THE JAPAN-TAIWAN JOINT SURVEY ON COMBINING OCEAN RADAR DATA IN THE KUROSHIO UPSTREAM REGION

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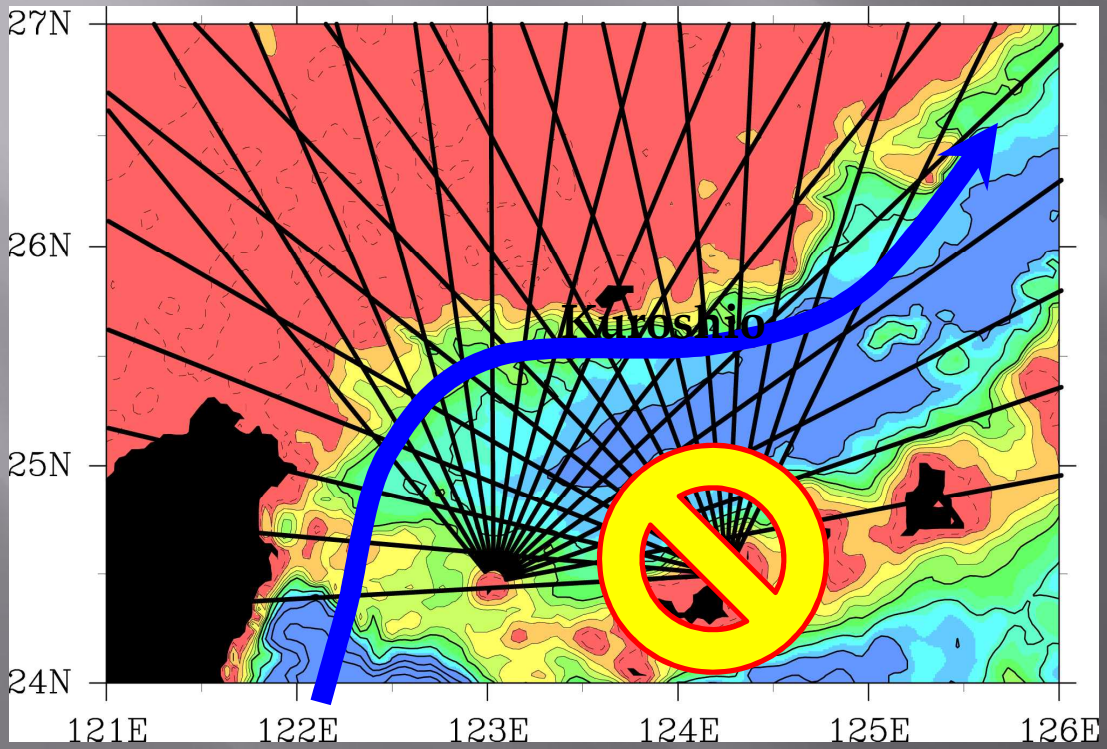
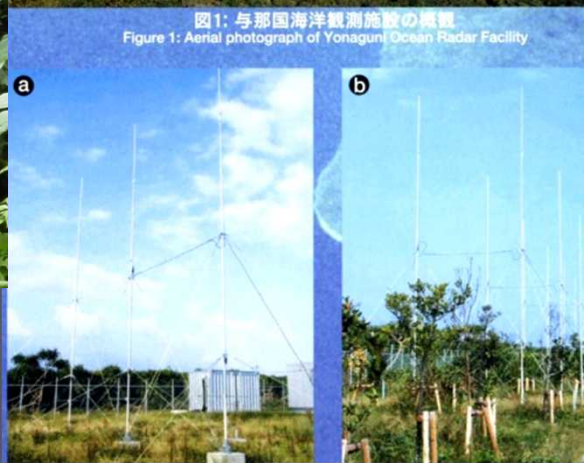
End of NICT Ishigaki radar

- Started in 2001/07, but **Closed** in 2010
  - due to the end of the land tenancy



Present Ishigaki site



- In June, 2012
  - quick recovery within 2 years

Yonaguni radar site and CODARs by TORI

- Still active, but radial velocity only
- Recently, many CODARs are deployed and maintained by TORI
  - Try to cooperate with TORI
    - with TORI and NICT, full upstream Kuroshio region will be covered

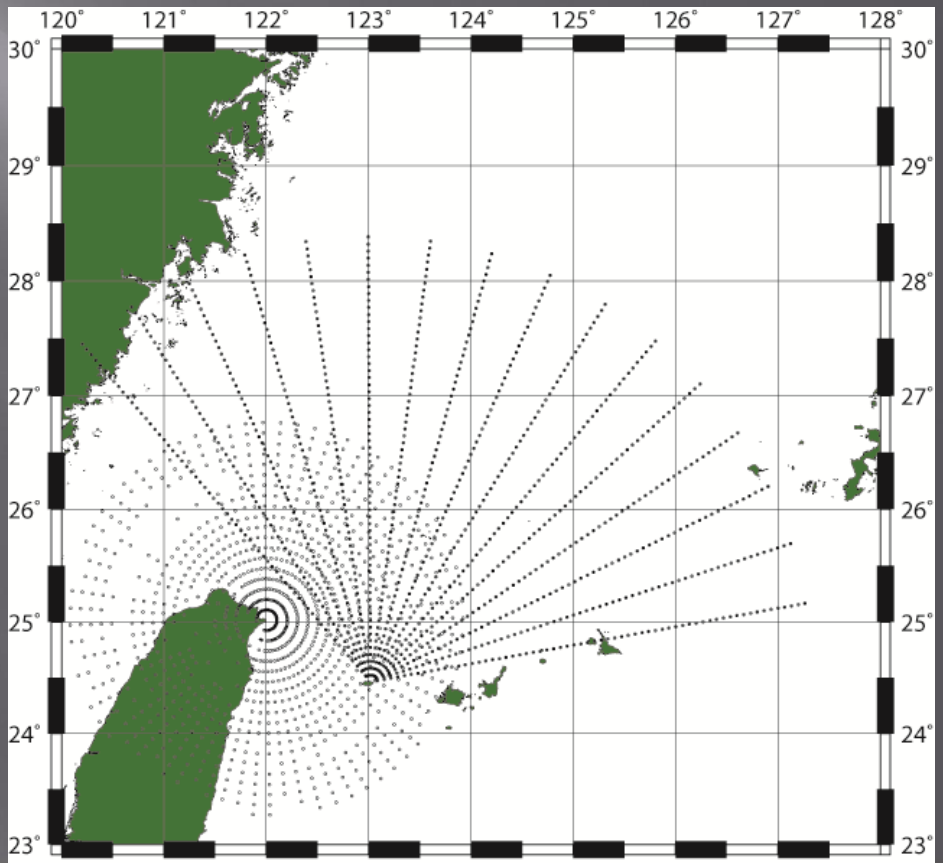
圖1：CODAR測流系統佈置規劃

MOU between HyARC and TORI

- MOU between TORI and HyARC, Nagoya Univ., the official provider of NICT ocean radar data
  - 2 years from 2012/1/1
- Sharing Ocean Radar Data
  - mutual data exchange via ftp servers
- Sharing technical/scientific knowledge
  - Data processing, error budgets of different ocean radars
  - Separation of tidal & wind-driven components
  - Mapping interpolations in space and time
- Conduct joint surveys

