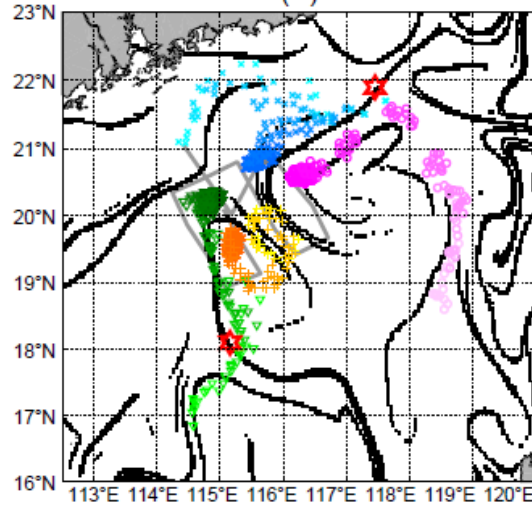
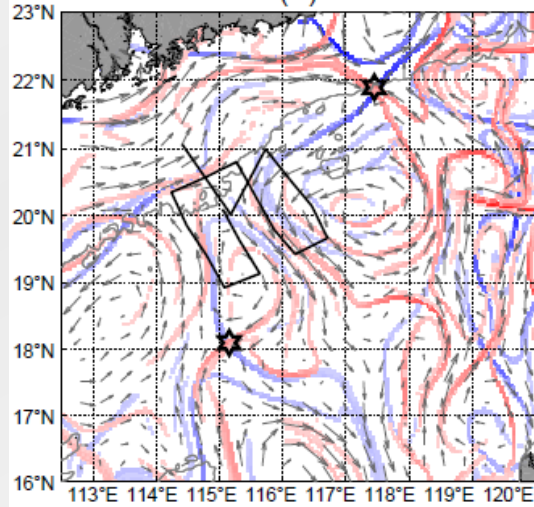


LEDS 2015

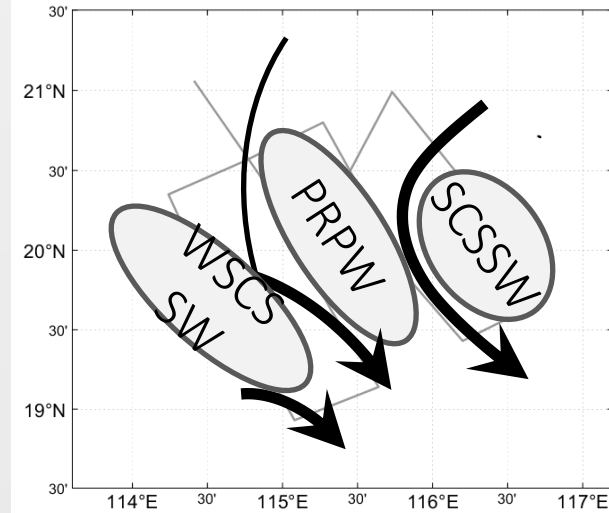
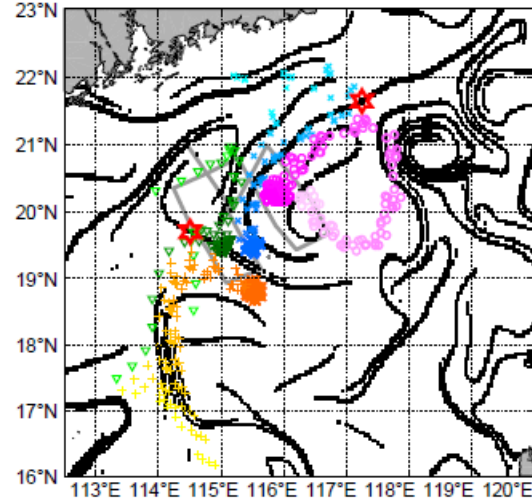
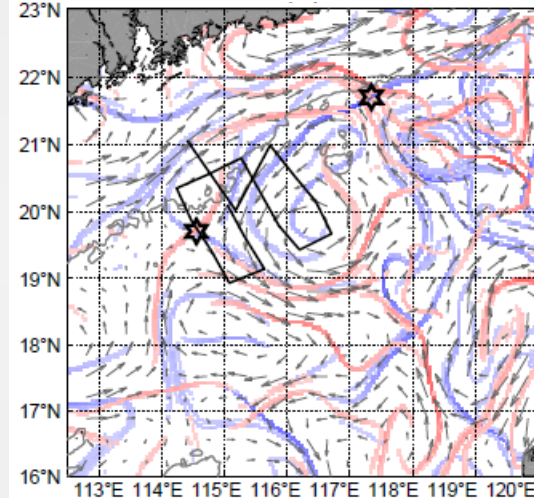


