Welcome to

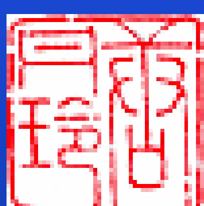
COSPAR Capacity Building Workshop
&
WMO Training Course on
satellite remote sensing and climate change

Satellite
Sensor
Data
Methods
Web
Process
…

Scientific
Question?
Idea?

Remote Sensing of Marine ecosystems respond to environment changes

唐丹玲



DanLing Tang
Lingzis

South China Sea Institute of Oceanology
Chinese Academy of Sciences

http://lingzis.51.net/
Lingzistdl@126.com

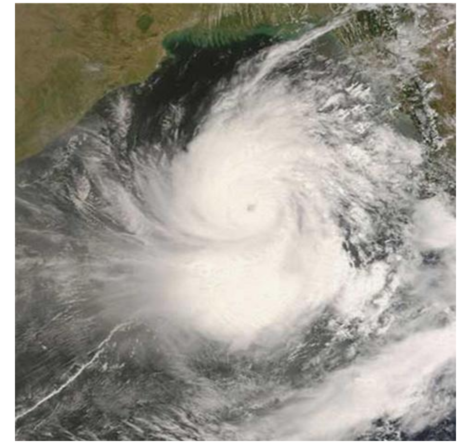
1. Introduction
2. Wind impact on Marine Ecosystem
3. Typhoon impact on Marine Ecosystem
4. Primary Production
5. Marine pollution
6. Remote sensing of Marine Ecology

中科院南海海洋研究所 唐丹玲

1 Introduction

http://lingzis.51.net/
http://people.gucas.ac.cn/~Lingzis
http://www.tech110.net/html/?uid-178

Climate Changes /Natural Hazards



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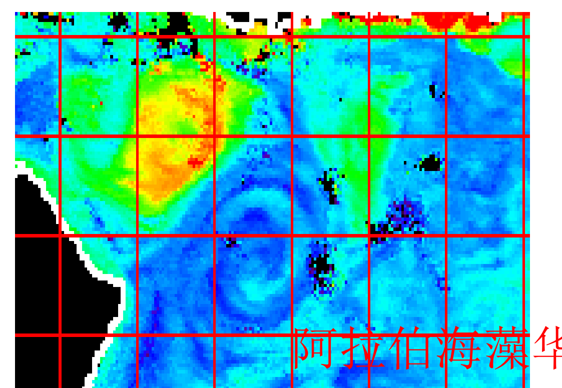
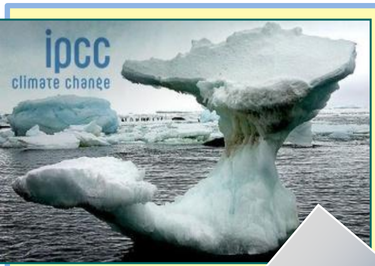
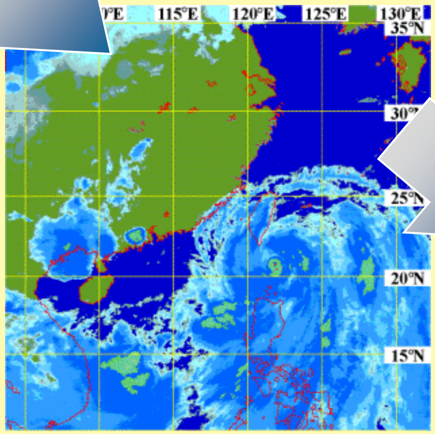


CO_2 Climate Changes



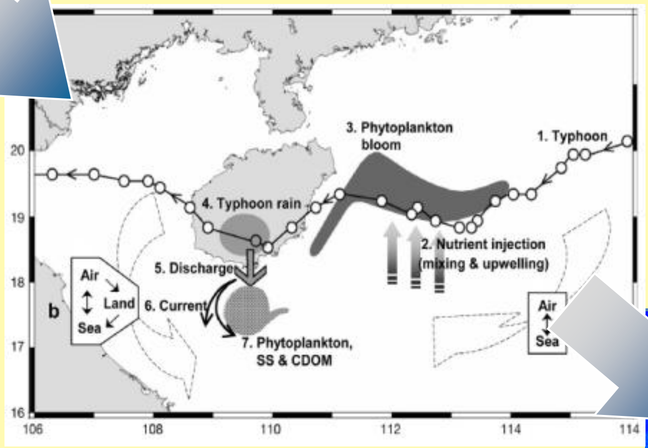
IPCC-5
2013 Oct

typhoon



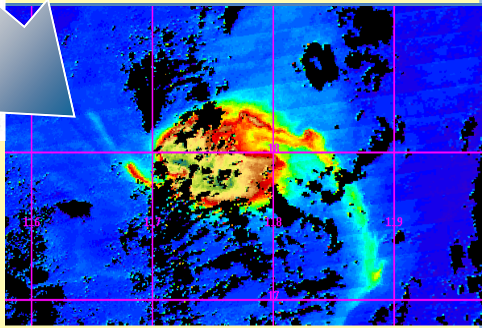
Ocean
dynamics

Up ocean

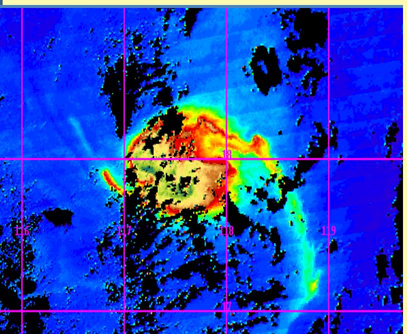


nutrients

Phytoplankton
bloom



Phytoplankt on bloom



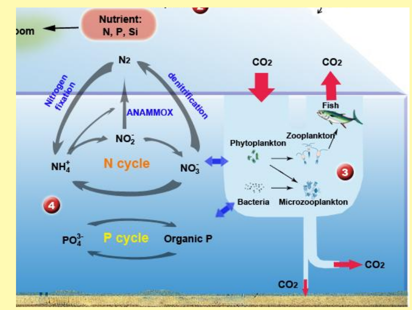
Primary Production

Respirations

photosynthesis

CO_2 DO

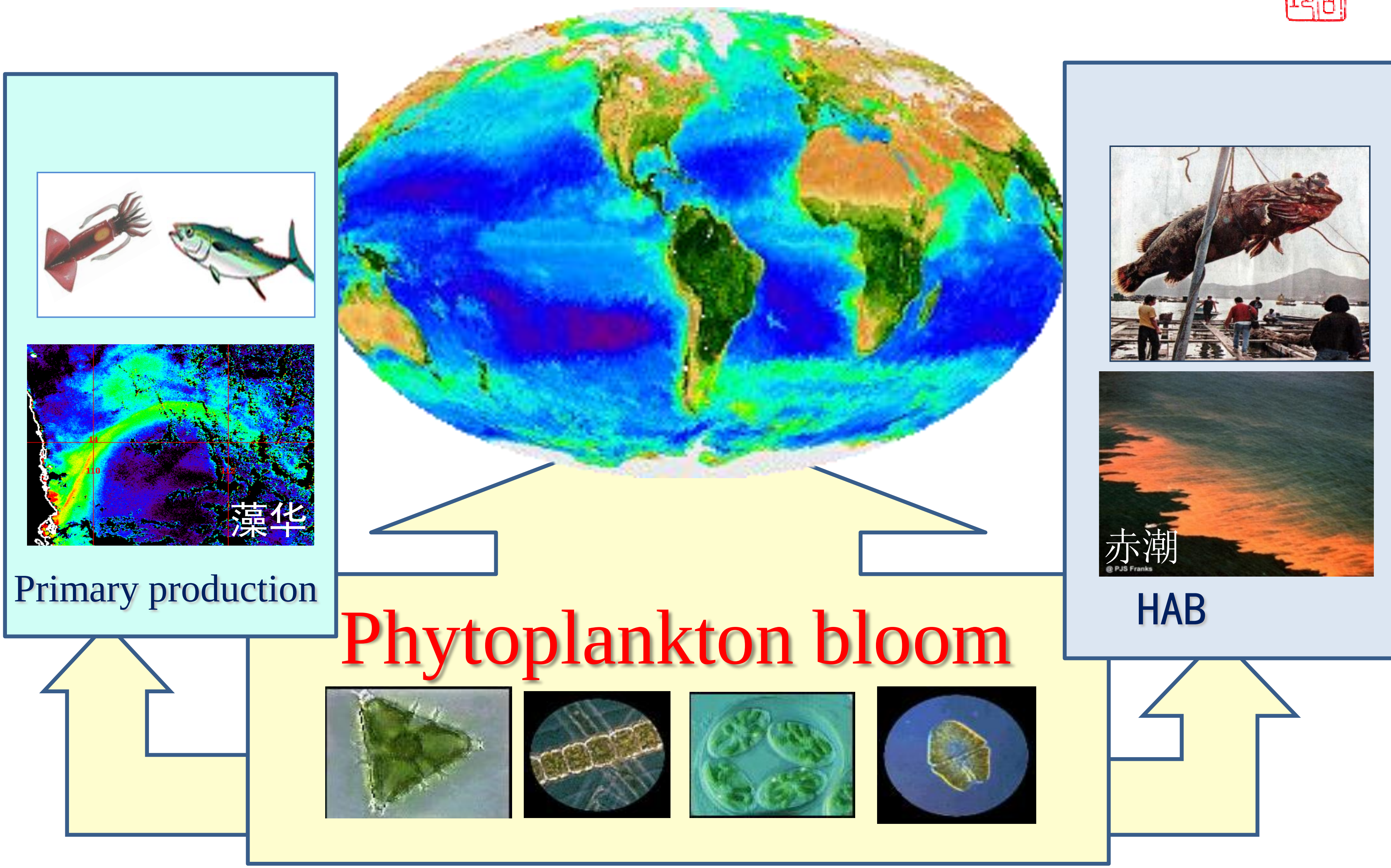
Marine system

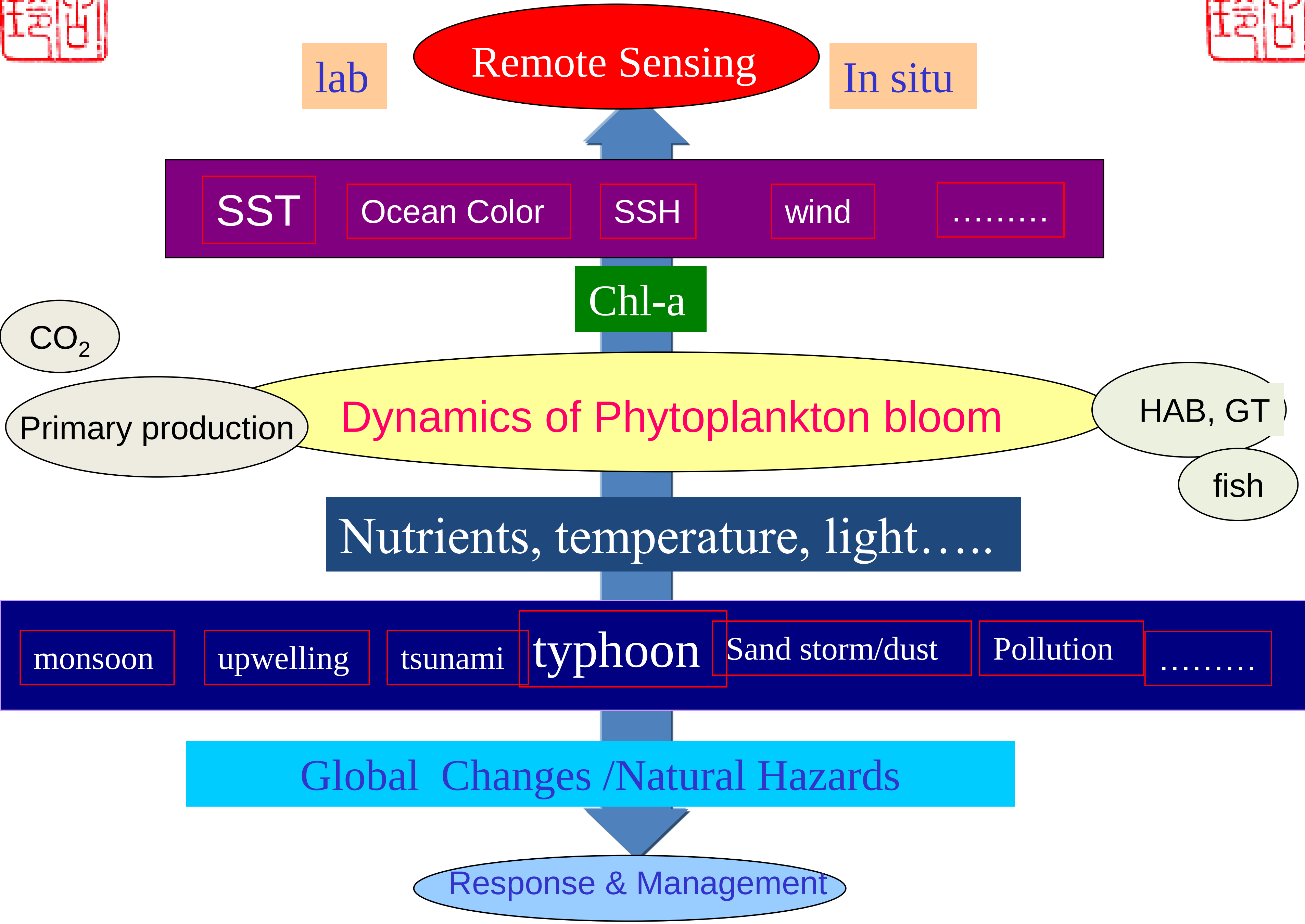


pCo2
DO

CO_2

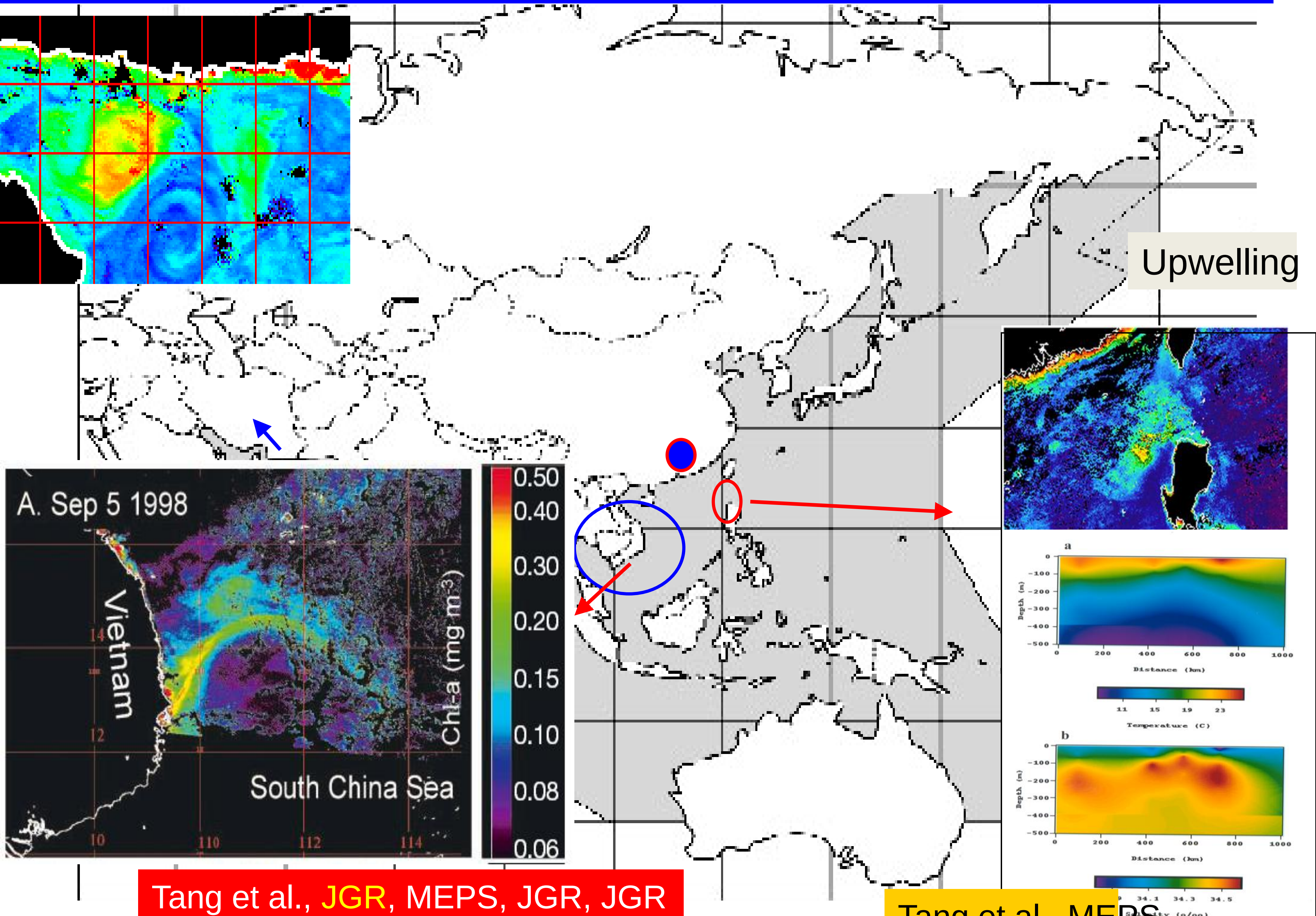
http://lingzis.51.net/list.htm




lab
Remote Sensing
In situ
SST
Ocean Color
SSH
wind
………
Chl-a
CO_2
Primary production
Dynamics of Phytoplankton bloom
HAB, GT
fish
Nutrients, temperature, light…..
monsoon
upwelling
tsunami
typhoon
Sand storm/dust
Pollution
………
Global Changes /Natural Hazards
Response & Management

中科院南海海洋研究所　唐丹玲

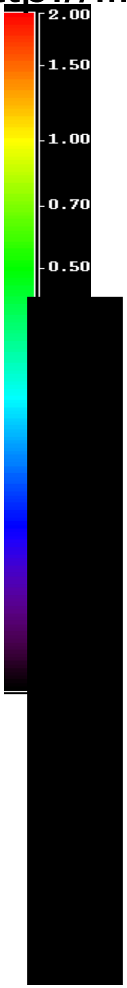
2 Phytoplankton bloom



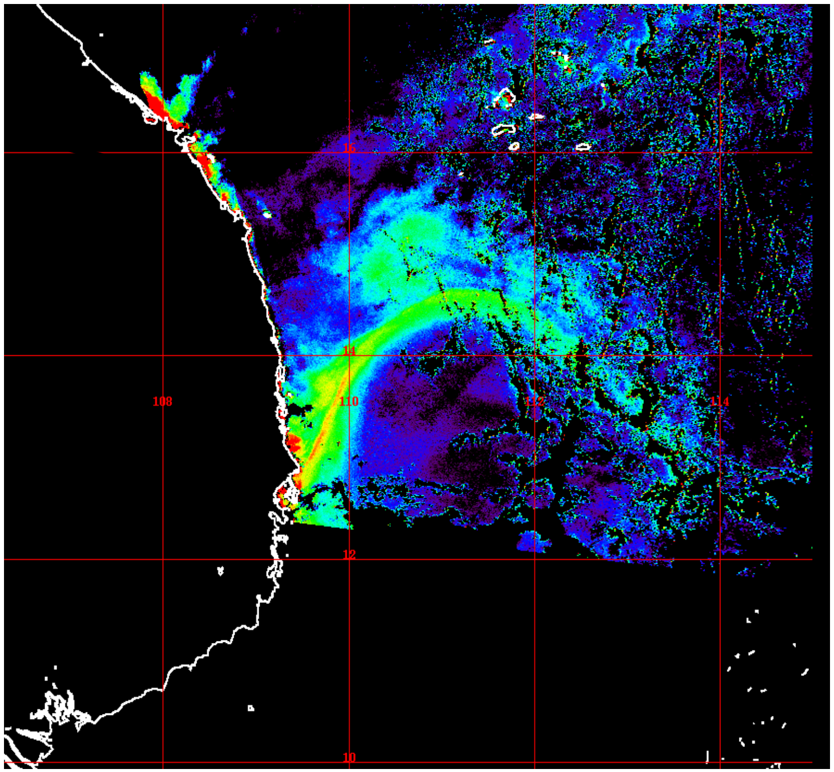
Tang et al., JGR, MEPS, JGR, JGR

Tang et al., MEPS

http://lingzis.51.net/



A. Sep 5 1998



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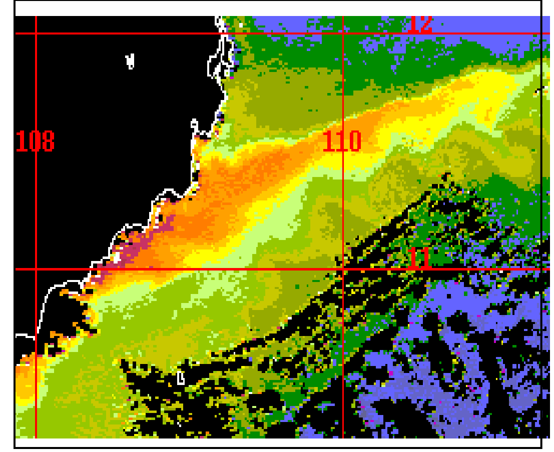
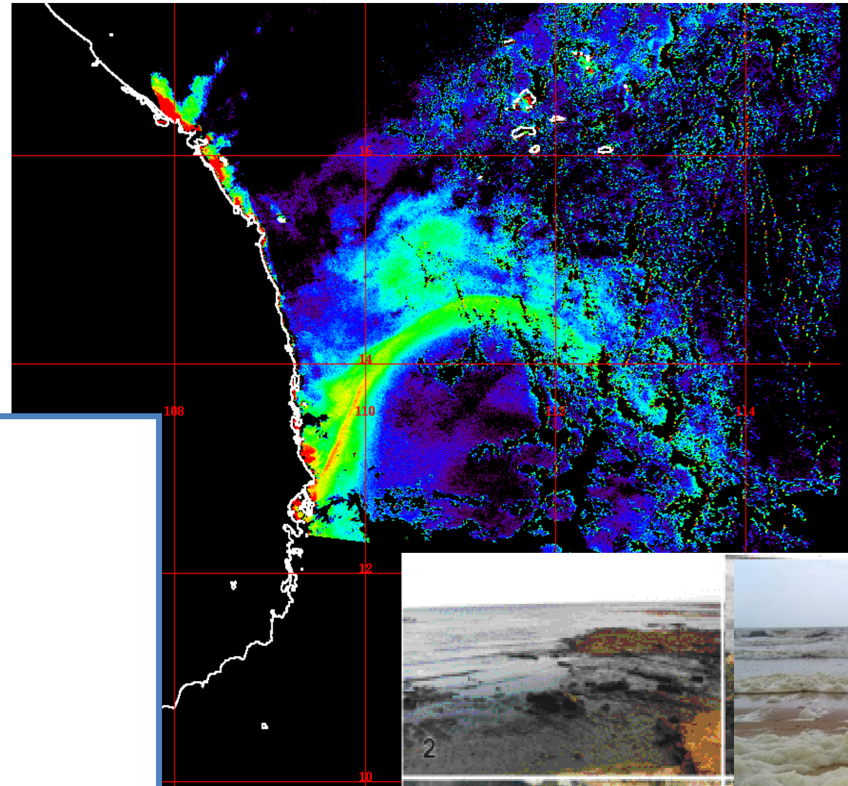
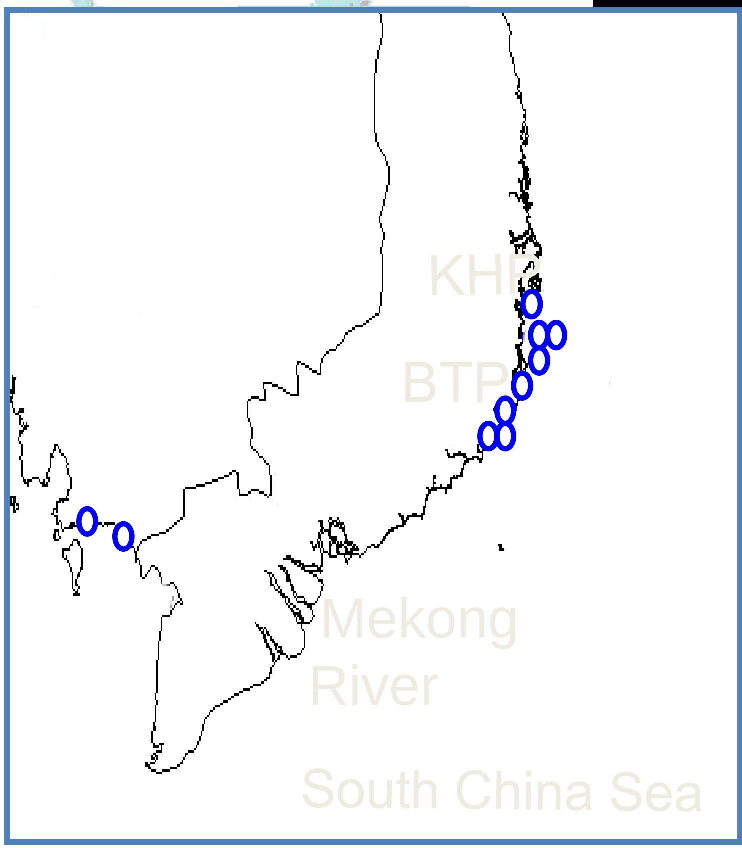


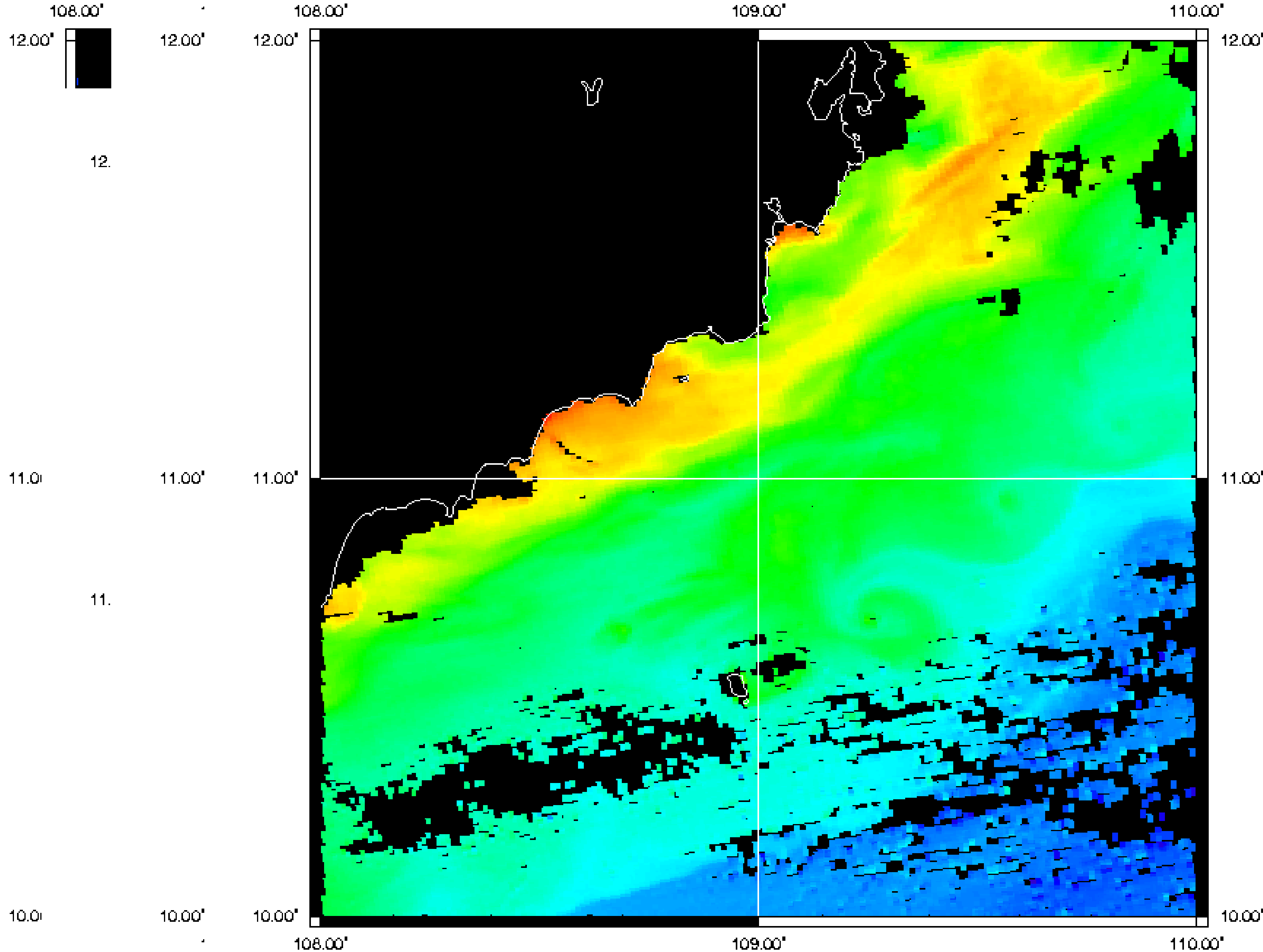
(Tang et al. 2004, JGR)

Tang DanLing





Tang DL et al., 2004, GJR



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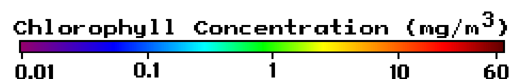
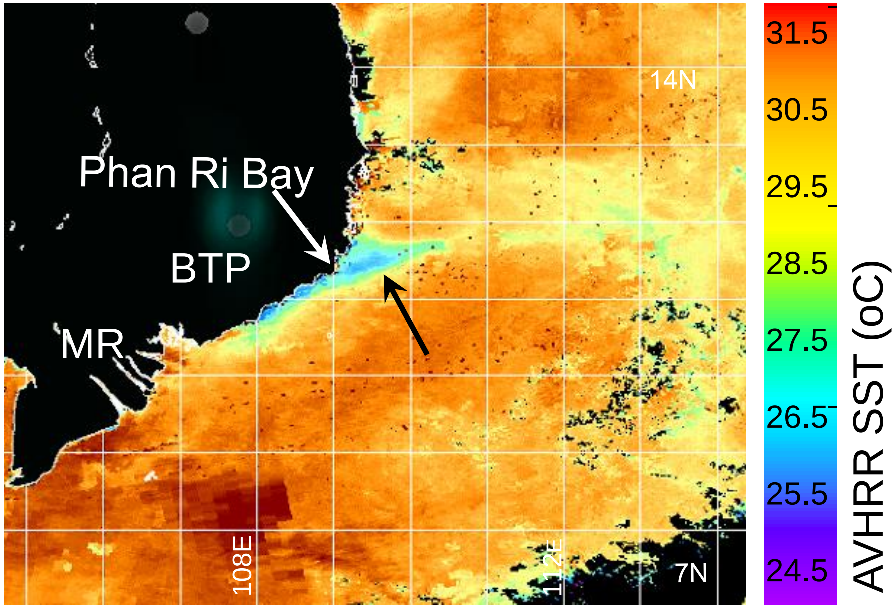
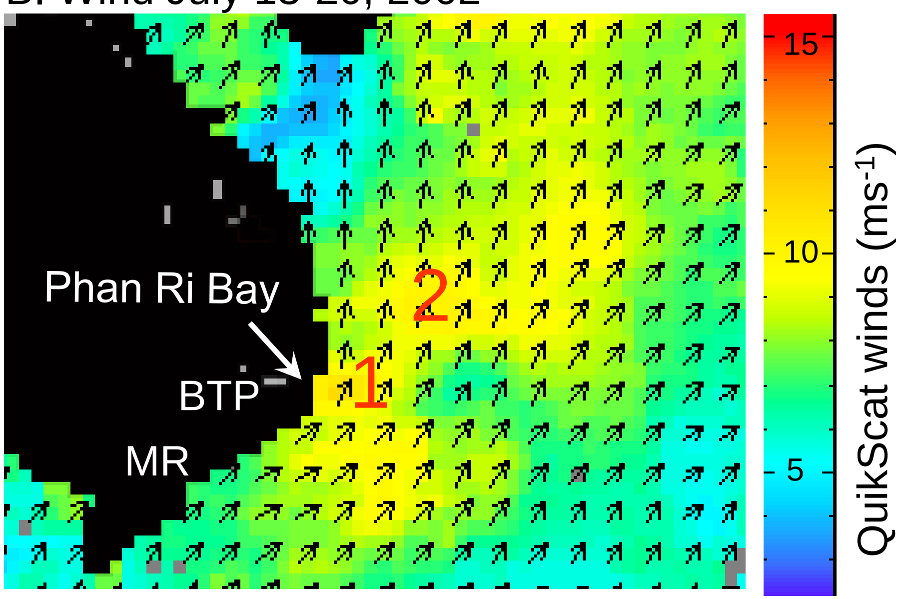
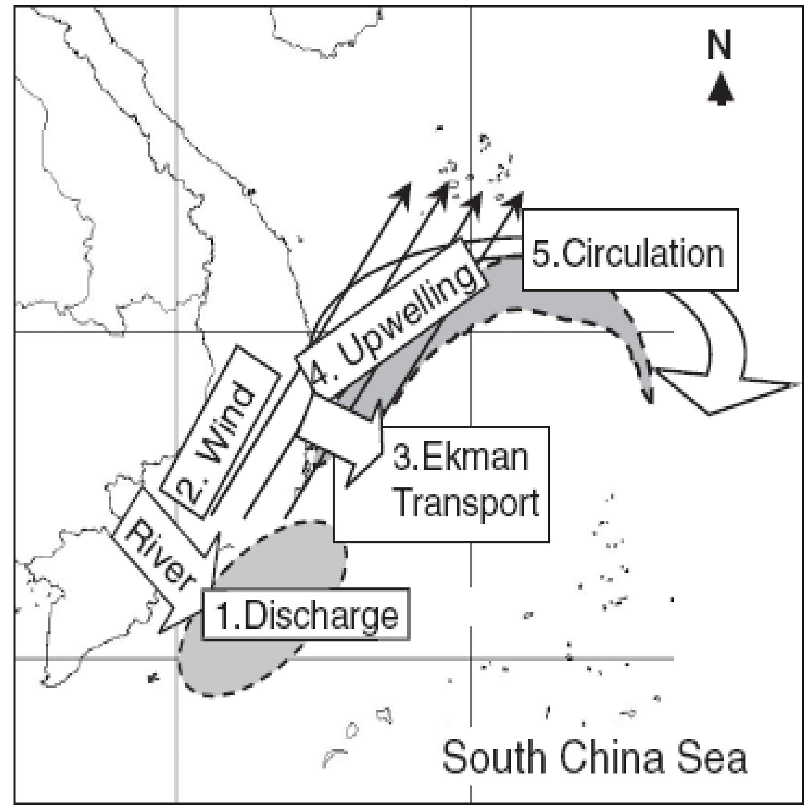


Wind

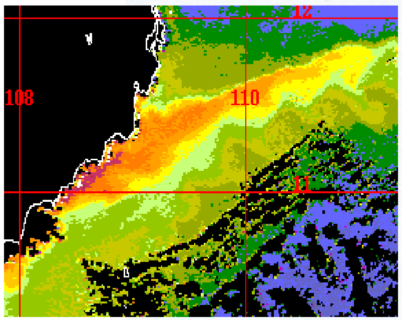


B. Wind July 13-20, 2002





Tang et al., 2004. JGR, MEPS 2004



14版　平成16年(2004年)5月9日　日曜日　産経新聞

地球観測衛星がとらえた巨大赤潮。矢印の部分に広がっていた　（川村宏教授提供）

ハノイ
ラオス
ベトナム
タイ
カンボジア
200km
ファンリー湾
ホーチミン
メコン川
強い南西風
南シナ海
冷水が上昇

ベトナム史上最悪被害の赤潮
強風が富栄養化招く
自然発生メカニズム解明
東北大教授ら

一昨年夏、ベトナム南部に同国史上最悪の被害をもたらした赤潮は、栄養分に富む海水が強い風の影響で沖合の深い海から沿岸部に押し寄せたために起きたとする研究結果を川村宏東北大教授（海洋物理学）らがまとめ、米地球物理学連合の学会誌に発表した。水質汚染による赤潮は世界各地で急増中だが、こうしたメカニズムでの発生は珍しいという。

問題の赤潮が起きたのはベトナム南部・ファンリー湾の東方沖。この海域では赤潮が繰り返し発生、エビ養殖などが被害を受けてきた。原因は不明だったが、同様に自然現象だった可能性が出てきた。川村教授は「研究が進めば、この種の赤潮を予測できるようになると思う」と話している。

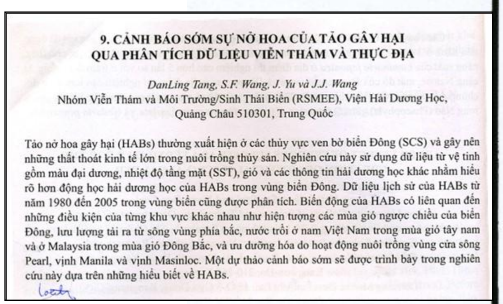
川村教授らは米航空宇宙局（NASA）の地球観測衛星のデータを分析し、一昨年六月末から約六週間、東の沖合にかけて幅五十キロ、長さ二百キロの巨大な帯状に赤潮が広がったことを解明した。

別の衛星データの分析から、赤潮の広がった海面の温度はその間、二四—二六度と周囲より一—四度低く、海岸線に沿って風速一〇メートル以上の強い南西風が吹いていたことが分かった。

これらの事実から川村教授らは、強い風が沿岸の表層の海水を沖に運び、その後を埋めるように沖合の深い海から冷水が上昇する「沿岸湧昇」が起きたと推定。冷水が豊富に含む無機物を栄養にして植物プランクトンが繁殖、巨大赤潮発生につながったと結論付けた。

共同研究者でベトナム・海洋学研究所のハイ・ドアンニュ研究員によると、この赤潮で沿岸の養殖業が約百億ドン（約七千万円）の被害を受けたほか、浅瀬の生物が大量に死滅したという。

赤潮　植物プランクトンが異常に増え、海や湖が赤色や褐色に染まる現象。生活排水や工場廃水が流れ込むことによる富栄養化が主な原因と考えられる。発生の頻度や規模が近年、世界的に増大傾向にあり、アジア各地でも経済発展に伴って深刻化している。赤潮が起きると水中の酸素が欠乏し、魚が大量死することもある。



9. CẢNH BÁO SỚM SỰ NỞ HOA CỦA TẢO GÂY HẠI QUA PHÂN TÍCH DỮ LIỆU VIỄN THÁM VÀ THỰC ĐỊA

DanLing Tang, S.F. Wang, J. Yu và J.J. Wang
Nhóm Viễn Thám và Môi Trường/Sinh Thái Biển (RSMEE), Viện Hải Dương Học, Quảng Châu 510301, Trung Quốc

Tảo nở hoa gây hại (HABs) thường xuất hiện ở các thủy vực ven bờ biển Đông (SCS) và gây nên những thất thoát kinh tế lớn trong nuôi trồng thủy sản. Nghiên cứu này sử dụng dữ liệu từ vệ tinh gồm màu đại dương, nhiệt độ tầng mặt (SST), gió và các thông tin hải dương học khác nhằm hiểu rõ hơn động học hải dương học của HABs trong vùng biển Đông. Dữ liệu lịch sử của HABs từ năm 1980 đến 2005 trong vùng biển cũng được phân tích. Biến động của HABs có liên quan đến những điều kiện của từng khu vực khác nhau như hiện tượng các mùa gió ngược chiều của biển Đông, lưu lượng tải ra từ sông vùng phía bắc, nước trồi ở nam Việt Nam trong mùa gió tây nam và ở Malaysia trong mùa gió Đông Bắc, và ưu dưỡng hóa do hoạt động nuôi trồng vùng cửa sông Pearl, vịnh Manila và vịnh Masinloc. Một dự thảo cảnh báo sớm sẽ được trình bày trong nghiên cứu này dựa trên những hiểu biết về HABs.

