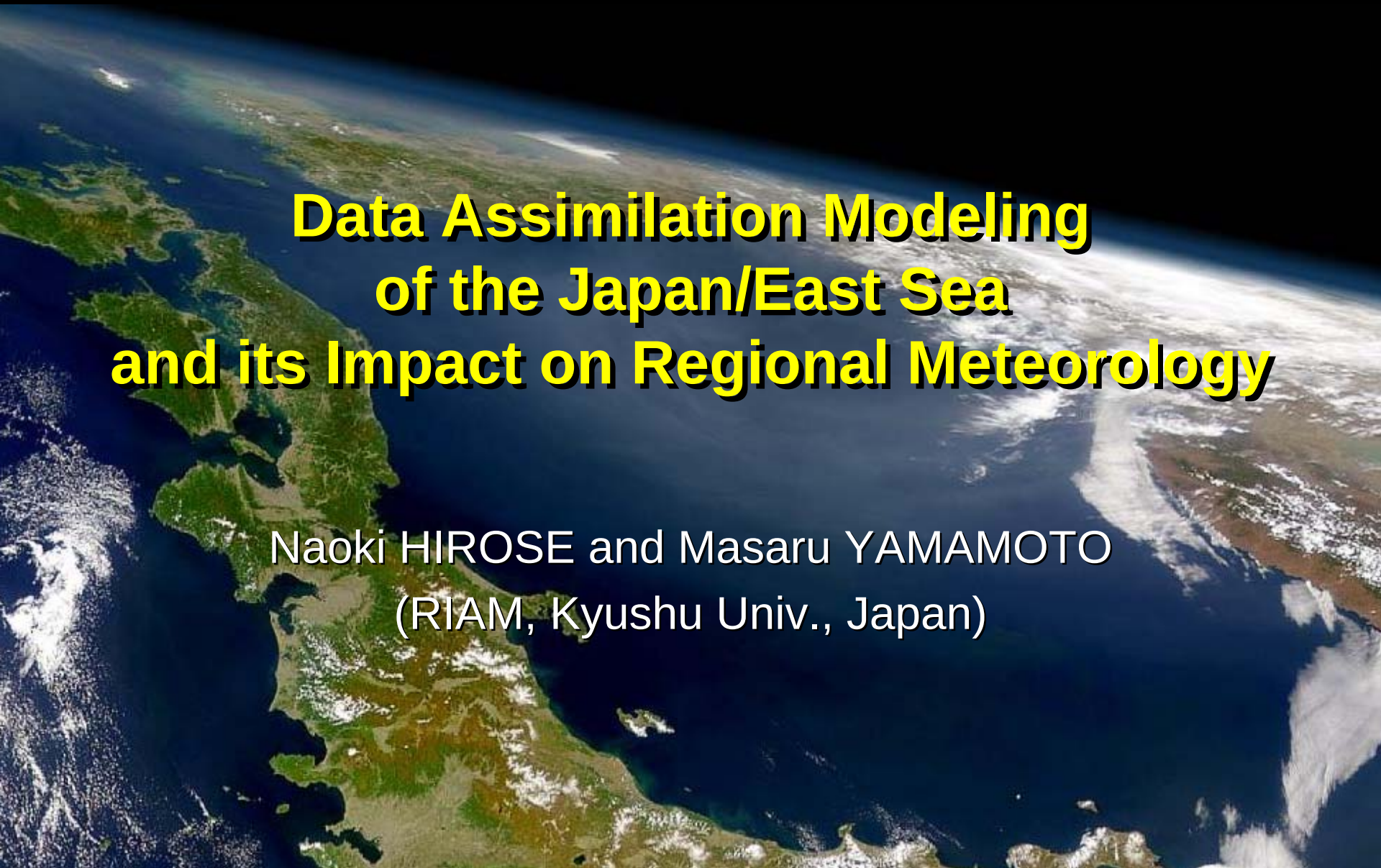
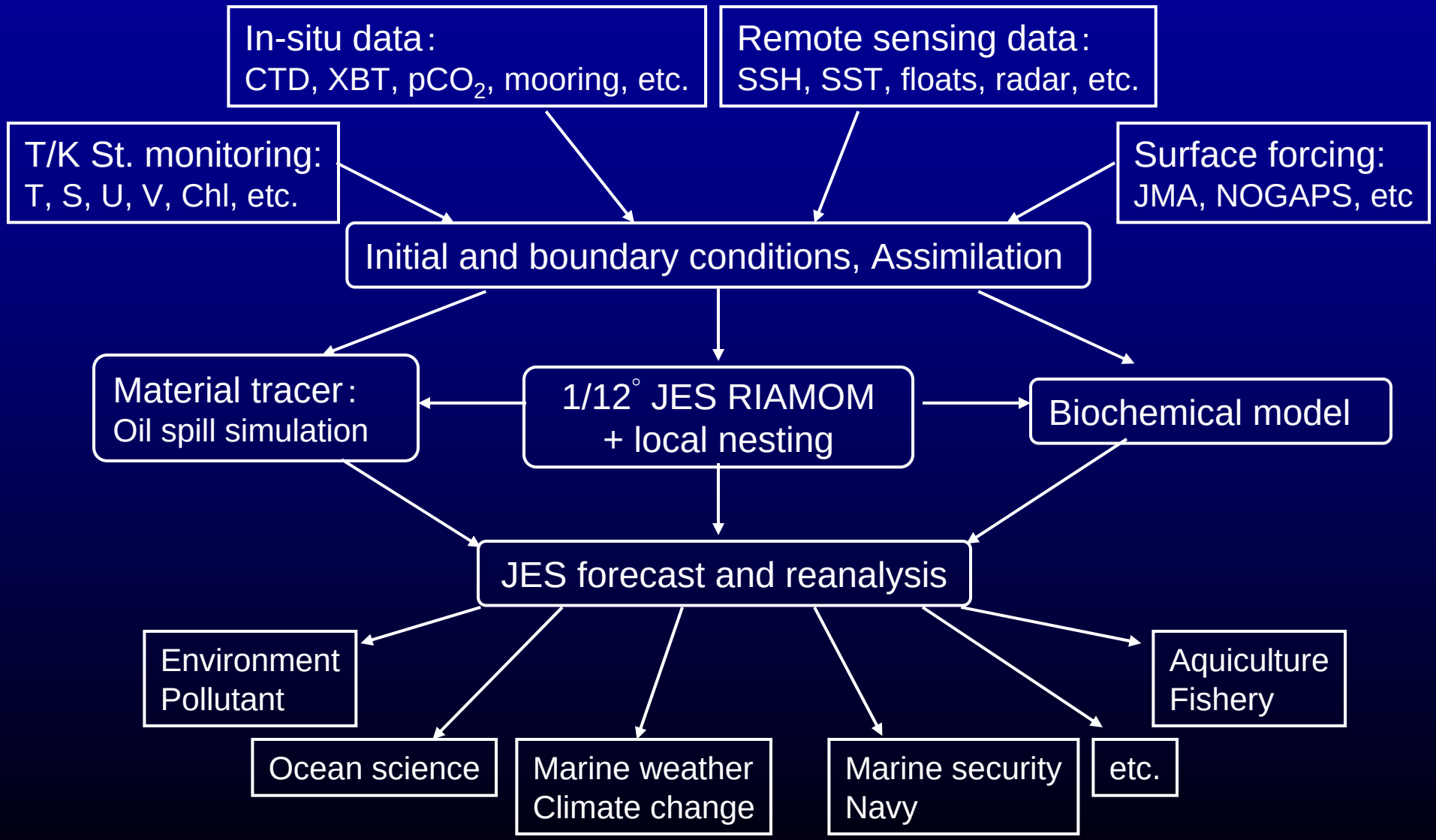
International Workshop for Numerical Ocean Modeling and Prediction
@National Taiwan University, 4/23-25, 2008



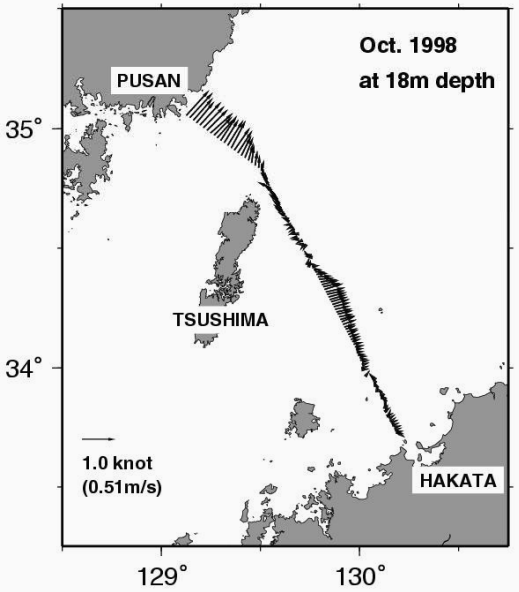
Data Assimilation Modeling of the Japan/East Sea and its Impact on Regional Meteorology

Naoki HIROSE and Masaru YAMAMOTO
(RIAM, Kyushu Univ., Japan)

JES Forecasting System



"Camellia"
(Hakata - Pusan)



Monthly mean velocity
at 18 m depth (Oct. 1998)

Transducer of
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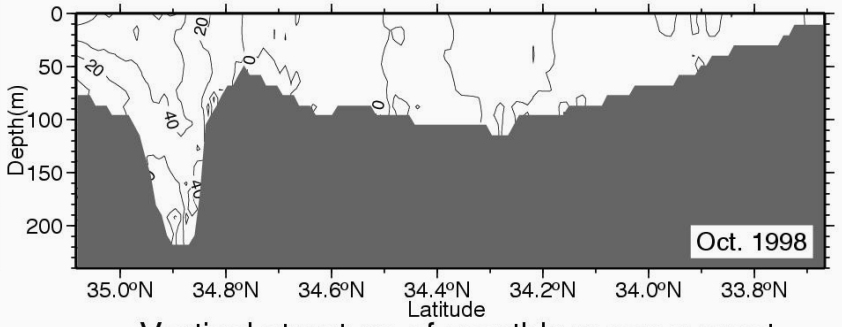
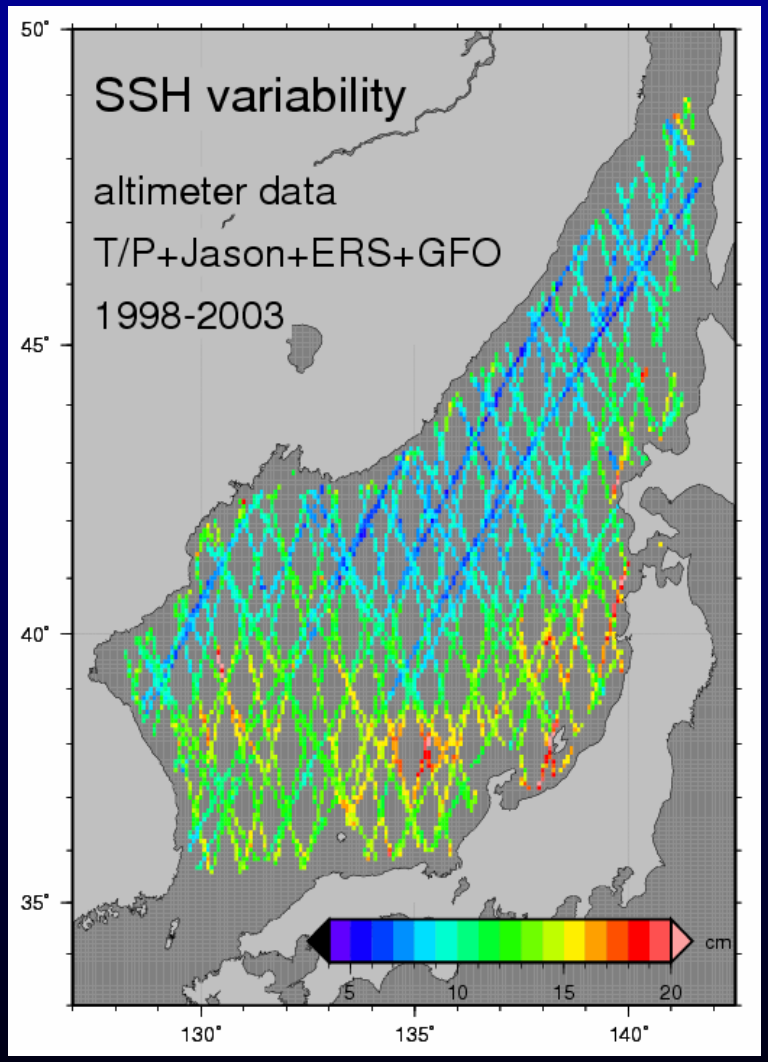
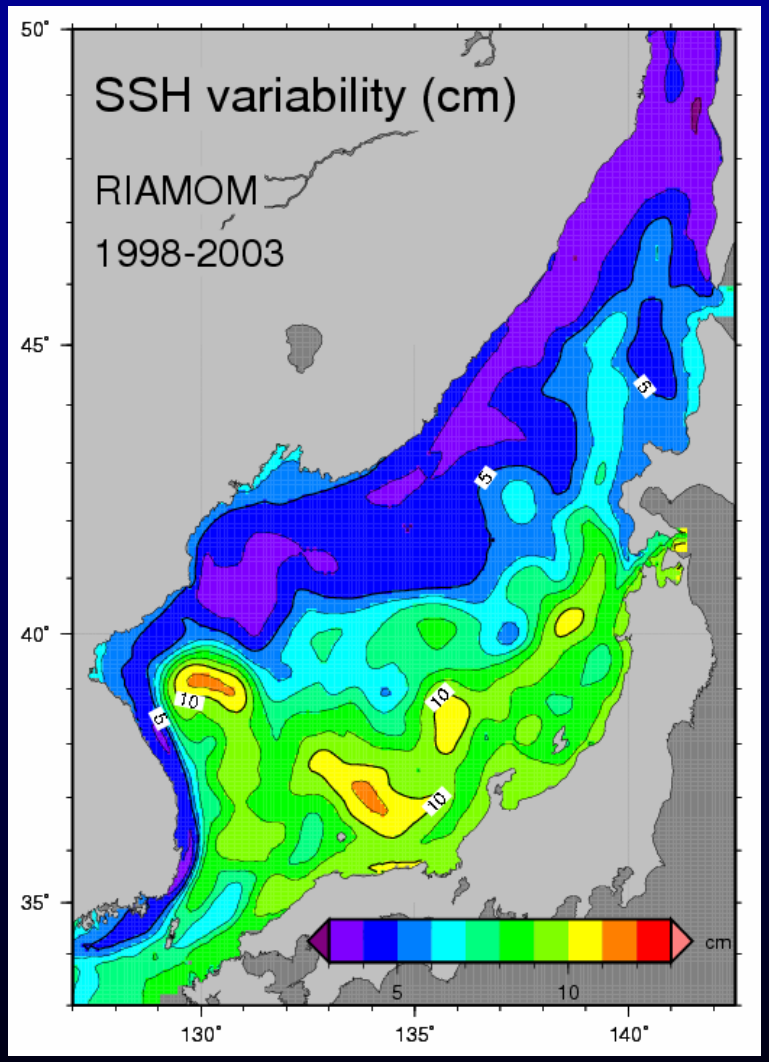


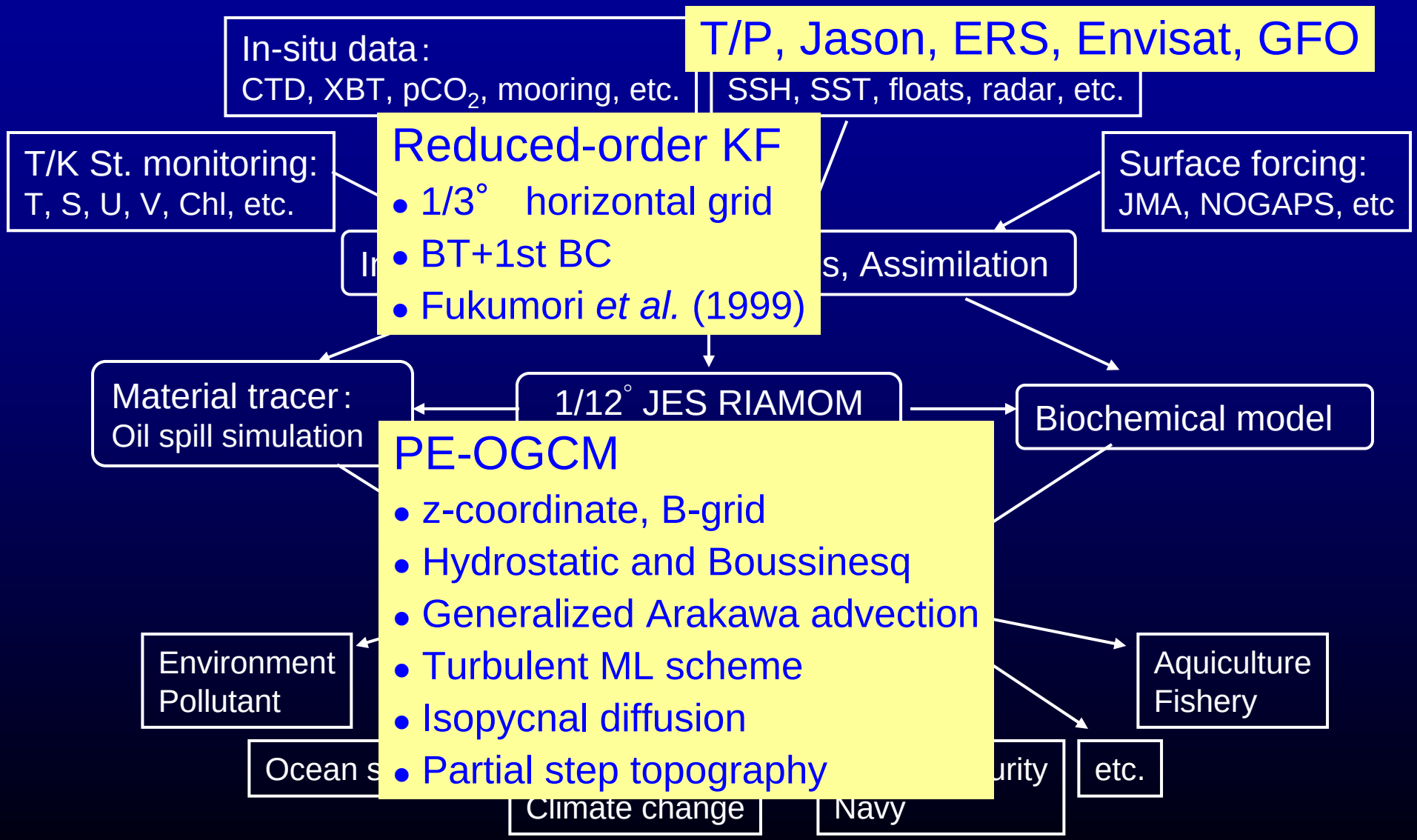
Vertical structure of monthly mean current
(Oct. 1998) (cm/s)