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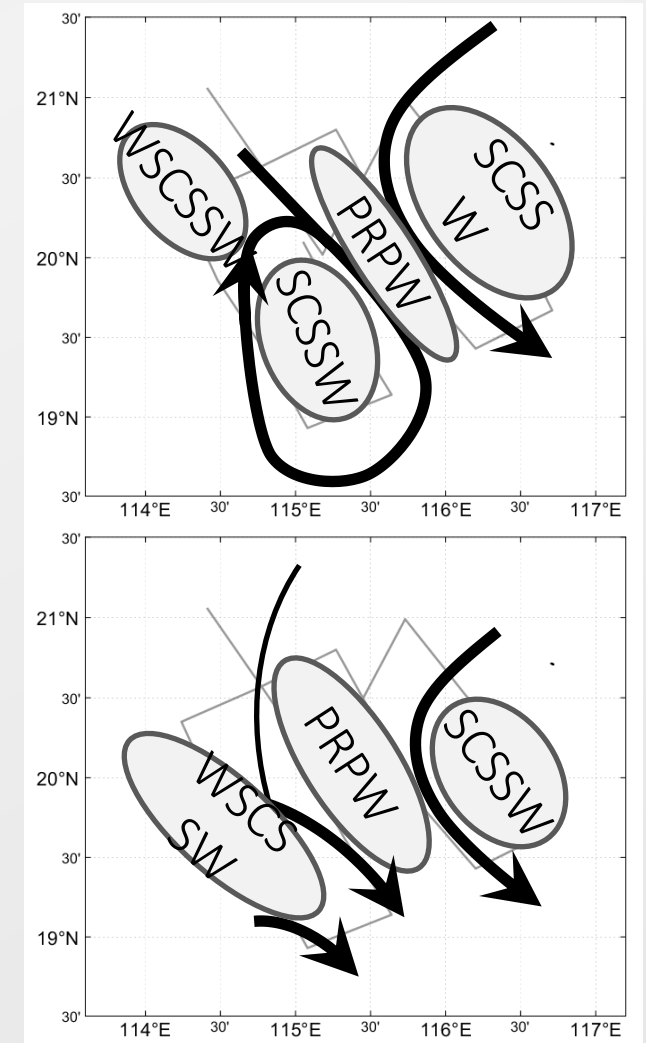
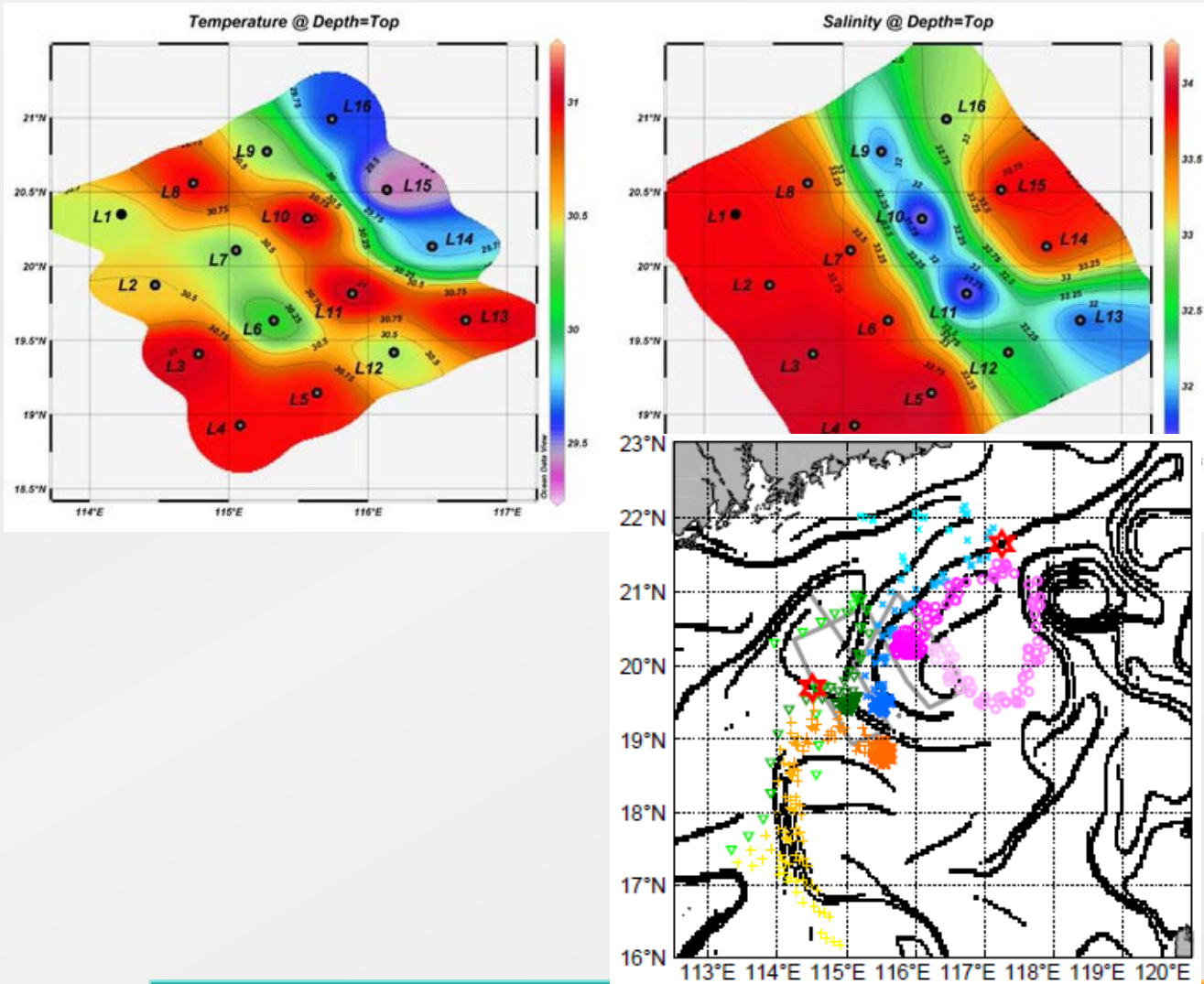
