Open-ocean, long-term moorings operated by Taiwan
Past, present, and future

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Acknowledgements:

Outline

I. Observations over the past two decades

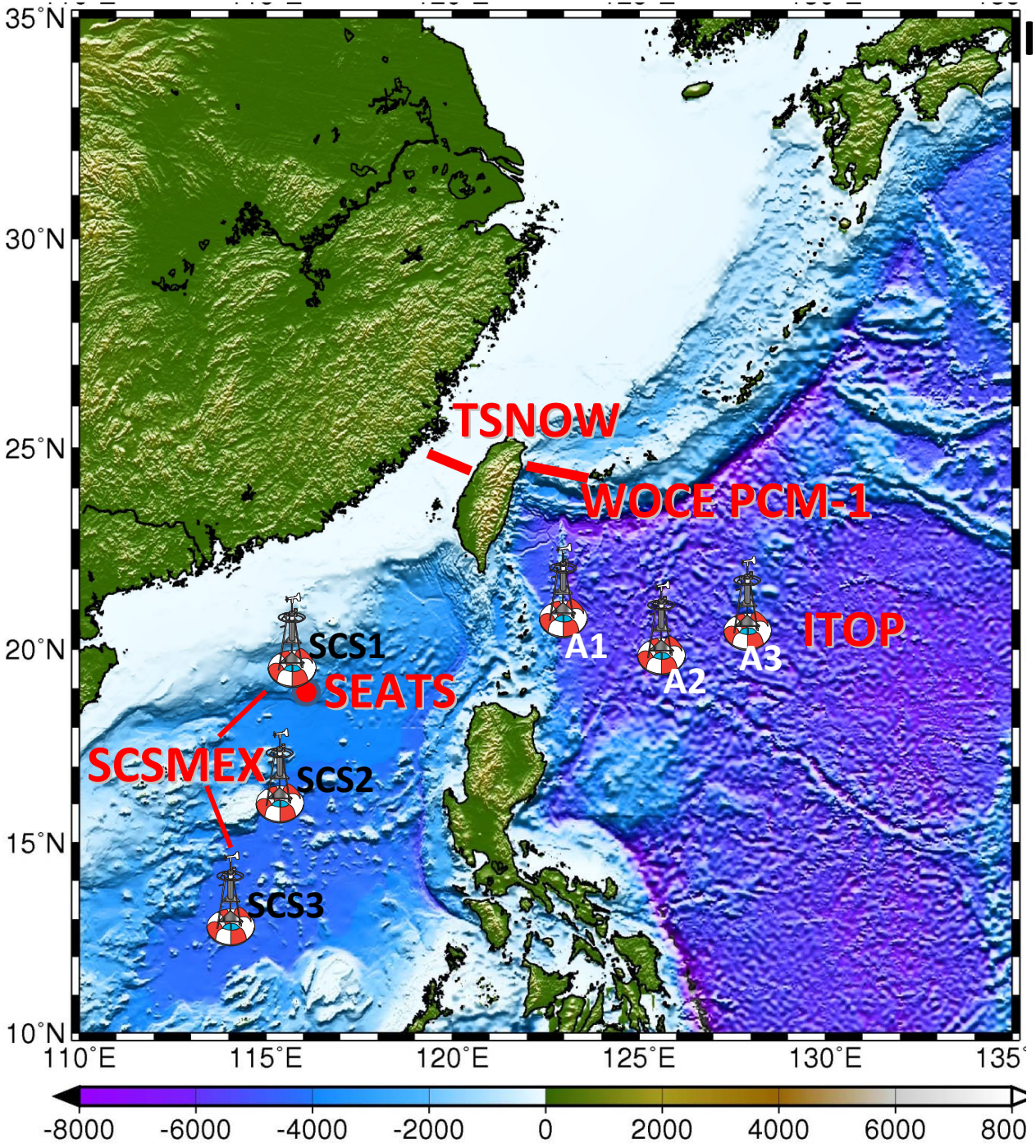
WOCE (PCM-1), SCSMEX, TSNOW, SEATS, and ITOP

II. Existing observations

SEATS and OKTV

III. Future plans

TLOIGO, OKTV, and SEATS



I. Historical observations

WOCE PCM-1 (1994-1996) 24±10 Sv (Johns et al., 2001; Yang et al., 1999, 2001, 2003)

Southeast Asia Time-series Station (SEATS, 1998-2007)

South China Sea Monsoon Experiment (SCSMEX, 1997-1999)

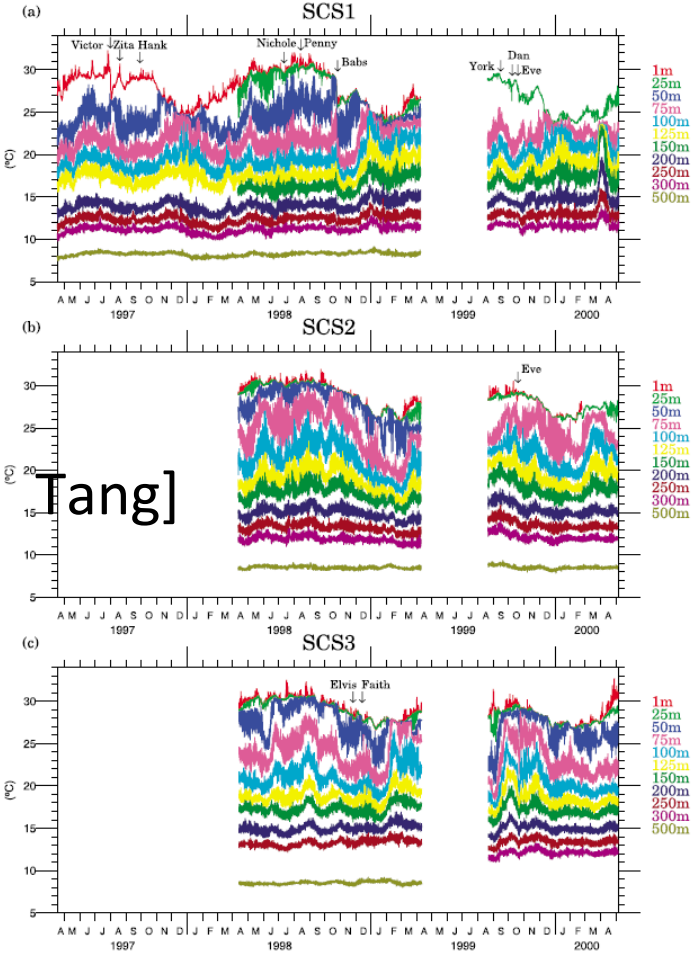
Taiwan Strait Nowcast (TSNOW, 1999-2001) -0.26 — 2.34 Sv (Jan et al., 2006)