Joint survey in June, 2012

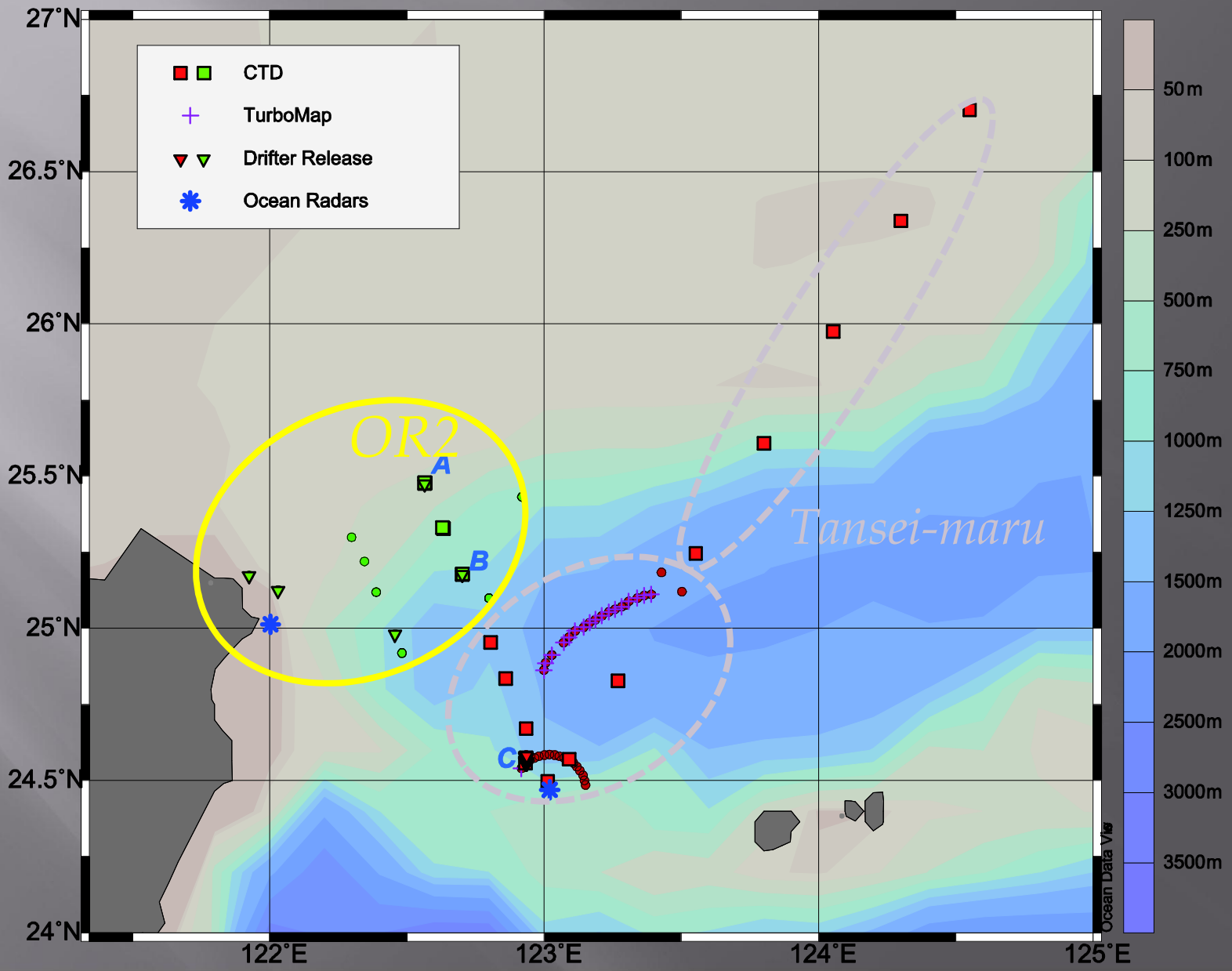
- TORI set test radar site at Sandiaojiao during 13-19 June, 2012. NICT keeps Ishigaki site.
- Simultaneous survey by both Japan and Taiwan R/Vs
  - Japan; *Tansei-maru*
    - Kyushu Univ.
    - Nagoya Univ.
    - Univ. of the Ryukyus
  - Taiwan; *OR2*
    - Nat. Taiwan Univ.
    - TORI



R/V

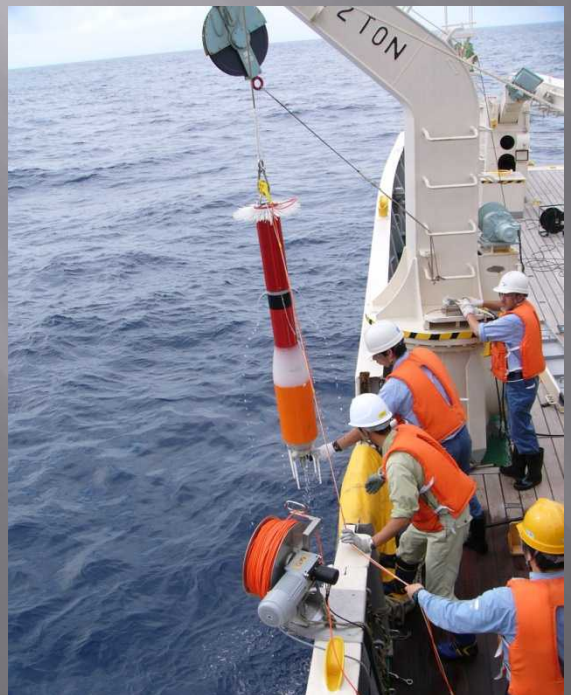
- Taiwanese *Ocean Researcher 2*
- Japanese *Tansei-maru*

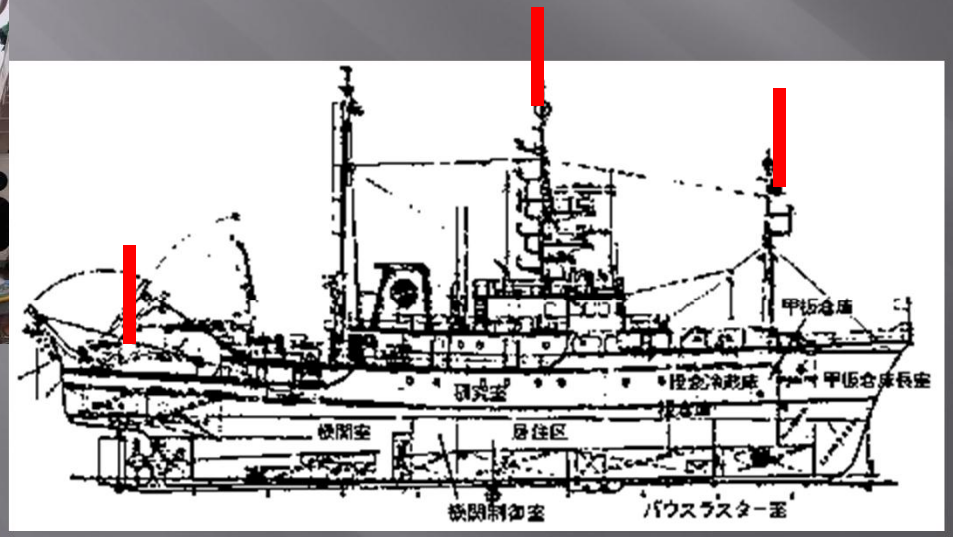
Stations


CTD
TurboMap
Drifter Release
Ocean Radars
OR2
A
B
C
Tansei-maru
27°N
26.5°N
26°N
25.5°N
25°N
24.5°N
24°N
122°E
123°E
124°E
125°E
50m
100m
250m
500m
750m
1000m
1250m
1500m
2000m
2500m
3000m
3500m
Ocean Data Vie

