

Predictability of location of the Kuroshio Extension and the Oyashio First Branch by JCOPE

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***FRA-FRCGC joint program
"Development of Ocean Prediction Model
in the North Pacific and Japan Coast area."***

Objectives

develop an ocean prediction model capable for 2-3 months prediction.

Present situation of ocean prediction in FRA

subjective prediction + discussion at meetings

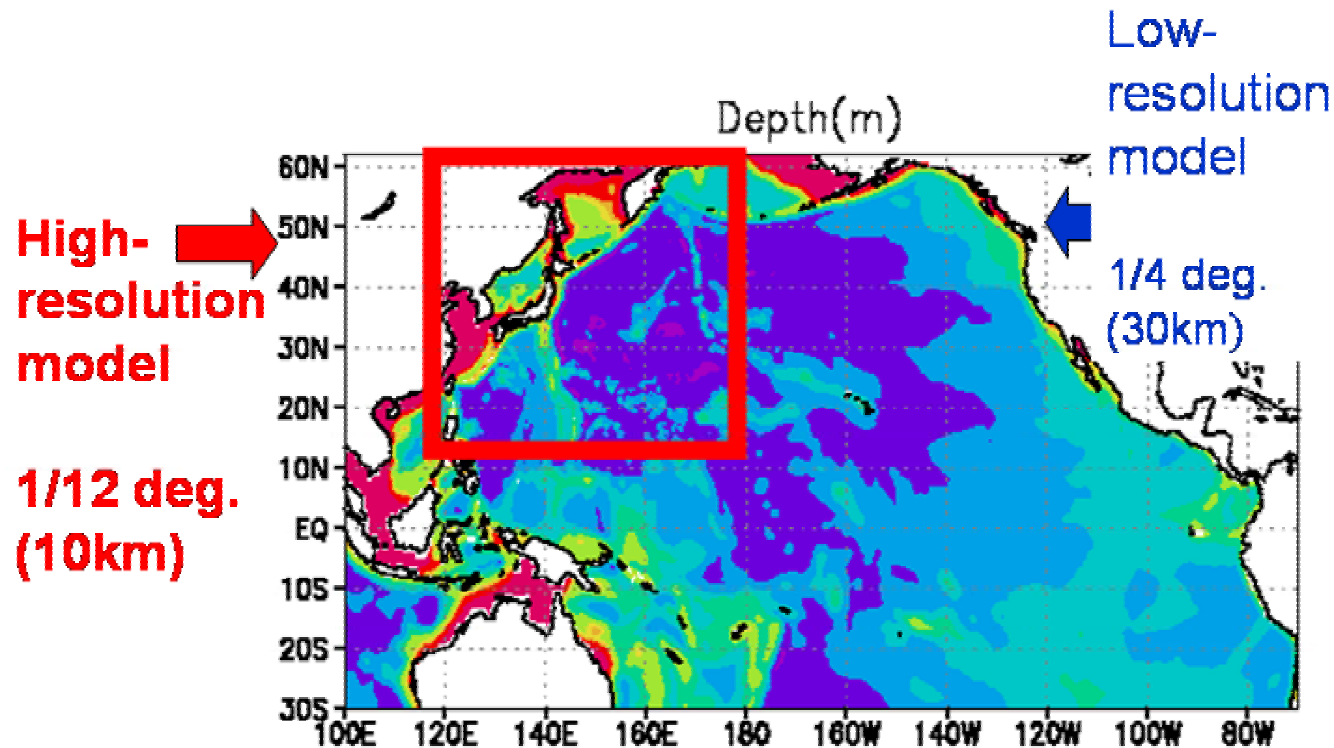
Future perspective

objective & scientific prediction

**FRCGC developed JCOPE
(Japan Coastal Ocean Predictability
Experiment) prediction system**

JCOPE

Princeton Ocean Model (POM/POMgcs)
sigma-coordinate
1/12 deg & 45 layer + 1/4 deg & 21 layer
one-way nesting method (Guo et al., 2003)



courtesy of Dr. Miyazawa

FRA-FRCGC joint program
***"Development of Ocean Prediction Model
in the North Pacific and Japan Coast area."***

