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."*

FRCGC developed *JCOPE* (Japan Coastal Ocean Predictability Experiment)
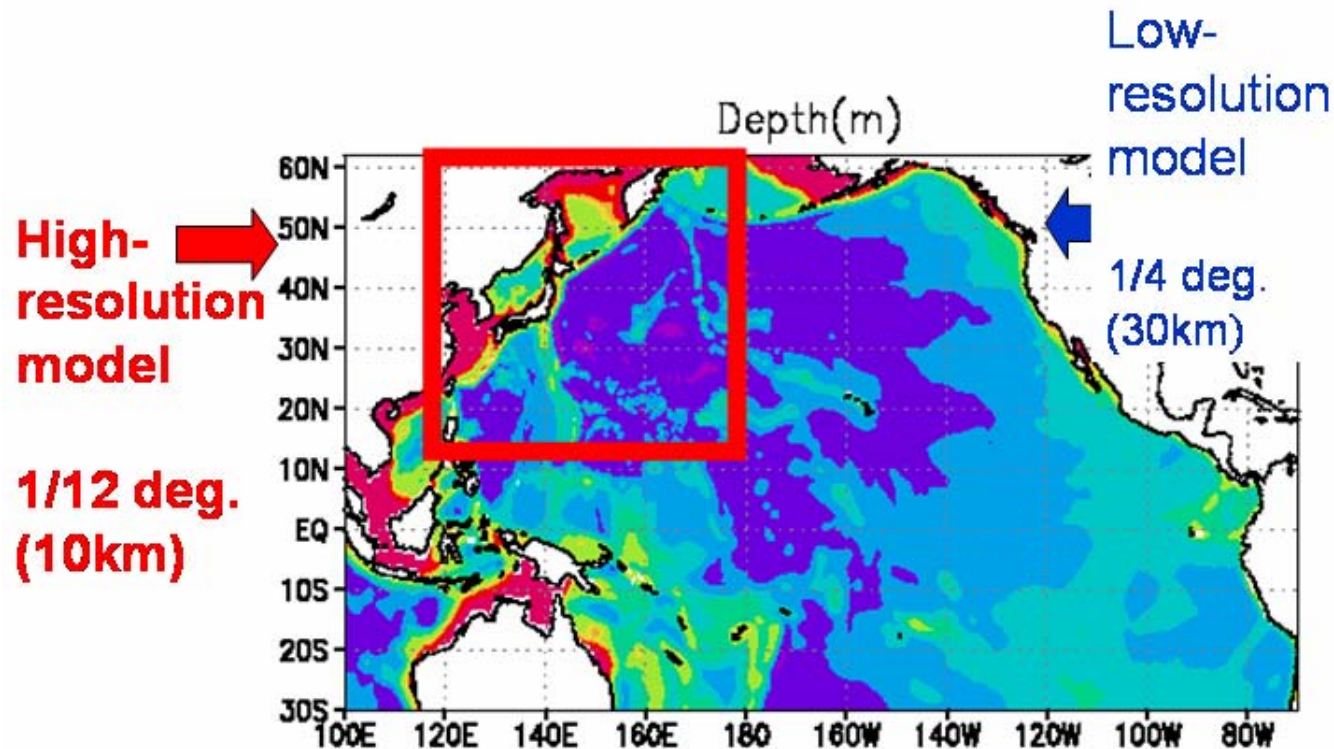prediction system
Objectives
    develop realtime data transfer system in fisheries observation network
    and improve the prediction system to be capable for 2-3 months prediction.
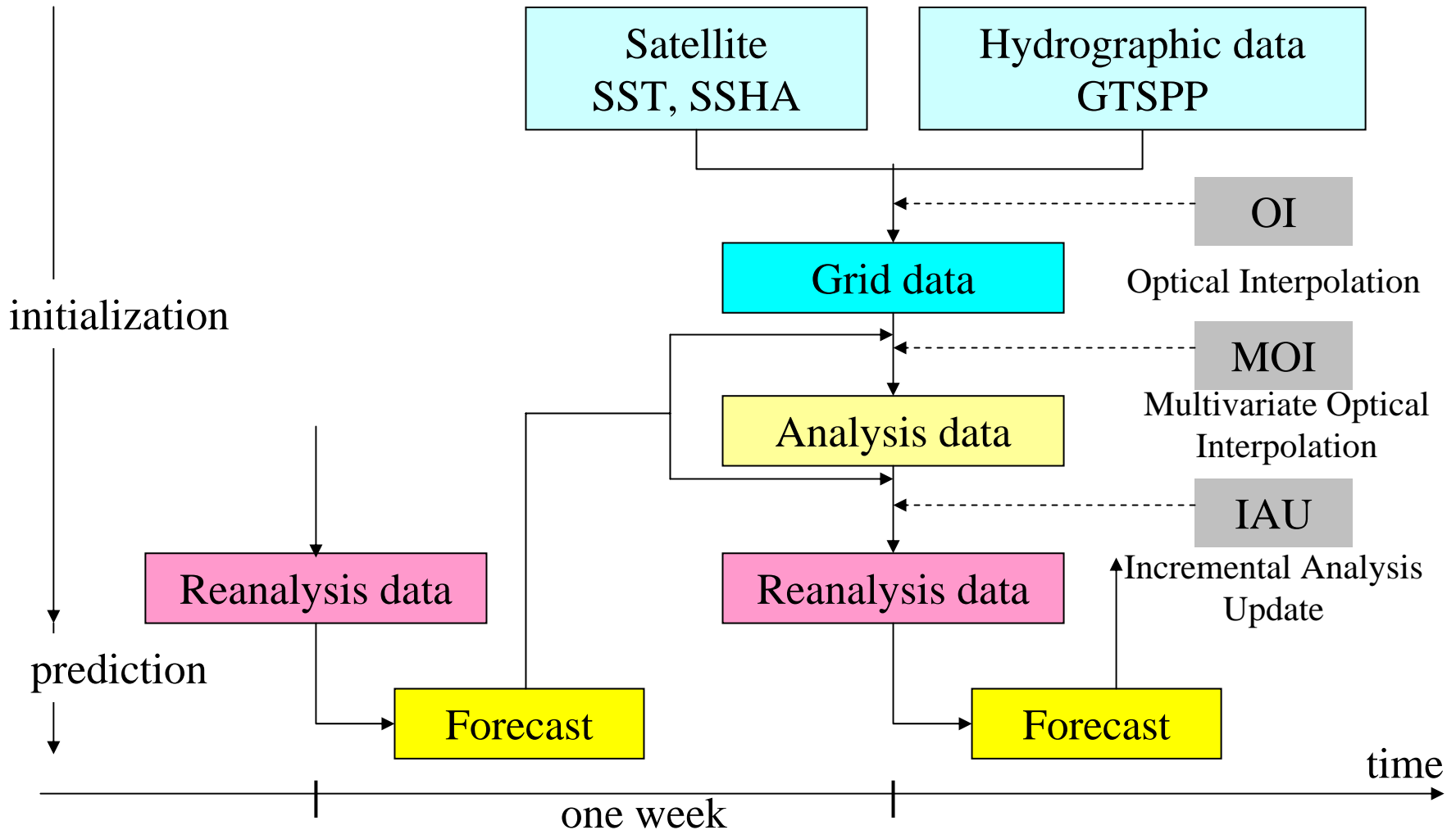   ➡ **FRA-JCOPE**