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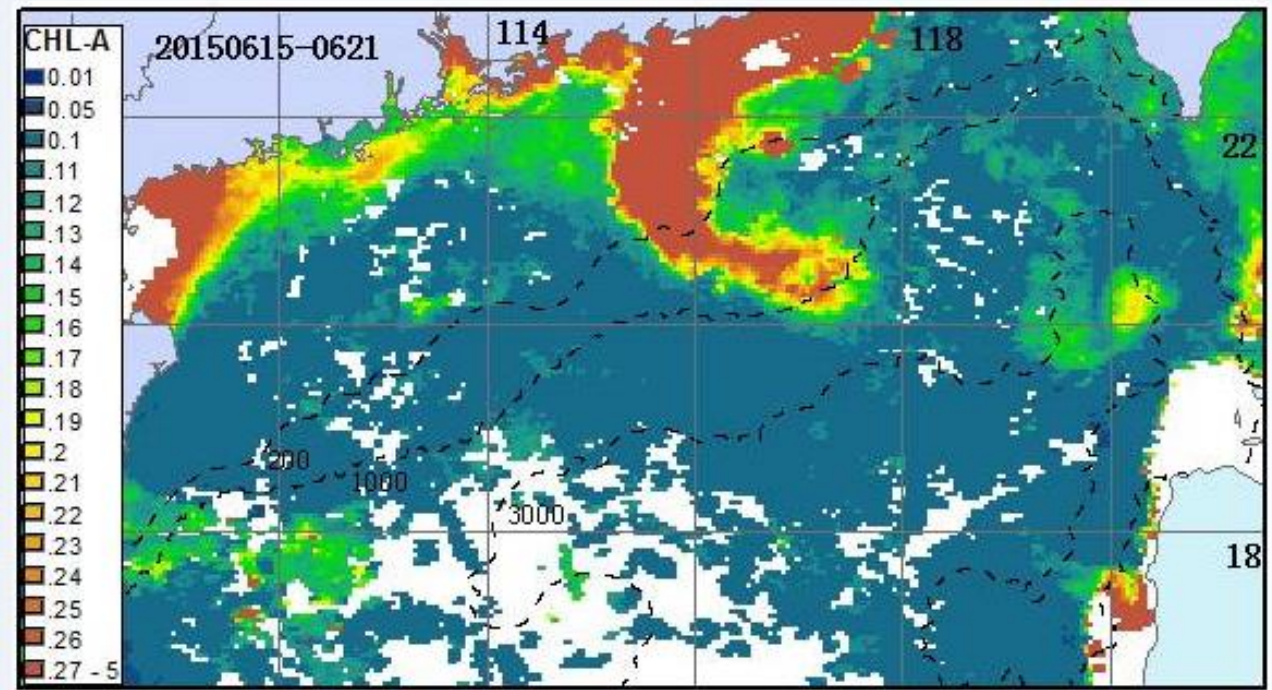
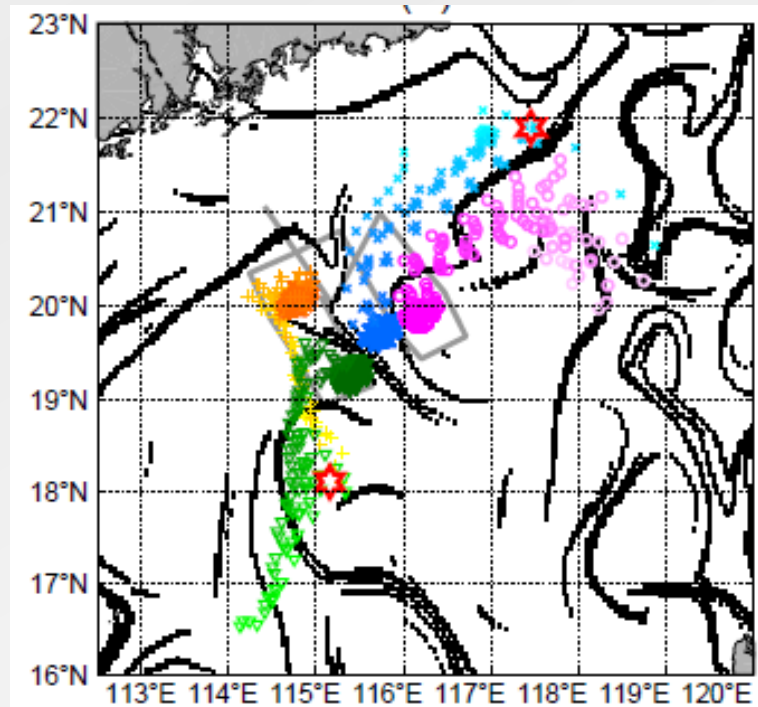
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