American Geophysical Union JOURNAL HIGHLIGHTS: Harvey Leifert

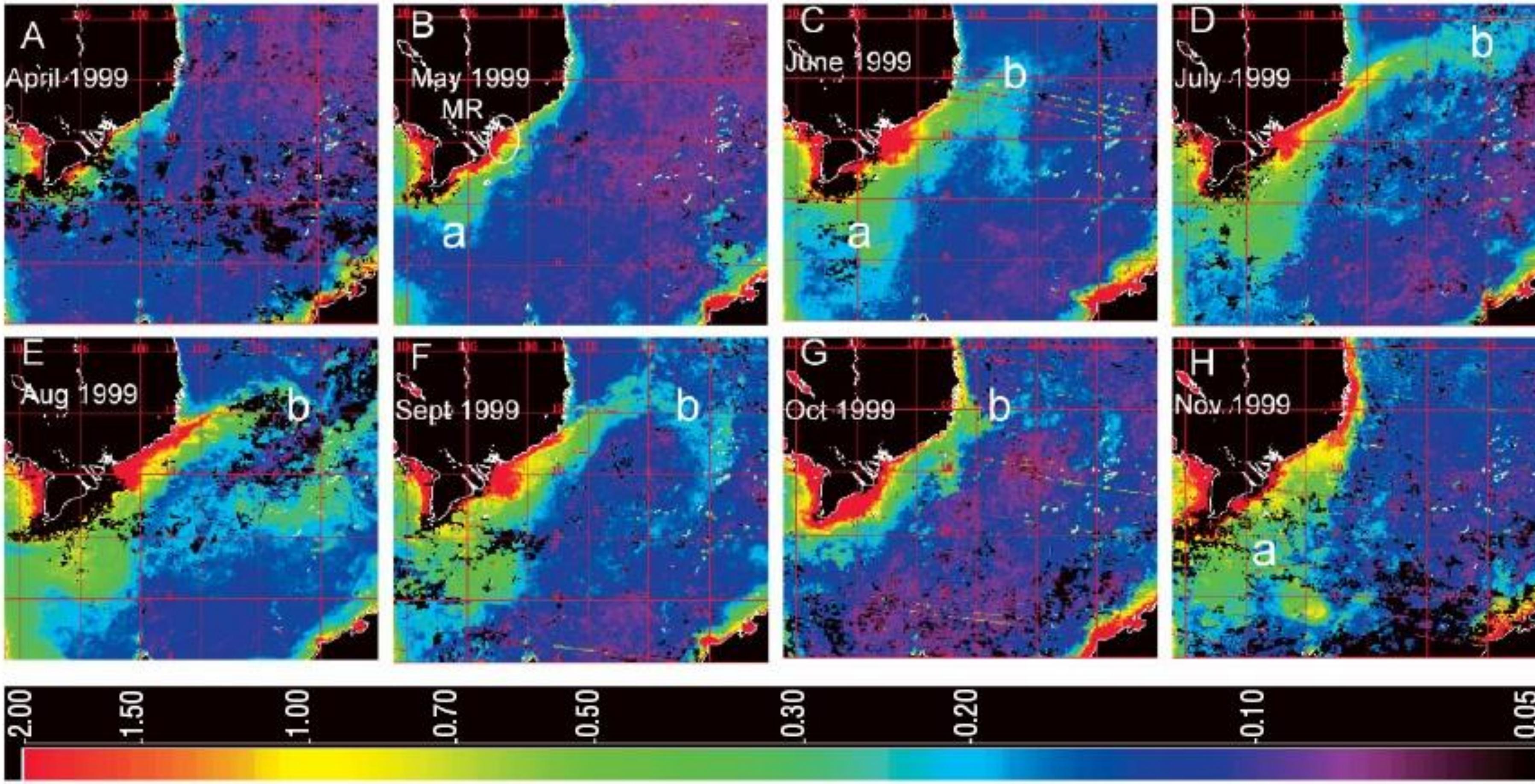
A study analyzing the harmful effects of algal blooms in Vietnam may help researchers better understand the cause of the increasingly common worldwide phenomenon. Tang et al. observed a 2002 bloom in the warm Vietnamese waters for approximately six weeks, using satellites to detect the ocean color and other instruments to track the ocean temperature and wind velocity. The plankton blooms and associated algal toxins, thought to be primarily caused by nutrient- and mineral-rich waters and moved by the wind, remove the dissolved oxygen in estuaries and coastal areas, killing fish and biological life in its path. The researchers found that the bloom was induced and supported by nutrients transported from the deep ocean to the surface by strong winds that created a cold-water plume from the coast to the open sea. They suggest that the study provides one of the first assessments of the formation and movement of a bloom, which can be used to predict and track the biogeochemical impacts from such events.

http://www.agu.org/sci_soc/prrl/jh040804.html#7

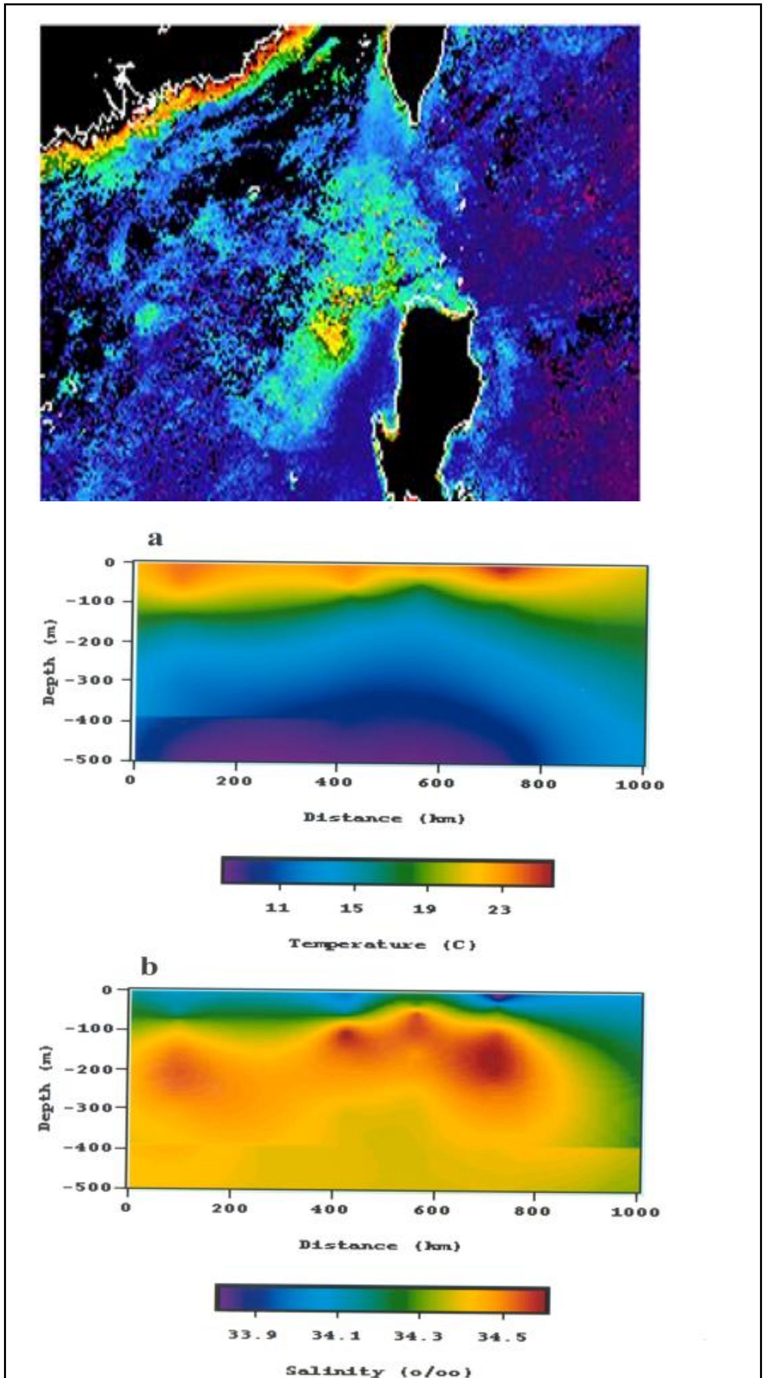
H. Leifert 2004, AGUJ highlight 2004

Tang et al., 2004 JGR

Upwelling and HAB in the western SCS



Monthly SeaWiFS (Tang et al., Hydrobiology)

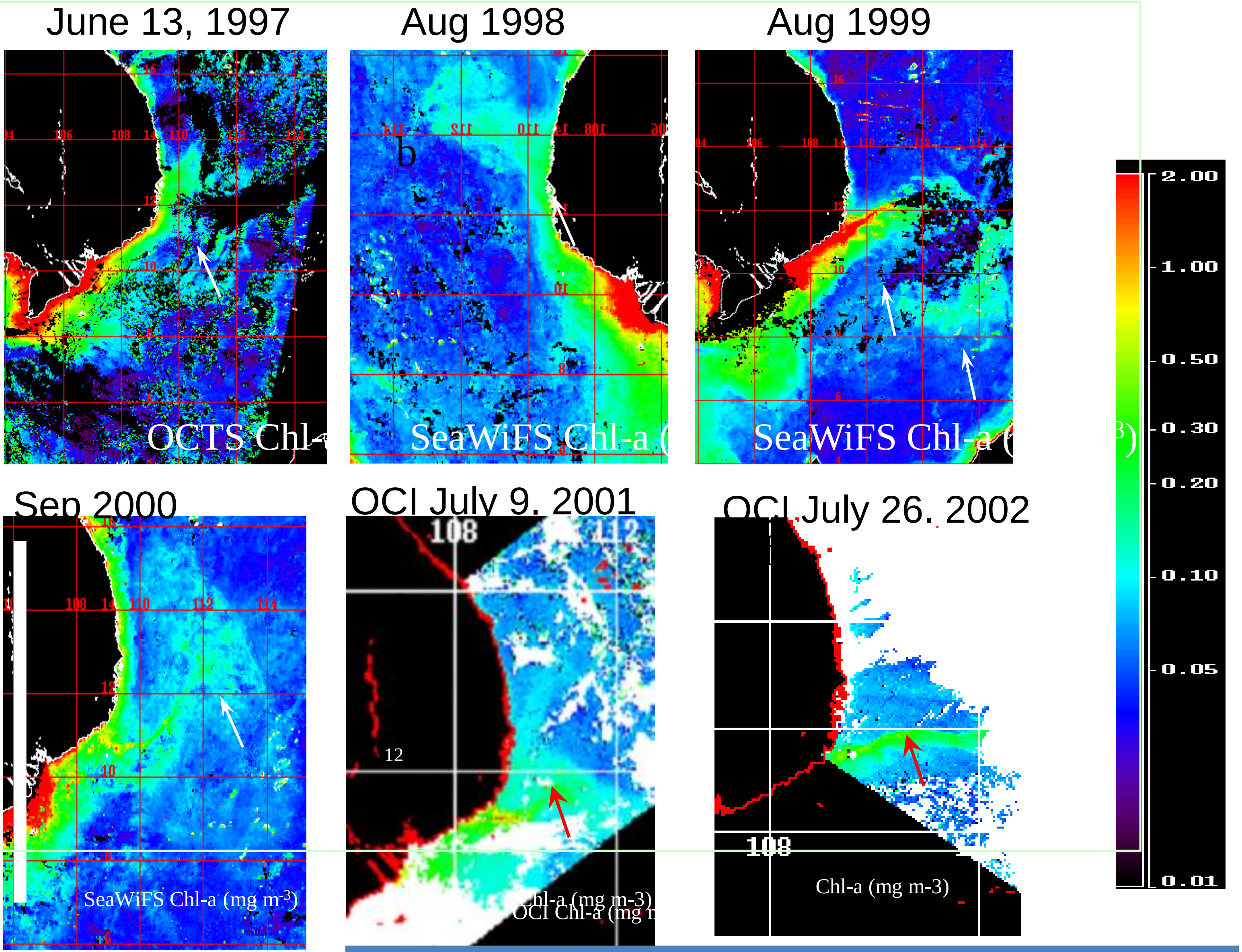


- Every year?

[DanLing Tang, H Kawamura, TV Dien. MA Lee, 2004. Offshore phytoplankton biomass increase and its oceanographic causes in the South China Sea. Marine Ecology Progress Series, 268: 31-41]

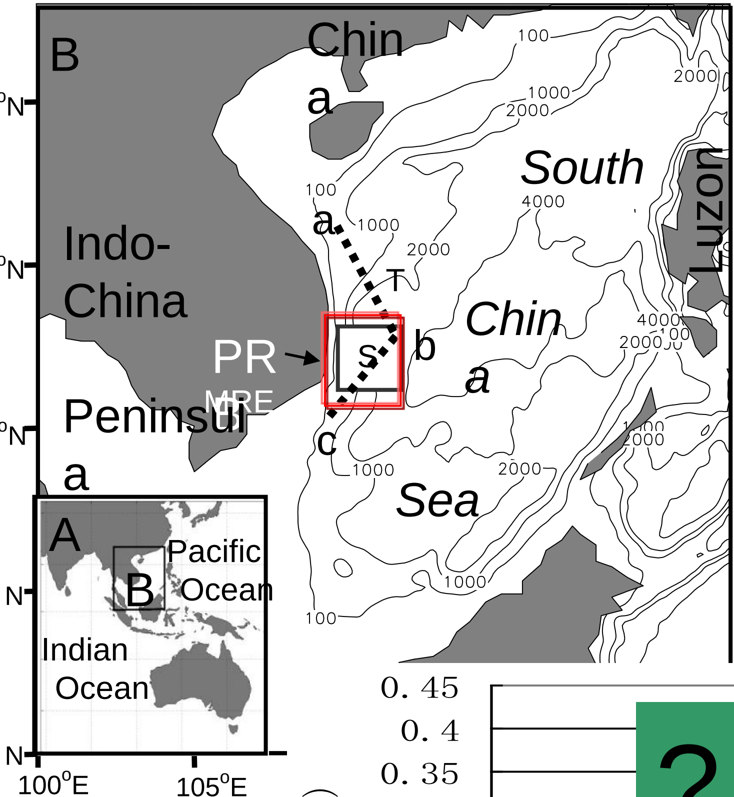
Chl-a in 1997 -2002

DanLing TANG

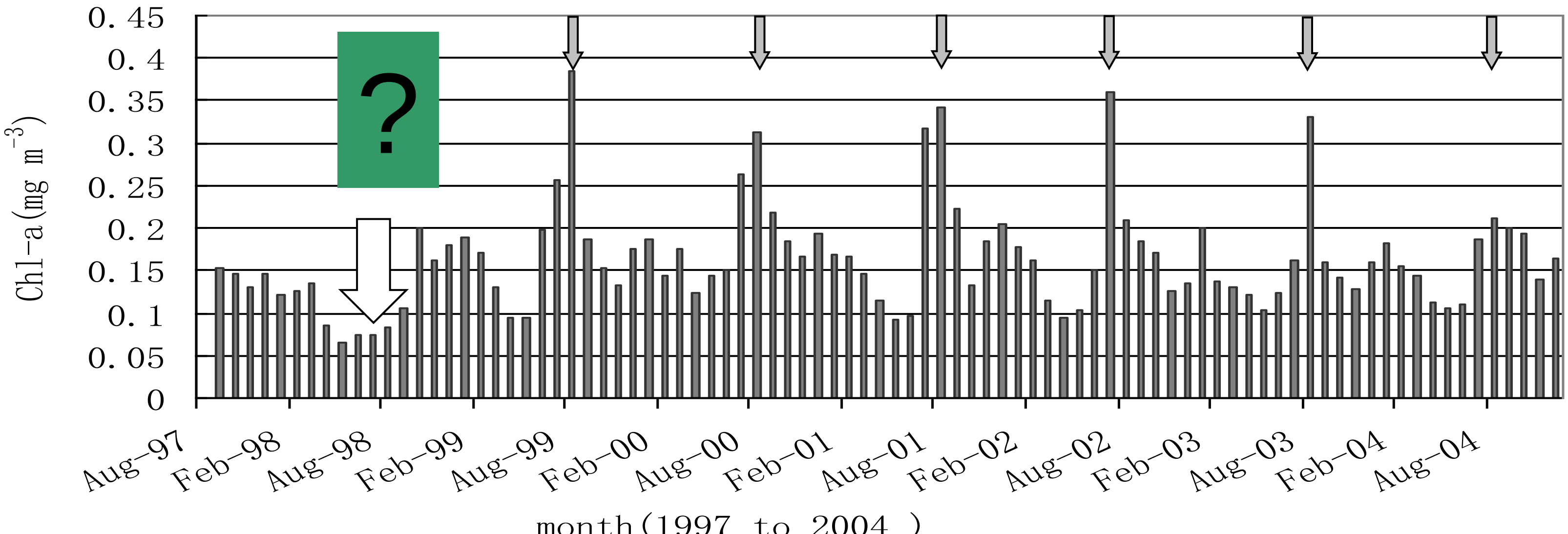


Tang et al., Marine Ecology Progress Series, 2004

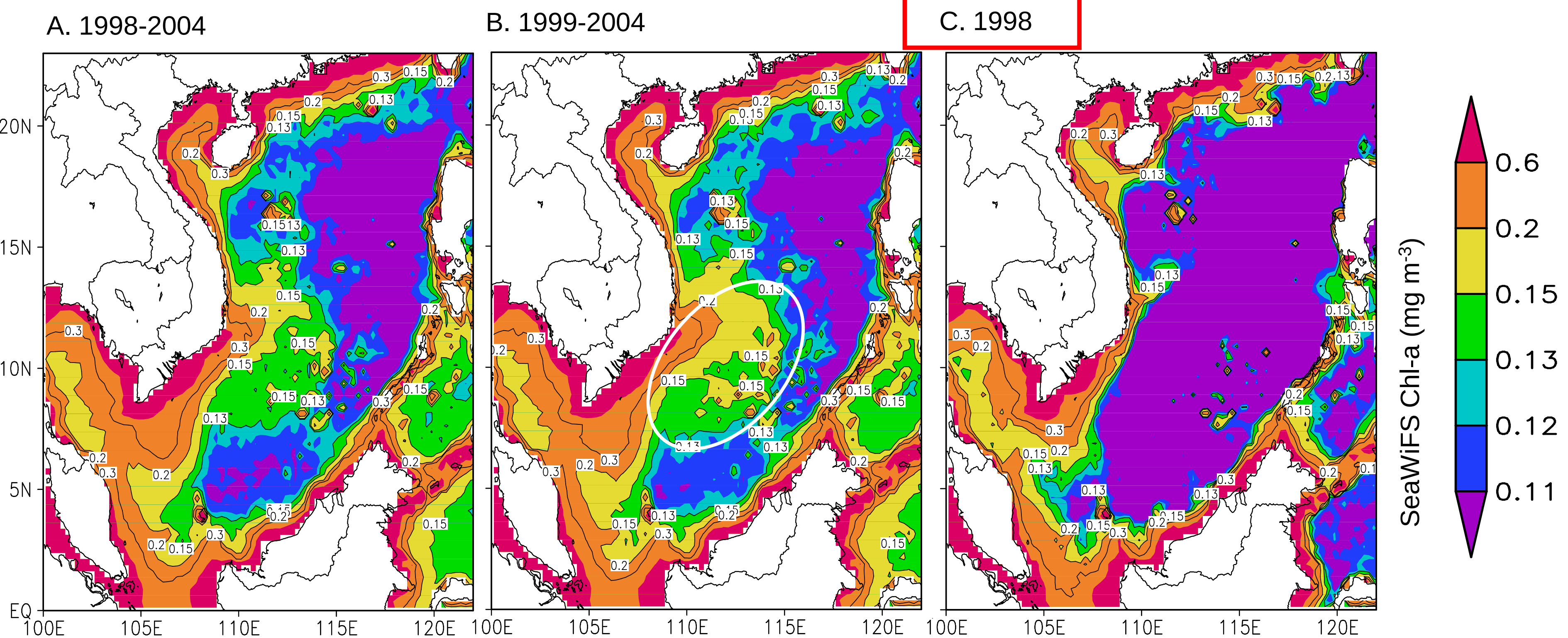
South China Sea



Zhao and Tang, JGR 2007



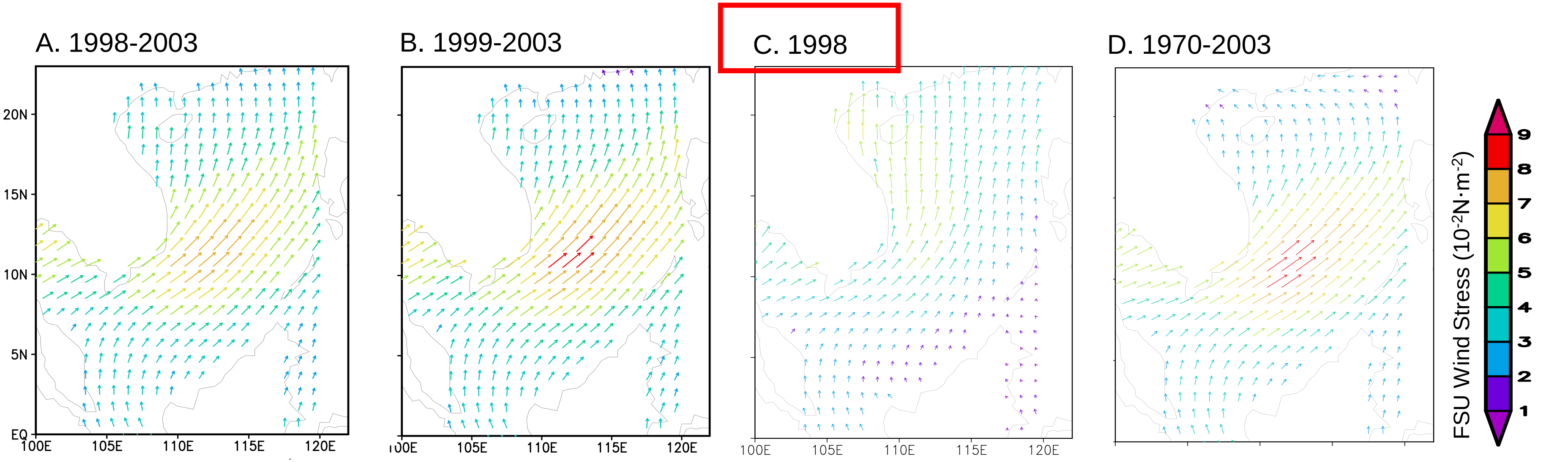
Chl-a



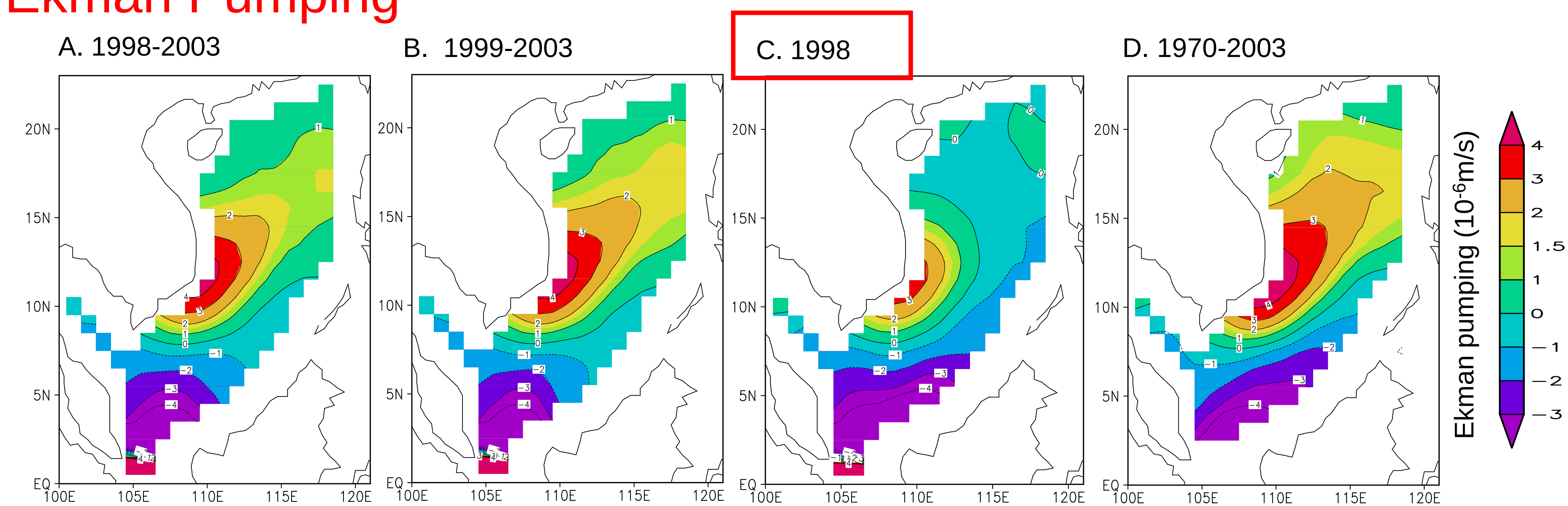
Zhao and Tang, JGR 2007

DanLing TANG

Wind



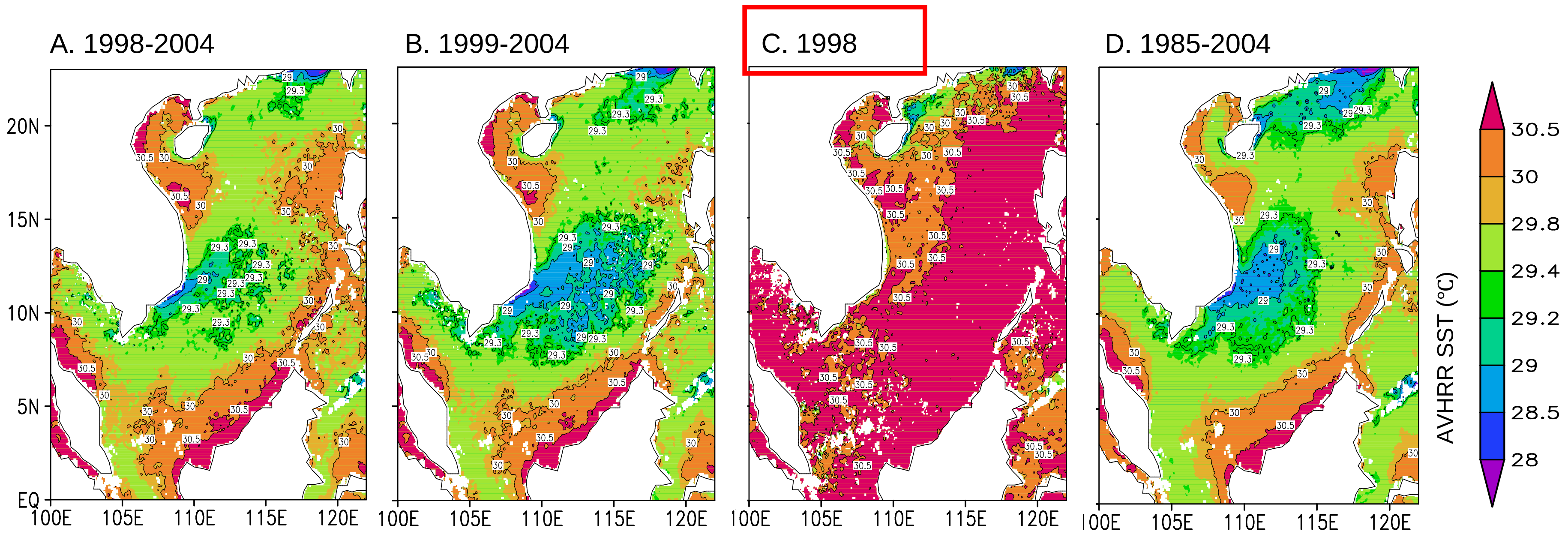
Ekman Pumping



Zhao and Tang, JGR 2007

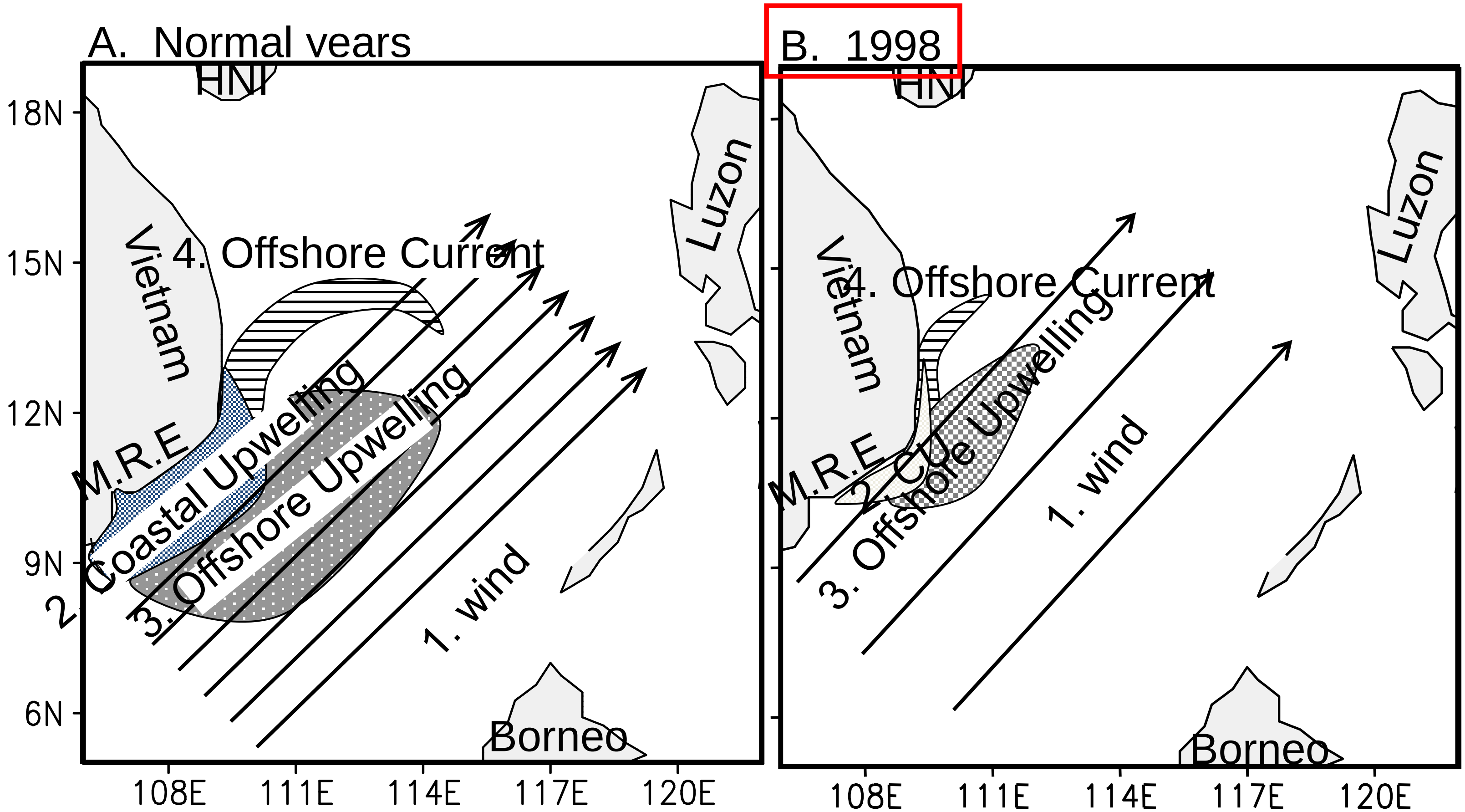
DanLing TANG

SST



Zhao and Tang, JGR 2007

DanLing TANG

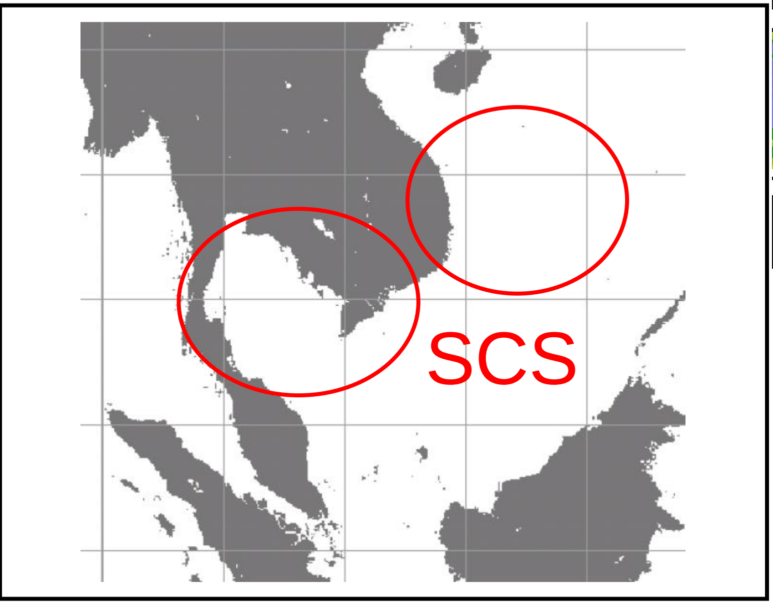


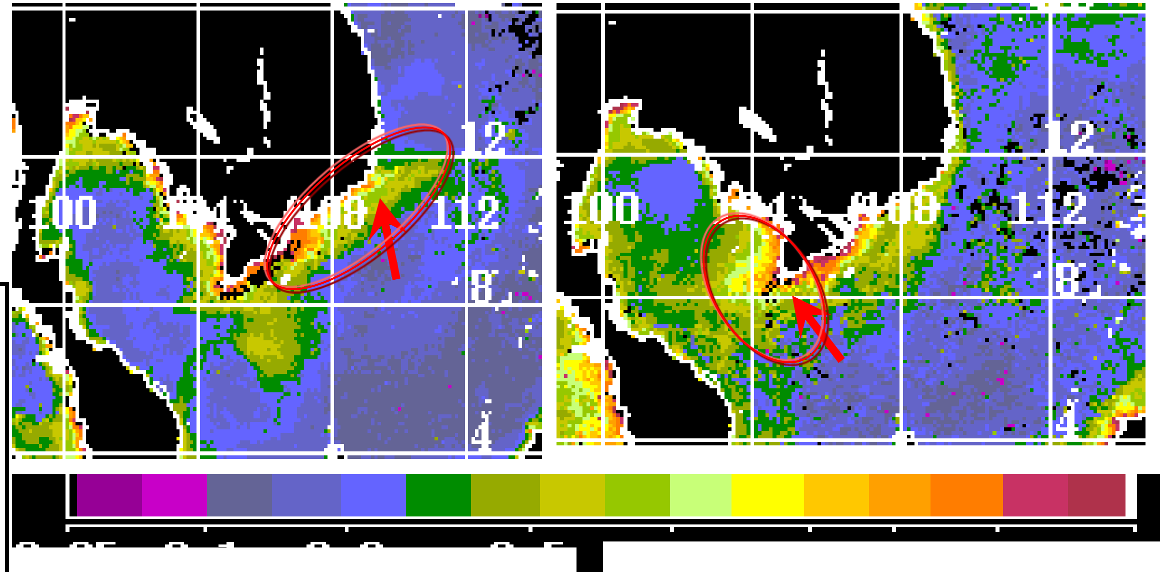
Zhao and Tang, JGR 2007

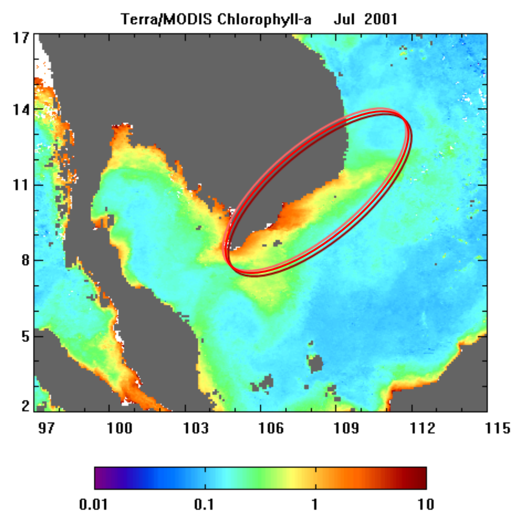
- Wind Direction

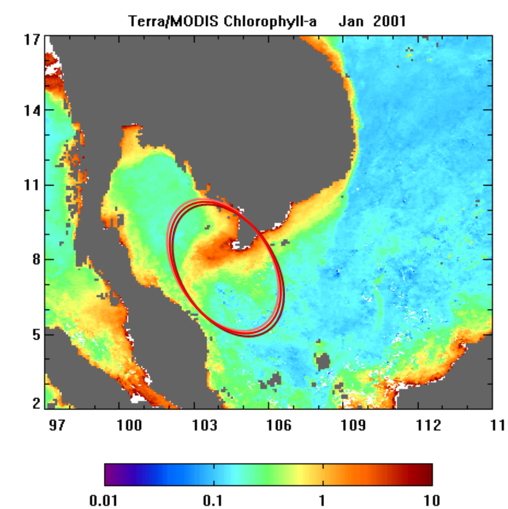
Tang DanLing

Tang et al., 2006, JGR









[Tang DanLing, H Kawamura, P Shi, W Takahashi, T Shimada, F. Sakaida, O Isoguchi, 2005. Seasonal phytoplankton blooms associated with monsoonal influences and coastal environments in the sea areas either side of the Indochina Peninsula. JGR-Biogeo (SCI, IF: 2.63). VOL. 111, G01010,]