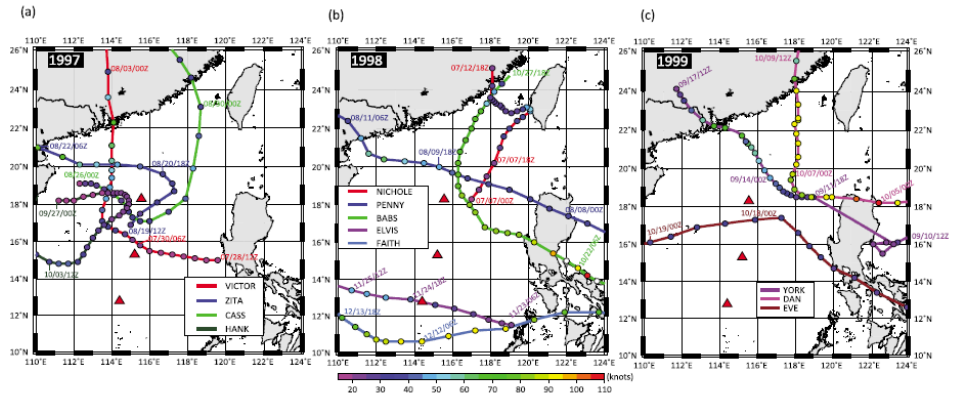
Impact of Typhoons on the Ocean in the Pacific (ITOP, 2009-2010)

More explanations

SEATS — The operation has been transferred to Academia Sinica since 2008, measuring CTD, Velocity, DO, Nuts, Chla, DIC, POC/N, Low DIP, Iron, Trichoes., TM, BB/BP, PP, ^{13}C, Zooplan. , and Sed.

SCSMEX —Captured 7 typhoons in the South China Sea over 1997-1999 and found dramatic temperature changes and velocity fluctuations during and after typhoons. The data greatly improve our understanding of influences from typhoons to the SCS. [Credit: David Tang]

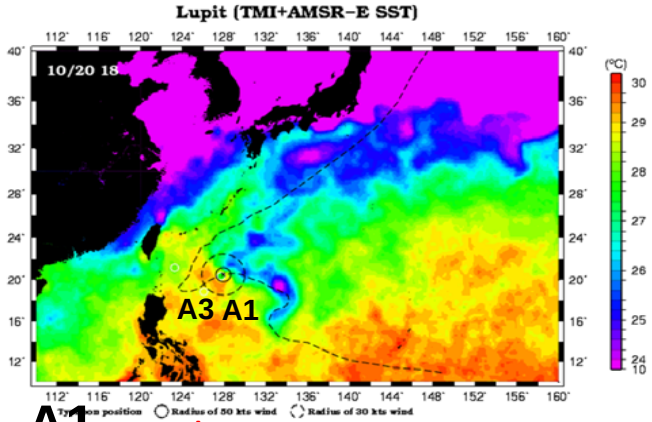




[Credit: David Tang]

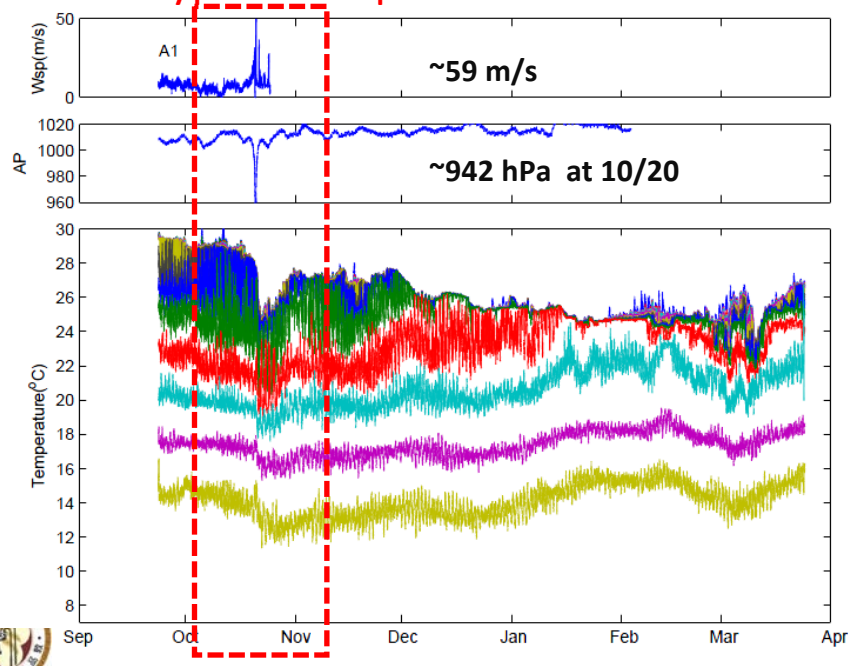
More explanations

ITOP — Two of the three surface moorings captured ocean responses to Typhoon Lupit (category 5) during Oct. 15-27, 2009.

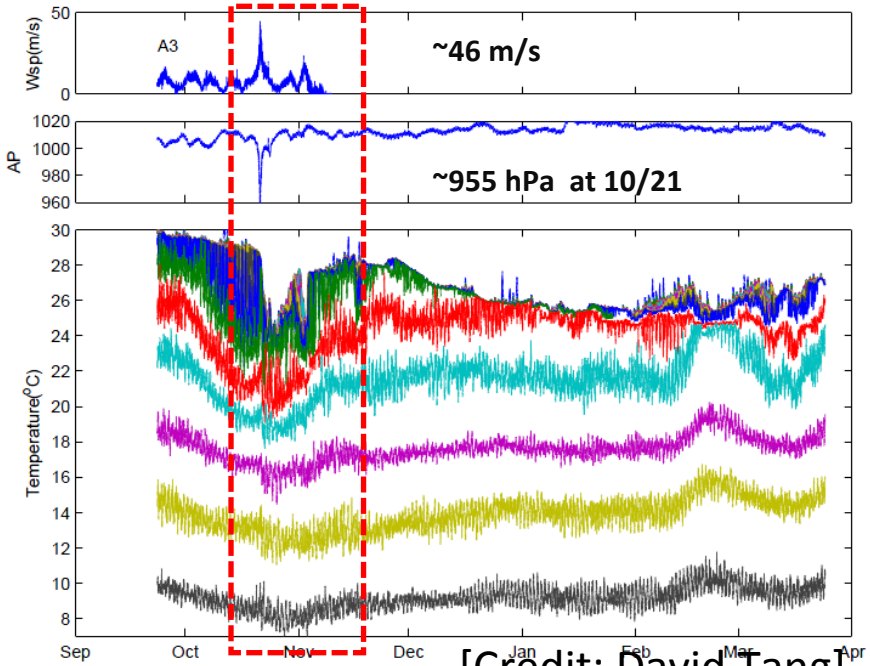


200920 Lupit	
Formation	2009-10-15
Dissipation	2009-10-27
Minimum Pressure	930 (hPa)
Maximum Wind	95 (knots)
Average Speed	20.8 (km/h)
Largest Diameter of Storm Wind	370 (km)