JCOPE system model

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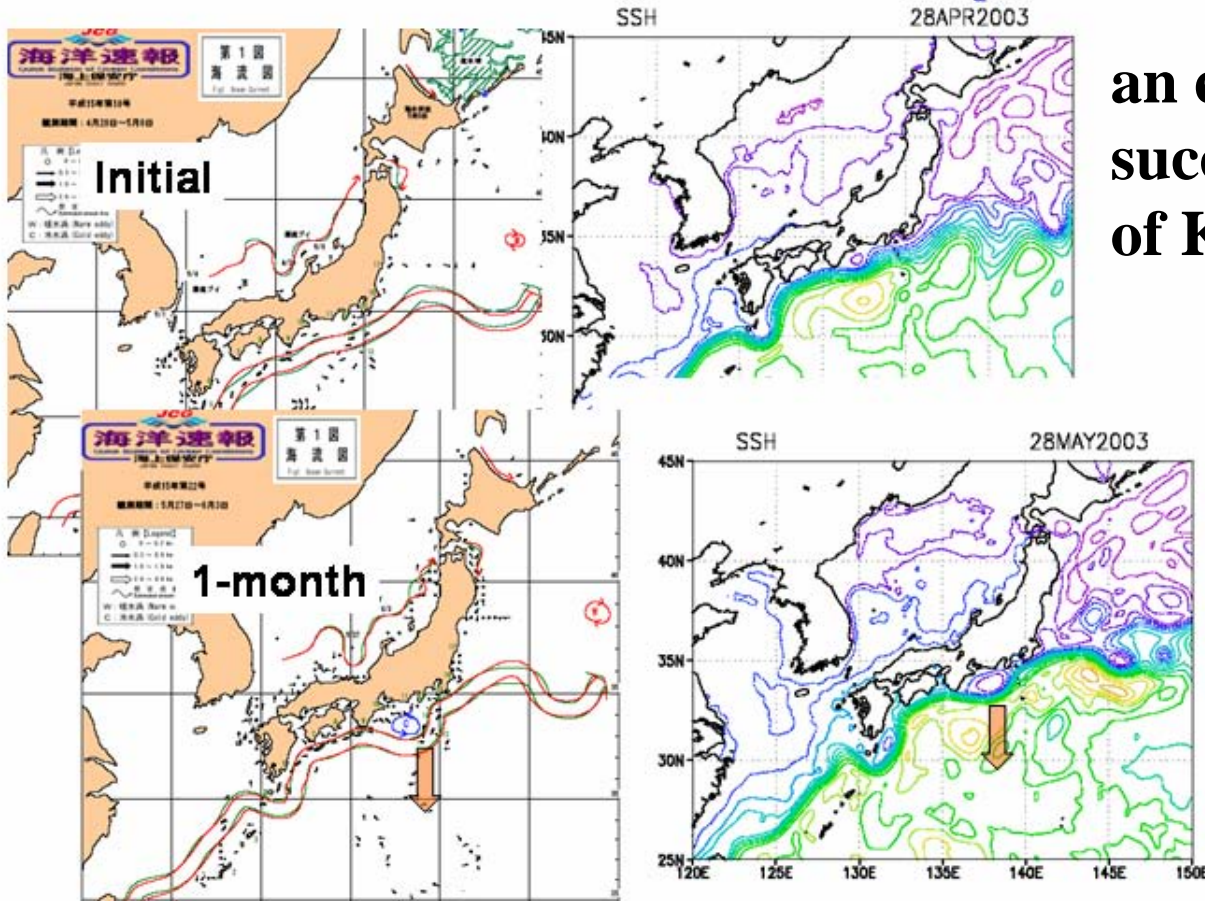**one-way nesting method (Guo et al., 2003)**

