ヤマセに関する2-3の話題

1. 高解像度海上風と東北・北海道沿岸域波浪
2. 親潮とヤマセ時の海流変動
3. その他（時間があれば）

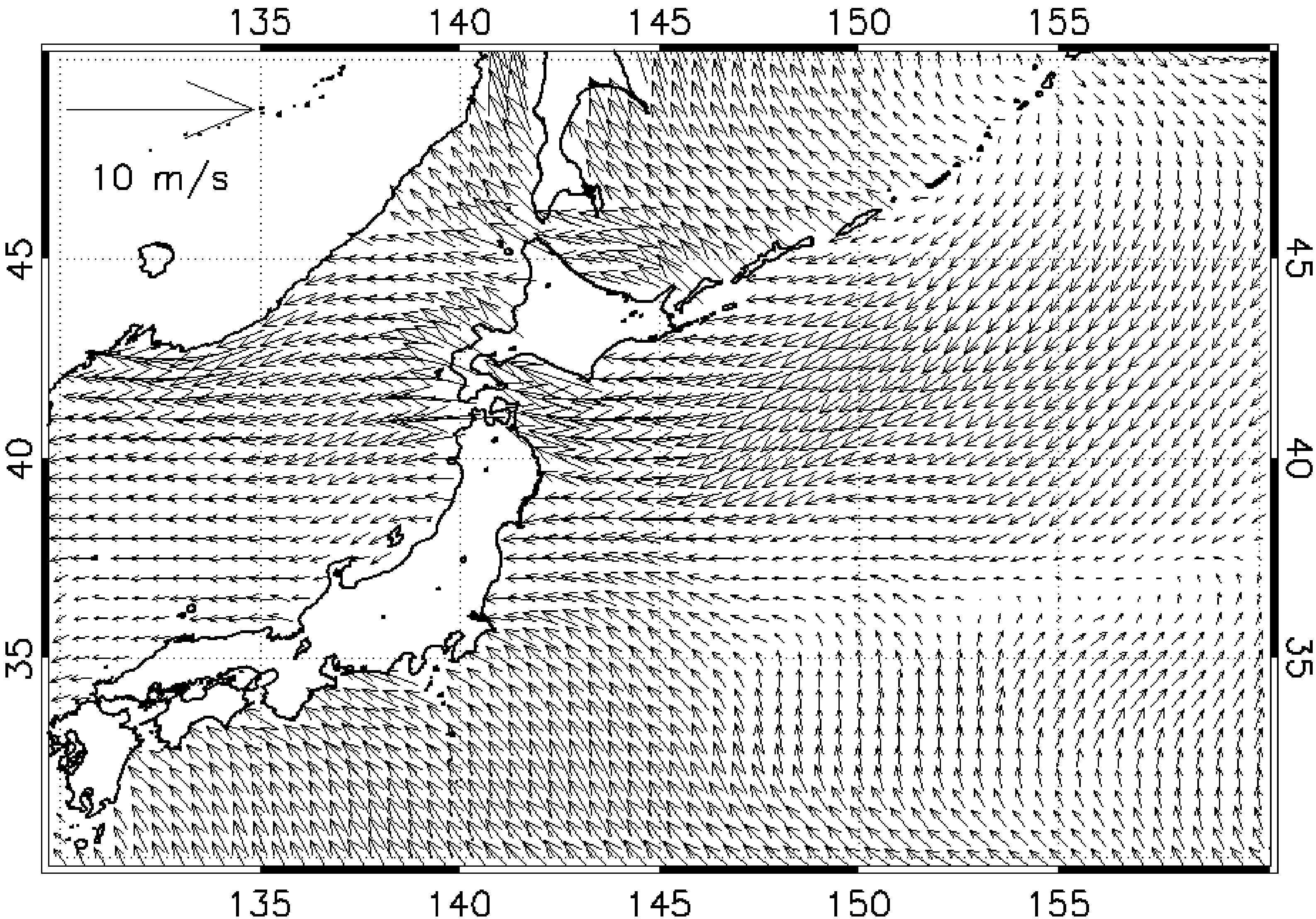
川村　宏
東北大学大学院理学研究科

Case Study of Wind Jet Transition and Localized Responses of Wind Wave along the Pacific Coast of Northern Japan by Synergetic Use of Satellite and In Situ Observations

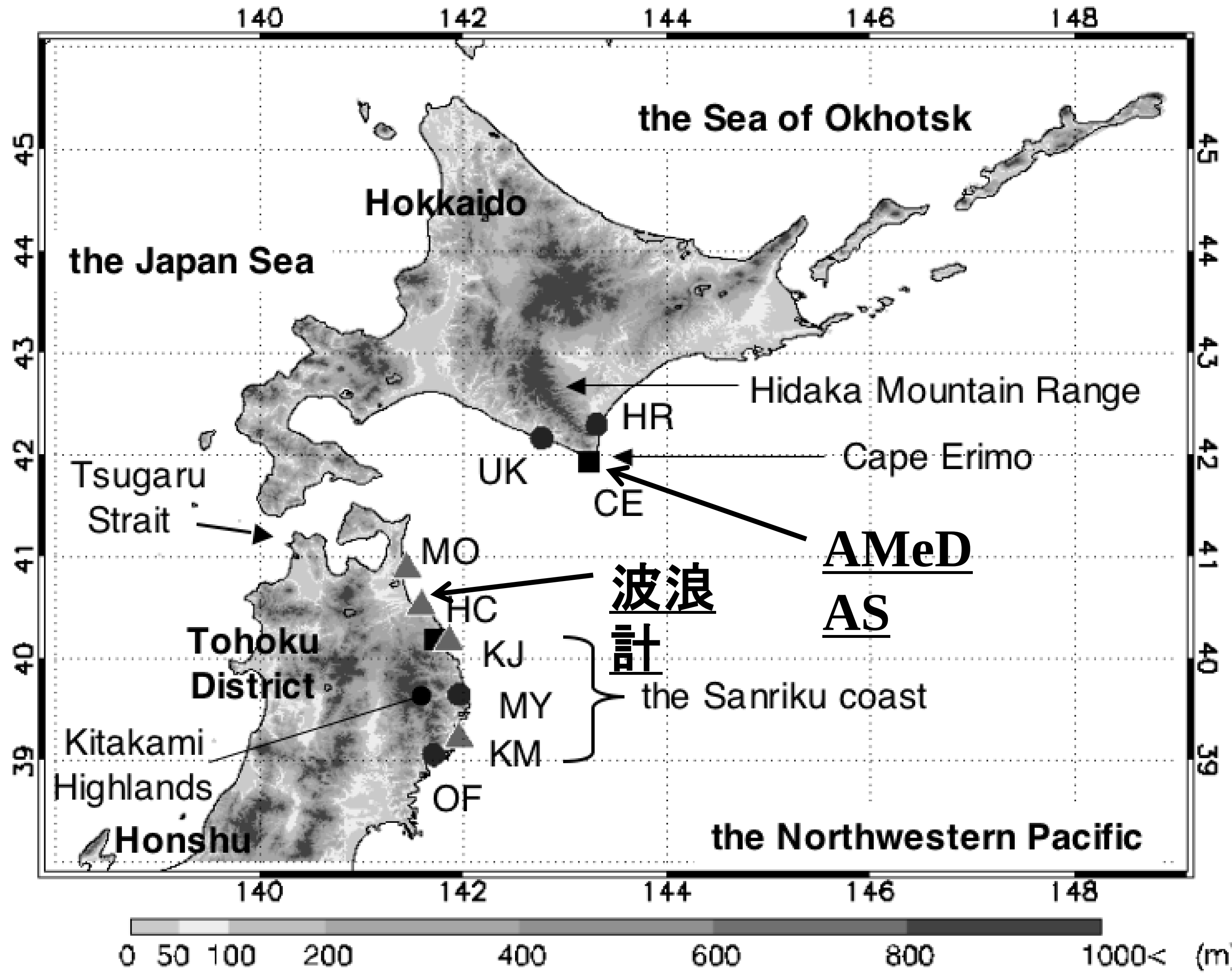
Shimada and Kawamura, J.Oceanogr., 63, pp. 953 to 966, 2007

キーワード:
散乱計海上風、海上ジェット気流、地形効果、太平洋沿岸域

ヤマセ海上風(Takai et al., 2006)

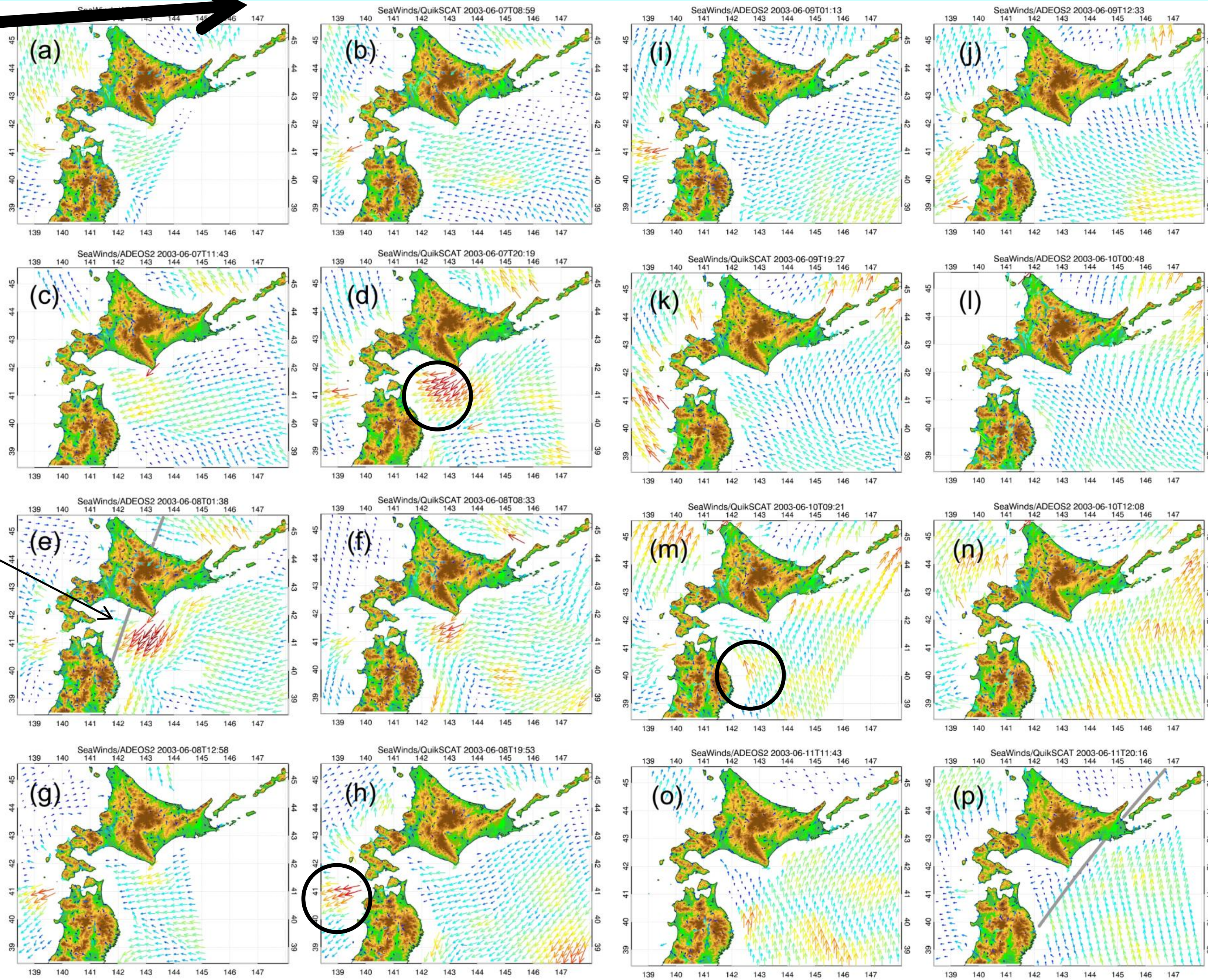


研究海域と気象・波浪観測点



2003年6月7-11日海上風場(SeaWinds on board Quickscats + ADEOS-II)