Tang DanLing

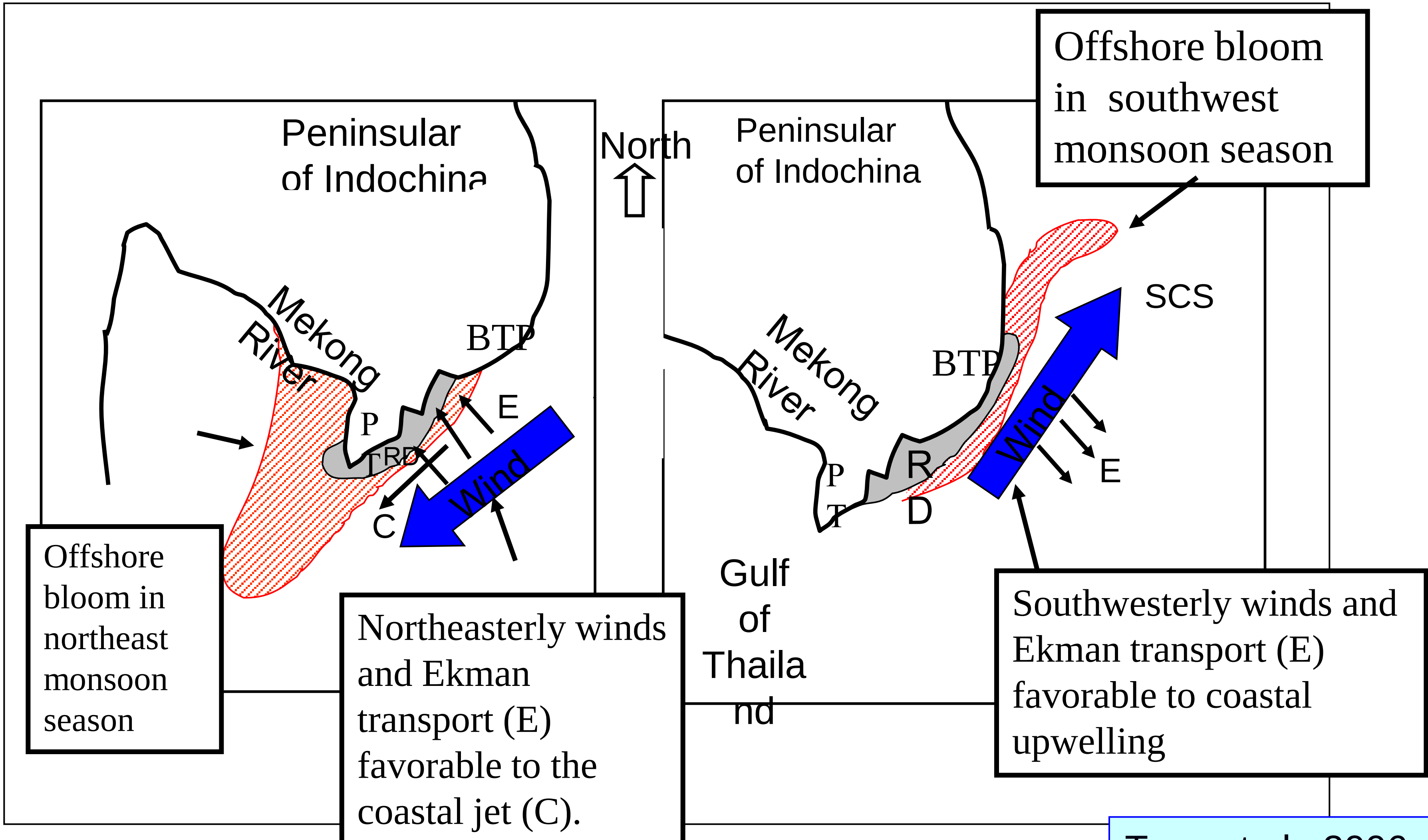
• Direction

A. Gulf of Thailand

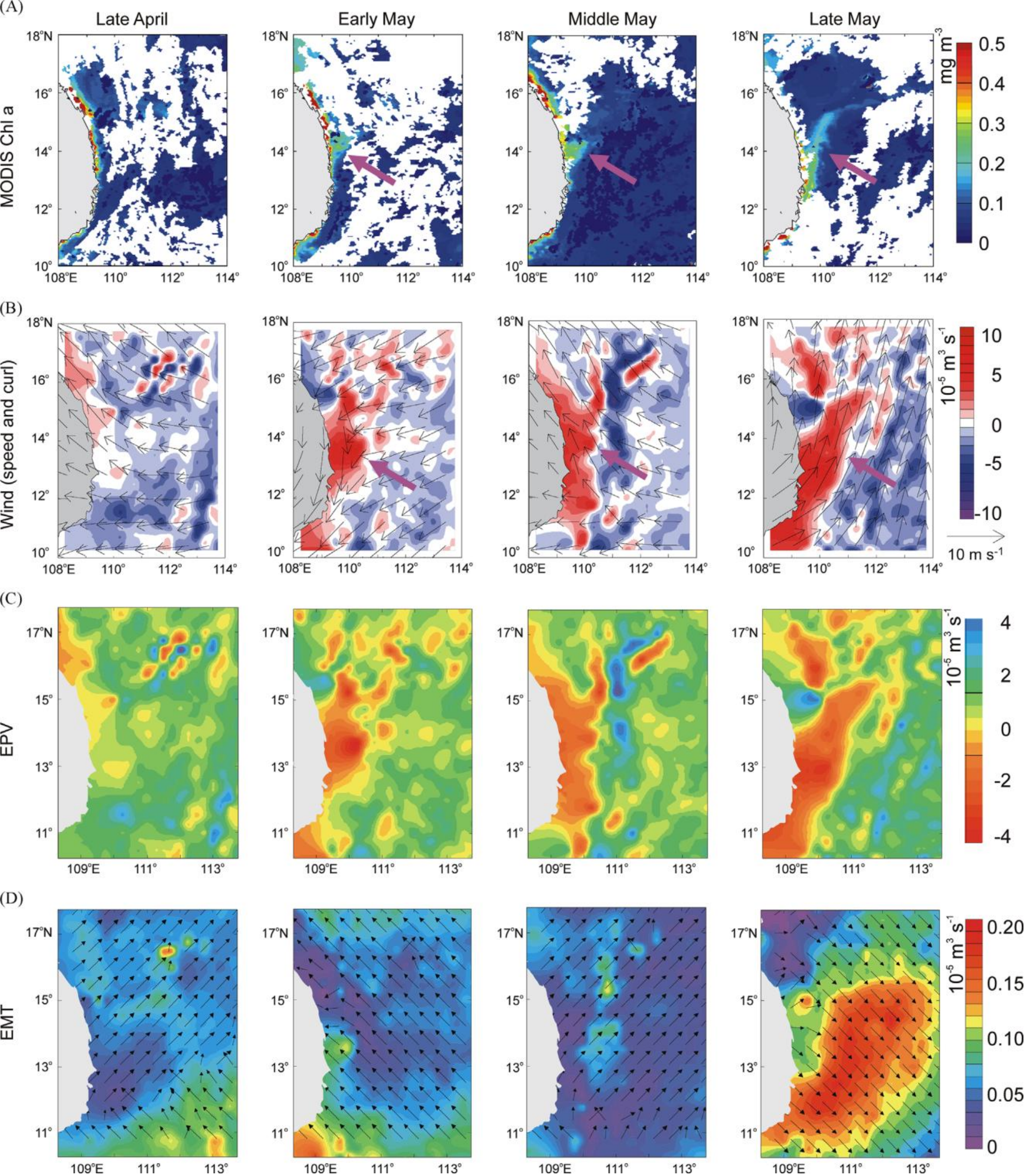
Dec-Feb, NE wind

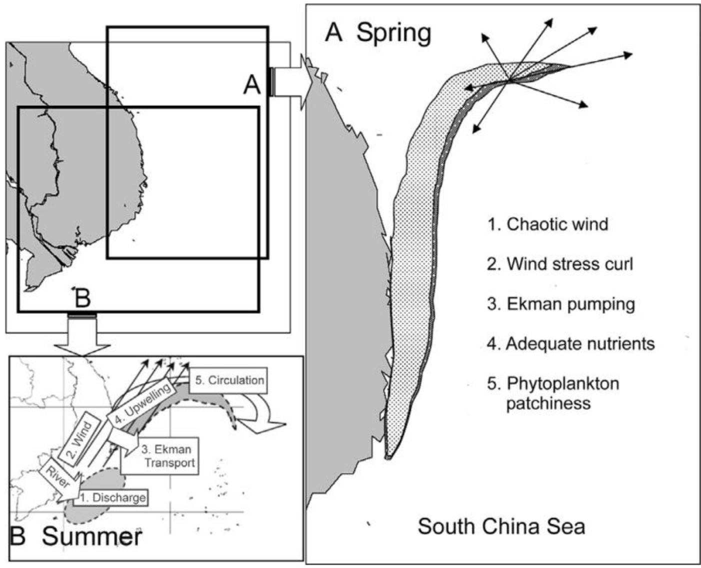
B. South China Sea

Jul-Sep, SW wind



Tang et al., 2006, JGR

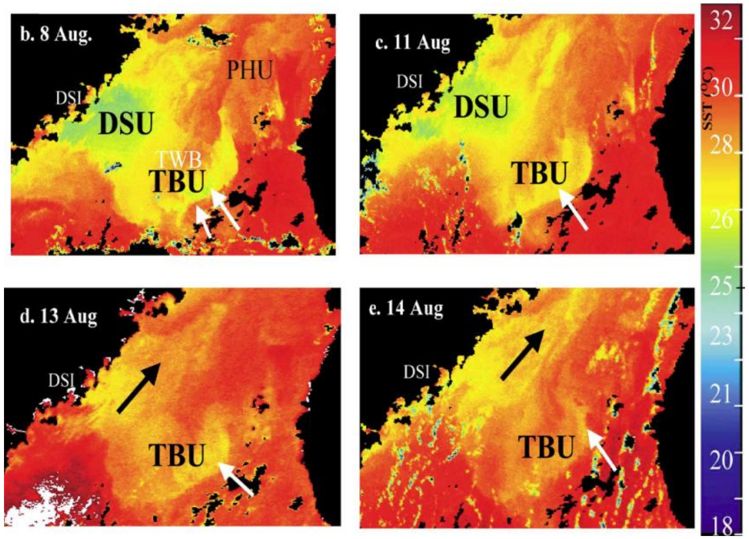


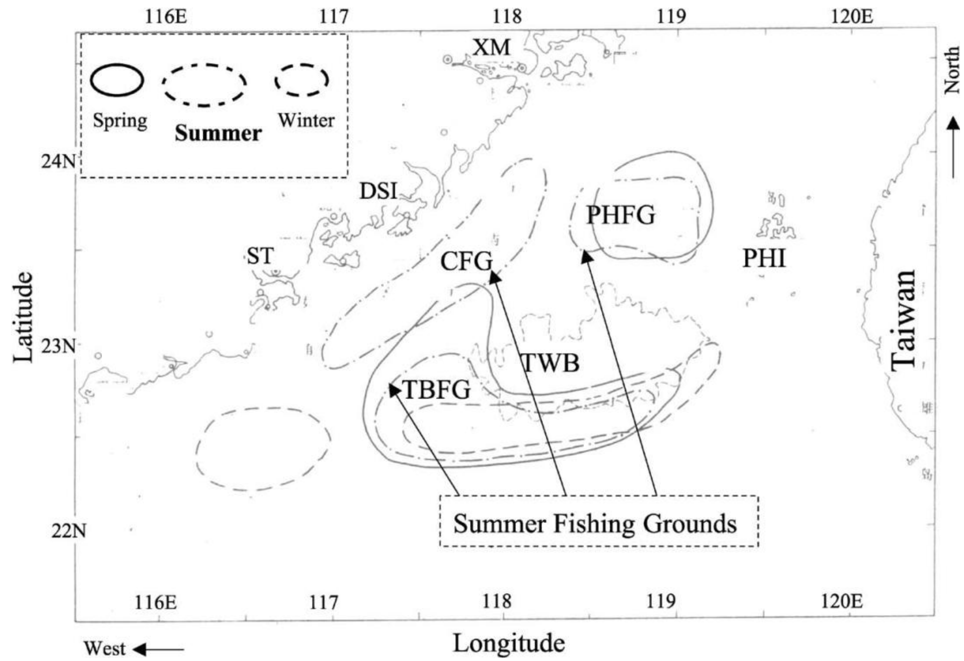


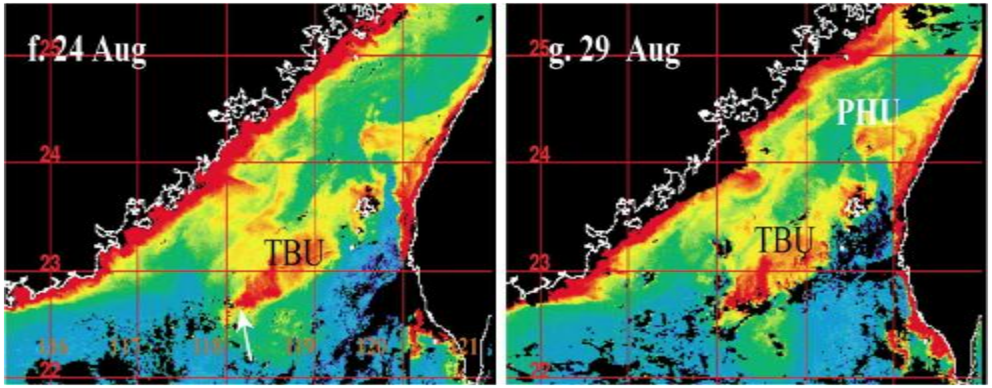
Phytoplanktonpatchinessduring springintermonsooninwestern coast ofSouthChinaSea Jiu-Juan Wang a,b, DanLingTang a,b,n

Deep-Sea Research II

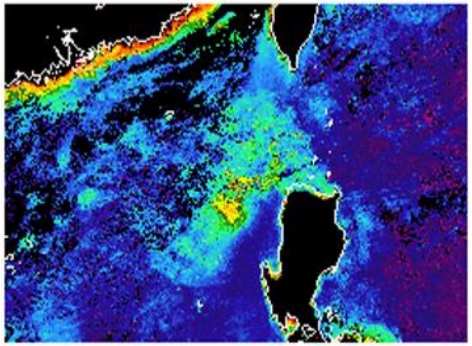
29

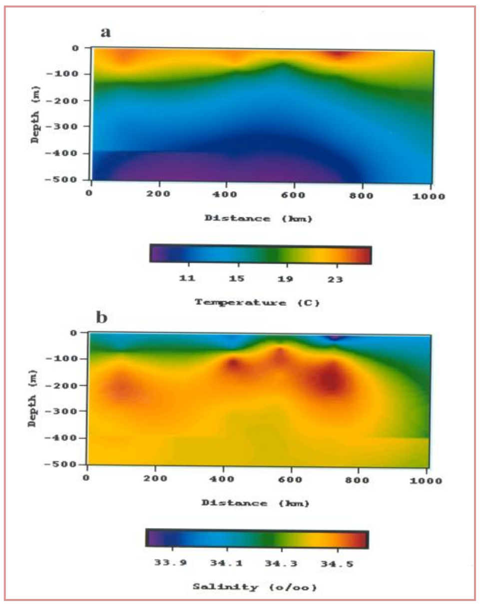


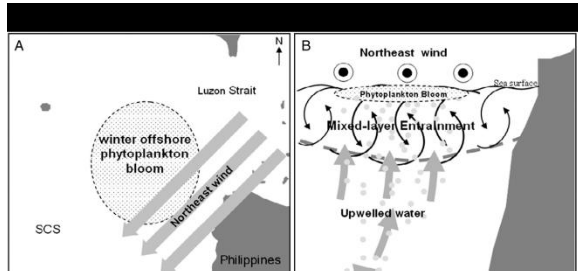


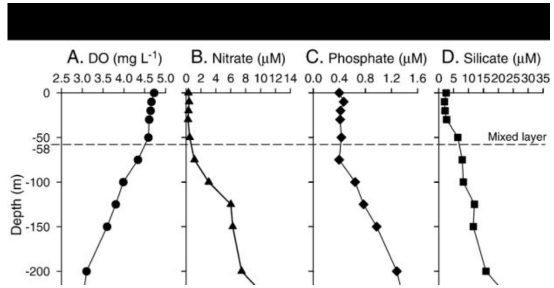


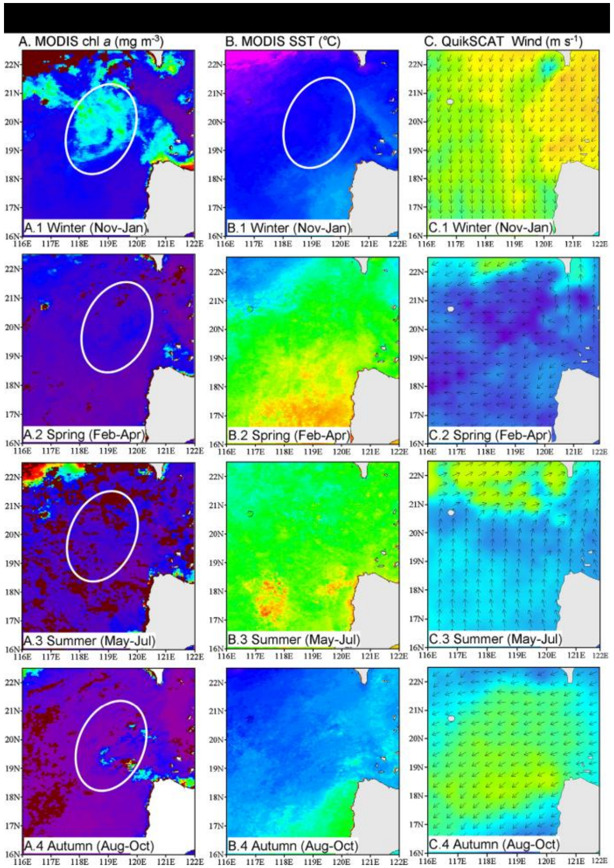
[DanLing Tang, DR Kester, I-H Ni, H Kawamura, HS Hong. 2002. Upwelling in the Taiwan Strait during the summer monsoon detected by satellite and shipboard measurements. *Remote Sensing of Environment* 83 (3): 457-471. (SCI),Impact factor: 2.197]











DanLing Tang, I-H Ni, DR Kester, FE Müller-Karger. 1999. Remote sensing observation of winter phytoplankton blooms southwest of the Luzon Strait in thine Ecology Progress Series 191: 43-51

Wang JJ, DanLing TANG, Yi SUI, 2010, Winter phytoplankton bloom induced by subsurface upwelling and mixed layer entrainment southwest of Luzon Strait. Journal of Marine Systems 83 (2010) 141–149 (SCI). doi:10.1016/j.jmarsys.

Wind is very important!

How about Typhoon?

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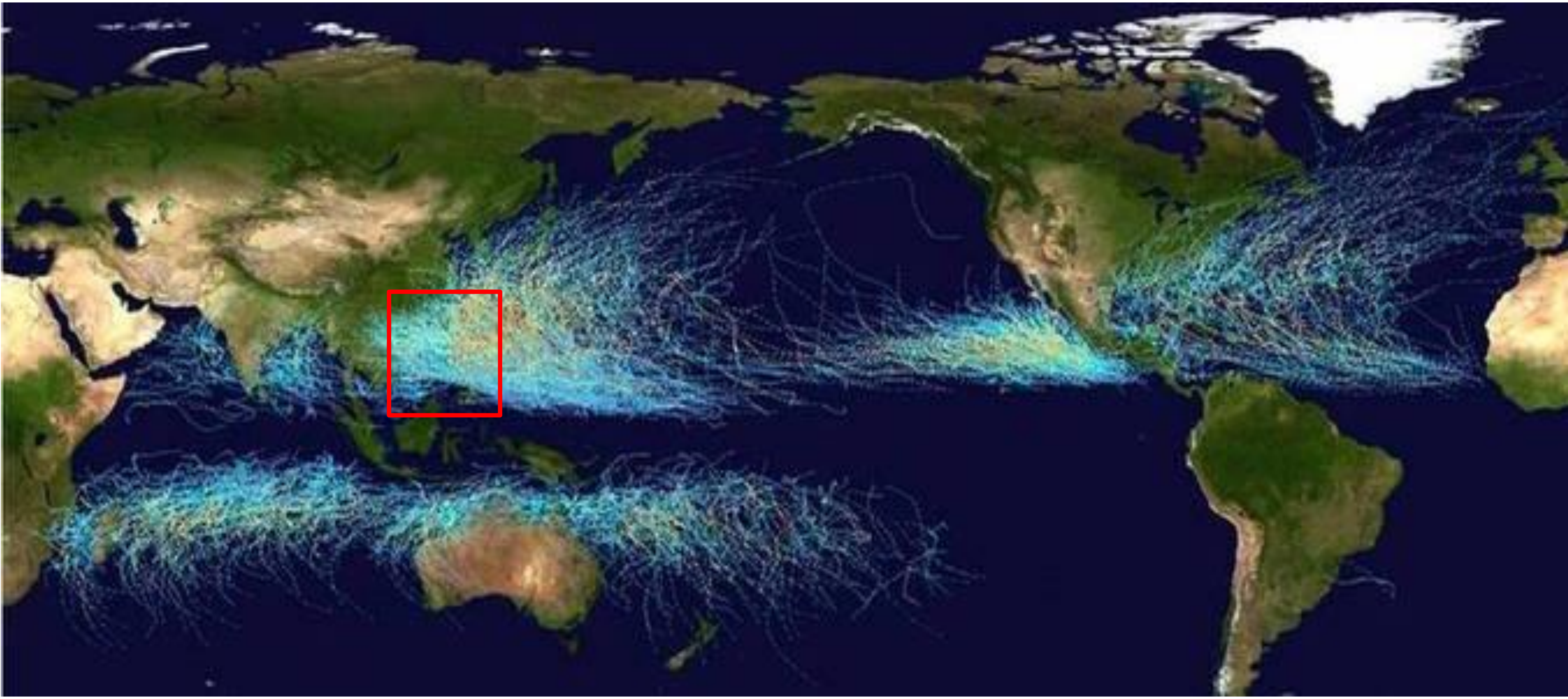
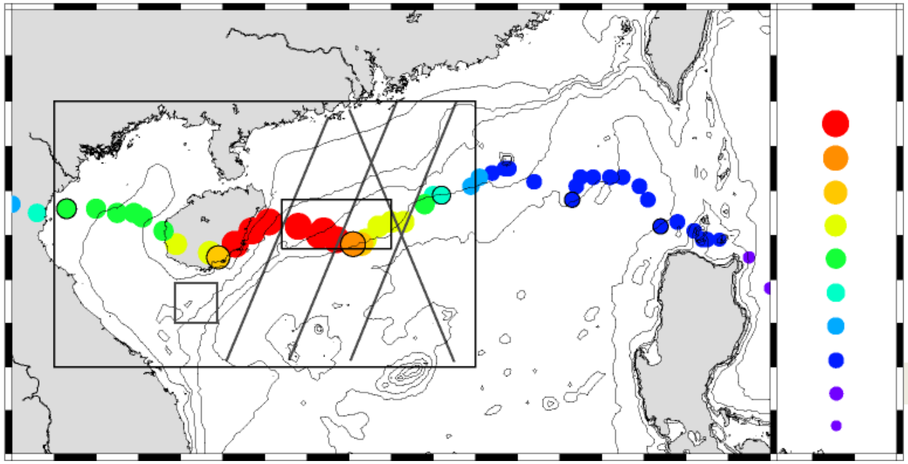
3

Typhoon impact on marine ecosystem



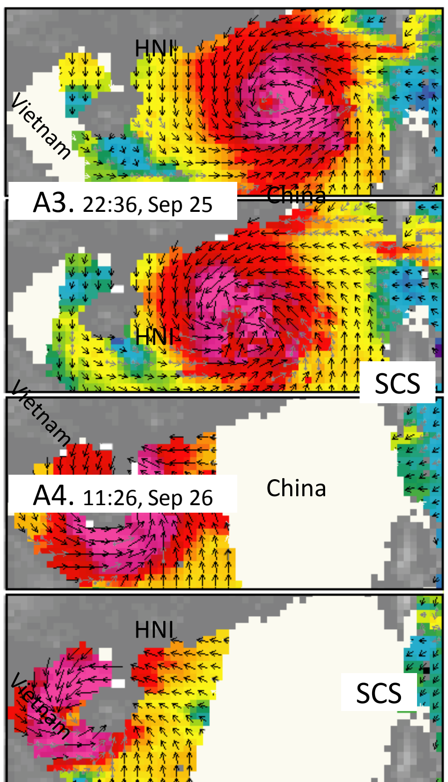
Distribution of typhoon

DanLing TANG



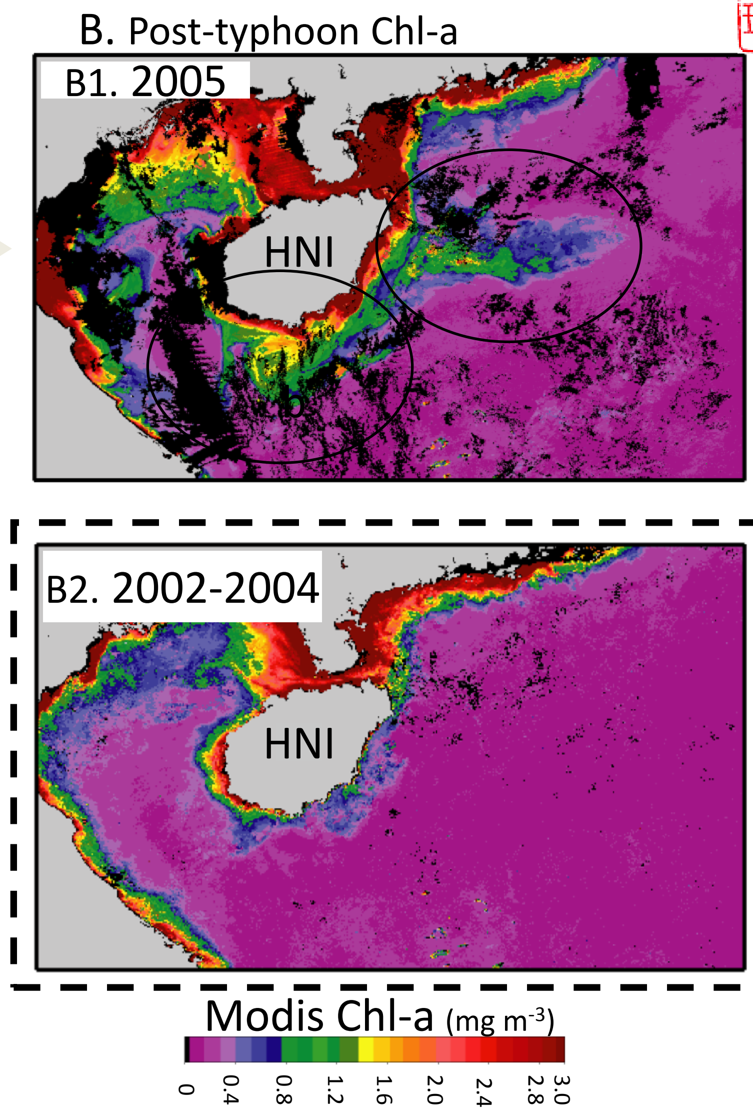
Damrey, Sep 2005

SCS



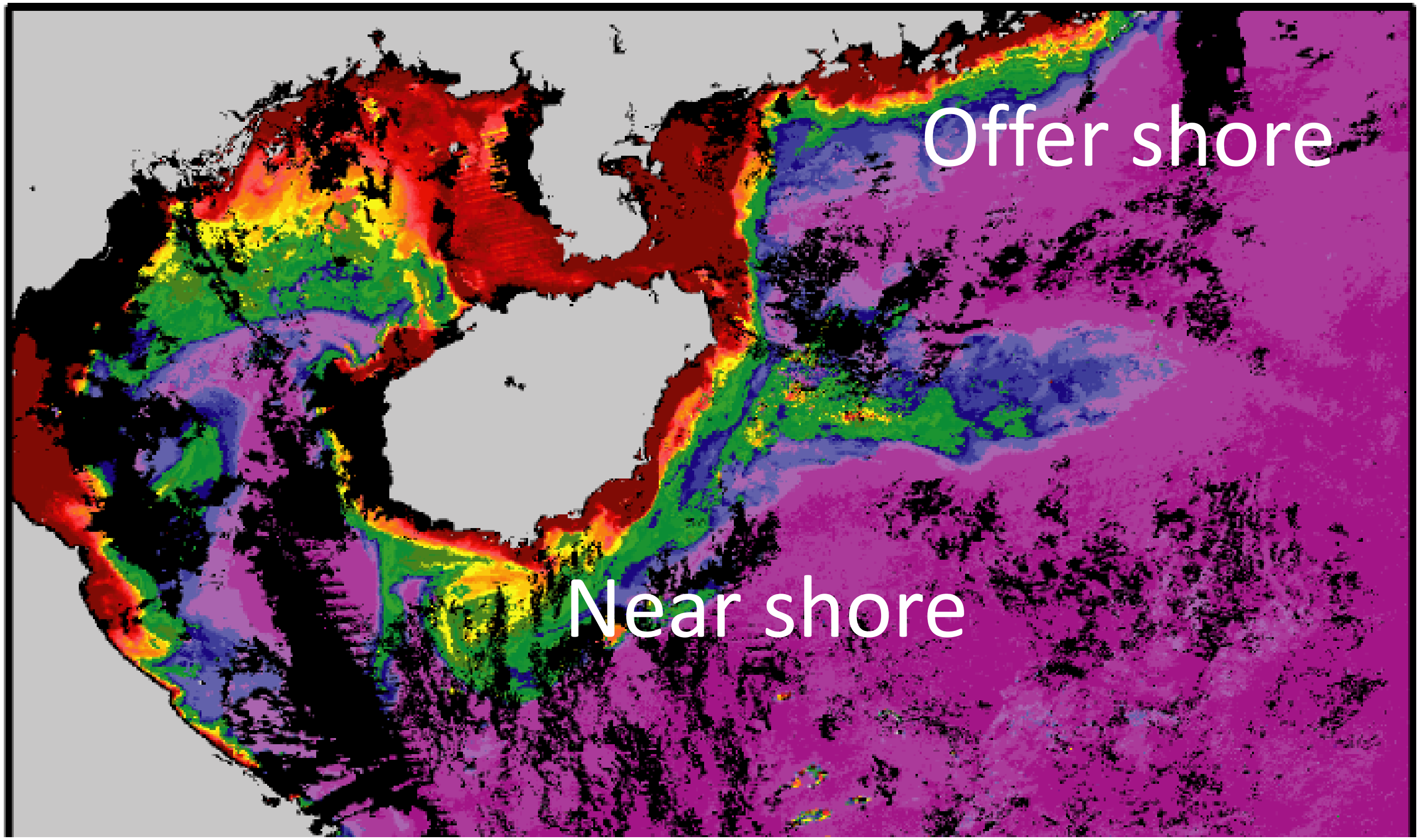
QuikScat Wind Vectors (m/s)

0 10 20 30

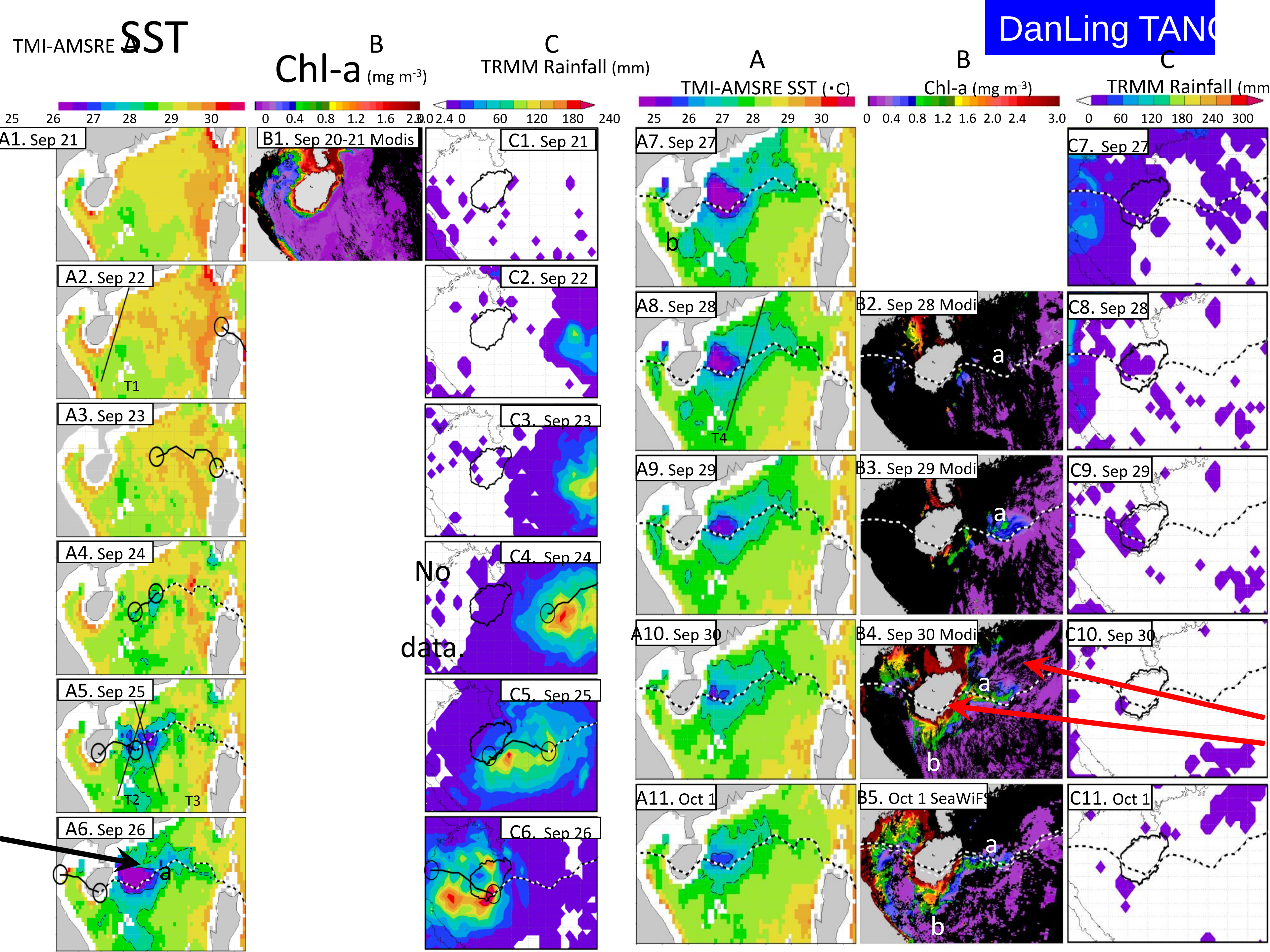


Zheng and Tang, MEPS 2007

Offshore and nearshore chlorophyll increases induced by typhoon and typhoon rain.