Group I : developing ocean prediction model

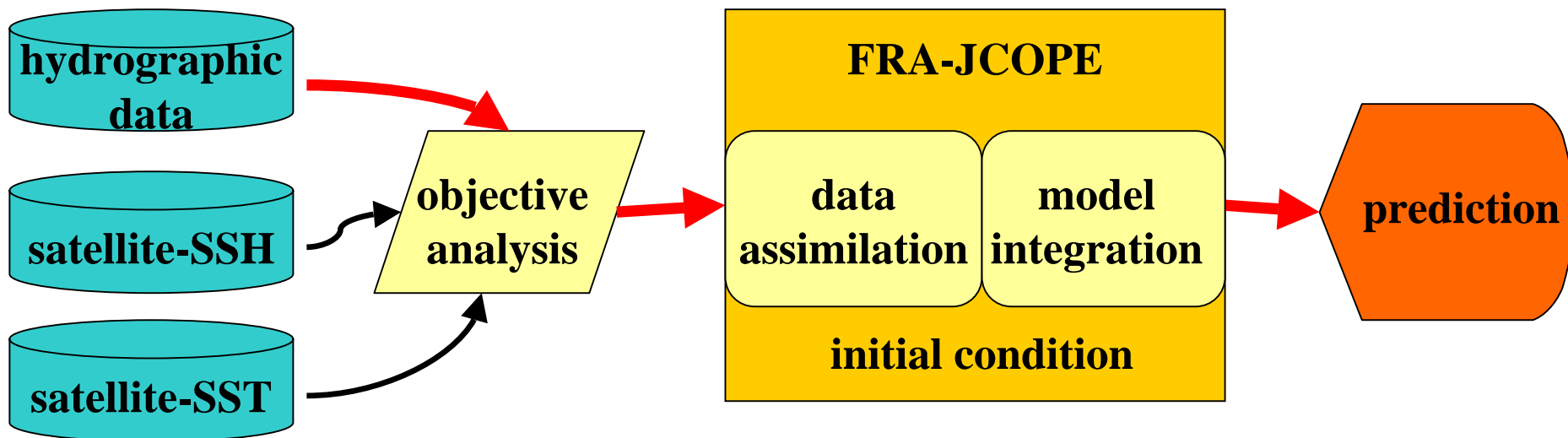
joint with FRCGC

FRA-JCOPE: transplant JCOPE into FRA

Group II : developing realtime data transfer system

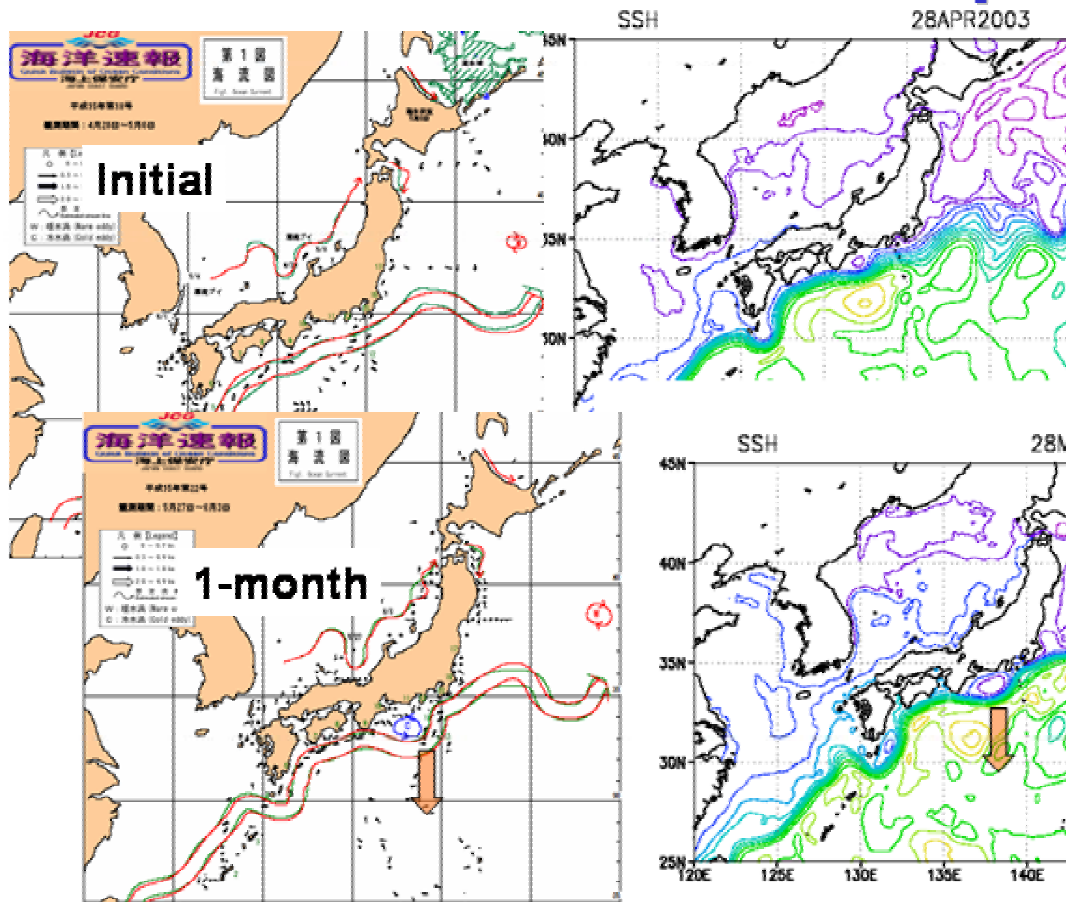
realtime data transfer

method to produce initial data set



predictability of JCOPE

Prediction of Kuroshio path



**an example of
successful prediction
of Kuroshio meander**

**1-2 months
predictability is
confirmed in the
Kuroshio region**

courtesy of Dr. Miyazawa

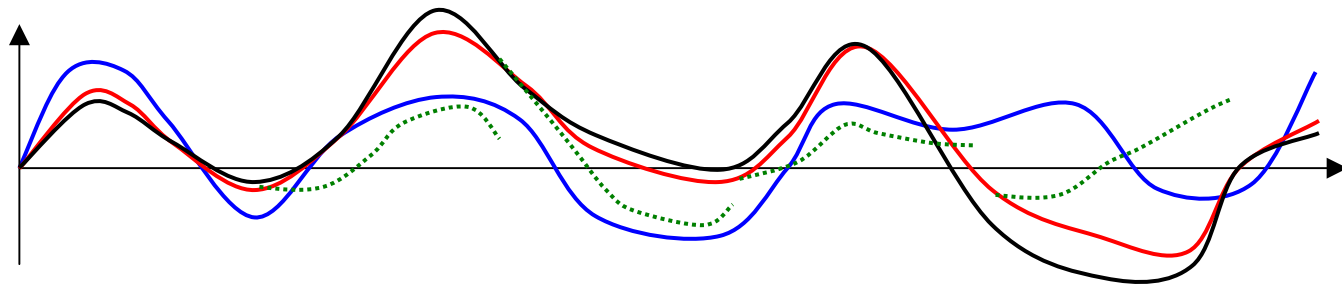
**How about the Oyshio region and
the mixed water region?**

method

observation	:hydrographic survey
simulation	:simulation with realistic forcing
assimilation	:assimilate to the observation

IAU method

prediction	:prediction with climatological forcing from the assimilated initial condition
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A. simulation vs observation