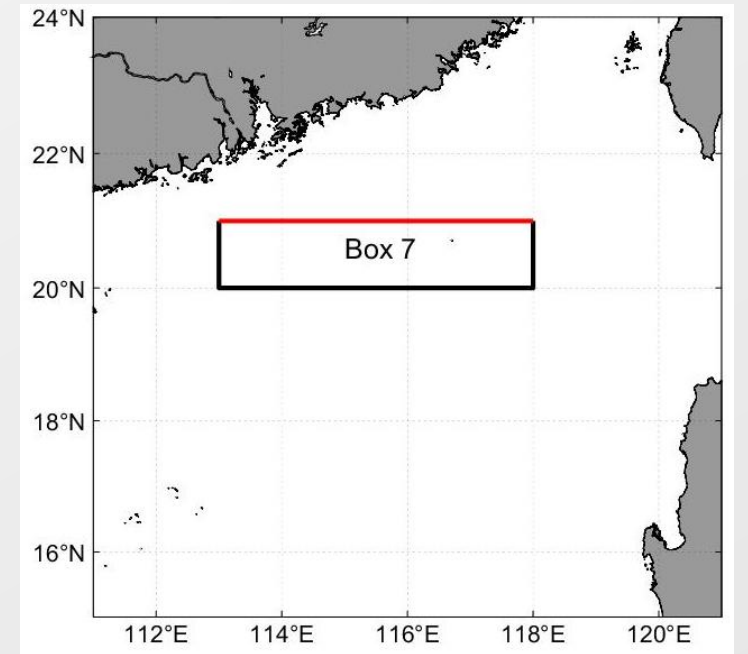
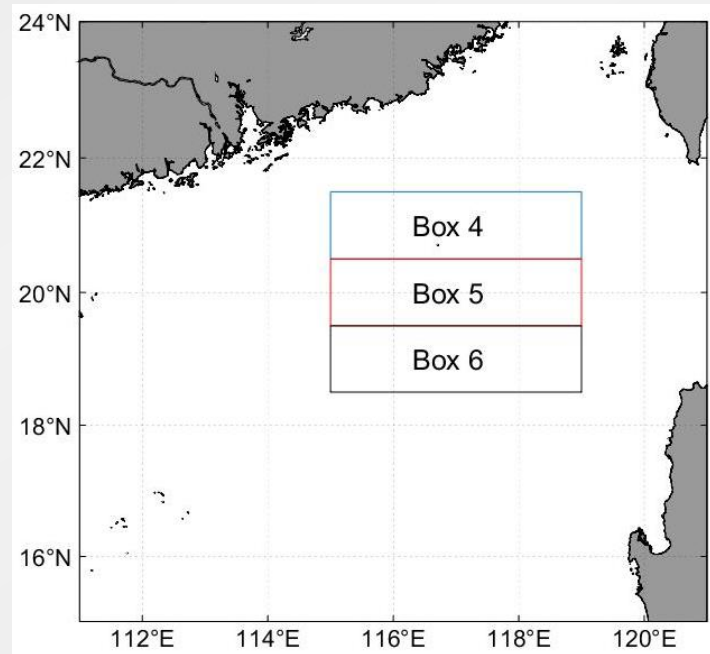
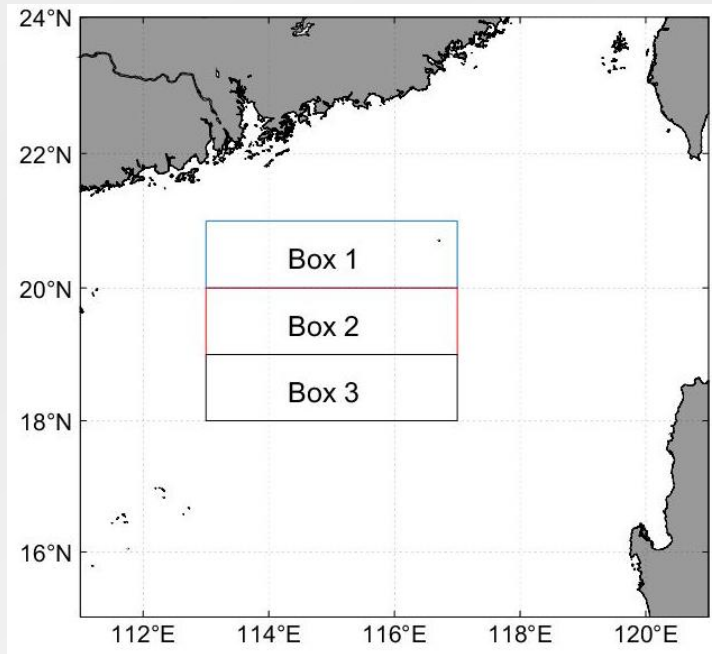