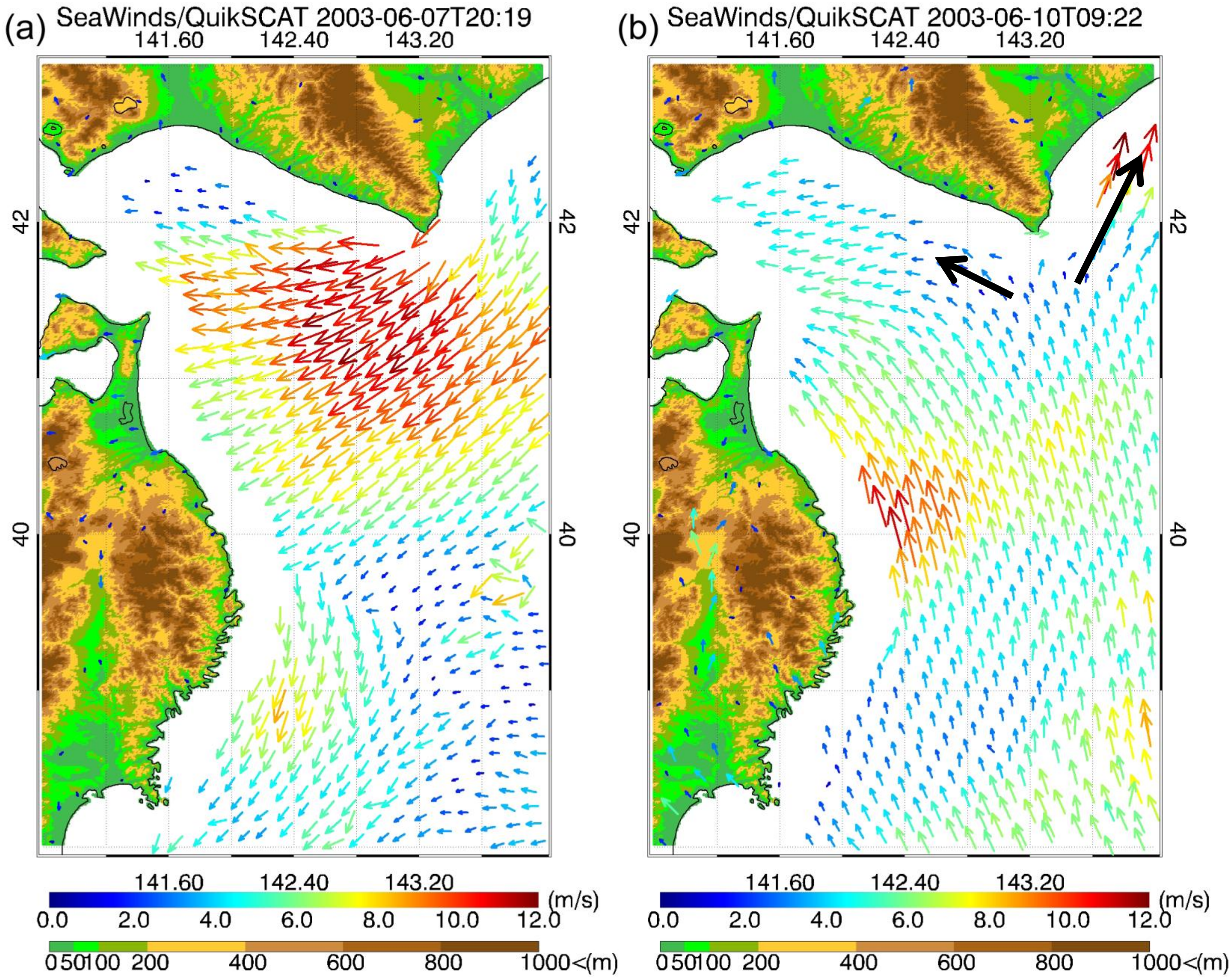
移動性高気圧

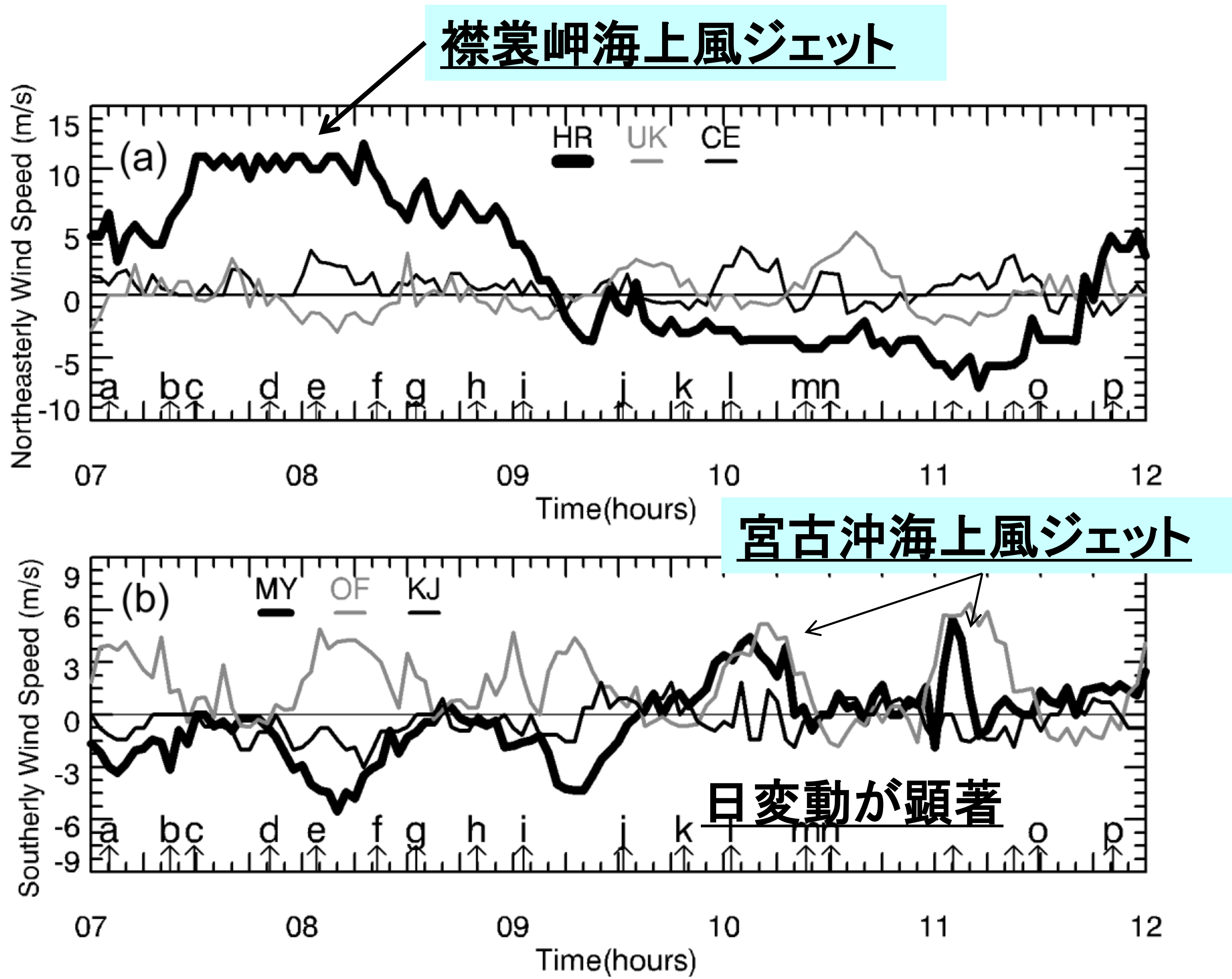


高度計

波浪計測

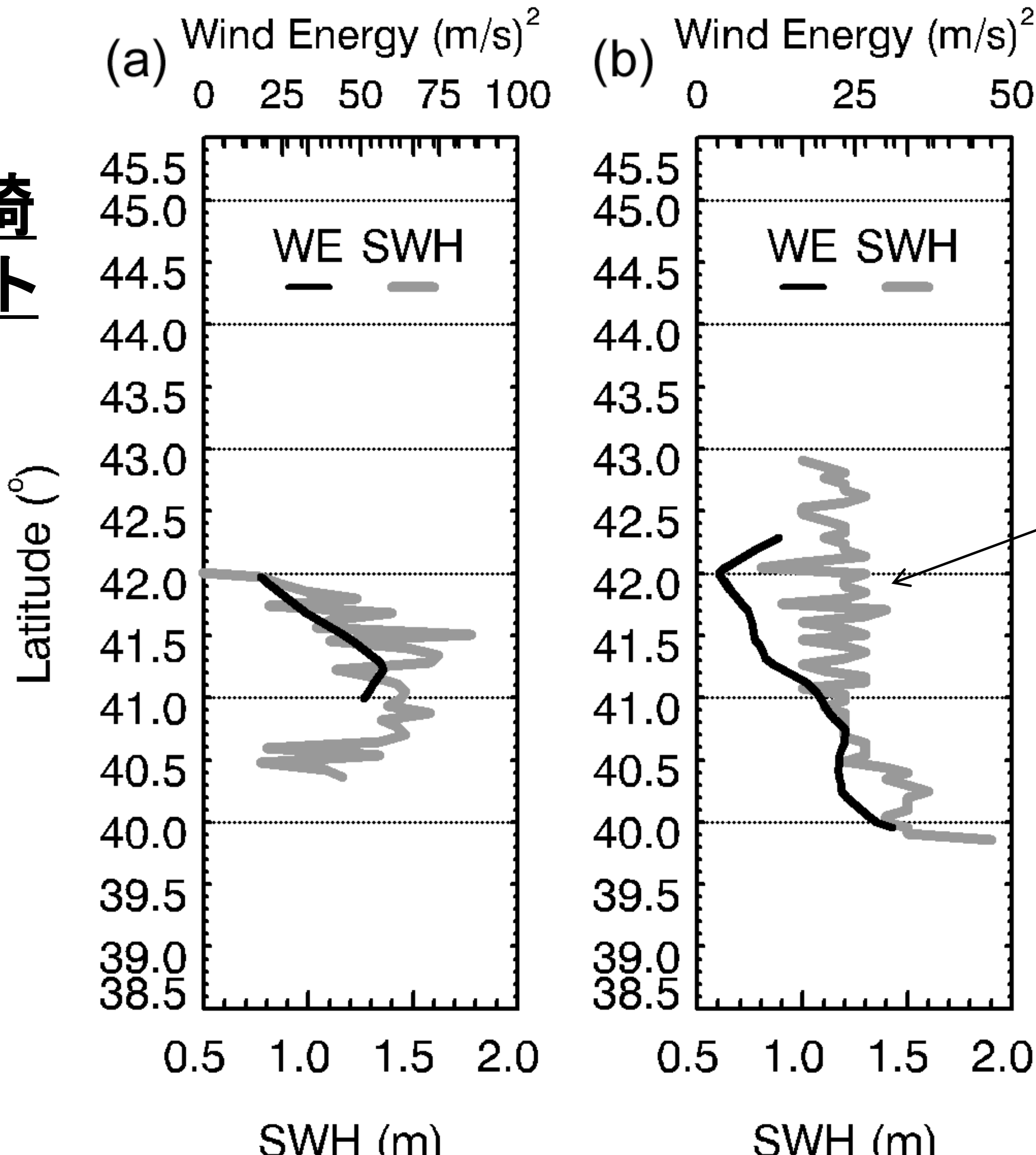
充分に発達した二つの海上風ジェットの例




襟裳岬海上風ジェット
(a)
HR
UK
CE
Northeasterly Wind Speed (m/s)
15
10
5
0
-5
-10
a b c d e f g h i j k l mn o p