Observed parameters

- CTD, ADCP (*OR2, Tansei-maru*)
- Surface drifters (*OR2, Tansei-maru*)
- Turbulence in the surface layer (*Tansei-maru*)
- Electro-Magnetic field (*Tansei-maru*)





51m

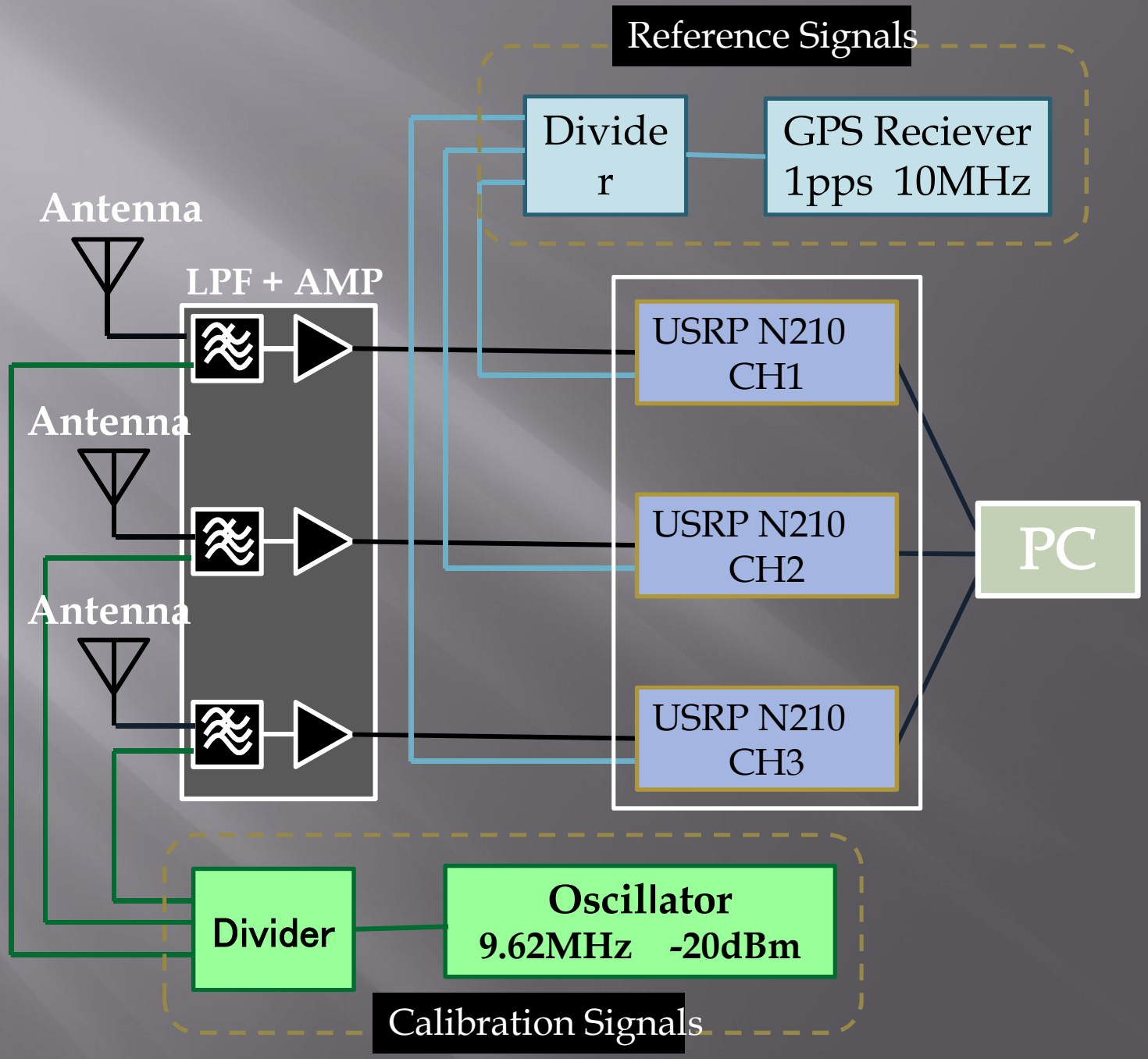
Anntena:
Broad-Band Monopole
7.13m

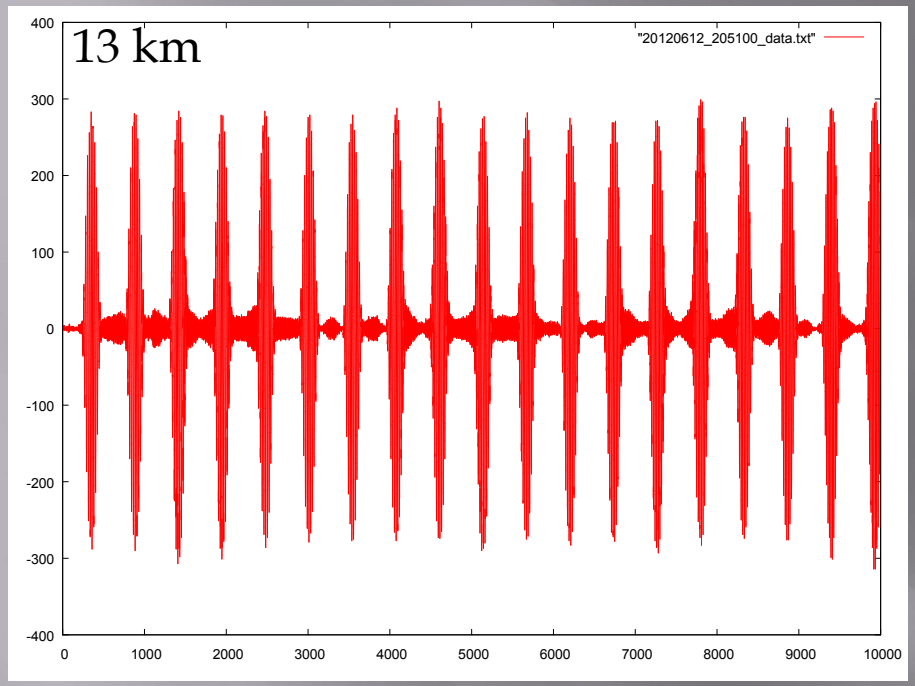
TANSEI MARU
(JAMSTEC)