LEDS 2015

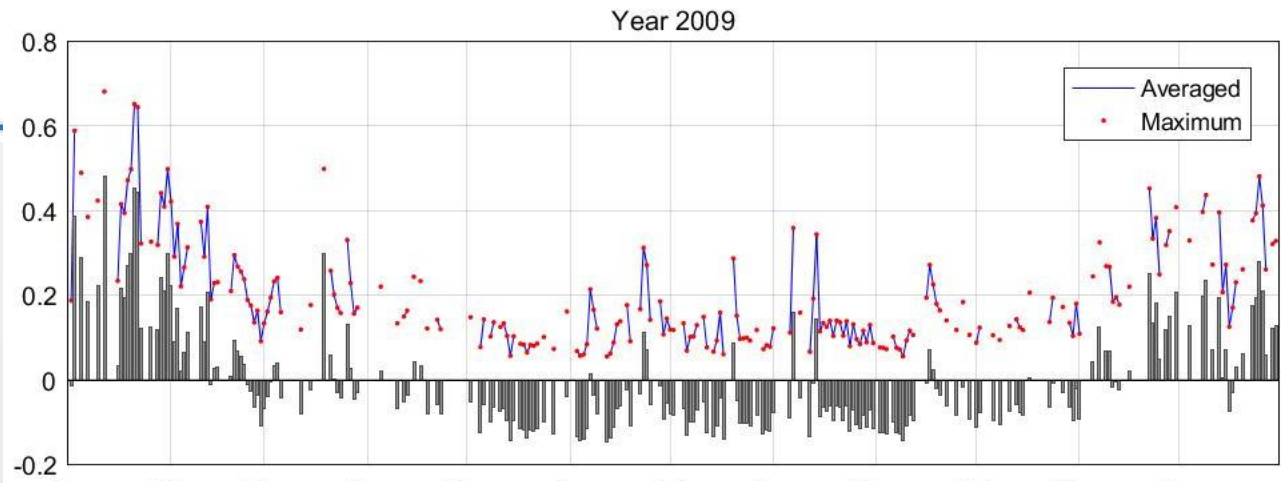


Eddy ↔ Cross-Slope transport ↔ Phytoplankton Bloom

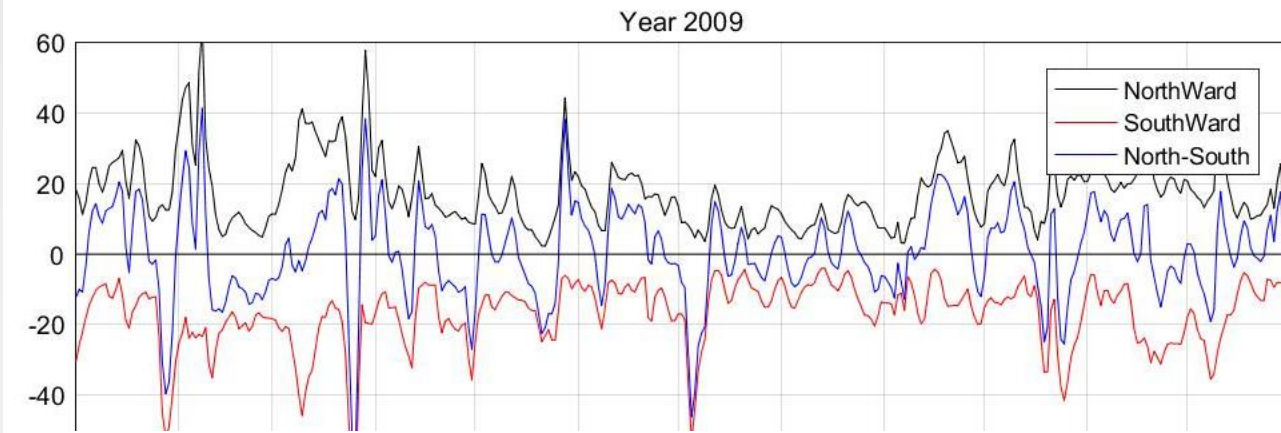




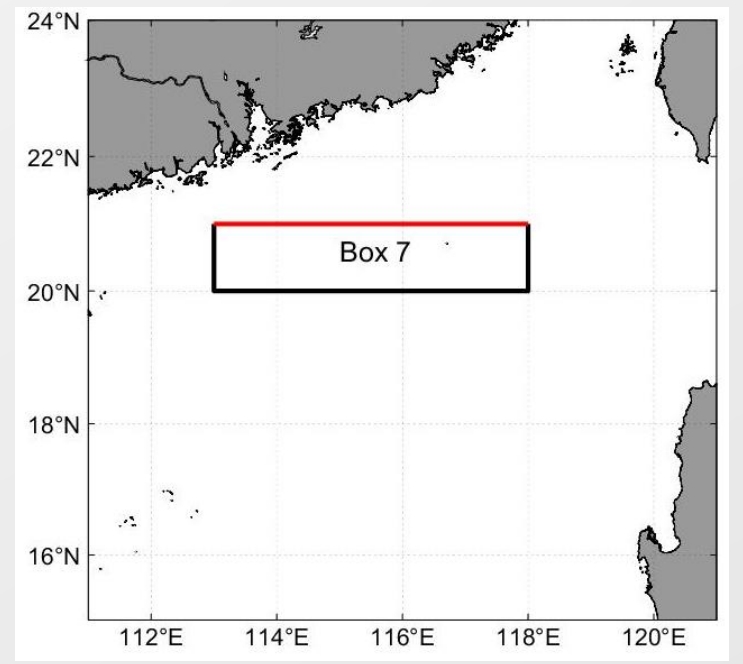
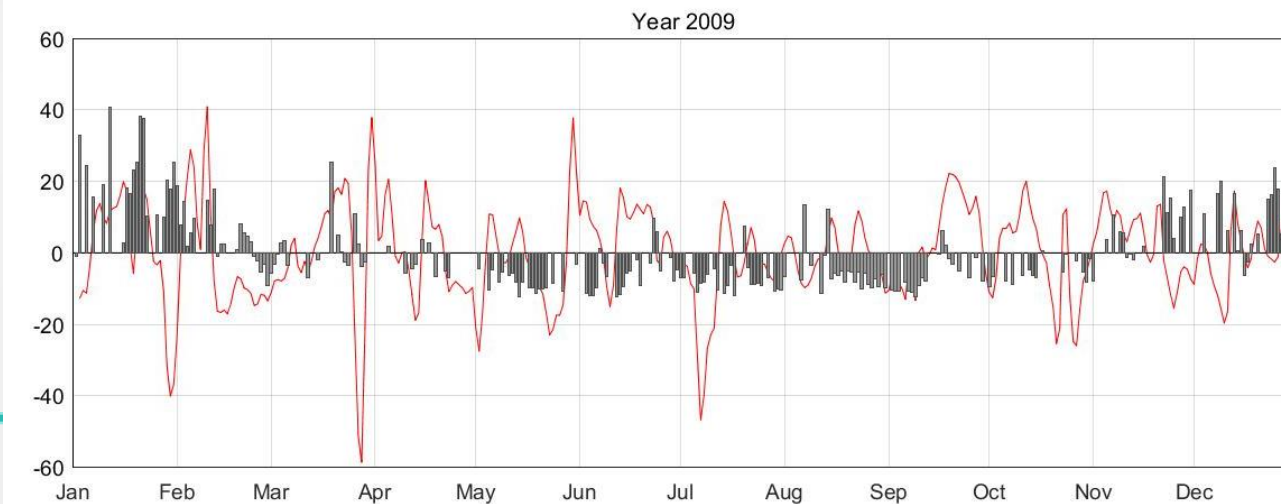
Chl

