

Linking the Tropic Oceanic Conditions to the Water Characteristics in the Subtropic Western Pacific Marginal Seas

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Motivation

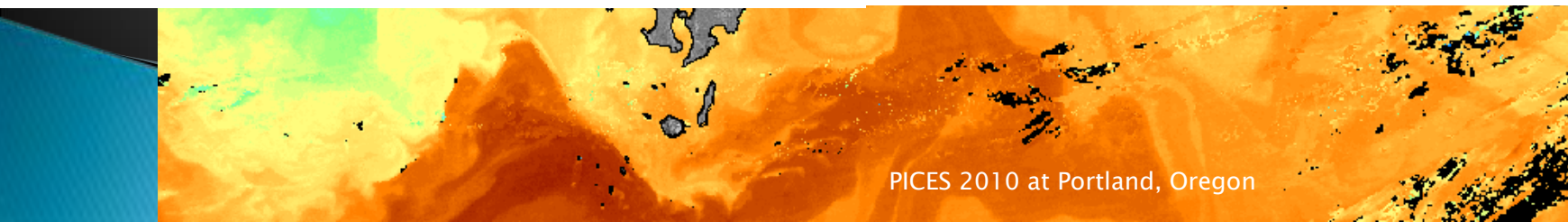
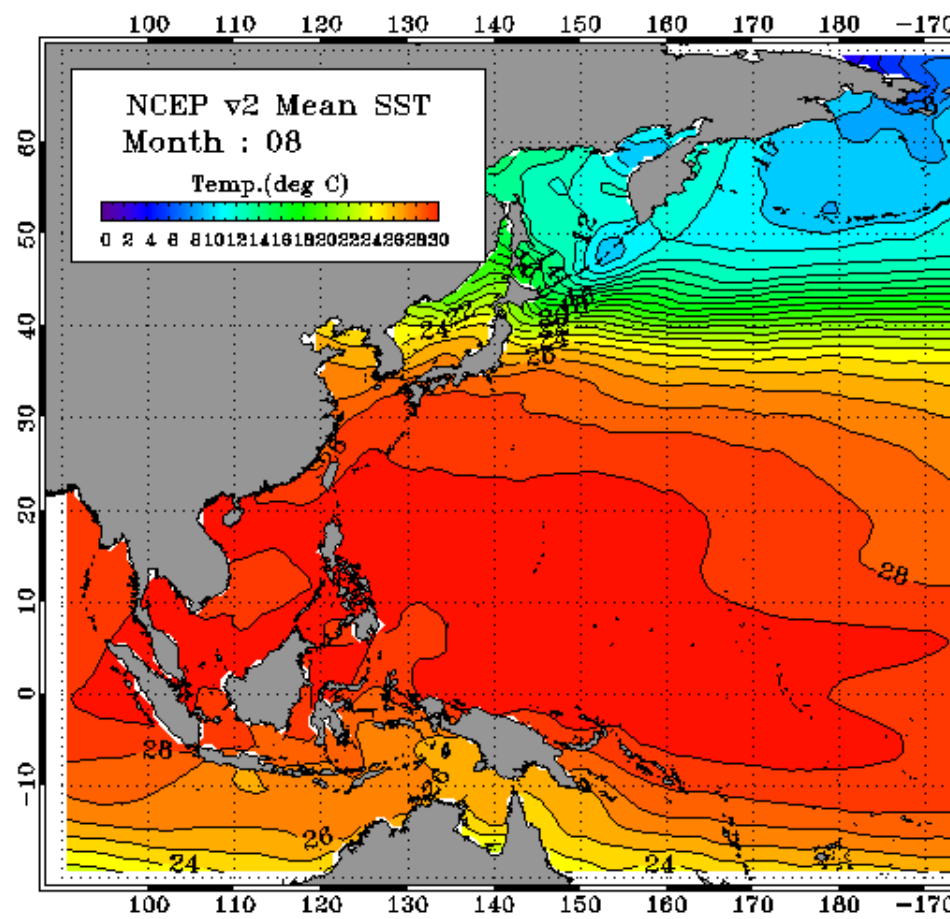
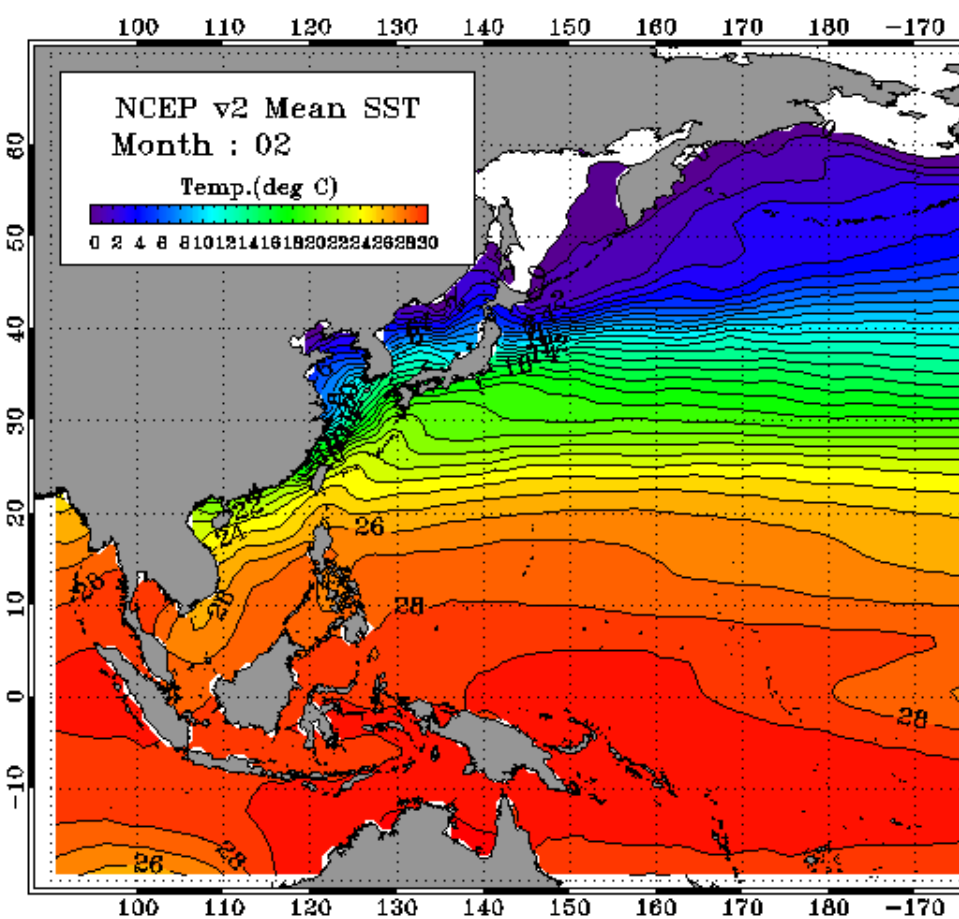
- ▶ Linking Tropics to Korean Waters lying in the subtropic/subarctic

Contents

- ▶ NCEP OI SST data analysis
- ▶ SODA data analysis
- ▶ KODC data analysis



Western Pacific Mean SST



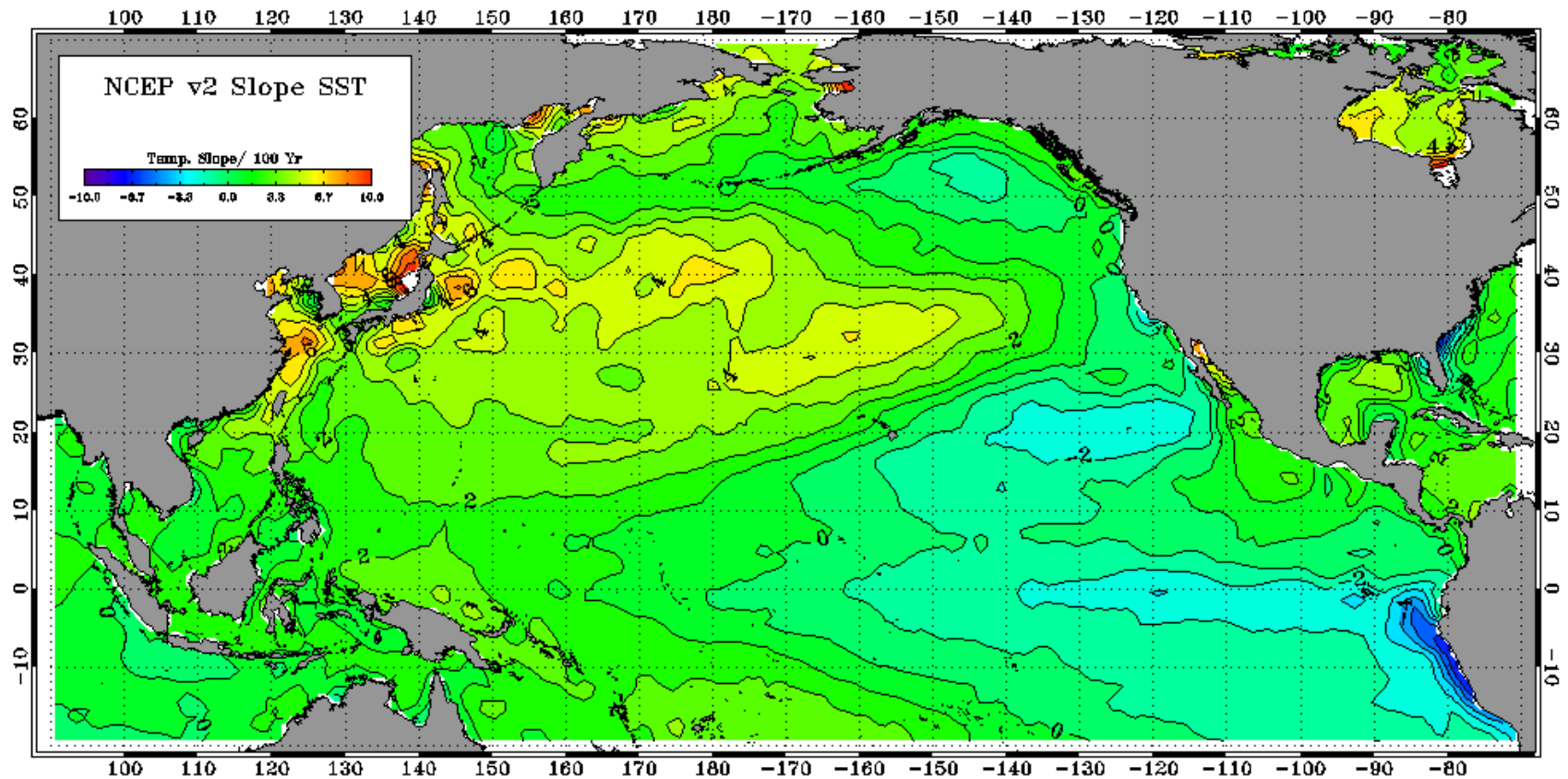
Statistical Analyses

- Long-Term Trend
 - EOF
 - Correlation Analysis
 - Spectral and Wavelet Analyses
- ▶ NCEP OI-SST,
 - ▶ KODC Hydrography for the East Sea,
 - ▶ SODA model outputs
 - 3-D ocean Temperature, Salinity, Current