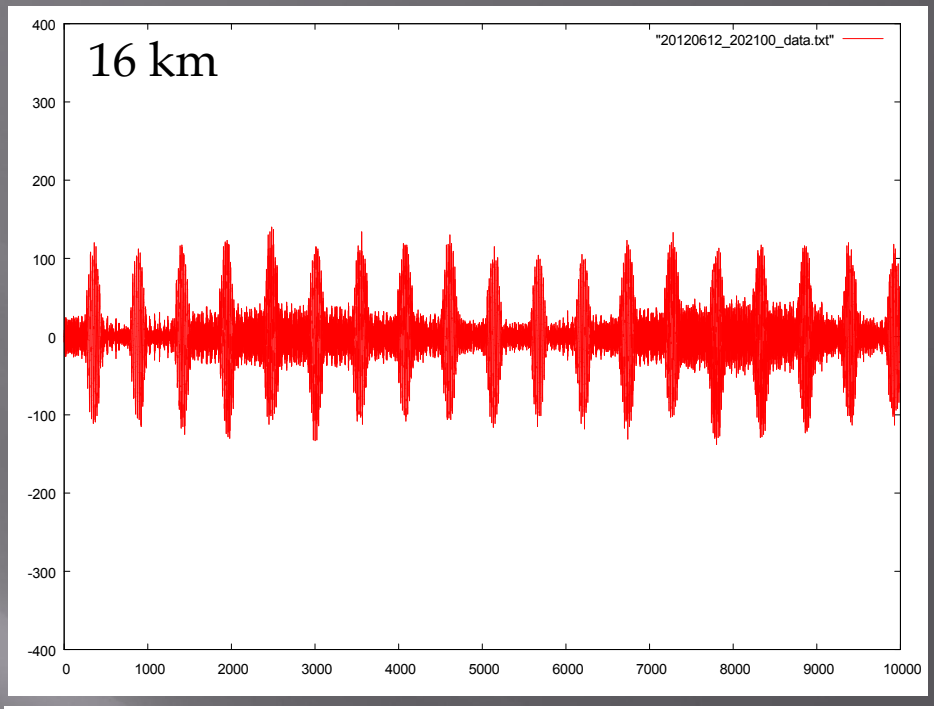
Data Acquisition System

USRP N210's
SDR Interface

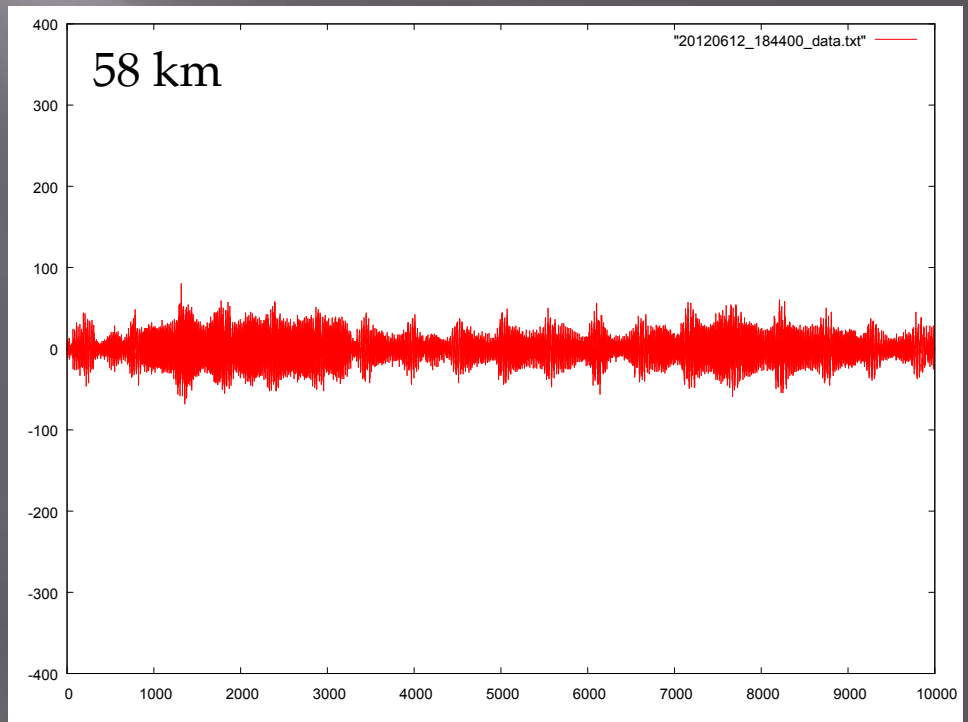
PCs for control and archive


Reference Signals
Divide r
GPS Reciever 1pps 10MHz
Antenna
LPF + AMP
Antenna
Antenna
USRP N210 CH1
USRP N210 CH2
USRP N210 CH3
PC
Divider
Oscillator 9.62MHz -20dBm
Calibration Signals





Received Signals (direct trans.)



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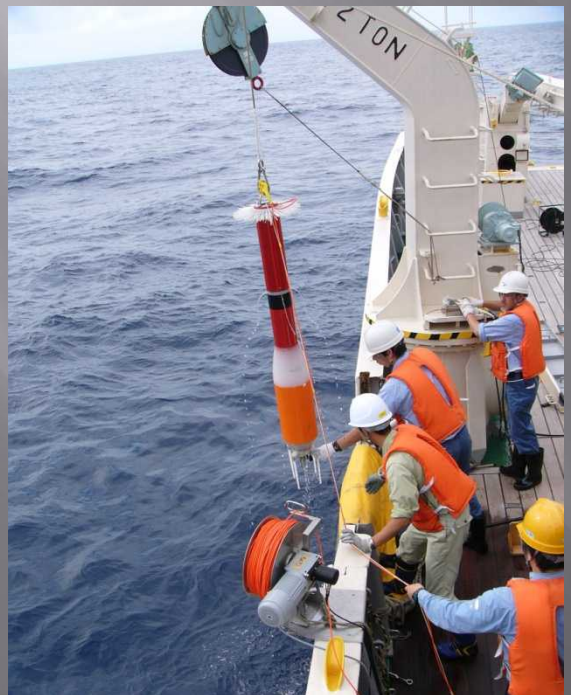
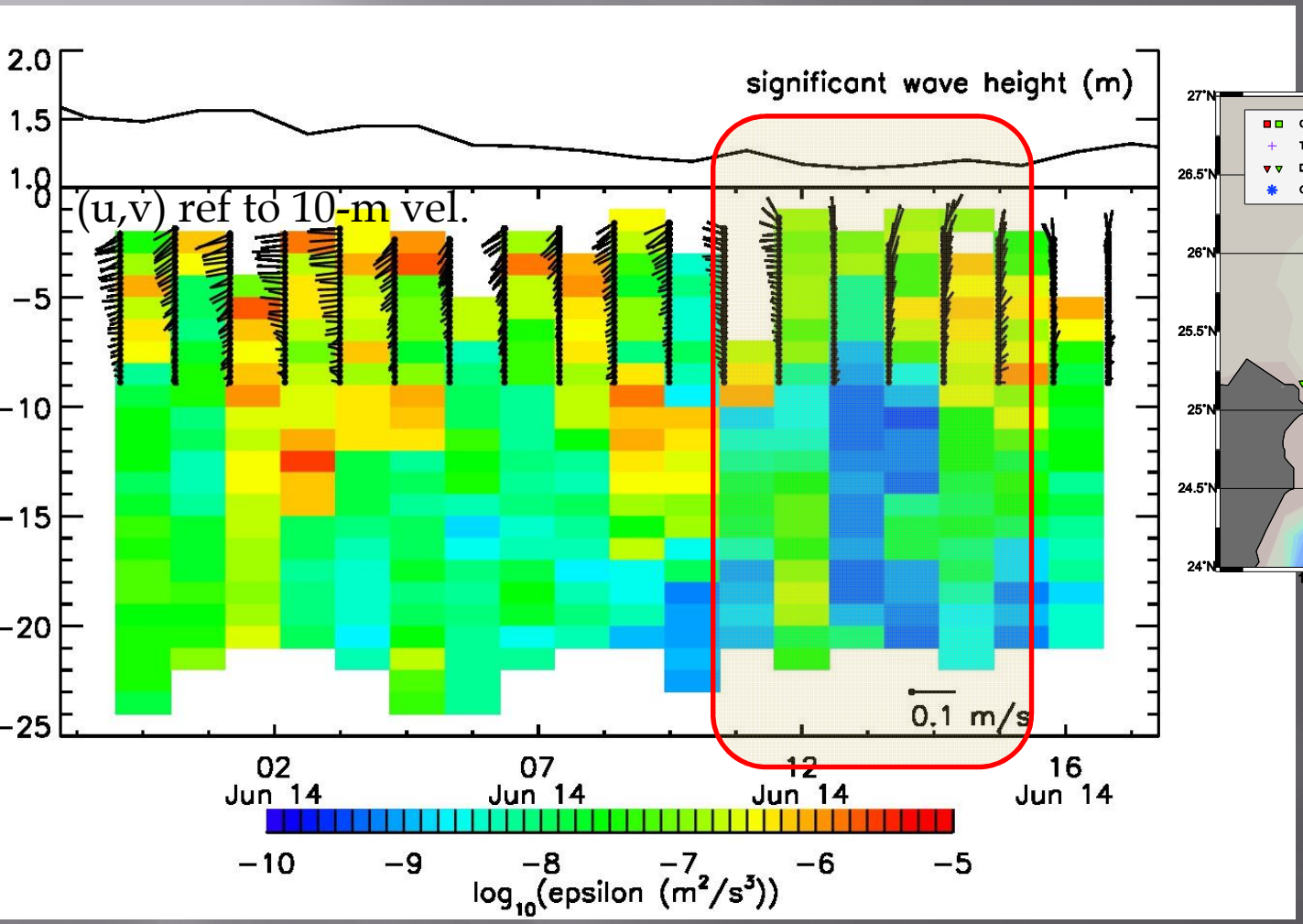
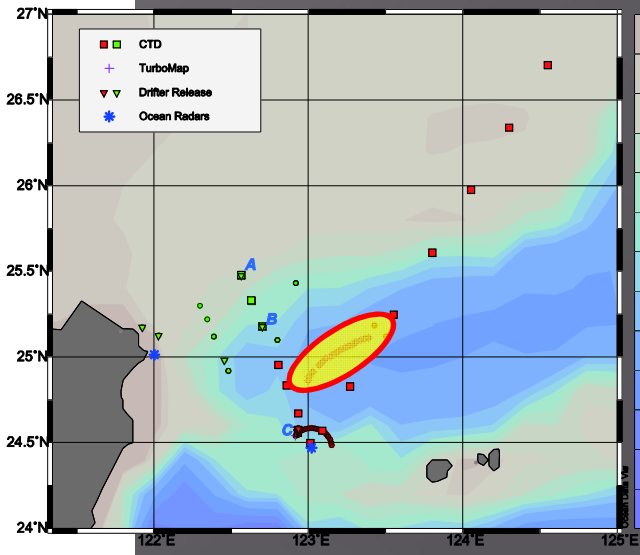