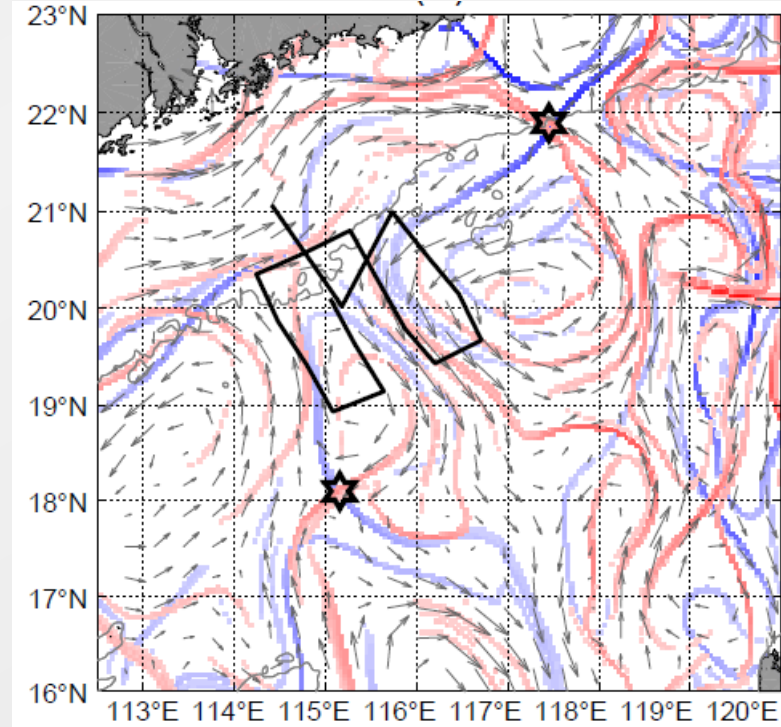
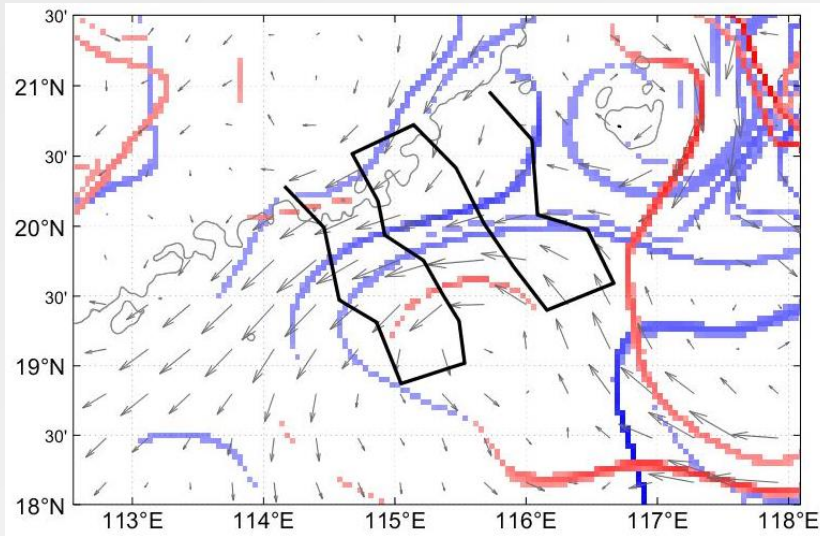