Method

Datasets

Slope for the Long-term Trend



Specific Questions

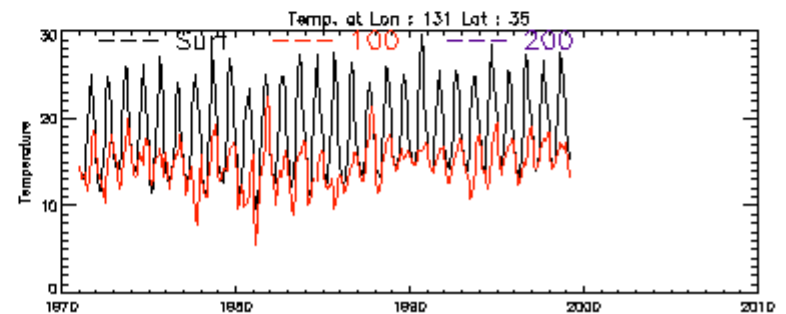
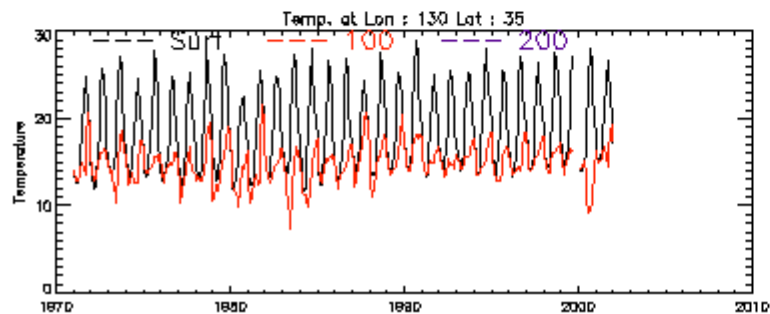
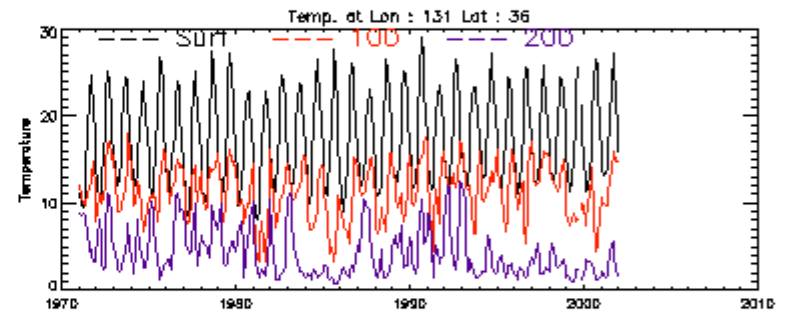
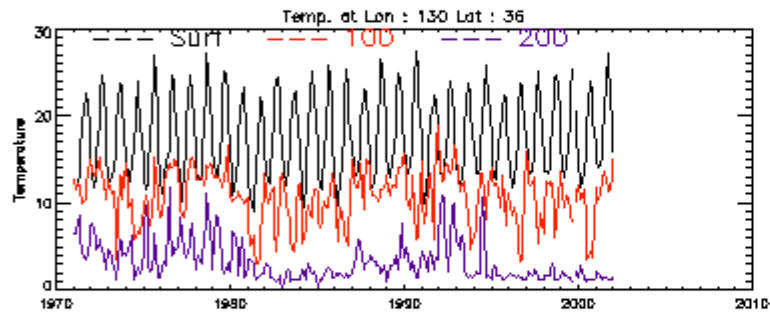
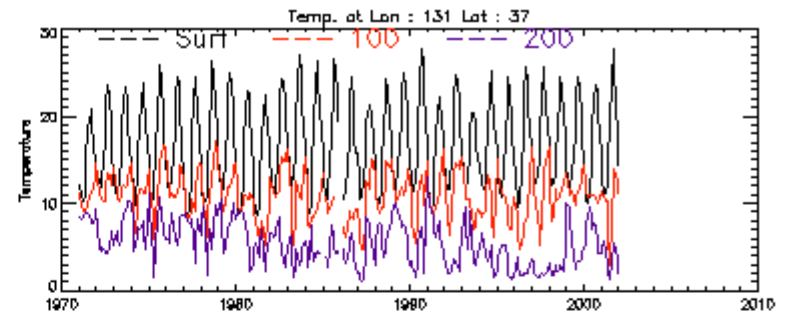
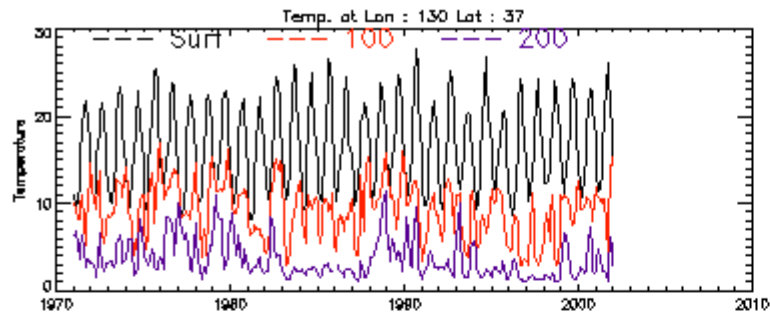
- ▶ Wrt Long-term trend in the regions,
**are there any similarities of
the long-term trend of
temperature, salinity, current?**

Objectives of SODA data Regional Reanalysis

- Variability of T, S, Vel.
 - Long-term trend
- Correlation Analysis
 - EC vs MC
 - MC vs Kuro, MC vs ITF
 - Kuro vs EKWC



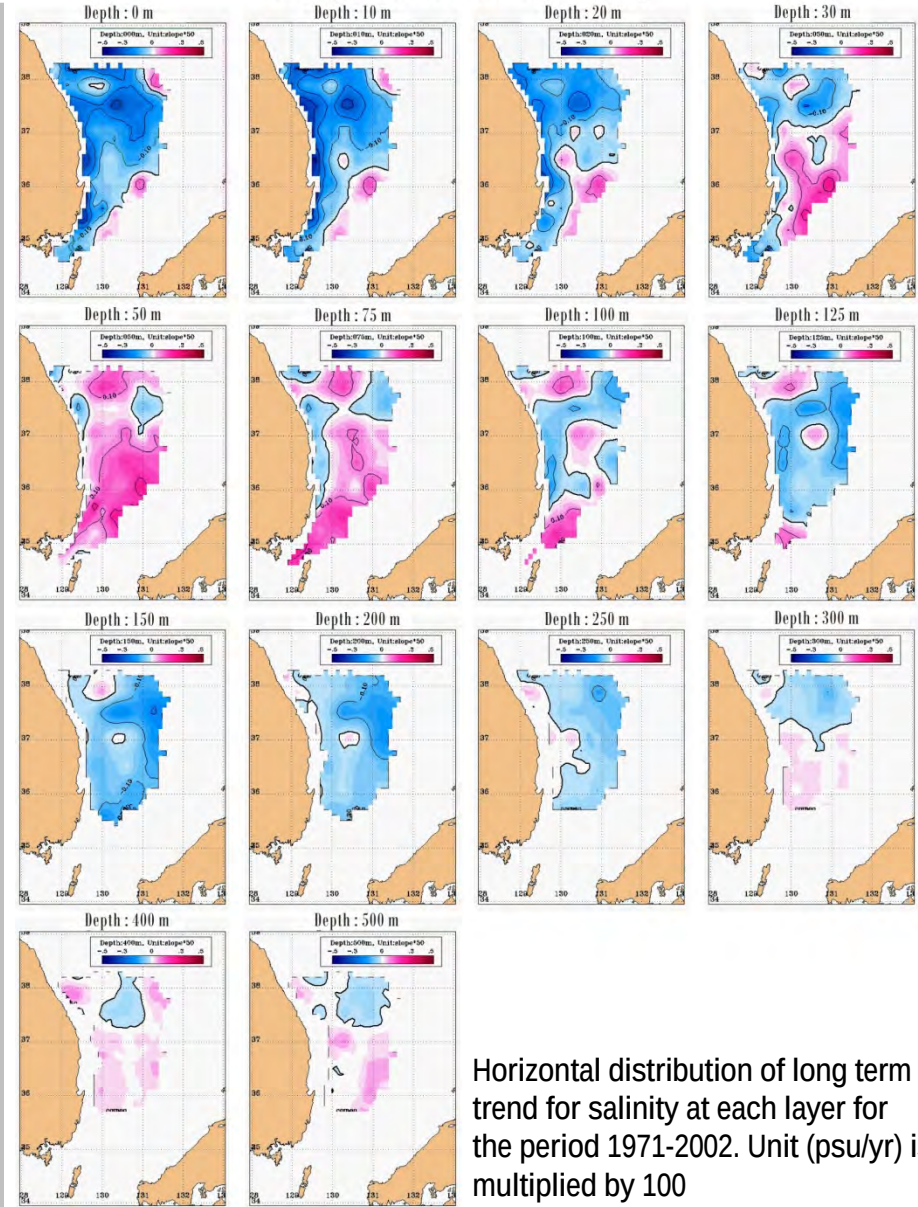
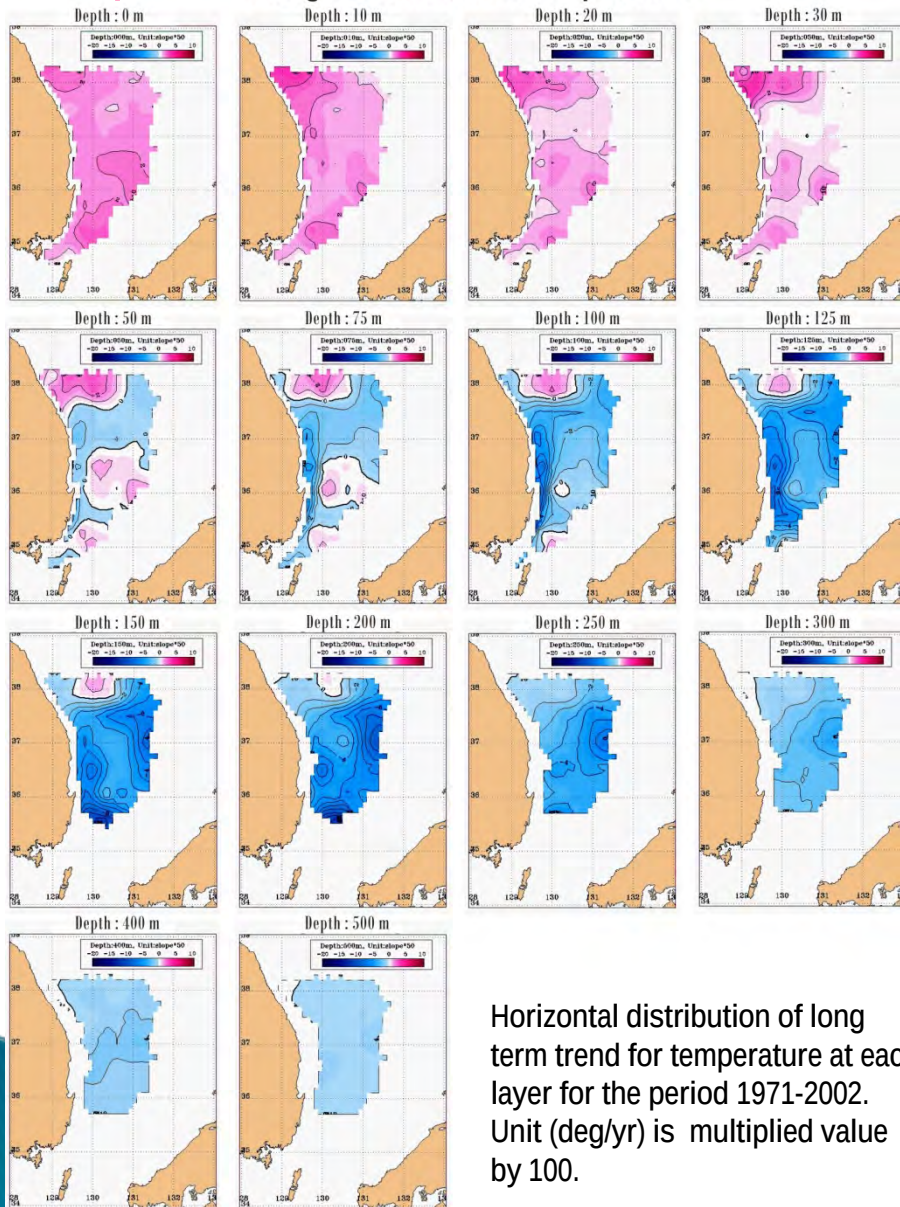
Monthly Time Series of KODC Temperature/ Salinity at three depths from 1971 to 2001