courtesy of Dr. Miyazawa

Flow of JCOPE system

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 e.g. Miyazawa et al. 2004, 2005

courtesy of Dr. Miyazawa

Questions for JCOPE system

1. **Prediction for Kuroshio meander south of Japan seems successful one. How about in other regions (e.g. Oyshio region and the mixed water region)?**
2. **Data from Coastal repeated hydrographic lines observed by prefectural fisheries institutions are not included because the data is not transferred to GTS.**
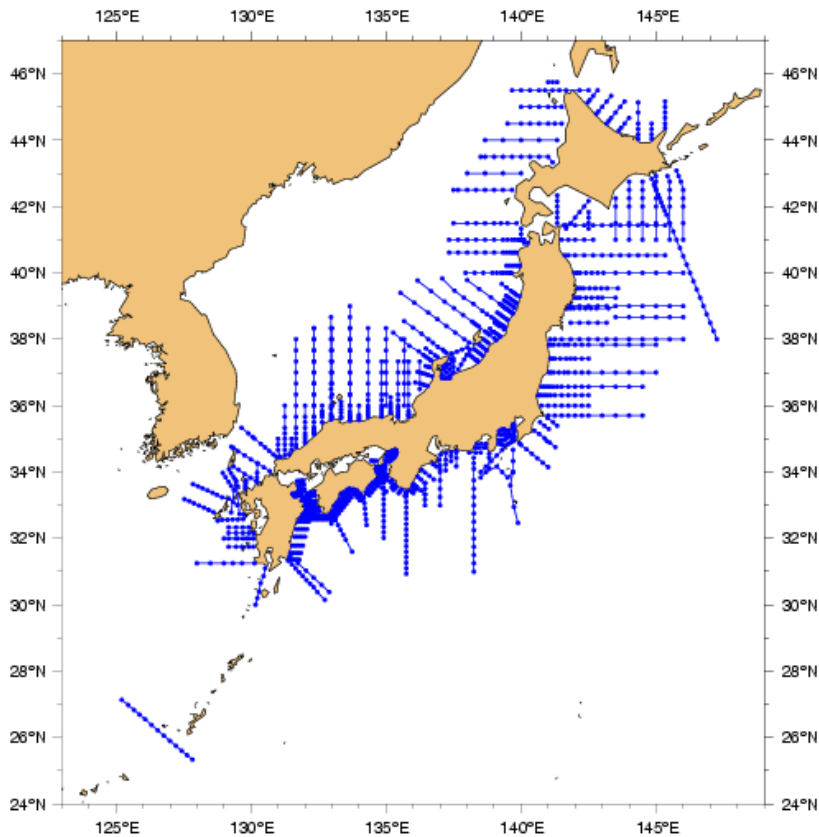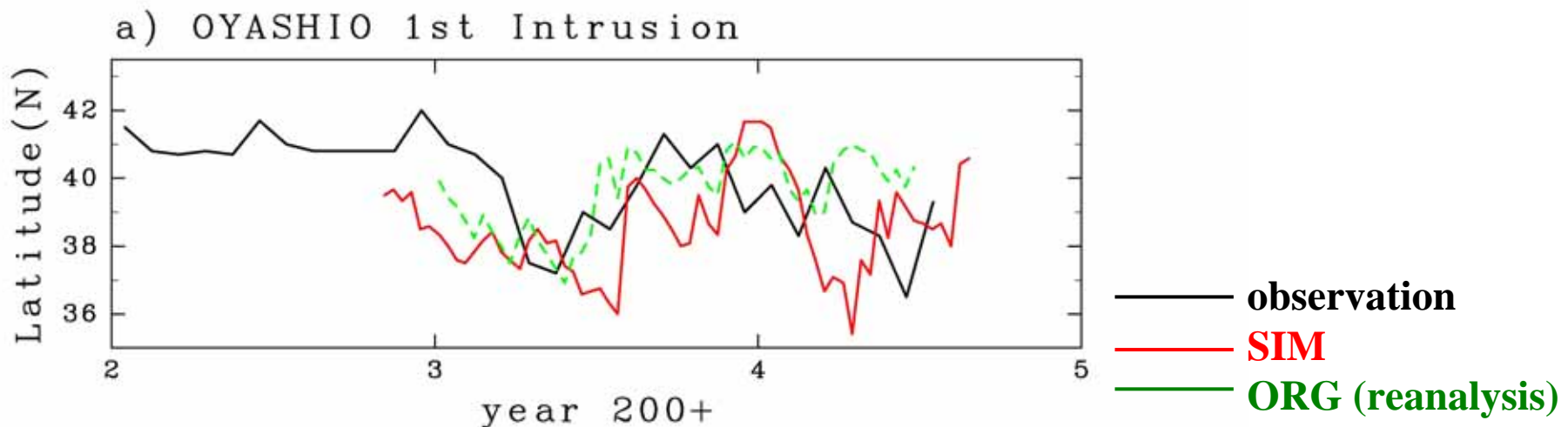