A1 Typhoon Lupit

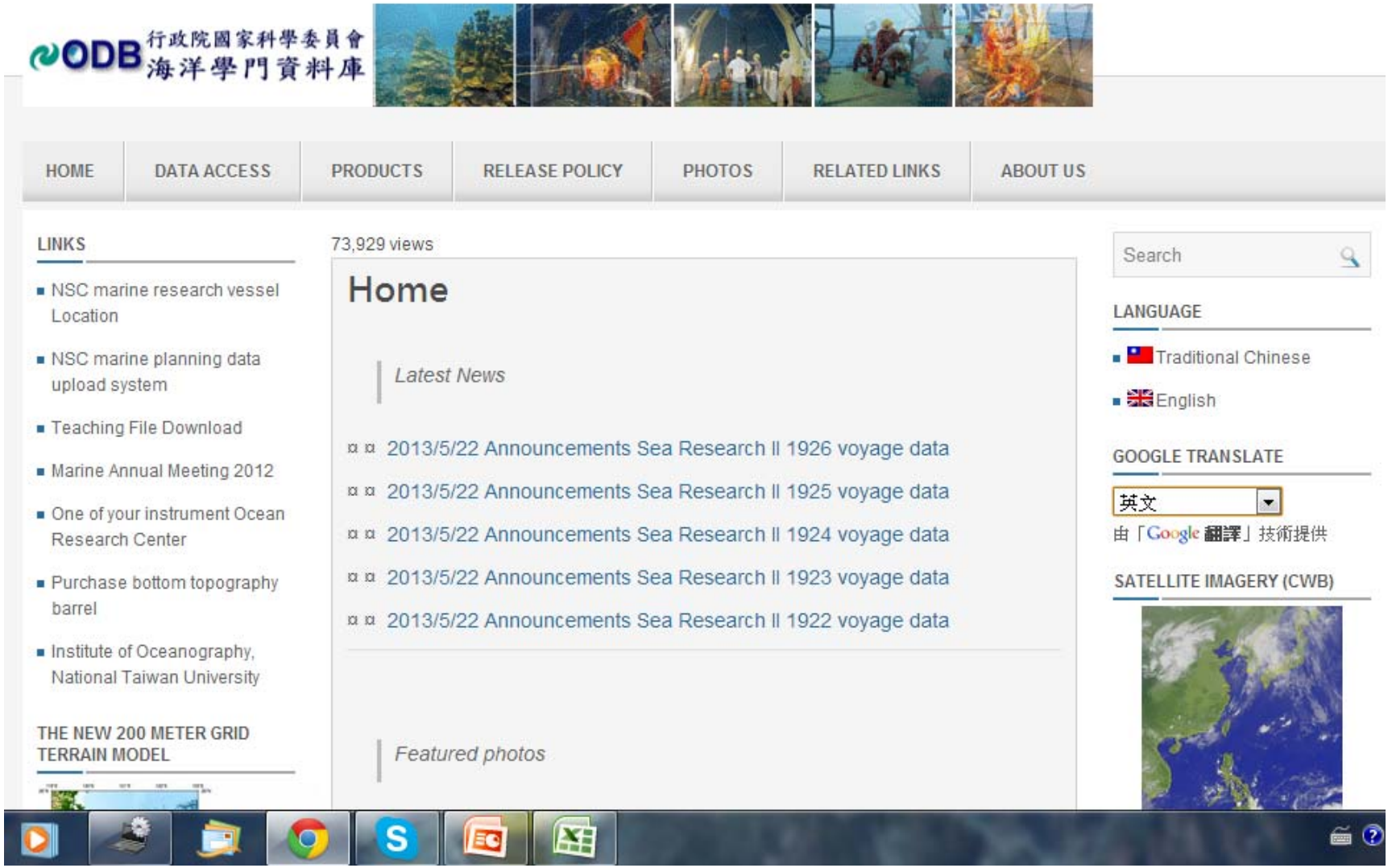


A3



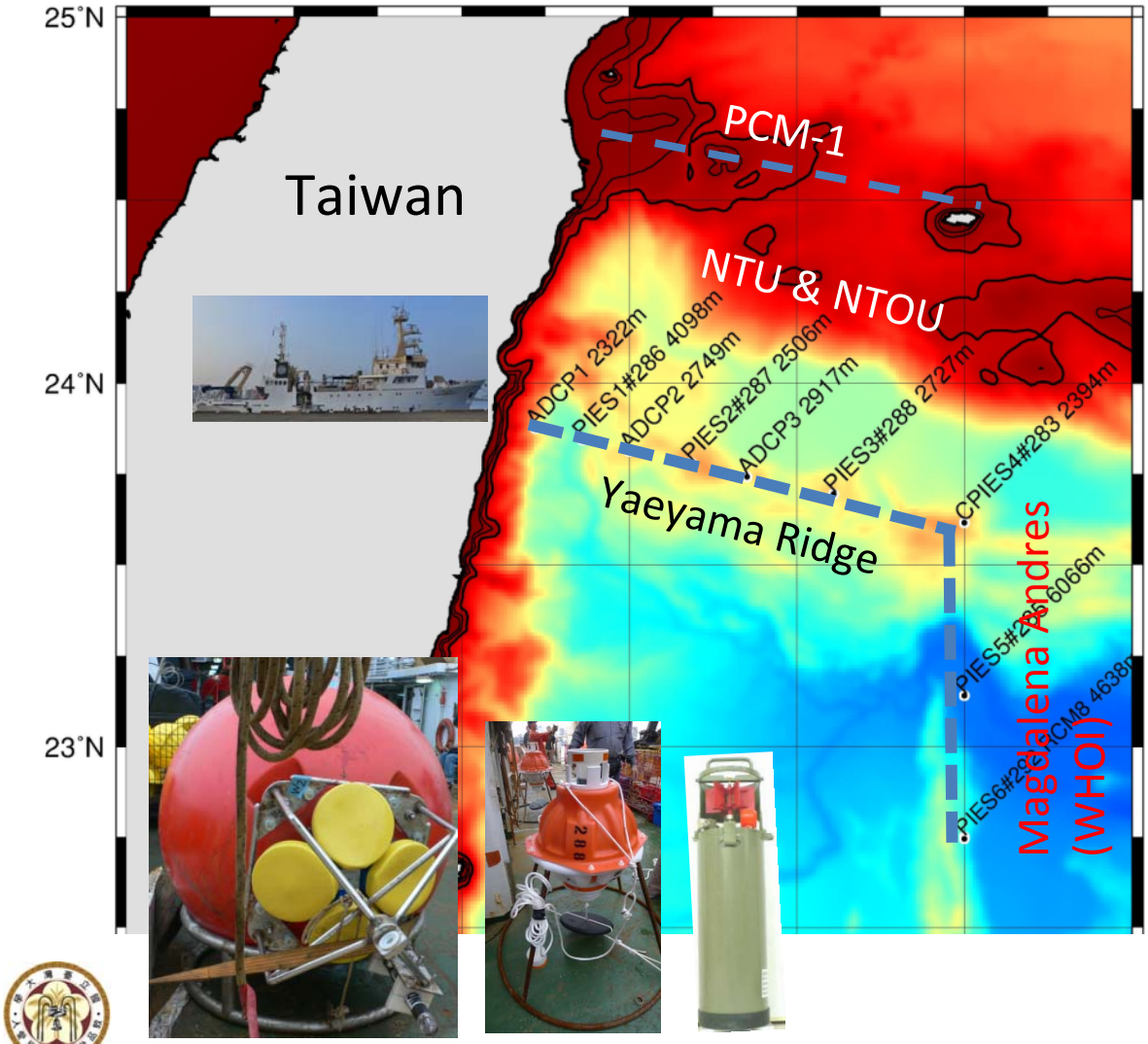
[Credit: David Tang]