SSH Variability

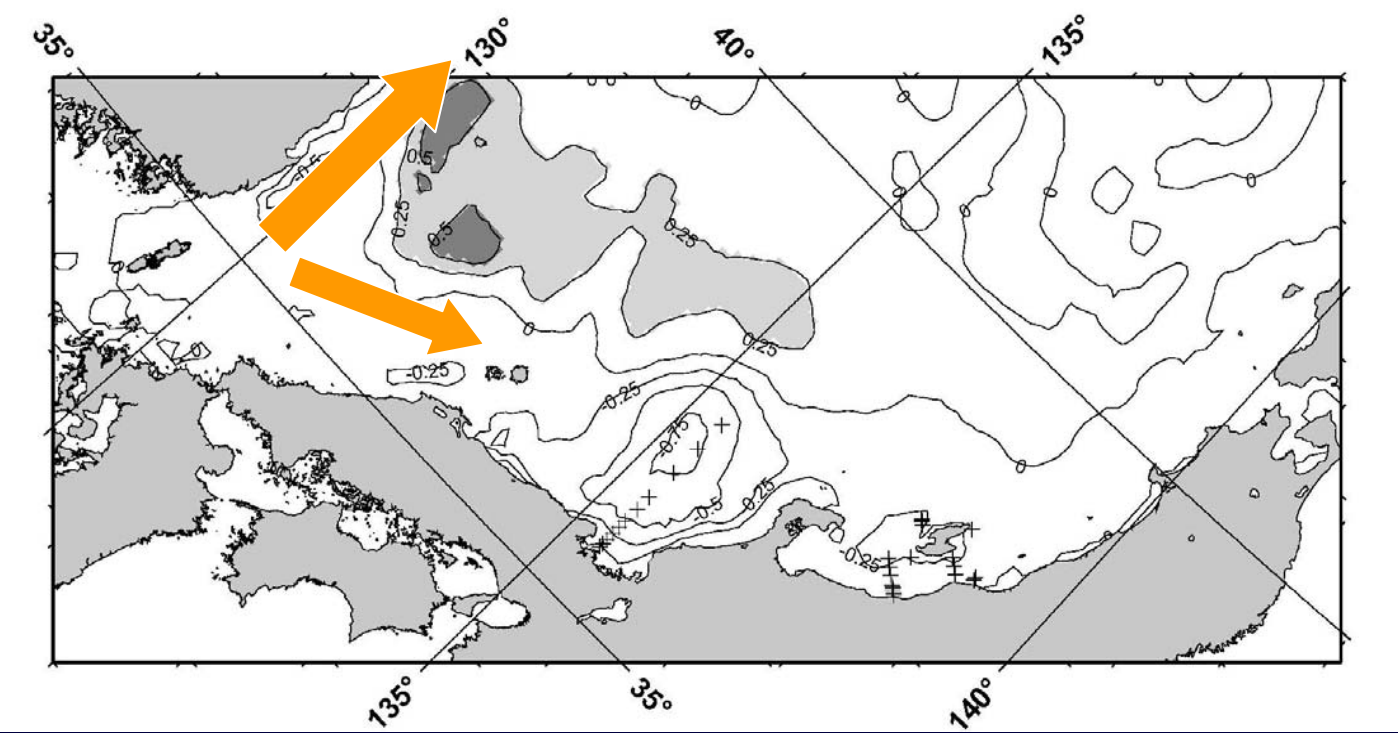




JES Forecasting System

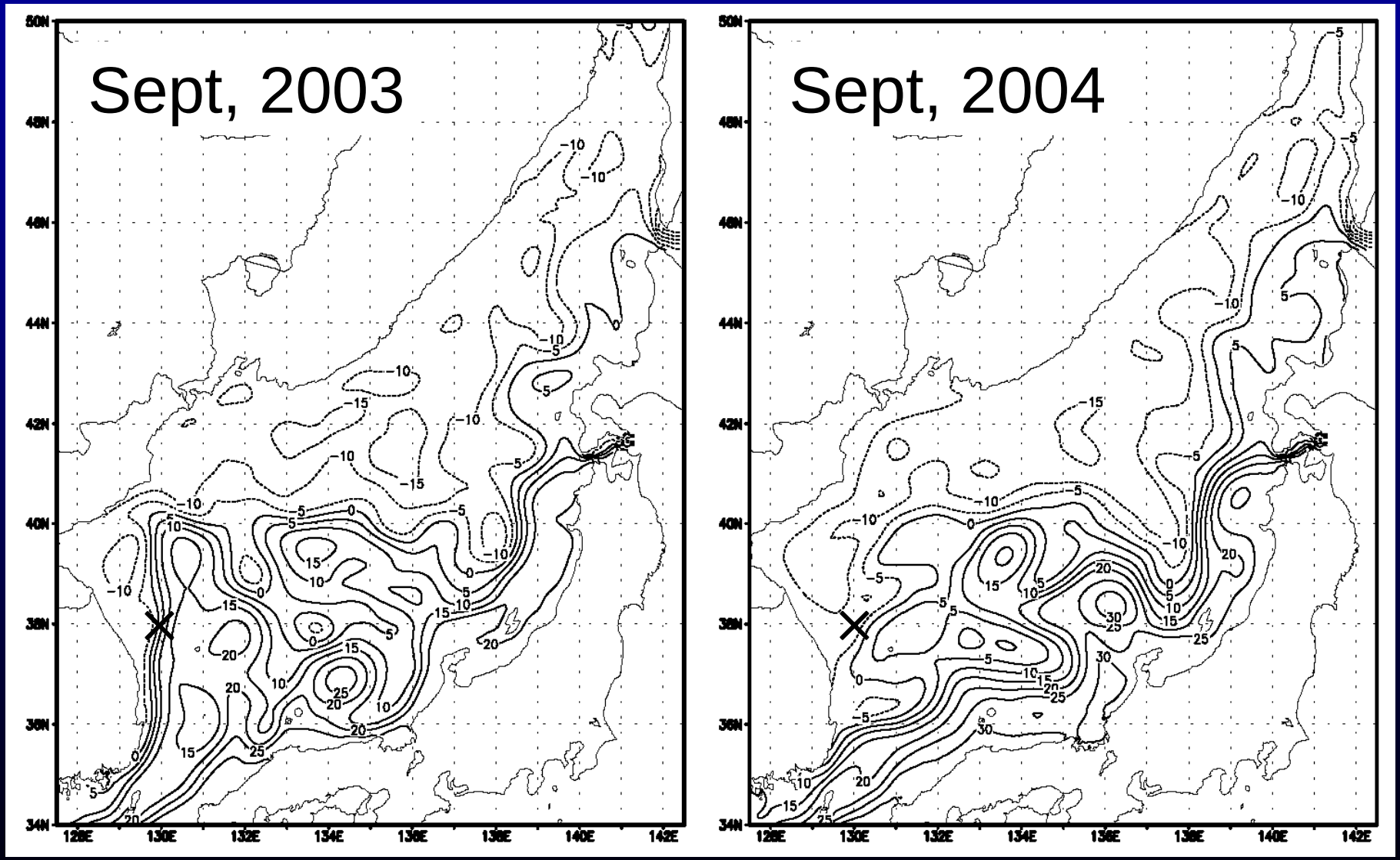


Example of Gain structure

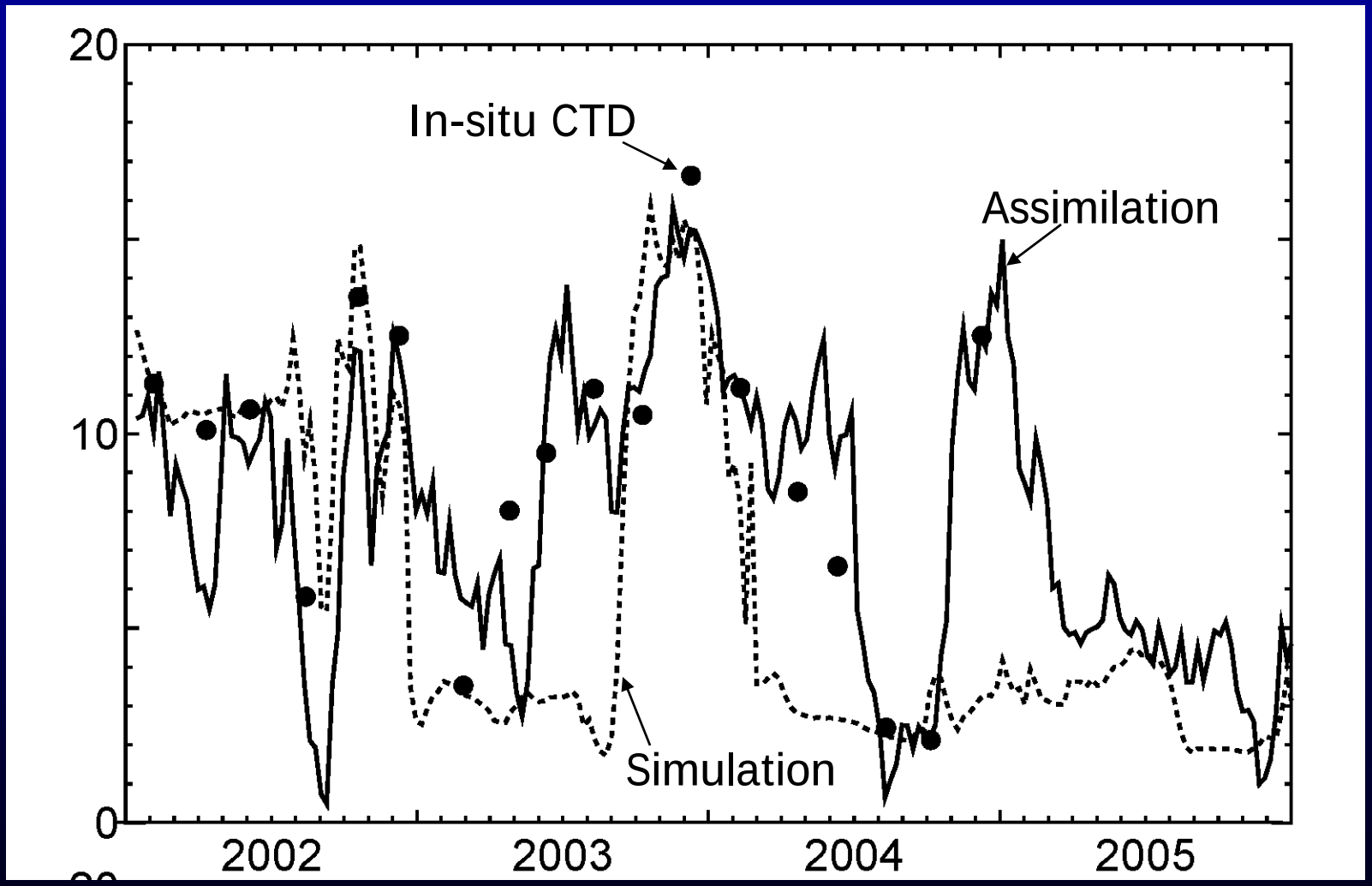


Temperature difference [°C] between filtered and predicted at 100m depth on 1st March 1999. Cross marks indicate CTD casting points.

SSH Estimates



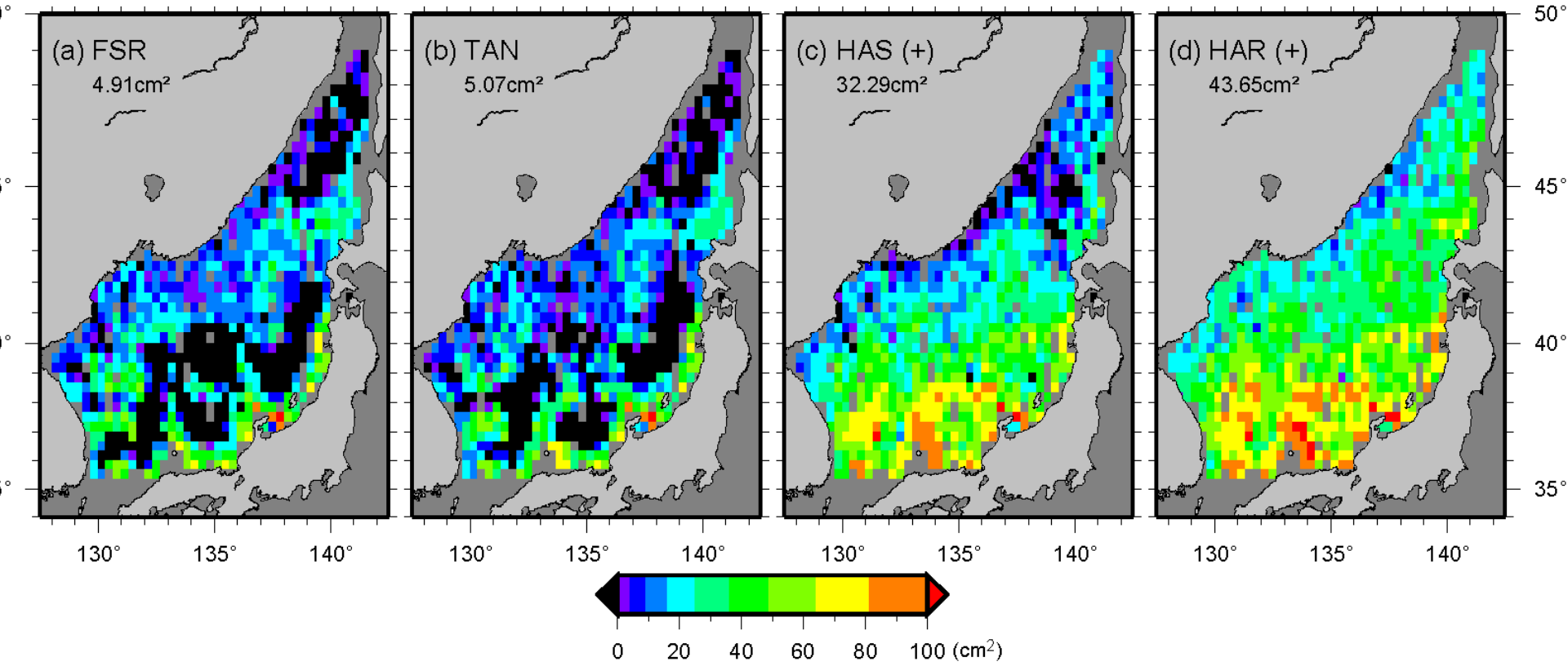
Temp at 100m in 38° N, 130° E



CTD data from NFRDI, Korea

SSH Explained Variance

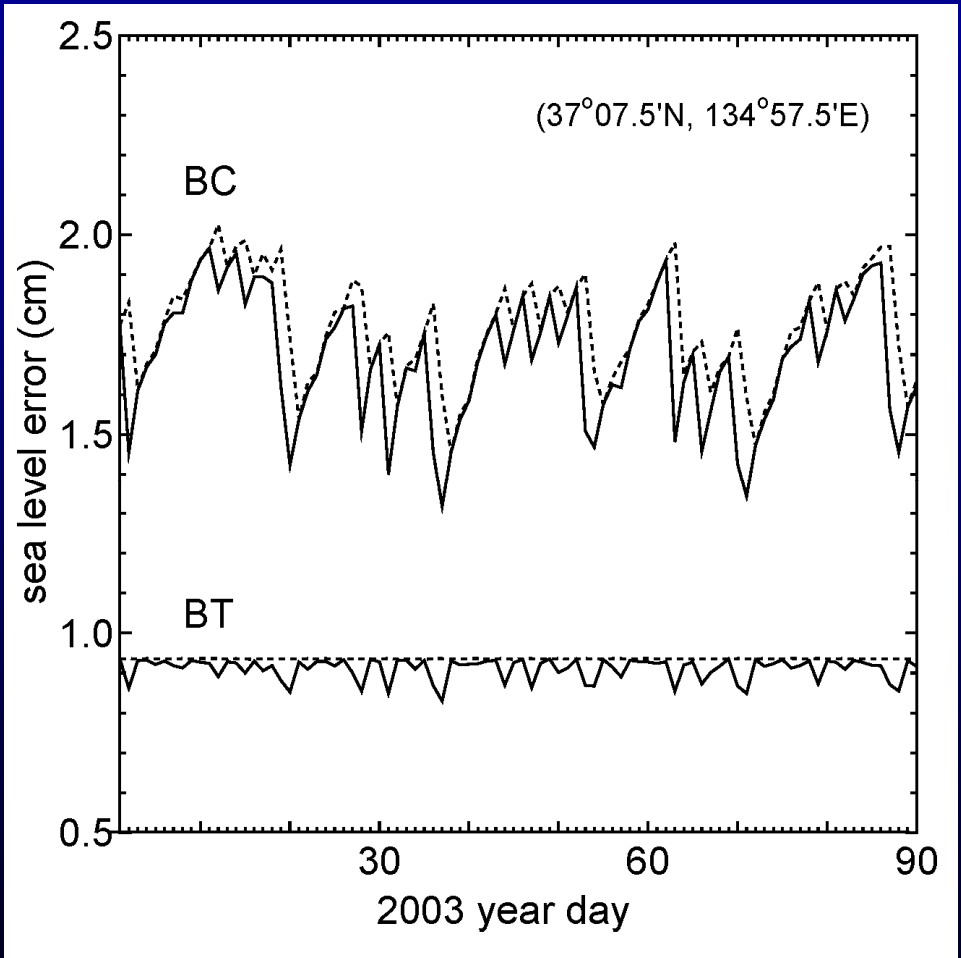
Forward Simulation	SST nudging	SSH DA by steady filter	SSH DA by RDE