SWH + Turbulence + vel. shear





- 6/14 daytime, current direction rotates as inertia oscillations, with smaller vertical shear, SWH and turbulent dissp.
  - weaker wind stress?

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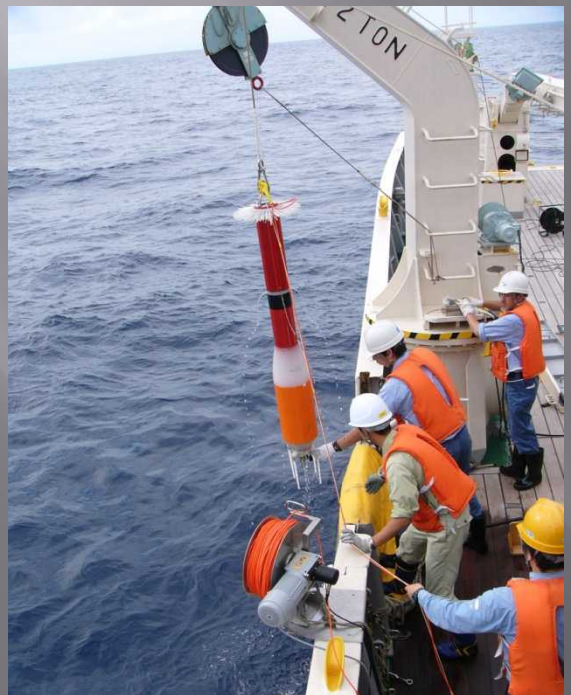
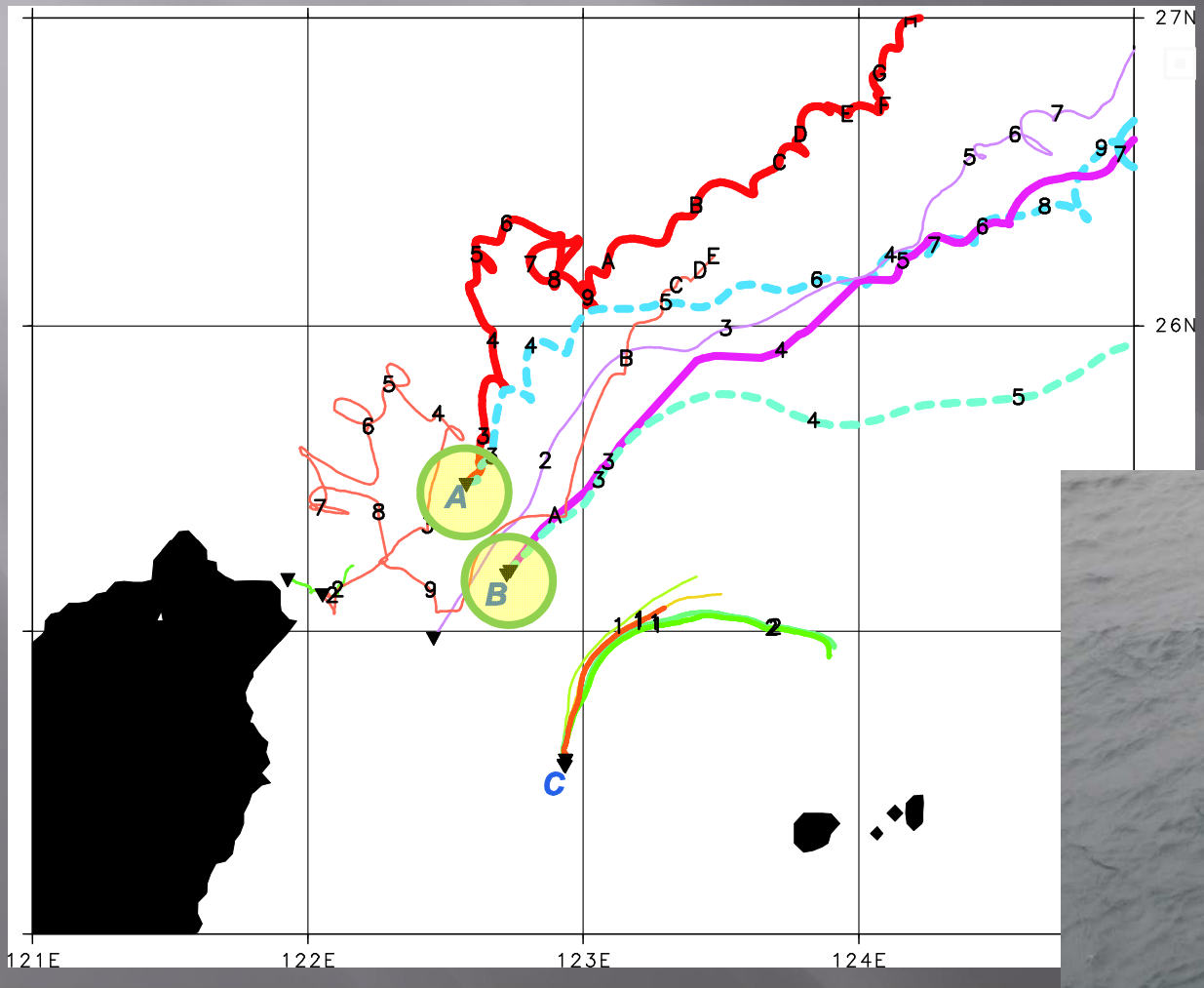