Objective of joint program

1. **confirm the predictability of JCOPE system in the regions outside the Kuroshio**
2. **Include the coastal lines data to JCOPE system**
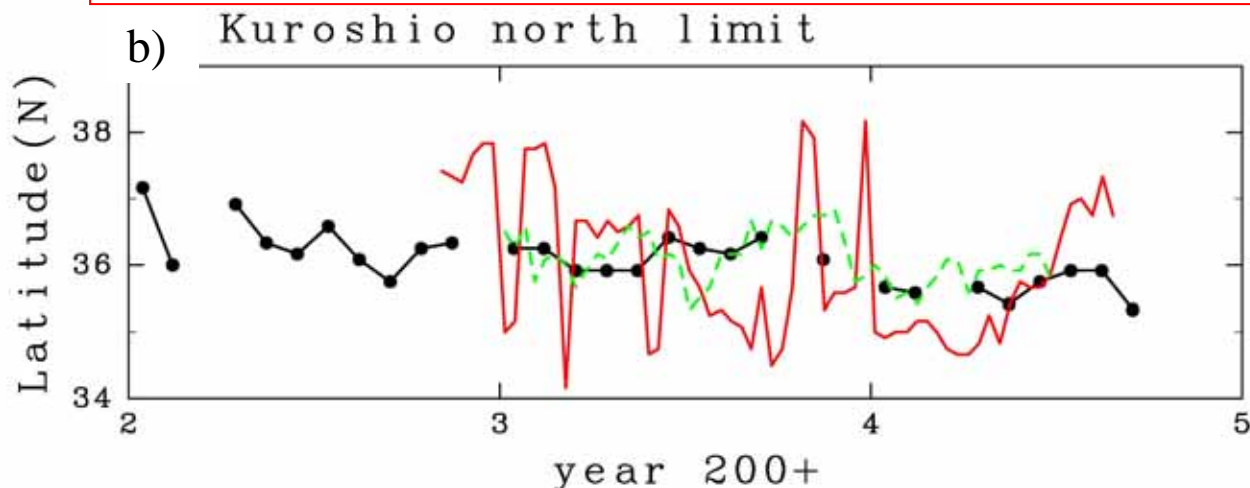3. **Improve the predictability**

