Towards downscaling small-scale coastal dynamics / 近岸小尺度水动力的降尺度研究

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Motivation

Temporal variability and changes of coastal small-scale dynamics are not well resolved by observations or re-analysis data sets. We suggest to apply empirical statistical downscaling methods to specifying those small-scale dynamics. For doing so, homogeneous data set across several decades is needed to build the links between large-scale states and small-scale statistics. We have examined one such simulation STORM with the 0.1 grid resolution forced by NCEP atmospheric re-analyses.

Outlook

Based on the STORM data set, three small-scale phenomena will be specified by constructing empirical statistical downscaling models:

(1) the coastal upwelling off Vietnam

(2) the curents deflecting from isobaths to deeper water while passing the Dongsha Island

(3) mesoscale eddies in the South China Sea (SCS).

Their variability in the past and possible projections in future will be explored.

Analysis

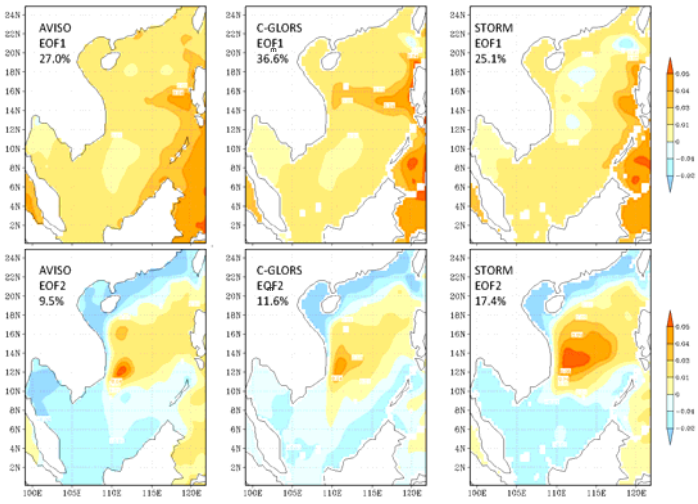
As a preparational step, we examine first, how well the re-analysis driven OGCM simulation STORM may serve as a substitute for real observations for fitting statistical linkages across scales.
For doing so we compare the derived products C-GLORS and STORM compare with AVISO in terms of SSHA . The realism of C-GLORS leads us to assessing the quality of STORM with respect to other variables [sea surface currents (SSC) and SST] by comparing it with C-GLORS.

- Statistical analysis demonstrates that C-GLORS and STORM have the ability to capture the main variability features of the SCS dynamic in terms of SSHA. (see figure)
- C-GLORS shows greater similarity, which is not surprising as it has assimilated AVISO satellite data. (see figure)
- The seasonal mean surface current fields of STORM and C-GLORS show similar variability: the strong current along the western boundary and the gyre in the south SCS with opposite directions in winter and summer. (not shown)
- Their EOF1 patterns presents the strong alongshore southward currents and a gyre located in the middle SCS. (see figure)
- STORM agrees well with C-GLORS in the seasonal SST pattern. (not shown)
- STORM shows more details along the coast area, due to its higher resolution. (not shown)

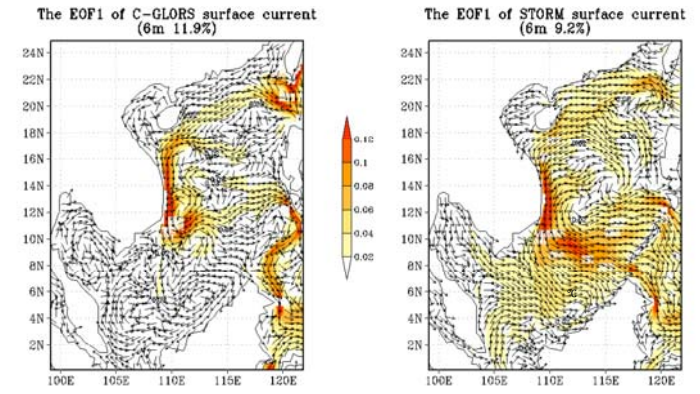
Data sets	Data type	Time period	Grid	Variables
STORM	Ocean Simulation	1950-2010	0.1	Sea surface height anomaly (SSHA)
AVISO	Satallite observations	1993-2010	0.25	SSHA, Sea surface temperature (SST) and so on
C-GLORS	Ocean re-analysis data	1982-2013	0.25	SSHA, SST and so on

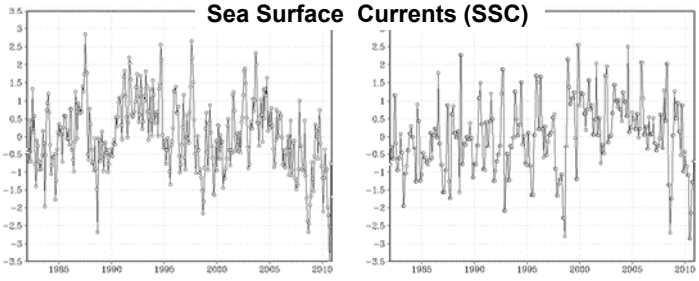
Results

SSHA



The first two modes from EOF (Empirical Orthogonal Functions) decompositon (removing mean annual cycle)





Conclusions

- STORM realistically captures regional-scale dynamical features in the South China Sea.
- The STORM simulation is suitable for building empirical downscaling models in the SCS.

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