~1.800 hour	~1.800 hour	~1.870 hour	~2.167 hour

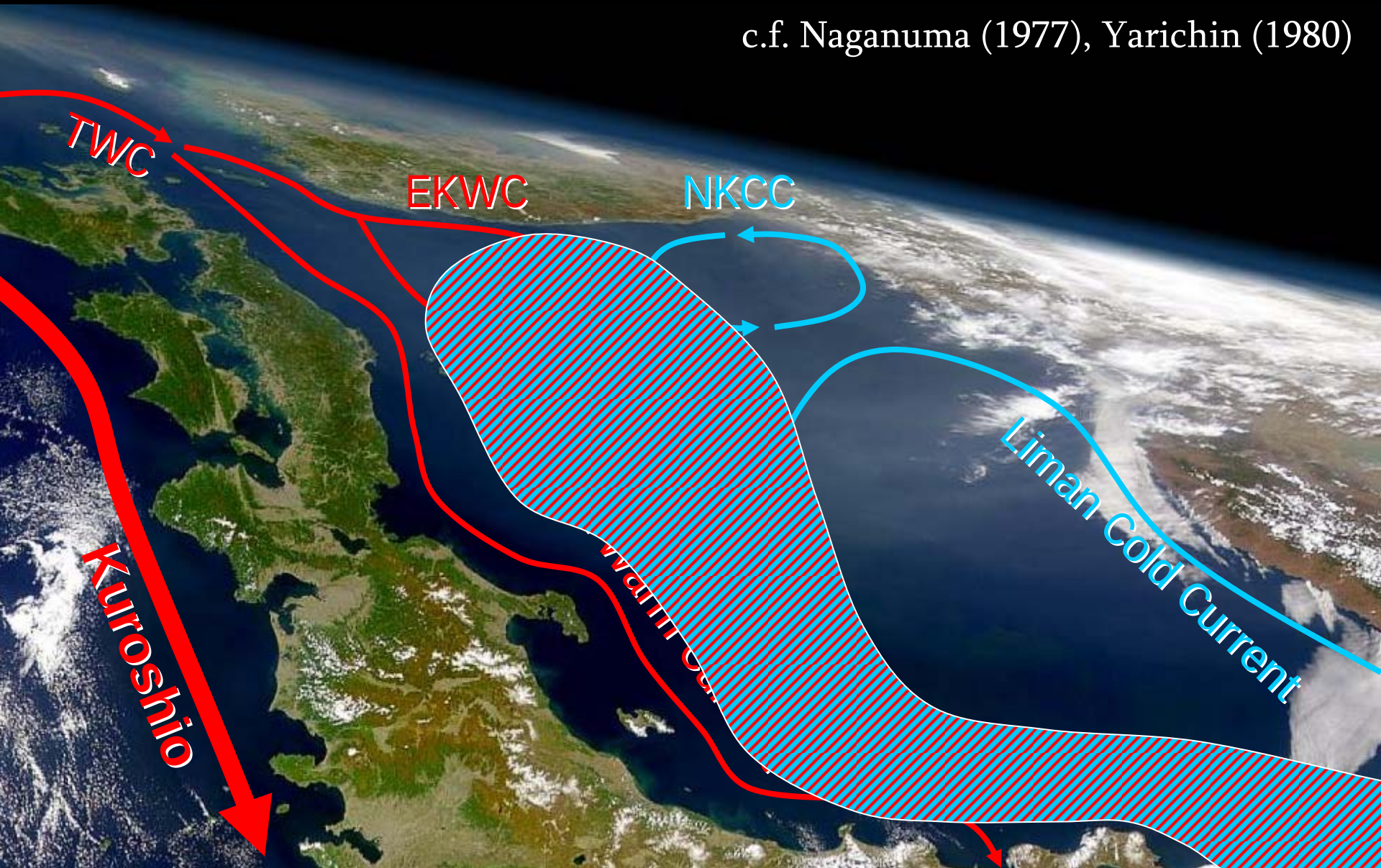
CPU time

Variable Error Covariance

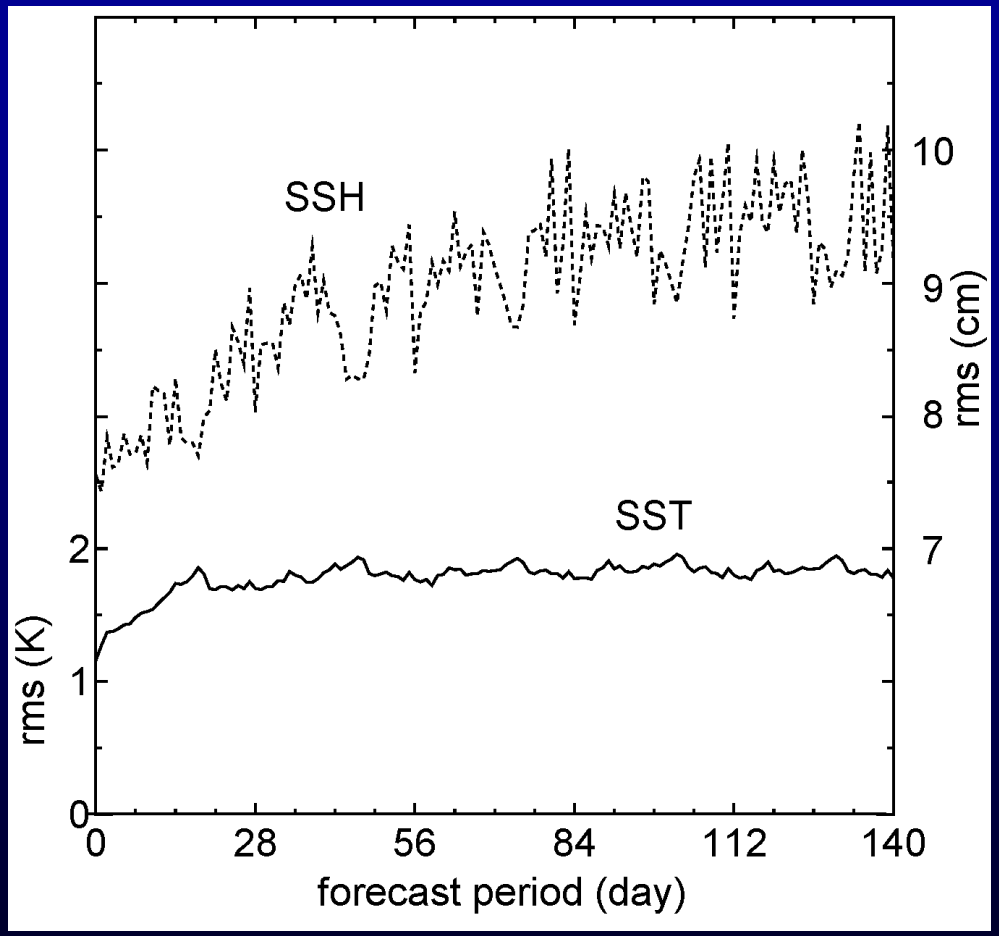


Surface Current

c.f. Naganuma (1977), Yarichin (1980)

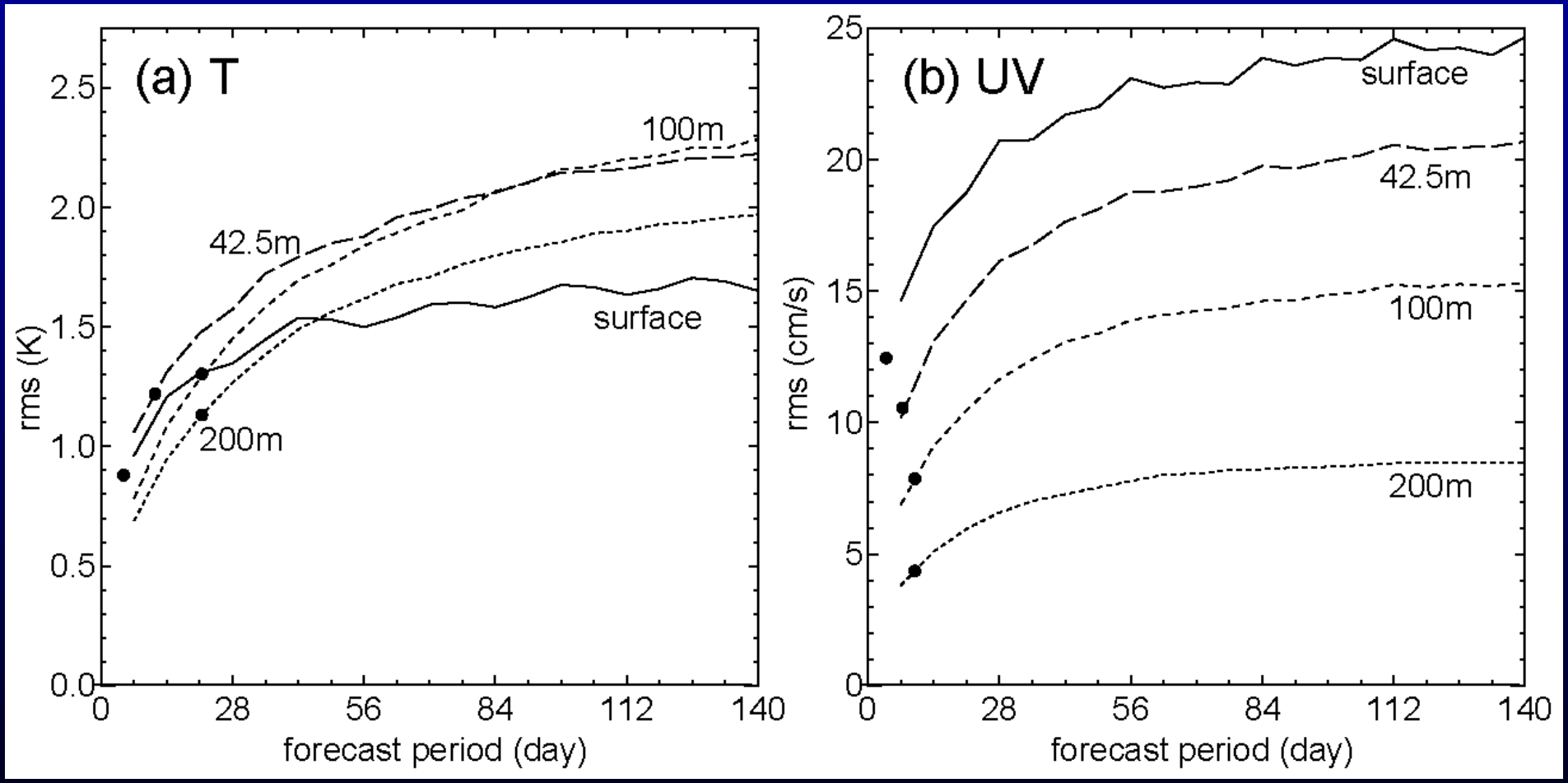


Forecast RMSE

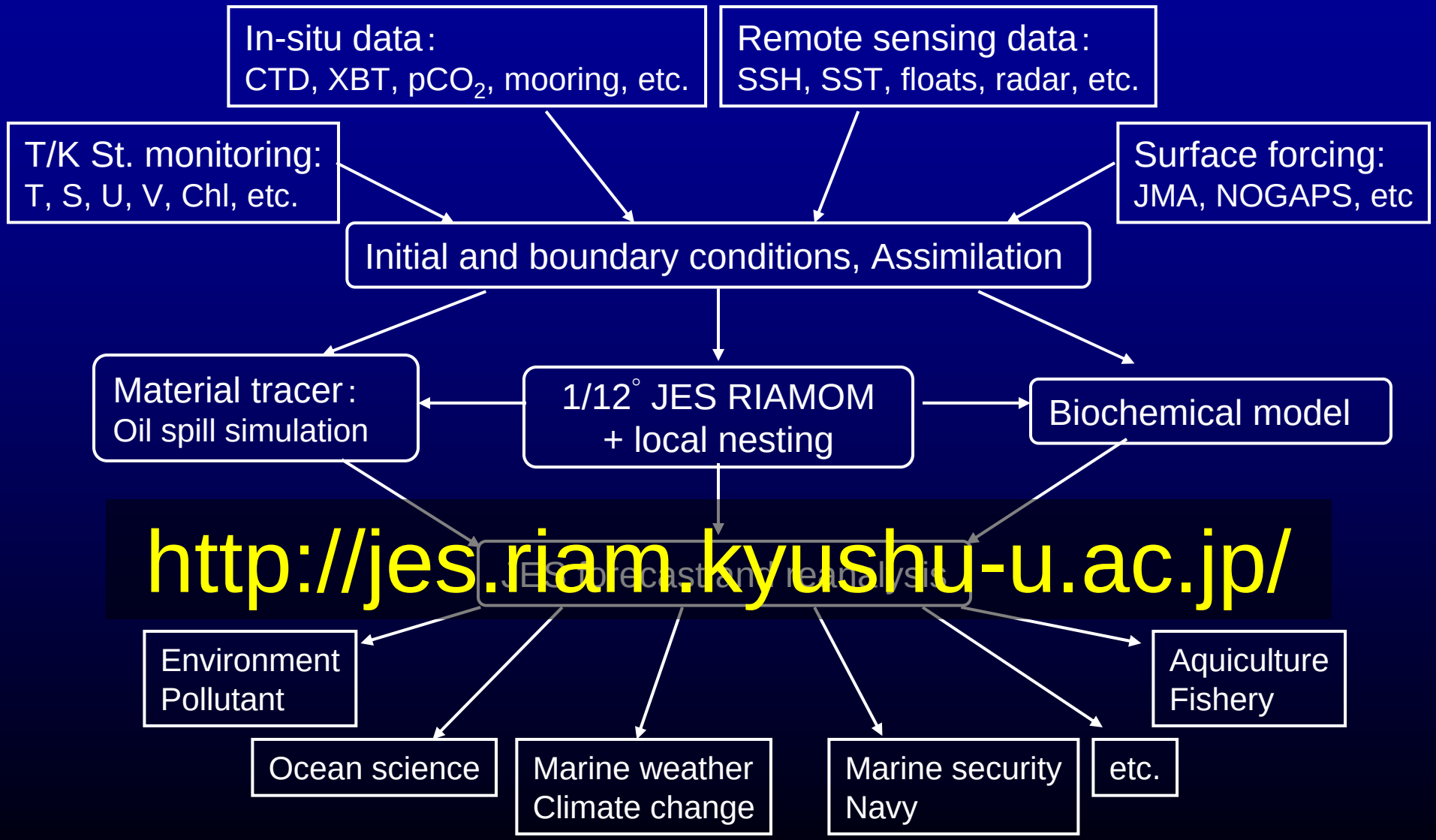


Average of 40 forecasts

Dependence on depth



JES Forecasting System



Operational Japan Sea forecasts with the RIAM Ocean Model

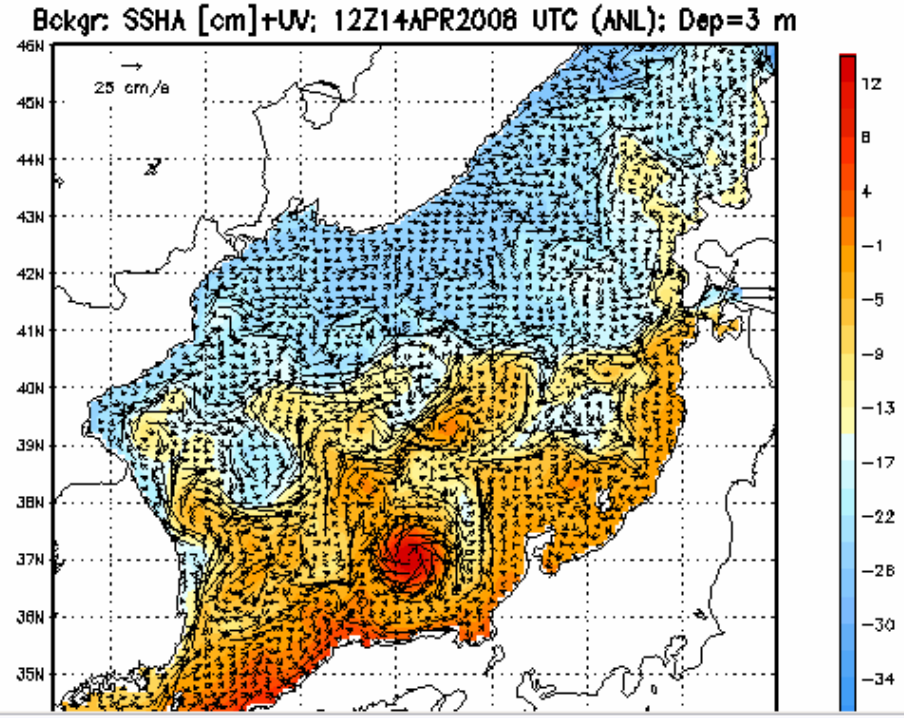
The sequential forecasting of the Japan/East Sea has started October 2004.
This top page shows a few examples of recent forecasts.
Go to the interactive data visualization page for choice of modelling system *version*, parameters, regions and depths that you are interested in.
We welcome your constructive suggestions and questions.

Open access
RIAM Japan Sea operational ocean prediction system
RIAM system description
Selected climate and reference data sets

Restricted access
Operational oceanography for Pacific and Global oceans
Meteorology
Development of the Tokyo and Sagami Bays regional ocean prediction system
Experimental Japan Sea initialized short term prediction system
Atlantic Ocean and Mediterrenian Sea European (MERSEA) and USA operational oceanography products

[Japanese] [Korean] [Russian]

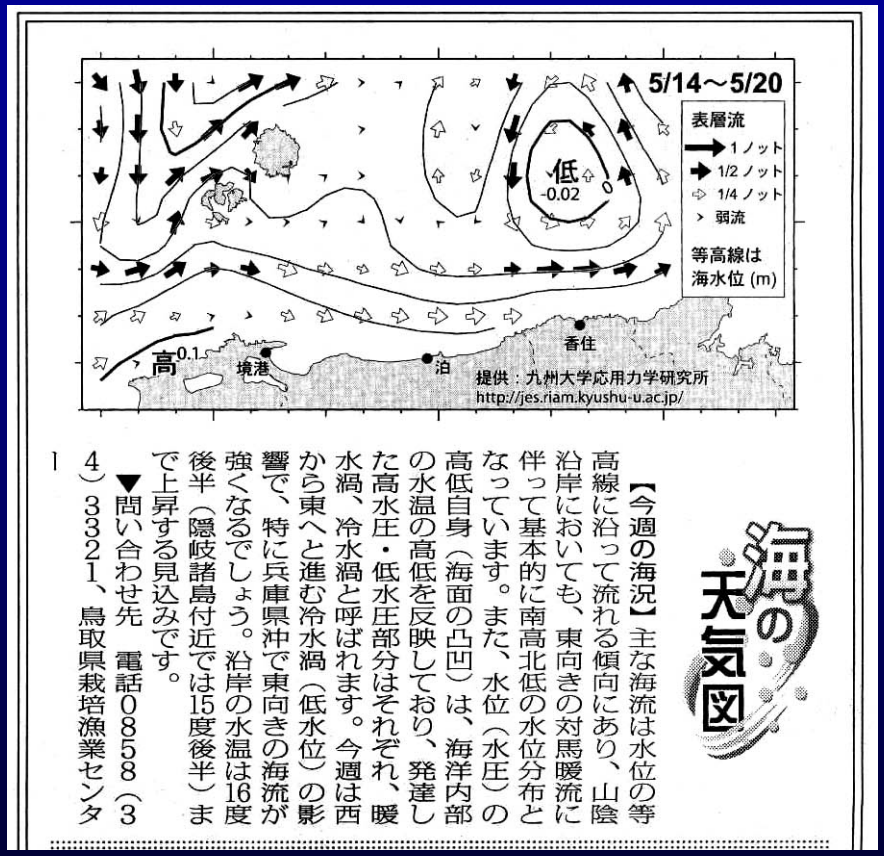
10-weeks nowcast/forecast based on data assimilation excluding tide, updated weekly



Nowcast of the sea surface height (cm) and current (cm/s)

Regular article

on a local newspaper
“日本海新聞”
biweekly since 5/14, 2007



海の天気図

【今週の海況】主な海流は水位の等高線に沿って流れる傾向にあり、山陰沿岸においても、東向きの対馬暖流に伴って基本的に南高北低の水位分布となっています。また、水位（水圧）の高低自身（海面の凸凹）は、海洋内部の水温の高低を反映しており、発達した高水圧・低水圧部分はそれぞれ、暖水渦、冷水渦と呼ばれます。今週は西から東へと進む冷水渦（低水位）の影響で、特に兵庫県沖で東向きの海流が強くなるでしょう。沿岸の水温は16度後半（隠岐諸島付近では15度後半）まで上昇する見込みです。

▼問い合わせ先　電話0858（34）3321、鳥取県栽培漁業センタ

「海の天気図」開始に寄せて

漁場環境類推にひと役

山陰沖を流れる対馬暖流は、時々刻々と変化しています。海の中にも高気圧や低気圧があり、海流や水温の変化に作用して、さらにさまざまな生物の分布や行動にも影響を与えます。例えば鳥取県の沿岸では、東向きの海流が時に西向きに転じて漁場環境が一変する、逆潮（さかしおと呼ばれる現象が知られています。

海洋観測と数値計算法の進展により、こうした海洋変動をかなり正確に再現し、予測することも可能になってきました。また国会では海洋基本法が成立し、海洋環境の利用と保全に対する意識も高まりつつありま

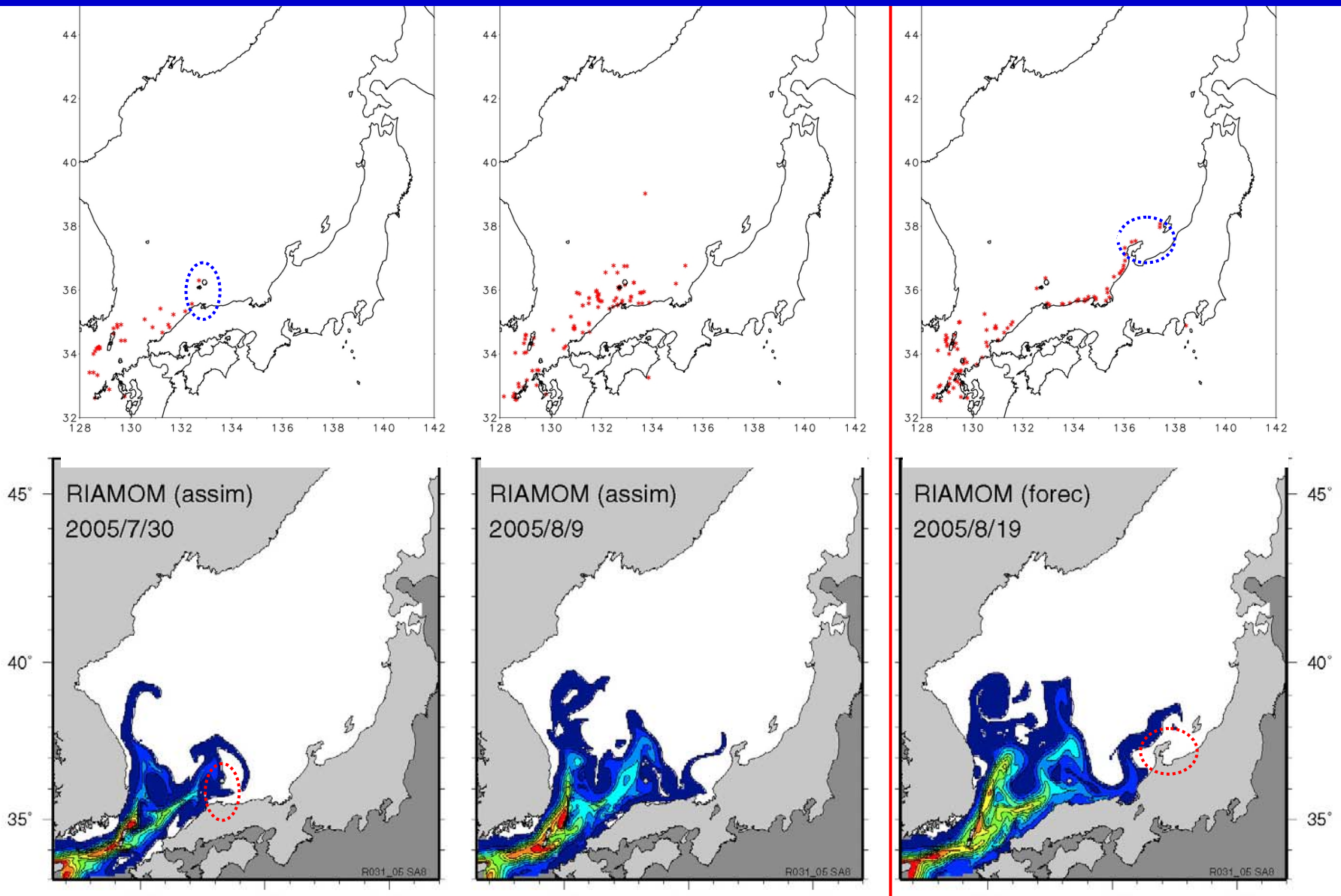
す。

そこで、今回から二週間ごとに、海洋関連産業全般に基礎的な情報となる、海面付近の流れの方向と強さ、および海水位を「海の天気図」として本紙に掲載する運びになりました。海流の情報によって船舶の効率的な運航や漂流物の追跡が容易になり、海面の高低から深部の海流や暖水・冷水の分布を知り、ひいては漁場環境を類推することも可能になります。最新の海洋科学が、山陰地方の各種産業の発展に寄与できれば幸いです。