The historical data are stored at Ocean Data Bank, NSC



II. Existing observations

Observations of Kuroshio Transports and their Variability (OKTV) is a counterpart of the U.S. Origins of Kuroshio and Mindanao Currents (OKMC).

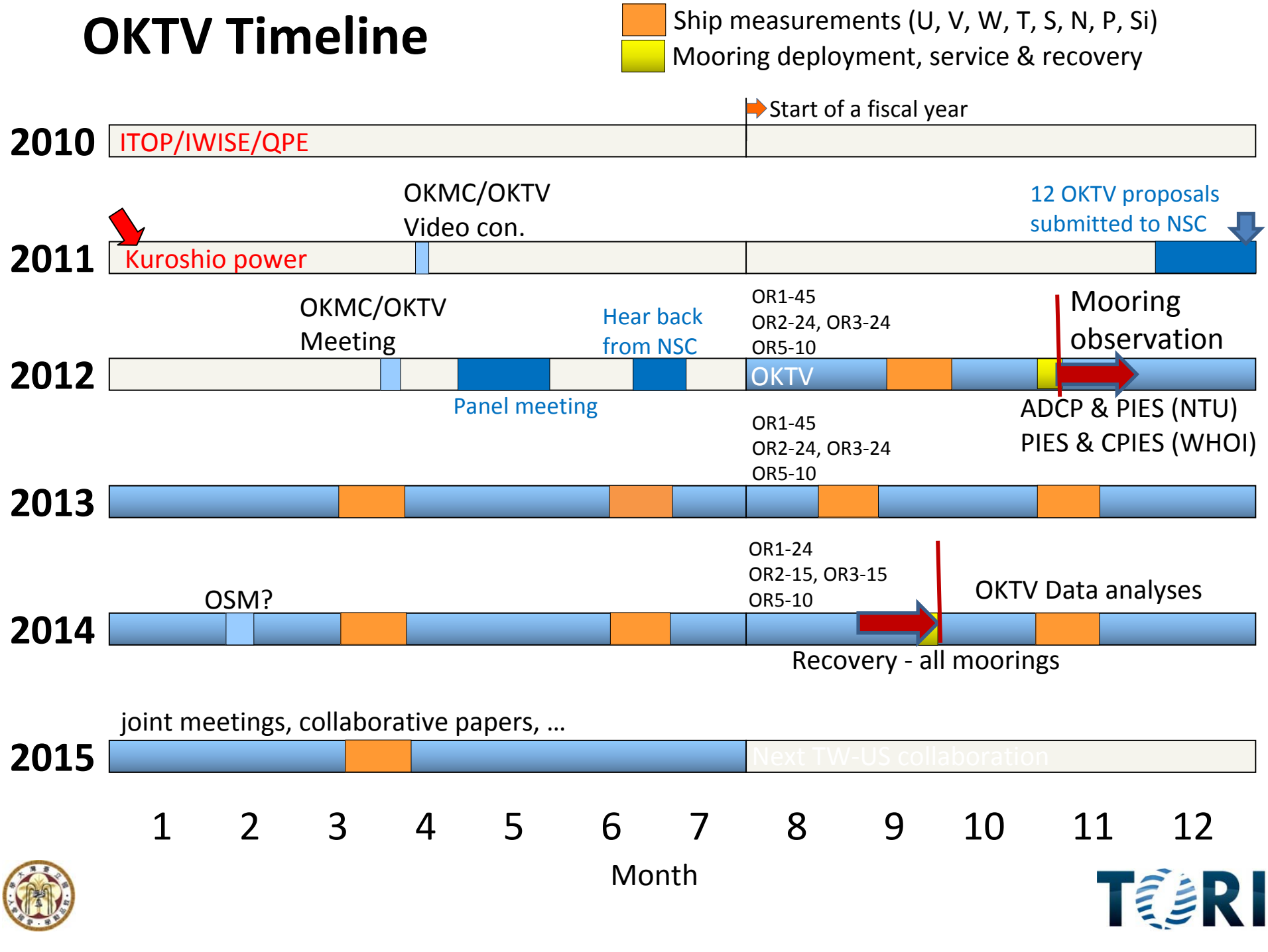


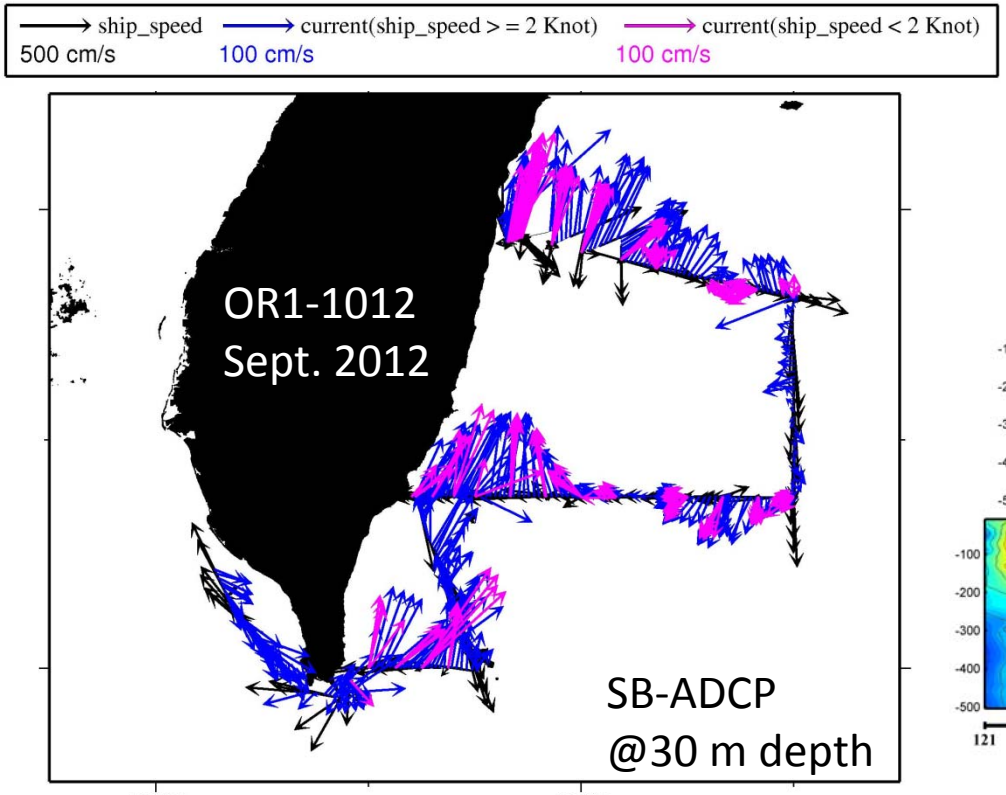
OKTV with 12 sub-projects is sponsored by the NSC, which aims to answer