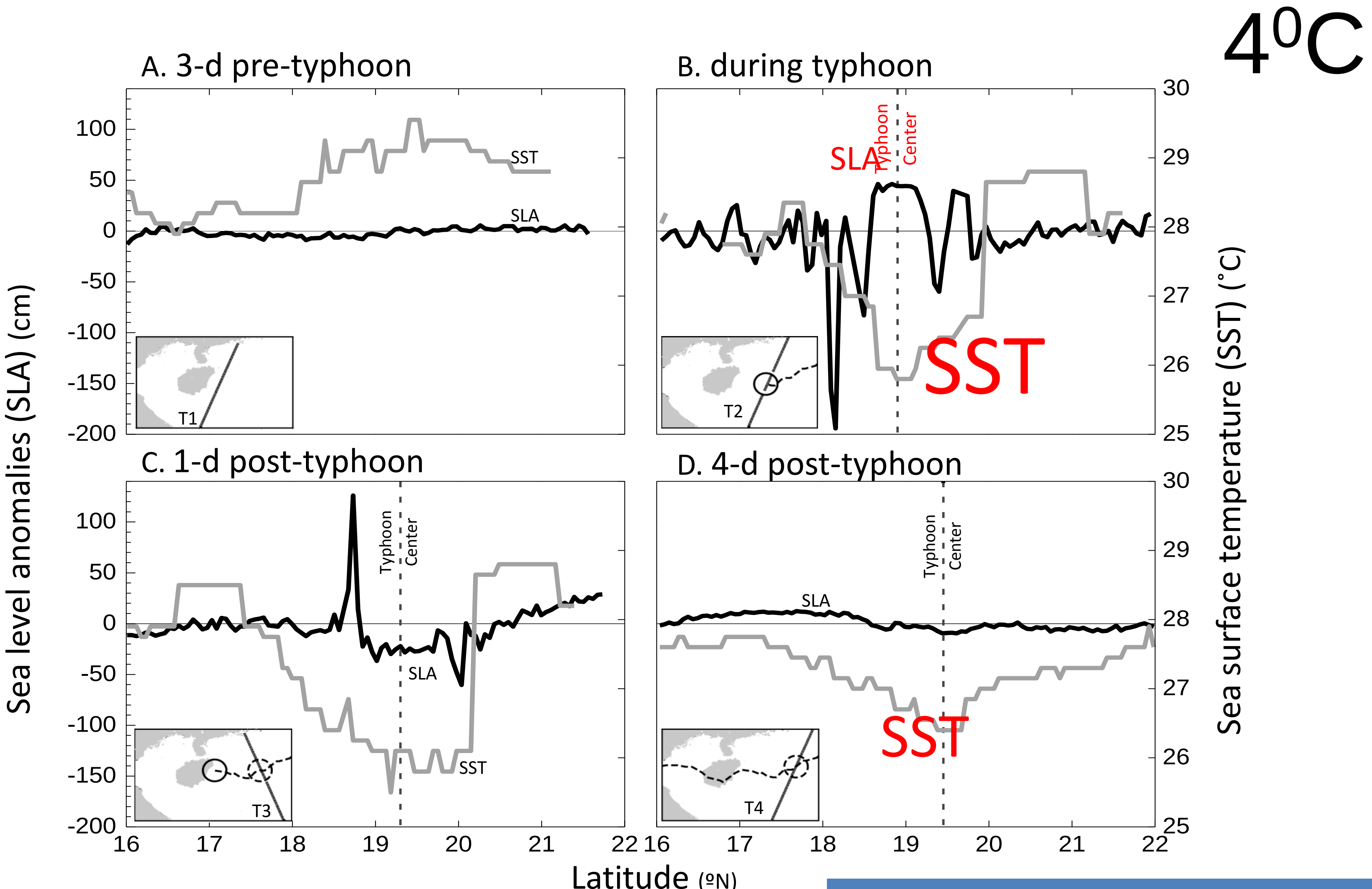


Guangming Zheng and Danling Tang, 2007,
Marine Ecology Progress Series, 333：61-74，2007 (SCI)

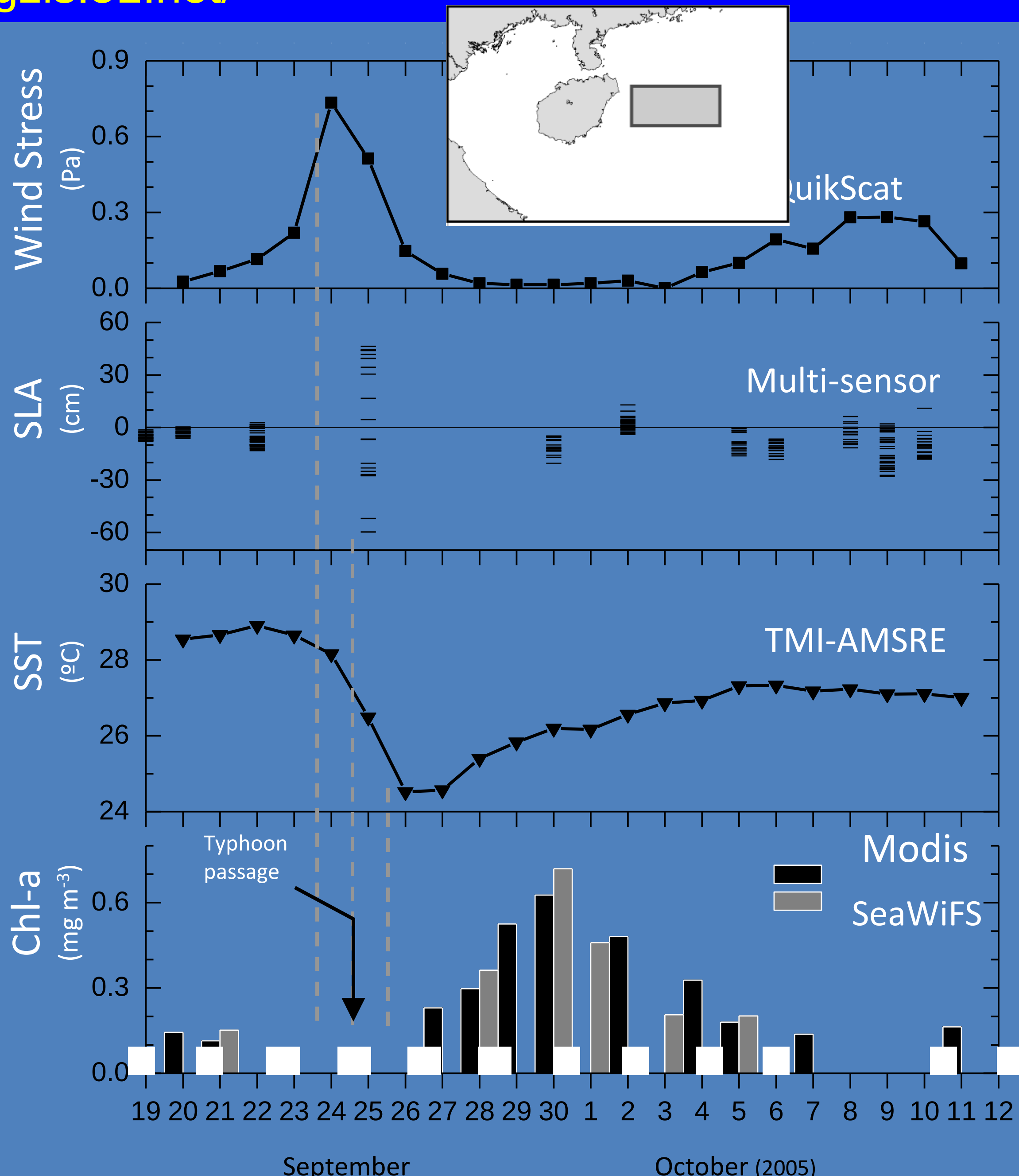


DanLing TANG
TMI-AMSRE SST
A
B
Chl-a (mg m-3)
C
TRMM Rainfall (mm)
25 26 27 28 29 30
0 0.4 0.8 1.2 1.6 2.0 2.4 3.0
0 60 120 180 240
TMI-AMSRE SST (·C)
0 60 120 180 240 300
A1. Sep 21
A2. Sep 22
A3. Sep 23
A4. Sep 24
A5. Sep 25
A6. Sep 26
A7. Sep 27
A8. Sep 28
A9. Sep 29
A10. Sep 30
A11. Oct 1
B1. Sep 20-21 Modis
B2. Sep 28 Modi
B3. Sep 29 Modi
B4. Sep 30 Modi
B5. Oct 1 SeaWiFS
C1. Sep 21
C2. Sep 22
C3. Sep 23
C4. Sep 24
C5. Sep 25
C6. Sep 26
C7. Sep 27
C8. Sep 28
C9. Sep 29
C10. Sep 30
C11. Oct 1
T1
T2
T3
T4
a
b
No
data.

Sea level variation & sea surface cooling



Zheng and Tang, MEPS 2007



Typhoon wind

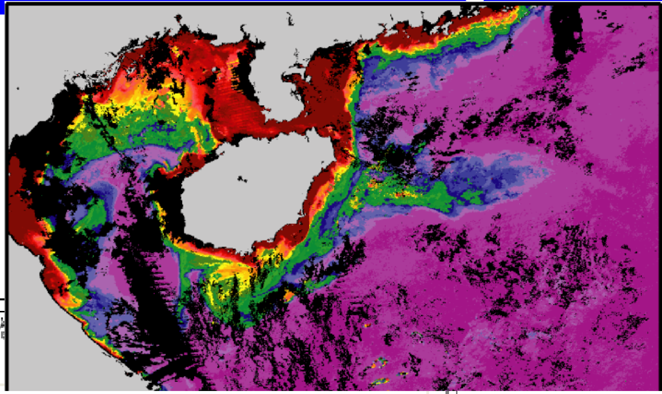
sea level variation

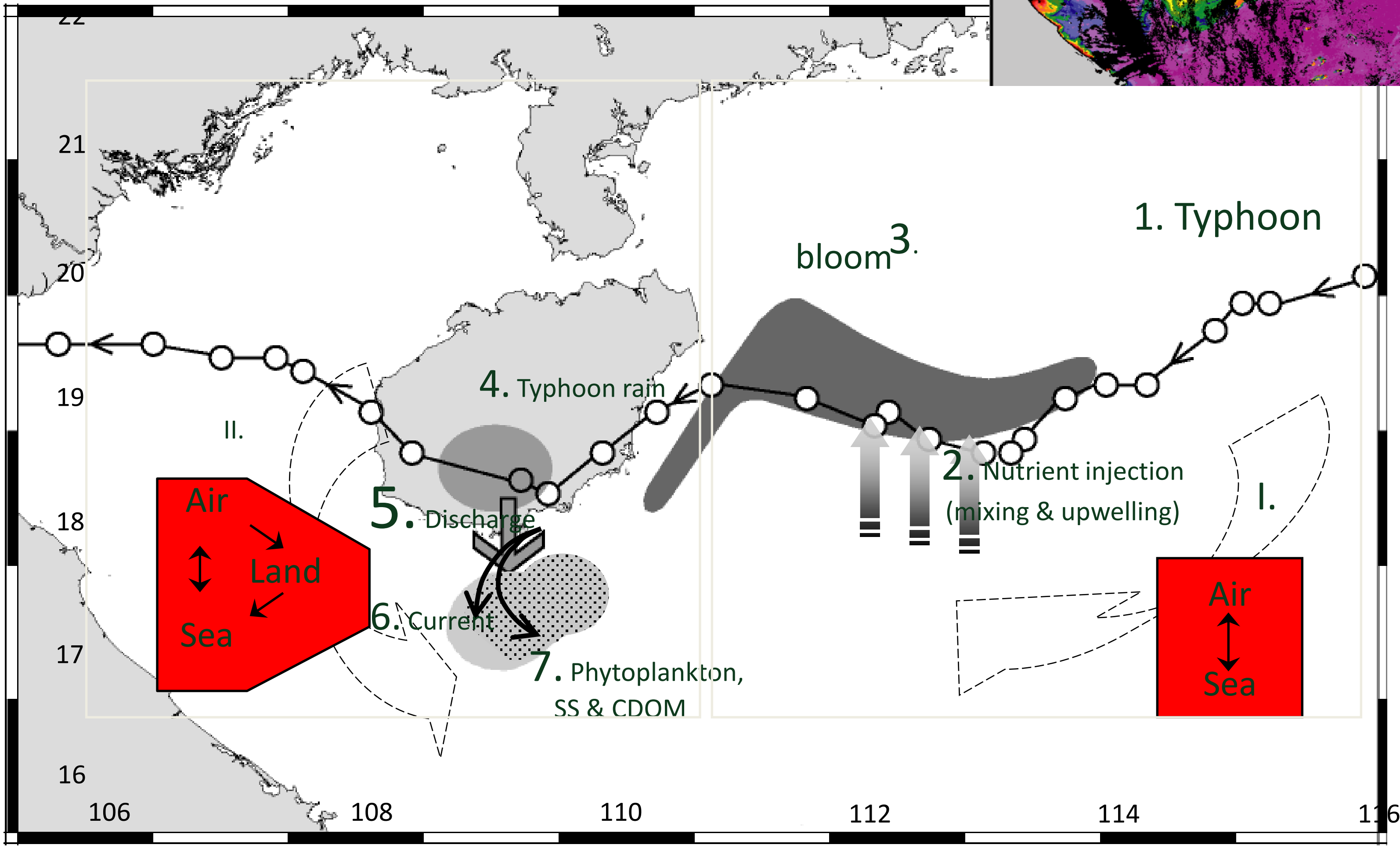
SST decrease

Chl-a peak

Zheng and Tang, MEPS 200

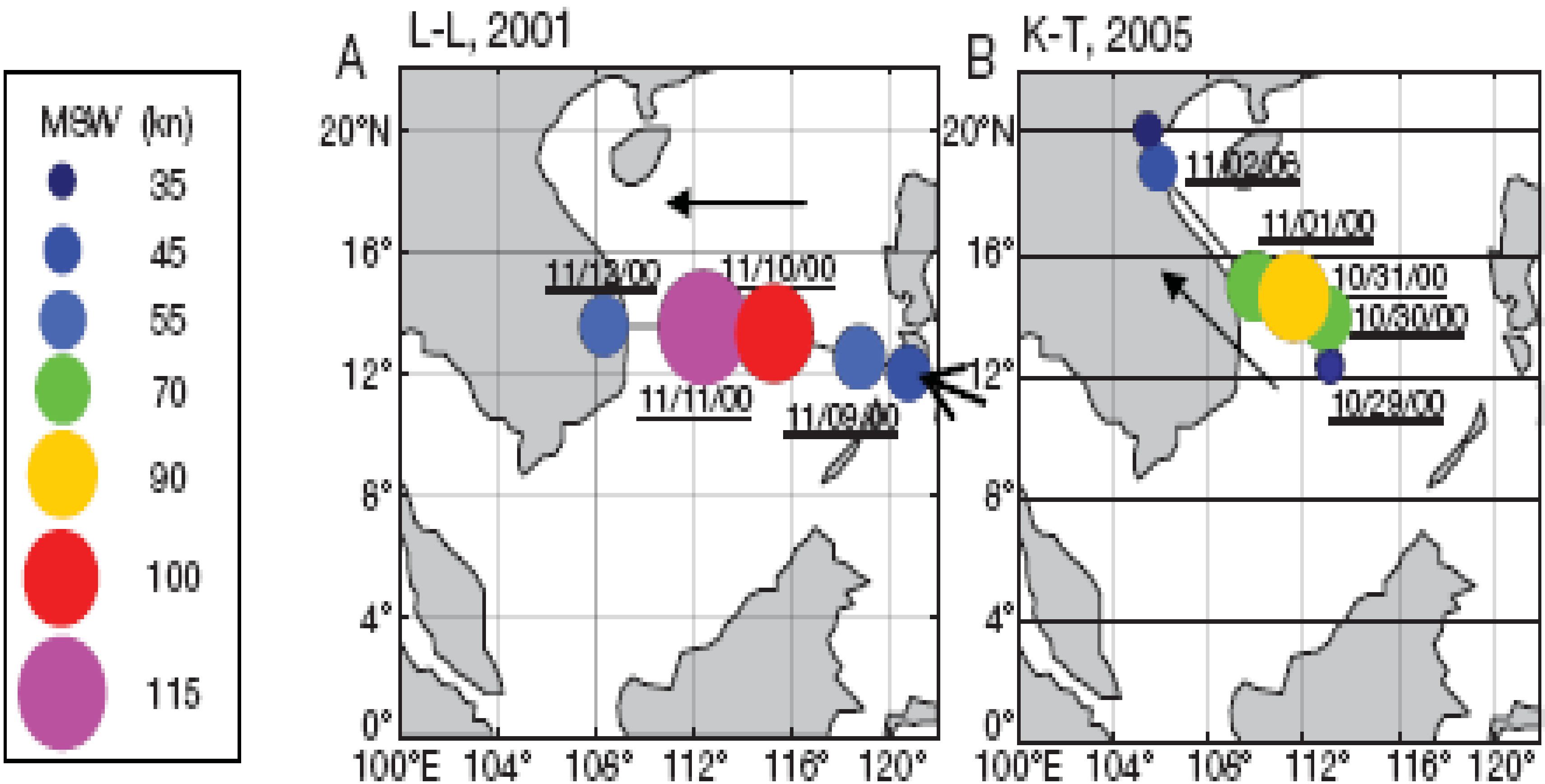
two Chl-a blooms induced by typhoon and rain





Tang MEPS 2007

- **intensities /Wind Speed?**
- **translation speeds**



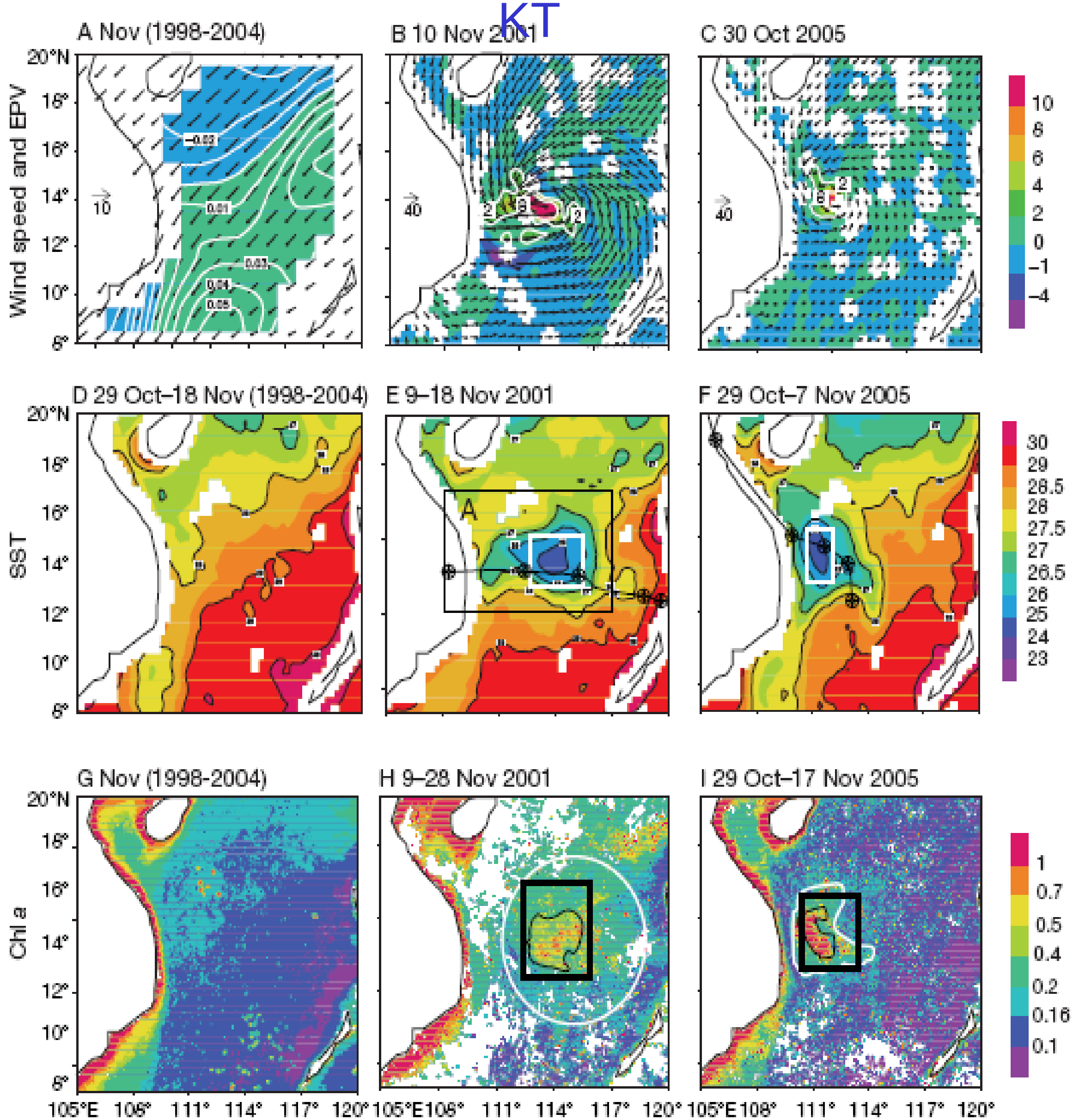
) Track and intensity of typhoons L-L (2001) and K-T (2005) in the SCS. MSW: maximum sustaine
(in knots, 1 kn = 0.514 m s^{-1})

Zhao H, DanLingTang, Wang Y. 2008 MEPS

Tang DanLing 唐丹玲

Strong, fast-moving (4.4m s-1)

Weak, slow moving (2.87 m s-1) KT



Wind

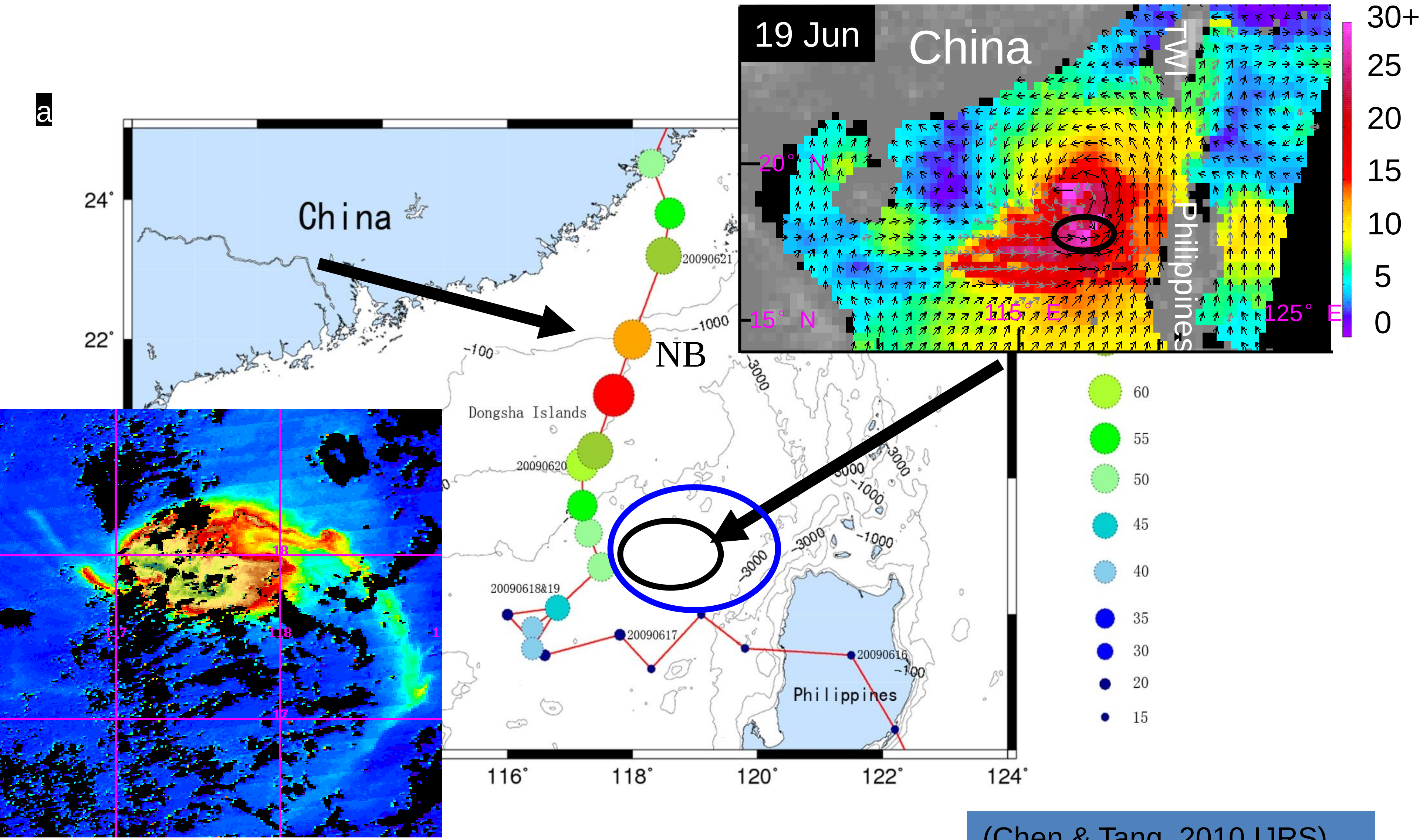
SST

Chl a

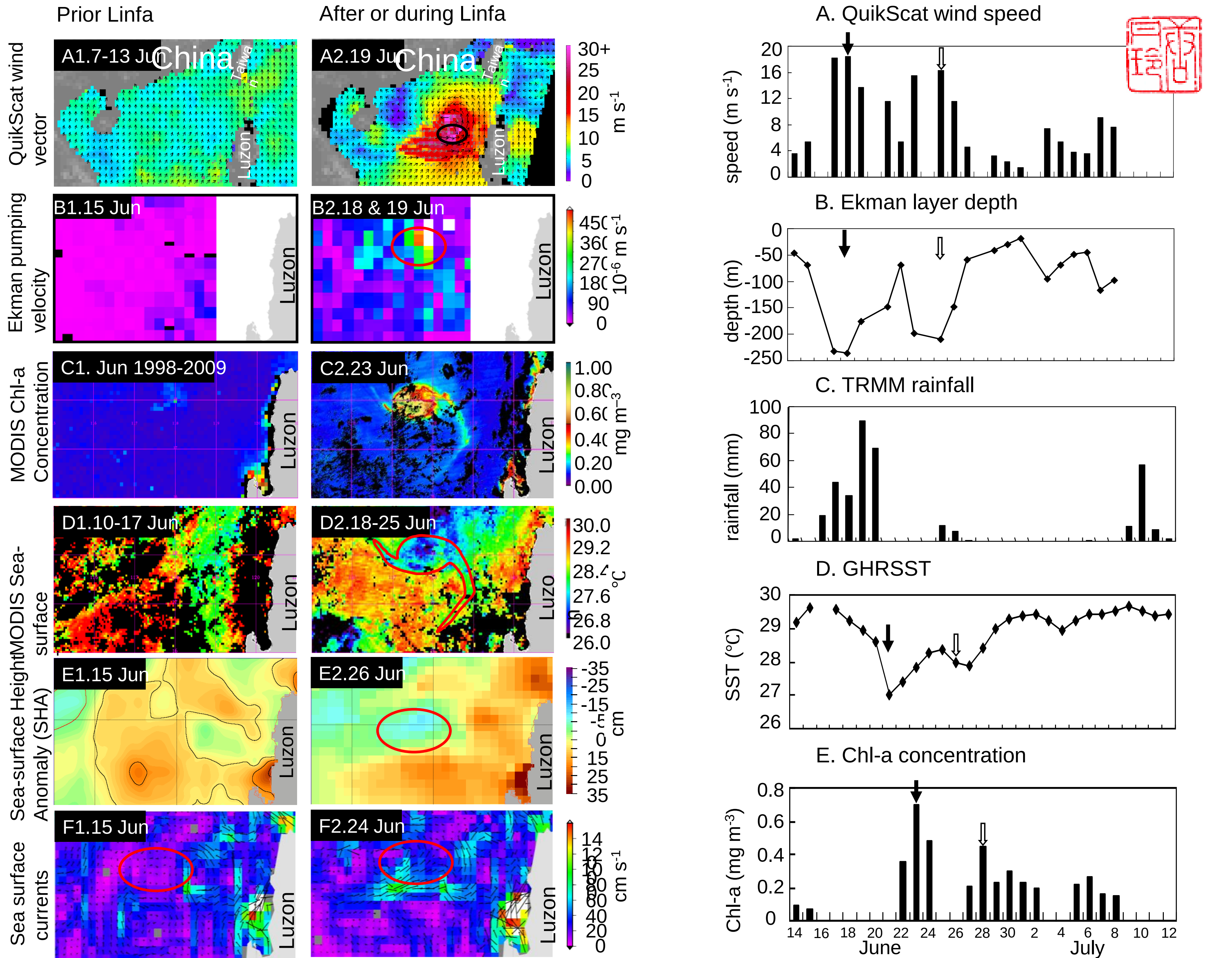
MEPS 2008

1. Intensities /Wind Speed – large area bloom
2. Slow transition speeds
   --- large SST decrease
   --- high phytoplankton increase
3. Stay time!

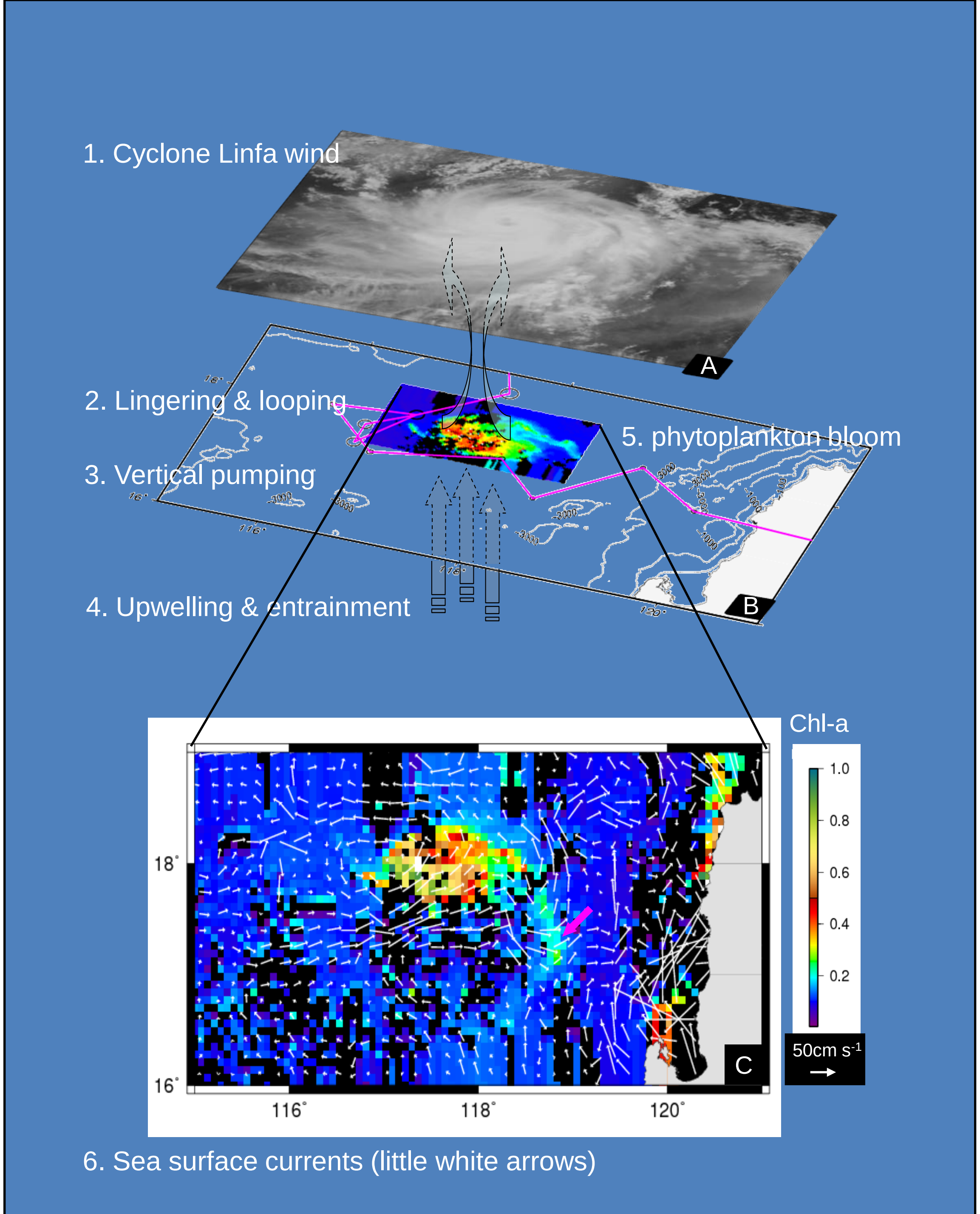
Eddy-feature phytoplankton bloom induced by tropical cyclone in the South China Sea,



(Chen & Tang, 2010,IJRS)



Prior Linfa
After or during Linfa
QuikScat wind vector
A1.7-13 Jun
China
A2.19 Jun
Luzon
30+
25
20
15
10
5
0
m s-1
Ekman pumping velocity
B1.15 Jun
B2.18 & 19 Jun
450
360
270
180
90
0
10-6 m s-1
MODIS Chl-a Concentration
C1. Jun 1998-2009
C2.23 Jun
1.00
0.80
0.60
0.40
0.20
0.00
mg m-3
MODIS Sea-surface
D1.10-17 Jun
D2.18-25 Jun
30.0
29.2
28.4
27.6
26.8
26.0
°C
Sea-surface Height Anomaly (SHA)
E1.15 Jun
E2.26 Jun
-35
-25
-15
-5
0
15
25
35
cm
Sea surface currents
F1.15 Jun
F2.24 Jun
14
12
10
80
60
40
20
0
cm s-1
A. QuikScat wind speed
speed (m s-1)
B. Ekman layer depth
depth (m)
C. TRMM rainfall
rainfall (mm)
D. GHRSST
SST (°C)
E. Chl-a concentration
Chl-a (mg m-3)
14 16 18 20 22 24 26 28 30 2 4 6 8 10 12
June
July



Yongqiang CHEN, DANLING TANG, 2012,

Eddy-feature phytoplankton bloom induced by tropical cyclone in the South China Sea,

International Journal of Remote Sensing. Vol. 33, No. 23, 10 December 2012, 7444–7457.（SCI）

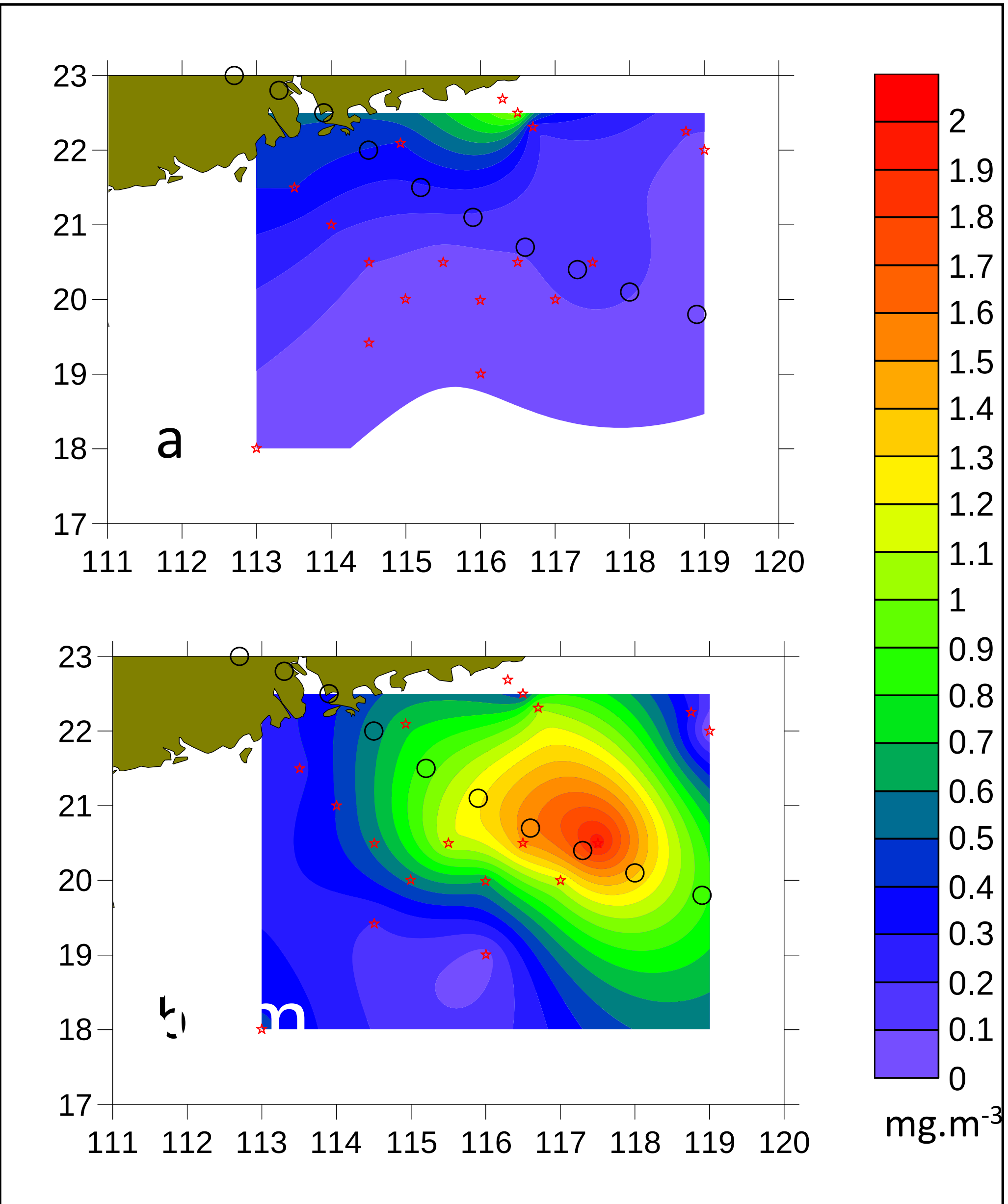
Chen, Tang , 2011, IJRS

- Surface? Depth ?