Long Term Trend of T, S Period 1971-2002

Temp

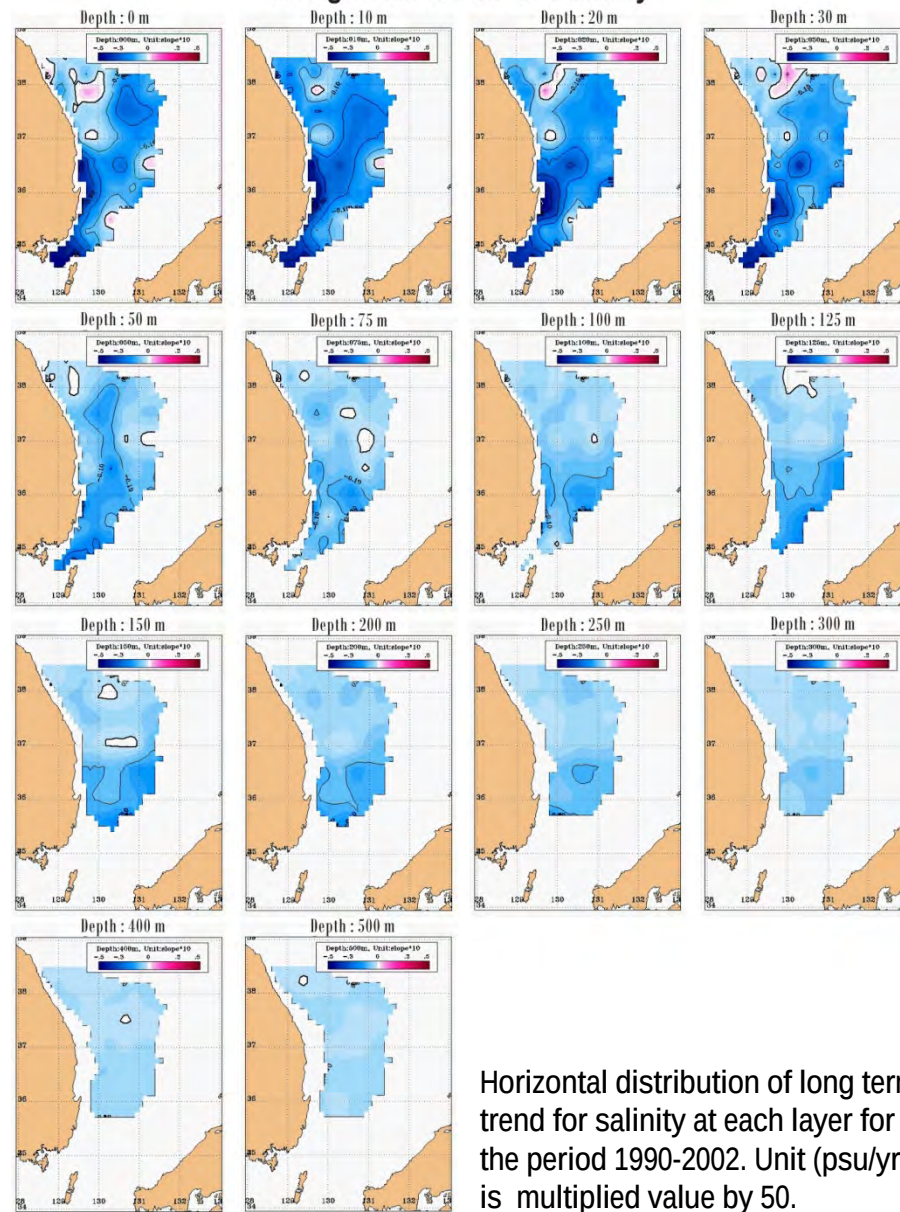
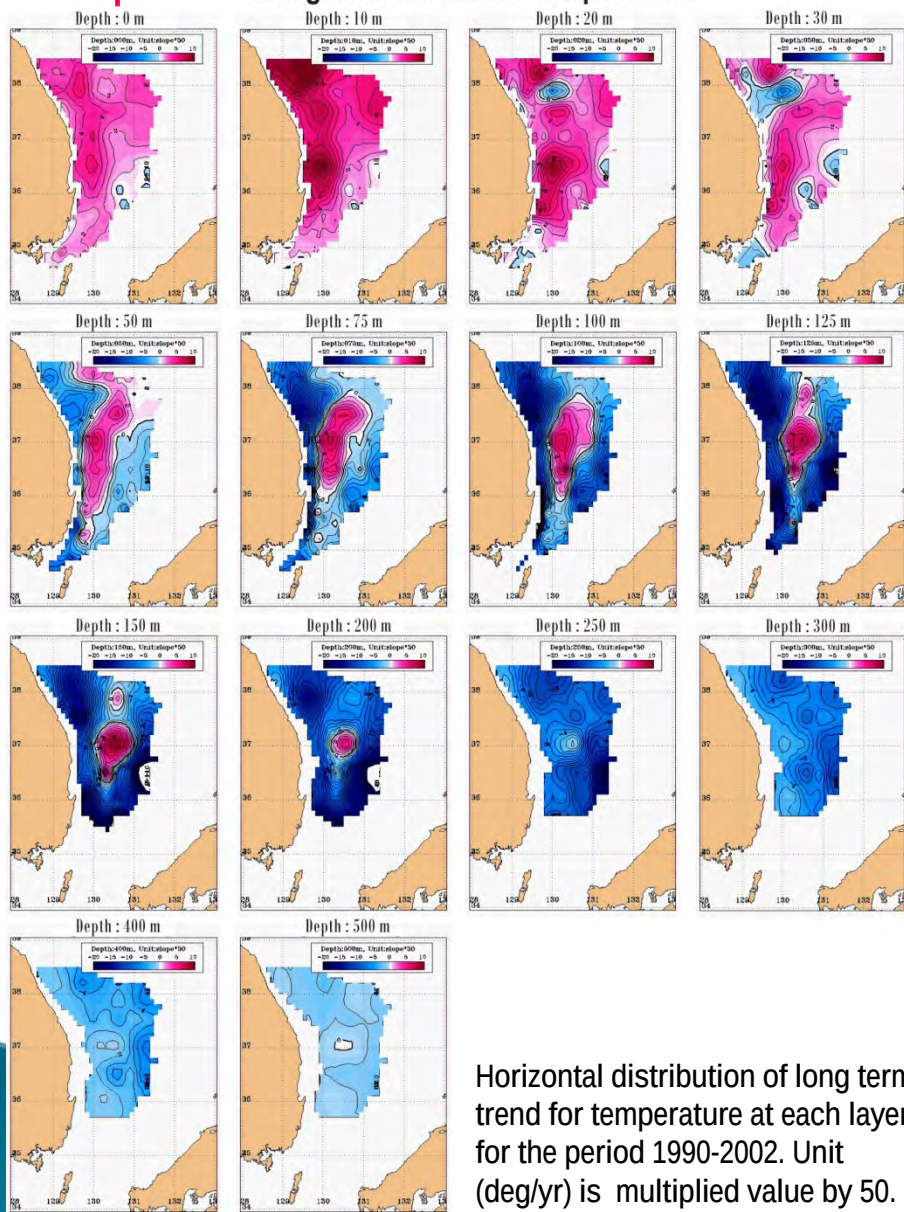
Salt



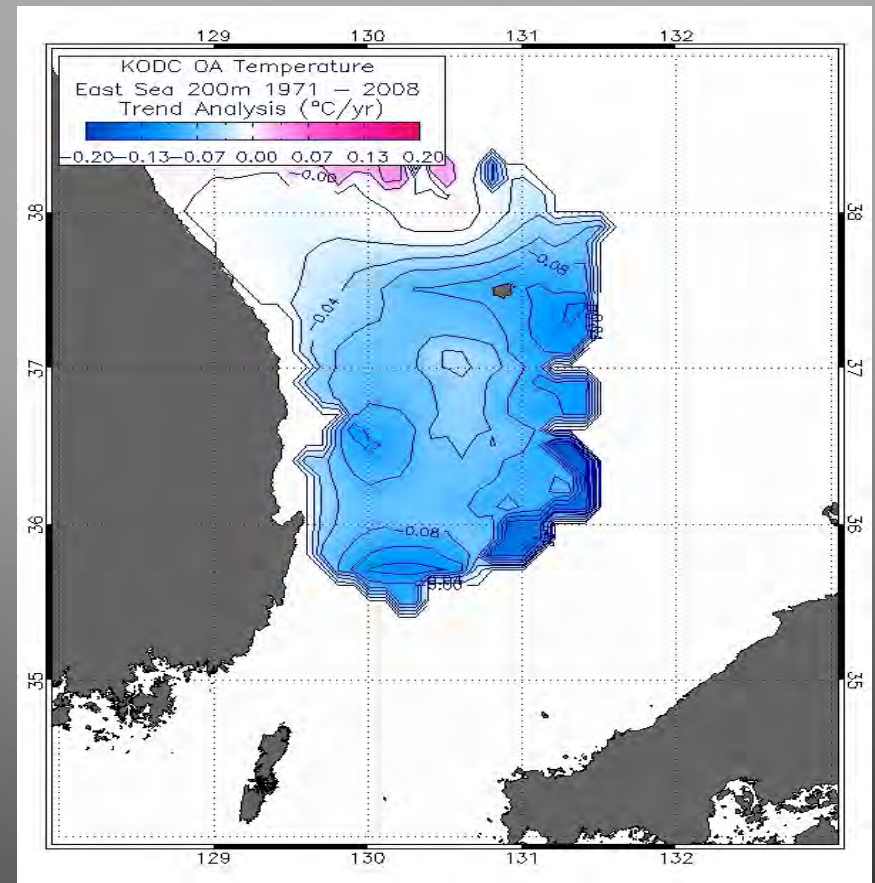
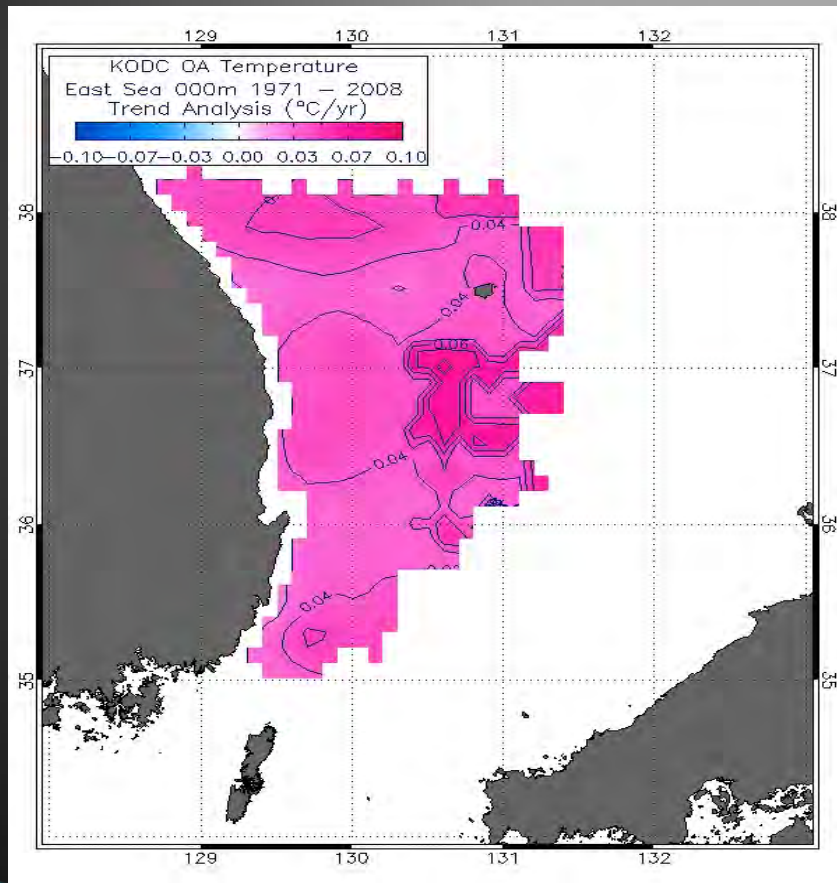
Long Term Trend of T, S Period 1990-2002

Temp

Salt



Long-term Trend of Temp at 0, 200 m in the East(Japan) Sea

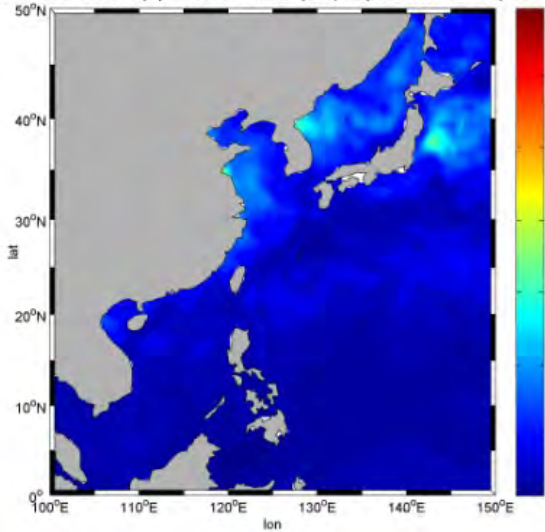


Variability of Western Pacific

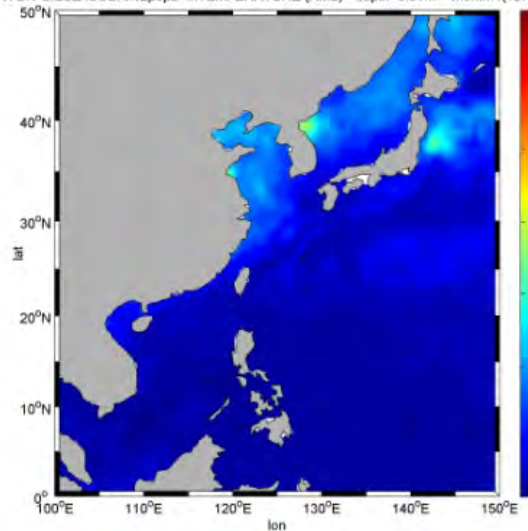


Bimonthly Anomaly Temp at 5 m

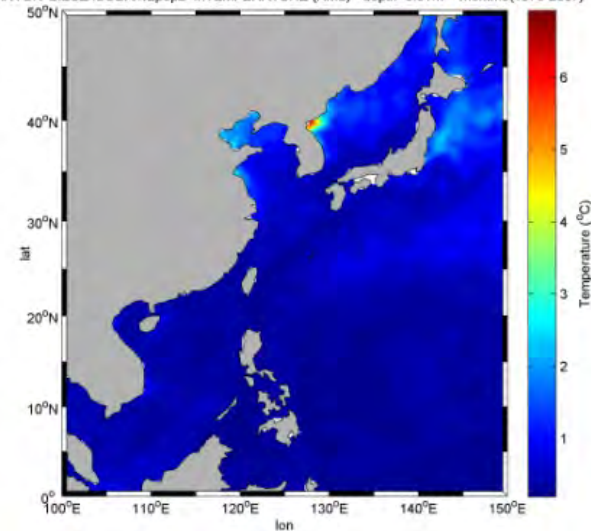
CARTON-GIESE/SODA/v2p0p2-4/TEMPERATURE (RMS) - depth=5.01m - month:2(1978-2007)



