A Study in the neighbouring sea variation of Cheju and Influence of China Coastal Water by Topex/Poseidon Altimeter Data and in-situ Salinity Data

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Abstract: Appearance and disappearance of the China Coastal Waters(CCW) in the neighbouring sea of Cheju Island was very different yearly but usually appeared strongly in summer. At this time, sea level and salinity were varied in this area by the influence of the CCW. Satellite data(T/P;Topex/Poseidon) and Salinity (NFRID;National Fisheries Research and Development Institute) were used from 1993 to 2001. We compared with TG data of NORI and T/P data in the observed station(33 31'N, 126 32'E). Coefficient of correlation was 0.6~0.8 with the exception of 1993 and 1995. And variations of salinity was higher than 32.00‰ in the southwestern part of Cheju Island and the southern part of the South Sea of Korea during June~October and SLA(Sea level Anomaly) was 10~11cm. Salinity of the southeastern part was higher than those of the southwestern part and SLA was 12~13cm because of the influence of Tsushima Current.

Keyword : CCW, Topex/Poseidon, Salinity, SLA

1. Introduction

In the neighbouring sea of Cheju was affected by Tsushima warm current going north(Rho, 1985), but Korea south-sea longshore-water affects north of Cheju strait(cHOI, 1989). The outer layer in summer was affected by CCW(Kim and Rho, 1994). Because CCW by Yangja river blow down-water extended through East China Sea in summer(宇田,. 1934, 1936; 井上, 1974), lowering of salinity of in the neighbouring sea of Cheju and Koea South-Sea, East Sea, and highering of Sea level height. About path of CCW was presume from East China sea oceanic-current and outer salinity distribution(宇田, 1936).

Also Beardsely et al.(1983), Le(1983), Limeburner et al.(1983) announced that Yangja river water flow in south along the China Coastal. After then it mixed Tsushima and flow in north-east after.

In order to observe path and variation of CCW T/P satellite was planed for acquirement information about world's ocean and information about oceanic current for a long time. T/P accurately estimate Sea Level Height every 10 days and investigate Sea Level Variation and weather's pattern.

This study investigated that affect of CCW appears in the neighbouring sea of Cheju Island. So that, it understand that SLA variation and Salinity variation by CCW, and Appearance and disappearance, path of CCW.

2. Data and Method

1. Examine objectivity of T/P

Topex/Poseidon(T/P) data used MSLA of French CNES.

We are compared to Tide Gauge(TG) data in Cheju(33°31'N, 126°32'E) of NFRDI(National Fisheries Research and Development Institute) in the period of 1993 to 2001 in order to examine objectivity of T/P.

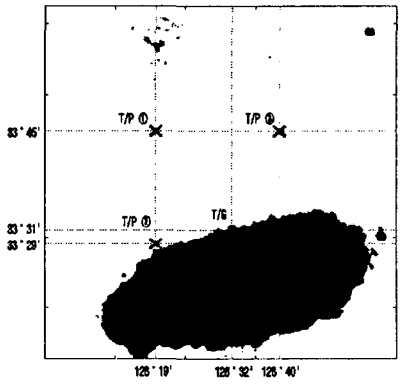

Fig. 1 Location of in-situ TG(•) and T/P(×) passes.

2. Estimate path of CCW

In order to make sure path of CCW investigated SLA of latitude at longitude yearly from the mouth of a Yangja river(123°E) to the exit of a Cheju strait(129°E).

3. An Index Salinity

Using Temperature and Salinity data of outer layer(0, 10m) in the period of 1993 to 2001. The outer layer salinity of in the neighbouring sea of Cheju in winter is 32.00~34.80‰. If water mass of winter appear in summer, and salinity distribution of summer have to be similar in winter(Kim and Rho, 1994). Thus we defined an index salinity below 32.00‰.

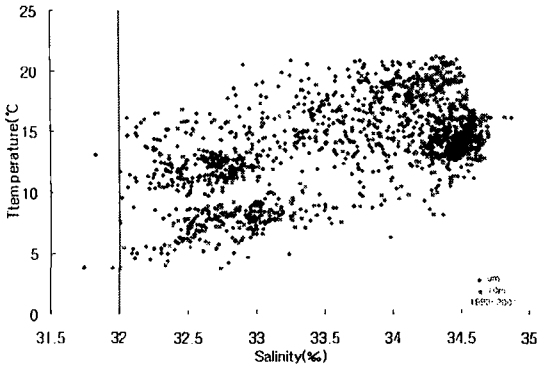

Fig. 2. T-S diagram plotted by the data of the serial oceanographic stations.