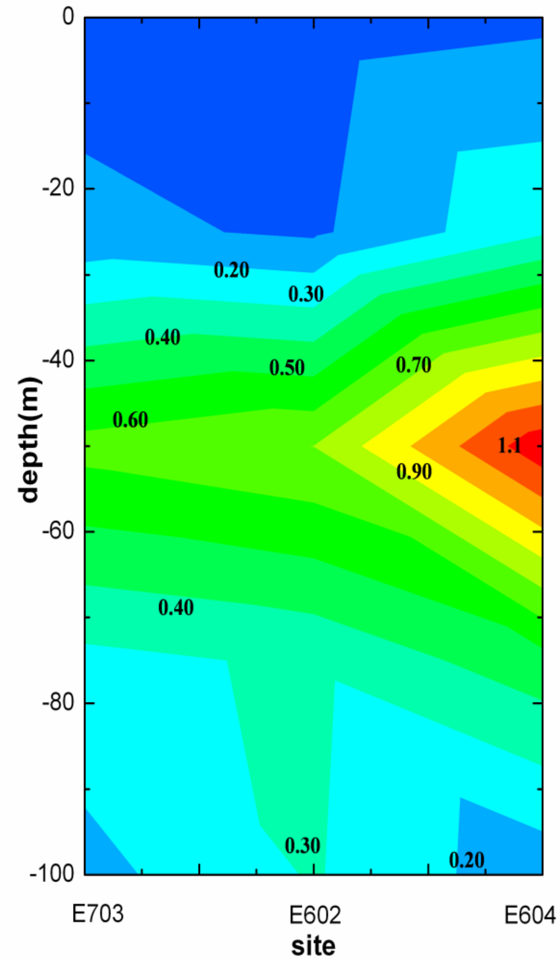
In situ observations

HaiJun. Ye, Yi. Sui, Danling. Tang, Y. D. Afanasyev， 2013, A Subsurface Chlorophyll a Bloom Induced by Typhoon in the South China Sea. Journal of Marine Systems（SCI）. ttp://dx.doi.org/10.1016/j.jmarsys.2013.04.010

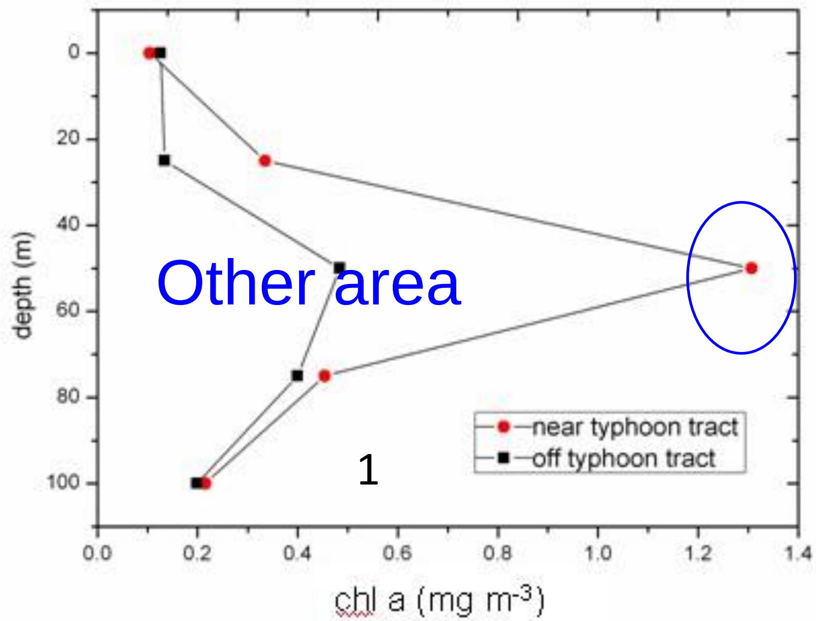
Chlorophyll on surface and subsurface

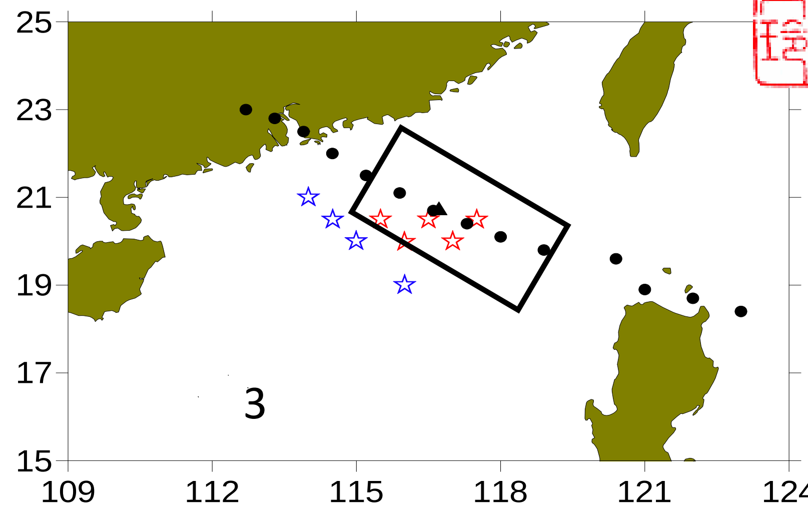


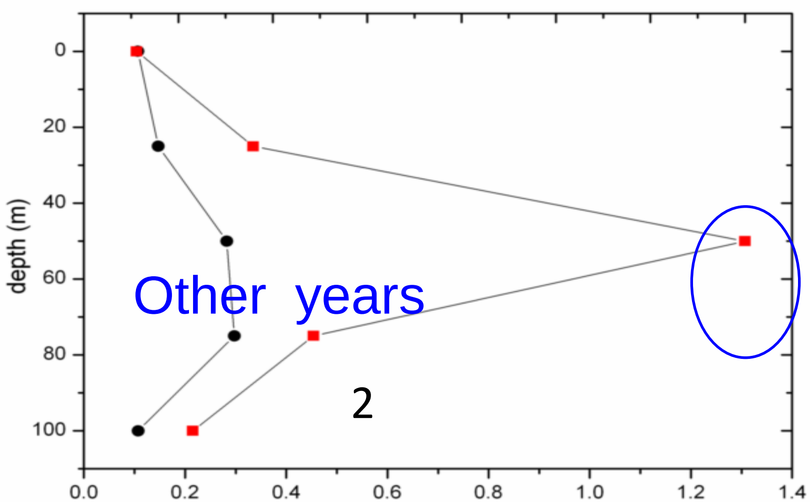
After typhoon

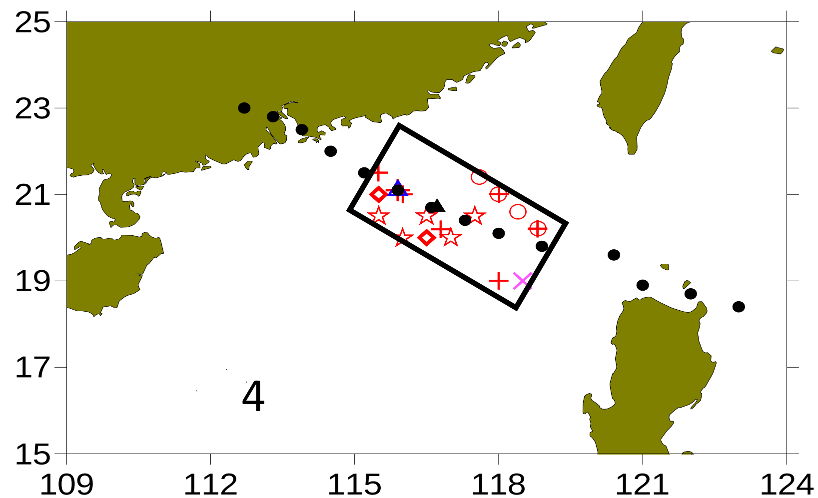


Ye and Tang, 2013, JMS









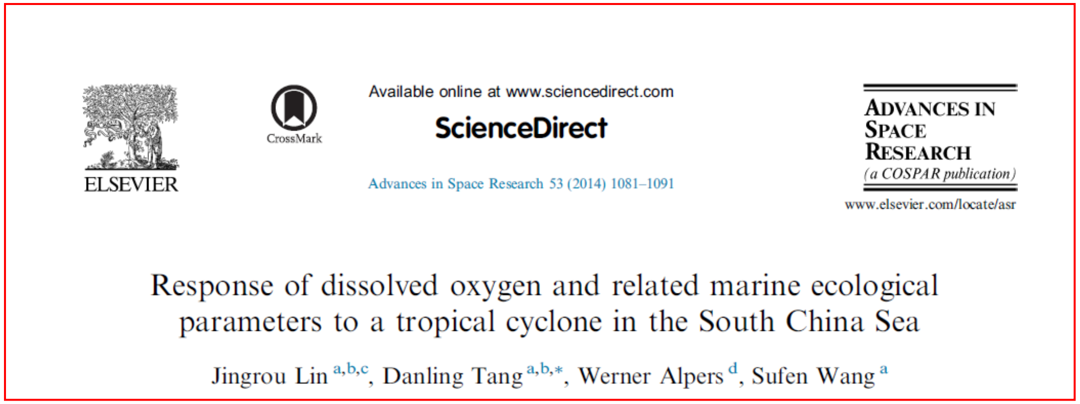
chl a (mg m^{-3})

HaiJun. Ye, Yi. Sui, Danling. Tang, Y. D. Afanasyev， 2013, A Subsurface Chlorophyll a Bloom Induced by Typhoon in the South China Sea. Journal of Marine Systems （SCI）.

Dissolved oxygen (DO)

?

typhoon / tropical cyclone



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Advances in Space Research 53 (2014) 1081–1091

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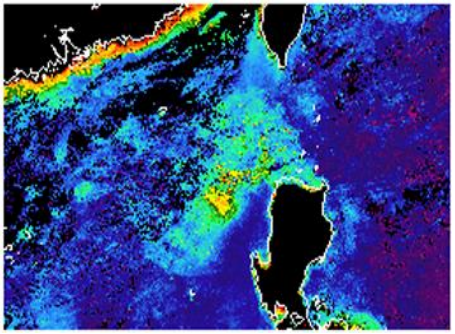
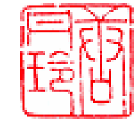
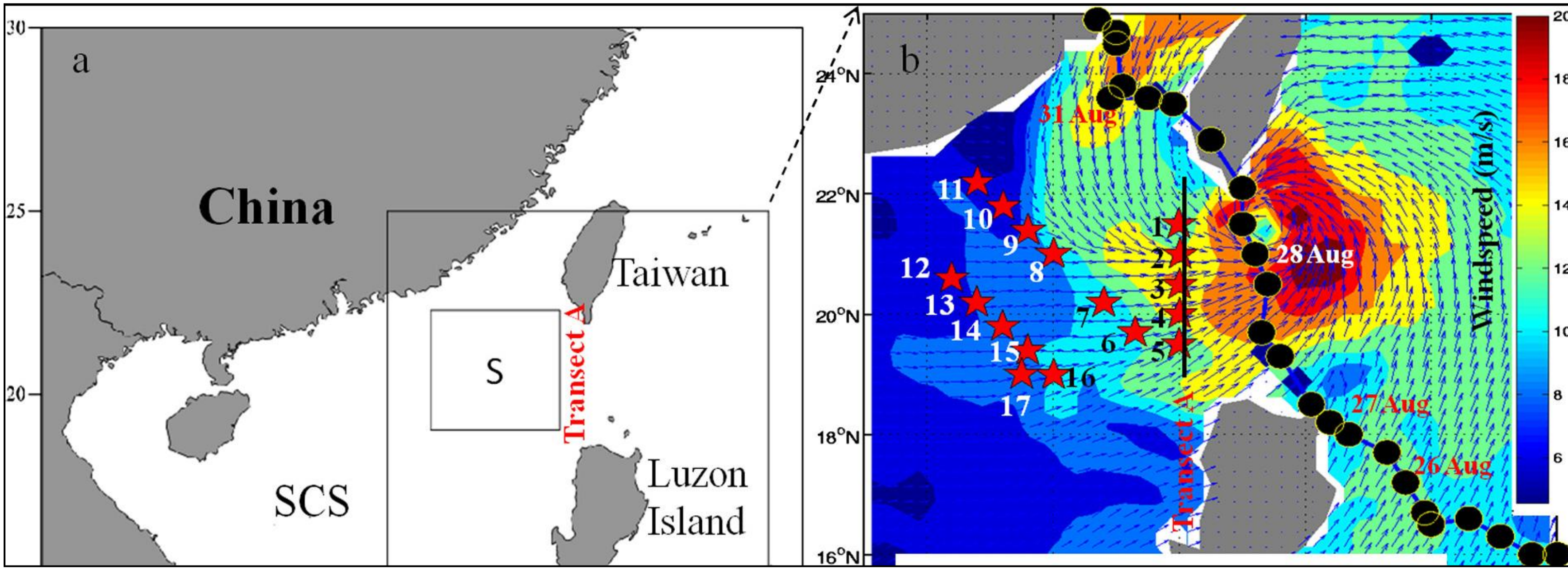
Response of dissolved oxygen and related marine ecological parameters to a tropical cyclone in the South China Sea

Jingrou Lin[a,b,c], Danling Tang[a,b,*], Werner Alpers[d], Sufen Wang[a]

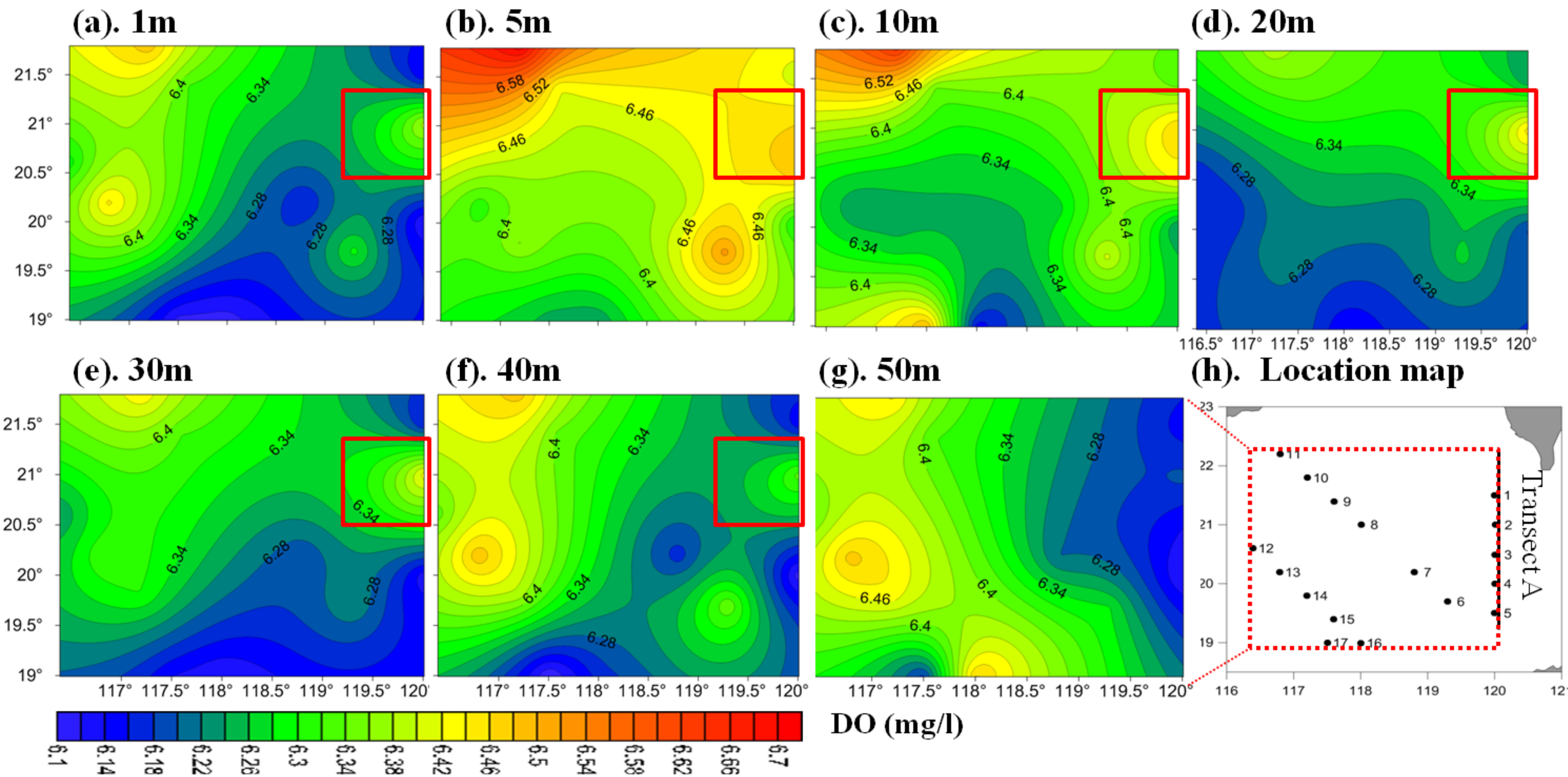






the super-typhoon Nanmadol between 22 and 30 August 2011,

Horizontal distribution of DO concentration



(in mg l1) at different depths at 19–22N, 116–120E (a–g).

Jingrou Lin, Danling Tang*， Werner Alpers, Sufen Wang， 2014. Response of dissolved oxygen and related marine ecologicalparameters to a tropical cyclone in the South China Sea。 Advances in Space Research。 http://dx.doi.org/10.1016/j.asr.2014.01.005

Fig.2

Horizontal distribution

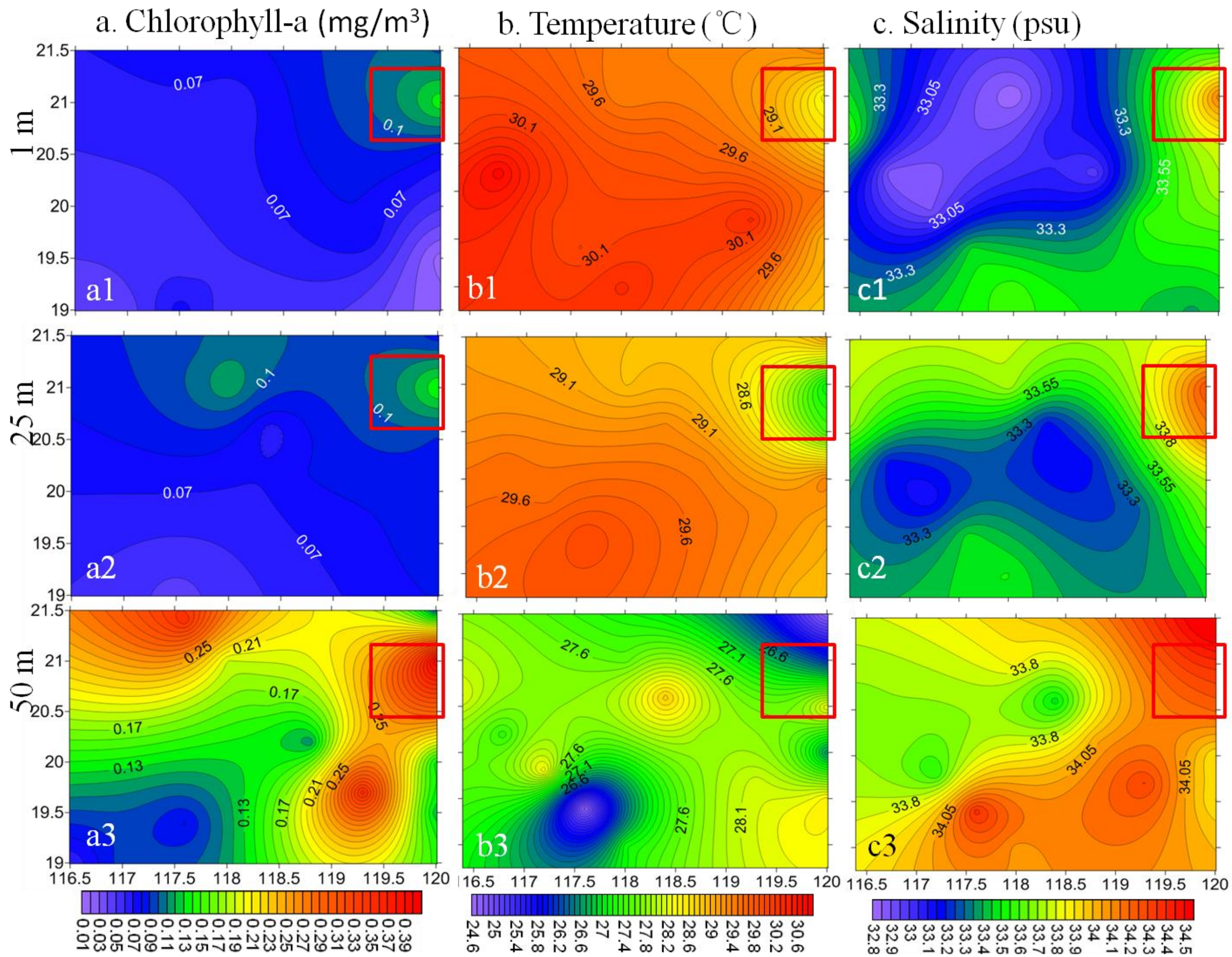
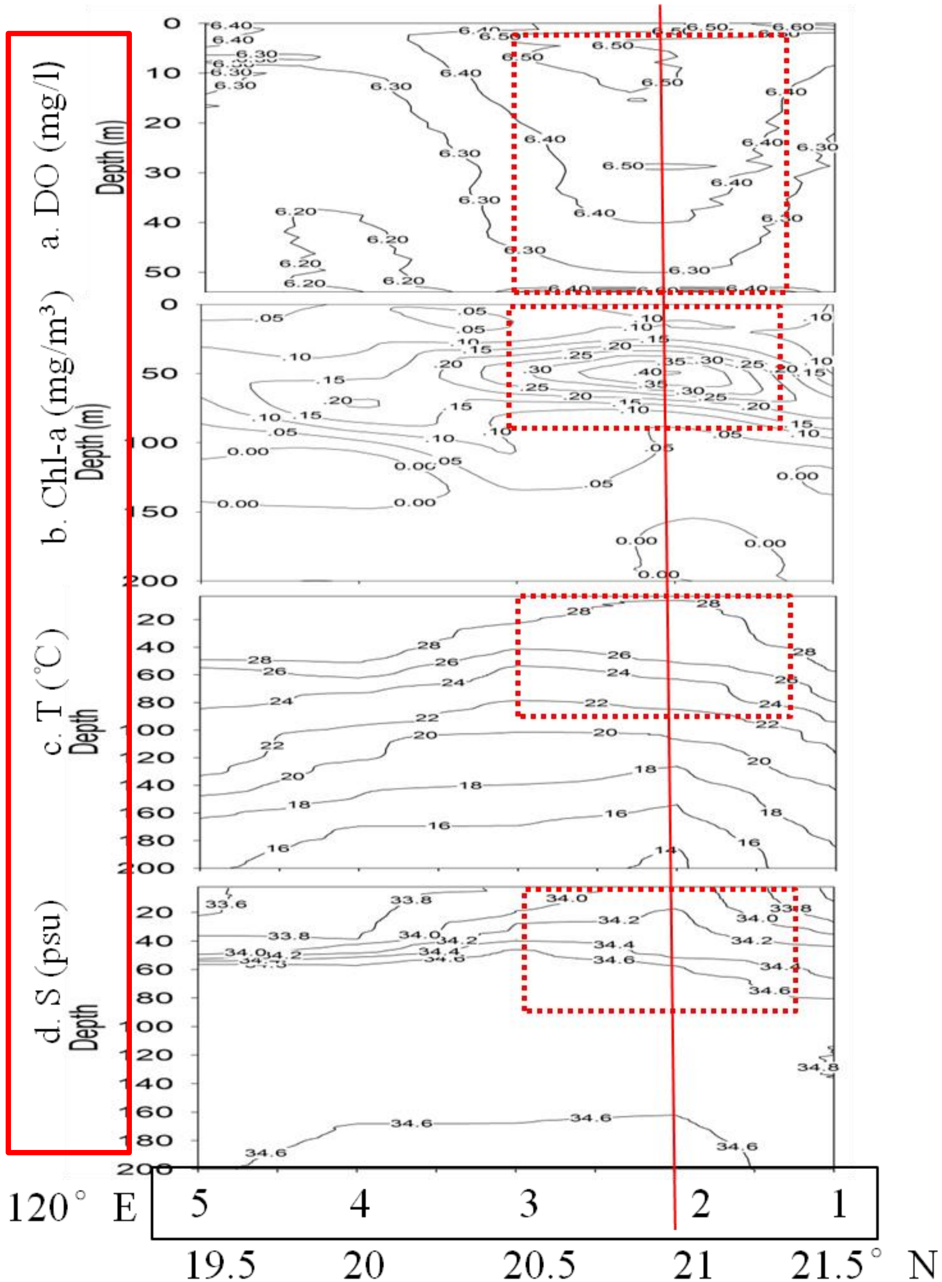


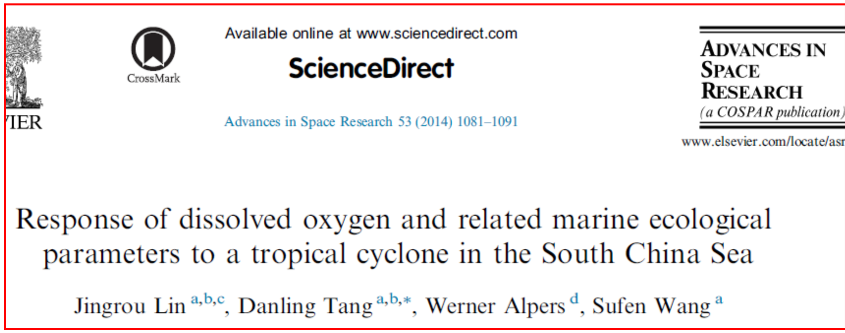
Fig.3



Depth profiles of the

DO (a) and
Chl-a concentrations (b),
temperature (c),
and salinity (d)

along the transect A one week after the passage of the typhoon.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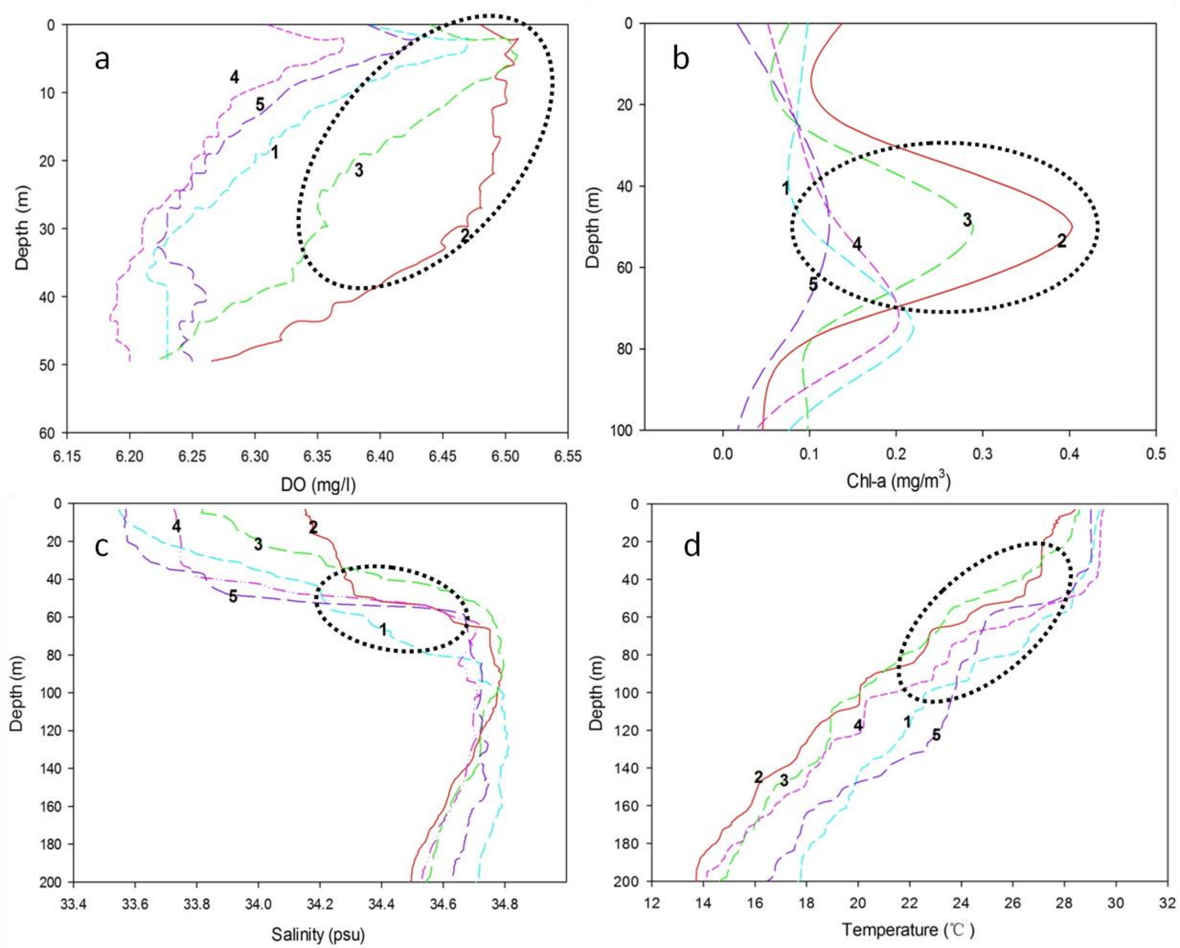
Response of dissolved oxygen and related marine ecological parameters to a tropical cyclone in the South China Sea

Jingrou Lin [a,b,c], Danling Tang [a,b,*], Werner Alpers [d], Sufen Wang [a]

Depth profiles of the DO (a) and Chl-a concentrations (b), temperature (c), and salinity (d) along the transect A

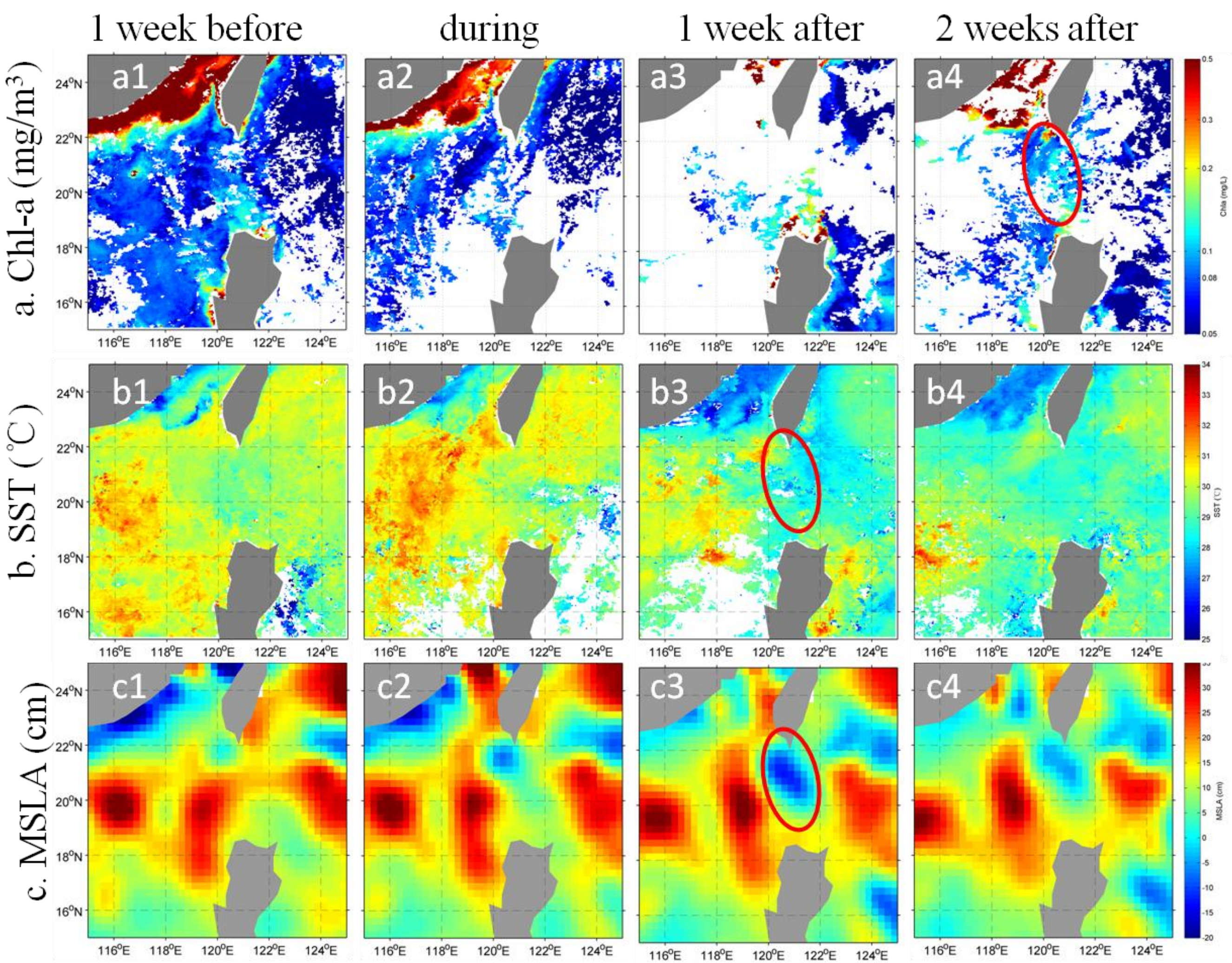


1 week after the passage of the typhoon.