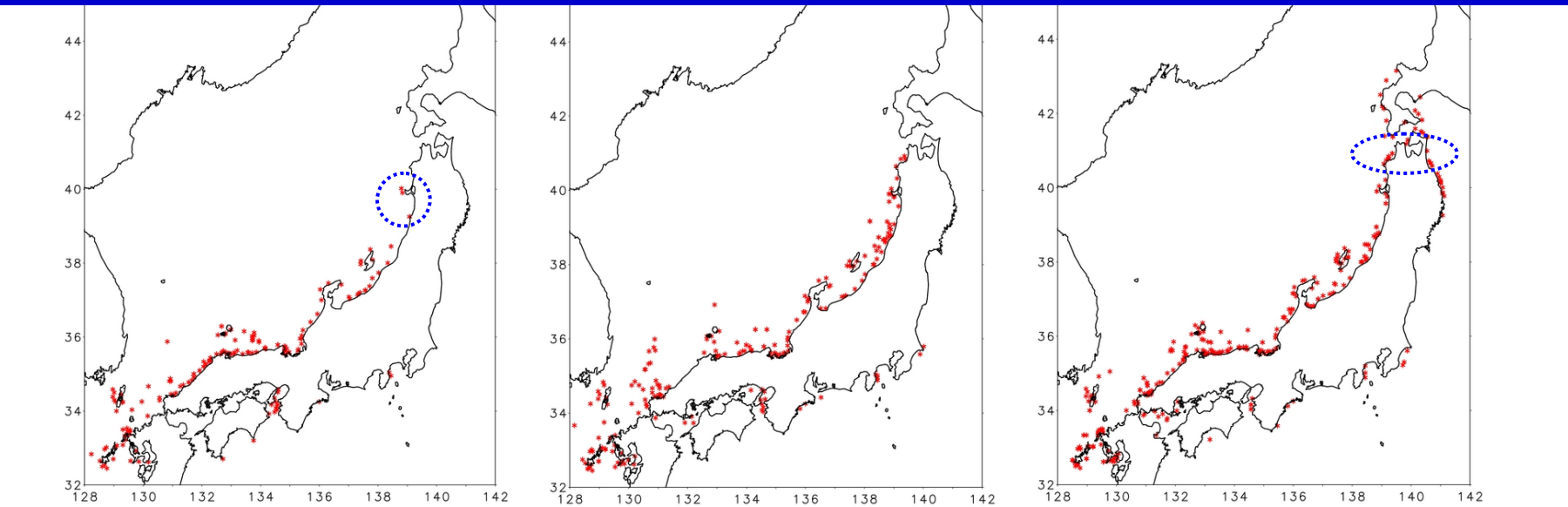
（九州大学応用力学研究所准教授・広瀬直毅）

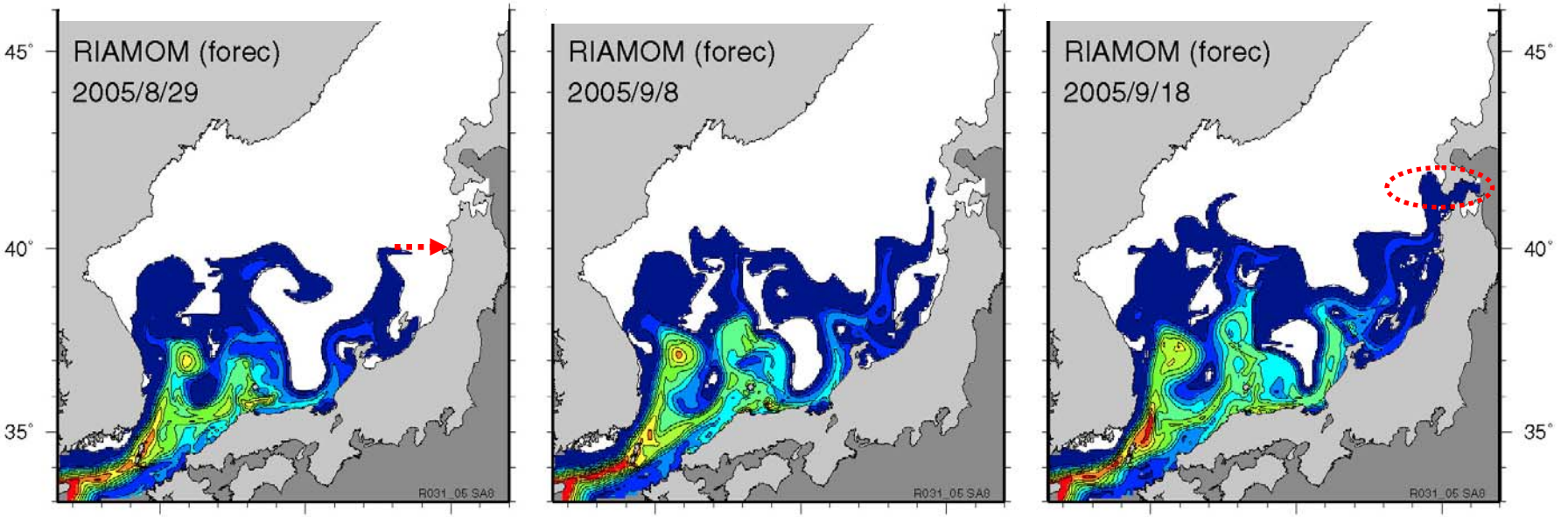
Giant Jellyfish

Giant Jellyfish Simulation

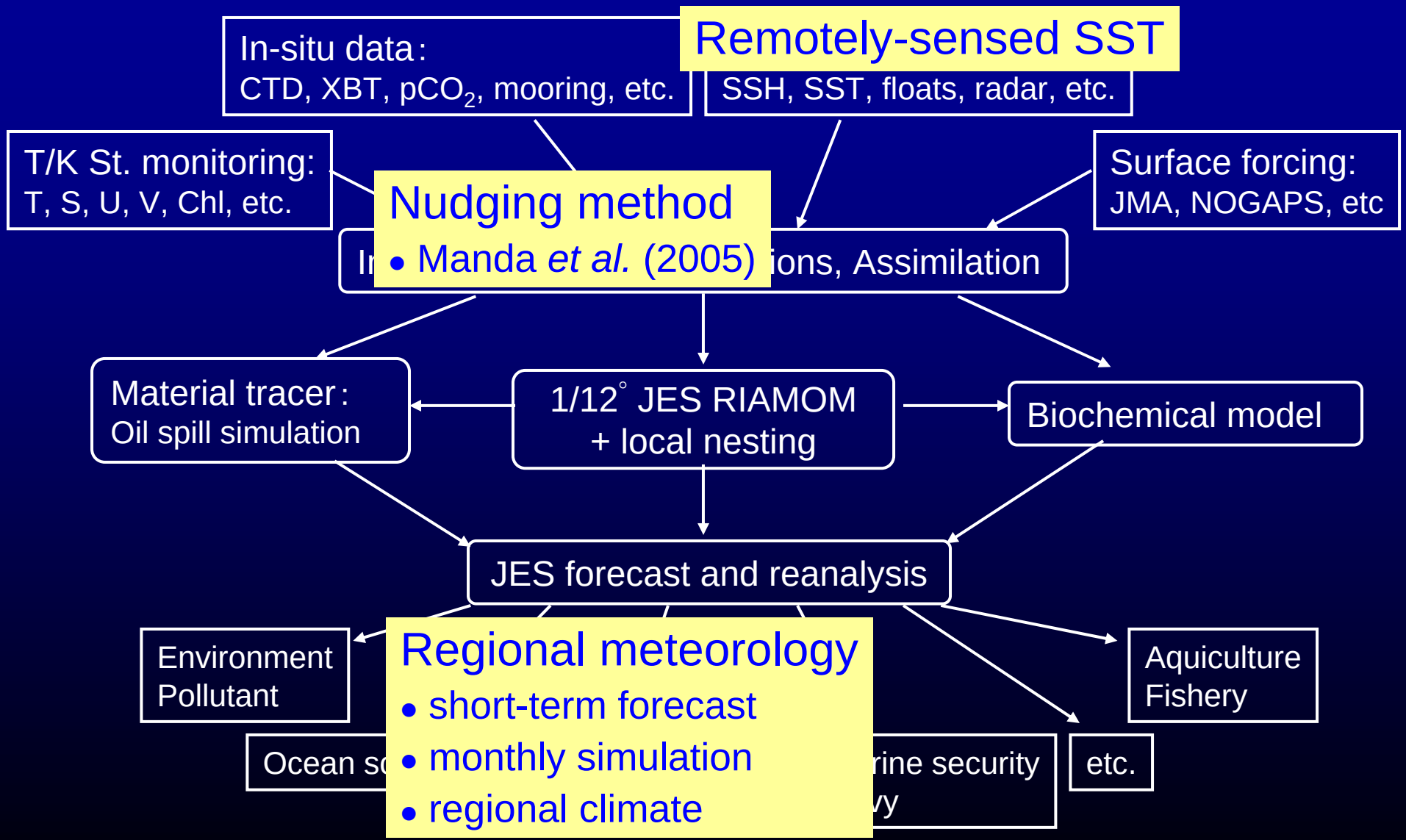


Giant Jellyfish Simulation

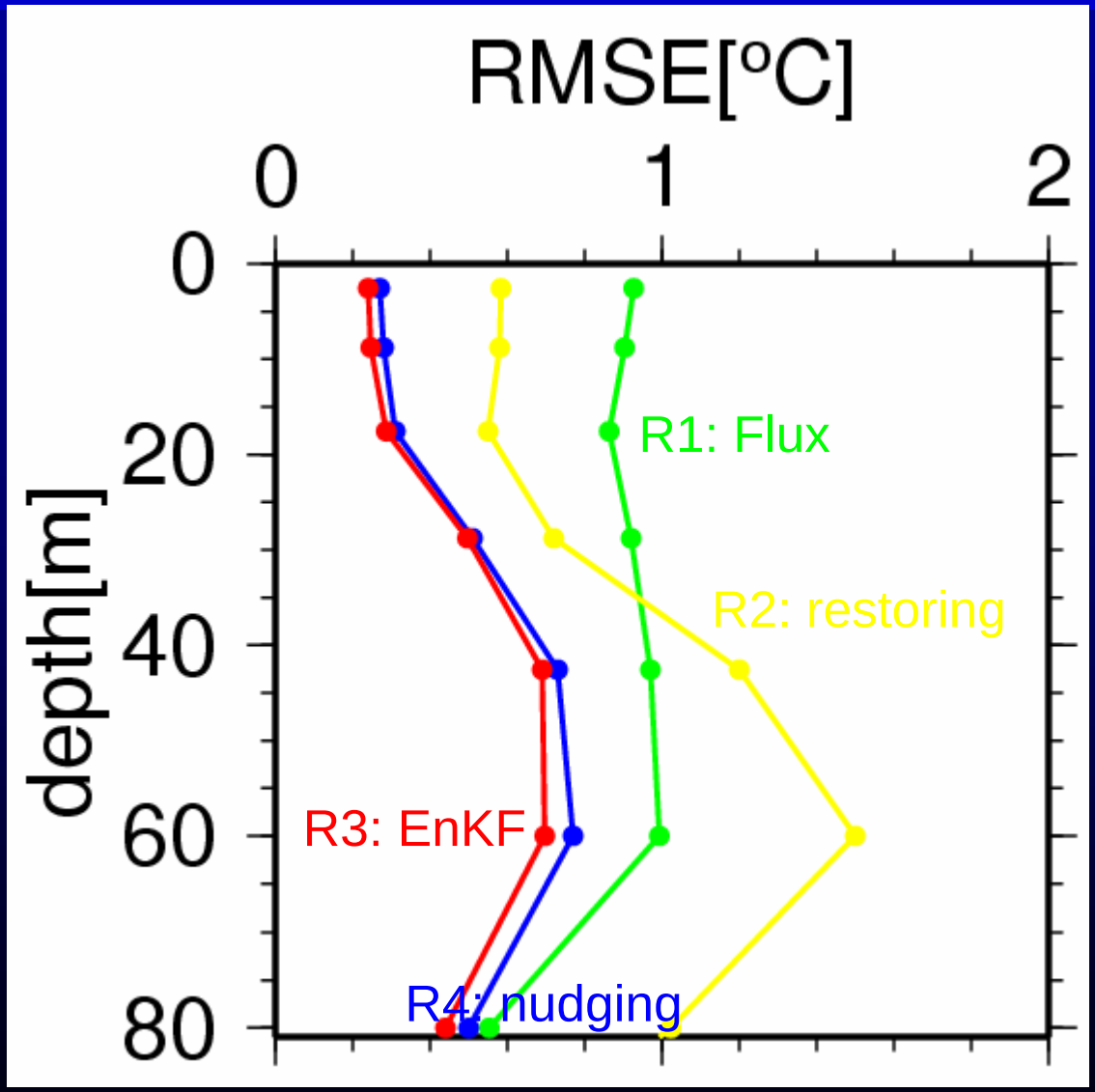




JES Forecasting System



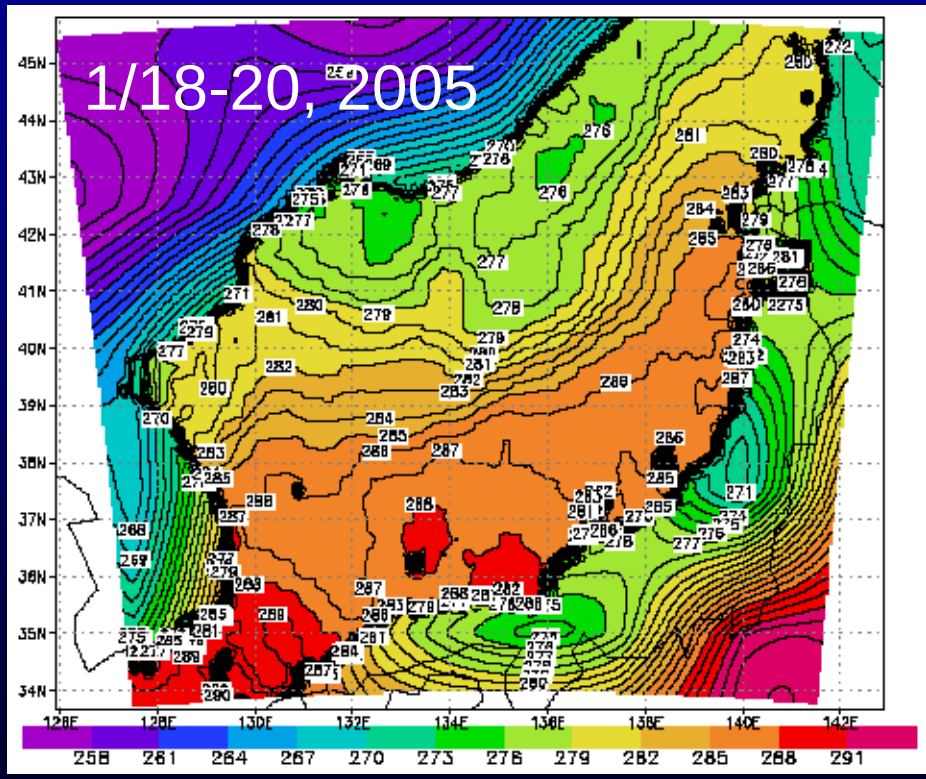
SST assimilation



Manda et al., *JAOT* (2005)