07
08
09
10
11
12
Time(hours)
宮古沖海上風ジェット
(b)
MY
OF
KJ
Southerly Wind Speed (m/s)
9
6
3
0
-3
-6
-9
日変動が顕著
a b c d e f g h i j k l mn o p
07
08
09
10
11
12
Time(hours)

海上風エネルギー(WE)と海面高度計波高分布(SWH)

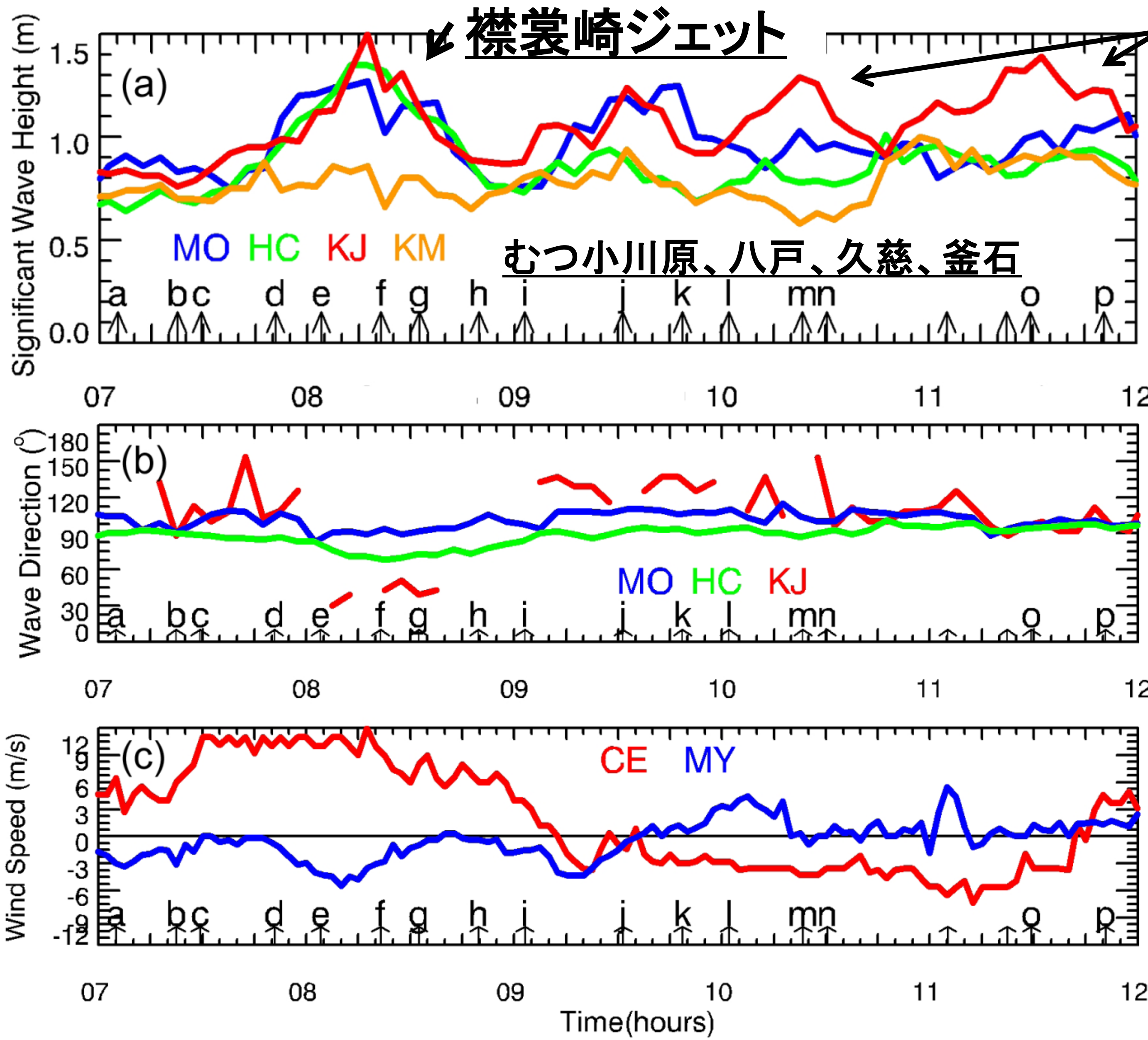
襟裳崎ジェット(e)



南風の場合(p)

多分、うねり(?)