: investigate model tendency

B. assimilation vs simulation vs observation

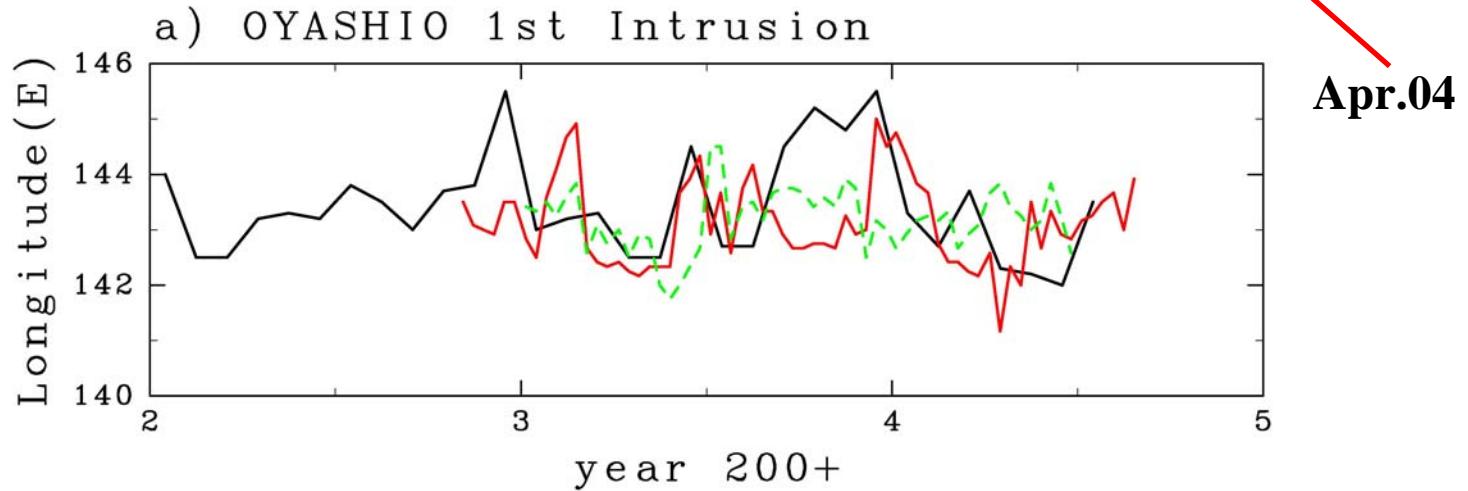
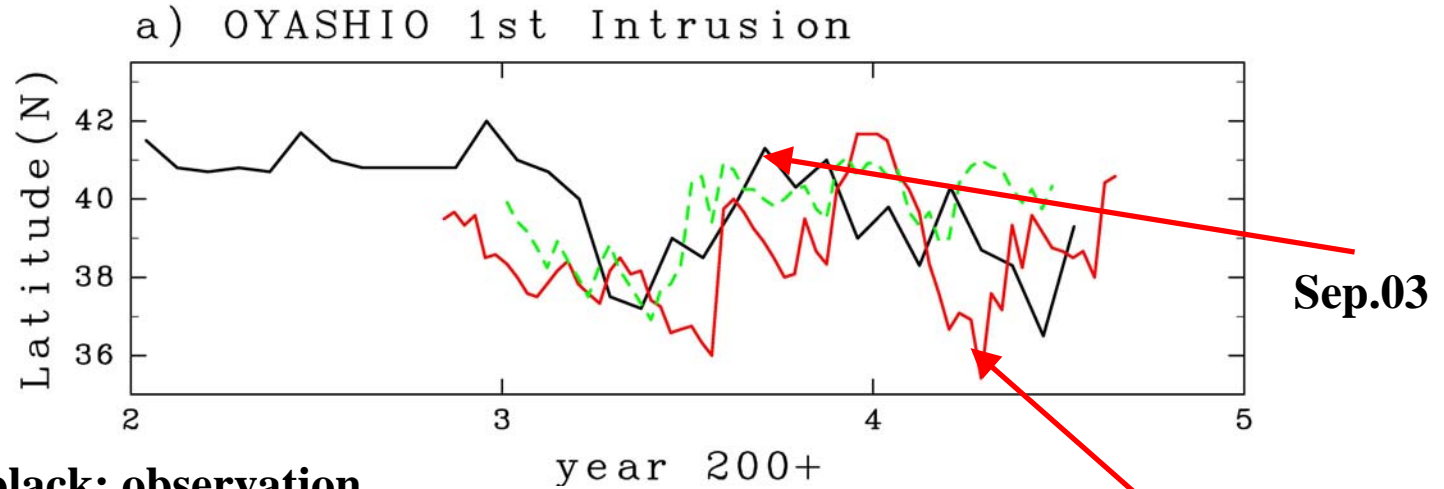
: confirm effect of assimilation

C. prediction vs observation

: evaluate predictability

Oyashio 1st intrusion
Kurshio Extension

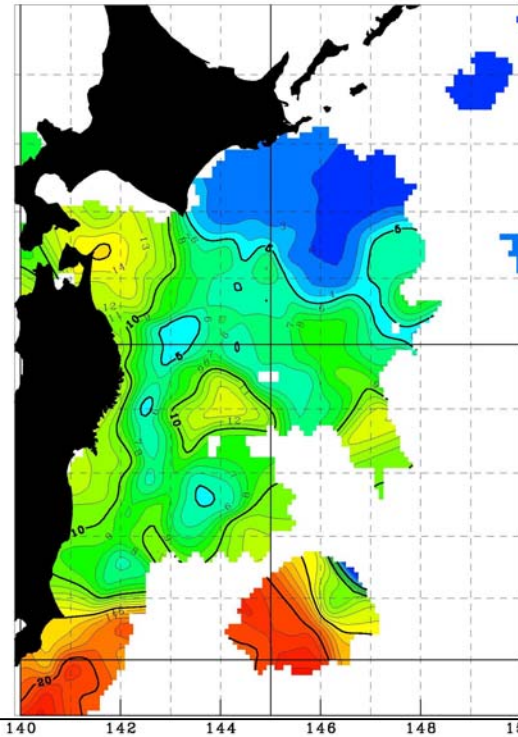
Oyashio 1st Intrusion



Oyashio 1st Intrusion

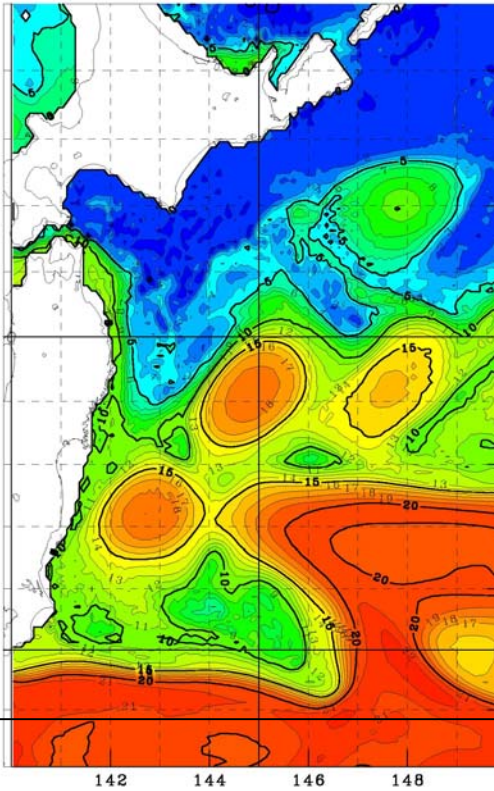
Obs. SEP.

TEMPERATURE AT 100m DATE:



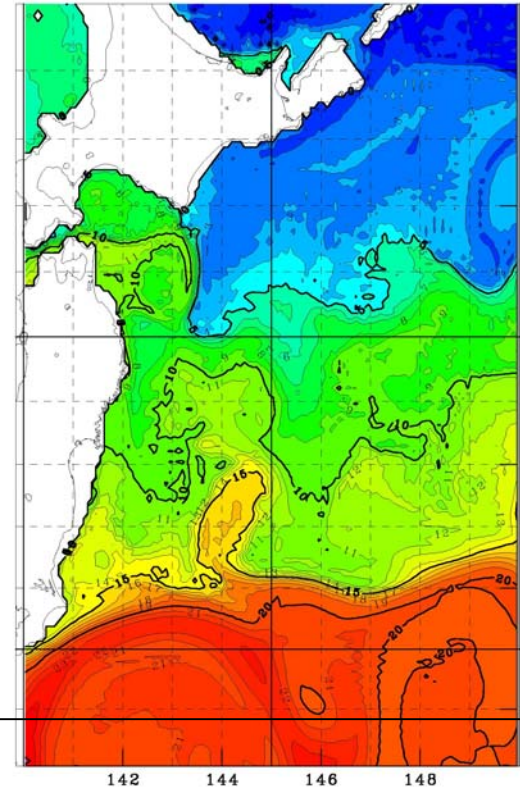
simulation

TEMPERATURE AT -100m 20030914



assimilation

TEMPERATURE AT -100m 20030915

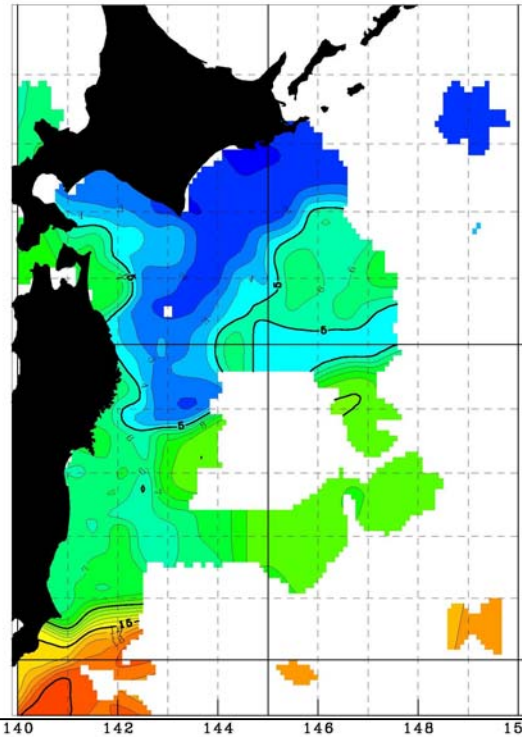


The position of the Oyashio 1st Intrusion was improved, however, the temperature was overestimated.

Oyashio 1st Intrusion

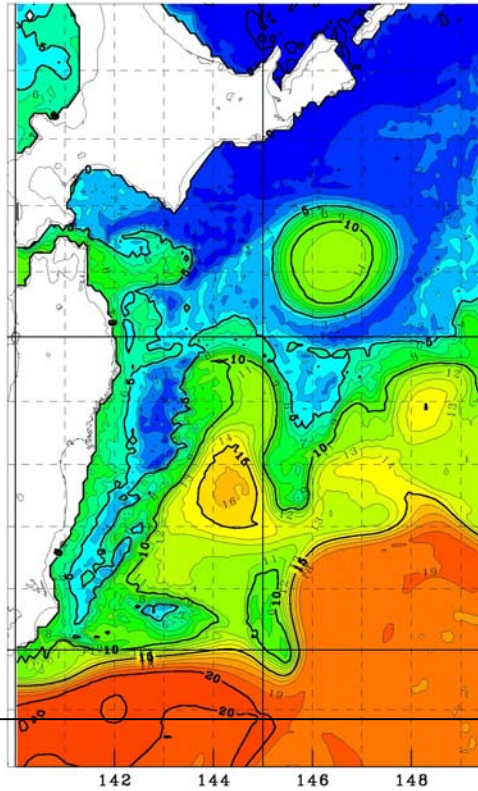
Obs. APR.

TEMPERATURE AT 100m DATE:



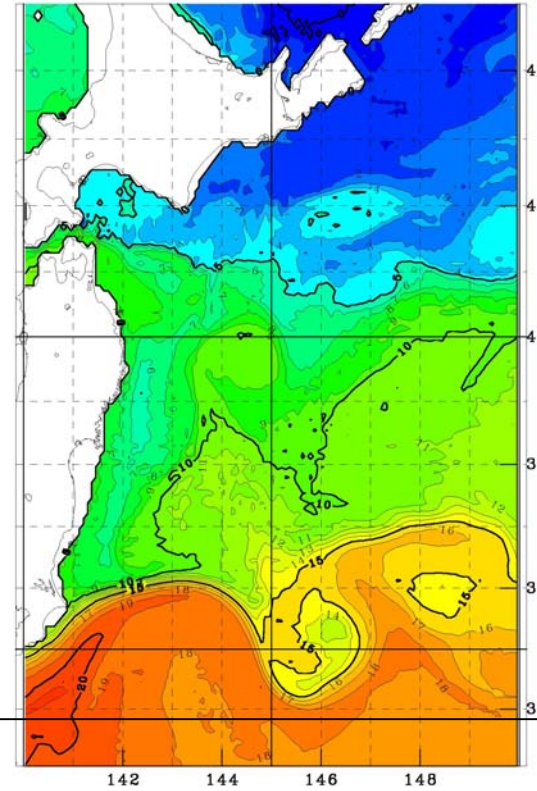
simulation

TEMPERATURE AT -100m 200404



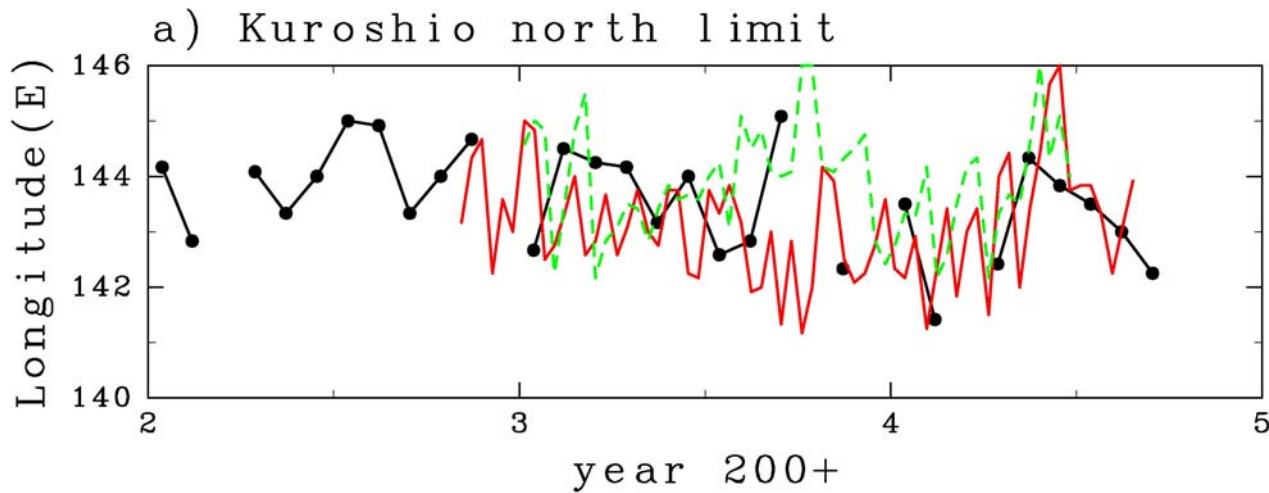
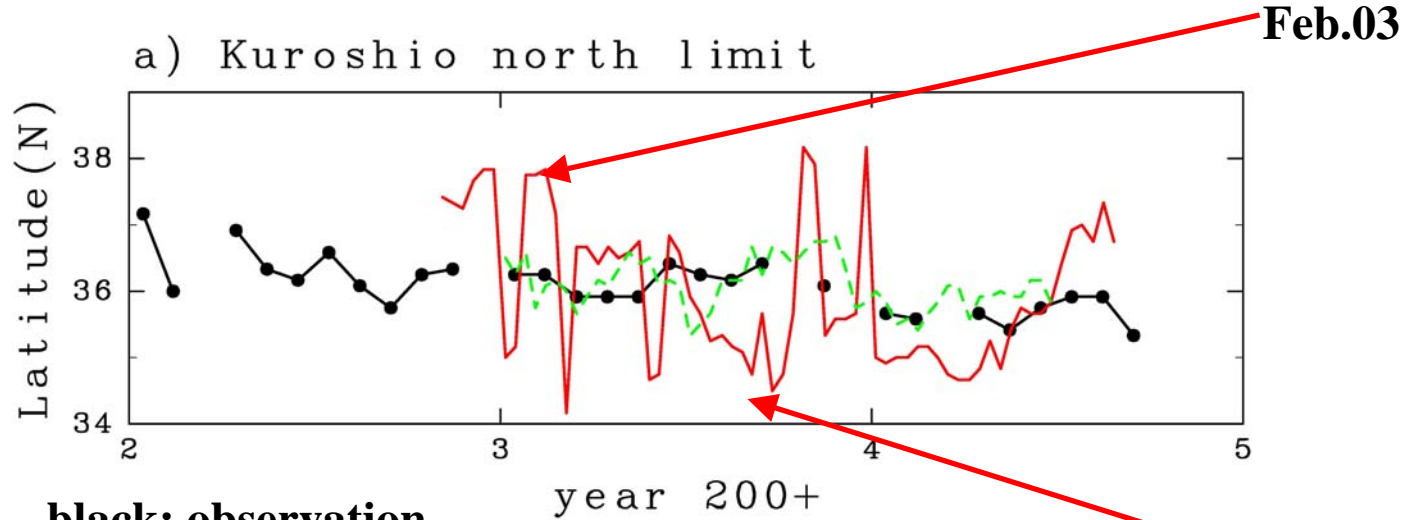
assimilation