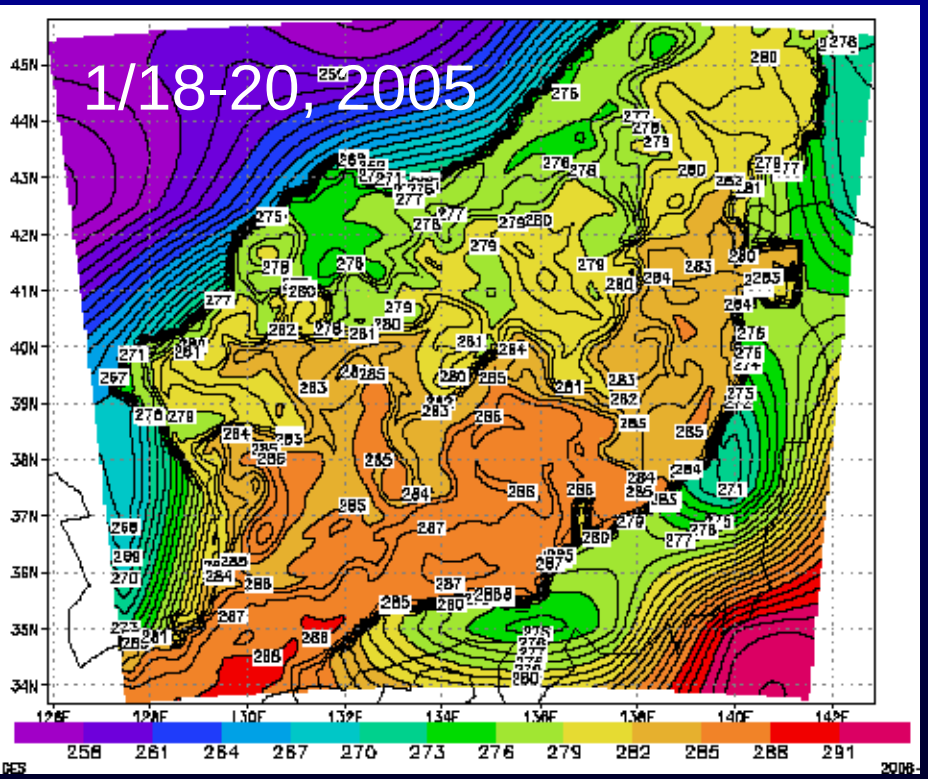
SST Estimates

Optimal Interpolation



http://www.ocean.caos.tohoku.ac.jp/

Data Assimilation

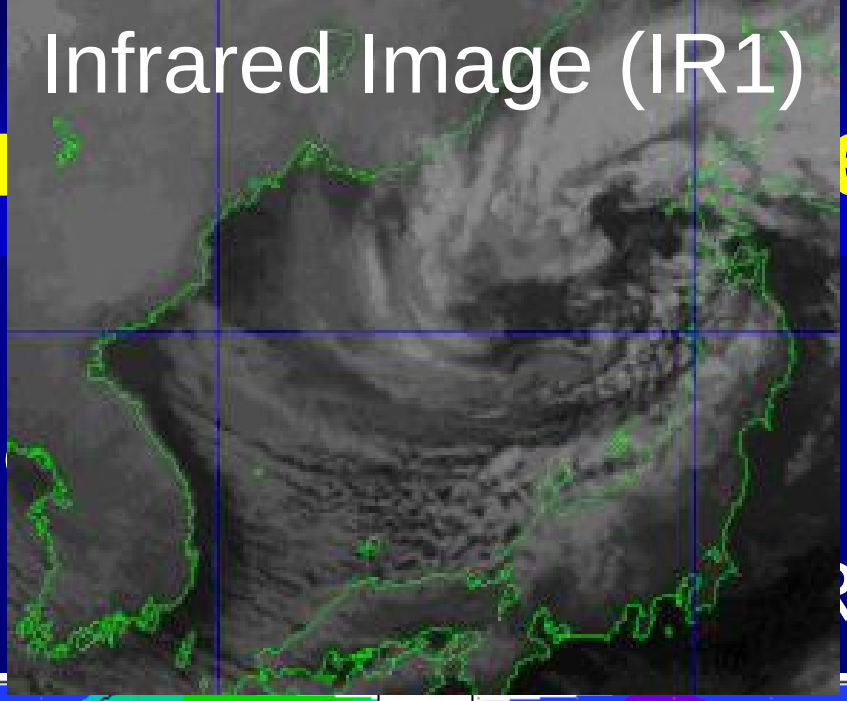


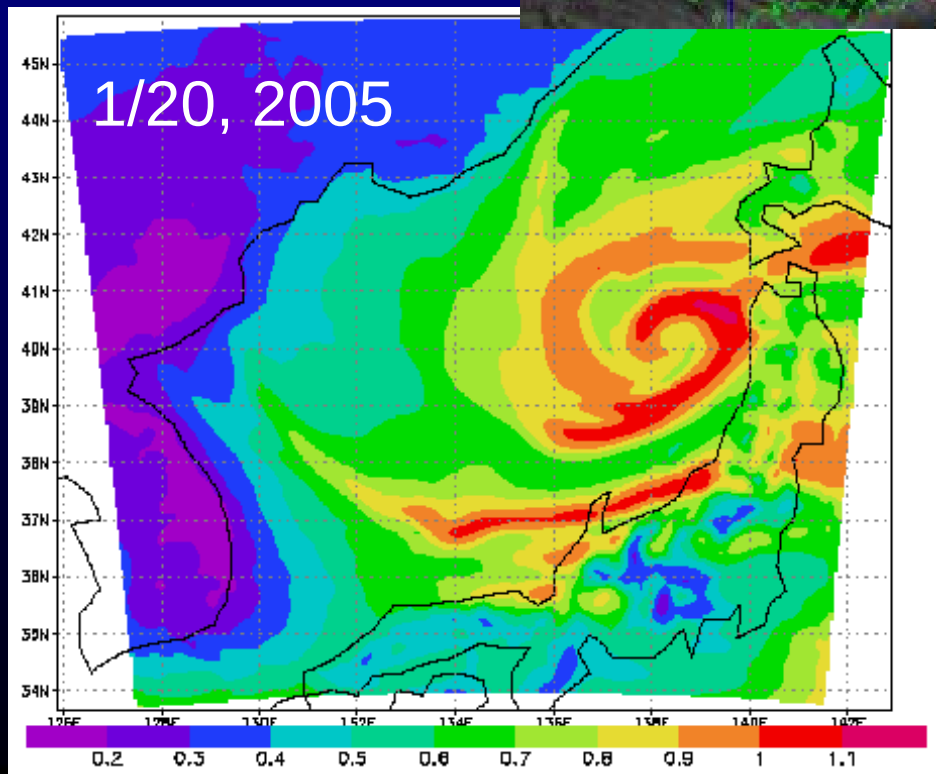
http://jes.riam.kyushu-u.ac.jp/

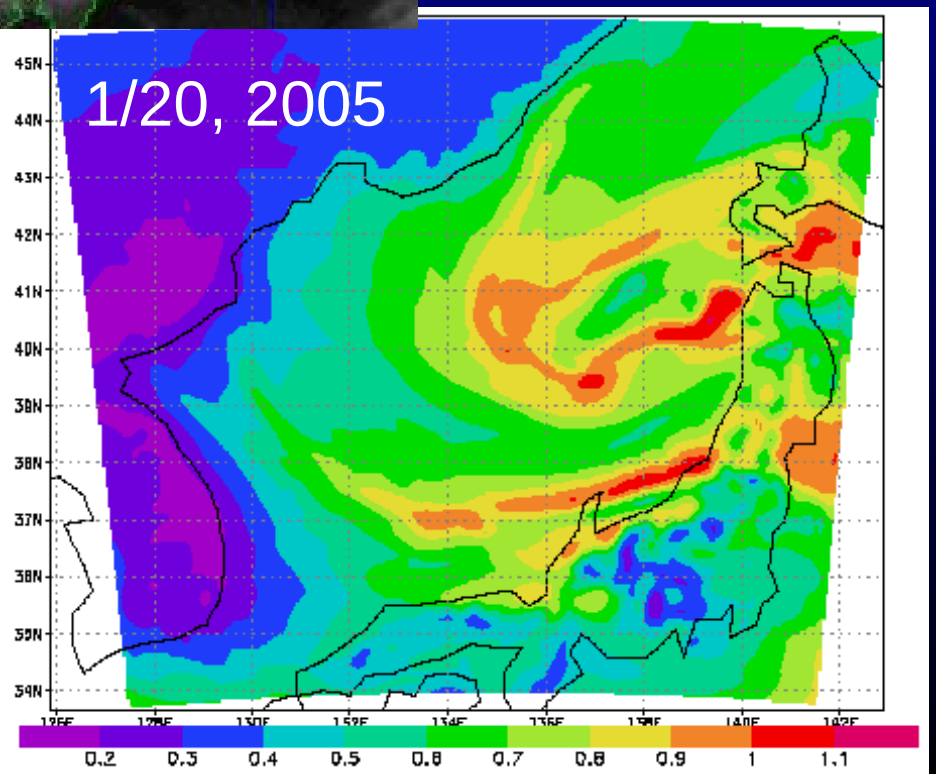
Pr er

- 48-hour
  - Yamam

Exp. N by OI R by DA SST



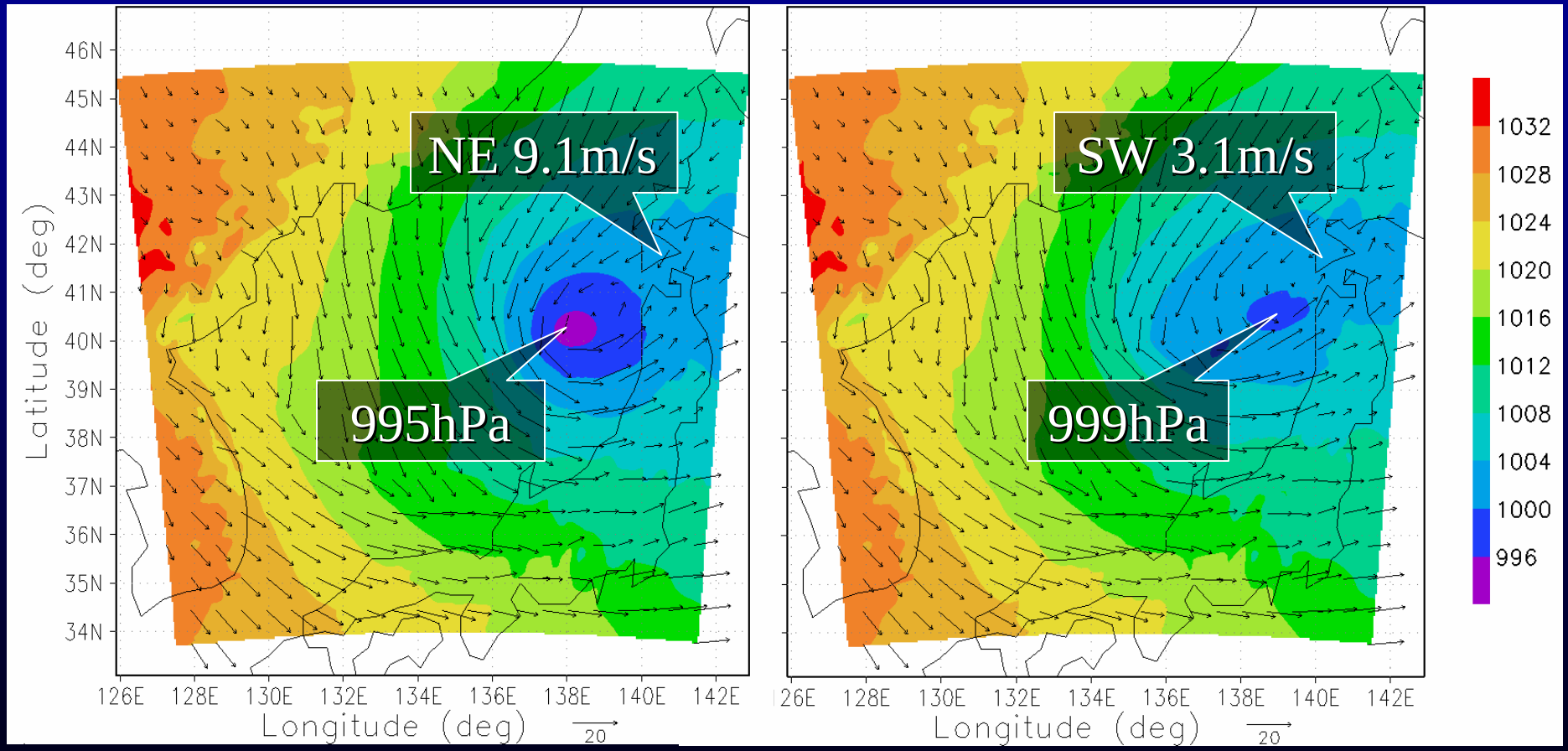




SLP and SSW after 48h

Exp. N

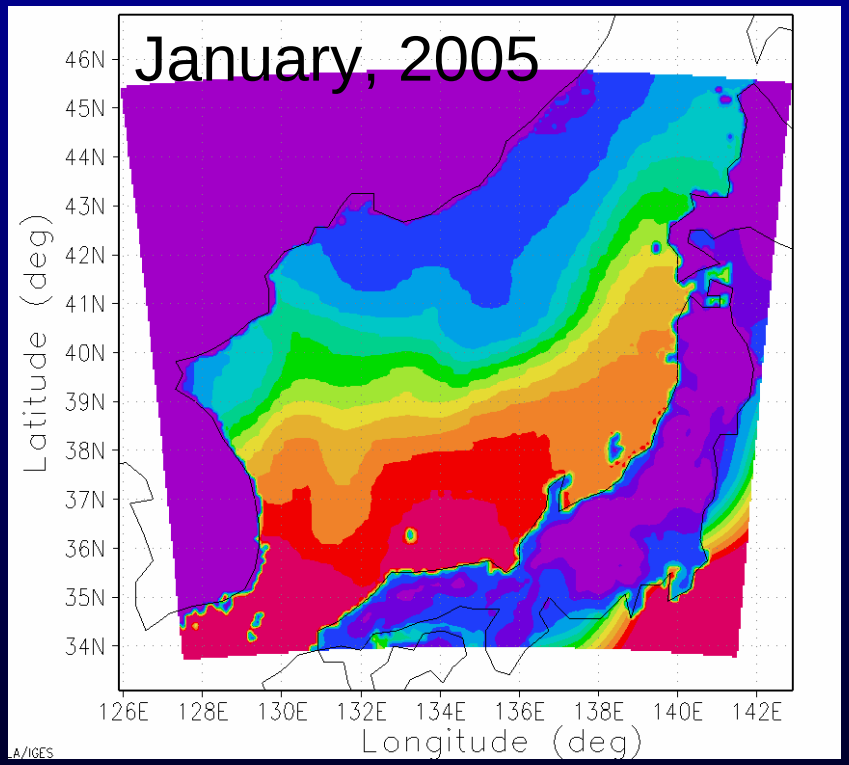
Exp. R



Observation: CP=1000hPa, SW 5m/s at Hakodate

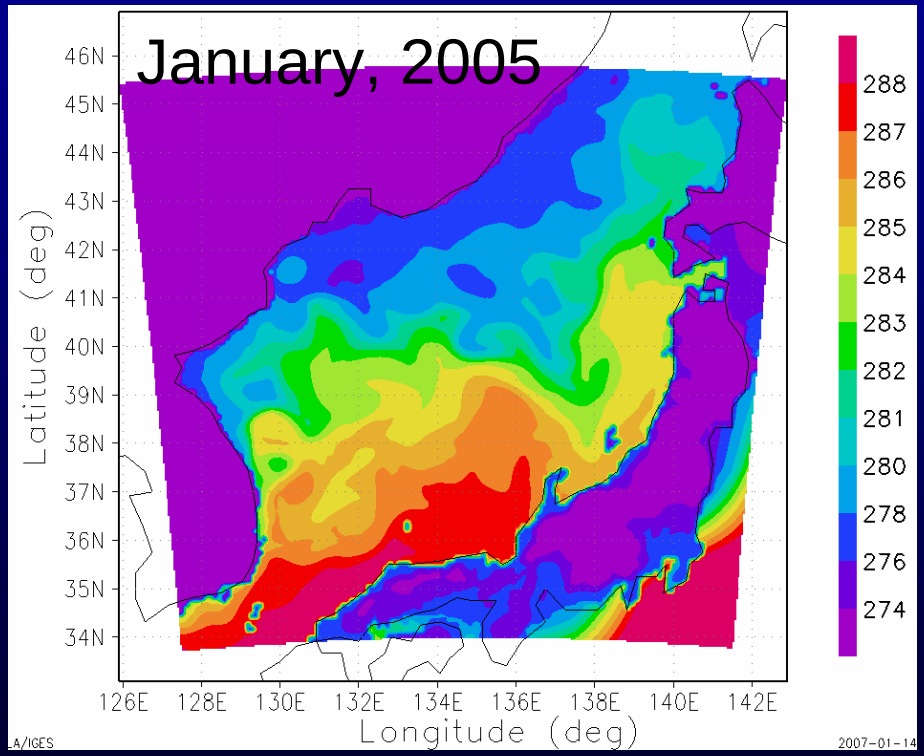
Monthly mean SST (K)

Optimal Interpolation



http://www.ocean.caos.tohoku.ac.jp/

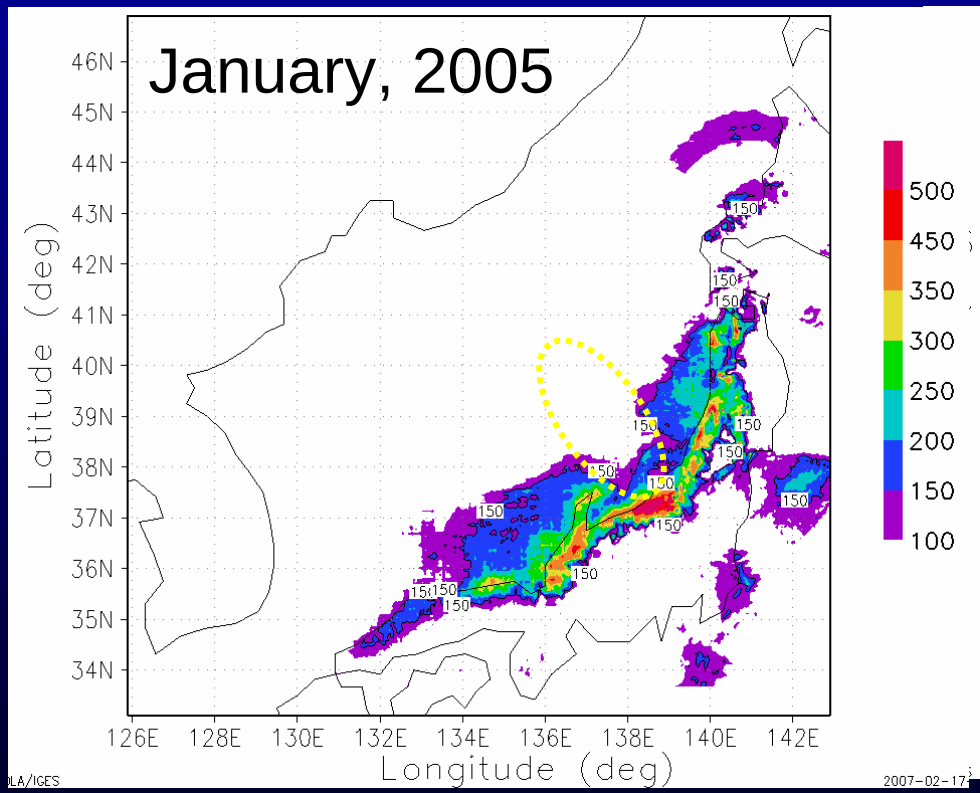
Data Assimilation



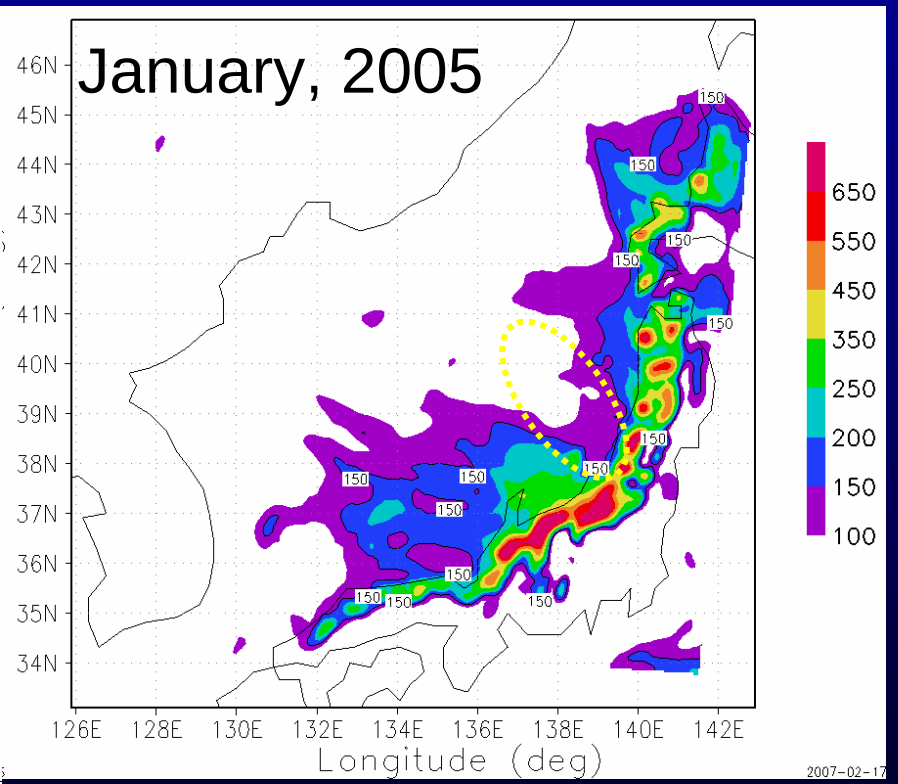
http://jes.riam.kyushu-u.ac.jp/

Monthly Precip (mm)