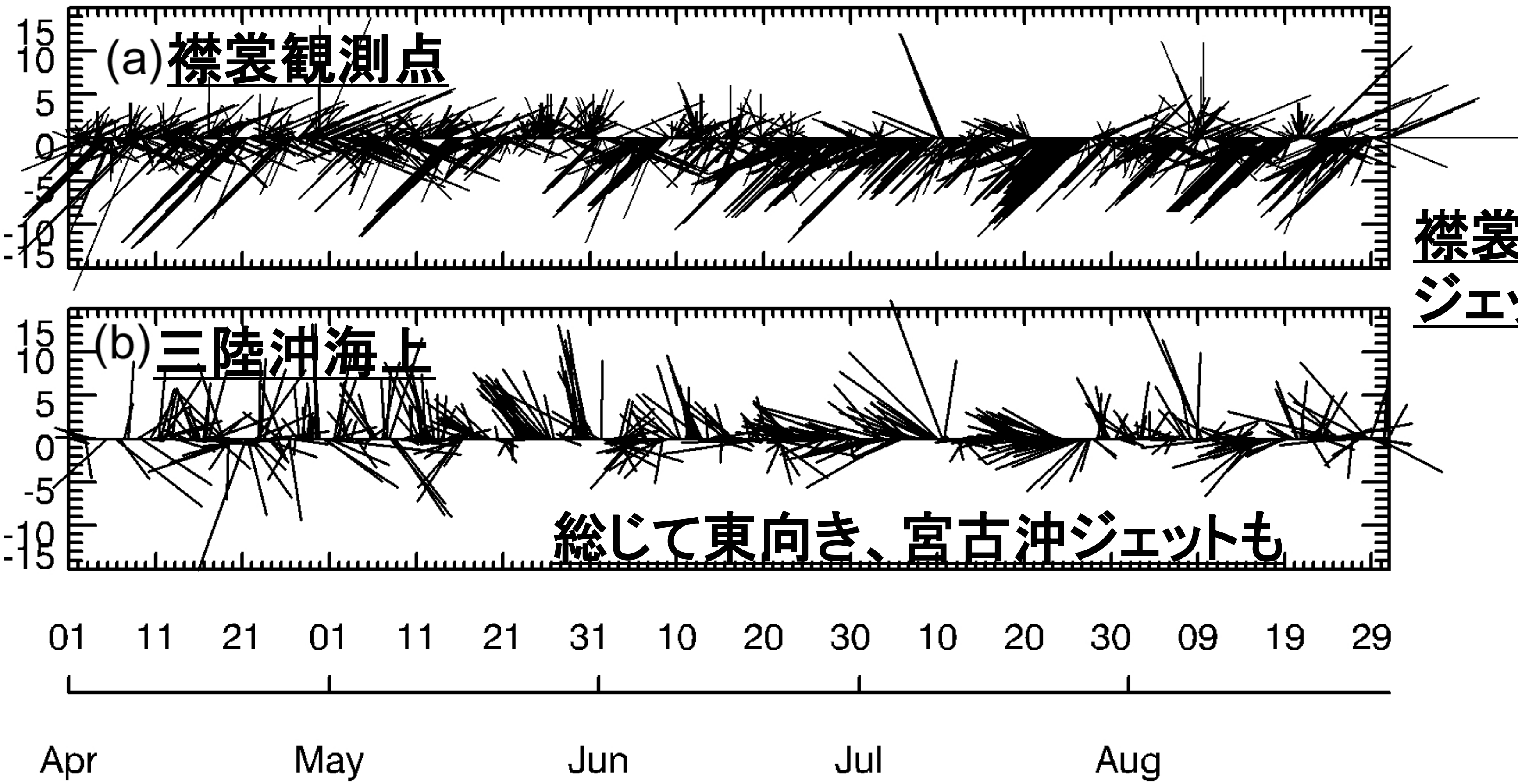
沿岸域観測点の波高・波向と海上風速



宮古沖ジェット

波の影響は久慈まで

2003年4-8月の襟裳観測点(a)と三陸沖海上(b)の風ベクトル時系列

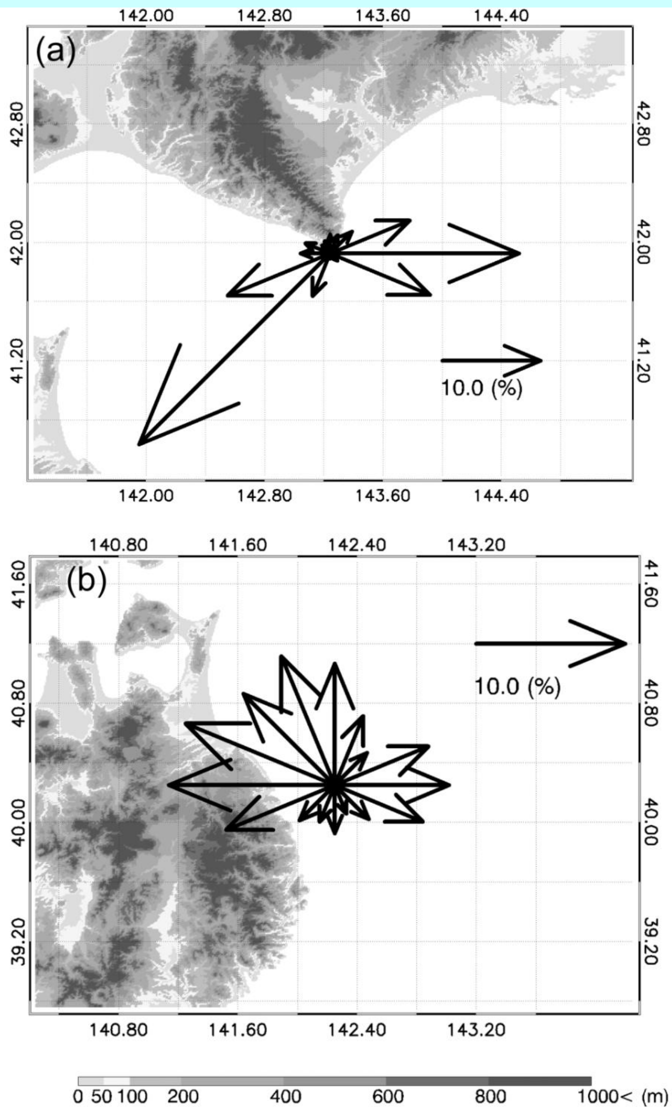


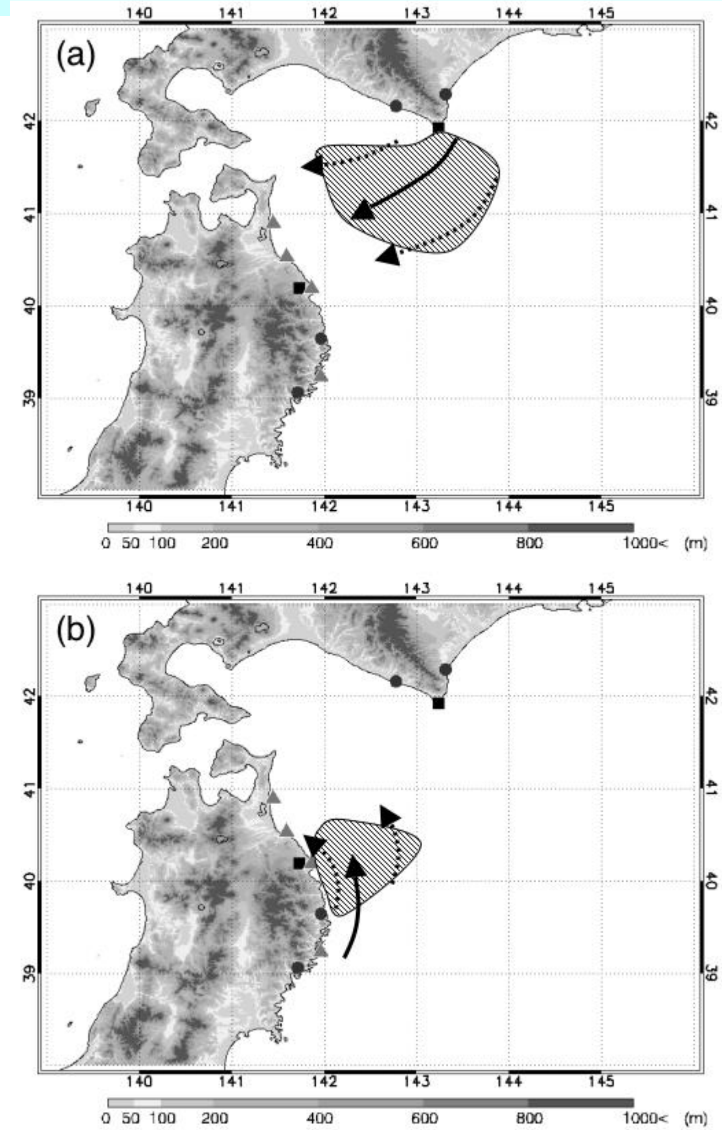
襟裳崎ジェット

総じて東向き、宮古沖ジェットも

長期風向頻度分布と海上風場（本研究）

襟裳崎観測点（10年）
三陸沖（6年）





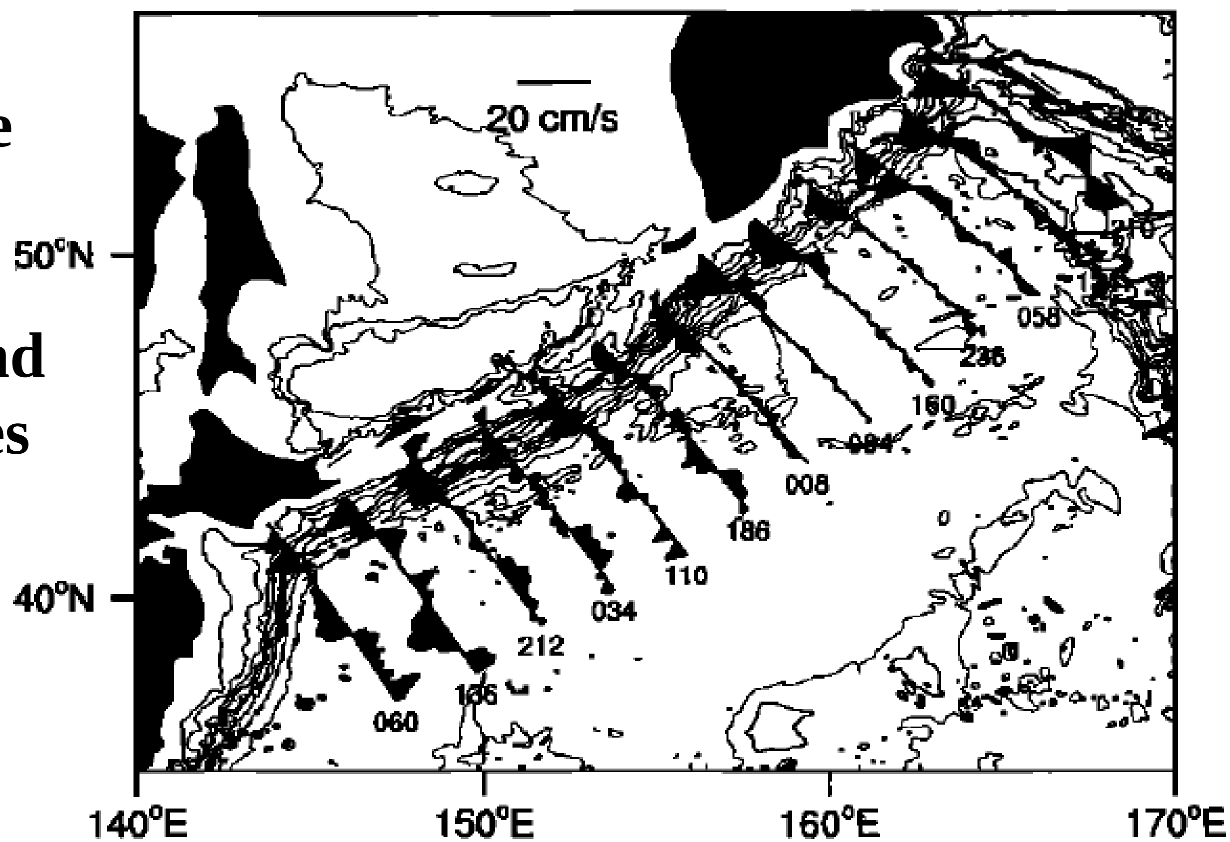
A study on wind-driven circulation in the subarctic North Pacific using TOPEX/POSEIDON altimeter data

Osamu Isoguchi and Hiroshi Kawamura
Center for Atmospheric and Oceanic Studies, Faculty of Science, Tohoku University, Sendai, Japan

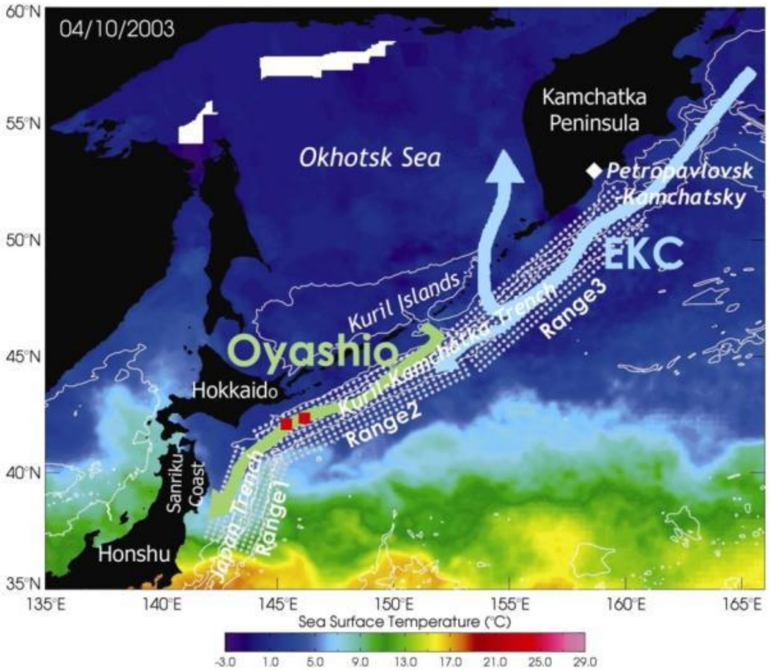
Tokihiro Kono
Hokkaido National Fisheries Research Institute, Kushiro, Japan

Covariance between the time series of the first EOF of the SLA (Sveldrup transport) and the cross-track velocities

JGR (1997)



Previous works about Oyahio/East Kamchatka Current variations



Interannual variation

✓Southward shift of Oyashio water (subsurface temperature field) shows a good correlation with wintertime atmospheric forcing (Aleutian low and related Sverdrup transport) (Sekine 1988; Hanawa1995)

Seasonal variation

✓Hydrographic and moored buoy observations: strong (weak) current/transport in winter/spring (summer/fall)