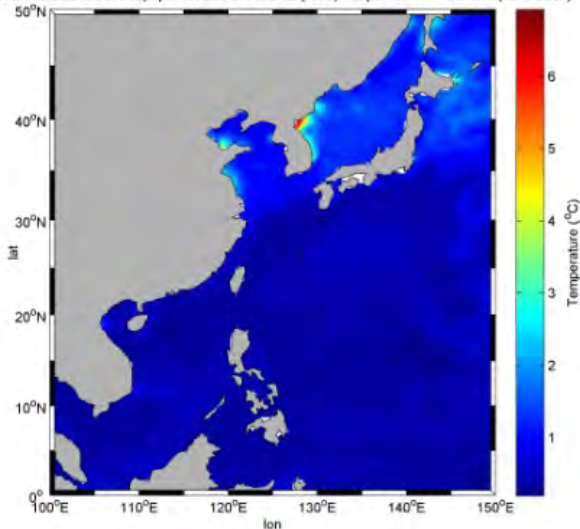
CARTON-GIESE/SODA/v2p0p2-4/TEMPERATURE (RMS) - depth=5.01m - month:4(1978-2007)



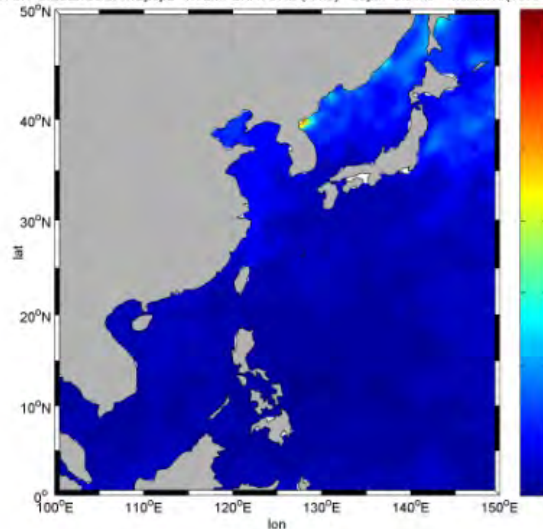
CARTON-GIESE/SODA/v2p0p2-4/TEMPERATURE (RMS) - depth=5.01m - month:6(1978-2007)



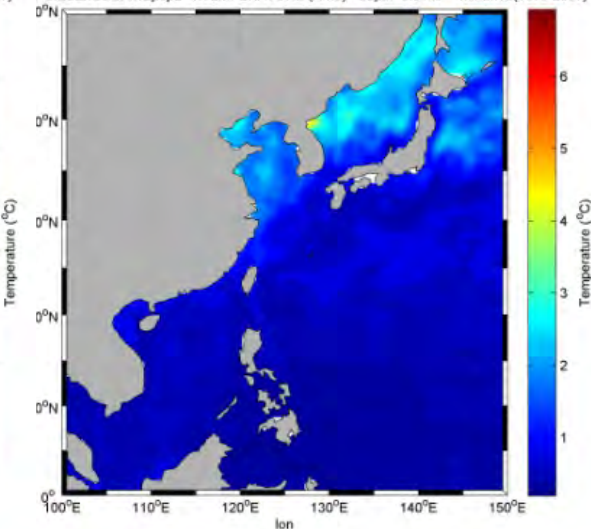
CARTON-GIESE/SODA/v2p0p2-4/TEMPERATURE (RMS) - depth=5.01m - month:8(1978-2007)



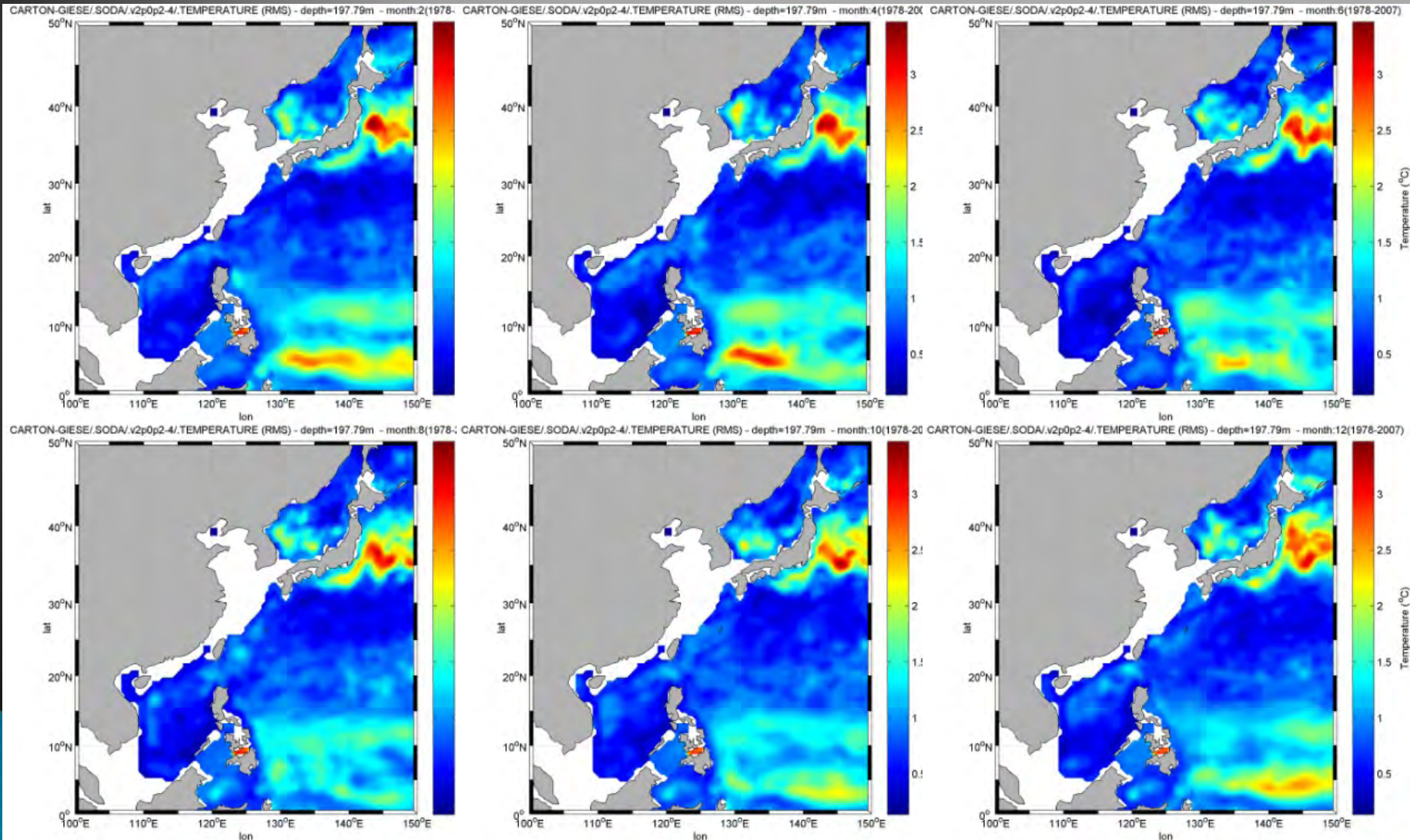
CARTON-GIESE/SODA/v2p0p2-4/TEMPERATURE (RMS) - depth=5.01m - month:10(1978-2007)



CARTON-GIESE/SODA/v2p0p2-4/TEMPERATURE (RMS) - depth=5.01m - month:12(1978-2007)

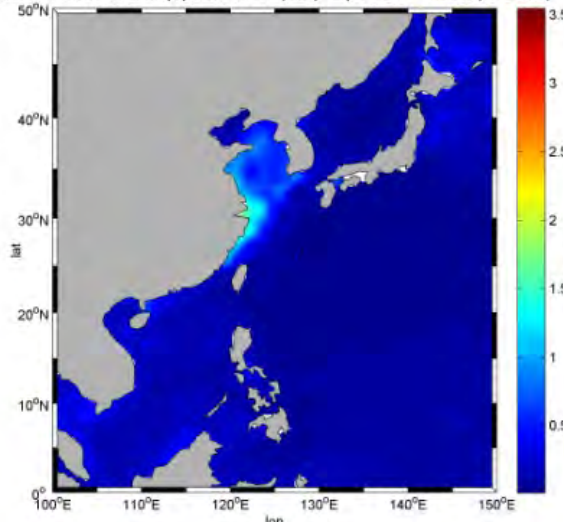


Bimonthly Anomaly Temp at 200 m

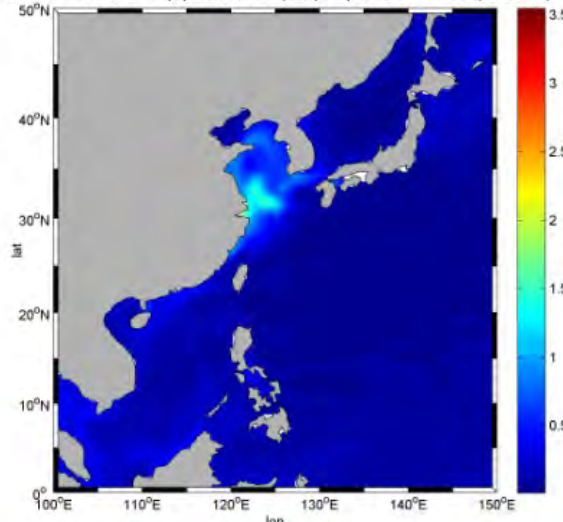


Bimonthly Anomaly Salt. at 5 m

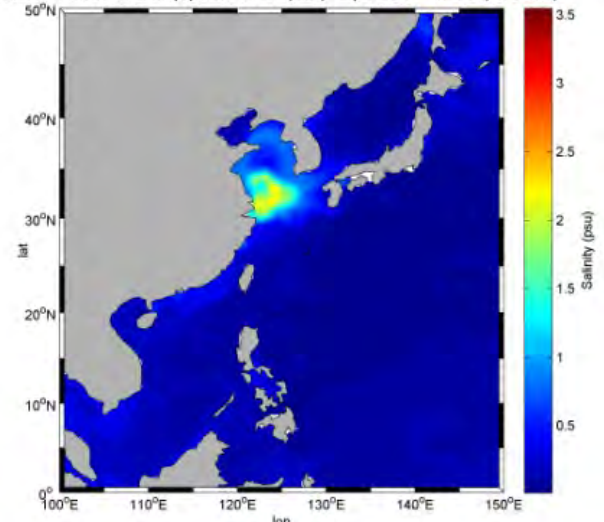
CARTON-GIESE/SODA.v2p0p2-4/SALINITY (RMS) - depth=5.01m - month:2(1978-2007)



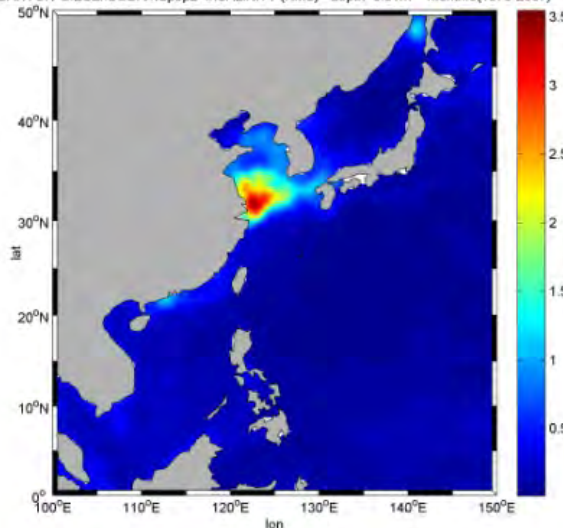
CARTON-GIESE/SODA.v2p0p2-4/SALINITY (RMS) - depth=5.01m - month:4(1978-2007)