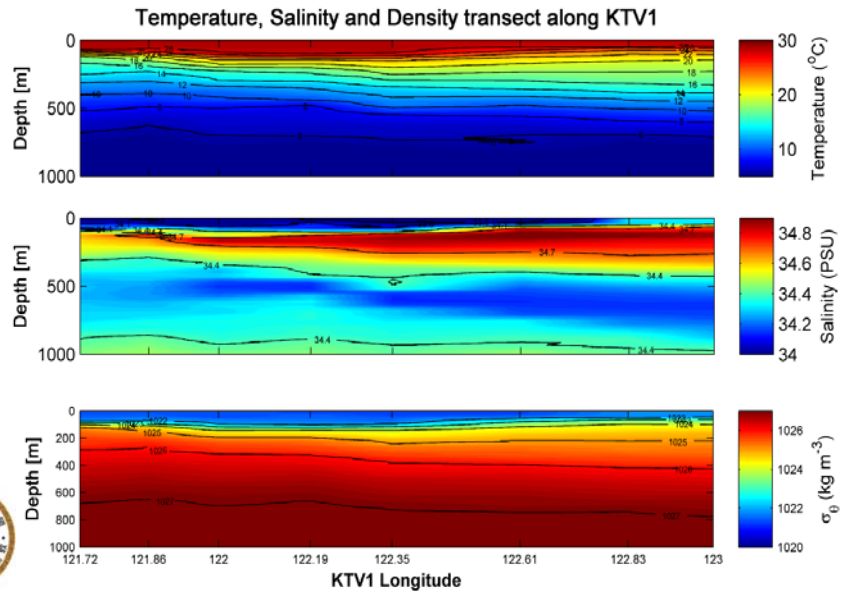
- Where is the Kuroshio?
- What are its hydrography and velocity structures?
- How is it affected by meso-scale eddies? etc.

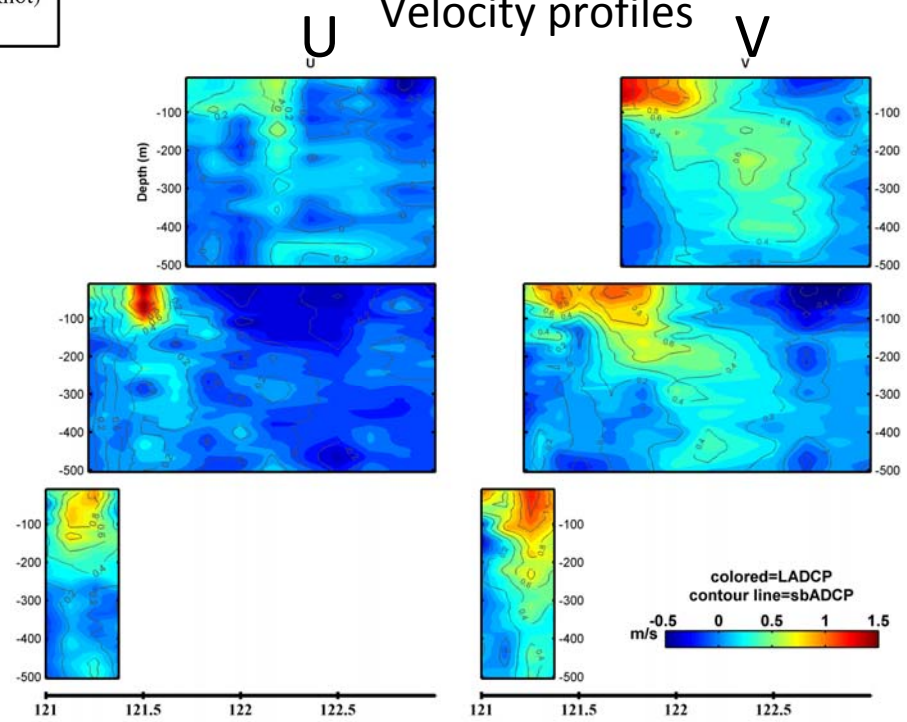
The hydrography, currents velocity, and biogeochemical concentrations are routinely measured by R/Vs four times a year for two and a half years. The current velocity is being measured by ADCPs, RCM-8s, PIES, and CPIES roughly along 24 ° N over Yaeyama Ridge and 123 ° E. The observation will last for two years.