Present study

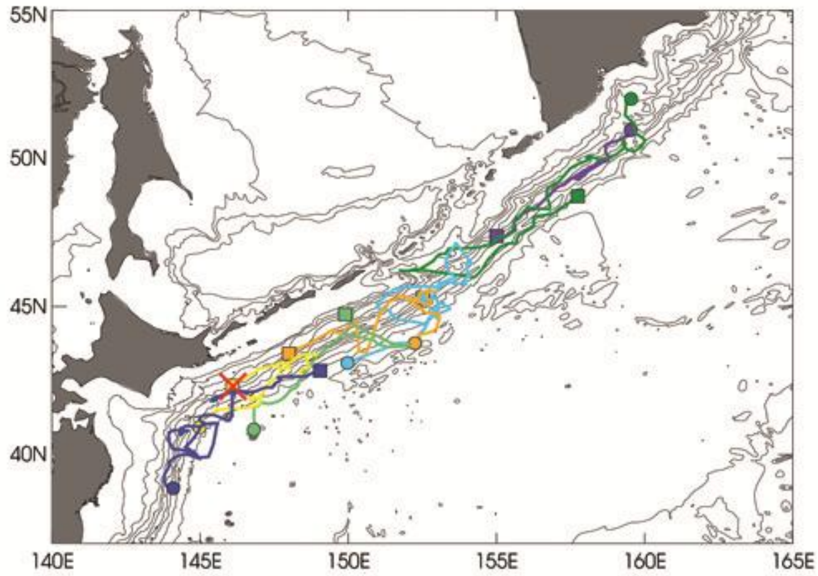
✓We demonstrate that altimeter and tide gauge sea levels are **good indices** of Oyashio/EKC variations, which could connect dynamically the relationship between atmospheric forcing and subsurface temperature fields in the previous studies.

✓We investigate in detail **seasonal/intraseasonal evolution** of Oyashio current and its effect on sea surface/subsurface temperature fields off the Sanriku coast of Japan using derived indices.

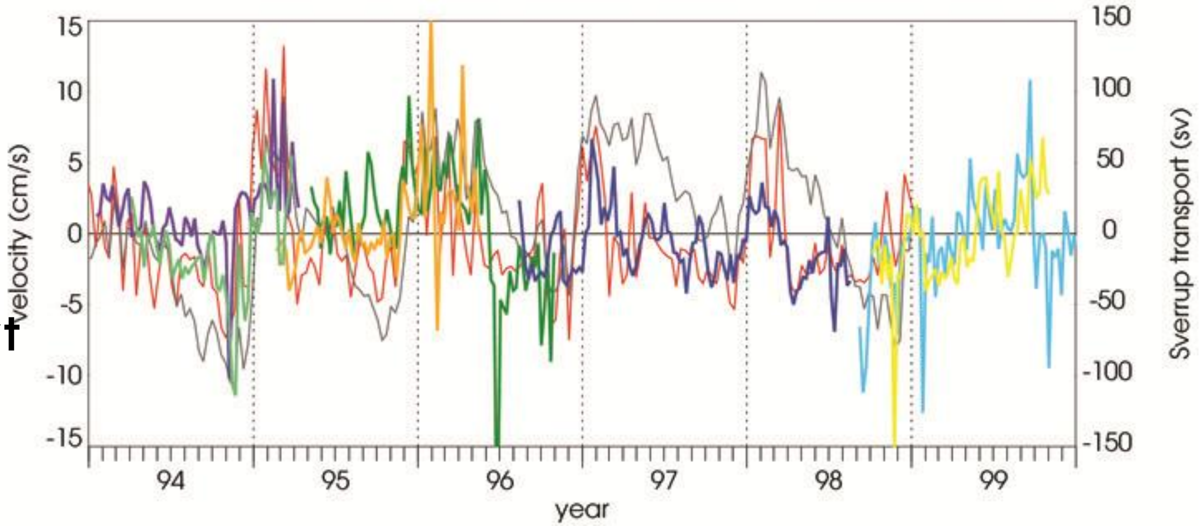
- **Indices of Oyashio/EKC variations**
  - Altimeter-derived Eddy Drifting Velocity (EDV) and Geostrophic Current Anomaly (GCA)
  - Tide gauge sea levels
- **Seasonal/intraseasonal variation**
- **Interannual variation**

Indices of Oyahio/EKC variations

Trajectories of eddies

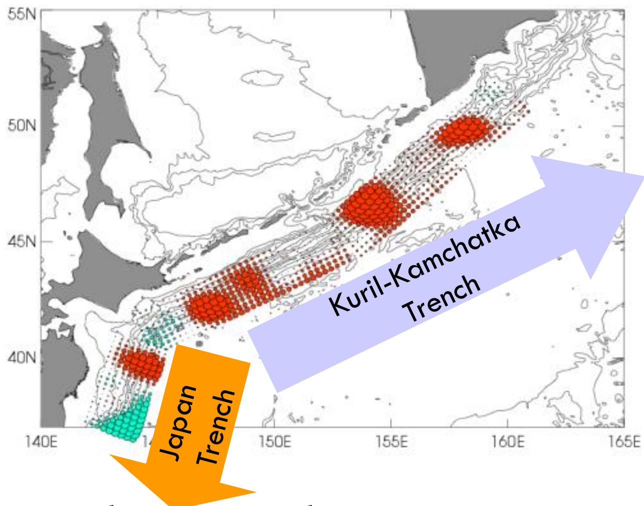


Comparison between eddies propagating velocity and Sverdrup transport



✓Movement of eddies over Japan Trench and Kuril-Kamchatka Trench could be a good index of Oyashio and EKC short term variation [Isoguchi and Kawamura ,2006]

1) Eddy Drifting Velocity (EDV)



Sea Level Anomaly

-Maps of SLA provided by AVISO

-Merged data from Jason-1,Envisat,Topex/Poseidon,GFO

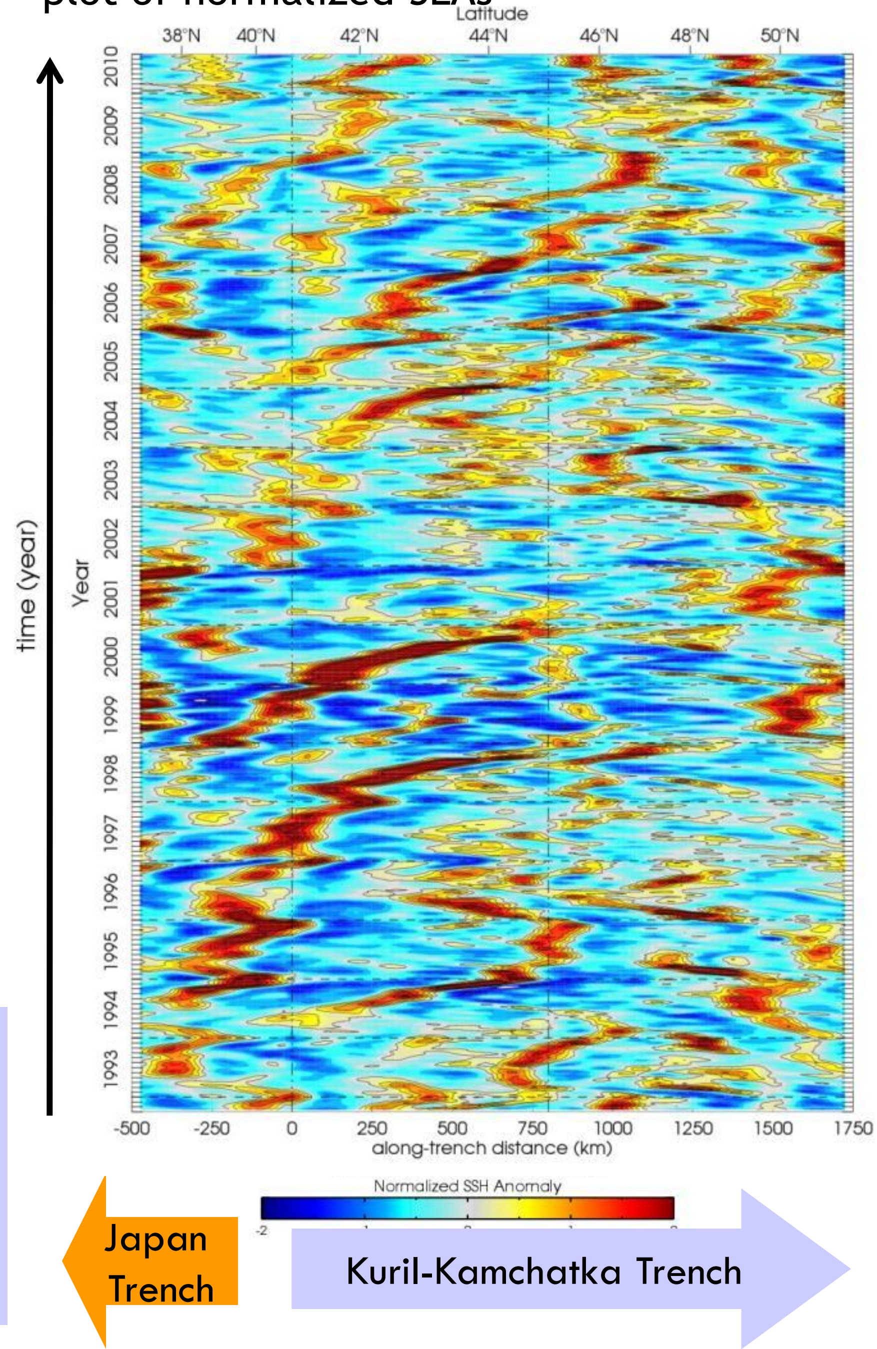
- time: Oct 1992 – Aug 2010
- 1/3 deg gridded SLAs every 7 day