TEMPERATURE AT -100m 20040416



The position of the Oyashio 1st Intrusion was rebounded to far north by the assimilation. Also the temperature in the Oyashio region was overestimated.

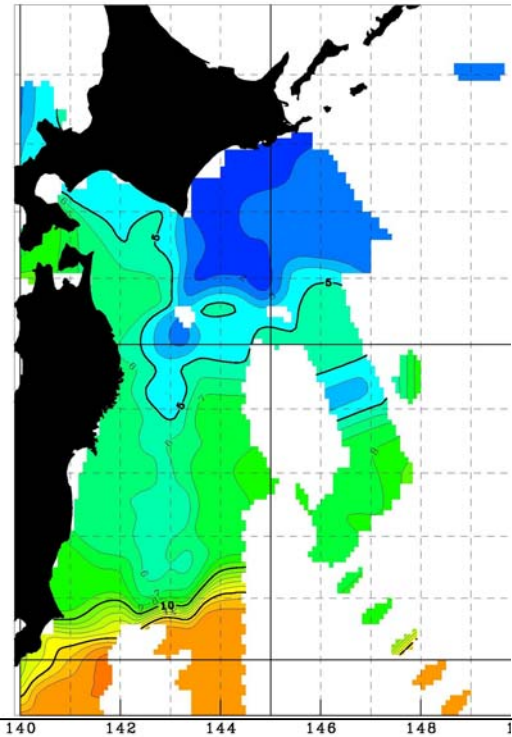
North limit latitude of the Kuroshio Extension



North limit latitude of the Kuroshio Extension

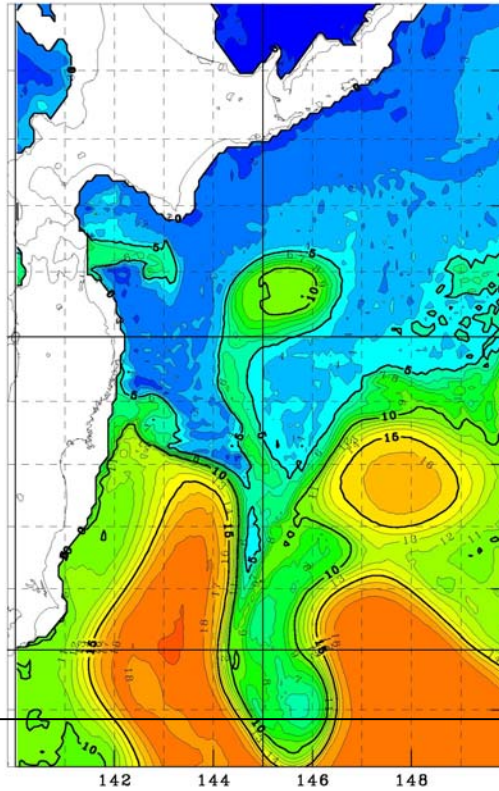
Obs. FEB.

TEMPERATURE AT 200m DATE:



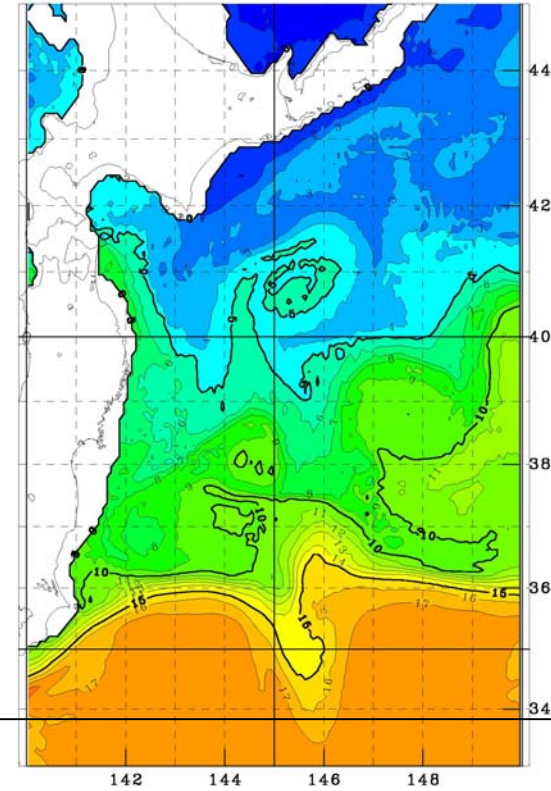
simulation

TEMPERATURE AT -200m 2003021



assimilation

TEMPERATURE AT -200m 20030215

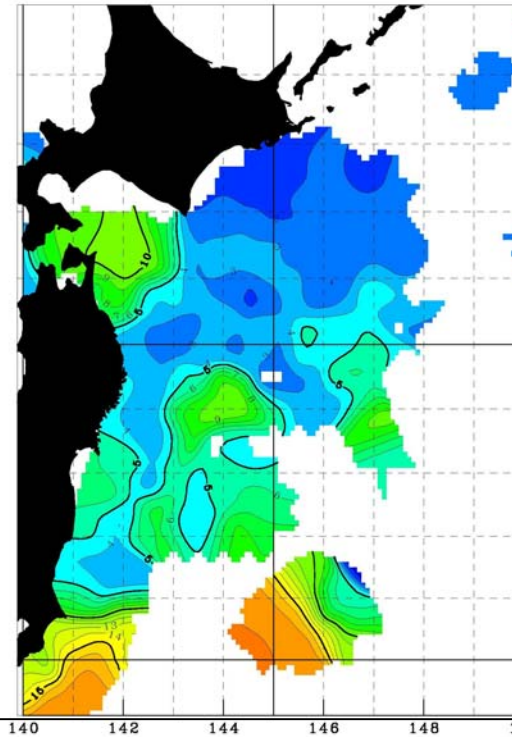


The position of the Kuroshio Extension was fairly improved

North limit latitude of the Kuroshio Extension

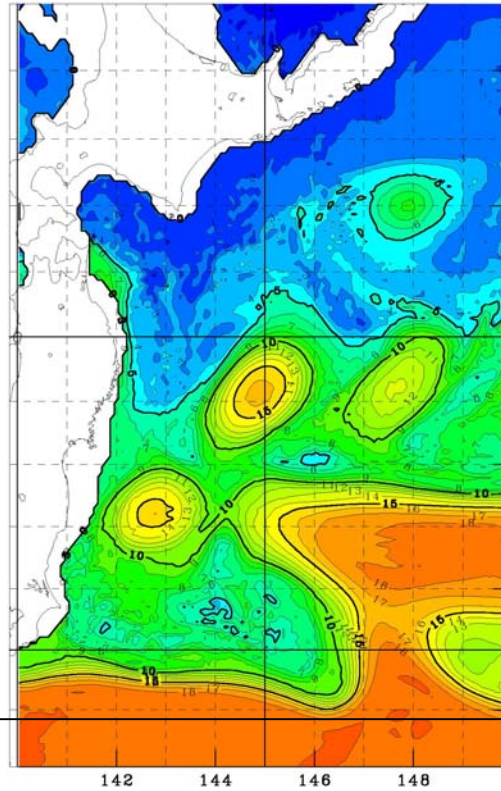
Obs. SEP.

TEMPERATURE AT 200m DATE:



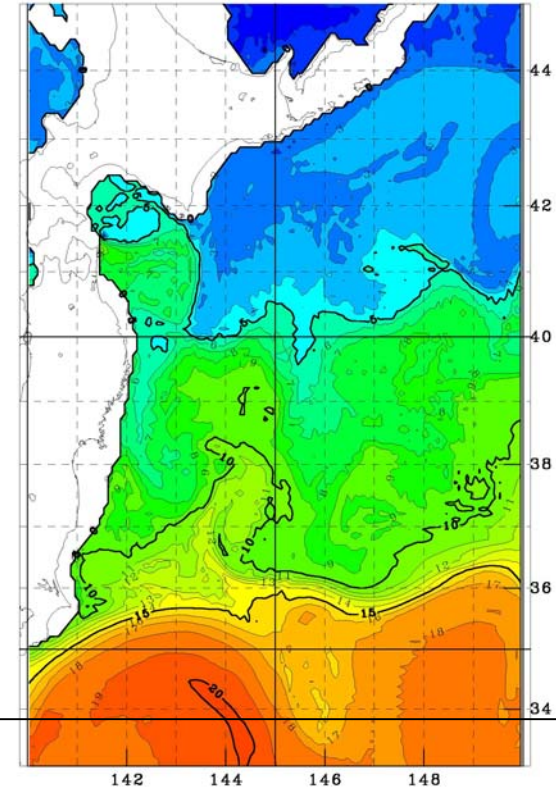
simulation

TEMPERATURE AT -200m 20030914



assimilation

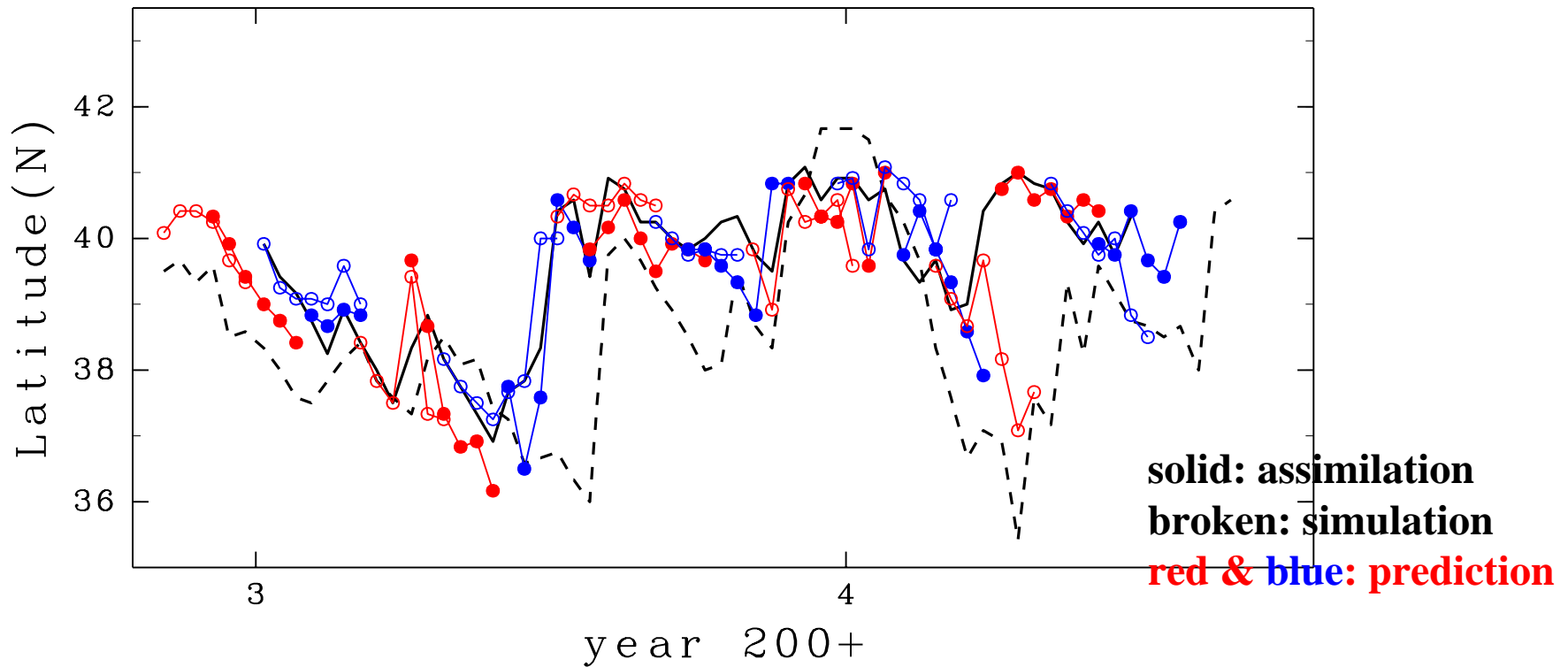
TEMPERATURE AT -200m 20030915



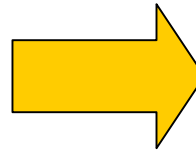
The position of the Kuroshio Extension was fairly improved