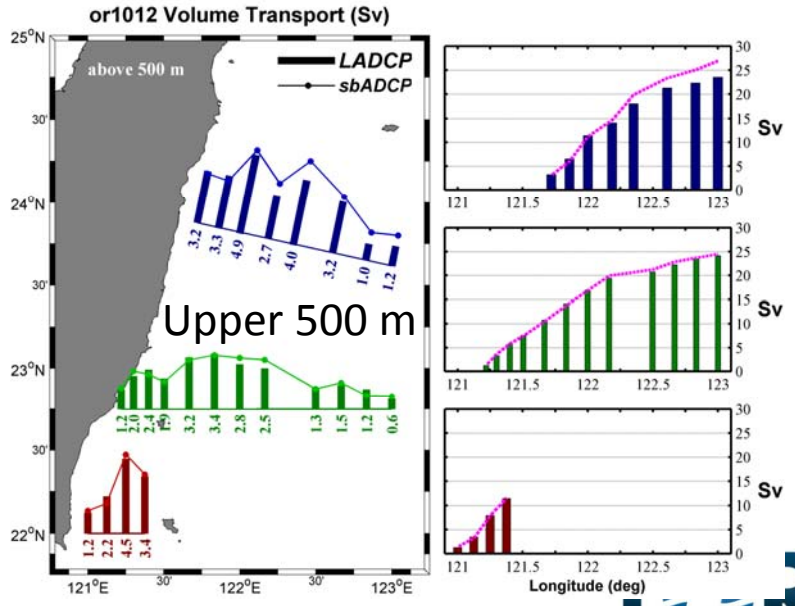
OKTV Timeline



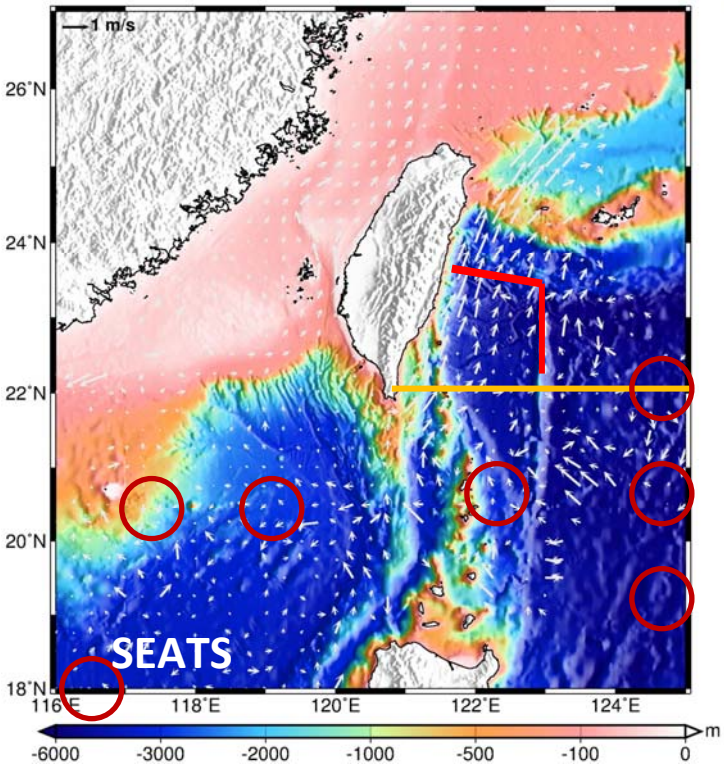

ship_speed
500 cm/s
current(ship_speed > = 2 Knot)
100 cm/s
current(ship_speed < 2 Knot)
100 cm/s
OR1-1012
Sept. 2012
SB-ADCP
@30 m depth
120°E
122°E


Temperature, Salinity and Density transect along KTV1
Depth [m]
Temperature (°C)
Salinity (PSU)
σθ (kg m-3)
KTV1 Longitude


Velocity profiles
U
V
Depth (m)
colored=LADCP
contour line=sbADCP
m/s


or1012 Volume Transport (Sv)
above 500 m
LADCP
sbADCP
Upper 500 m
Sv
Longitude (deg)

III. Future plans



Potential area for data buoy

Subsurface mooring array

Repeated ship measurement

TORI is planning to operate long-term surface and subsurface mooring observations in the seas around Taiwan and vicinity. The primary goals are to better understand

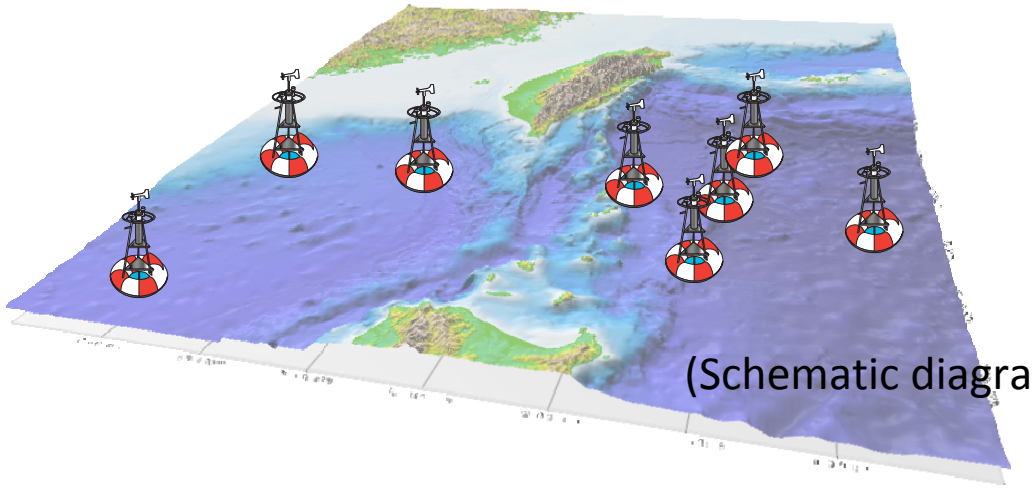
- Influence from global change to marine environment
- Air-sea interactions under the influence of typhoons
- Upper ocean variations to strong typhoon winds
- Impacts of typhoons and eddies on biogeochemical profiles in the upper 200 m
- Meso-scale eddies and western boundary current interactions
- Evolution of internal tides to nonlinear internal waves

and to support predictions.

Taiwan **L**ong-term **O**bservations of **I**mpacts from **G**lobal change to **O**ceans

Network of long-term Deep Sea Data Buoy

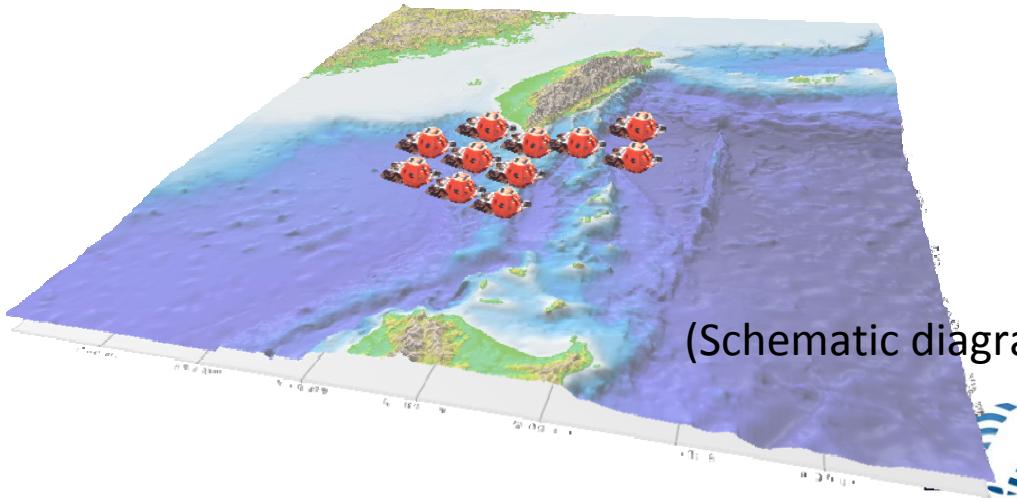
for better predicting of typhoons and understanding of climate change