EDV= Δx/ Δt

Δx: Lag distance in which cross-correlation has a maximum

Δt: temporal distance of SLAs

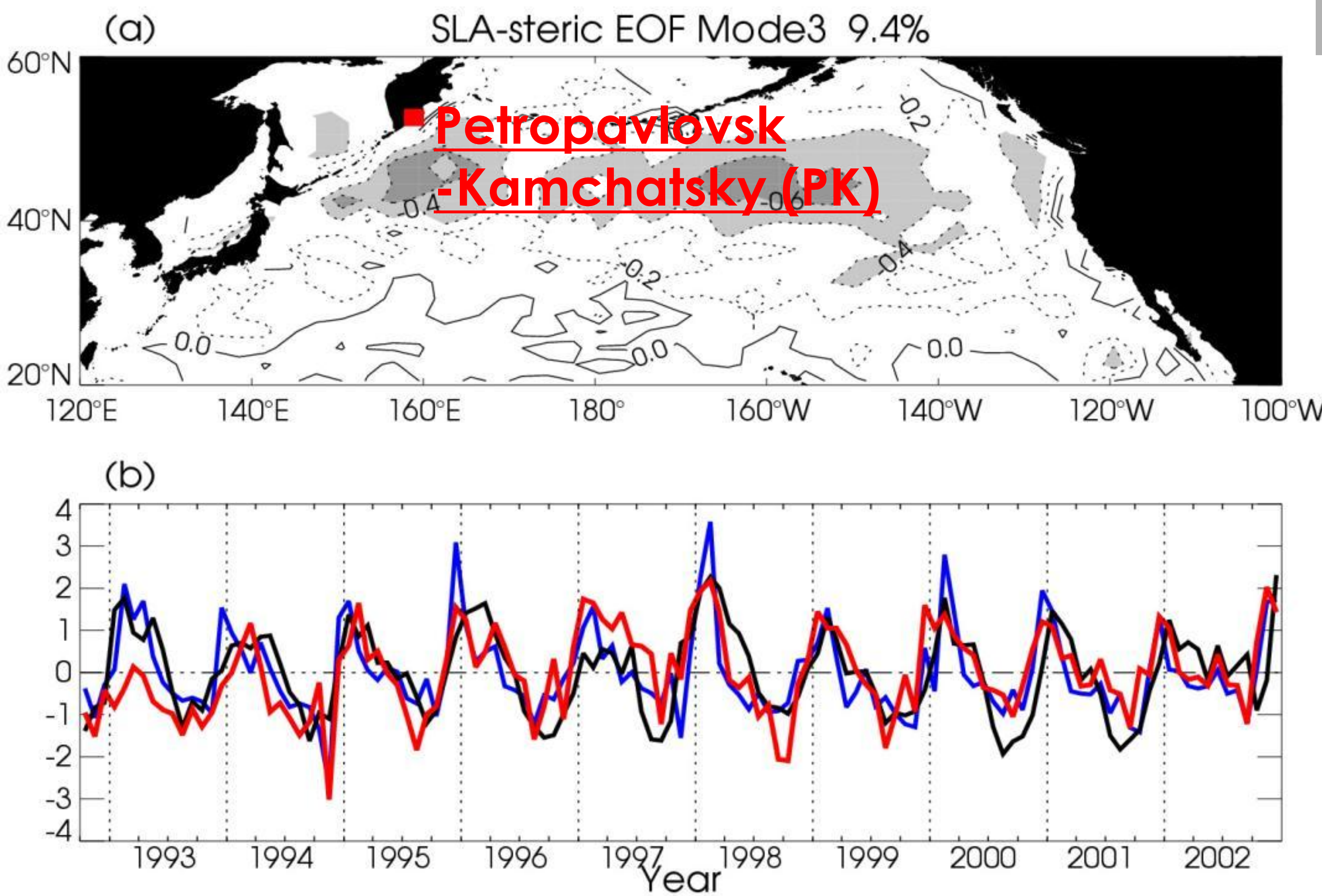
Along-trench distance (x-axis)-time (y-axis) plot of normalized SLAs

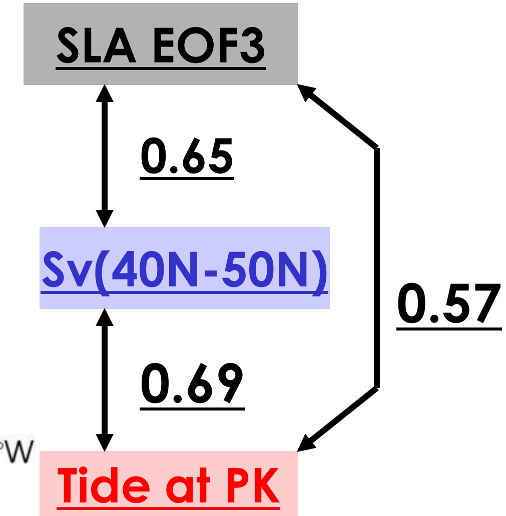


3) Tide sea levels at Petropavlovsk-Kamchatsky (PK-Tide)

Why Tide-PK ?

SLA EOF Mode 3（9.4%）

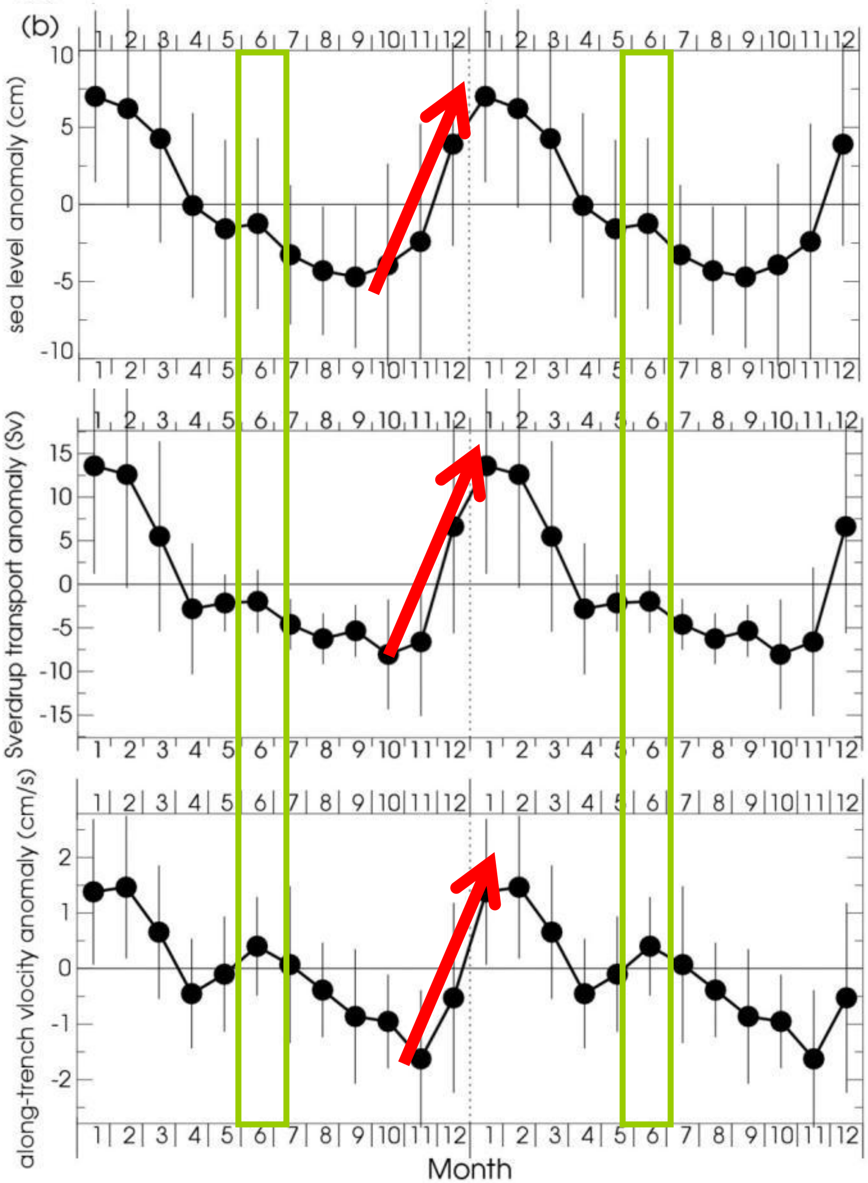




✓**PK Tide** is representative of **sea level gradients** across the KK Trench which is related to **large scale Sverdrup circulation.**

- ✓ **Indices of Oyashio/EKC variations**
  - ✓Altimeter-derived Eddy Drifting Velocity (EDV) and Geostrophic Current Anomaly (GCA)
  - ✓Tide gauge sea levels
- ✓ **Seasonal/intraseasonal variation**
- ✓ **Interannual variation**

Annual cycles of Tide-PK , Sv, EDV



Tide-PK

PSMSL

1957/7-2002/12(45.5 years)

Removal of thermal steric

Sverdrup (40-50N)

NCEP/NCAR reanalyses

1957/7-2002/12(45.5 years)

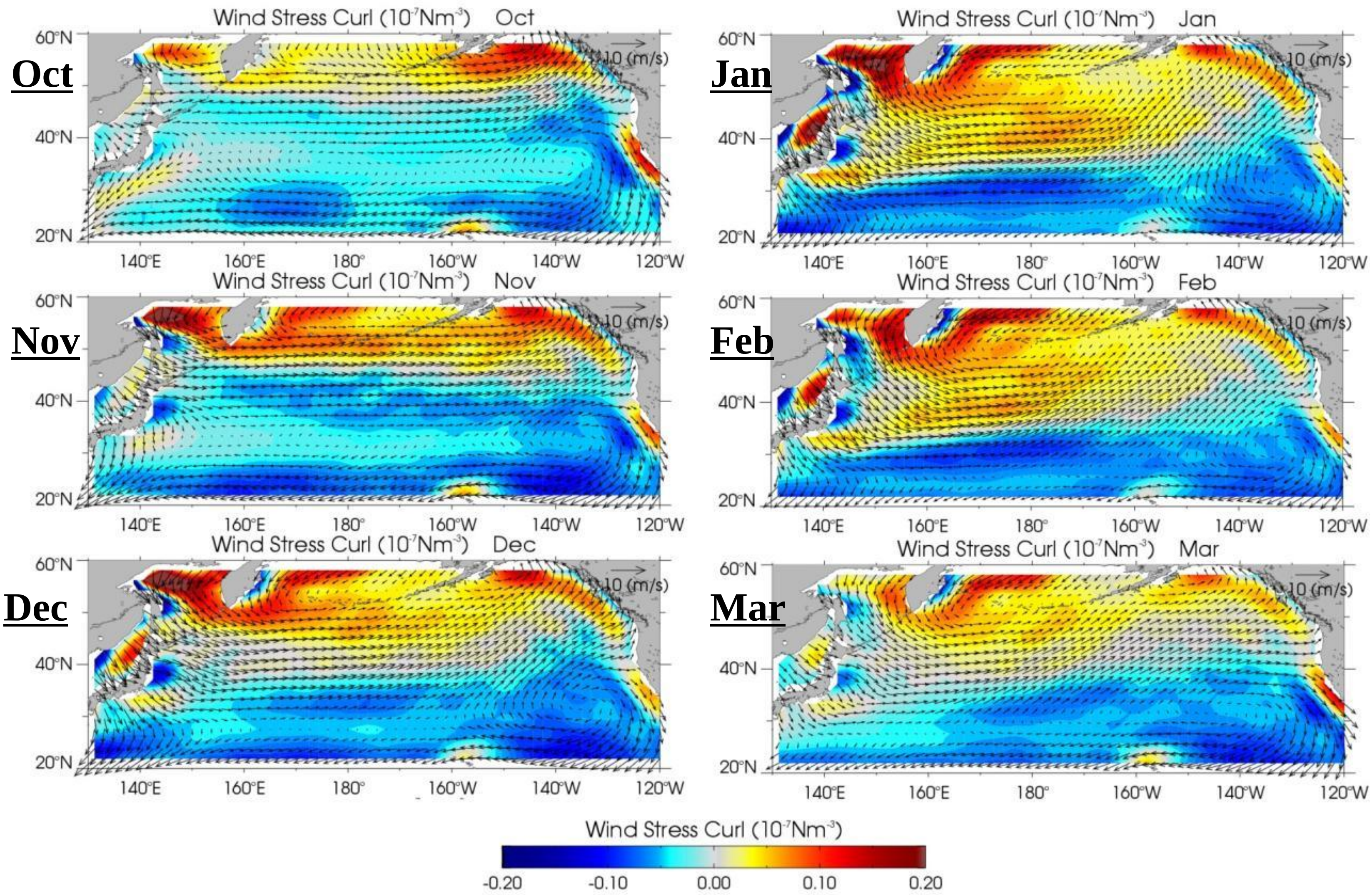
Eddy drifting velocity

1992/10-2003/9(11years)