Radar AMeDAS



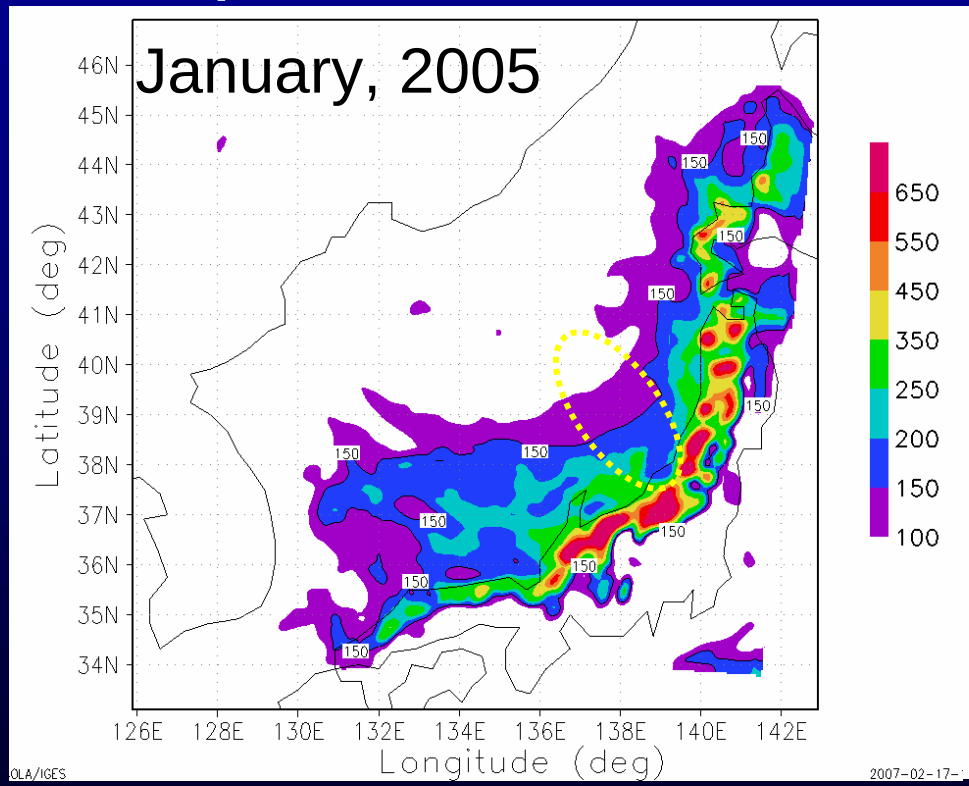
Exp. R



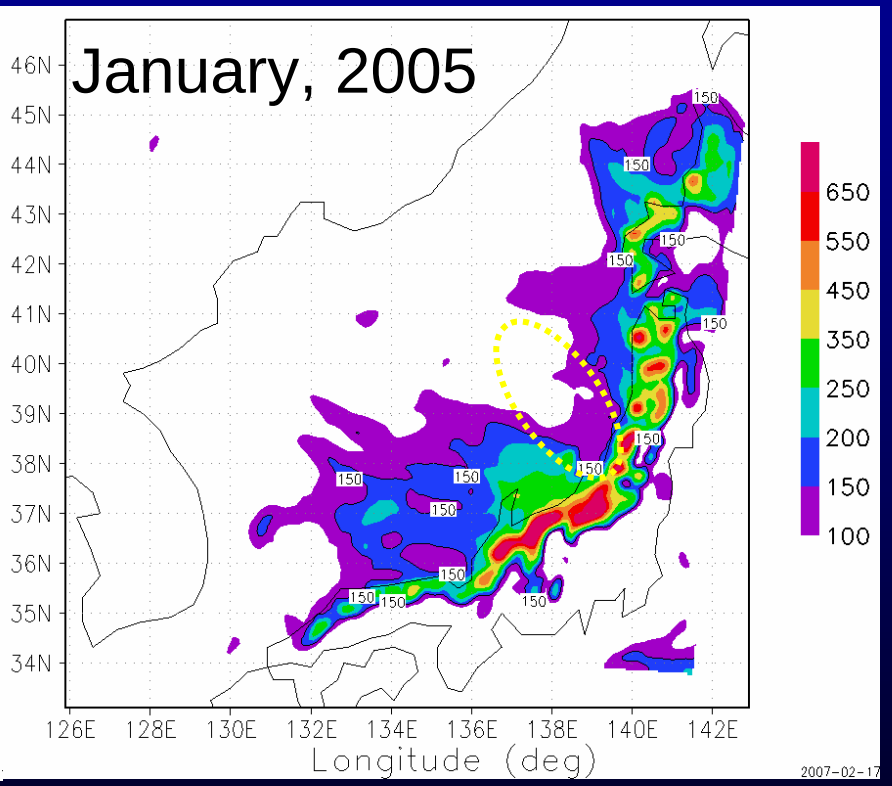
Cold water ~ Less precipitation

Monthly Precip (mm)

Exp. N

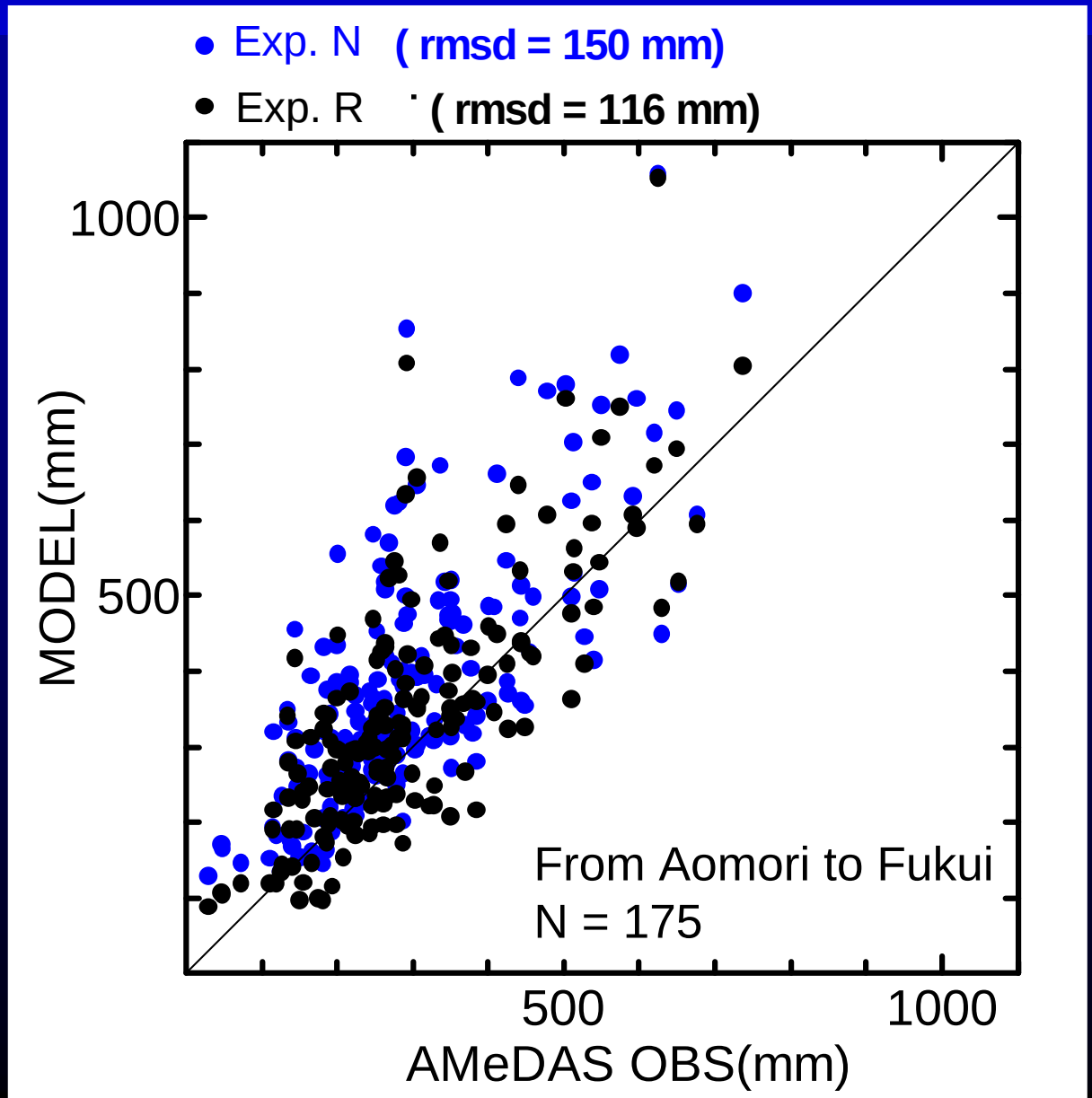


Exp. R



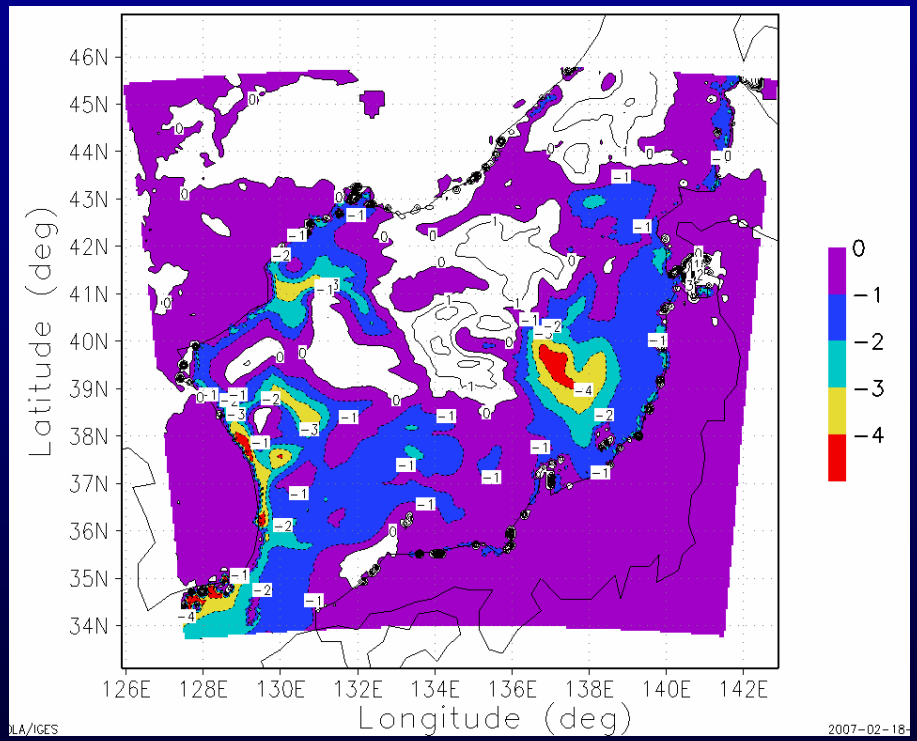
Cold water ~ Less precipitation

Model-Data Comparison

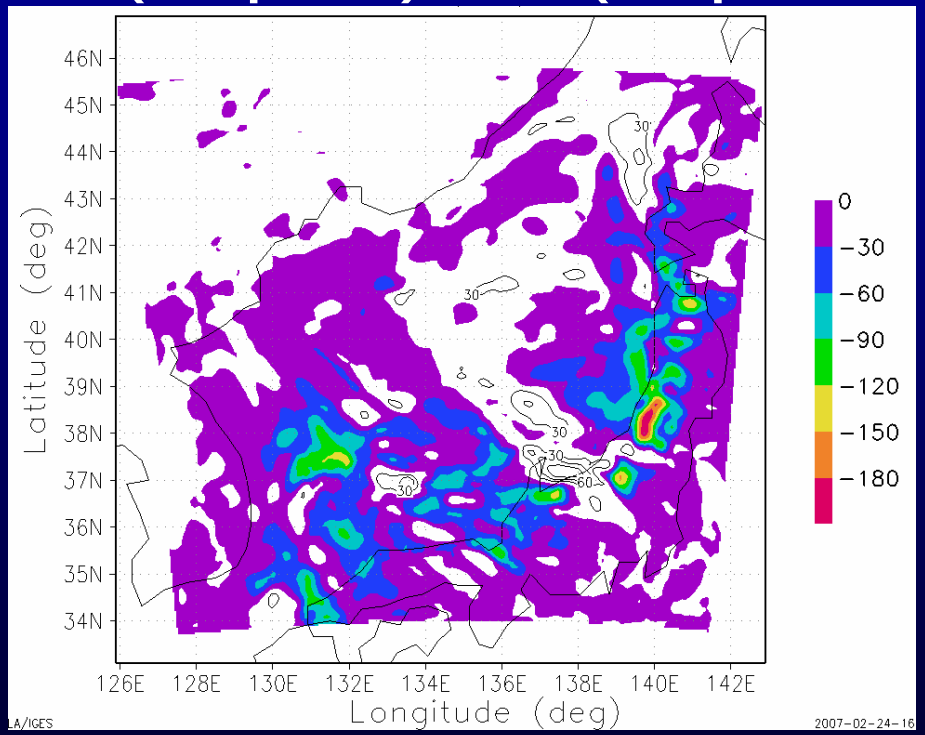


Monthly differences

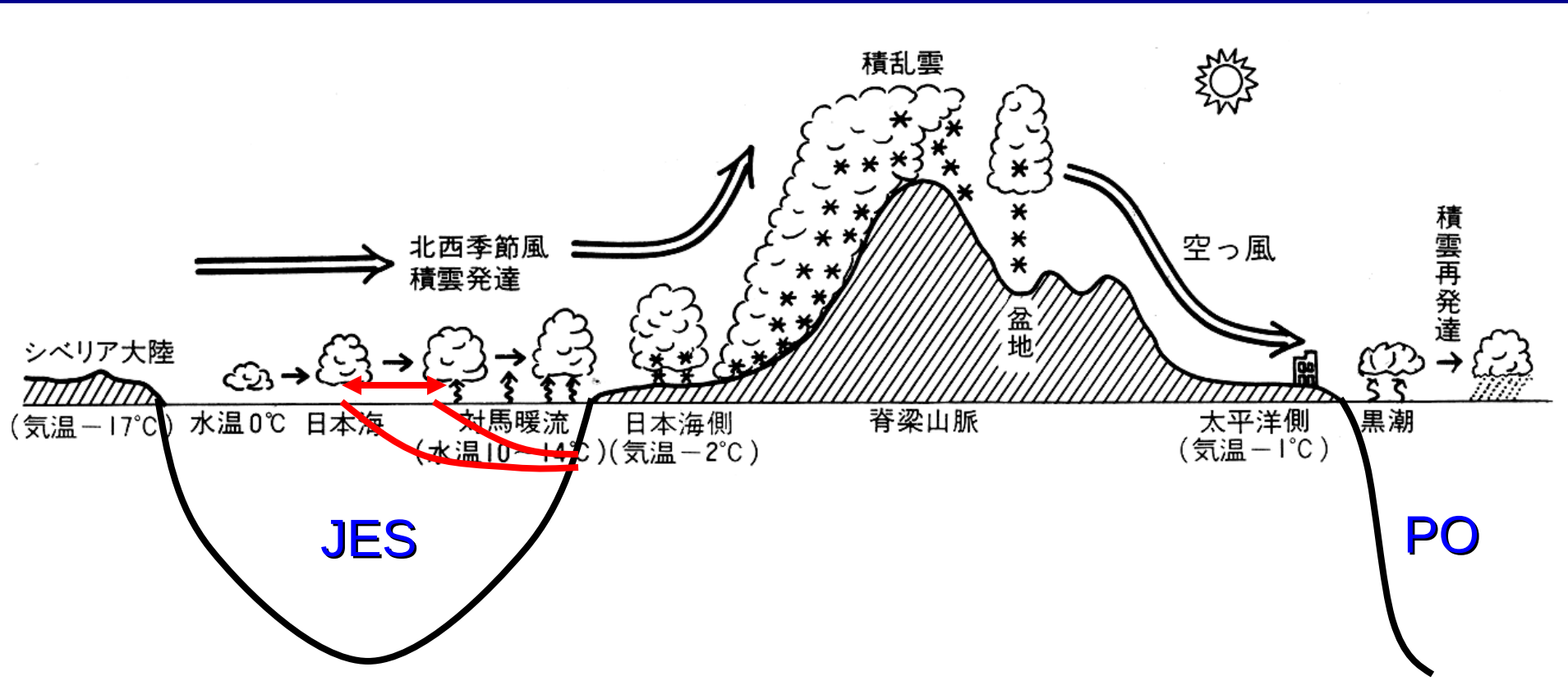
DA SST – OI SST



P(Exp. R) – P(Exp.

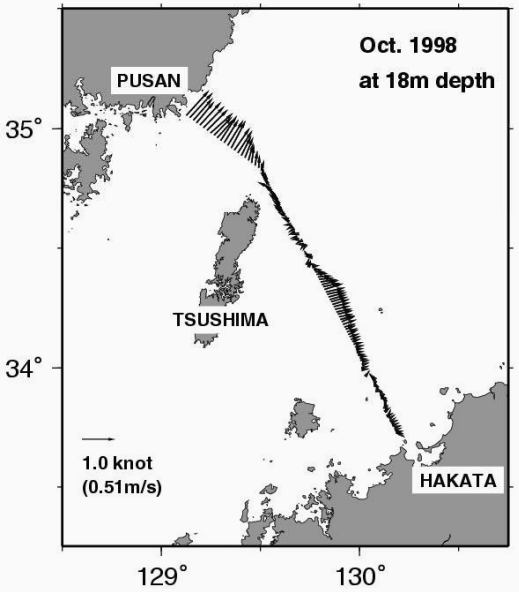


Snowfall in Japanese Islands



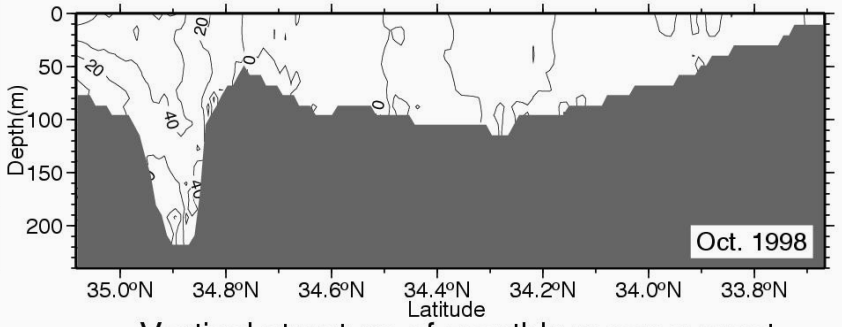
winter monsoon + TWC → snowfall

"Camellia"
(Hakata - Pusan)



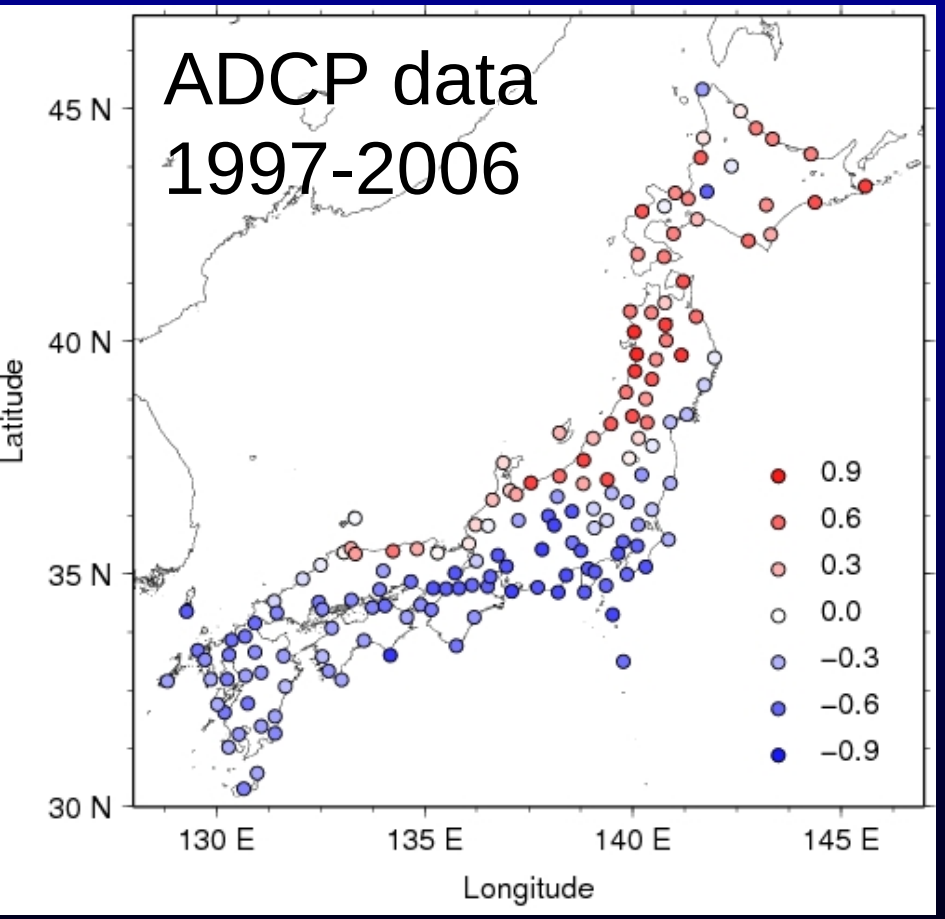
Monthly mean velocity
at 18 m depth (Oct. 1998)