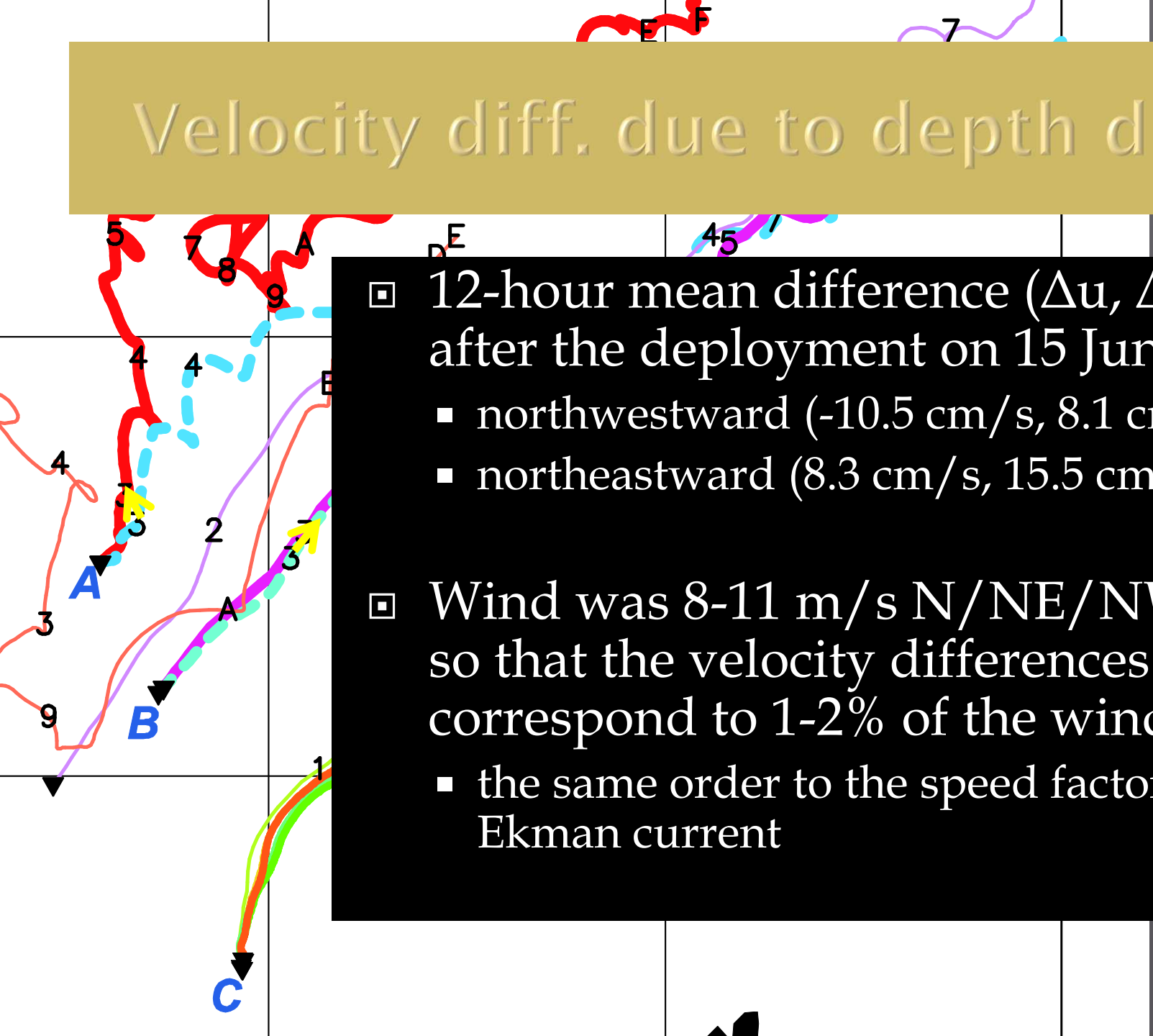
Tracks of surface drifters



At A and B, 2 pairs of identical drifters were deployed

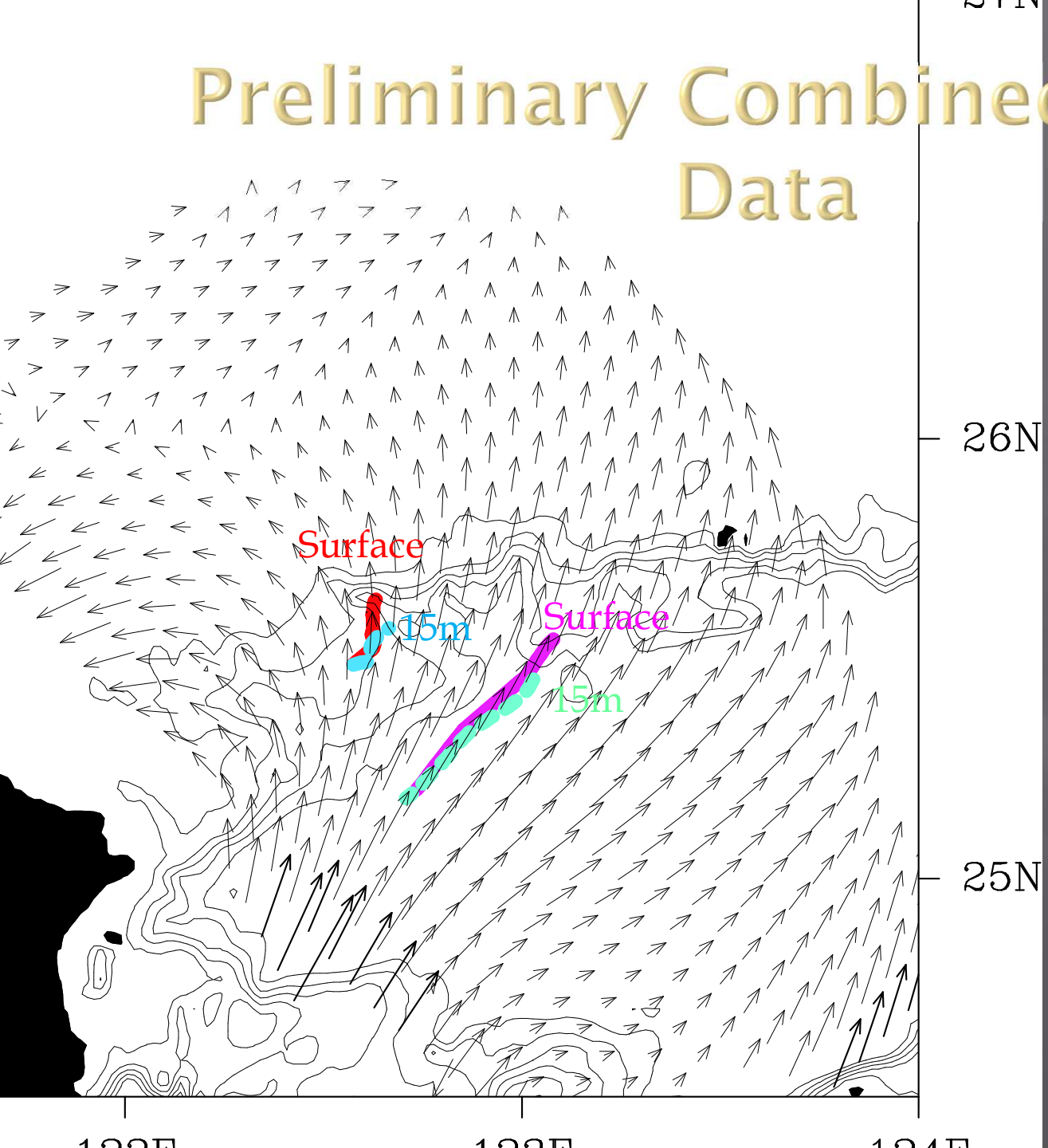
- with/without 4-m length drogues at the 15-m depth

Velocity diff. due to depth diff.