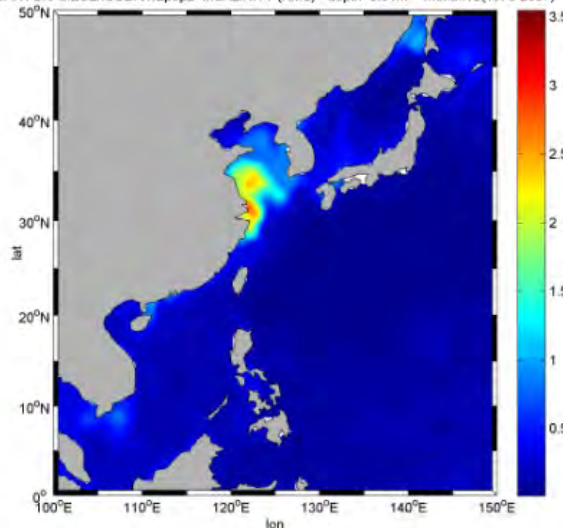
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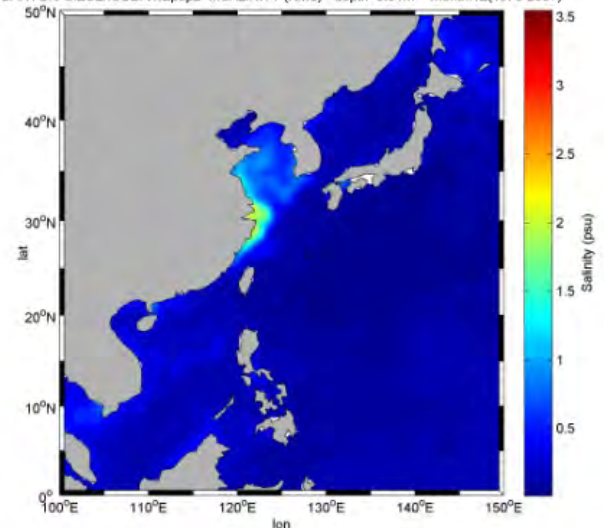
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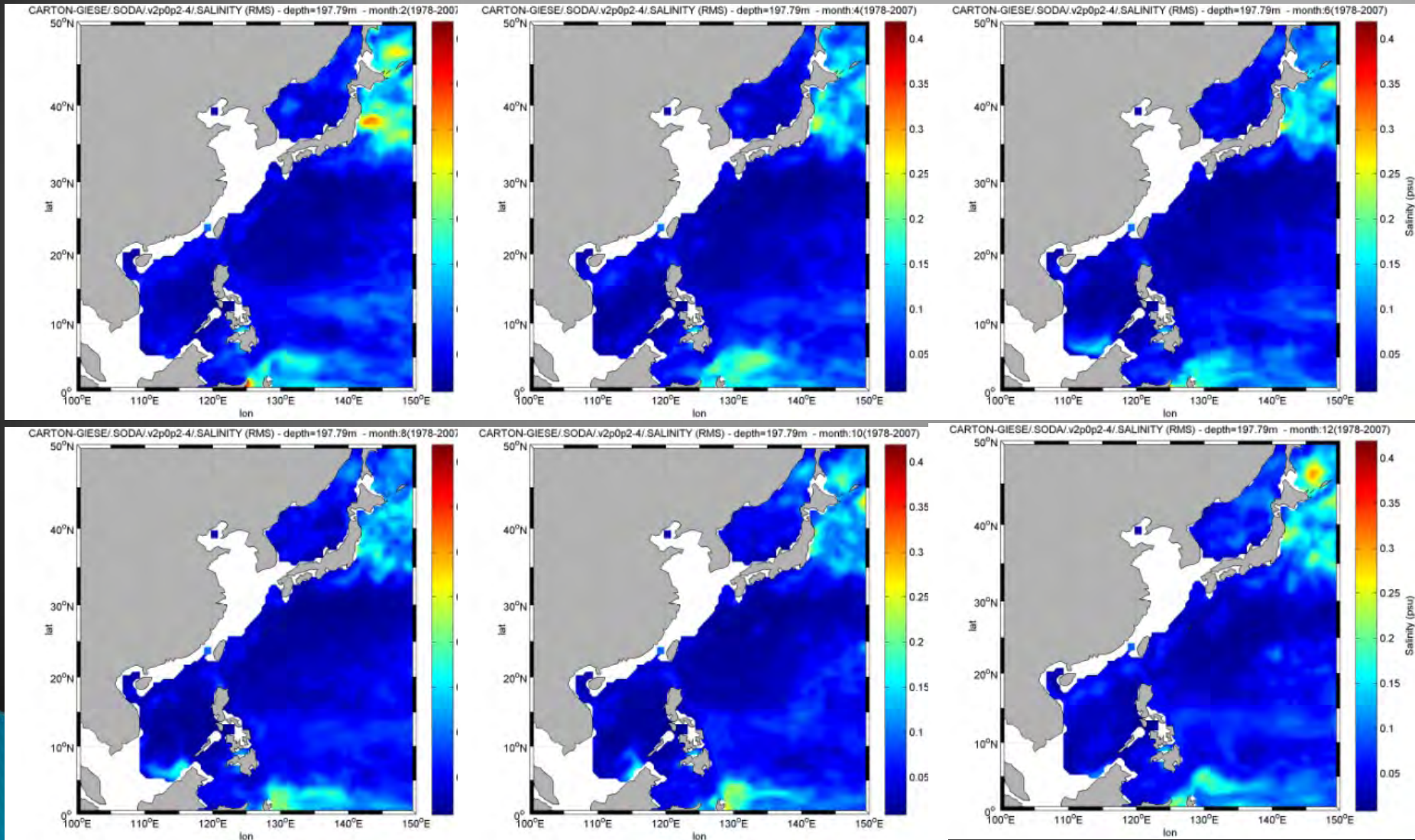
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CARTON-GIESE/SODA.v2p0p2-4/SALINITY (RMS) - depth=5.01m - month:12(1978-2007)

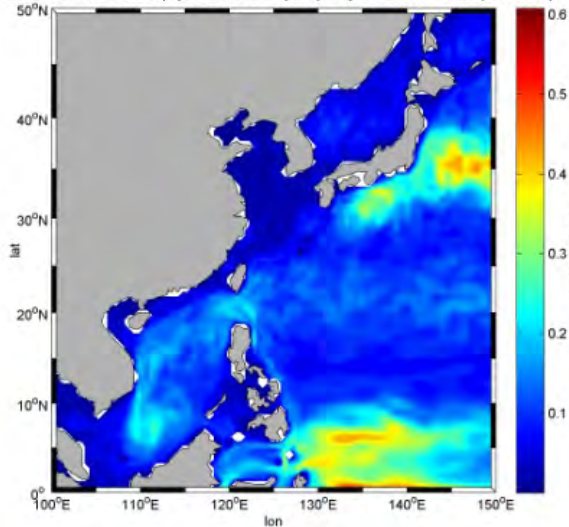


Bimonthly Anomaly Salt. at 200 m

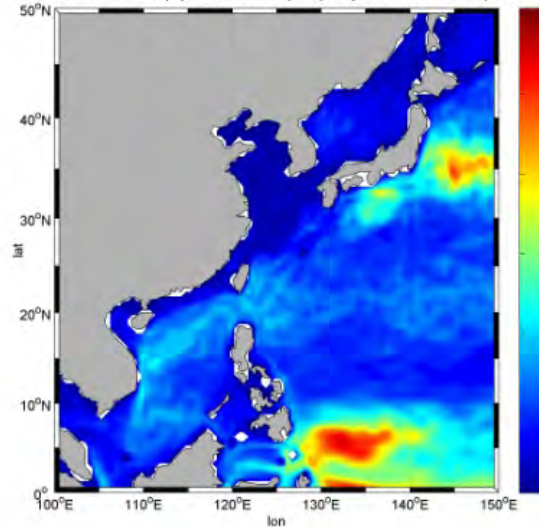


Bimonthly Anomaly Speed at 5 m

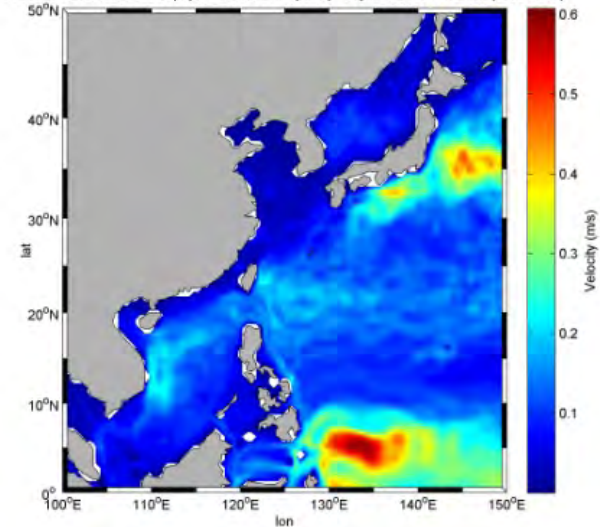
CARTON-GIESE/SODA.v2p0p2-4/VELOCITY (RMS) - depth=5.01m - month:2(1978-2007)



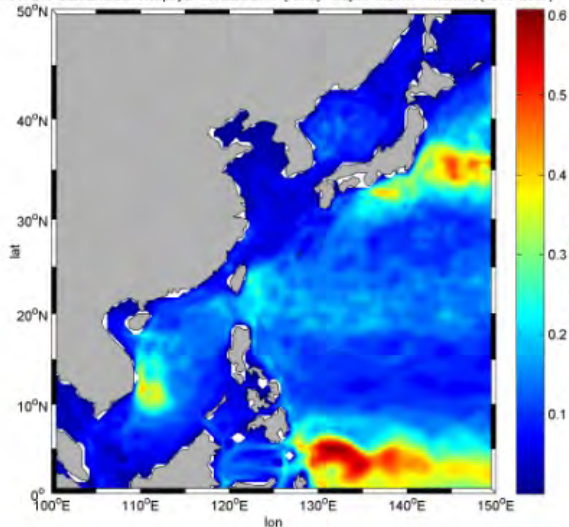
CARTON-GIESE/SODA.v2p0p2-4/VELOCITY (RMS) - depth=5.01m - month:4(1978-2007)



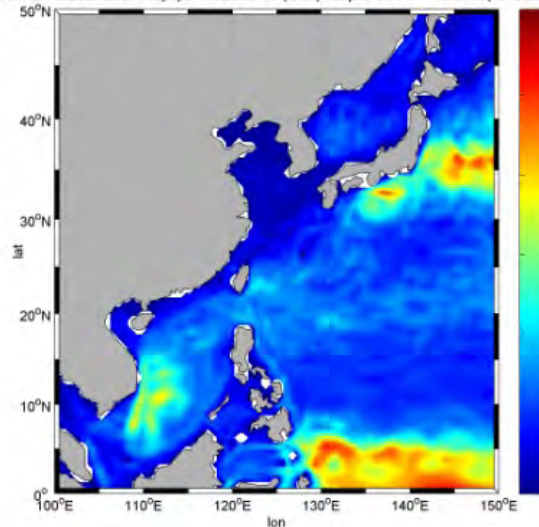
CARTON-GIESE/SODA.v2p0p2-4/VELOCITY (RMS) - depth=5.01m - month:6(1978-2007)



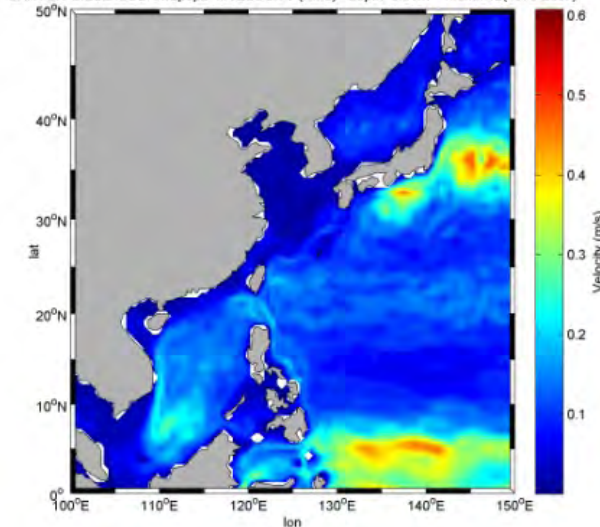
CARTON-GIESE/SODA.v2p0p2-4/VELOCITY (RMS) - depth=5.01m - month:8(1978-2007)



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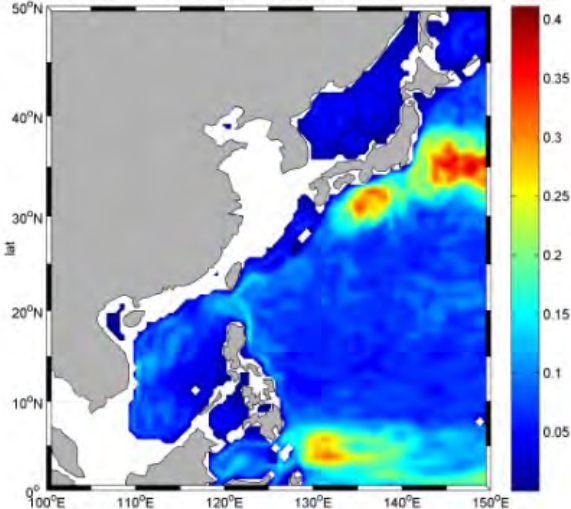


CARTON-GIESE/SODA.v2p0p2-4/VELOCITY (RMS) - depth=5.01m - month:12(1978-2007)