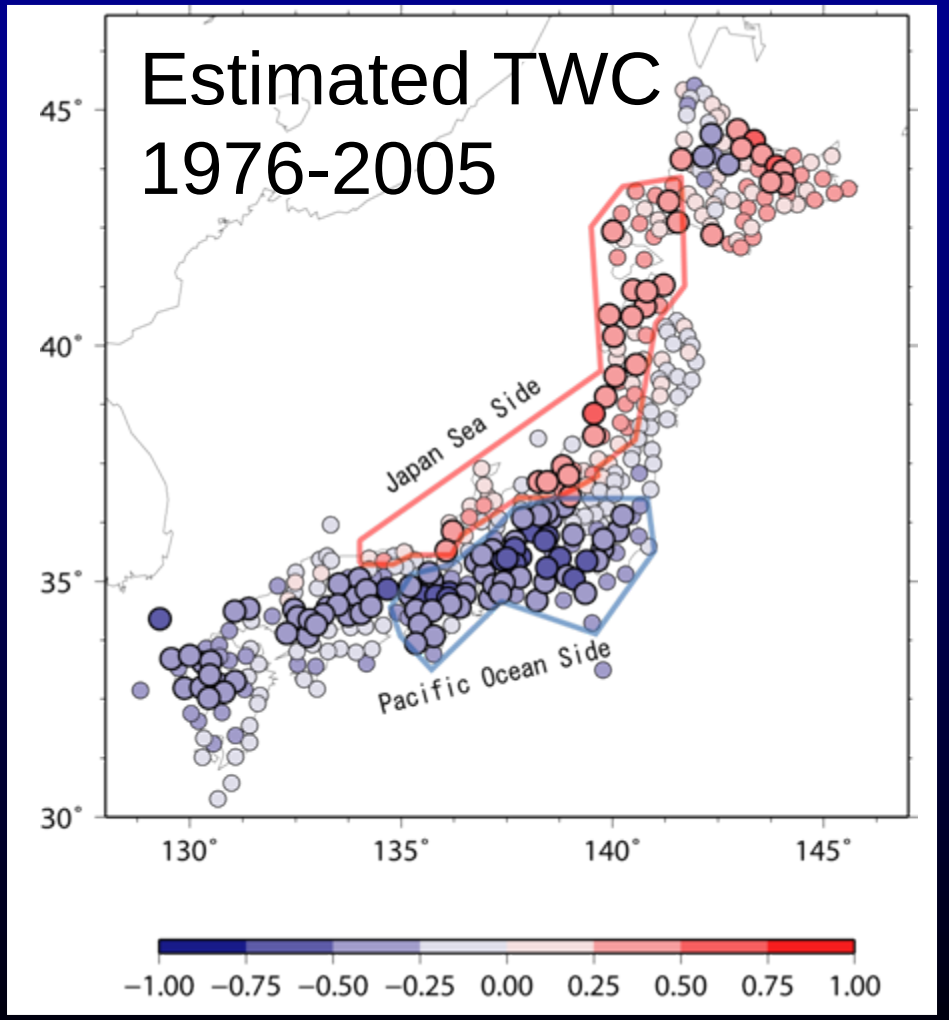
Transducer of
bottom mounted
ADCP



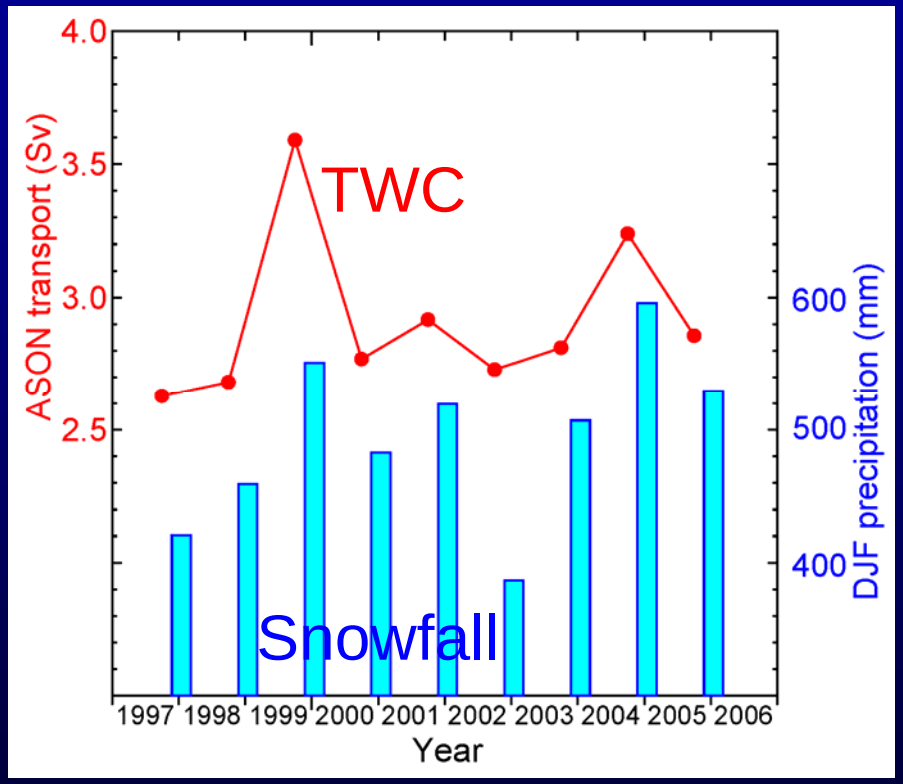
Vertical structure of monthly mean current
(Oct. 1998) (cm/s)

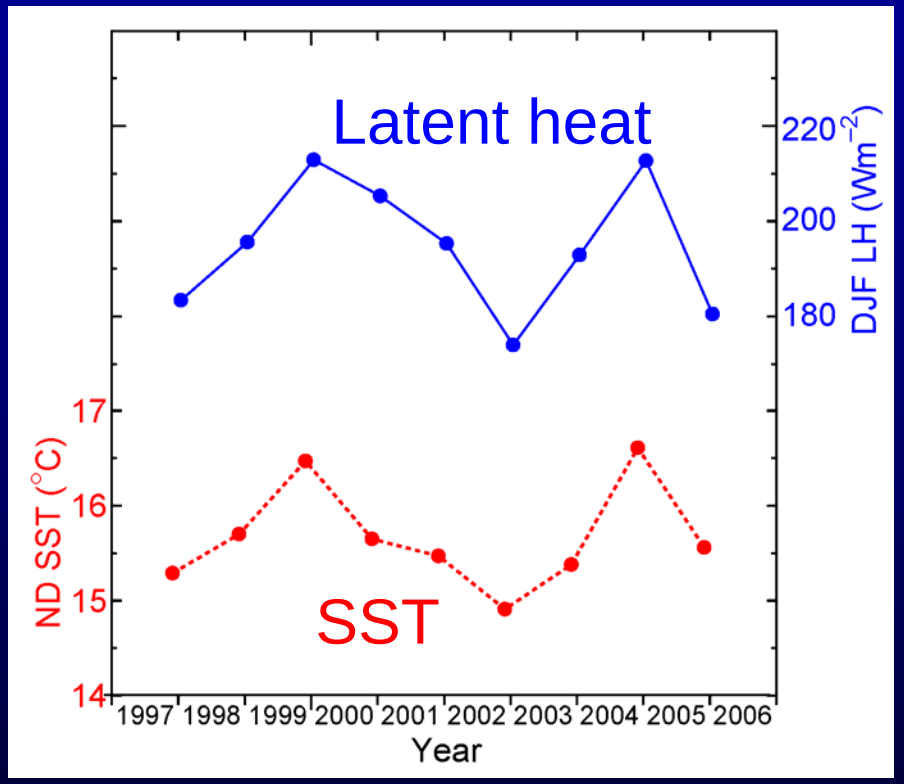
Strong correlation between SON TWC and DJF precip





Local effect to winter precip

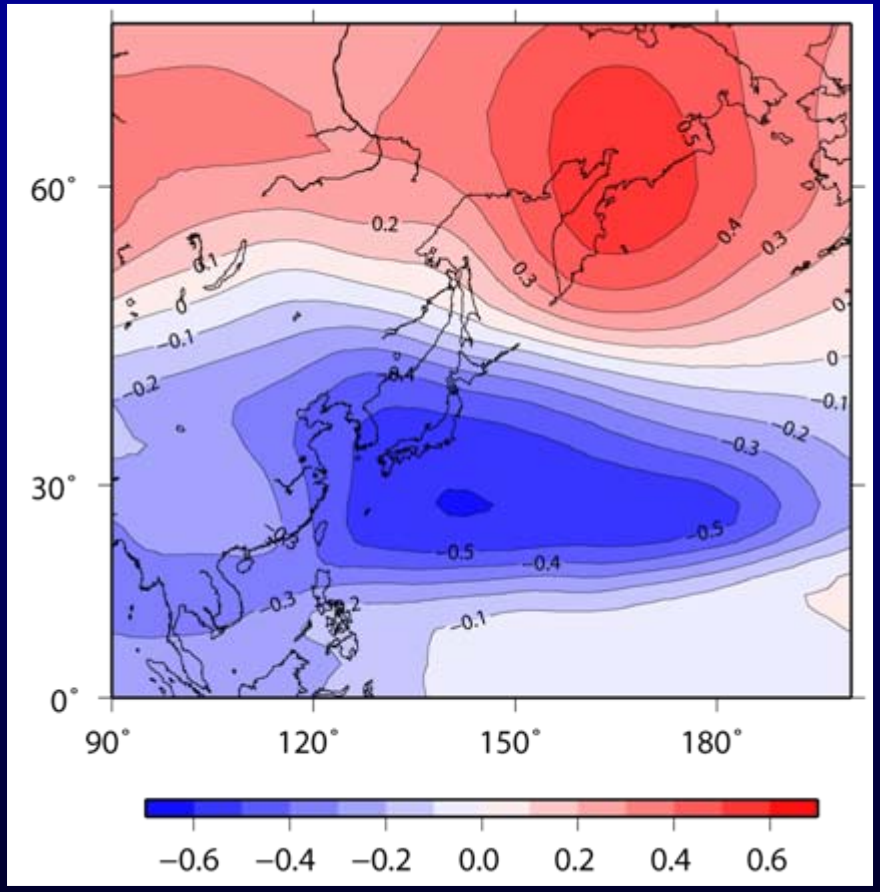




Autumn TWC → SST + Winter monsoon

→ Latent heat ~ Snowfall

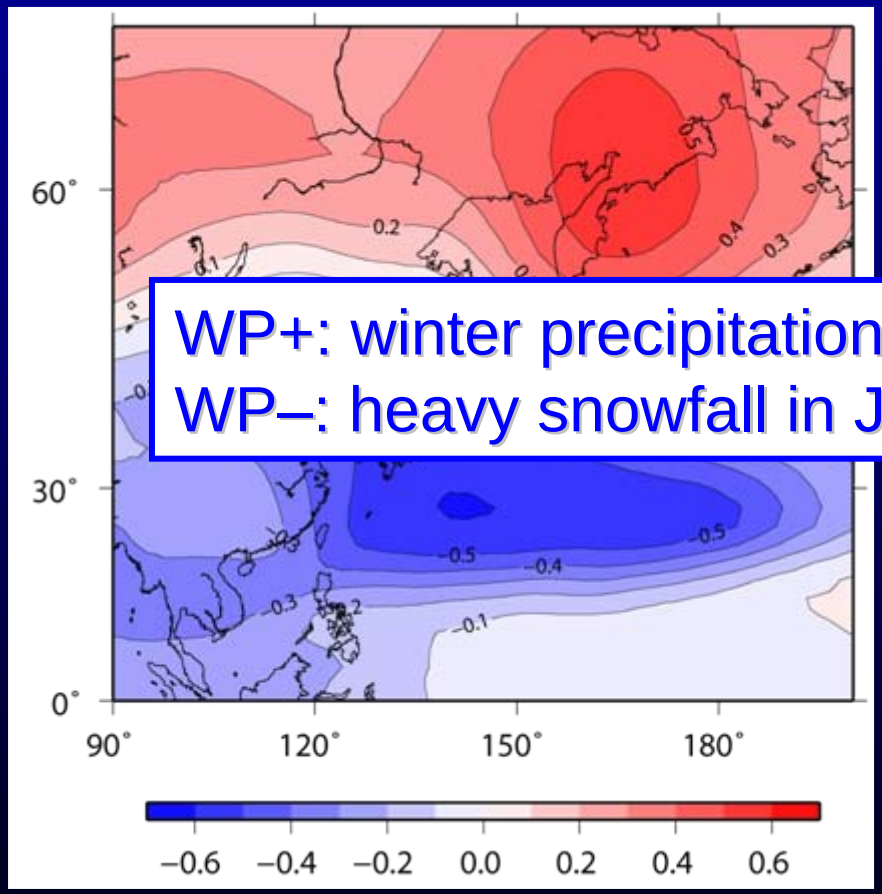
Impact on regional climate



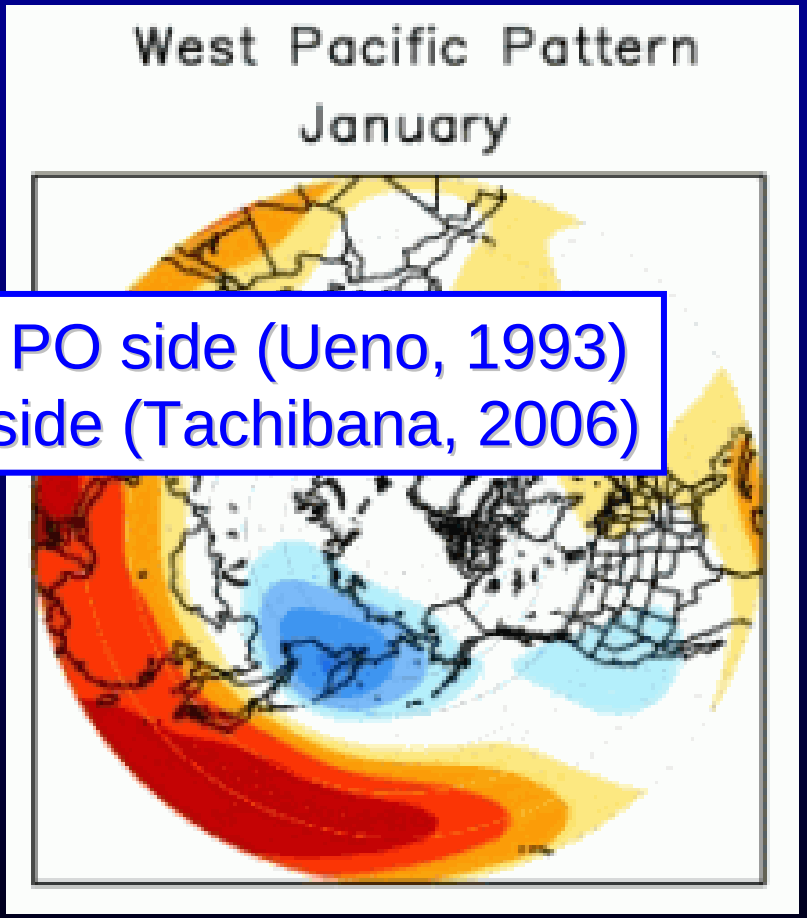
Correlation between SON TWC transport and DJF 500hPa HGT for 1976-2005

Western Pacific (WP) pattern

TWC – 500hPa



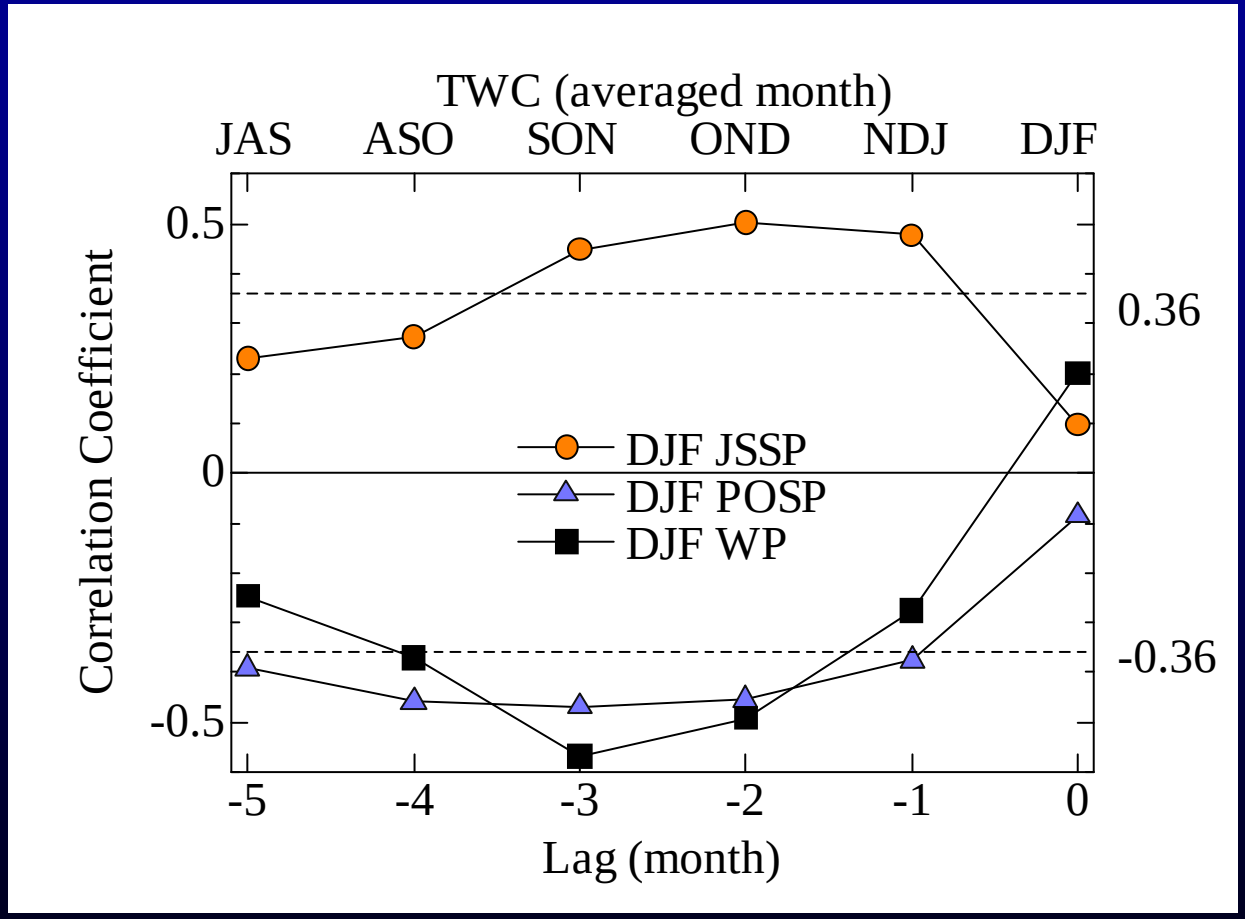
WP index – 500hPa



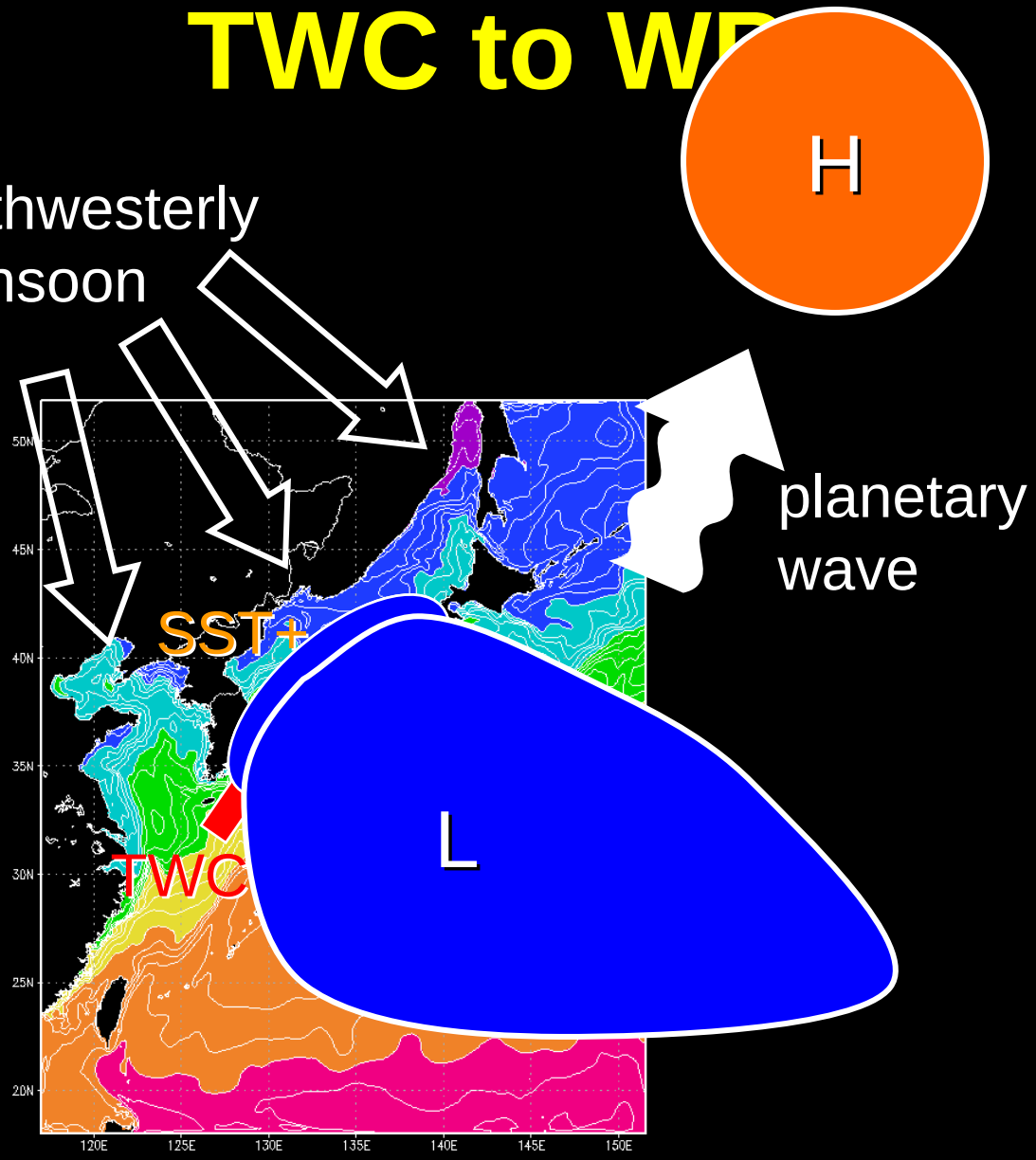
WP+: winter precipitation in PO side (Ueno, 1993)
WP–: heavy snowfall in JS side (Tachibana, 2006)