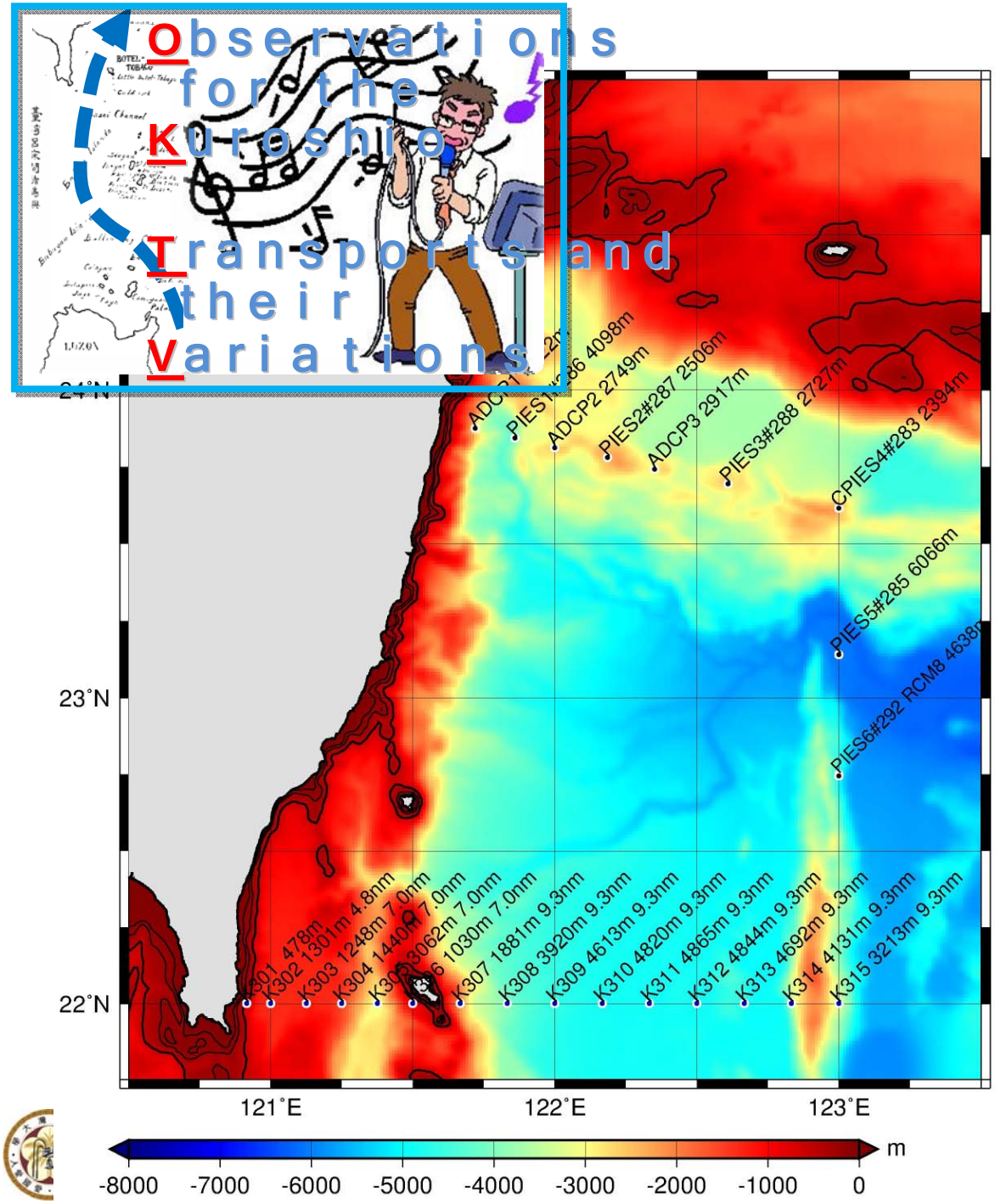
(Schematic diagram)

Network of Ocean Bottom Seismometer

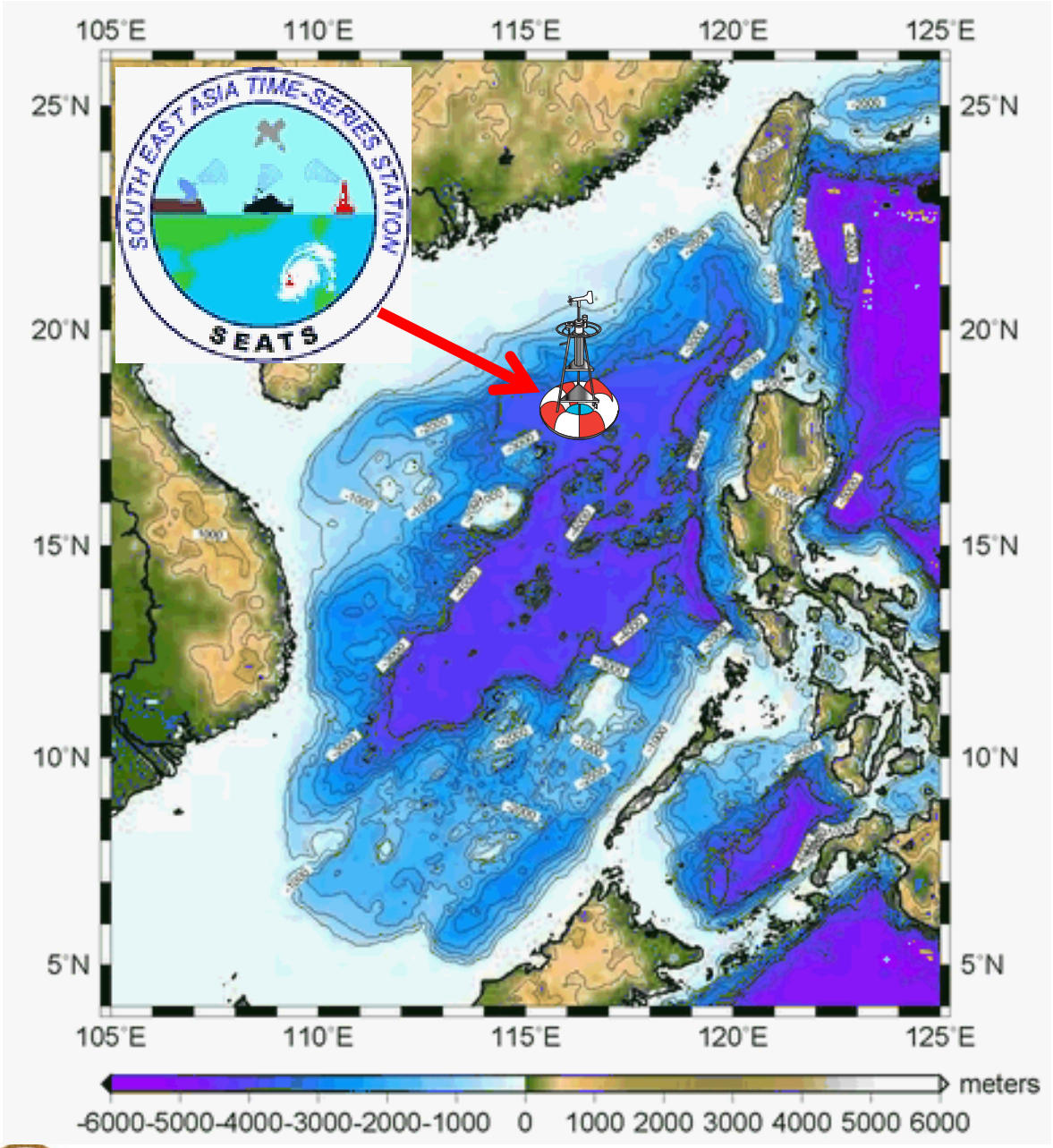
for better understanding of the movement of tectonic plates