Oyashio 1st Intrusion (prediction)

a) OYASHIO 1st Intrusion



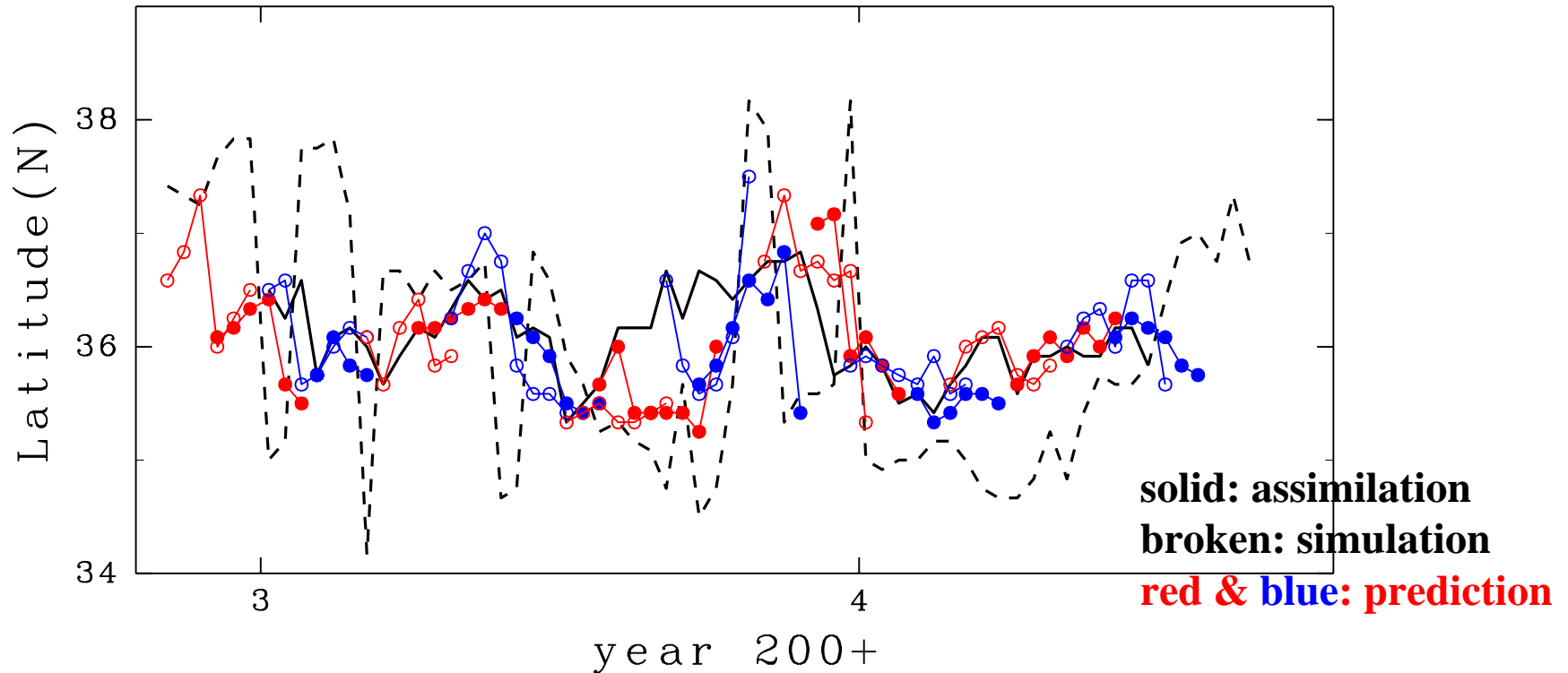
**prediction tends to follow
the assimilation**



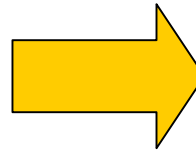
**dependency on the initial
condition is high**

North limit latitude of the KE (prediction)