Jingrou Lin, Danling Tang*， Werner Alpers, Sufen Wang， 2014. Response of dissolved oxygen and related marine ecologicalparameters to a tropical cyclone in the South China Sea。 Advances in Space Research。 http://dx.doi.org/10.1016/j.asr.2014.01.005

Fig.5

Horizontal distribution

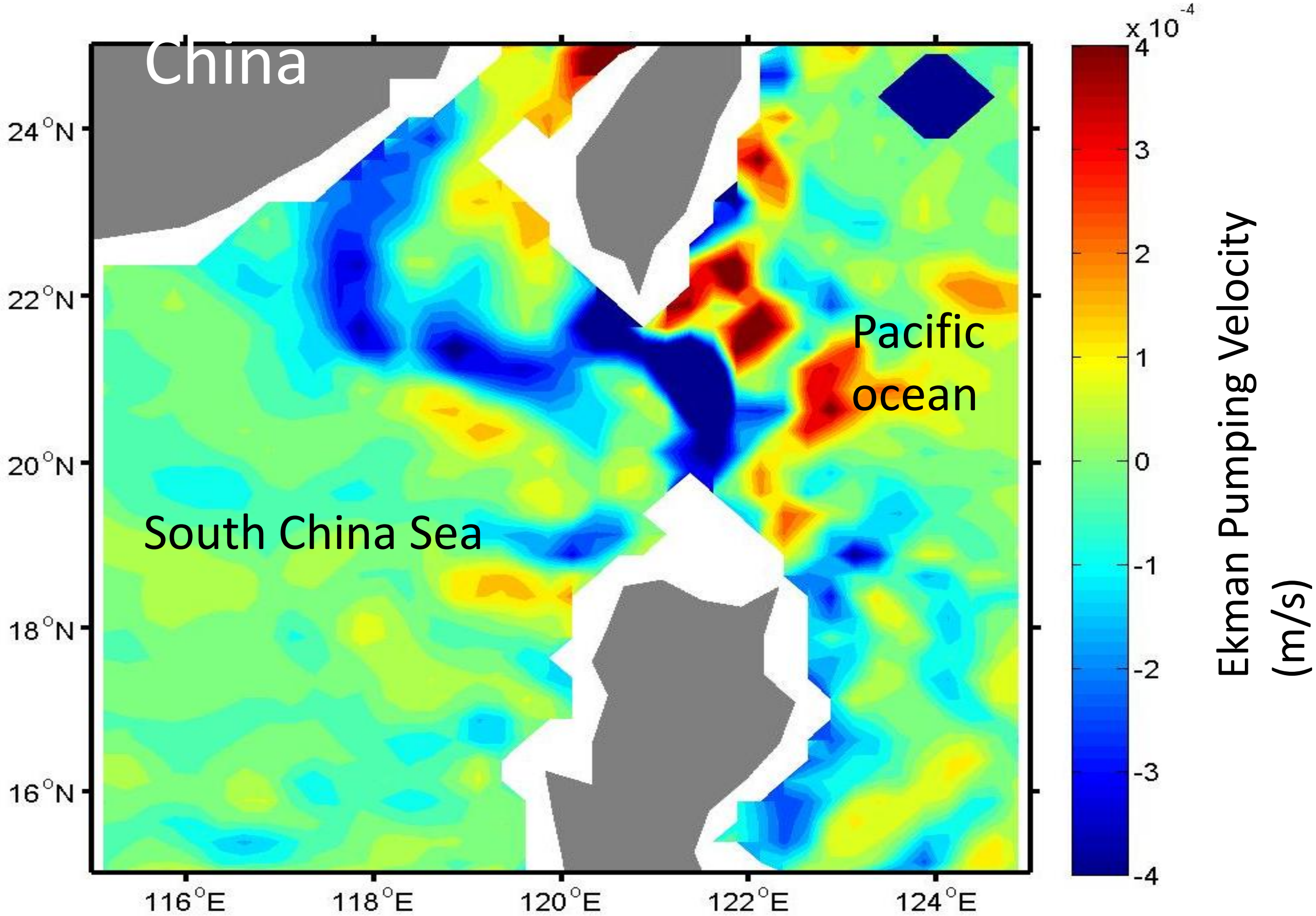


The Chl-a (mg m3) and SST (C) maps are 8-day composites retrieved from MODIS data

the SLA (cm) maps are weekly composites retrieved from altimeter data of several satellites

Fig.6

Daily averaged Ekman pumping velocity (m s1)



28 Aug 2011.

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Jingrou Lin [a,b,c], Danling Tang [a,b,*], Werner Alpers [d], Sufen Wang [a]

Sea surface current (m s1), the passage of the typhoon in Luzon Strait.

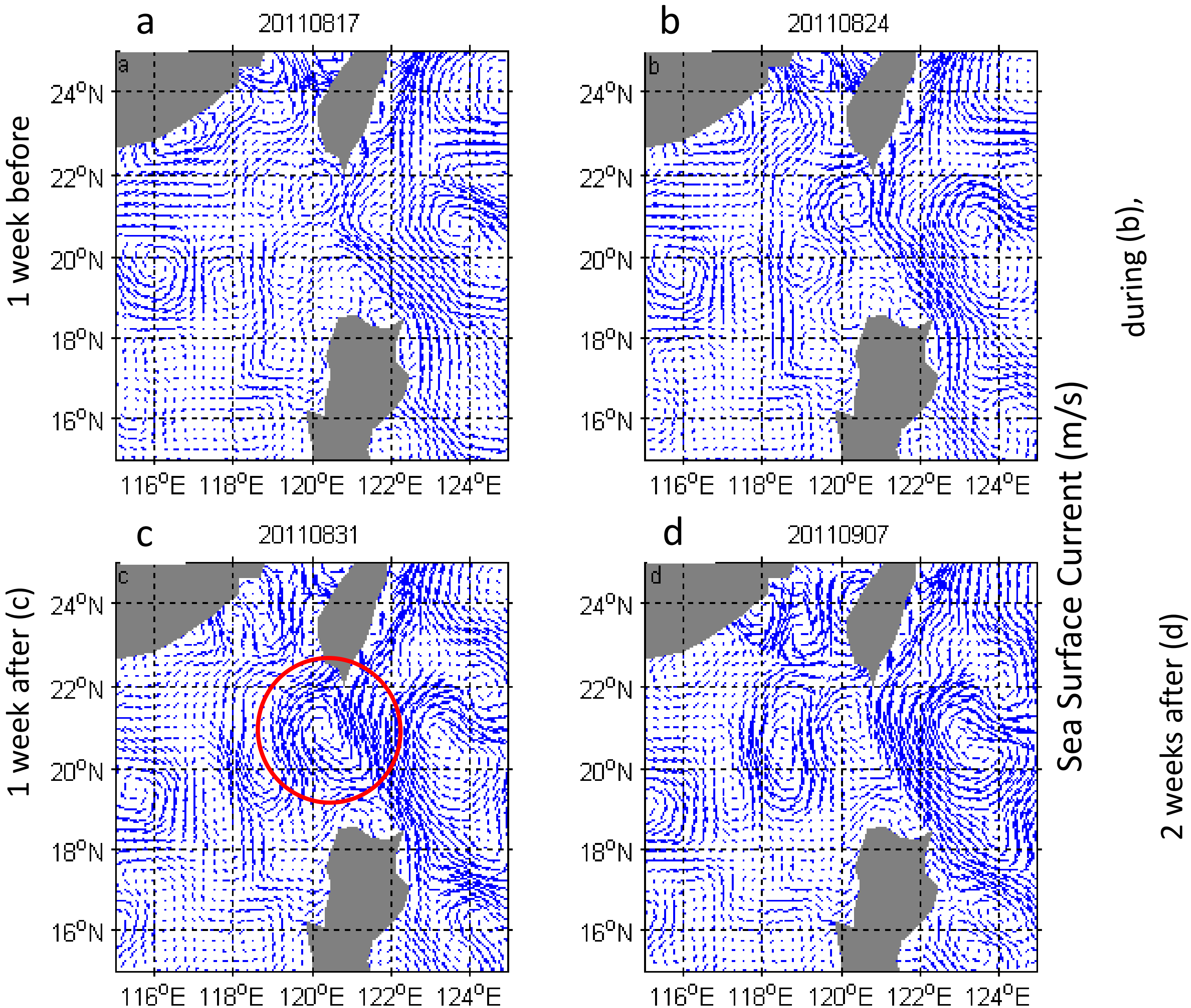

Fig.8

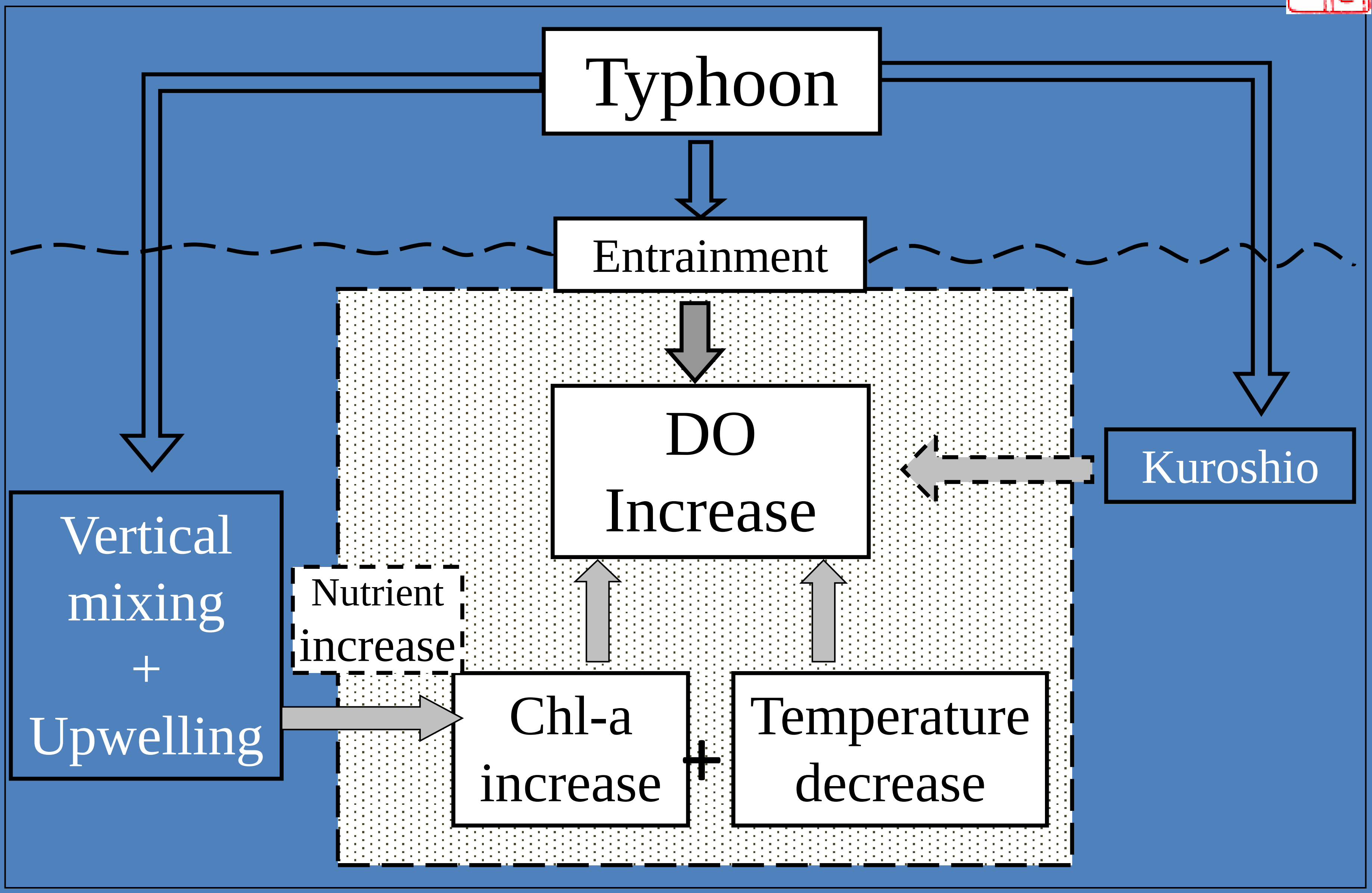
Typhoon
Entrainment
DO
Increase
Kuroshio
Vertical
mixing
+
Upwelling
Nutrient
increase
Chl-a
increase
+
Temperature
decrease

Fig.9

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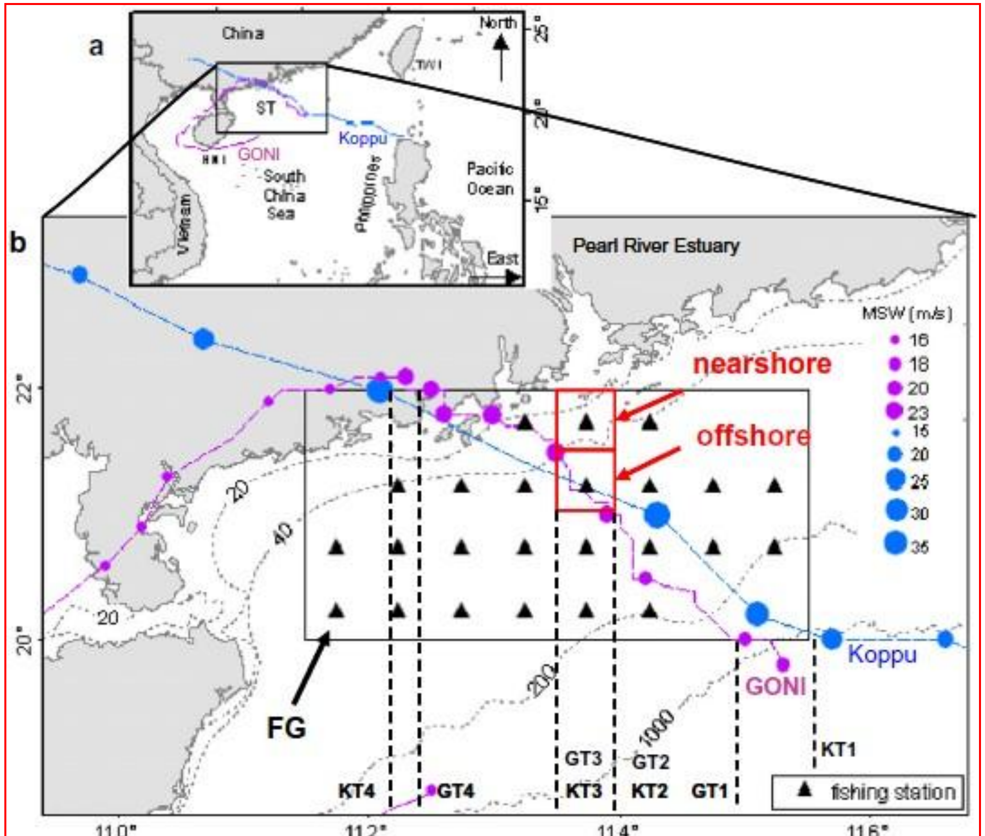
4

Typhoon impact on primary production

- Primary production /Fisheries ?

(1) Increase in fish abundance during two typhoons in the South China Sea



GONI: 20:00 Aug 3(Begin)-14:00 Aug 9(End)

Koppu: 02:00 Sep 13(Begin)-05:00 Sep 16(End)

GT4: 13:00 Aug 5 KT4: 08:00 Sep 15

GT3: 20:00 Aug 4 KT3: 01:00 Sep 15

GT2: 13:00 Aug 4 KT2: 20:00 Sep 14

GT1: 02:00 Aug 4 KT1: 09:00 Sep 14

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Advances in Space Research 51 (2013) 1734–1749

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Increase in fish abundance during two typhoons in the South China Sea

Jie Yu[a,b,c], Danling Tang[a,c,*], Yongzhen Li[b], Zirong Huang[b], Guobao Chen[b]

Yu & Tang, 2013, ASR

②台风----渔获物种类增加

No	1	2	3	4 to 8	9	10	11	12	13	14	15	16	17	18	19	20
e7		√									√					
s3		√						√								
s4		√						√							√	√
s5		√						√	√	√	√	√	√	√	√	√
s7		√						√	√	√	√	√	√	√	√	√
s8		√						√	√	√	√	√	√	√	√	√
s10		√						√							√	
s11		√		G				√	√						√	√
s12		√		O				√			√					
s13		√		N				√	√	√	√	√	√	√	√	
s14		√		I				√	√	√	√	√	√		√	√
s15		√						√				√	√		√	√
s16		√						√			√		√		√	√
s21		√						√				√			√	√
s22		√						√		√		√	√	√	√	
o1		√						√	√	√	√	√	√	√	√	
o4		√						√							√	
o5		√						√	√	√	√	√	√	√	√	√
s9		√														
e1								√								
e2								√								
e6								√							√	√
s6								√	√				√	√		√
s17								√		√					√	√
s18								√							√	√
s19								√								√
s20								√			√				√	√
o3								√				√	√		√	√

Increased records

No	1	2	3	4	5	6	7	8	9	14 to 15	16	17	18	19	20	25	26
s5	√		√						√		√	√	√	√	√	√	√
s8	√								√		√	√	√	√	√		√
s11	√		√						√		√	√	√	√	√		√
s13	√		√						√	K		√	√	√			
s14	√		√						√		√	√	√	√	√		
s16	√		√						√	o	√	√	√				√
s17	√		√							p		√	√				
s21	√									p	√	√	√	√	√		√
o1			√						√	u	√	√	√				
o5	√		√						√		√	√	√	√	√		√
e2												√					
e3													√				
e5												√	√				√
e6												√	√	√	√		
e7											√	√	√	√	√		√
s2											√						
s3											√	√	√	√			
s4											√	√	√	√		√	
s6												√	√				
s7											√	√	√	√			
s10											√	√	√	√			
s12												√	√	√	√		
s15												√	√	√			
s18											√	√	√				
s19												√	√				
s20												√	√	√			
s22											√	√	√	√	√		
o3											√	√	√	√	√		
o4												√	√	√	√		

Increased records

New records

Yu & Tang, 2013, ASR

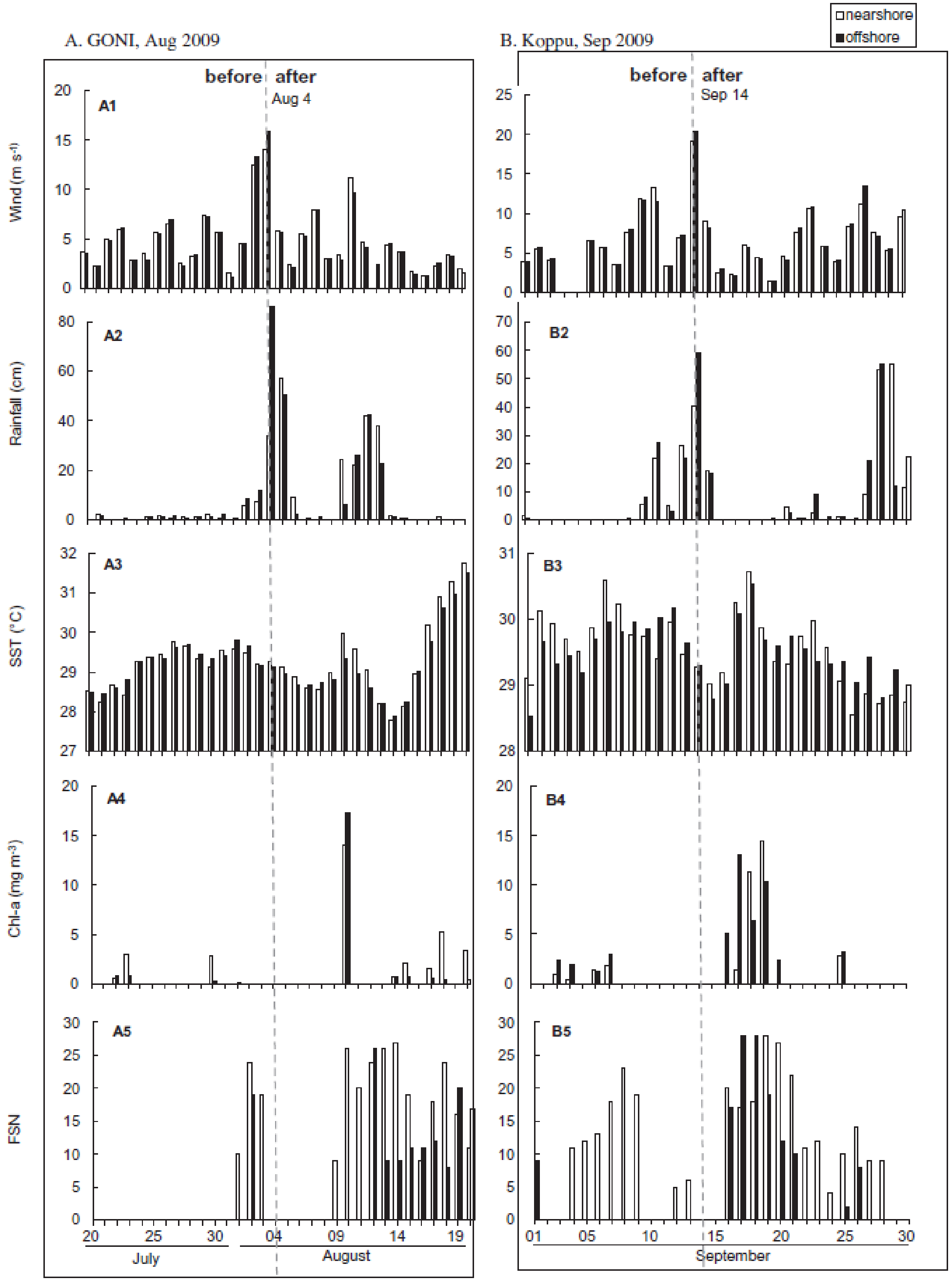
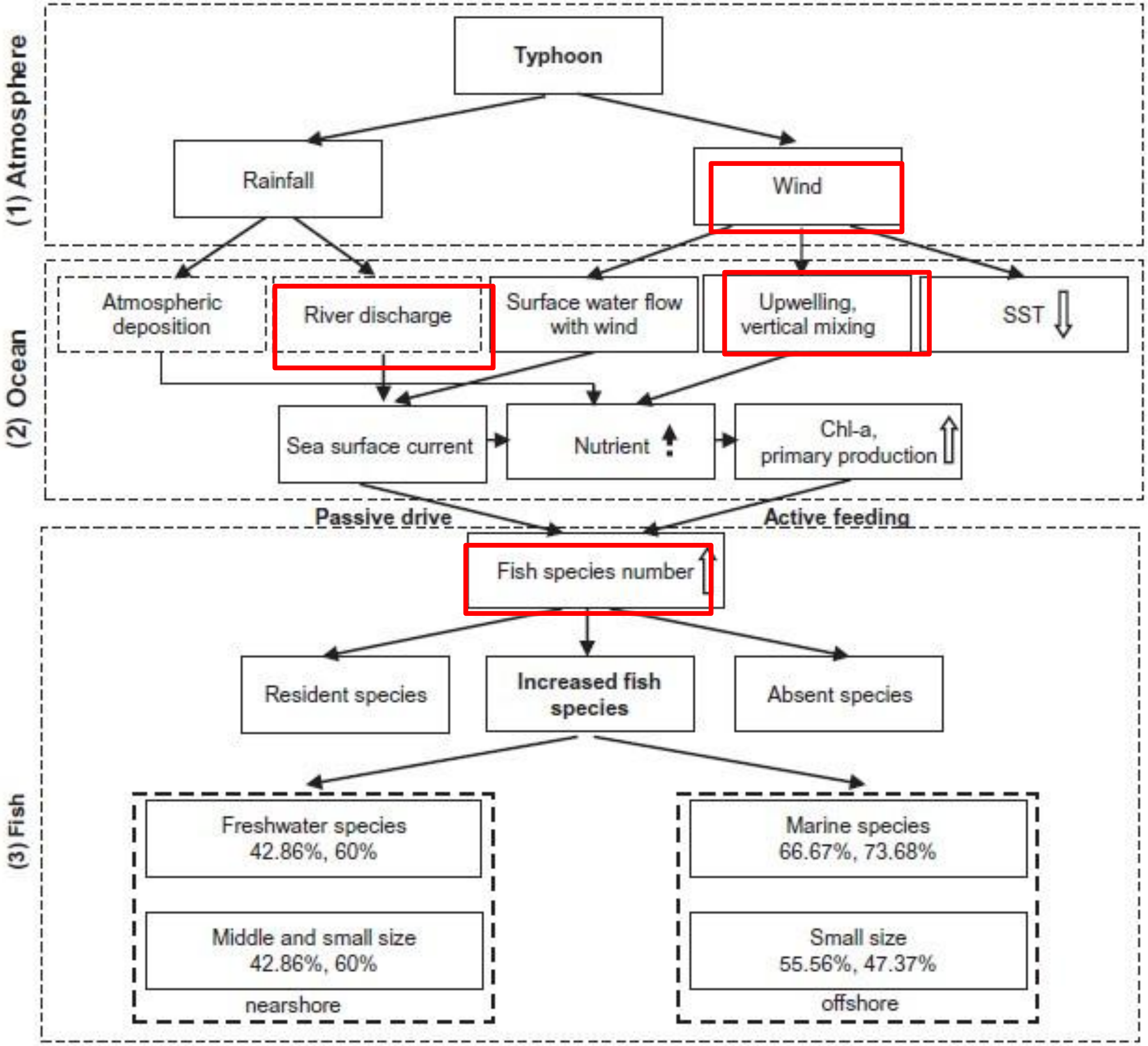


Fig. 6. Time series of wind (m s^{-1}), rainfall (cm), SST (°C), Chl-a (mg m^{-3}) and FSN. A: During typhoon GONI from July 20 to August 20th (A
A3, A4 and A5); B: During typhoon Koppu from September 1st to 30th (B1, B2, B3, B4 and B5). Blank bar represents the nearshore changes; Bla
denotes the offshore distribution; gray dashed lines indicate the occurrence of typhoons.



Jie Yu , Danling Tang, Yongzhen Li , Zirong Huang, Guobao Chen，2013，Advances in Space Research (SCI)。51(2013):1734-1749

2. Positive effects on Fish CPUE (fish catch per unite effort)

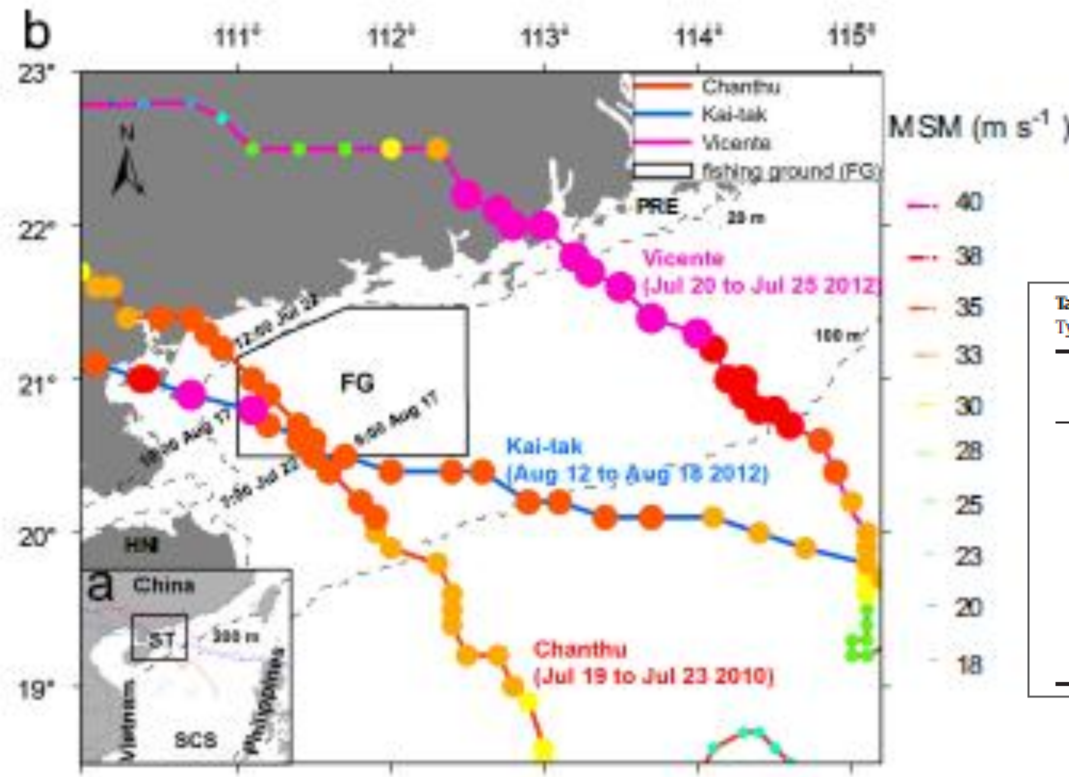


Table 2
Typhoon information.

No	Typhoon	Start and end time	Class	Note	Pass the FG in Fig. 1
1	Soudelor	July 11–12, 2009	2	Tropical storm	No
2	Goni	August 3–9, 2009	2	Tropical storm	No
3	Koppu	September 13–16, 2009	4	Typhoon	No
4	Parma	September 29–October 14, 2009	2	Tropical storm	No
5	Chanthu	July 19–23, 2010	4	Typhoon	Yes
6	Roke	July 25–30, 2011	3	Strong tropical storm	No
7	Vicente	July 20–25, 2012	4	Typhoon	No
8	Kai-tak	August 12–18, 2012	4	Typhoon	Yes

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Research papers

The positive effects of typhoons on the fish CPUE in the South China Sea

CrossMark

Jie Yu[a,b,c], Danling Tang[a,c,*], Guobao Chen[b], Yongzhen Li[b], Zirong Huang[b], Sufen Wang[a]

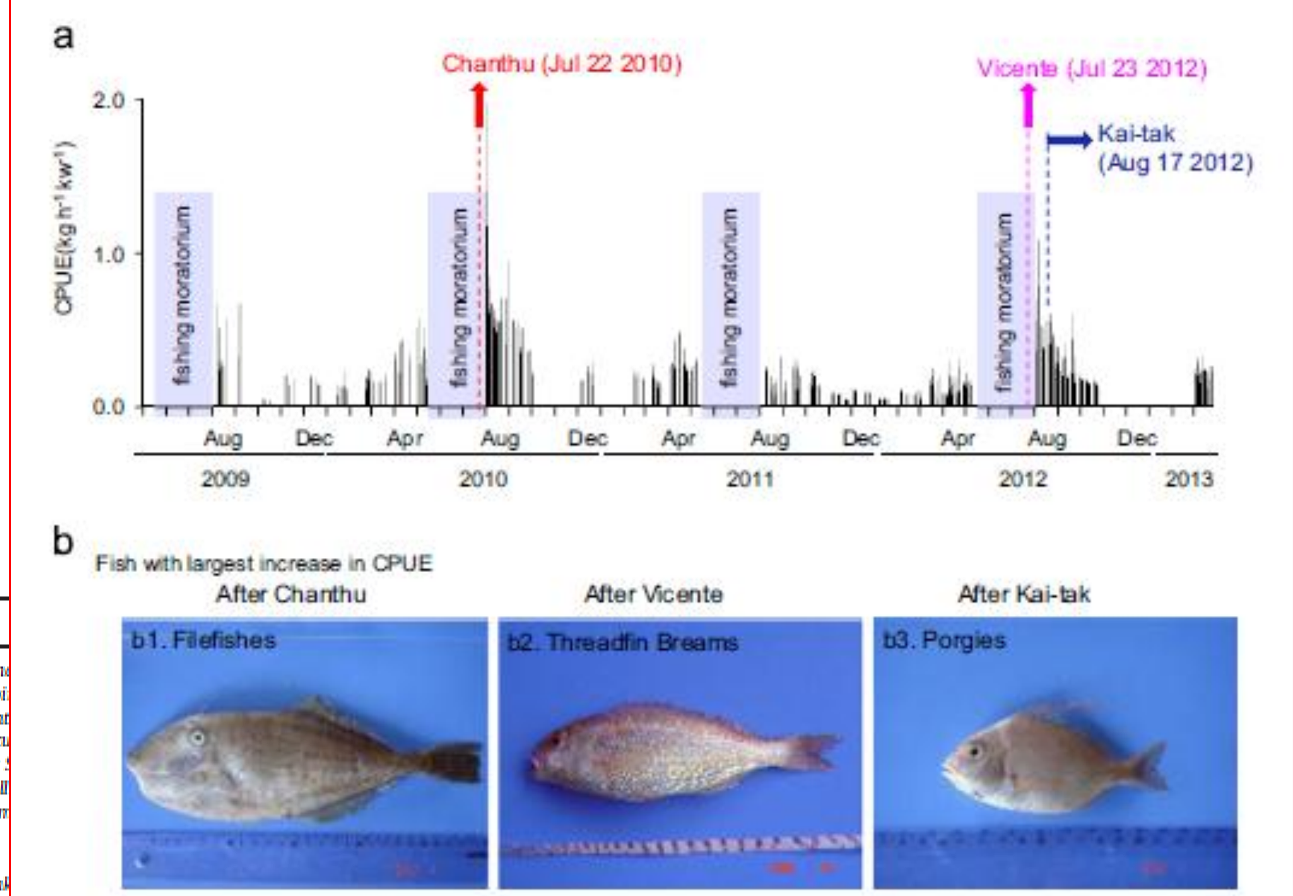
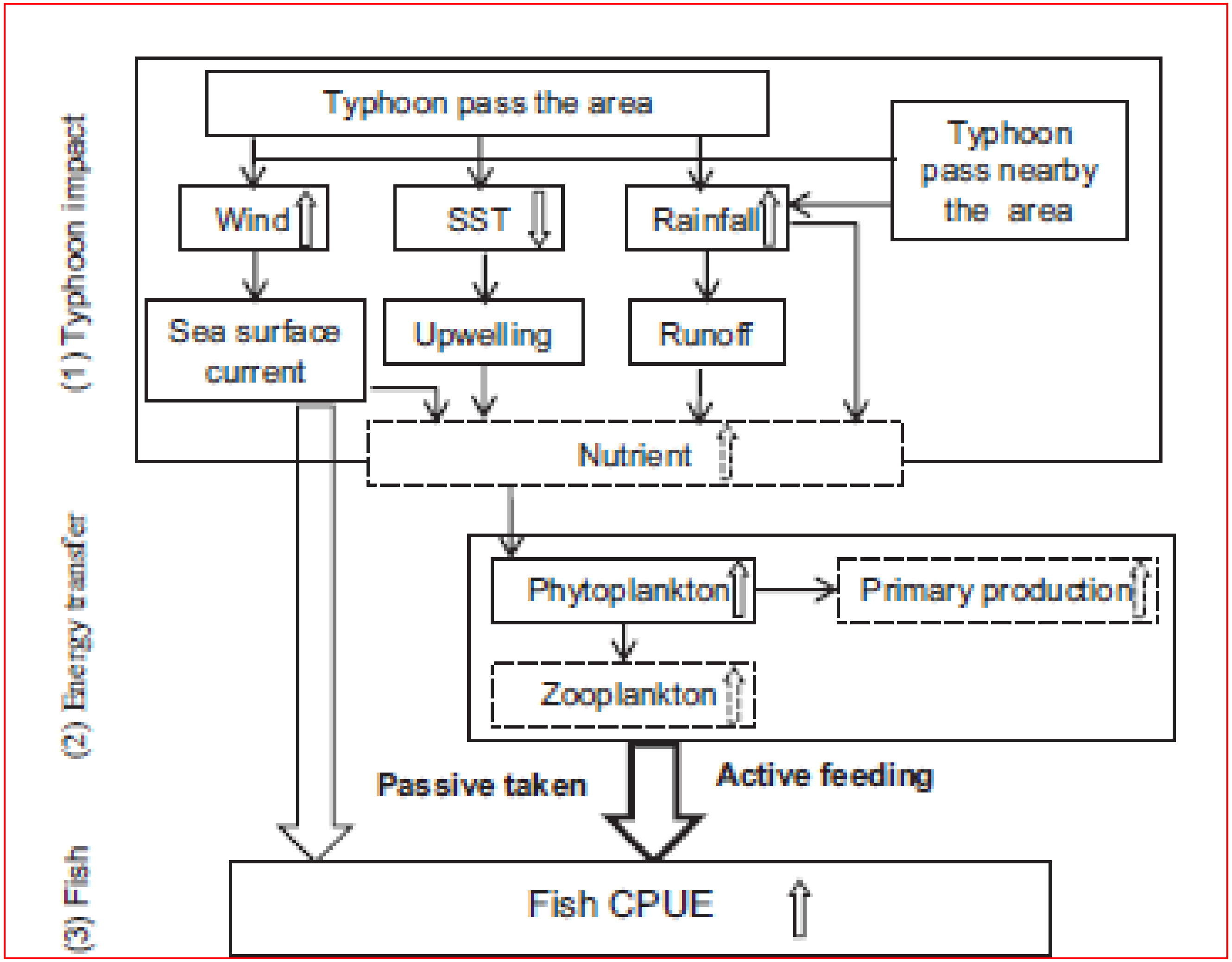


Table 1
Information of 30 main fishes sampled in the area.