Schematics of the mixed water region

a) OYASHIO 1st Intrusion

Latitude (N)

observation
SIM
ORG (reanalysis)

year 200+
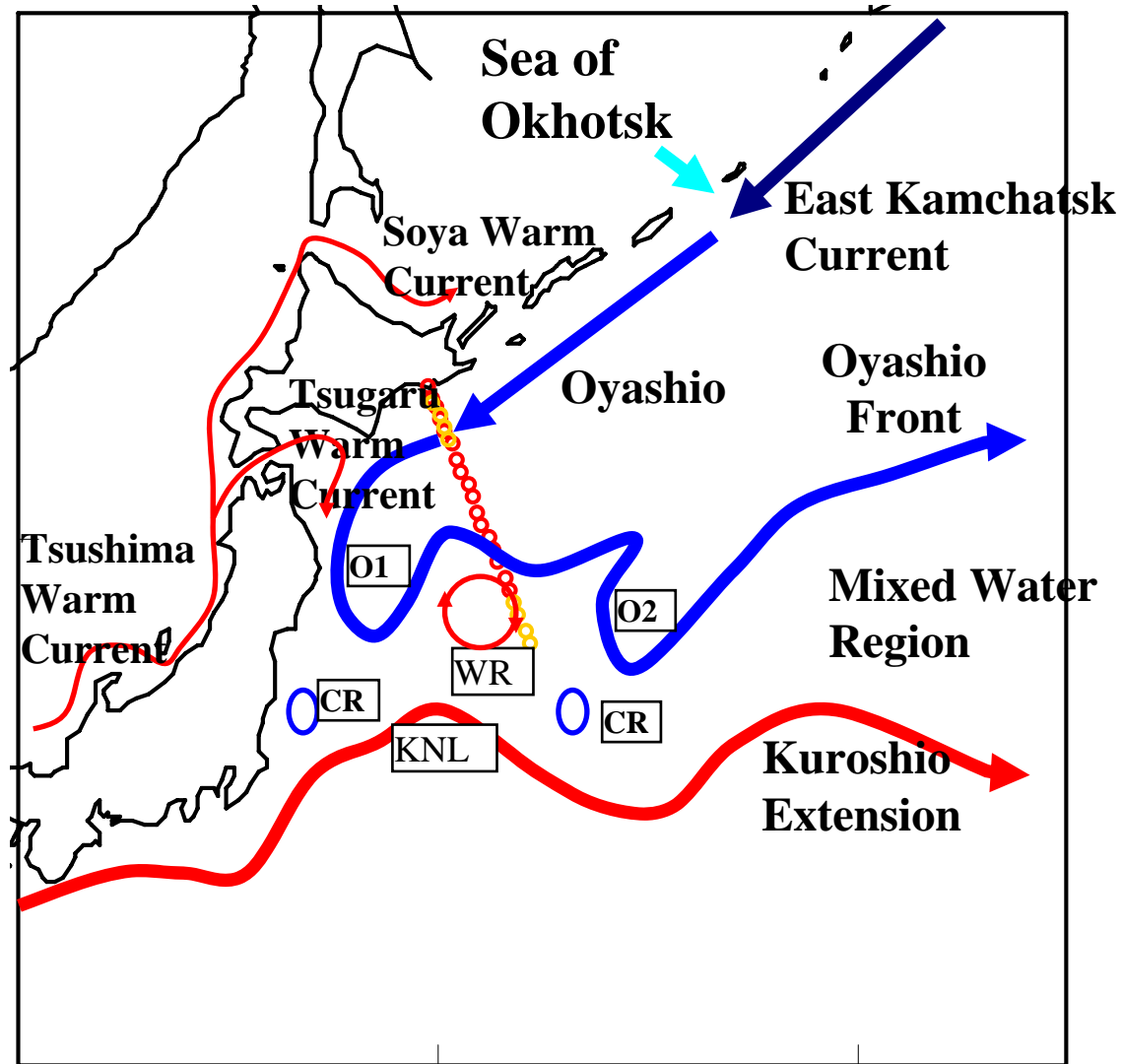
Simulation showed different variation with observation.
The position of the Oyashio 1st Branch was improved by data assimilation.
However, the improvement is insufficient.

b) Kuroshio north limit
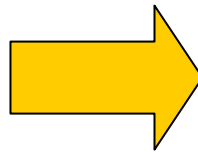
Latitude (N)

year 200+

Ito et al. (2006)

Simulation showed different variation with observation.
The position of the Kuroshio Extension 1st Crest was fairly improved by data
assimilation.