4. Compared to Salinity Sea Level Height

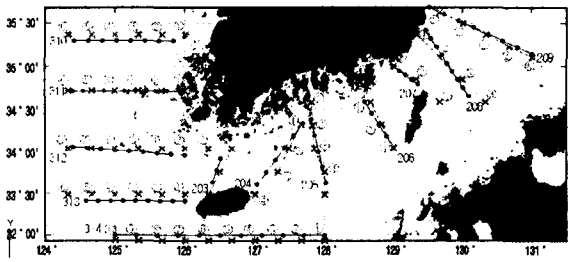

Fig. 3 Location of oceanographic stations observed salinity of NFRDI(•) and SLA of T/P(×).

When CCW appeared, in order to investigate salinity variation and sea level height variation in the neighbouring sea of Cheju and compared with Salinity location of oceanographic station of NFRDI and T/P data.

3. Results and Discussion

1. Correlation analysis of T/P and TG

Table 1. Correlation coefficient between T/P and TG

	①	②	③	Total
1993	0.41	0.43	0.44	0.42
1994	0.80	0.80	0.80	0.80
1995	0.41	0.35	0.41	0.41
1996	0.66	0.66	0.70	0.68
1997	0.62	0.60	0.63	0.63
1998	0.57	0.55	0.66	0.61
1999	0.70	0.70	0.72	0.70
2000	0.75	0.74	0.76	0.75
2001	0.62	0.56	0.65	0.62
	24.11 ㎞	35.03 ㎞	29.56 ㎞	

This study are compared to Tide Gauge(TG) data in Cheju(33°31`N, 126°32`E) of NFRDI in order to examine objectivity of T/P. Comparison station is (126°19'-33°29'), ②(126°19'-33°45'), ③(126°40'-33°45') (Fig. 1.). So, coefficient of correlation was 0.6～0.8 with the exception of 1993 and 1995. Because the more satellite data is far from coastal, the better data is accurate(Yoon, 1999), station ③(29.56㎞) is more accurate than station ②(24.11㎞).

2. Path of China Coastal Water

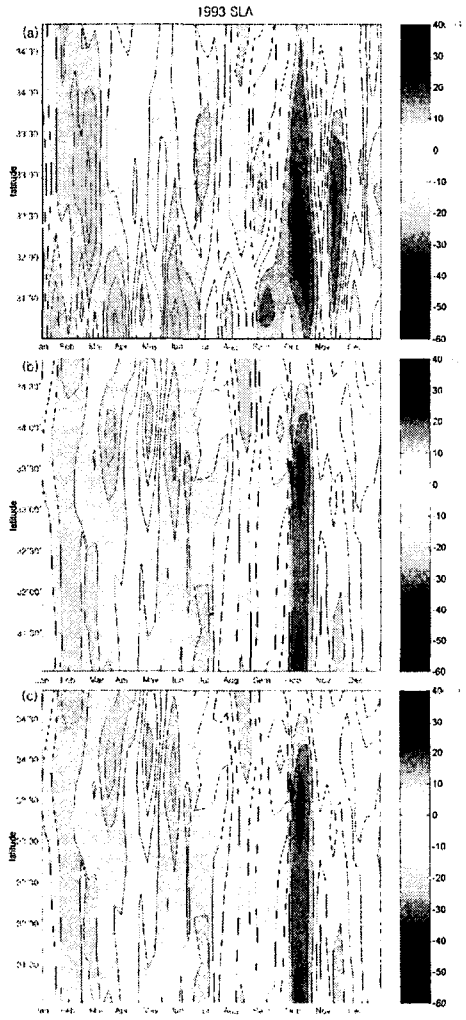

Fig. 4. Variations of SLA at longitude(a)124°E, (b)126°E, (c)128°E

Fig. 4. is SLA of latitude(33°12'～34°00'N) about longitude(124°E, 126°E, 128°E) in order to confirm path of CCW. To clear distinguish, except end of Yangja river(121°～123°E). High SLA showed on August and December. Maximum value is going noth for in the neghbouring of Cheju. 33°～33.5°E showed high value at 126°N, 128°N. So that, we could confirm that CCW flow into in the neighbouring sea of Cheju.

Also SLA is 20cm at 124°E, 32°～33.5°N(Fig. 4a). But in the neighbouring sea of Cheju(126°N,

33°~34°E) is 15cm and this area is lower than Yangja river. This reason is CCW flow into in the neighbouring sea of Cheju and CCW is getting weaker. So we are supposed to be SLA low.

But confirm path of CCW using only satellite data was difficult. Just this way can at clear SLA.

3. Comparison with Salinity and SLA

Fig. 5, 6, 7 show total mean in the period of 1993~2001 in order to compare to SLA and Salinity.

This estimated every two month.