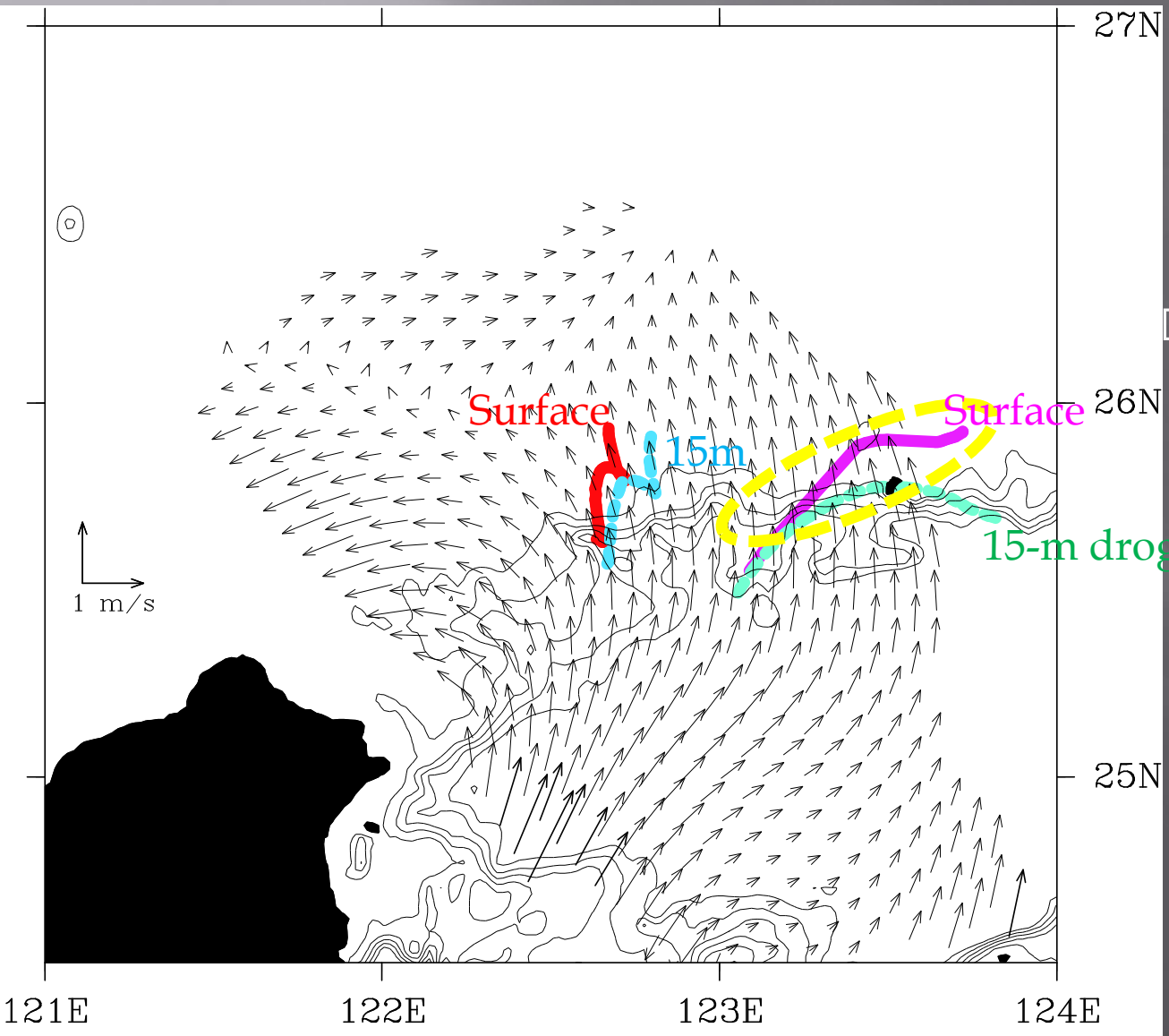
- 12-hour mean difference (Δu, Δv) just after the deployment on 15 June, 2012
  - northwestward (-10.5 cm/s, 8.1 cm/s) at A
  - northeastward (8.3 cm/s, 15.5 cm/s) at B
- Wind was 8-11 m/s N/NE/NW-ward, so that the velocity differences correspond to 1-2% of the wind speed
  - the same order to the speed factors of the Ekman current

Preliminary Combined Radar Data



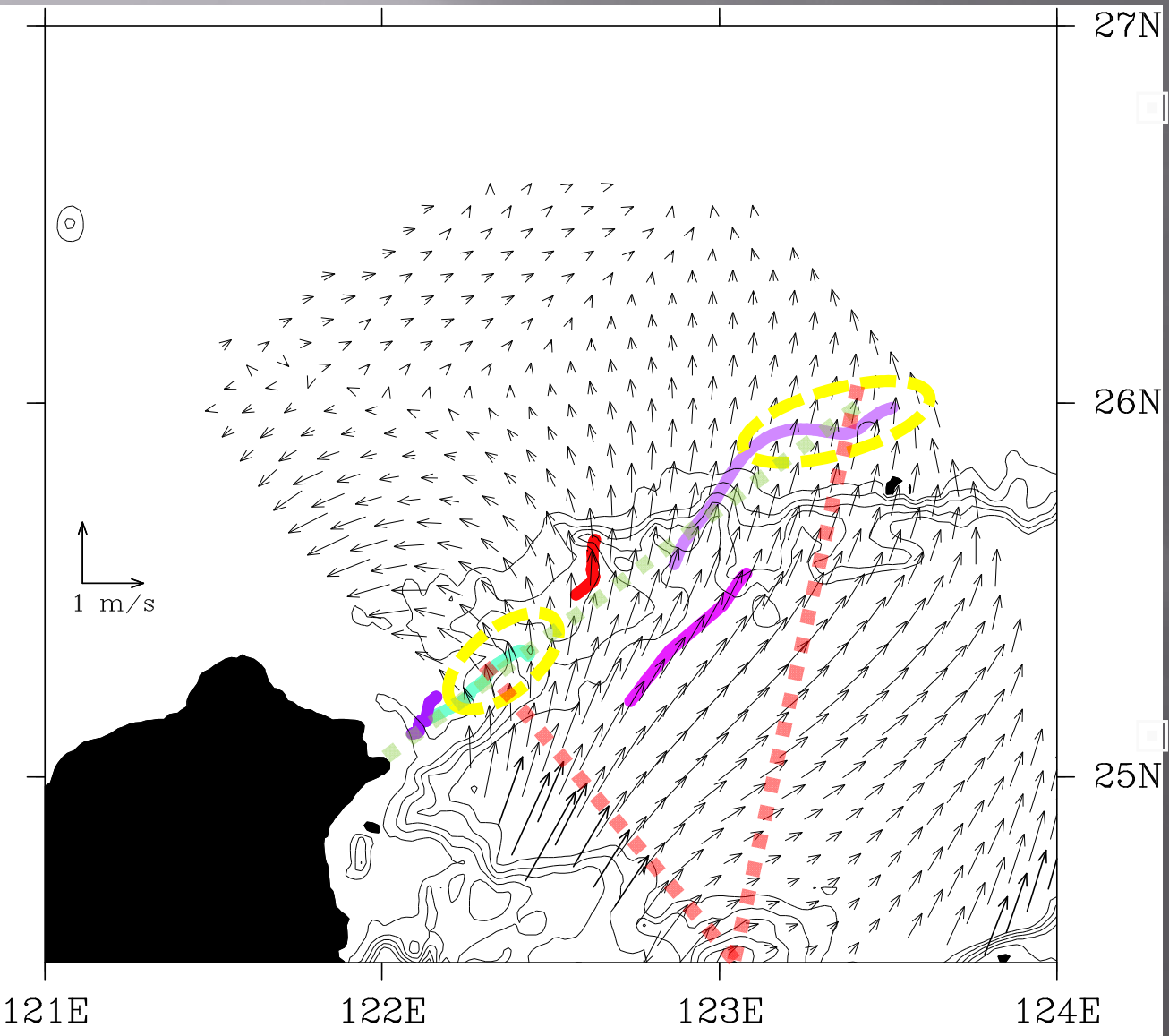
- De-tided for each radar by harmonic analysis
- Daily average on 15/June
- Surface current
  - northward at A
  - northeastward at B
- consistent with surface drifters