No	Common name	Description		
1	Pelagic scad	*Decapterus* spp. dominated by *D. m*		
2	Ponyfish	*Leiognathus* spp. dominated by *L. bi*		
3	Pomfret	*Pampus* spp. dominated by *P. argent*		
4	Chub mackerel	A single species of *Scomber japonicu*		
5	Spanish mackerel	*Scomberomorus* spp. dominated by		
6	Spinyhead croaker	*Collichthys* spp. dominated by a *Coll*		
7	Jewfish	*Johnius* spp. dominated by *J. dussum*		
8	Yellow drum	a single species of *Nibea albiflora*		
9	Silver croaker	*Pennahia argentatus*		
10	Grouper	*Epinephelus* spp. dominated by *E. ak*		
11	Red barracuda	a single species of *Sphyraena pinguis*	Meso demersal	High class carnivorous fish
12	Hairtail	*Trichiurus* spp. dominated by *T. lepturus*	Meso demersal	High class carnivorous fish
13	Pacific rudderfish	a single species of *Psenopsis anomala*	Demersal	Low class carnivorous fish
14	Threadfin bream	*Nemipterus* spp. dominated by *N. virgatus*	Demersal	Low class carnivorous fish
15	Porgies	a single species of *Parargyrops edita*	Demersal	Low class carnivorous fish
16	Bigeye	*Priacanthus* spp. dominated by *P. tayenus* and *P. macracanthus*	Demersal	Low class carnivorous fish
17	Filefish	Thamnaconus spp. dominated by *T. hypargyreus*	Demersal	Low class carnivorous fish
18	Goatfish	Upeneus spp. dominated by *U. moluccensis* and *U. sulphureus*	Demersal	Low class carnivorous fish
19	Tonguesole	*Cynoglossus* spp.	Demersal	Low class carnivorous fish
20	Sillago	*Sillago sihama* and *S. japonica*	Demersal	Low class carnivorous fish
21	Monkfish	*Lophius* spp. dominated by *Lophius litulon*	Demersal	Middle class carnivorous fish
22	Snakefish	a single species of *Trachinocephalus myops*	Demersal	Middle class carnivorous fish
23	Conger pike	*Muraenesox cinereus*	Demersal	High class carnivorous fish
24	Lizardfish	*Saurida* spp. dominated by *S. tumbil* and *S. undosquamis*	Demersal	High class carnivorous fish
25	White-spotted spinefoot	*Siganus* spp. dominated by *Siganus oramin*	Reef	Omnivorous fish
26	Octopus	*Octopus* spp.	Cephalopoda	Low class carnivorous fish
27	Squid	*Loligo* spp.	Cephalopoda	Low class carnivorous fish
28	Cuttlefish	*Sepia* spp.	Cephalopoda	Low class carnivorous fish
29	Crab	*Portunus* spp. and *Charybdis* spp.	Crab	Low class carnivorous fish
30	Shrimp	*Penaeidae*	Shrimp	Low class carnivorous fish



1. The increased CPUE recoveredt othe normal level nearly 3 weeks aftert yphoons;

2. with low trophicl evel carnivorous exhibit increase in CPUE;

3 typhoon with a slower translational speed can cause a larger increase in CPUE.

- **Fish**

  - Primary production

    phytoplankton

    food

    nutrient

    fall down

    discharges

    deep water

    oceanic environment

    upwelling …….

- wind

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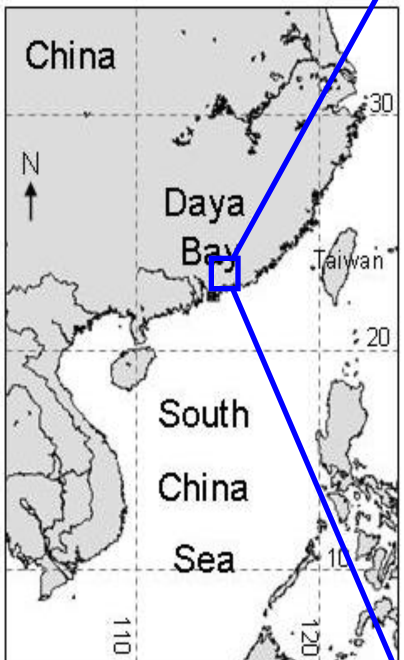
5

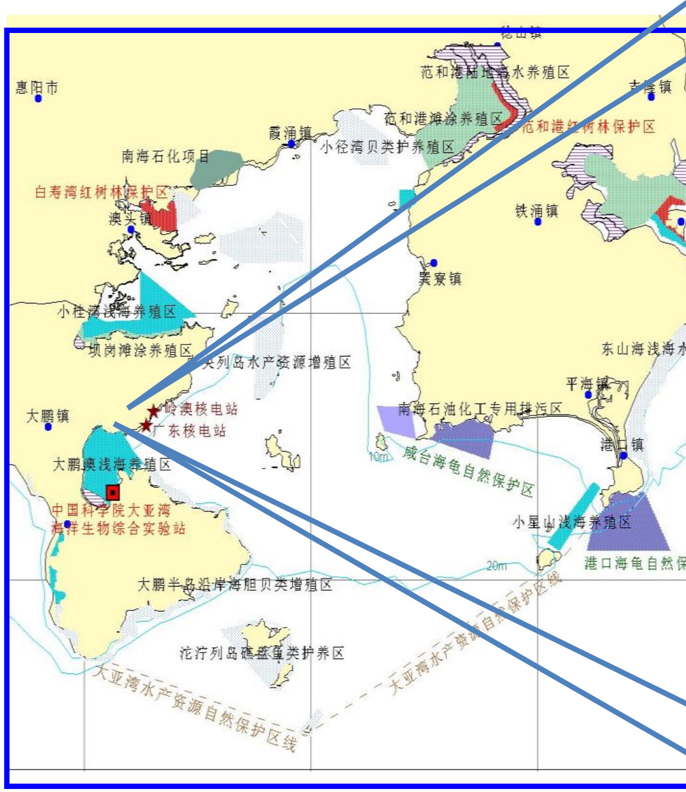
Pollution

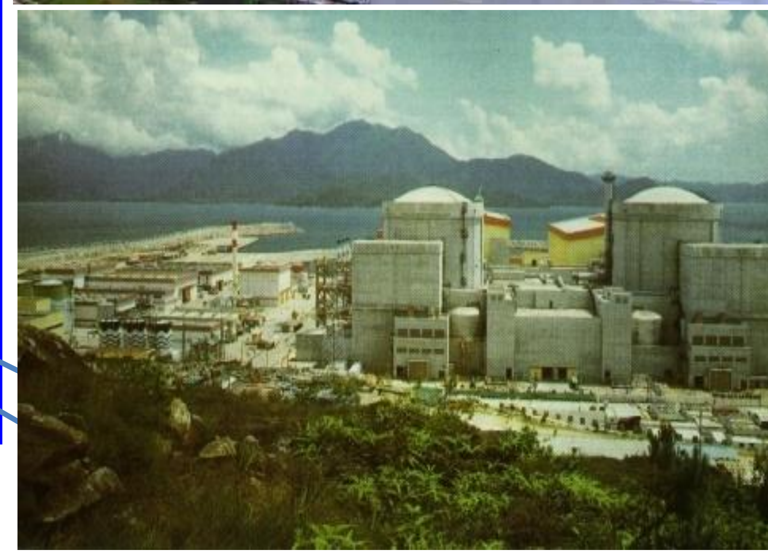
HAB

Nuclear Power Station

LNPS
2003







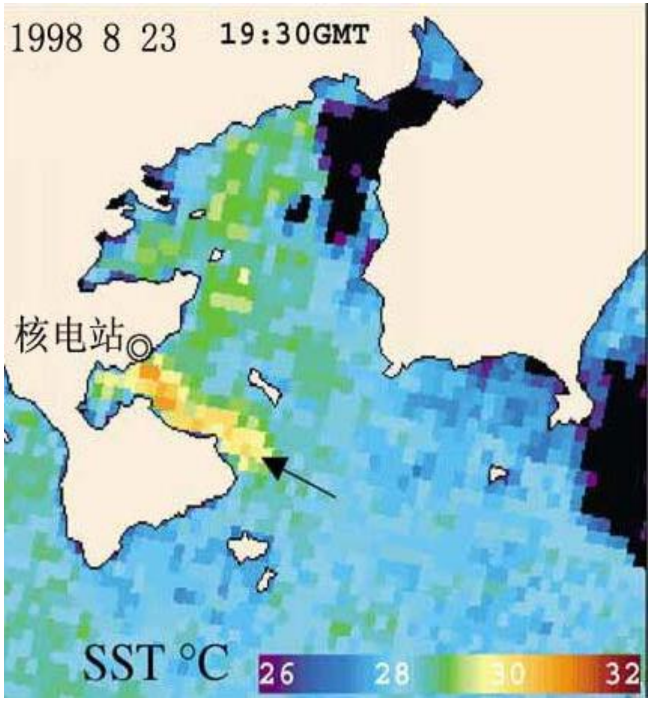
Short time investigation, spars data

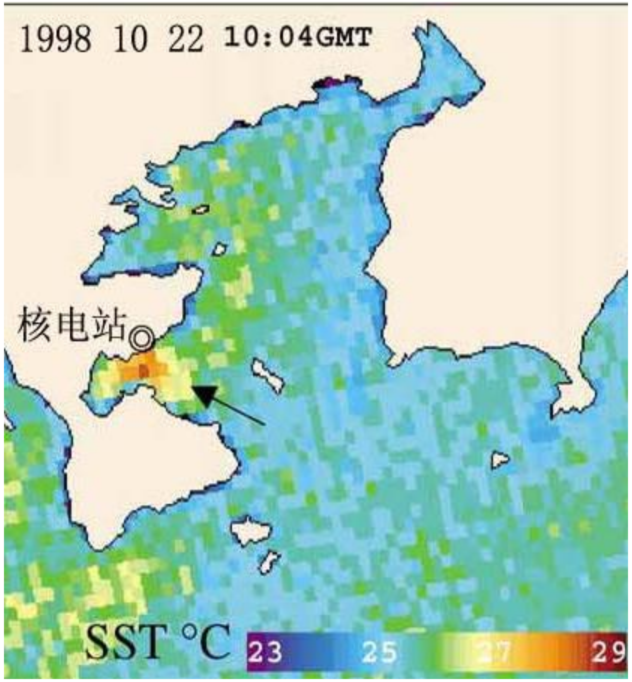
* Long-term environmental situation

DNPS,
1994

>400 NPP(2001), 17%

AVHRR Satellite remote sensing and shipboard measurements of the thermal plume from the Daya Bay, Nuclear Power Station, China.





AVHRR SST images (Tang 2003)

fast, simultaneous, large scale, long-term

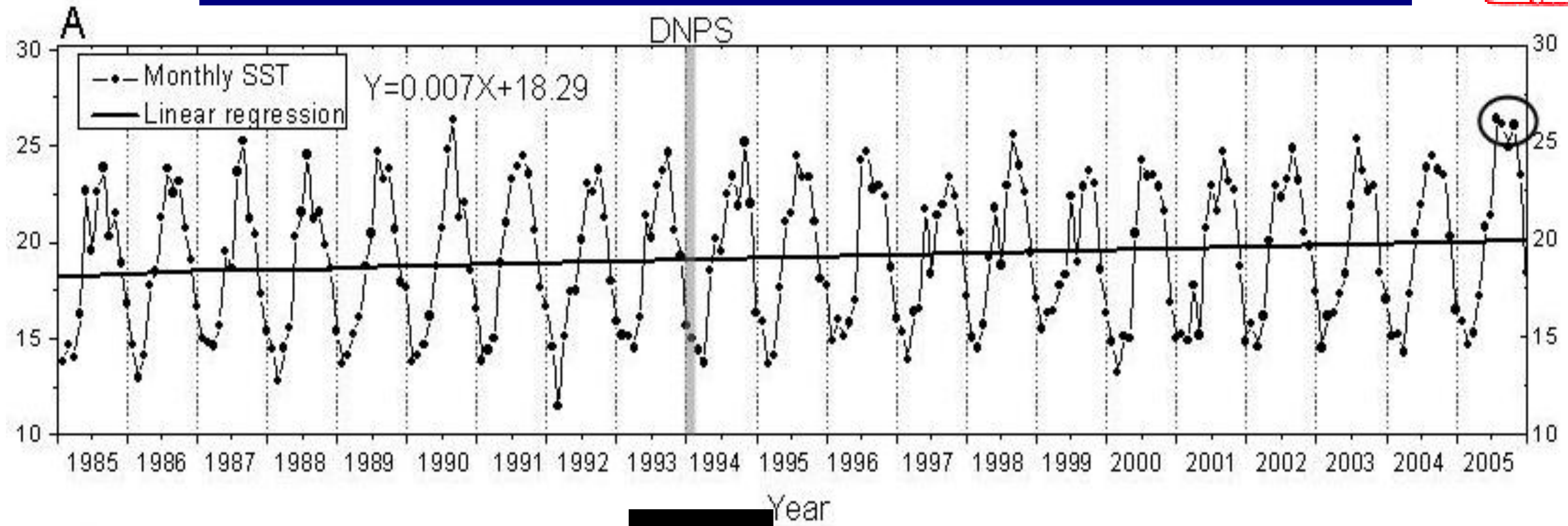
DanLing Tang, DR Kester, ZD Wang, JS Lian. H. Kawamura. 2003. *Remote Sensing of Environment*. 84 (4): 506-515

http://www.int-res.com/abstracts/meps/v191/p43-51.html

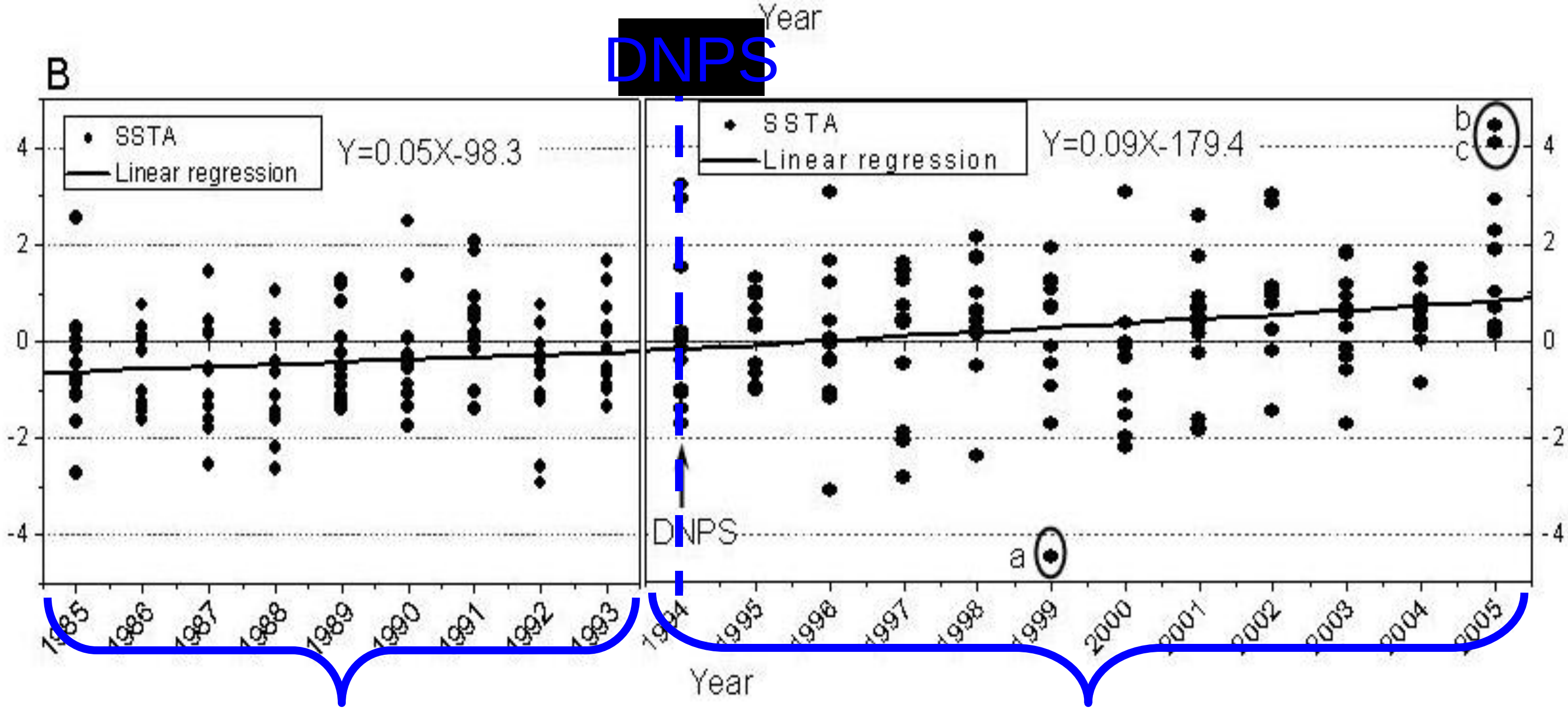
Seasonal variation of SST

Monthly SST

Ascending trend



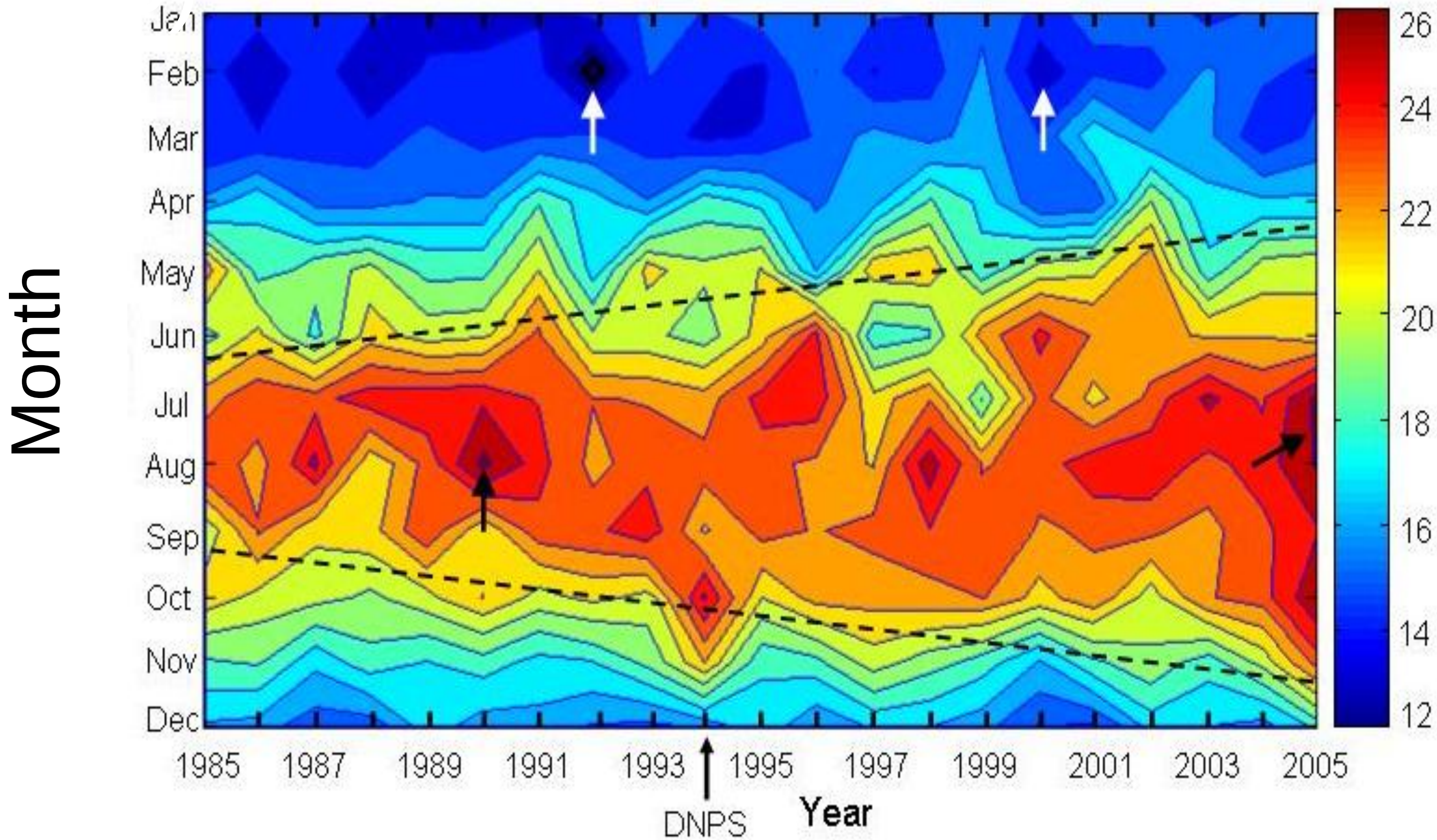
Monthly SSTA



Global warming

Thermal discharge

Increasing of Monthly (1985-



??

Jing Yu, DanLing Tang, Im-Sang Oh, Li-Jun Yao, 2007. Response of Harmful Algal Blooms to environmental changes in Daya Bay, China. Terr. Atmos. Ocean. 18(5): 1011-1027 (SCI)

Jing Yu, DanLing Tang,SF Wang, JS Lian, YS Wang, 2007. Changes of water

Tang DanLing 唐丹玲

Phytoplankton bloom over the Northwest Shelf of Australia after the *Montara* oil spill in 2009

Sheng YL, Tang DL, Pan G, 2011,
Geomatics, Natural Hazards and Risk.Vol. 2, No. 4, December 2011, 329–347。DOI: 10.1080/19475705.2011.564213. ISSN 1947-5705

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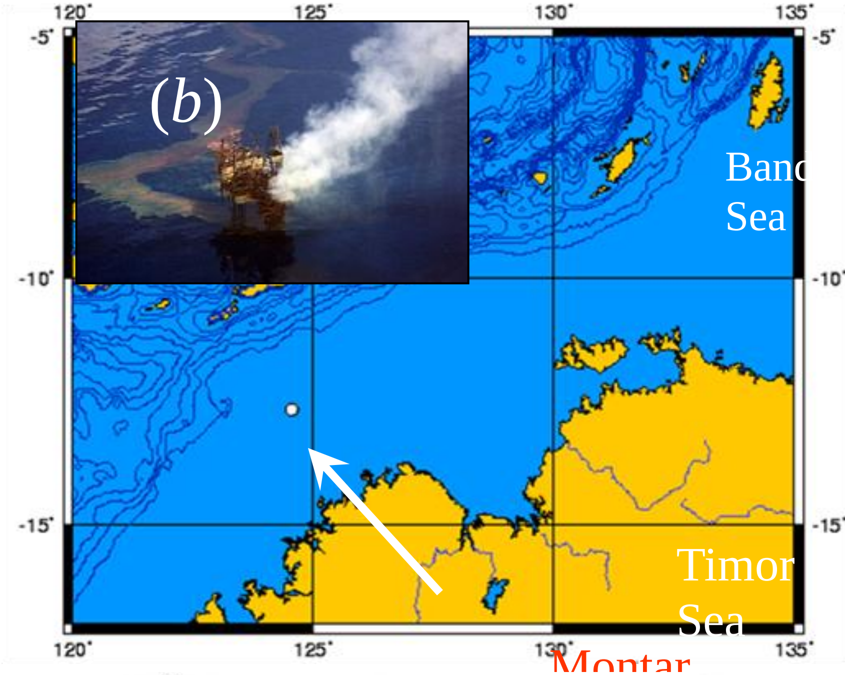
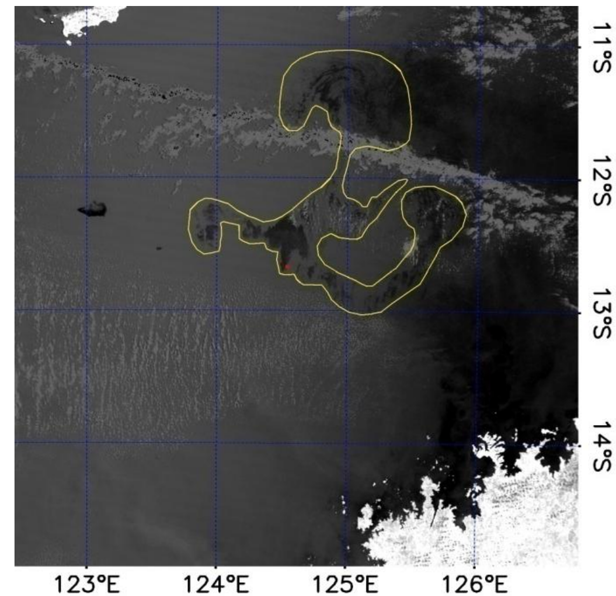
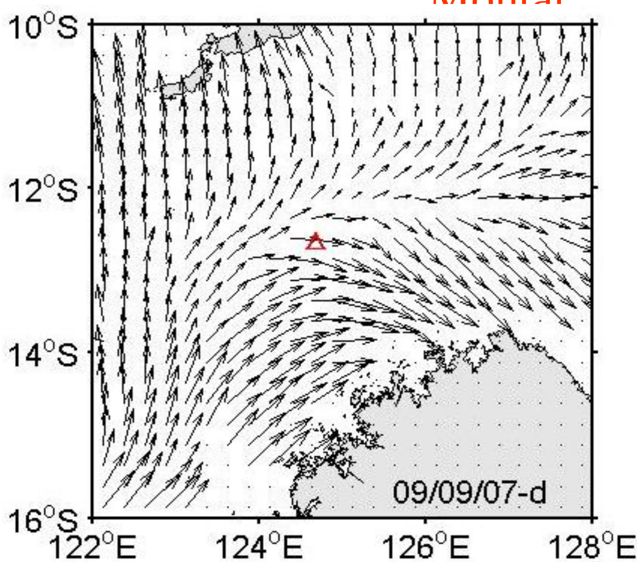
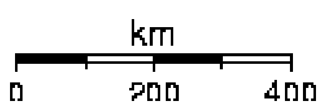