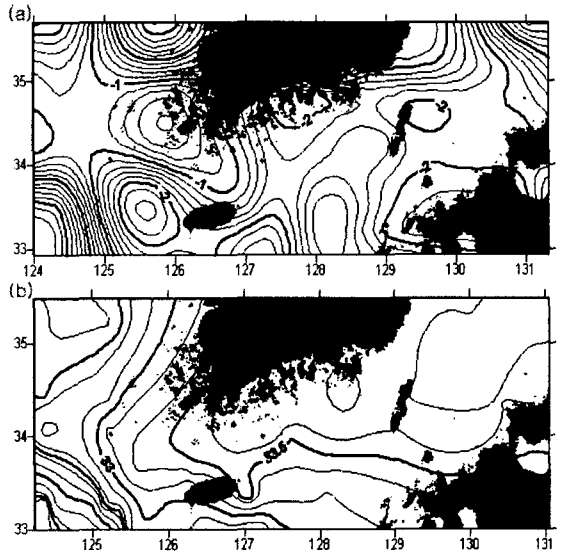

Fig. 5. Total mean on June from 1993~2001.

Fig. 5. show SLA and Salinity on June from mean in the period of 1993~2001. SLA is densely distribute at Cheju-westsouth(Fig. 5a). Salinity is higher than an index salinity by 1.00‰(Fig. 5b).

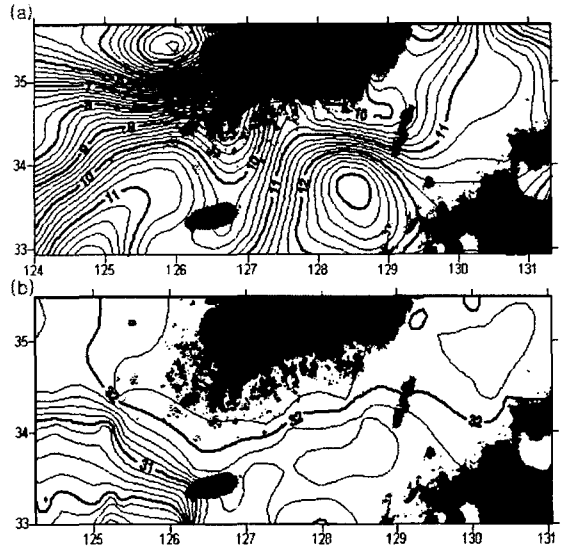

Fig. 6. Total mean on August from 1993~2001.

Fig. 6 show SLA and Salinity on August from mean in the period of 1993~2001. SLA is higher than June by over 10~11cm. Densely distribution at Hungsan Island, Hong Island, Hatae Island show mixed of CCW and outer water(Fig. 6a). Distribution of salinity is similar to SLA and salinity is below 32.00‰(Fig. 6b). Also Cheju east-south show high salinity because of Tsushima(Fig. 6b).

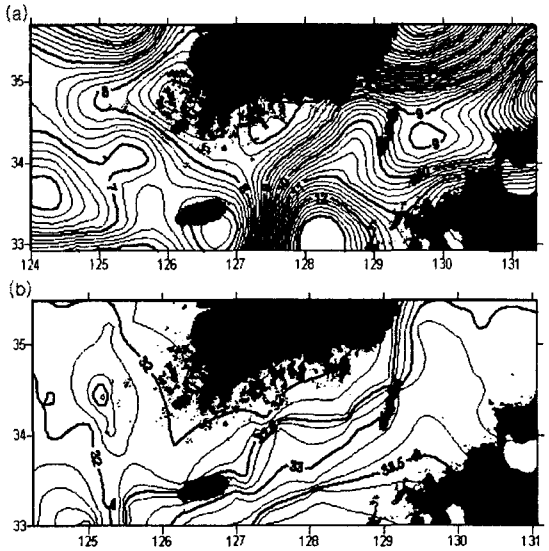

Fig. 7. Total mean on October from 1993~2001.

Fig. 7 show SLA and Salinity on October from mean in the period of 1993~2001. Also Cheju east-south show high salinity because of Tsushima(Fig. 7b). But SLA(10~12cm) is similar to August(Fig. 7a).

CCW appears strongly on August in the neighbouring sea of Cheju. Cheju-westsouth is influnced by CCW and Cheju-eastsouth is influnced by Tsushima.

4. Consideration

宇田(1934, 1936), 井上(1974, 1981) defined that CCW is low salinity because CCW is beginning from in the neighbouring Yangja river and CCW was made up of rivers(Whangha river, Yangja river).

Thus this study define influnce of CCW that salinity is lower than 32.00‰ and SLA appeared over (+).

CCW appeared on June, and influnce on August the best, disappeared on October. Cheju-eastsouth is higher than west-south by 1.00‰ because of Tsushima. SLA showed densitly distribution east-south, too.

So that, we could understand temporal and spatial variation about path, appearance and disappearance of CCW.

In the future, we are going to reseach concern of SLA and SST(Sea Surface Temperature) variation and Salinity of in the neighbouring sea of Cheju and influence of CCW.

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