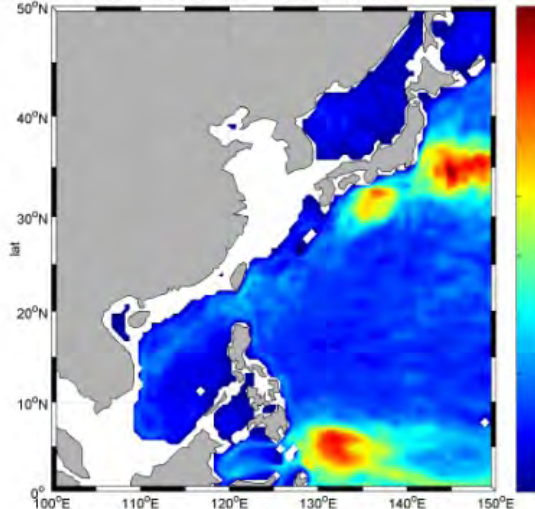


Bimonthly Anomaly Speed at 200 m

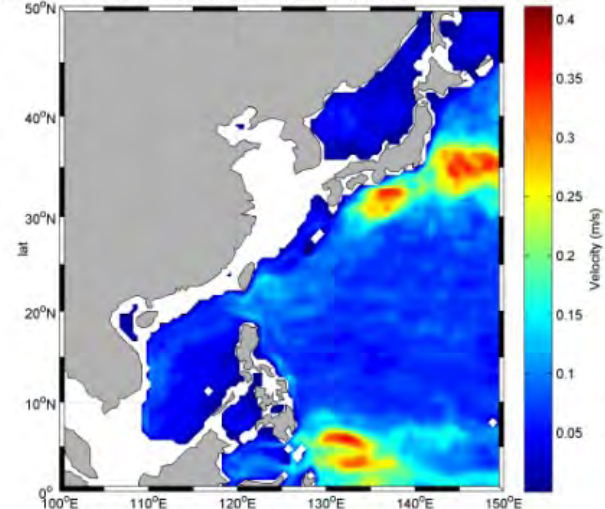
CARTON-GIESE/SODA/v2p0p2-4/VELOCITY (RMS) - depth=197.79m - month:2(1978-2007)



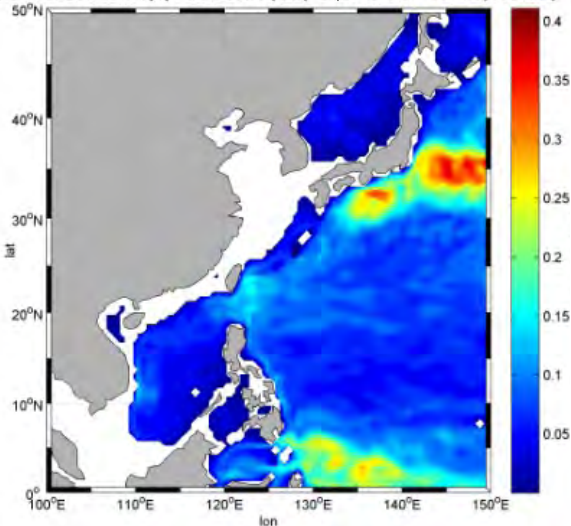
CARTON-GIESE/SODA/v2p0p2-4/VELOCITY (RMS) - depth=197.79m - month:4(1978-2007)



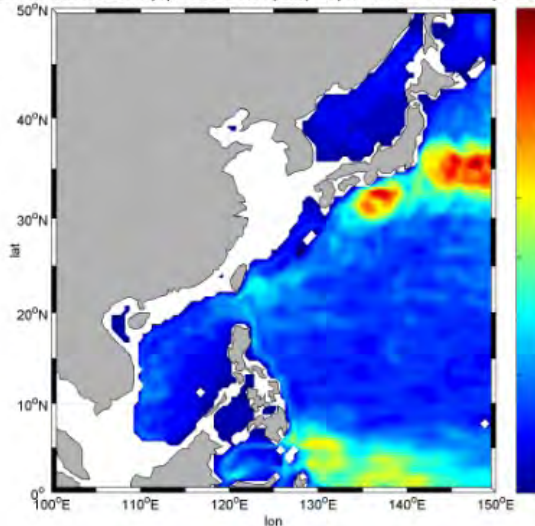
CARTON-GIESE/SODA/v2p0p2-4/VELOCITY (RMS) - depth=197.79m - month:6(1978-2007)



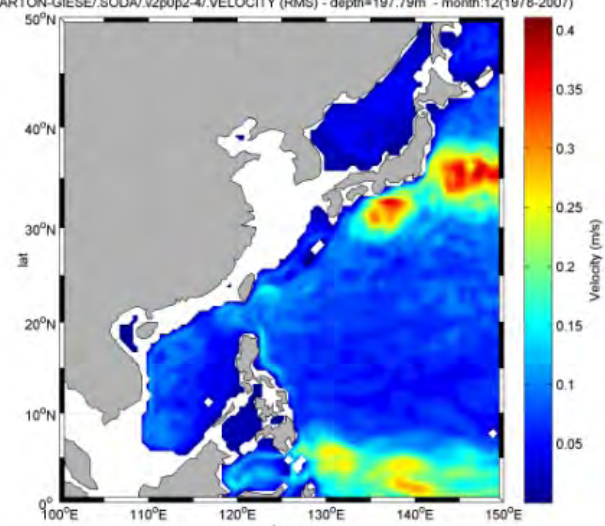
CARTON-GIESE/SODA/v2p0p2-4/VELOCITY (RMS) - depth=197.79m - month:8(1978-2007)



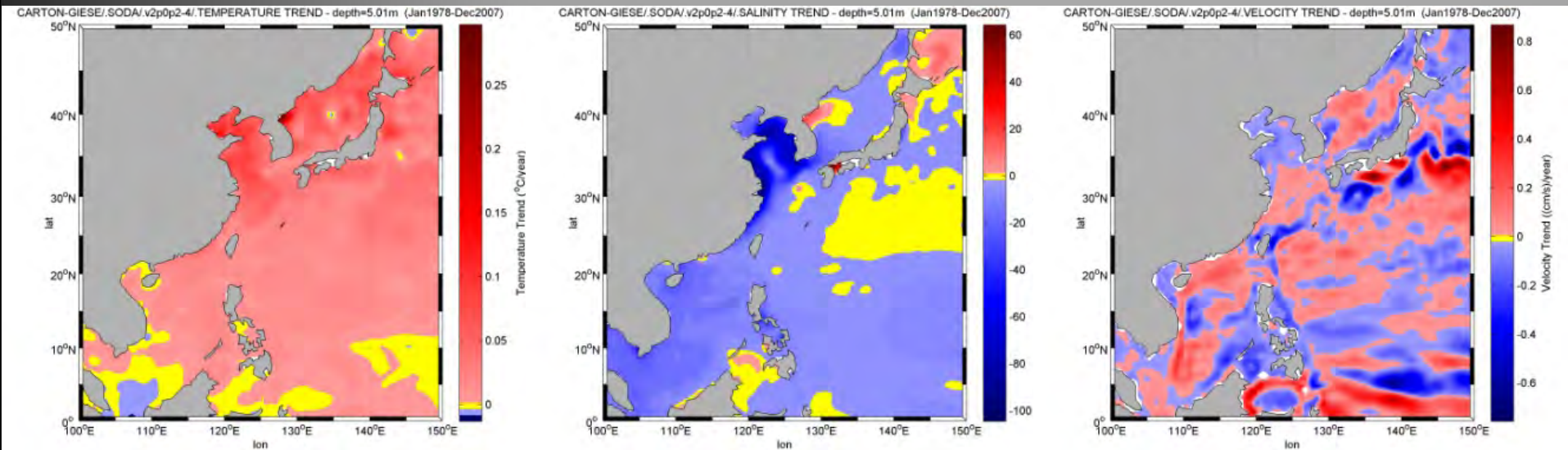
CARTON-GIESE/SODA/v2p0p2-4/VELOCITY (RMS) - depth=197.79m - month:10(1978-2007)



CARTON-GIESE/SODA/v2p0p2-4/VELOCITY (RMS) - depth=197.79m - month:12(1978-2007)



Long-Term Trend at Surface

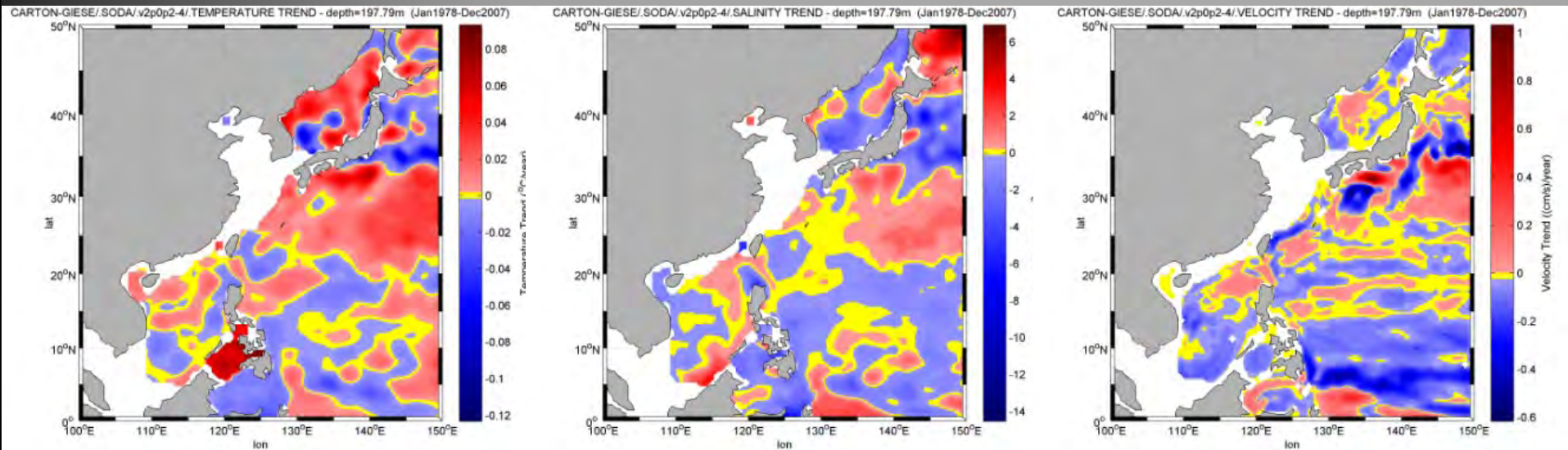


SST

Salinity

Current

Long-Term Trend at 200 m



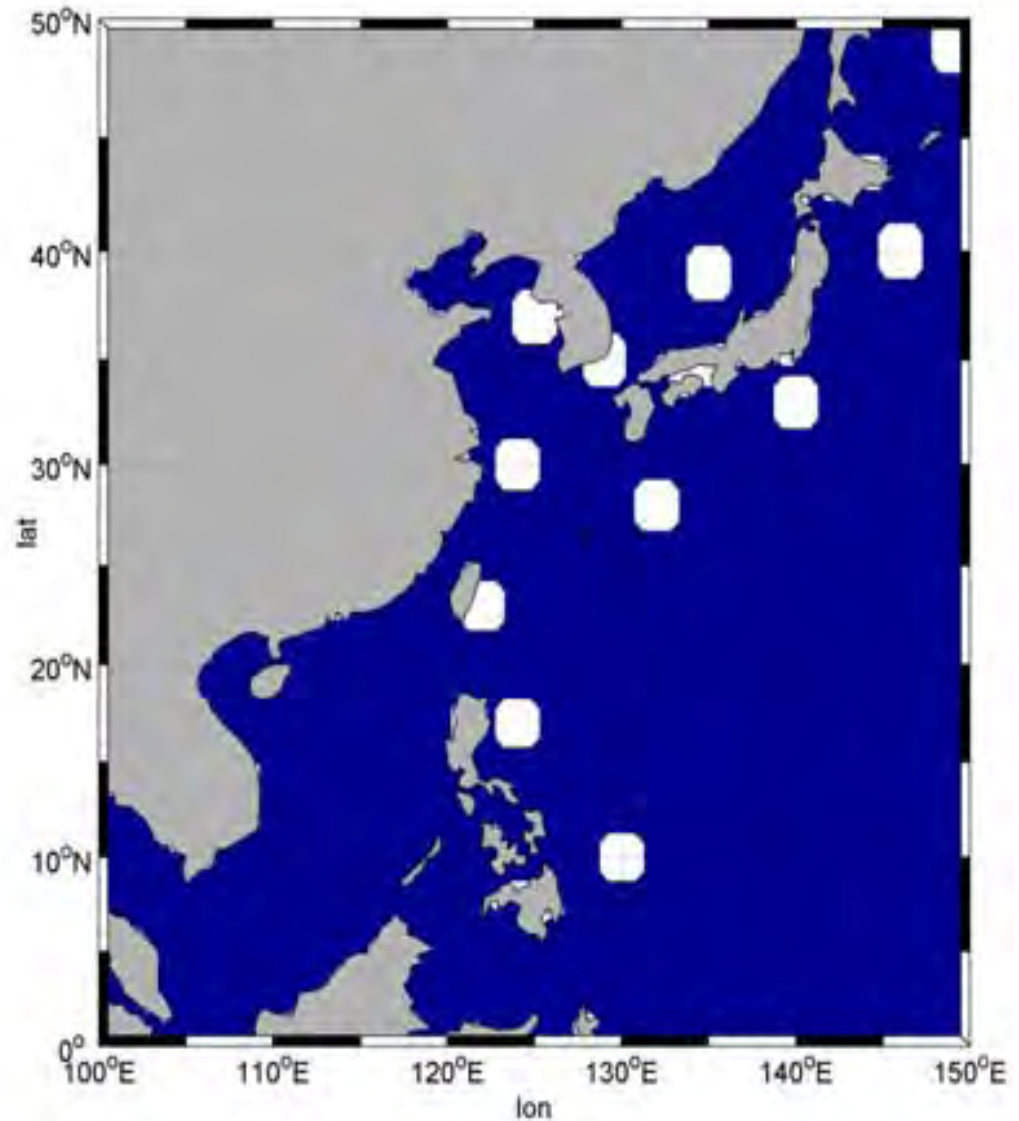
SST

Salinity

Current

Selected Regions

Region	lon	lat
NEq.	130	10
Phil	124	17
TwN	122	23
Kuro	132	28
Yntz	124	30
KuEx	140	33
KRST	129	35
Yell	125	37
ESPL	135	39
OYSH	146	40
Oktk	150	50