a) Kuroshio north limit



**prediction tends to follow
the assimilation**



**dependency on the initial
condition is high**

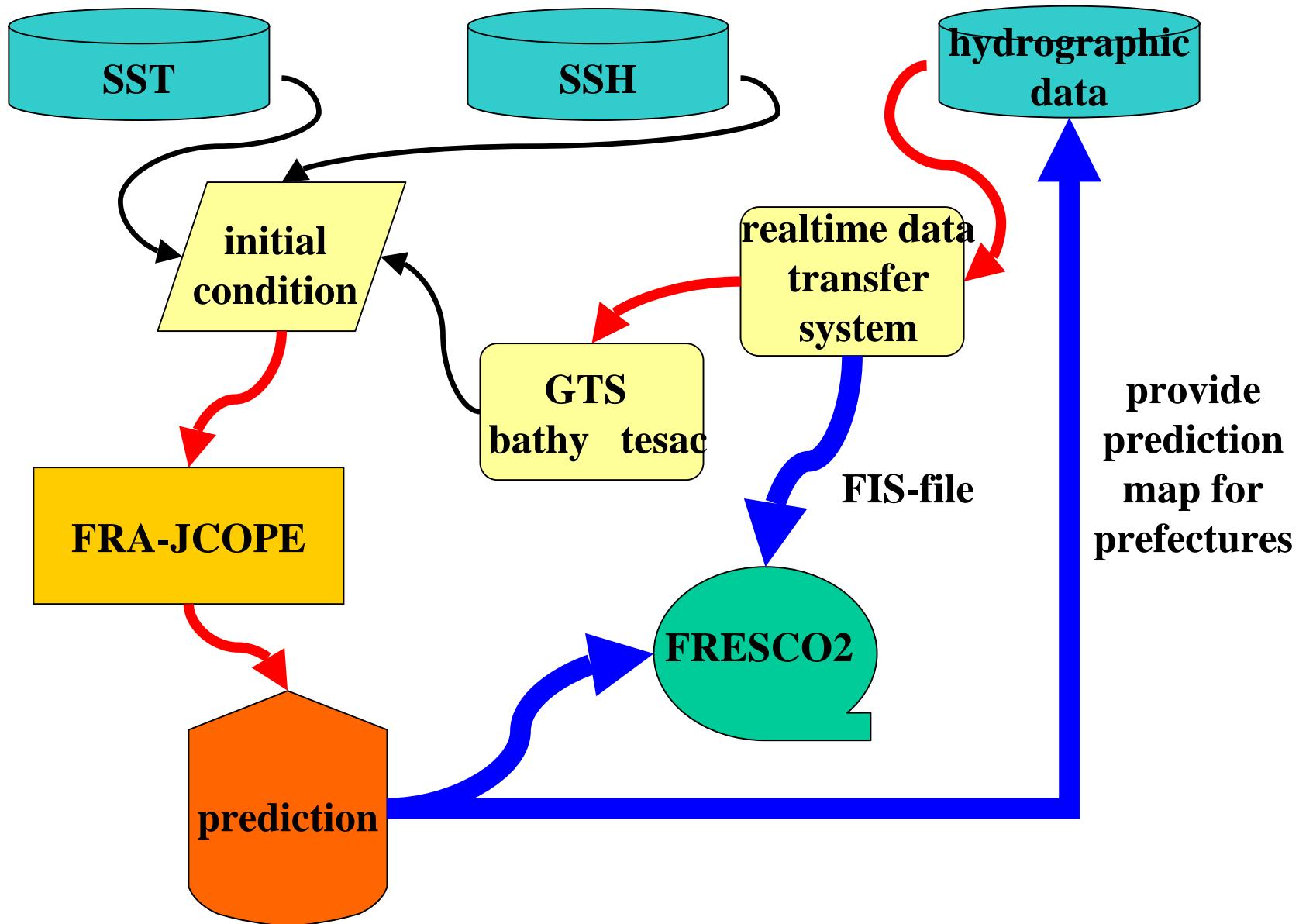
conclusion

- 1. model has tendency to enhance northward intrusion of Kuroshio warm water.**
- 2. The data assimilation appropriately reproduced the position of KE, although OFB was not correctly reproduced.**
- 3. The predicted positions of KE and OFB both separated from the observational values. However, the predictions had tendency to follow the data assimilated reanalysis values rather than the purely simulated values.**

The predictability of KE and OFB severely depends on the initial conditions.

The initial conditions are derived by the data assimilation, therefore, the model predictabilities will be improved if the data from local fisheries institutions are added to the data assimilation.

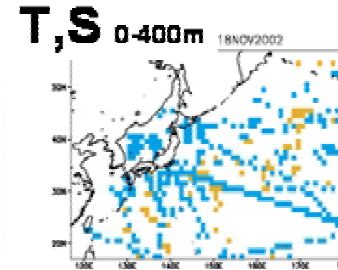
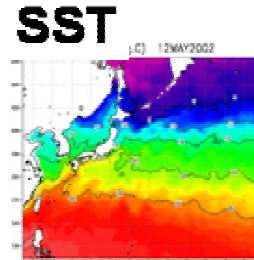
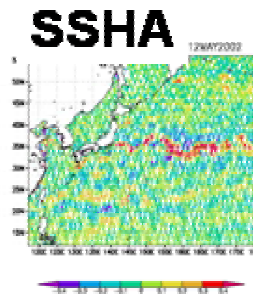
future view of FRA-JCOPE



initial condition (objective analysis)

Multivariate Optimum Interpolation

$$x = \begin{pmatrix} \eta \\ T \\ S \end{pmatrix}$$



**SSH, SST and T,S(0-400m)
are assimilated**

T,S: 0-3000m

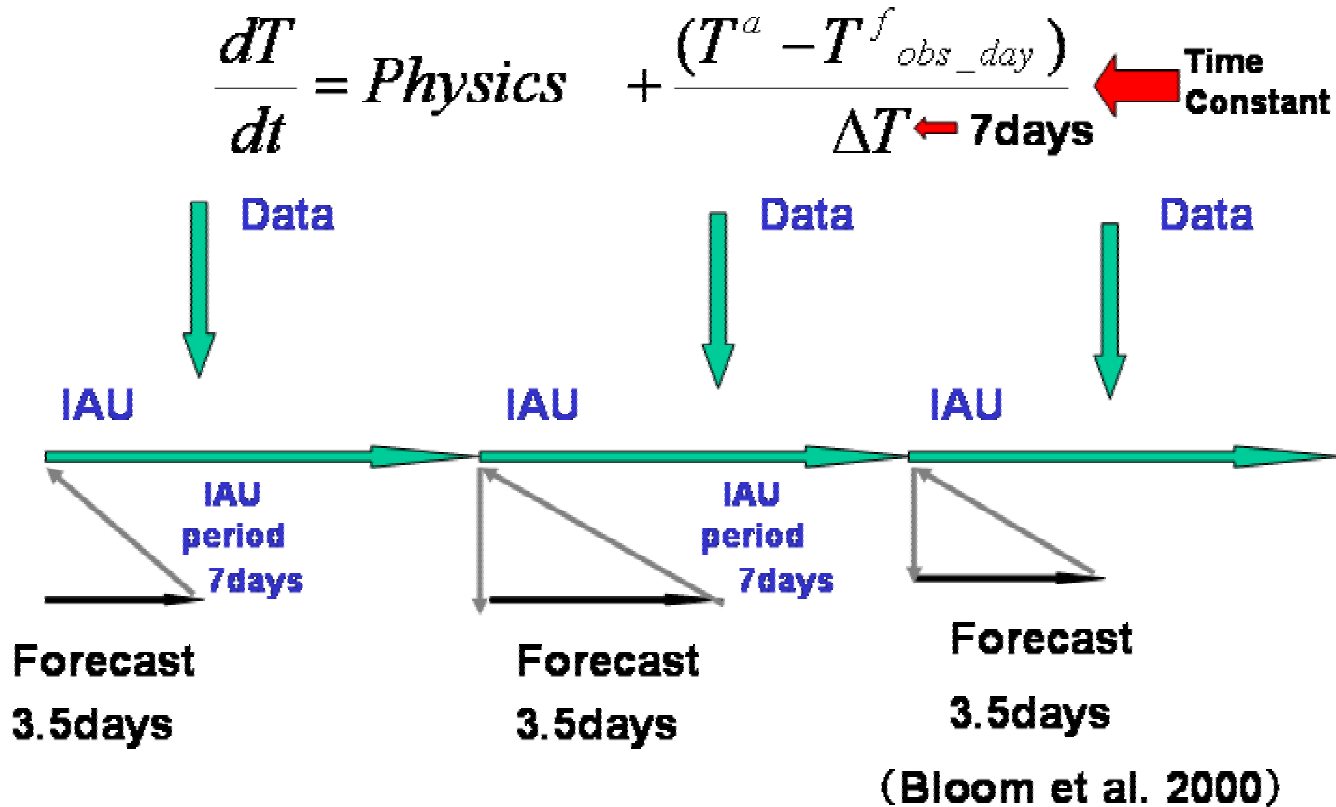
$$x^a = x^f + PH^T (HPH^T + R)^{-1} (y^o - Hx^f)$$

courtesy of Dr. Miyazawa

SSHA: NRL/SSC (Jason-1 + Geosat follow on)
SST: NAVOCEANO MCSST
T,S : GTSP

initial condition (data assimilation

Incremental Analysis Update



wind stress: QuickSCAT NRT
heat flux: NCEP/NCAR reanalysis 6-hourly
salinity: restored to monthly climatology