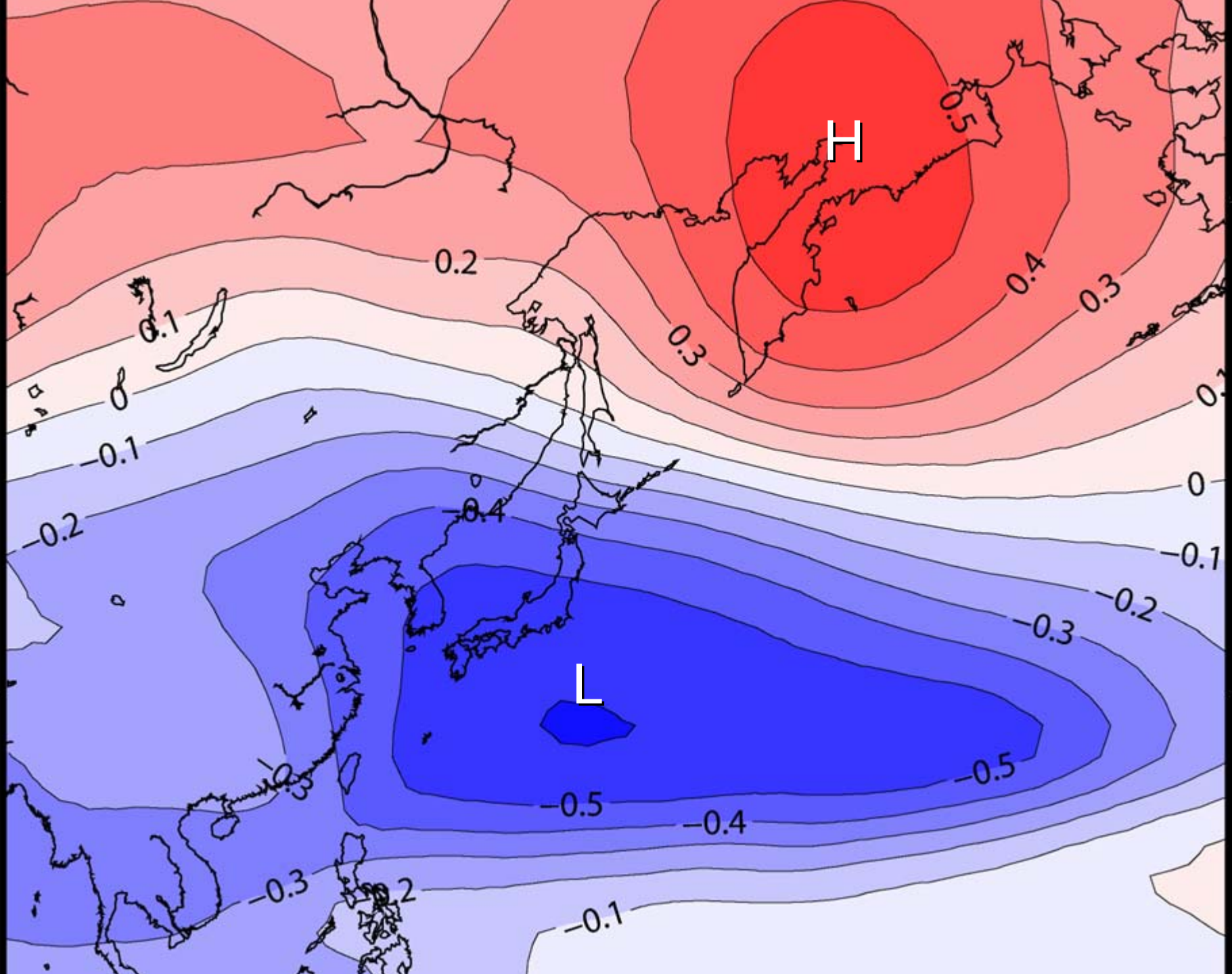
a NH teleconnection pattern,
as defined at CPC, NOAA

Lag correlations

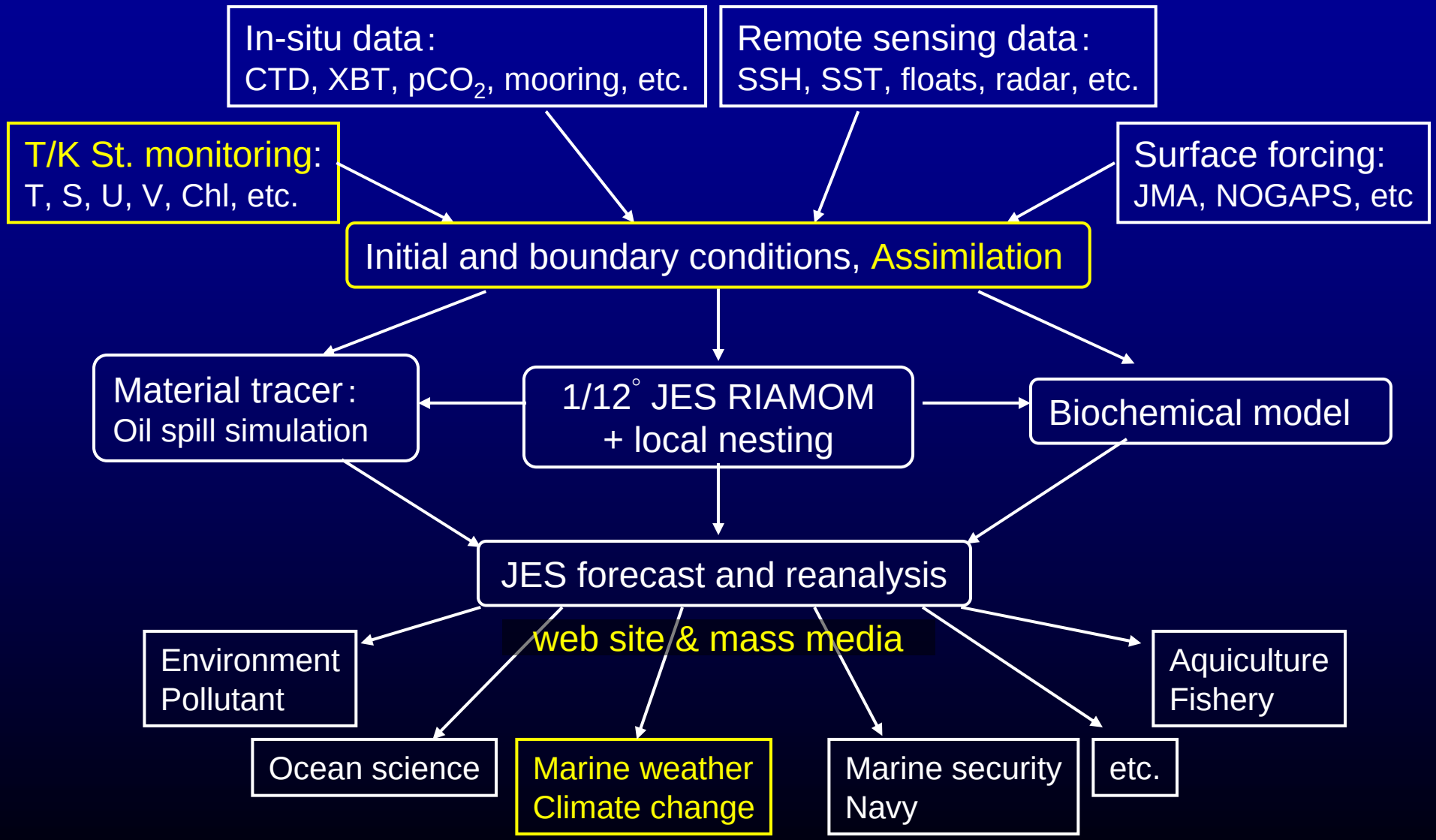


TWC to WP


H
northwesterly
monsoon
planetary
wave
SST+
TWC
L
50N
45N
40N
35N
30N
25N
20N
120E
125E
130E
135E
140E
145E
150E


H
L
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5

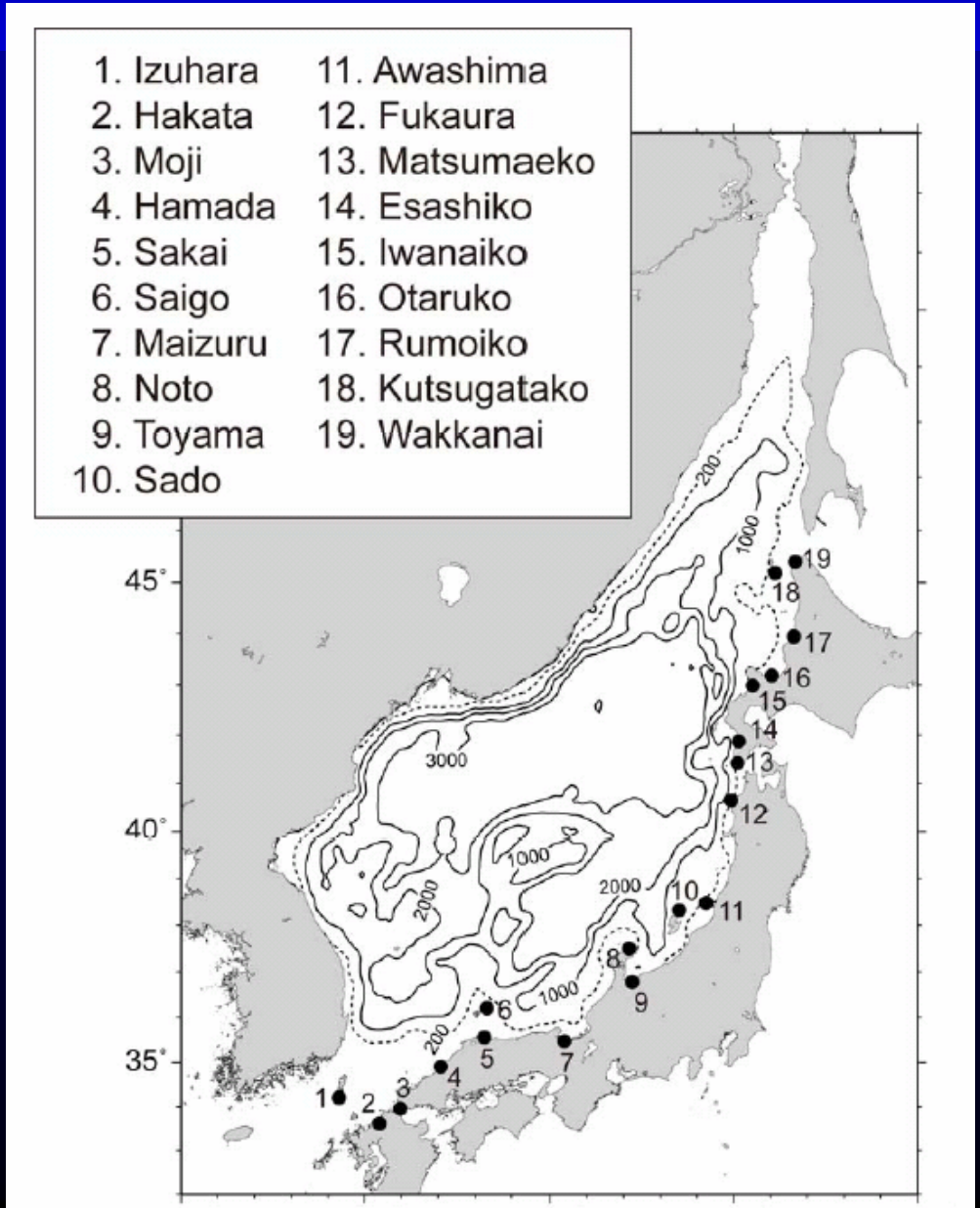
JES Forecasting System



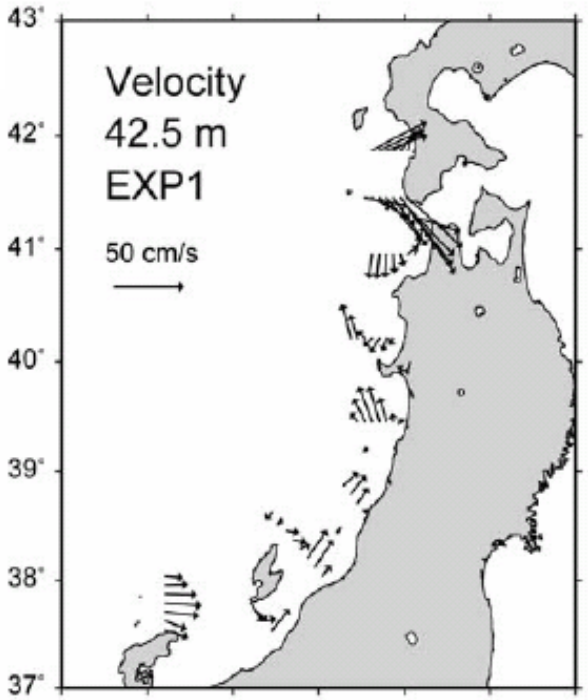
Data Assimilation (DA)

- Prediction
  - Weather forecast
- Smoothing (reanalysis)
  - Dynamical interpolation/extrapolation
  - Estimation of BCs or forcings
- Optimization
  - Parameter estimation
- Design
  - Observation network

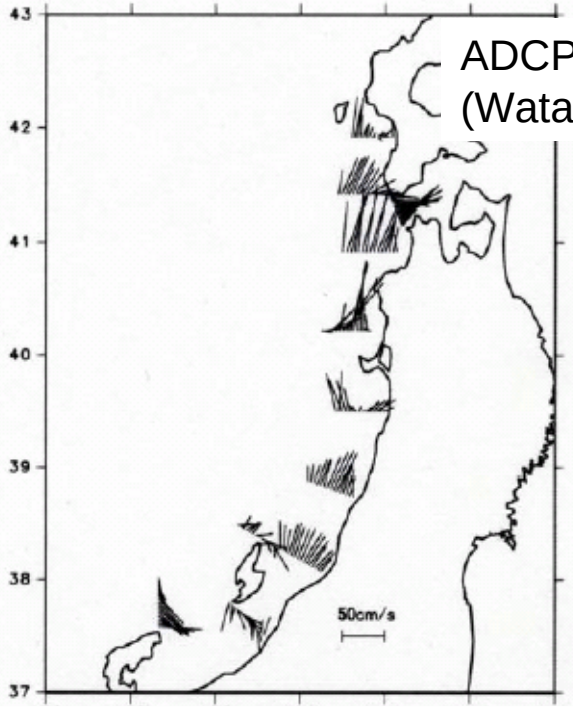
Tide-gauge data assimilation



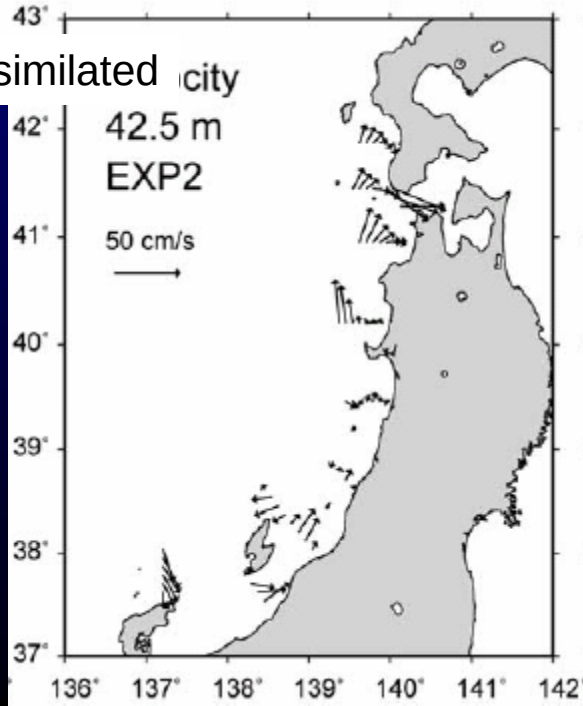
Forward model



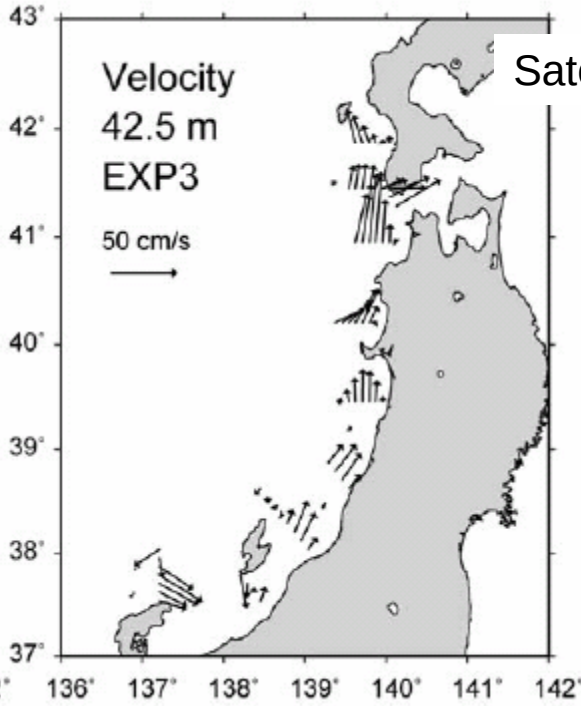
ADCP measurement
(Watanabe et al., 2006)



Satellite SSH assimilated



Satellite + in-situ SSH



Sep-Oct, 2000