Long-term **Trend** for Regions

Selected		Temperature		Salinity		Velocity	
Region	Lat.	(°C/100 year)		(psu/100 year)		(cm s ⁻¹ /100 year)	
		5 m	198 m	5 m	198 m	5 m	198 m
NEq	10	1.10	0.00	-0.30	0.00	-2.80	-7.50
Phil	17	1.40	0.60	-0.30	0.00	-2.00	-3.60
Twn	23	1.60	-0.40	-0.20	0.00	-9.20	-5.50
Yntz	28	5.40		-1.50		2.00	
Kuro	30	2.20	0.40	-0.20	0.00	-0.70	-2.60
KRST	33	3.30	1.50	-3.00	0.00	0.20	-0.20
Yell	35	4.80		-6.80		-2.90	
KuEx	37	4.40	5.50	-0.10	0.20	-10.50	-2.40
ESPL	39	2.90	-1.80	-0.20	-0.20	12.70	-0.50
OYsh	40	3.20	-0.30	-0.20	-0.30	2.50	0.80
Otkk	50	1.80	0.90	0.50	0.60	-9.10	-7.00



Cross Correlation of Monthly Temp. Anomaly at 5m

	NEq	Phil	Twn	Yntz	Kuro	KRST	Yell	KuEx	ESPL	OYSH	Oktk
NEq	1.00	0.51	0.37	0.06	0.25	0.00	-0.08	0.20	-0.15	-0.03	-0.08
Phil	0.51	1.00	0.67	0.26	0.43	0.16	0.05	0.20	-0.01	0.11	-0.08
Twn	0.37	0.67	1.00	0.38	0.52	0.21	0.14	0.29	0.08	0.13	0.05
Yntz	0.06	0.26	0.38	1.00	0.35	0.58	0.54	0.43	0.43	0.22	0.25
Kuro	0.25	0.43	0.52	0.35	1.00	0.30	0.18	0.50	0.21	0.19	0.05
KRST	0.00	0.16	0.21	0.58	0.30	1.00	0.66	0.38	0.65	0.32	0.24
Yell	-0.08	0.05	0.14	0.54	0.18	0.66	1.00	0.18	0.63	0.23	0.44
KuEx	0.20	0.20	0.29	0.43	0.50	0.38	0.18	1.00	0.26	0.19	0.01
ESPL	-0.15	-0.01	0.08	0.43	0.21	0.65	0.63	0.26	1.00	0.32	0.33
OYSH	-0.03	0.11	0.13	0.22	0.19	0.32	0.23	0.19	0.32	1.00	0.13
Oktk	-0.08	-0.08	0.05	0.25	0.05	0.24	0.44	0.01	0.33	0.13	1.00

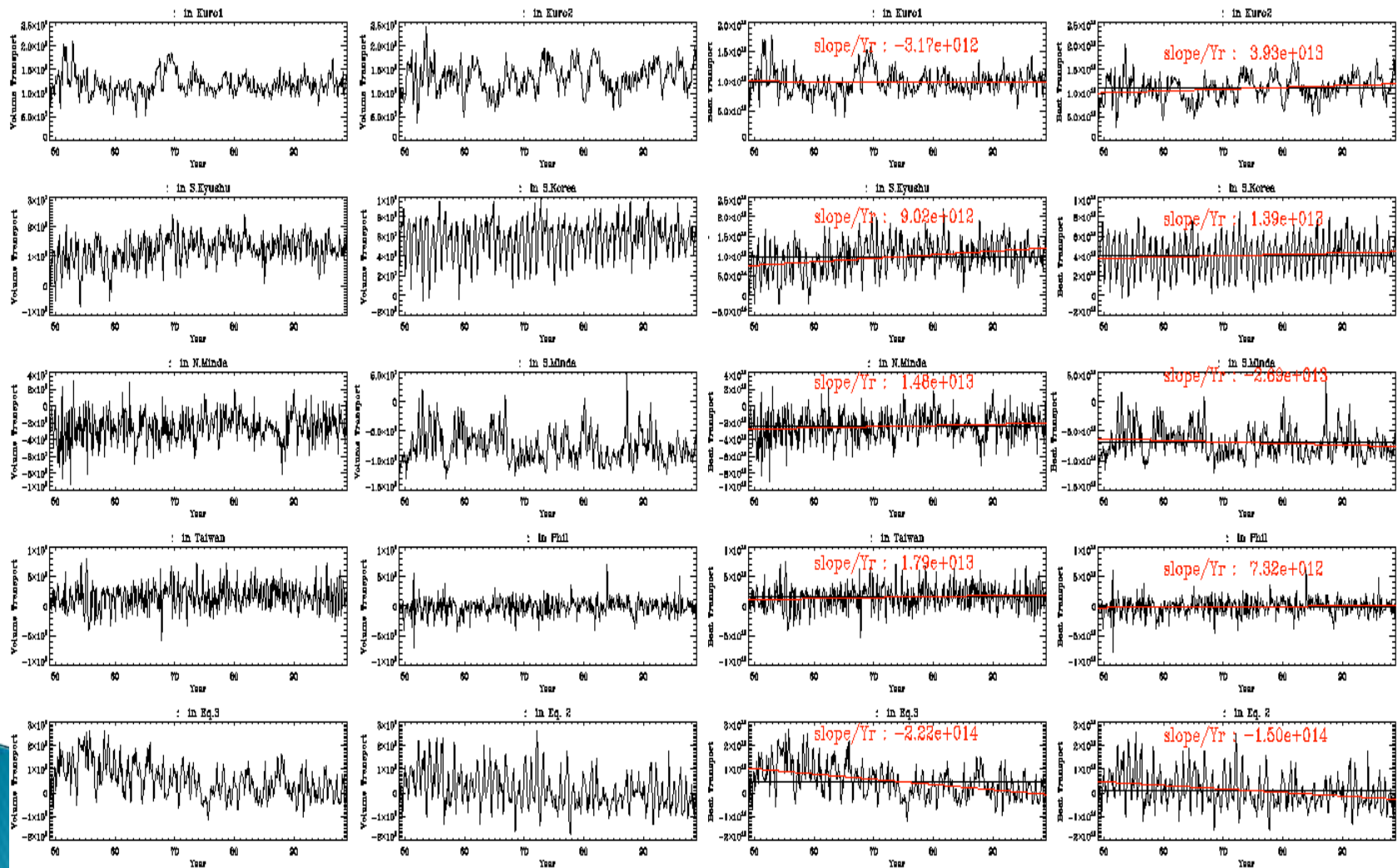
Cross Correlation of Monthly Salinity Anomaly at 5m

	NEq	Phil	Twn	Yntz	Kuro	KRST	Yell	KuEx	ESPL	OYSH	Oktk
NEq	1.00	0.31	0.29	0.09	0.05	0.23	0.31	0.04	0.05	0.13	-0.02
Phil	0.31	1.00	0.33	-0.06	0.11	0.06	0.18	0.08	0.10	-0.04	0.04
Twn	0.29	0.33	1.00	0.04	0.05	0.19	0.19	0.12	0.07	0.10	0.10
Yntz	0.09	-0.06	0.04	1.00	0.03	0.13	0.24	-0.03	-0.08	-0.05	-0.19
Kuro	0.05	0.11	0.05	0.03	1.00	0.20	0.20	0.35	0.05	-0.13	-0.13
KRST	0.23	0.06	0.19	0.13	0.20	1.00	0.64	0.10	0.17	0.06	-0.02
Yell	0.31	0.18	0.19	0.24	0.20	0.64	1.00	-0.08	0.18	0.07	-0.09
KuEx	0.04	0.08	0.12	-0.03	0.35	0.10	-0.08	1.00	-0.03	0.00	-0.05
ESPL	0.05	0.10	0.07	-0.08	0.05	0.17	0.18	-0.03	1.00	0.07	0.00
OYSH	0.13	-0.04	0.10	-0.05	-0.13	0.06	0.07	0.00	0.07	1.00	0.10
Oktk	-0.02	0.04	0.10	-0.19	-0.13	-0.02	-0.09	-0.05	0.00	0.10	1.00

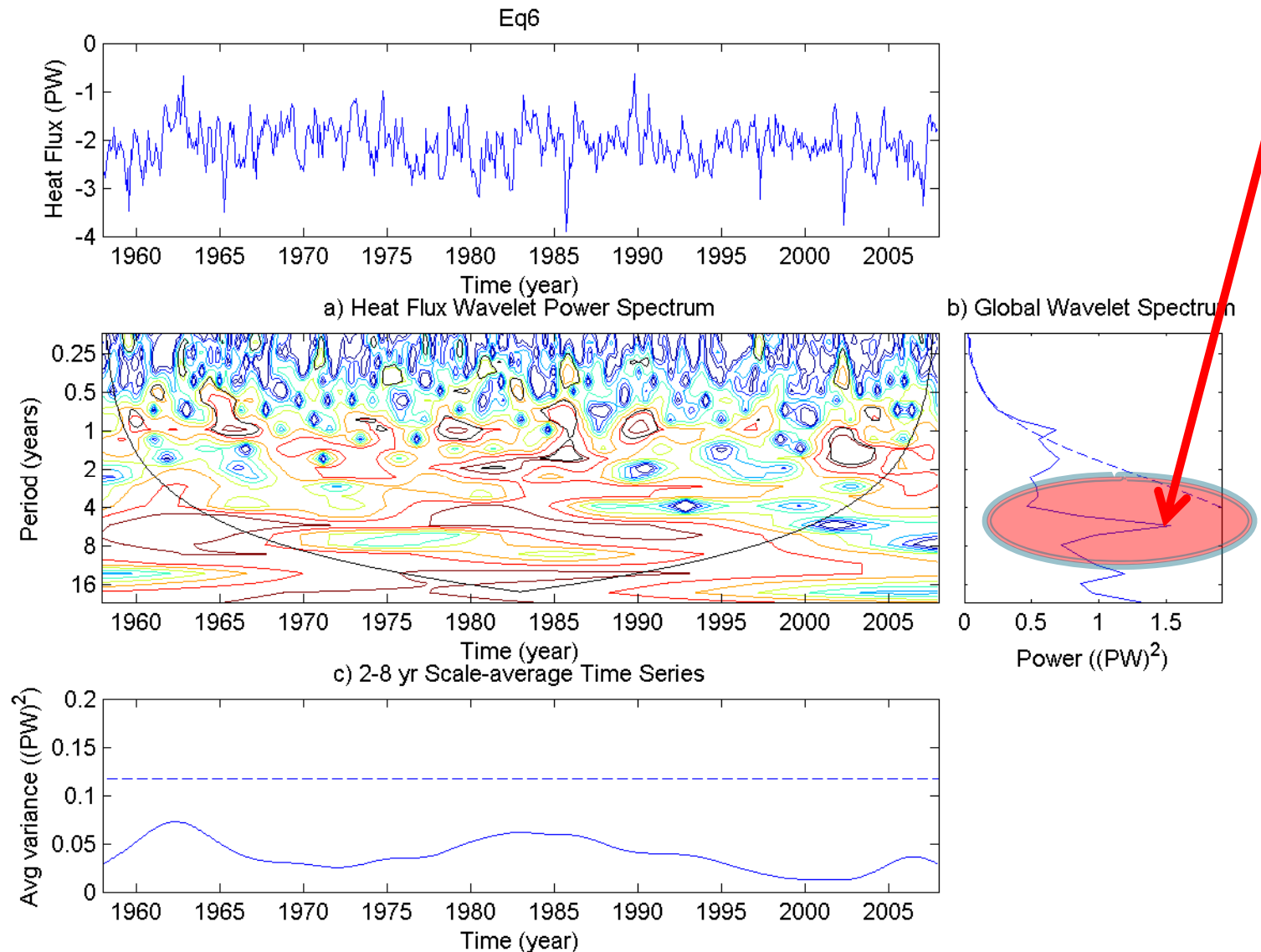
Cross Correlation of Monthly V-comp. Anomaly at 5m