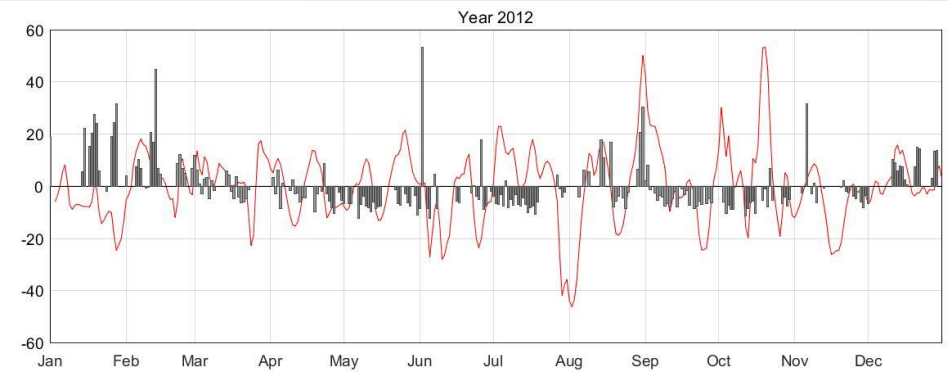
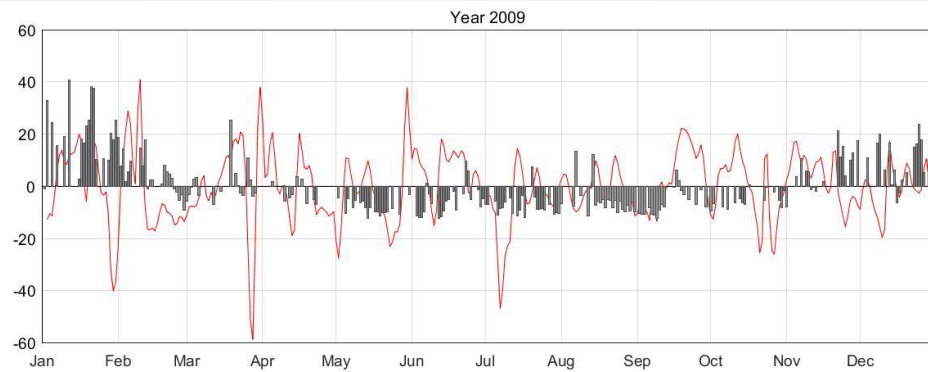
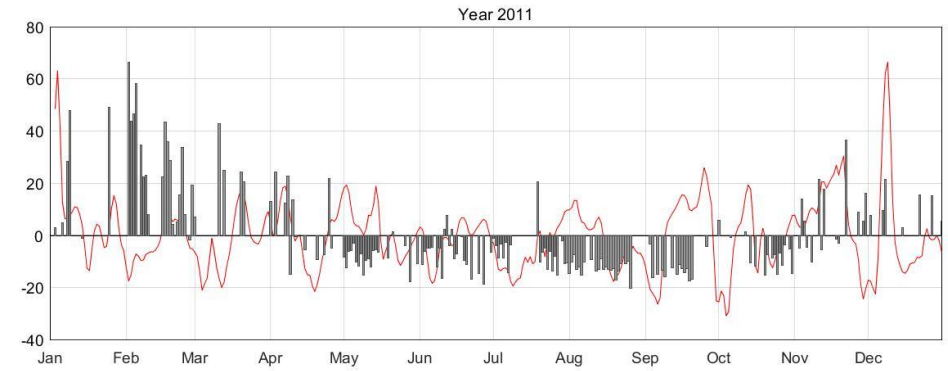
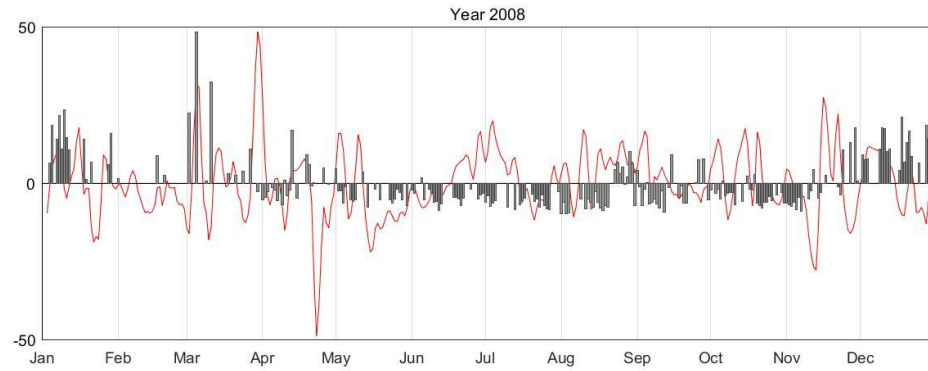
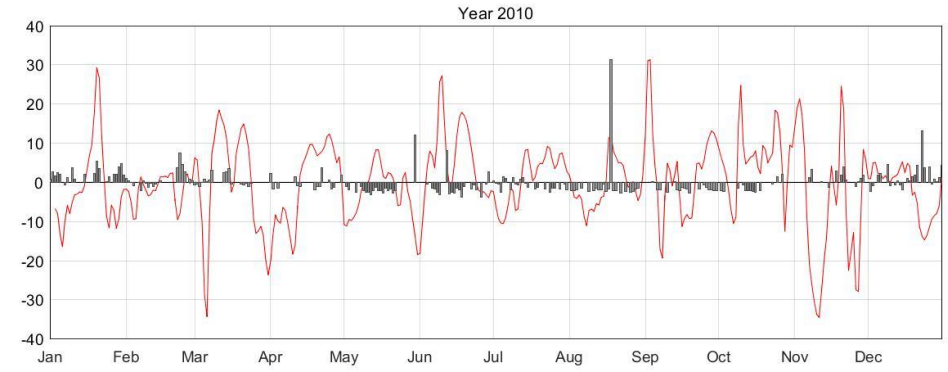
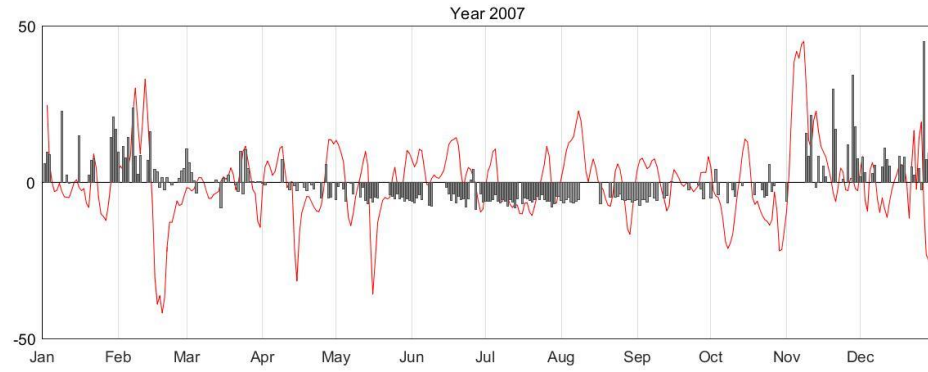
Transport



Comparison







	2007	2008	2009	2010	2011	2012
Corr. SW Transport & Chl	-0.0385	-0.1445	-0.2154	-0.2242	-0.0524	-0.2026
P	**	**	**	NS	NS	**
Corr. NW Transport & Chl	0.1838	0.2718	0.3118	0.1012	0.0938	0.2059
P	NS	*	**	**	NS	**

■ Limitations:

- spatial/temporal resolution, ageostrophic components, inaccuracy when approaching the coast

■ FSLE technique:

- Effective tool, providing important dynamical information of the horizontal transport properties

■ Cross-slope transport in the NSCS

Thank you !