Oyashio 1st Branch (prediction)
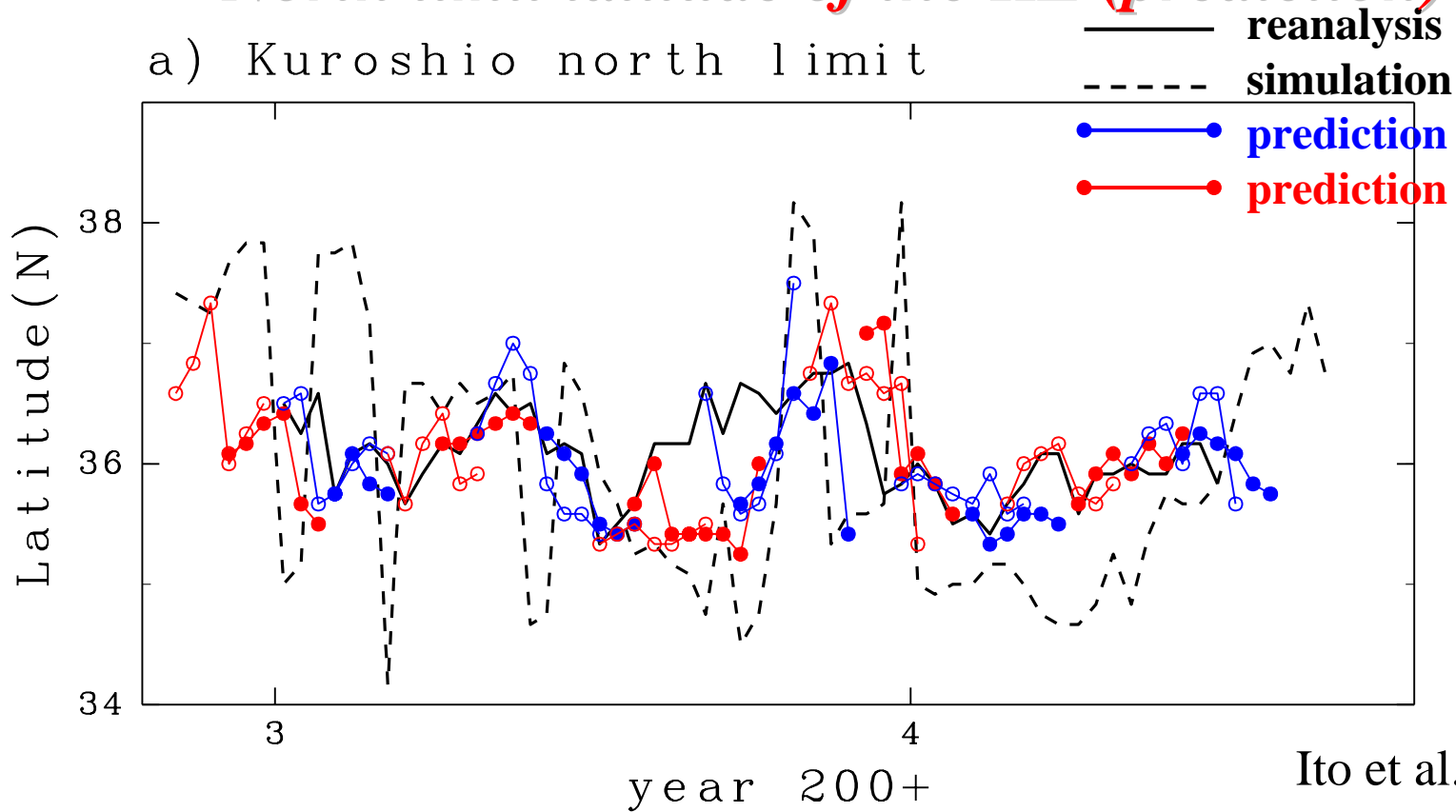

a) OYASHIO 1st Intrusion

Ito et al. (2006)
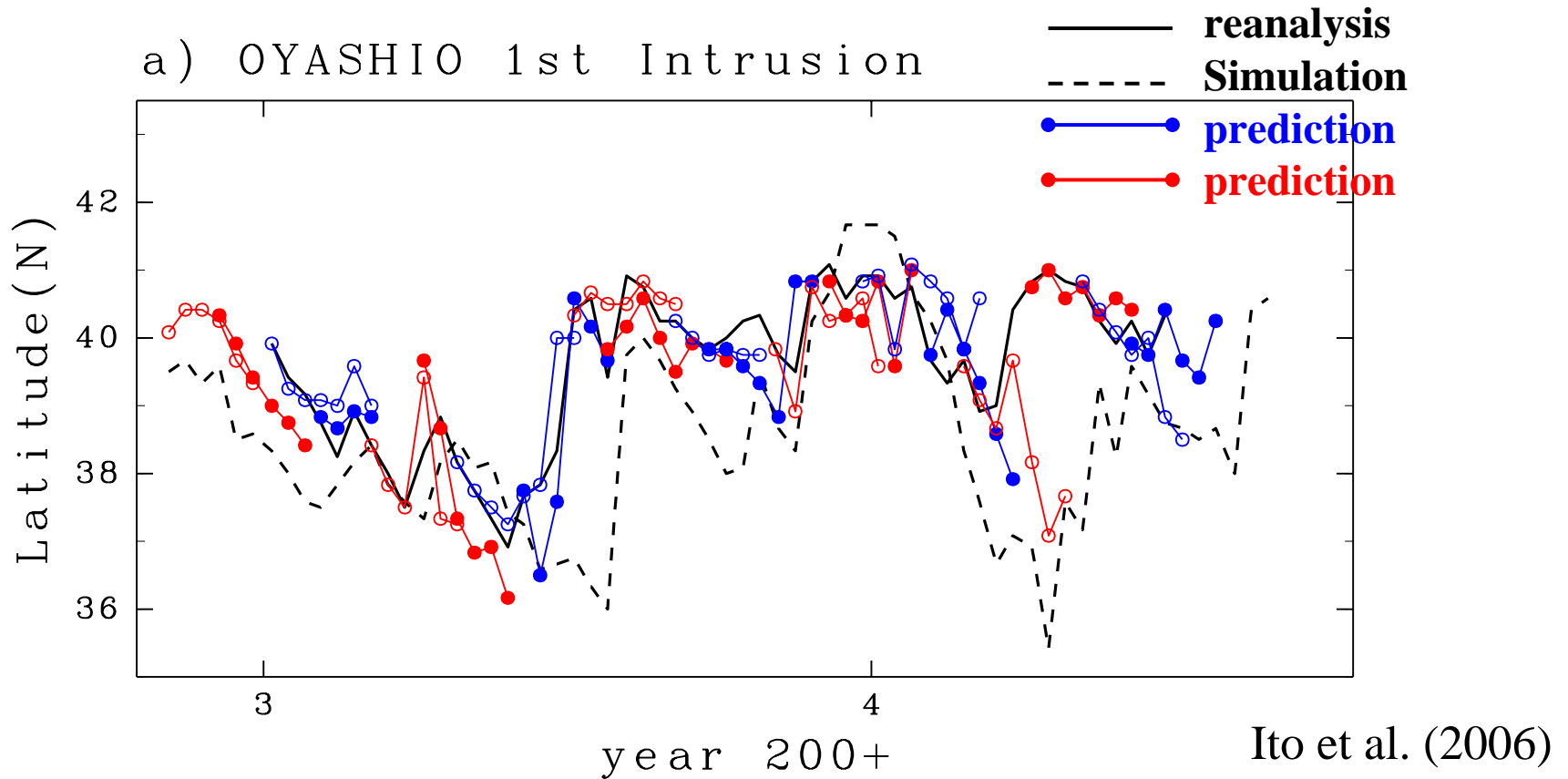
prediction tends to follow the assimilation ⟹ **dependency on the initial condition is high**

North limit latitude of the KE (prediction)

a) Kuroshio north limit

Legend:
— reanalysis
- - - simulation
—•— prediction (blue)
—•— prediction (red)

Latitude(N) axis: 34, 36, 38
x-axis: 3, 4 — year 200+

Ito et al. (2006)

prediction tends to follow the assimilation → **dependency on the initial condition is high**