	NEq	Phil	Twn	Yntz	Kuro	KRST	Yell	KuEx	ESPL	OYSH	Oktk
NEq	1.00	0.13	0.03	-0.11	-0.12	0.01	-0.07	-0.04	-0.04	0.06	0.09
Phil	0.13	1.00	-0.03	-0.04	-0.16	-0.02	0.02	-0.01	-0.07	0.05	0.02
Twn	0.03	-0.03	1.00	-0.01	0.04	0.03	0.10	-0.01	0.03	-0.09	0.03
Yntz	-0.11	-0.04	-0.01	1.00	0.19	0.50	0.22	0.17	-0.02	-0.06	0.09
Kuro	-0.12	-0.16	0.04	0.19	1.00	0.14	0.08	0.21	-0.03	-0.03	0.03
KRST	0.01	-0.02	0.03	0.50	0.14	1.00	0.26	0.16	-0.14	-0.04	0.20
Yell	-0.07	0.02	0.10	0.22	0.08	0.26	1.00	0.14	0.01	0.07	-0.02
KuEx	-0.04	-0.01	-0.01	0.17	0.21	0.16	0.14	1.00	-0.15	0.04	0.13
ESPL	-0.04	-0.07	0.03	-0.02	-0.03	-0.14	0.01	-0.15	1.00	0.17	-0.03
OYSH	0.06	0.05	-0.09	-0.06	-0.03	-0.04	0.07	0.04	0.17	1.00	0.00
Oktk	0.09	0.02	0.03	0.09	0.03	0.20	-0.02	0.13	-0.03	0.00	1.00

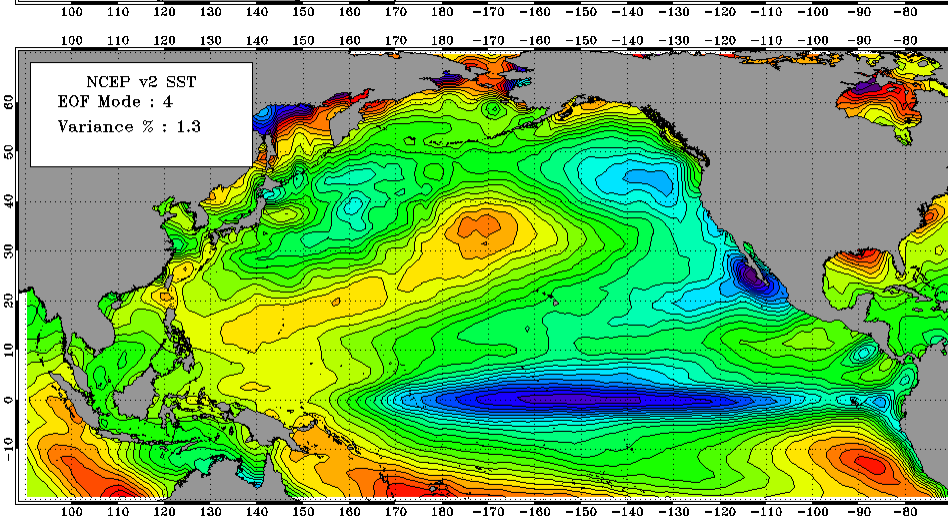
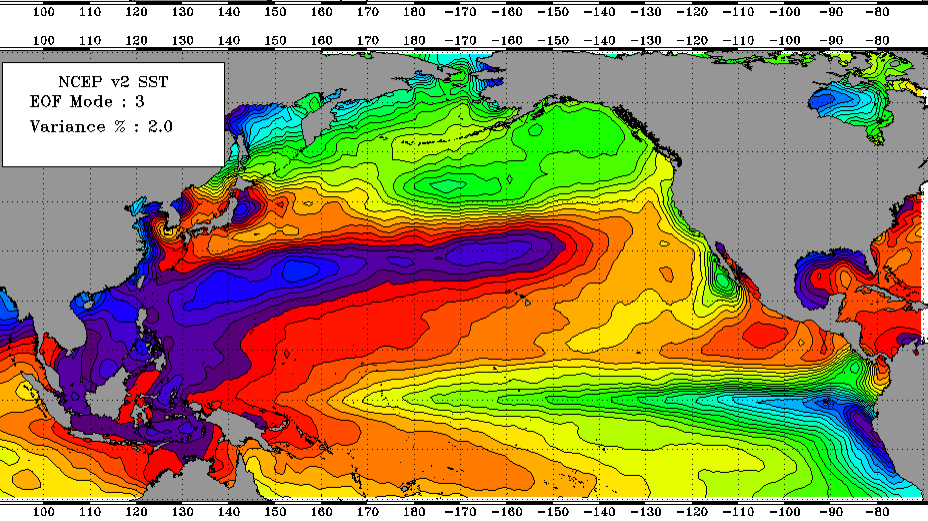
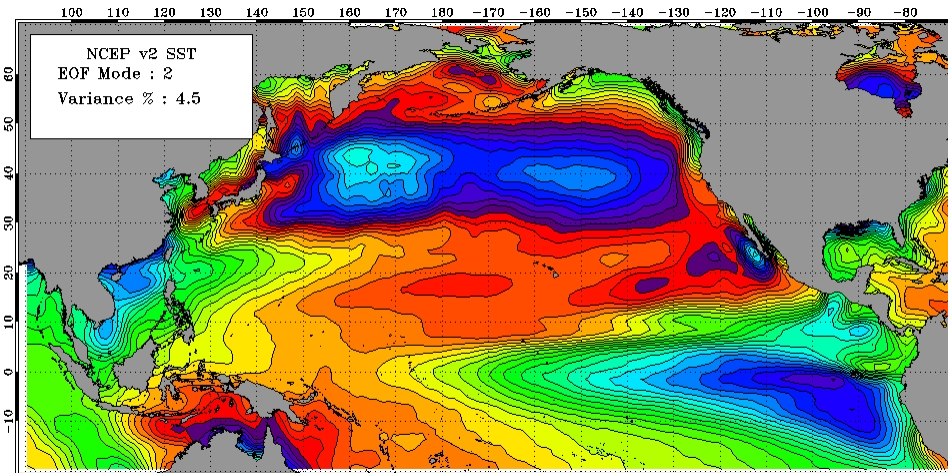
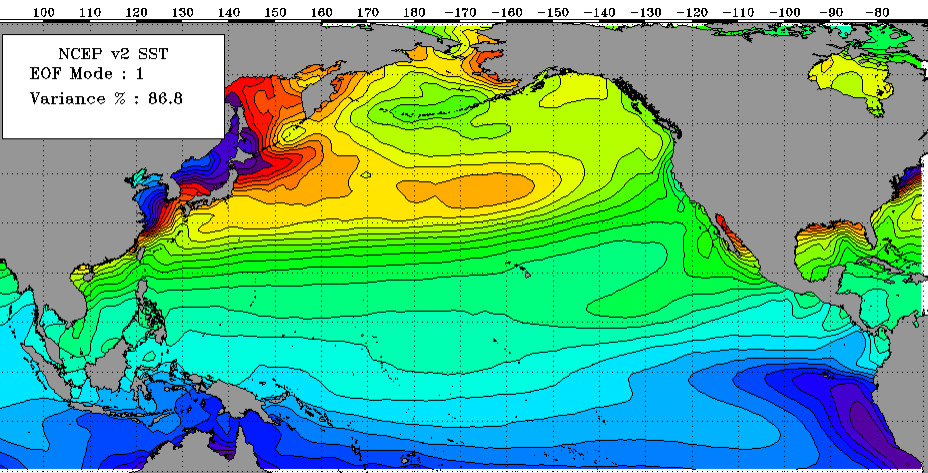
Volume and Heat Transport



Wavelet Power Spectrum for Heat Flux

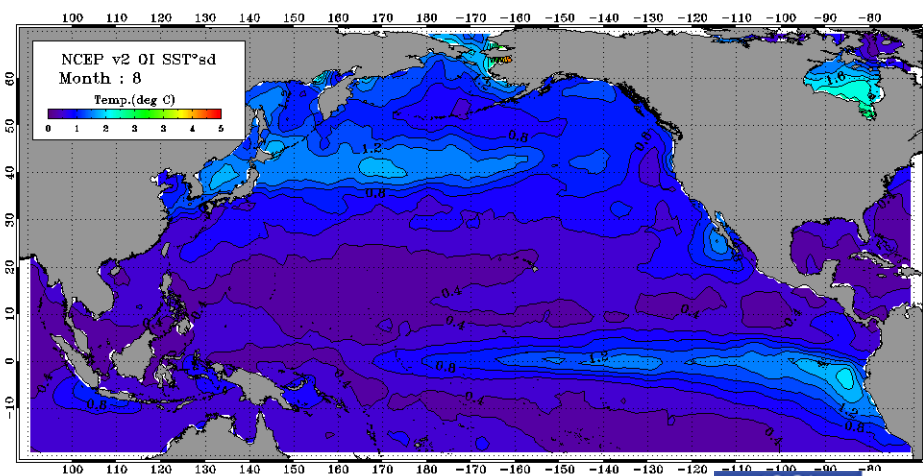
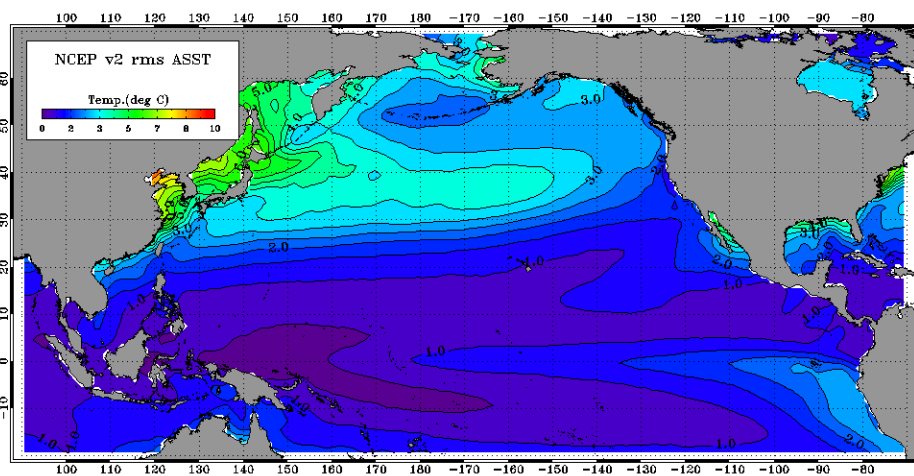
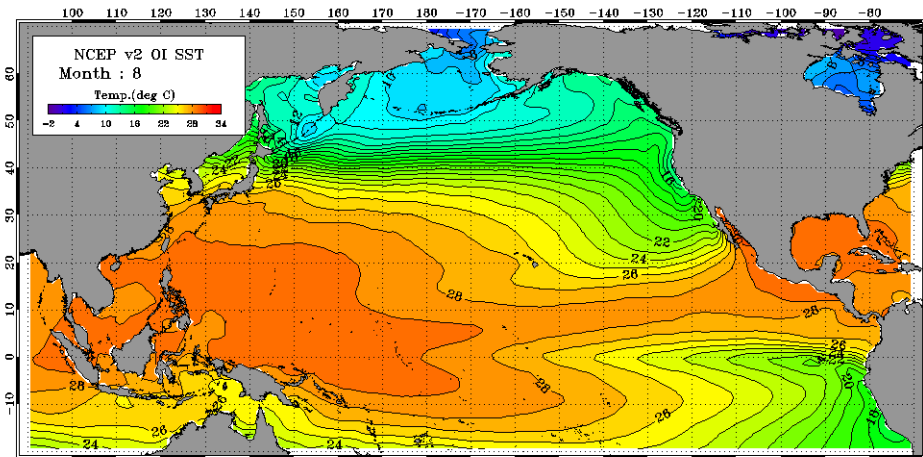
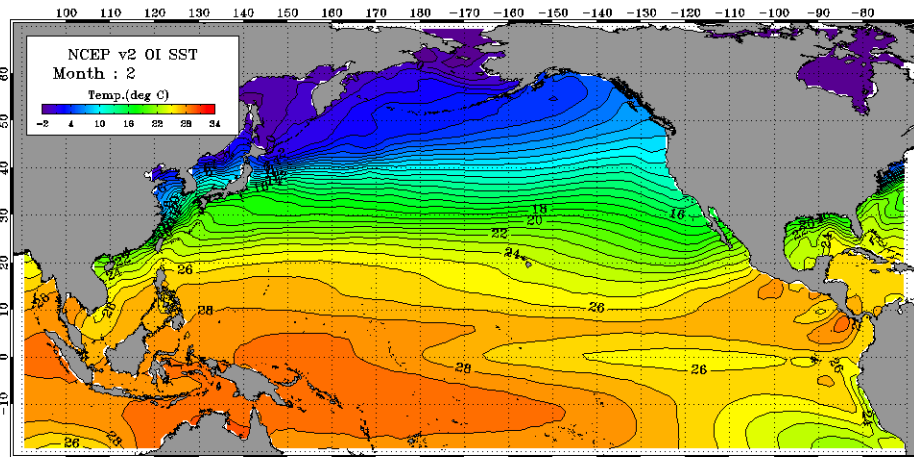


EOF Modes



SST Characteristics in the N. Pacific

Mean and Rms of SST



Summary & Conclusion

- ▶ High Variability from region to region
- ▶ Behaviors of Temp., Salt, Current different
- ▶ Partition of Impact from Tropic and Artic on East (Japan) Sea, still difficult to define

Thank You for your Attention