- ✓ **Wintertime abrupt intensification (from minimum in late fall to max in winter)**
- ✓ **Secondary peak in early summer (in June)**

✓Wintertime abrupt intensification

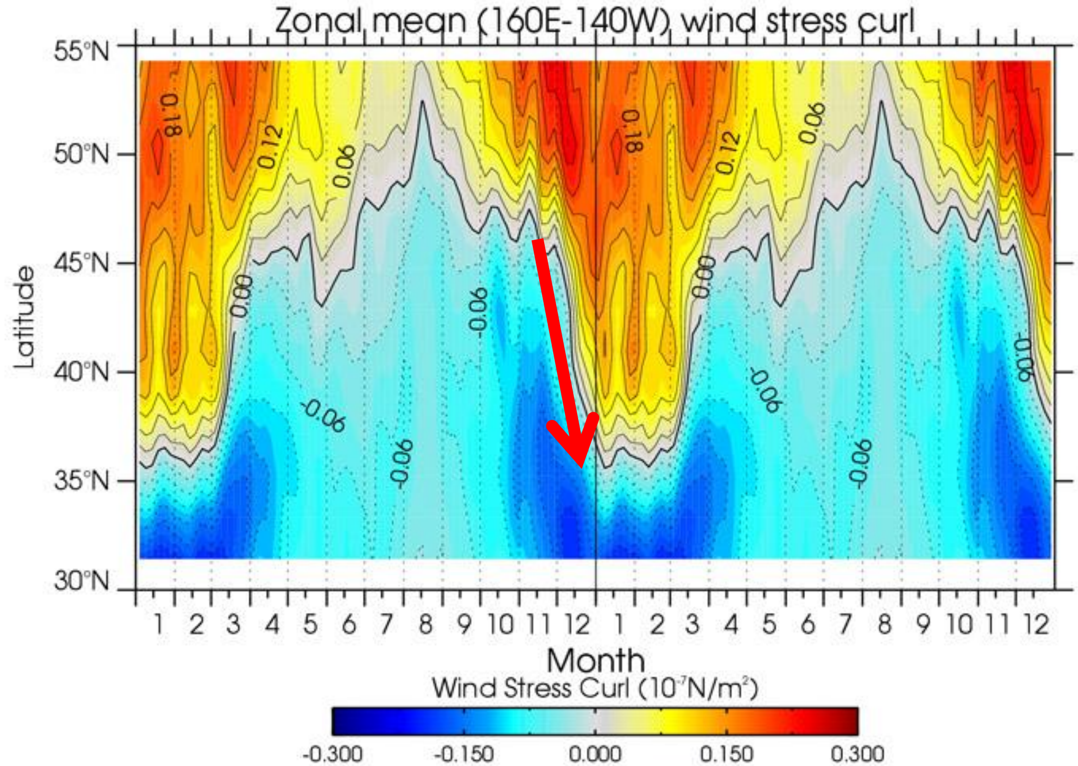
Climatology of Wind & Wind stress curl (October-March)



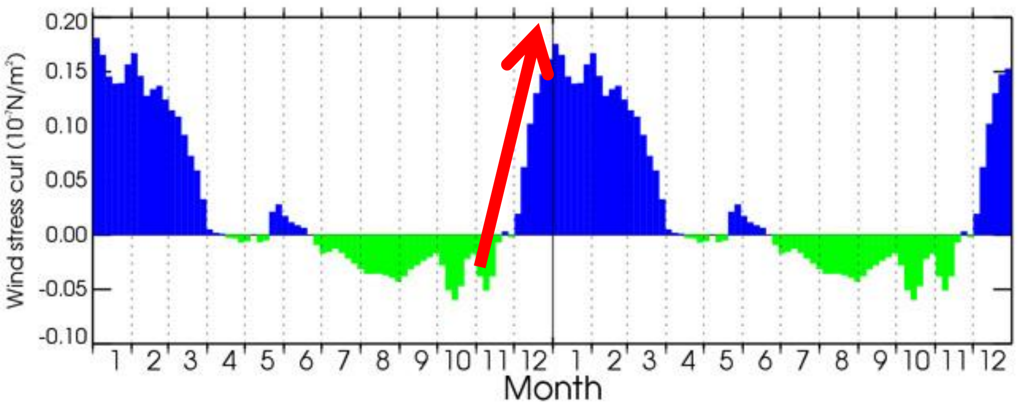
Westerlies rapidly shift southward from late fall to winter.

✓Wintertime abrupt intensification

Annual cycles of zonal mean wind stress curl based on NCEP 5-day climatology



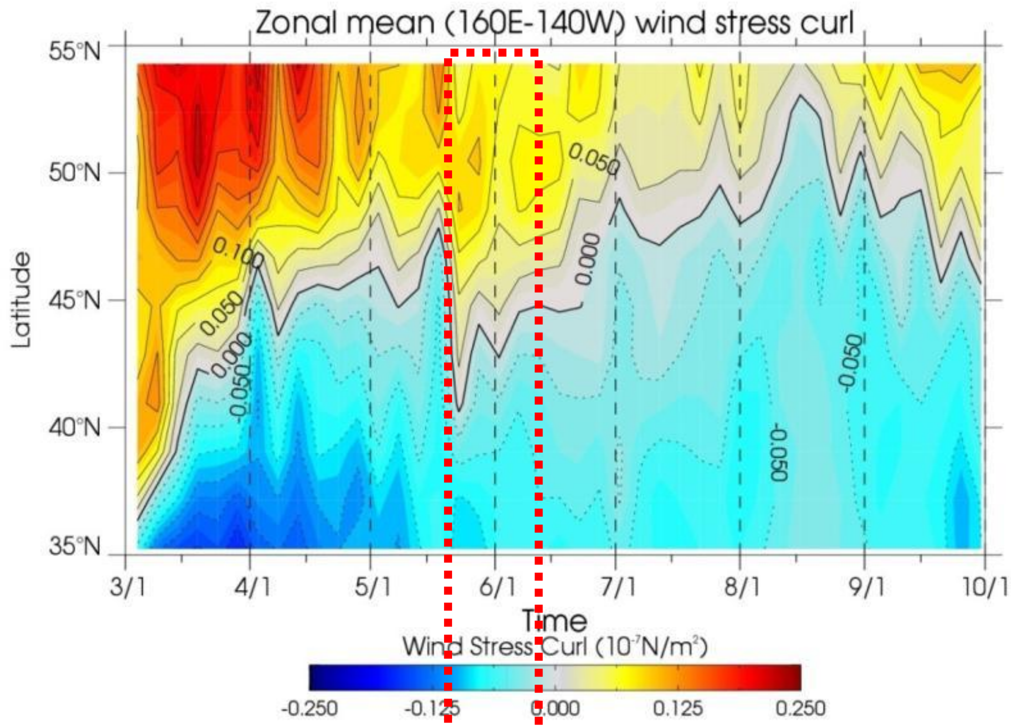
Annual cycles of area-averaged (160E-140W, 40-50N) curl



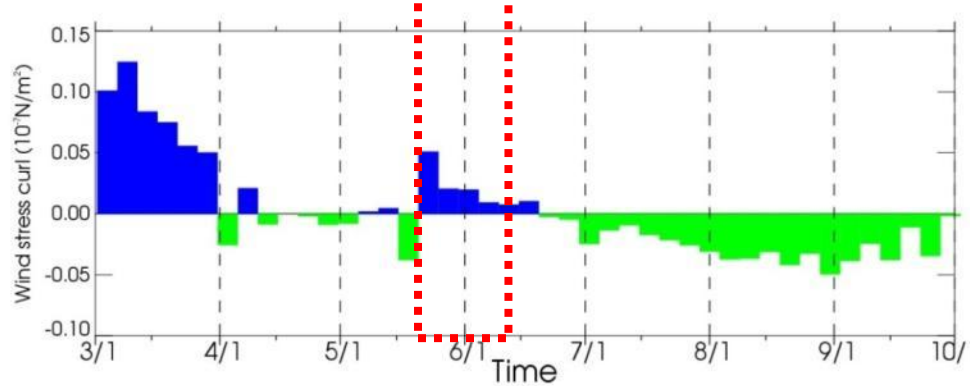
✓Abrupt intensification caused by rapid southward migration of westerlies

✓**Secondary peak in early summer (June)**

Climatology of zonal mean wind stress curl in summer



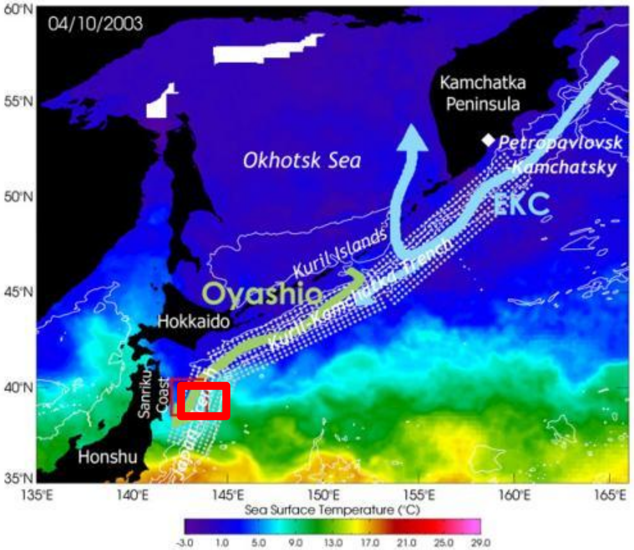
Area-averaged (160E-140W, 40-50N) curl



✓North Pacific Index(based on SLP: Trenberth and Hurrell, 1994) shows small peak in June.

✓Barotropic response to **intraseasonal atmospheric variation** seems to induce Oyashio variation.