(Schematic diagram)



After OKTV, TORI is willing to continue the subsurface mooring and shipborne measurements as one of her tasks on long-term monitoring of ocean environment.



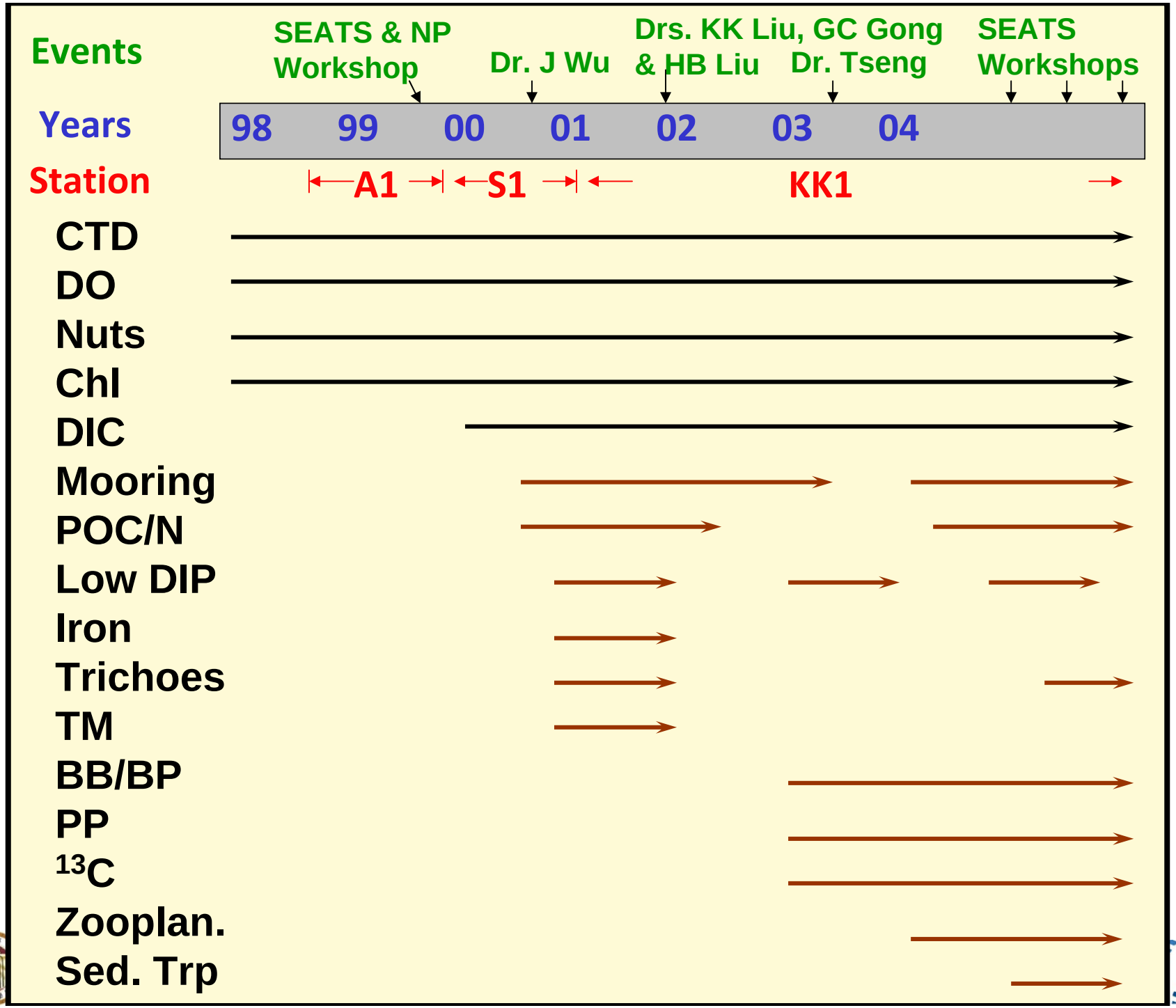
TORI will be collaborating with Academia Sinica to operate the surface mooring at SEATS.

We are here showing our willingness to participate OceanSITES.

Thank you!

Cruises conducted by National Center of Ocean Research (NCOR)

Year	Operations
1997	Proposal initiation
9/98-7/99	Bimonthly pilot sampling at St. A1
9/99-present	Seasonal samplings at St. S1/KK1/K1
1999	Sept., Nov.
2000	Jan., Mar., May, Jul., Oct., Mooring
2001	Feb., Jun., Oct., Dec., Mooring
2002	Mar., Jul., Sept., Nov., Mooring
2003	Jan., Mar., Aug., Oct., Dec., Mooring
2004	Mar., May, Aug., Nov., Mooring
2005	Jan., Mar, Jul., Nov., Dec
2006	Jun., Oct.
2007	Jan., Jul., Oct.


Events
SEATS & NP Workshop
Dr. J Wu
Drs. KK Liu, GC Gong & HB Liu
Dr. Tseng
SEATS Workshops
Years
98
99
00
01
02
03
04
Station
A1
S1
KK1
CTD
DO
Nuts
Chl
DIC
Mooring
POC/N
Low DIP
Iron
Trichoes
TM
BB/BP
PP
13C
Zooplan.
Sed. Trp

Platforms

- Cruises – samples for multiple measurements, less temporal resolution, reasonable spatial coverage.
- Satellites – few parameters measured, good temporal resolution, expansive spatial coverage confined to the sea-surface.
- Sediment traps – samples for multiple measurements, time integrated signals, depth coverage possible, limited spatial coverage.
- Sensors mounted on moorings – real time or near real time signals, few parameters measured, depth coverage possible, limited spatial coverage.

TORI