The effect of different criteria on tracking eddy in the South China Sea

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Ocean eddies with great energy play a vital role on the mixing and transport of ocean water, heat and mass (Faghmous et al., 2015). A 1/10-degree daily global ocean simulation STORM (from the German consortium project STORM) forced by the NCEP reanalysis-1 provides the access to resolving the variability of the global eddy (von Storch et al., 2012). In this paper, we discuss the effect of different criteria on identifying and tracking eddy in the South China Sea (SCS). There are mainly three steps in the process of tracking eddy: eddy detecting, eddy tracks connecting and tracks filtering. In the tracking process, small difference in criteria selecting can lead to quite different results. In this paper, we evaluated the effect of different criteria based on a series of sensitivity tests of the year 2001.

We define the extrema of sea surface height anomaly (SSHA), which is greater or less than its 24 neighbors as eddy (Faghmous et al., 2015). Eddy intensity is defined as the difference between the extremum and averaged SSHA of its 24 neighbors. Only eddy intensity stronger than certain threshold (threshold_A) will be chosen. Considering eddy travel speed and the spatial resolution of STORM, we define another value (threshold_B) as the limitation of eddy travelling distance within one day. When filtering tracks, the strongest eddy intensity within a track should fulfill certain thresholds (threshold_C). Furthermore, the selected tracks must travel over 100km, and the distance between the final position and the initial position should be over 50km. The tracked results (like Figure 1) will be used to analyze the variability of the eddy in the SCS.

In our sensitivity tests, threshold_A varies from 1mm to 7mm (Min_I_1mm … Min_I_7mm). Threshold_B is set as 20km or 25km (dis_20, dis_25). And threshold_C increases from 2mm to 10mm (Strongest_2mm … Strongest_10mm). The tables show the eddy track numbers (top) and the mean eddy travel lengths (bottom) in the various combinations.

Almost always, more cyclonic than anti-cyclonic eddy tracks are detected. Not surprisingly, the number of eddies decreases, when the minimum eddy intensity and the minima of the strongest intensity along the track are increased. The track lengths increase for almost all cases, when the minimum eddy intensity is lowered and when the minimum maximum intensity along the track is increased. An exception emerges, when the minimum maximum intensity is up to 10mm; then the number of anti-cyclonic eddies tracks is getting very small. If a distance for connecting daily eddies is increased from 20km to 25km, more tracks are detected. We conclude that results depend sensitively on the threshold of minimum maximum eddy intensity along the track and on the minimum eddy intensity.

Figure: The anti-cyclonic eddy tracks (left) and the cyclonic eddy tracks (right) for a given set of parameters: Min_I_3mm, dis_20 and Strongest_4mm.

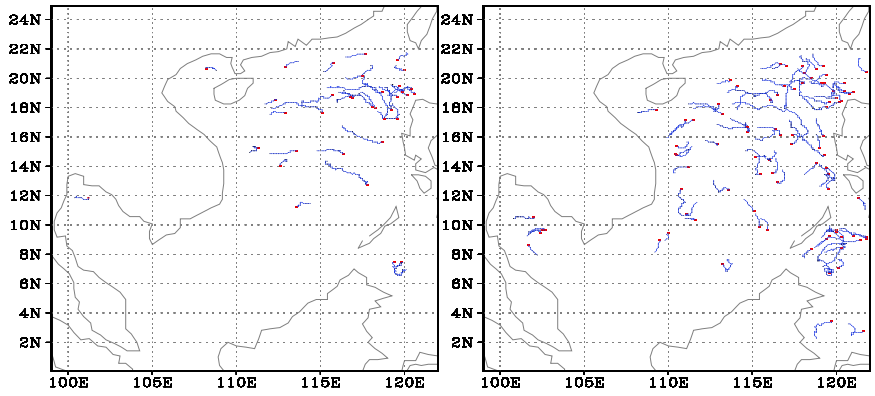

Table: The number of eddy tracks (top) and mean travel length of the eddy (bottom) when different parameters are set. "Anti" and "Cyc" mean anti-cyclonic eddy and cyclonic eddy respectively.

Number of_tracks		Min_I_1mm		Min_I_3mm		Min_I_5mm		Min_I_7mm	
		Anti	Cyc	Anti	Cyc	Anti	Cyc	Anti	Cyc
Strongest_2mm	dis_20	64	122	-	-	-	-	-	-
	dis_25	125	185	-	-	-	-	-	-
Strongest_4mm	dis_20	43	103	36	87	-	-	-	-
	dis_25	86	151	72	128	-	-	-	-
Strongest_6mm	dis_20	22	76	19	73	13	52	-	-
	dis_25	48	114	46	108	35	85	-	-
Strongest_8mm	dis_20	14	54	14	53	11	44	7	26
	dis_25	35	85	34	82	31	72	19	47
Strongest_10mm	dis_20	7	31	7	31	6	29	4	22
	dis_25	21	56	20	55	19	53	13	43

Mean_Length (km)		Min_I_1mm		Min_I_3mm		Min_I_5mm		Min_I_7mm	
		Anti	Cyc	Anti	Cyc	Anti	Cyc	Anti	Cyc
Strongest_2mm	dis_20	217	198	-	-	-	-	-	-
	dis_25	240	237	-	-	-	-	-	-
Strongest_4mm	dis_20	238	204	210	198	-	-	-	-
	dis_25	252	251	206	221	-	-	-	-
Strongest_6mm	dis_20	252	217	211	208	211	179	-	-
	dis_25	253	263	212	230	184	204	-	-
Strongest_8mm	dis_20	271	222	237	216	230	184	208	201
	dis_25	257	267	222	240	192	210	168	200
Strongest_10mm	dis_20	170	255	170	243	177	196	197	217
	dis_25	213	271	187	236	167	209	155	208

References

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