✓**Effect on subsurface temperature off the Sanriku coast (red square)**



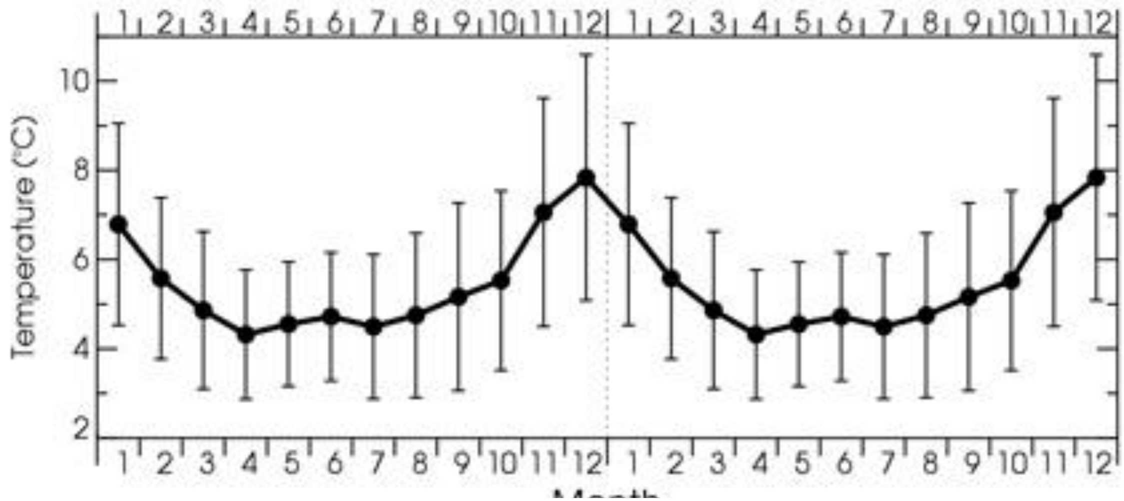
Estimation of **meridional velocity (v)** based on an assumption that temperature (*T*) variation is induced by **meridional heat advection;**

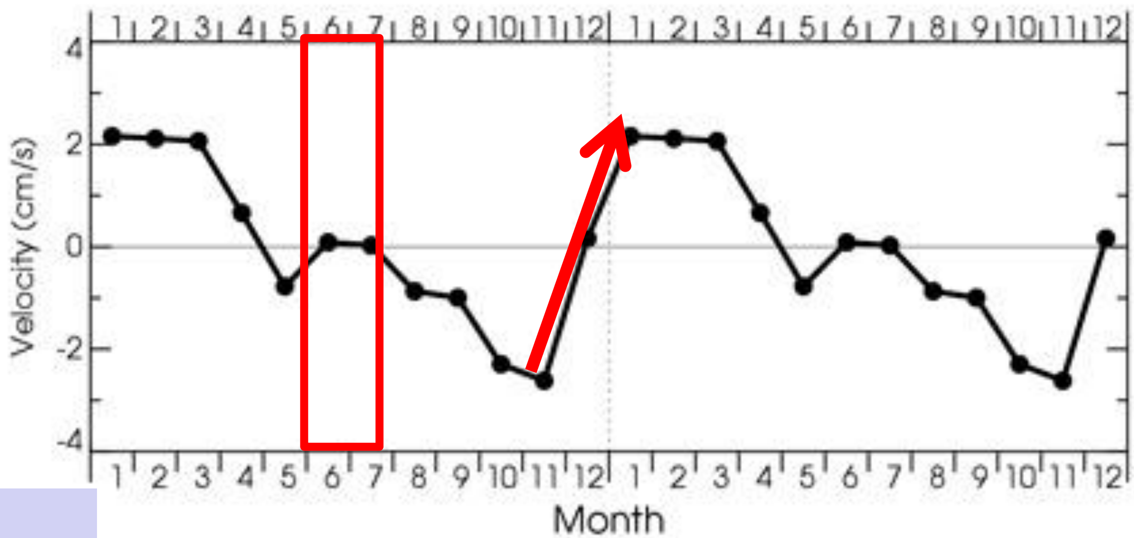
$$\frac{\partial T}{\partial t} = -v\frac{\partial T}{\partial y}$$

✓**Wintertime abrupt intensification**
✓**Secondary peak in early summer**

✓Seasonal variation

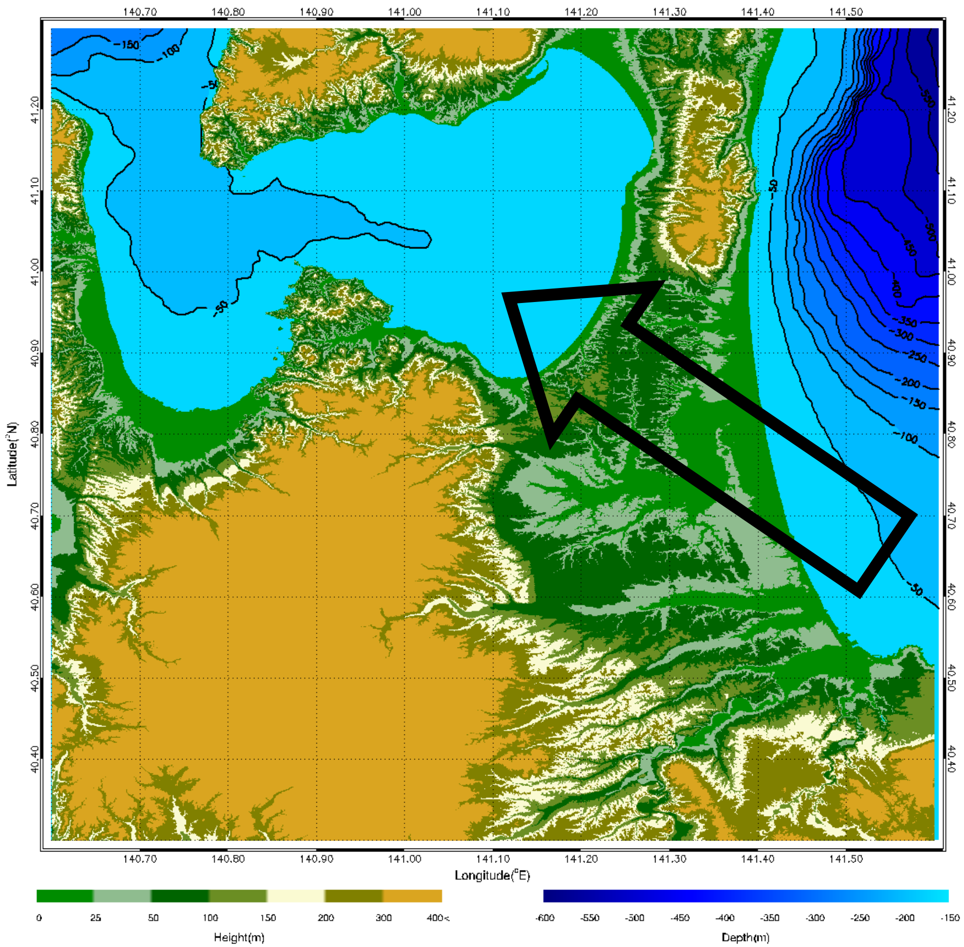
Annual cycle of subsurface (200m) temperature
- from SAGE (JMA,2001) from 1990 to 2000

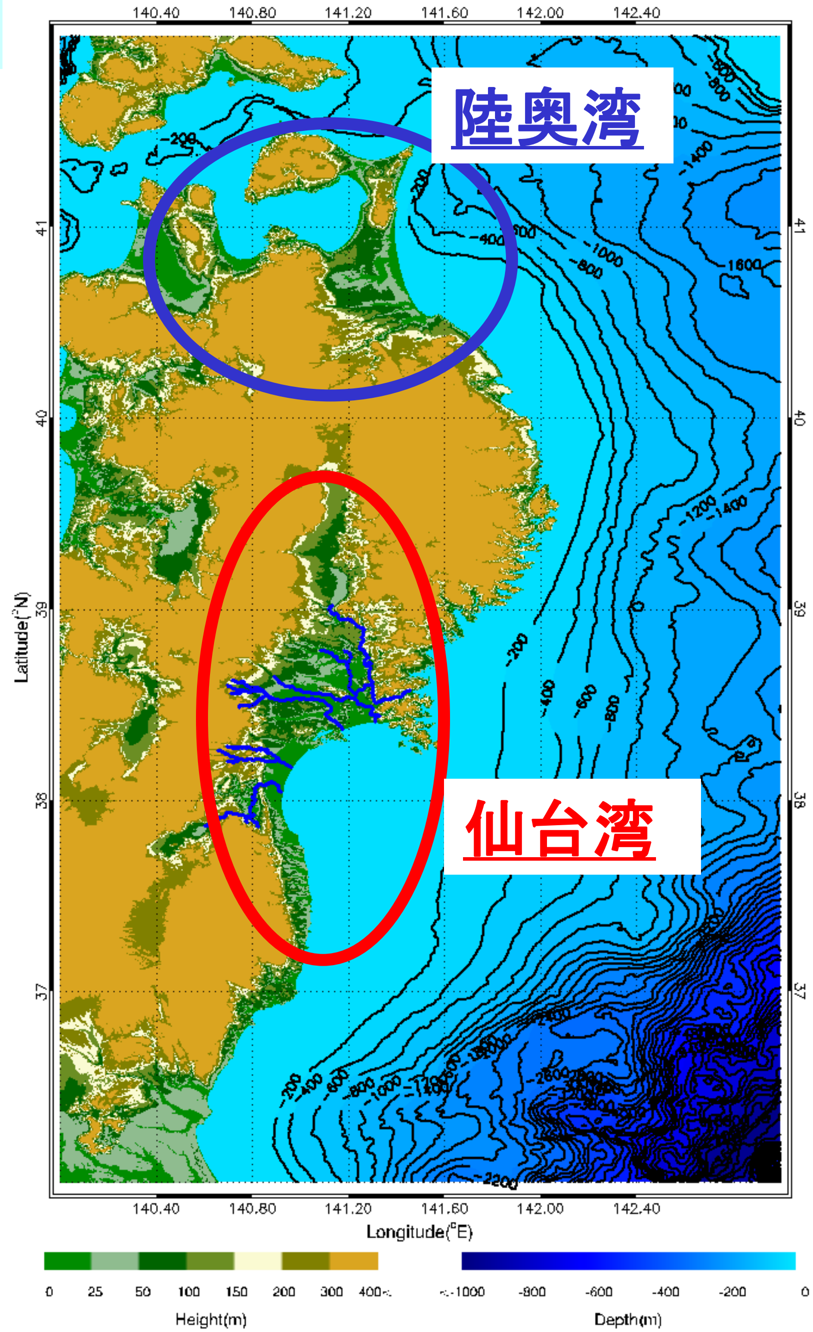




ヤマセと陸奥湾周辺地形

ヤマセ風





東北地方沿岸域の
大気･海洋･陸相互作用