But on 16/June….



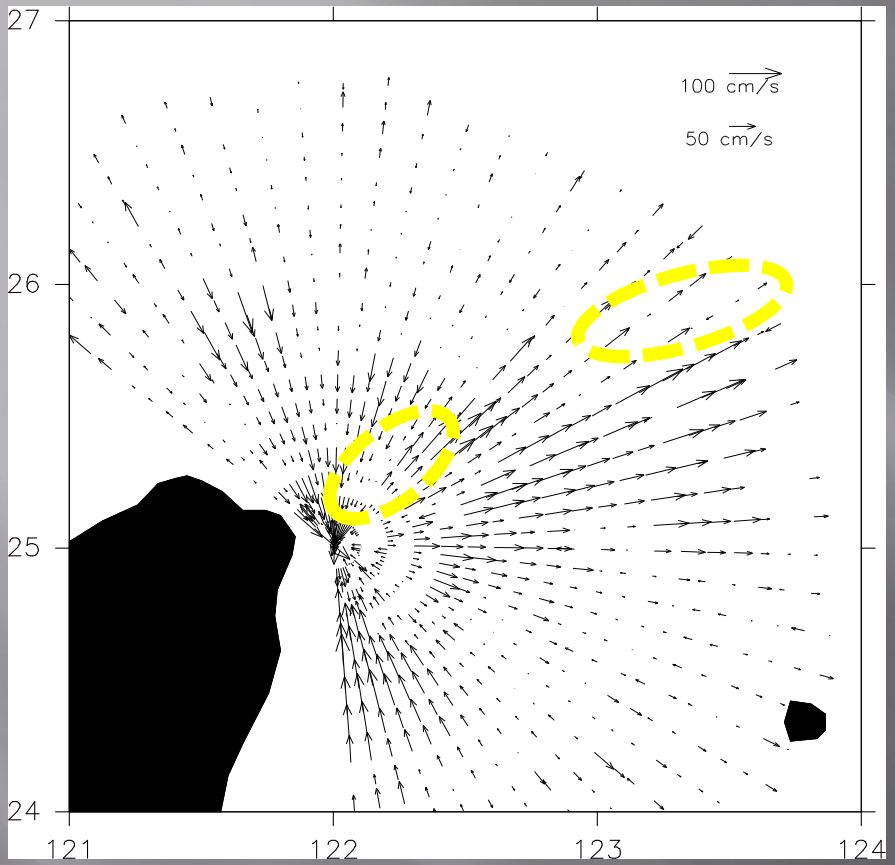
- Disagreement with radar velocity
  - in areas away from the radar sites?

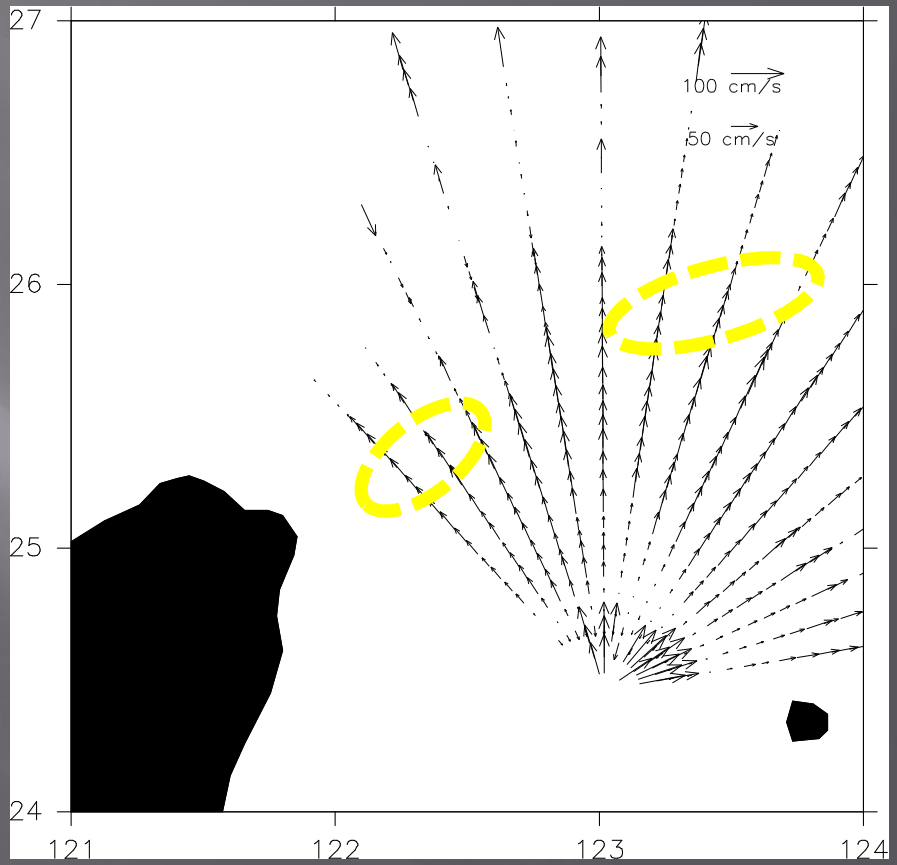
For other drifters on 15/June



- Drifters with ~1m depth drogues
  - discrepancy even in an area close to the TORI radar site
- weaker TORI or larger NICT?

Radial velocities





- Imbalance between TORI and NICT radial velocities?
  - need detailed analysis

Summary

- Japan-Taiwan cooperation for the combined radar data for full coverage of the Kuroshio upstream region is in progress
  - But, more refinements are necessary

- 1st joint survey was conducted in June, 2012
  - by *Tansei-maru* and *OR2*
    - for CTD, ADCP, drifters, turbulence and EM field measurements
  - wind-driven surface currents are present, with magnitude of 1-2% of wind speed
    - wind-driven current and inertia oscillations need to be separated for "monitoring of the Kuroshio"

- Precise analysis will be coming soon…..

Thank you