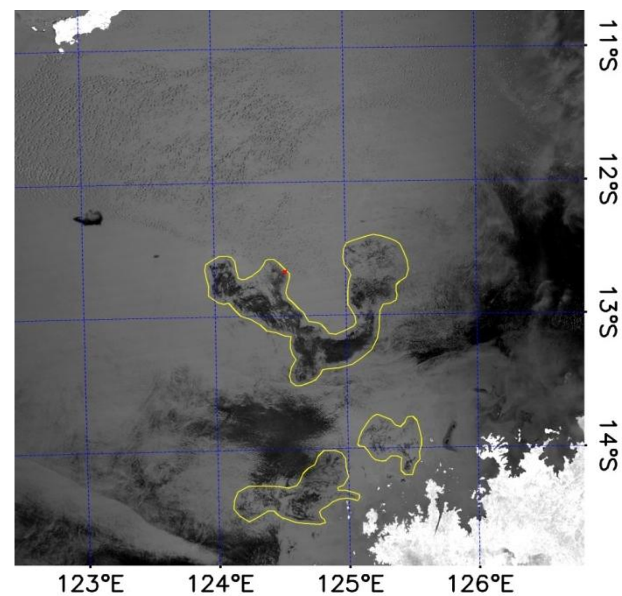
班达海



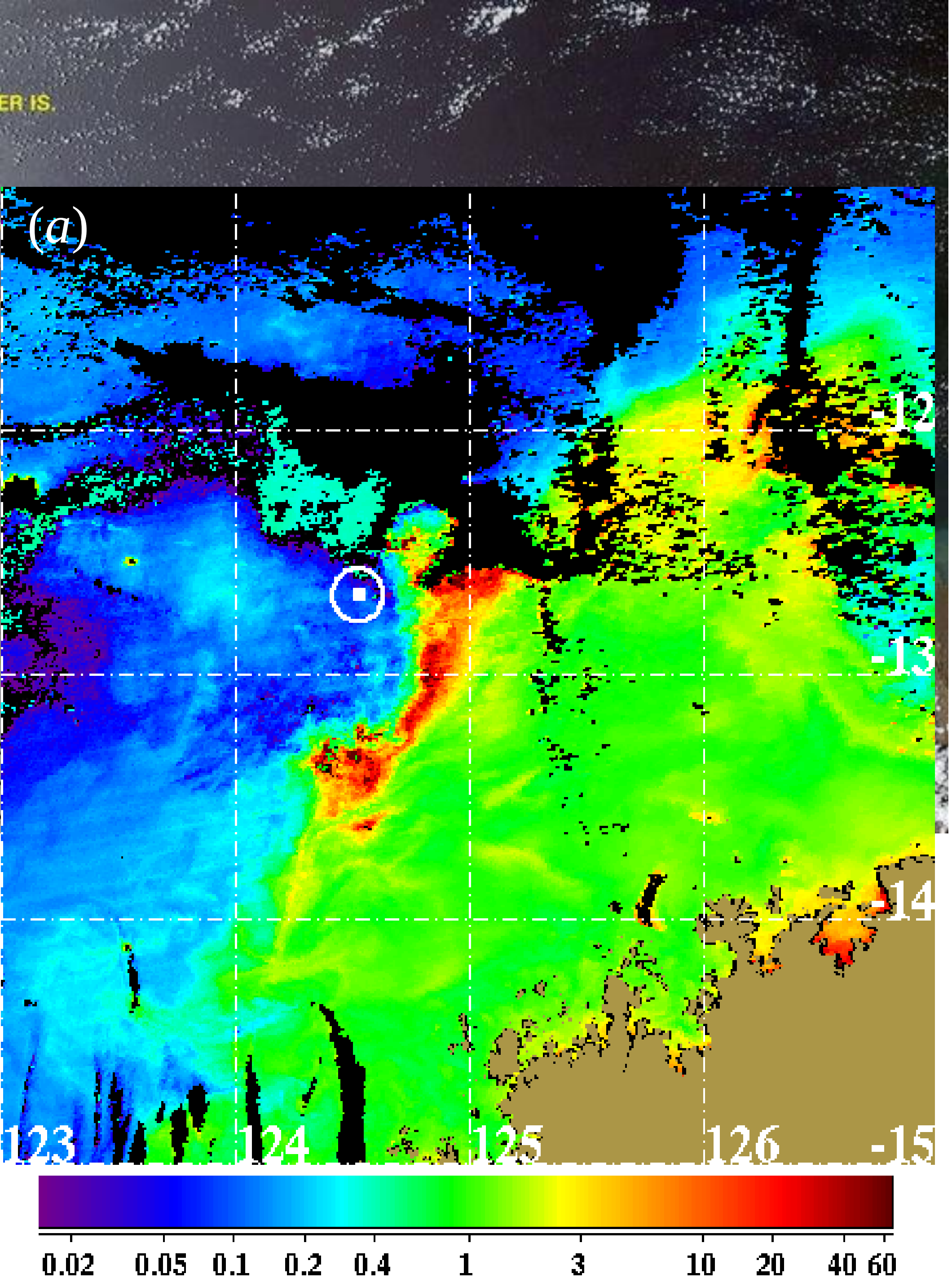


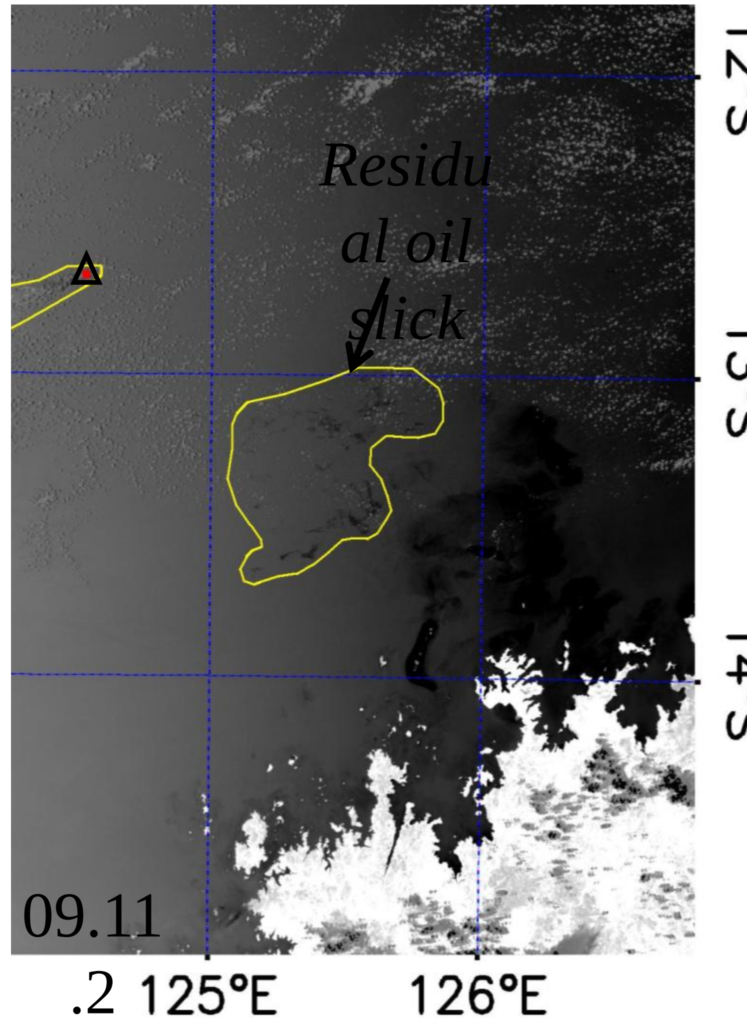
帝汶海





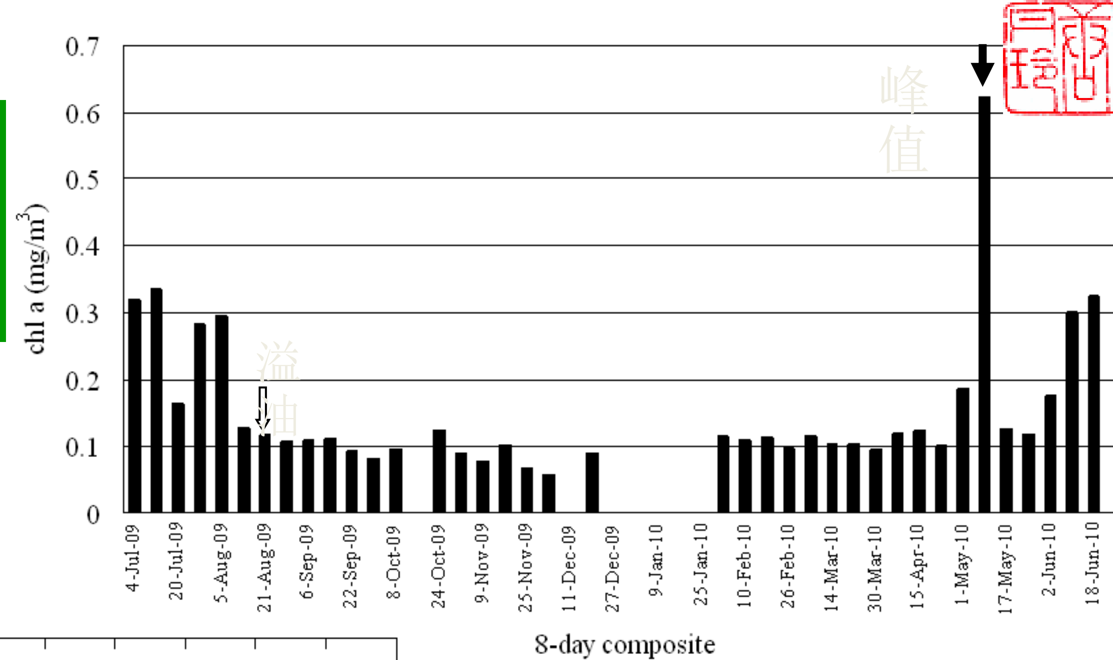
2. (2)Montara溢油后的海洋藻华

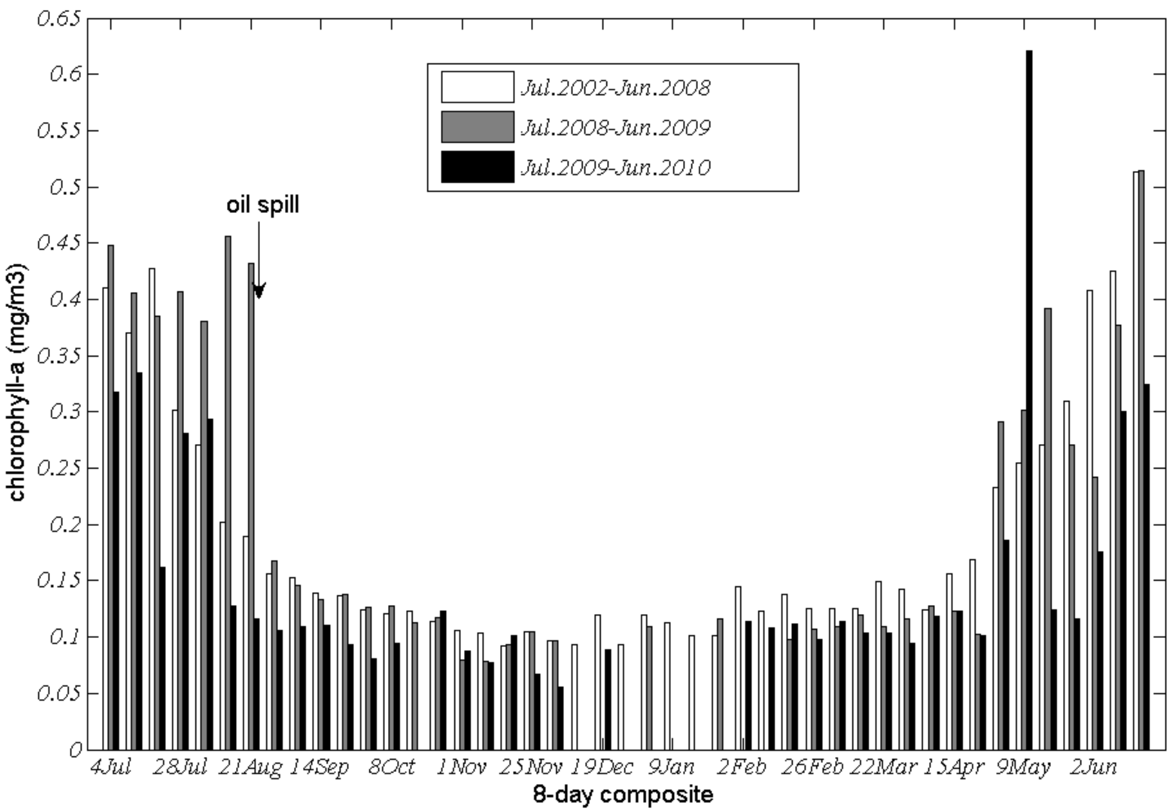




2. (2)Montara phytoplankton

Oil Spi



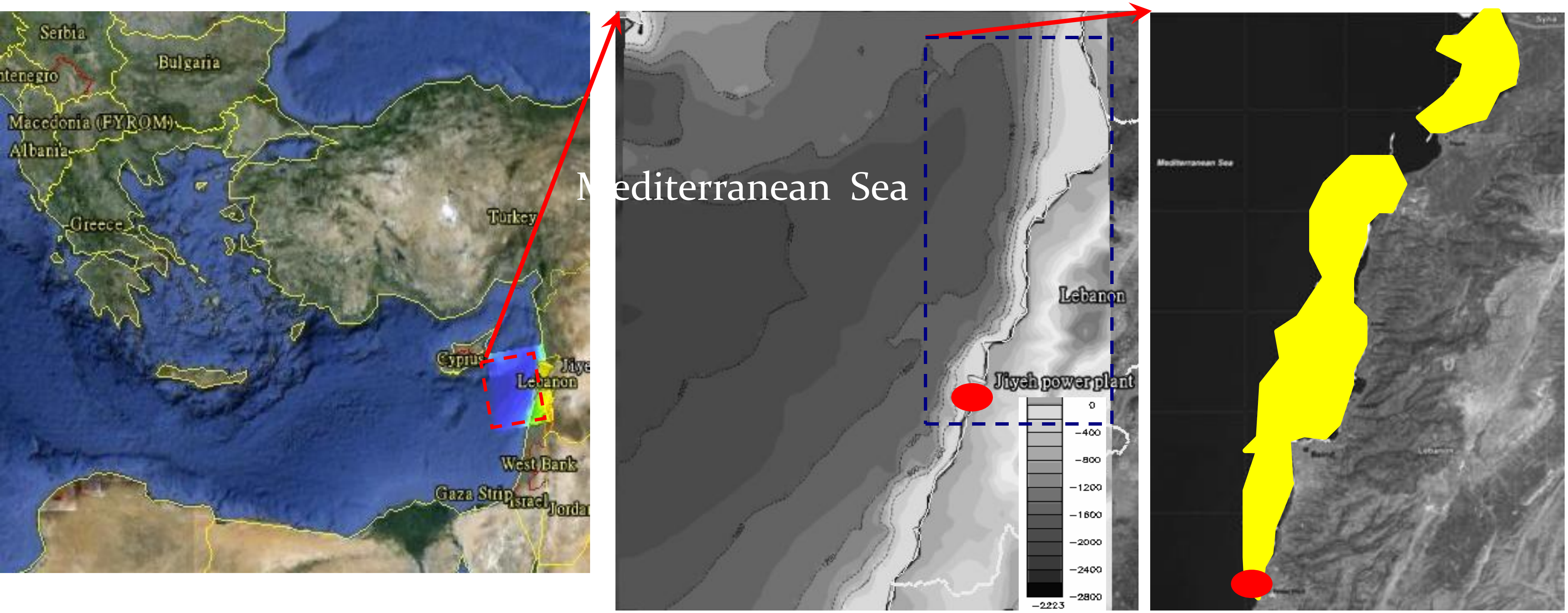


Satellite monitoring of phytoplankton in the East Mediterranean Sea after the 2006 Lebanon oil spill

Gang Pan, DanLing TANG， and Yuanzhi ZHANG201２, International Journal of Remote Sensing. Vol. 33, No. 23, 10 December 2012, 7482–7490。（SCI）

Tang DanLing 唐丹

Phytoplankton in the East Mediterranean Sea after the 2006 Lebanon oil spill



(b). The yellow area shows the extend of oil spill, which derived from ASAR and MODIS data

(c). The red ellipse in *(b)* and *(c)* show the Jiyeh Power Plant.

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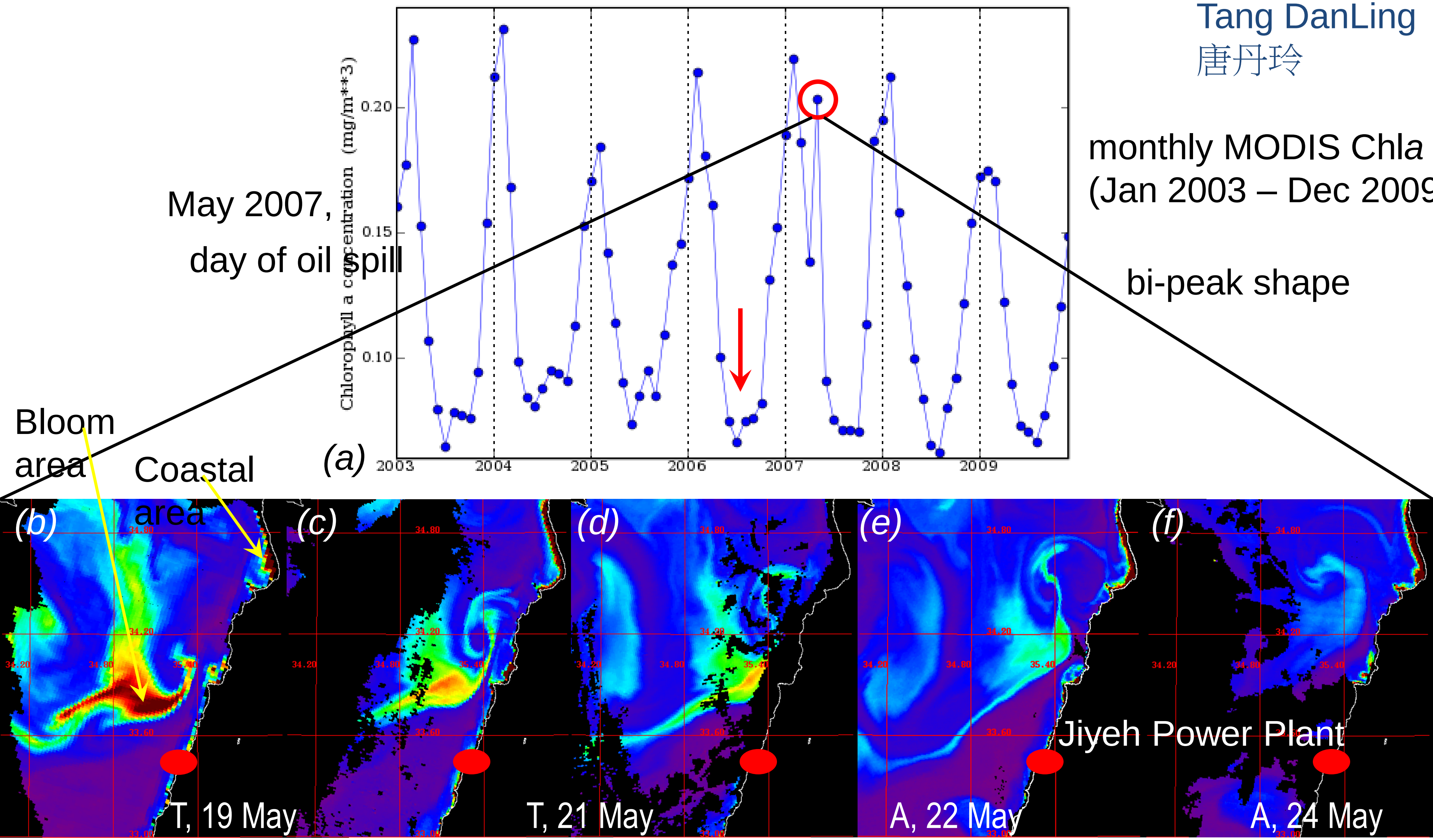

MODIS onboard Terra (T) and Aqua (A) from 19-27 May 2007.

Black area represents land, clouds or missing data. White line represents coastline.

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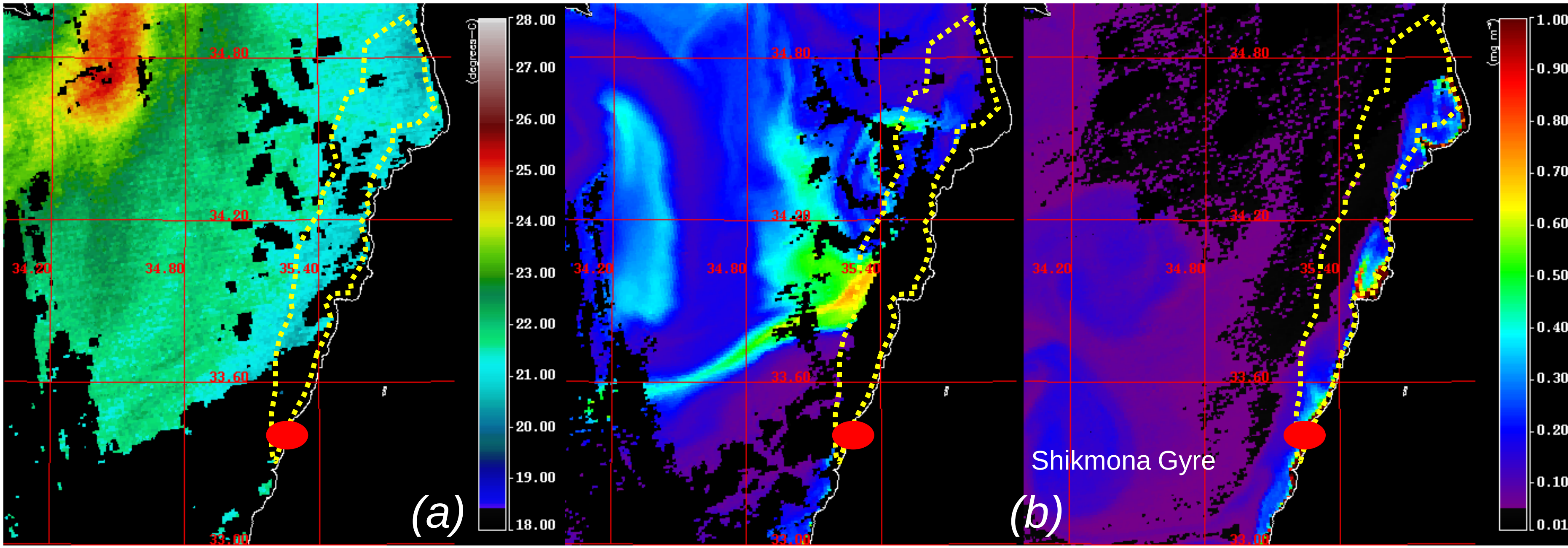
SST *(a)* and Chl*a* *(b)* on 22 May 2007 after 10 months of the oil spill accident were present.



Shikmona Gyre was located in the left lower of the Chl*a* image on 23 Aug 2006

Yellow dotted line represents the maximum extend of oil spill.

2.（3）重大溢油事故后浮游植物的变化情况

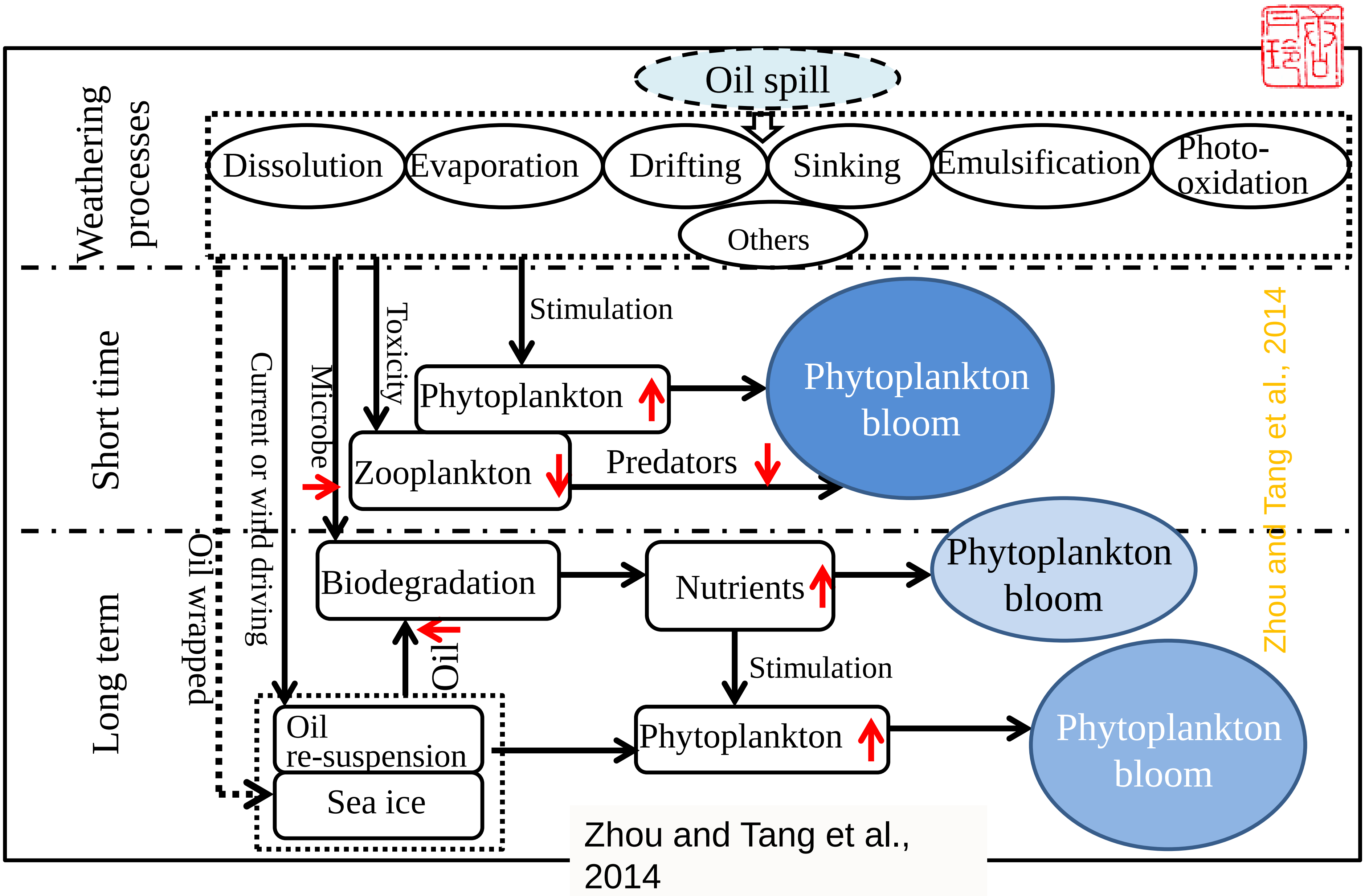

Oil spill
Weathering processes
Dissolution
Evaporation
Drifting
Sinking
Emulsification
Photo-oxidation
Others
Short time
Long term
Stimulation
Toxicity
Microbe
Current or wind driving
Oil wrapped
Phytoplankton
Phytoplankton bloom
Zooplankton
Predators
Biodegradation
Nutrients
Phytoplankton bloom
Oil
Stimulation
Oil re-suspension
Sea ice
Phytoplankton
Phytoplankton bloom
Zhou and Tang et al., 2014
Zhou and Tang et al., 2014

Fig.10

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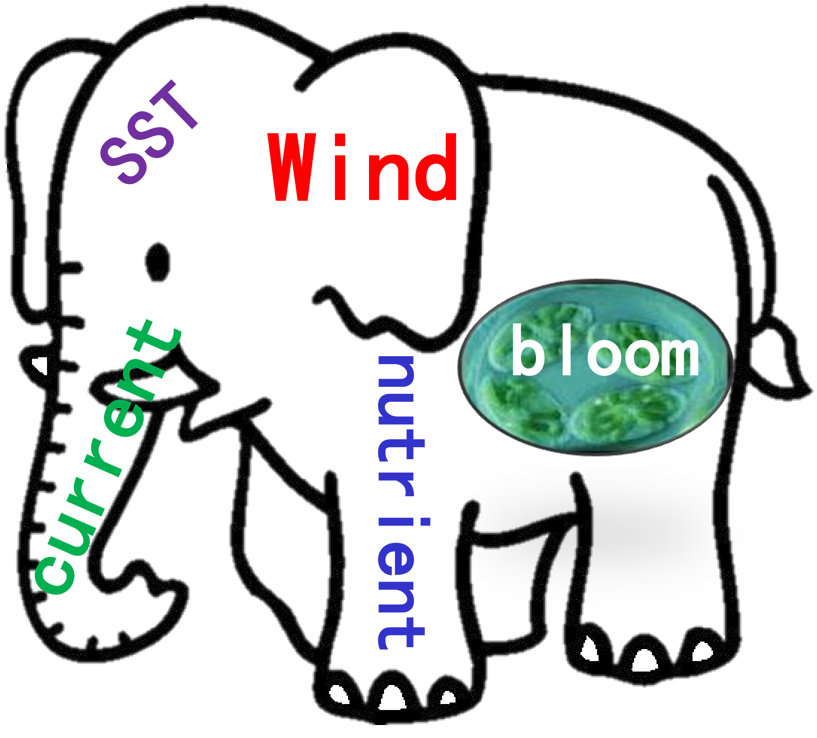
6

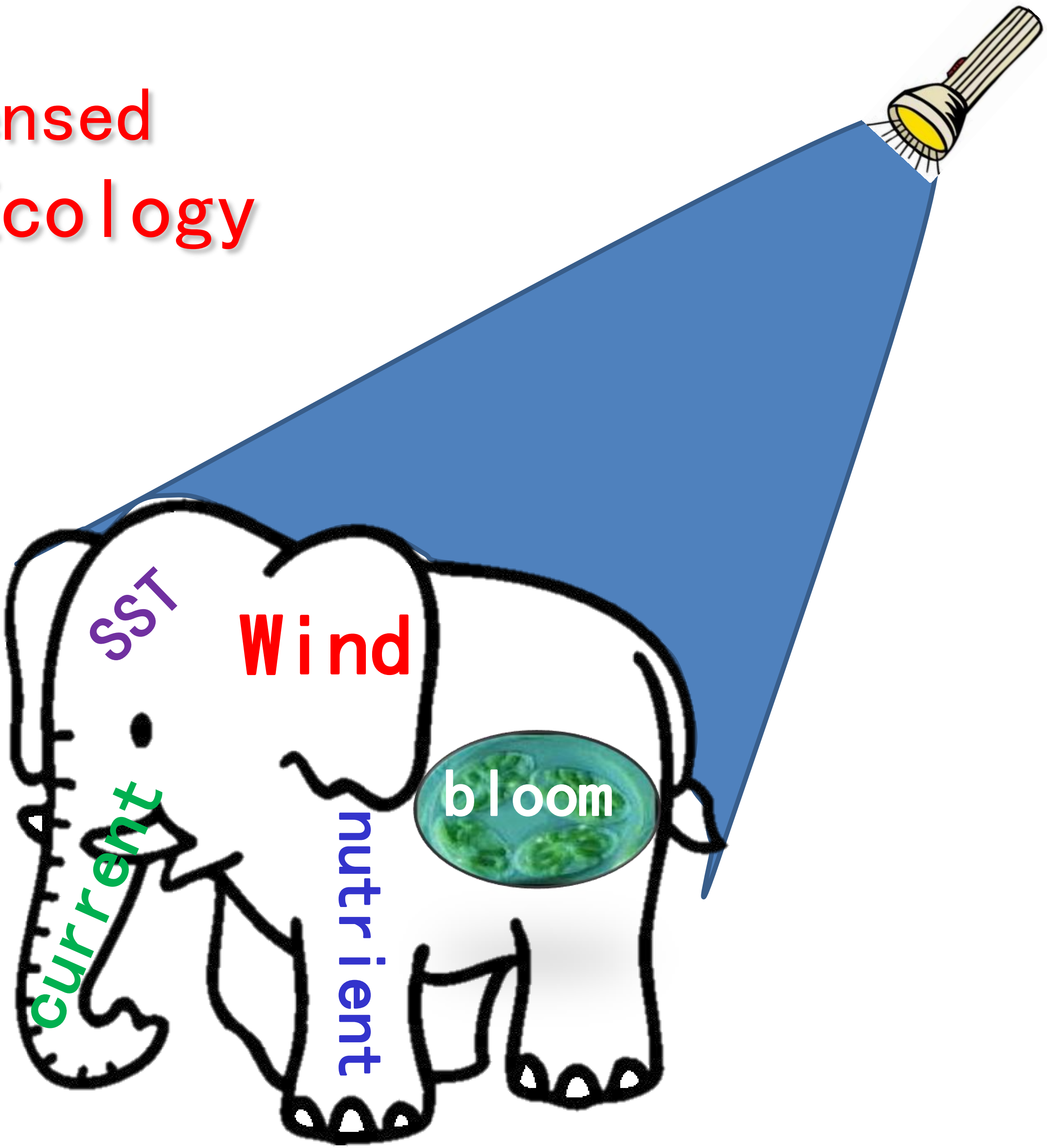
Remote Sensing Marine Ecology

遥感海洋生态

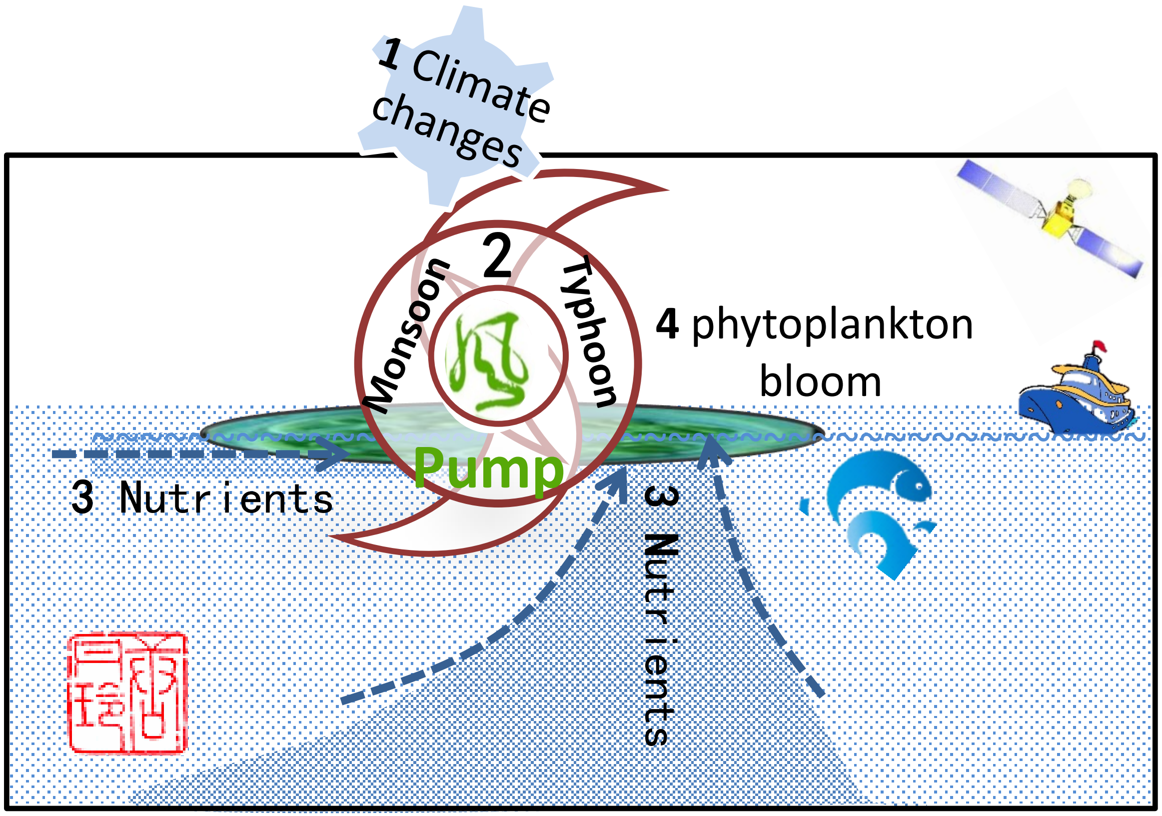


SST
Wind
current
nutrient
bloom

Remote Sensed Marine Ecology



http://lingzis.51.net/ Lingzistdl@126.com



Climate –wind –SST-nutrients—blooms- production--

Ecosystem

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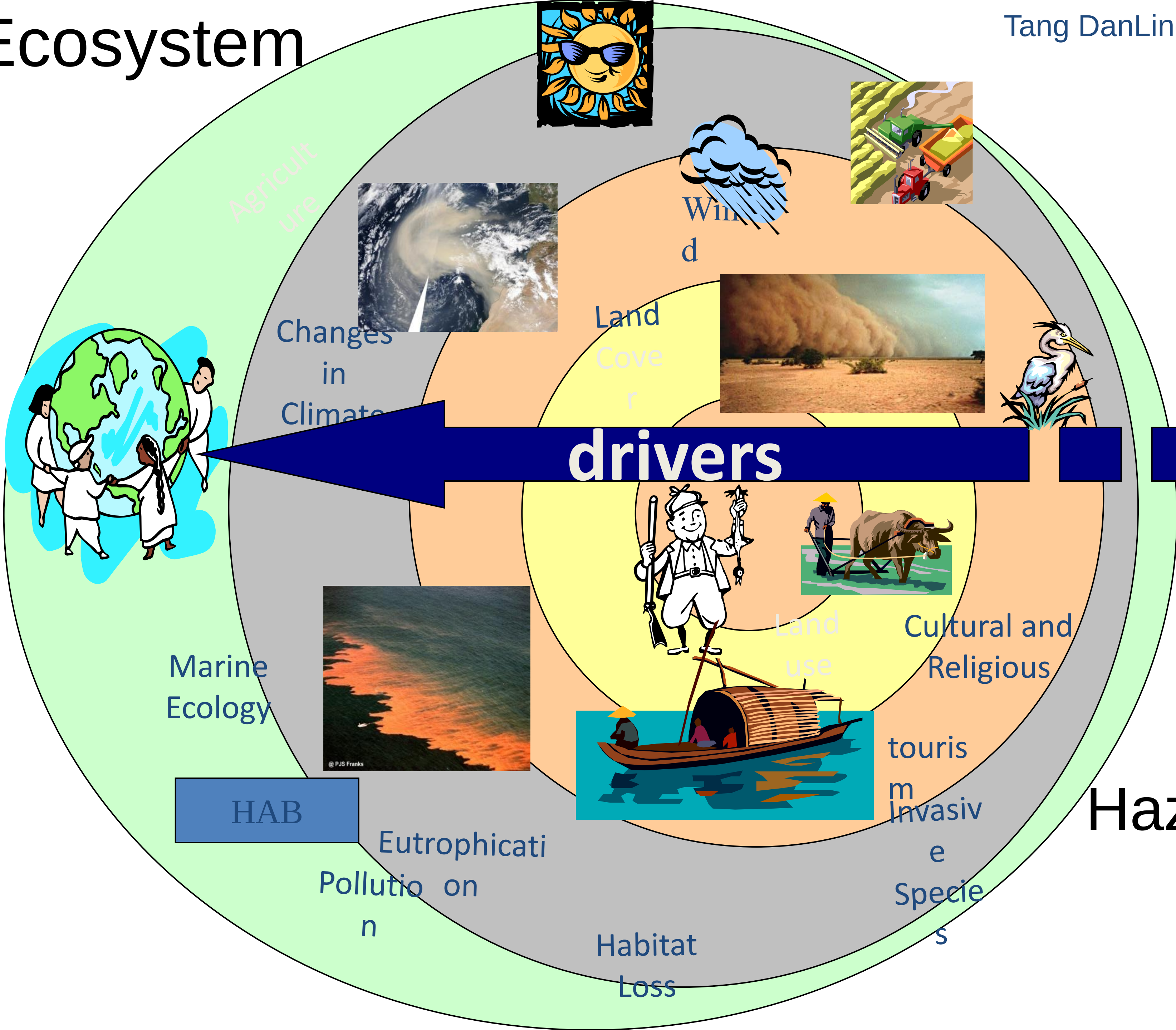

Hazard

welcome!

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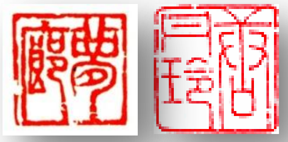

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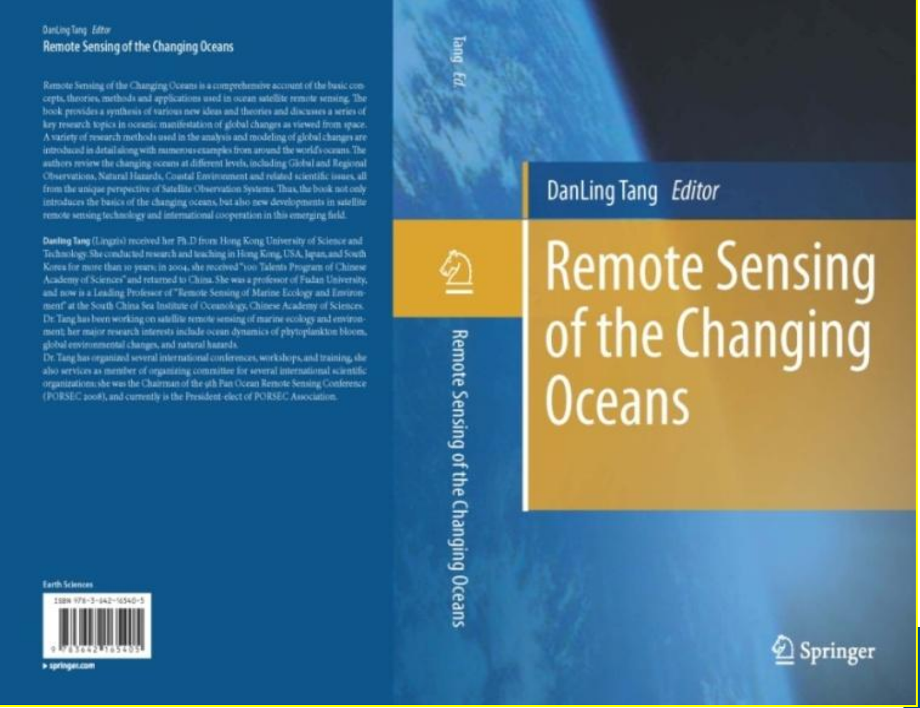
http://porsec2014.unud.ac.id/

PORSEC Training



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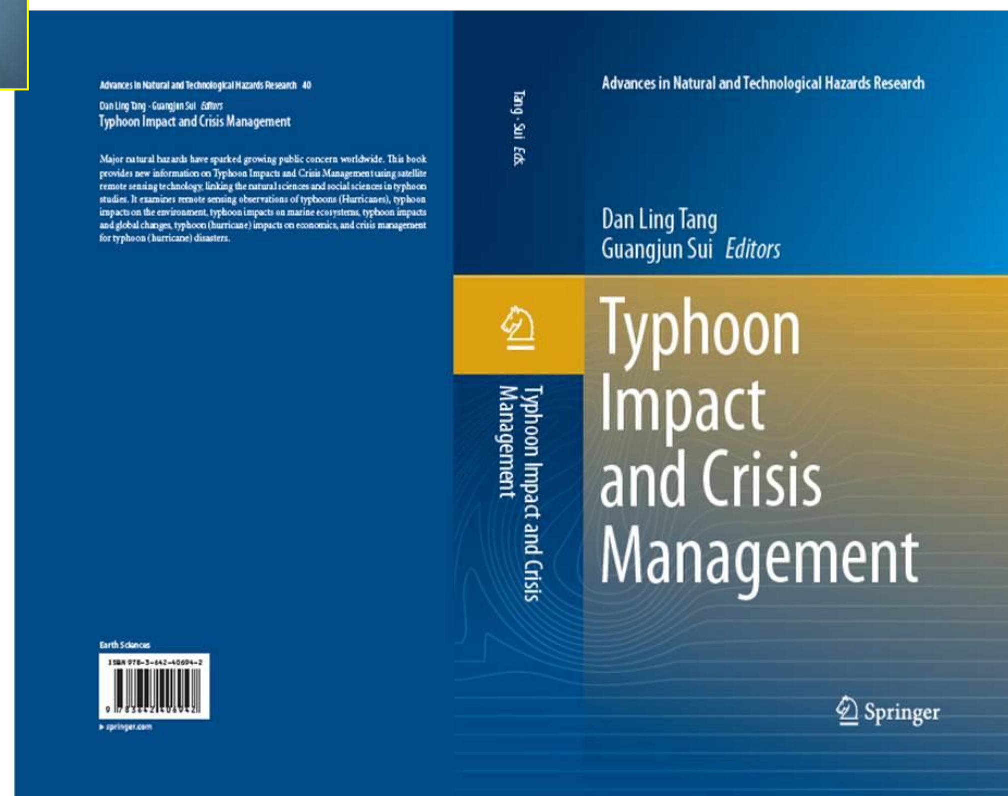

ISBN 978-3-642-40694-2

DanLing TANG (lingzis)

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