GTS

FRA-JCOPE

Satellite SST, SSHA

Hydrographic data GTSPP

OI — Optical Interpolation

Grid data

MOI — Multivariate Optical Interpolation

Analysis data

IAU — Incremental Analysis Update

Reanalysis data

Reanalysis data

prediction

Forecast

Forecast

one week

time

http://www.jamstec.go.jp/frcgc/jcope/index.html
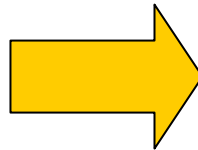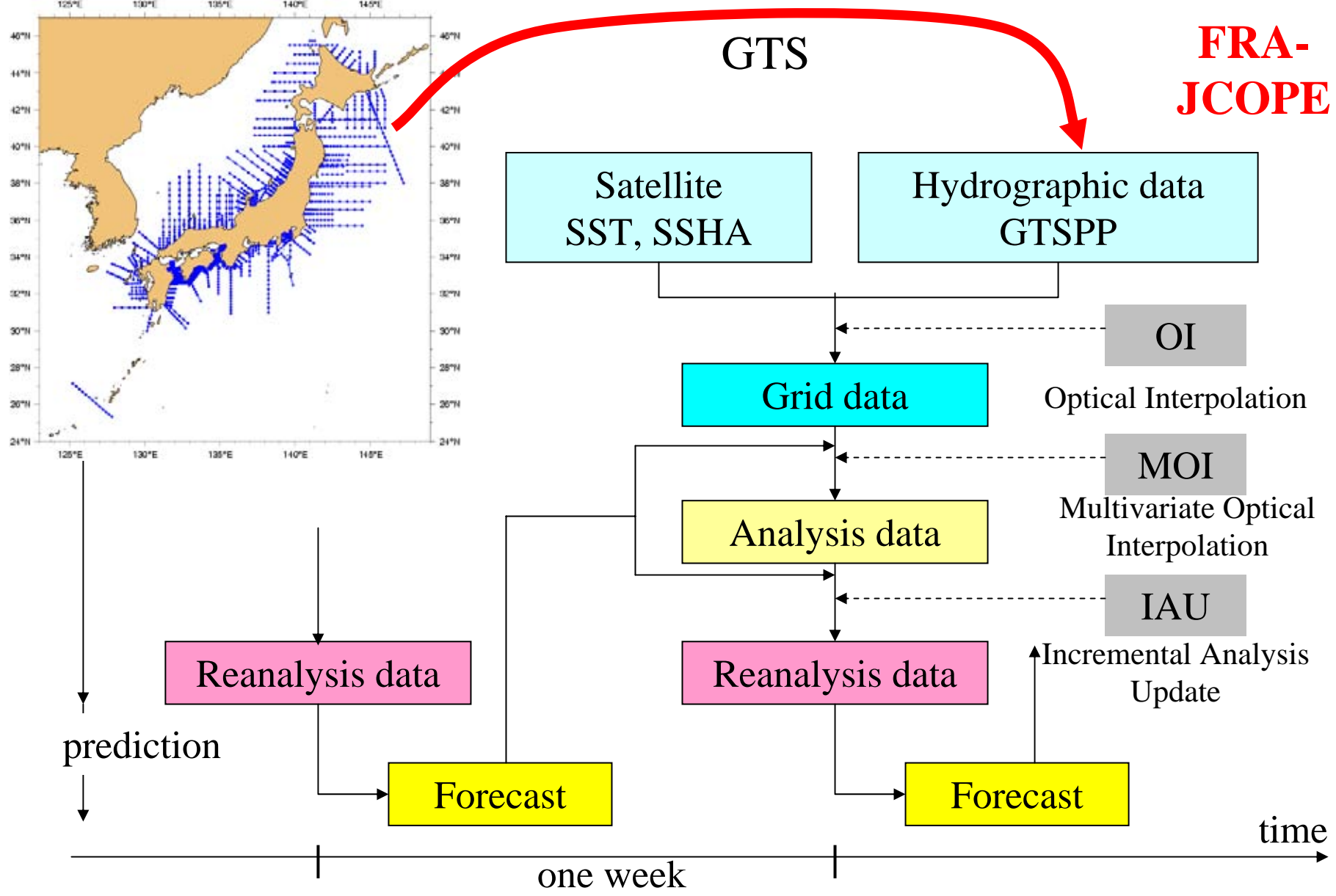
Coastal hydrographic lines data added

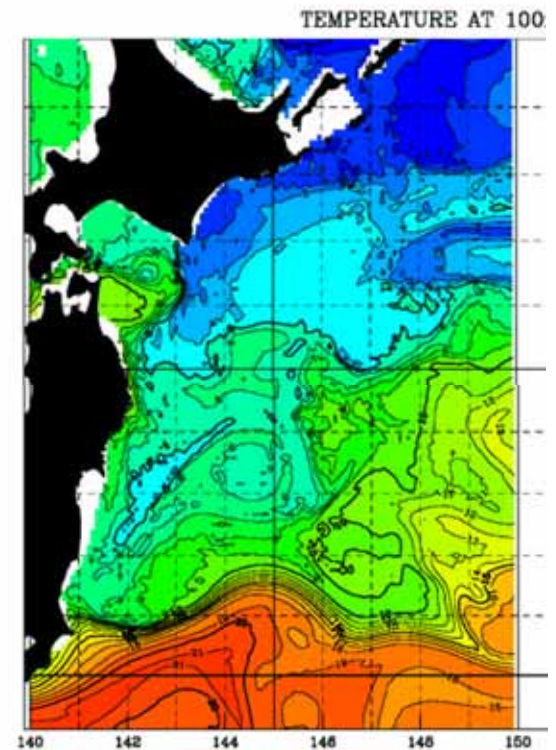## Temp. at 100 m depth in June 2004
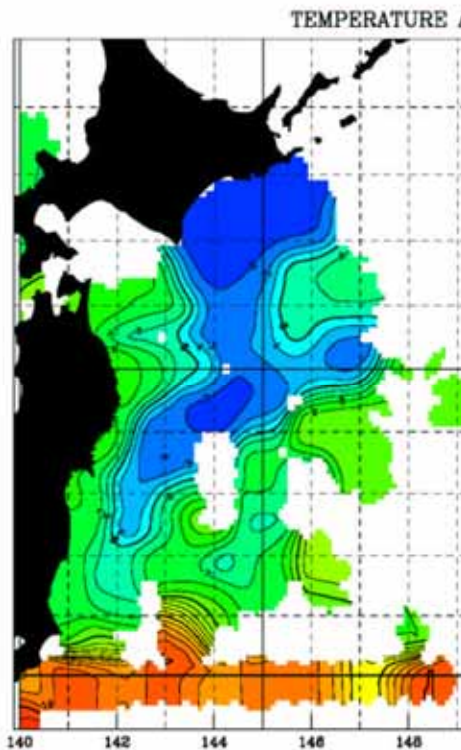
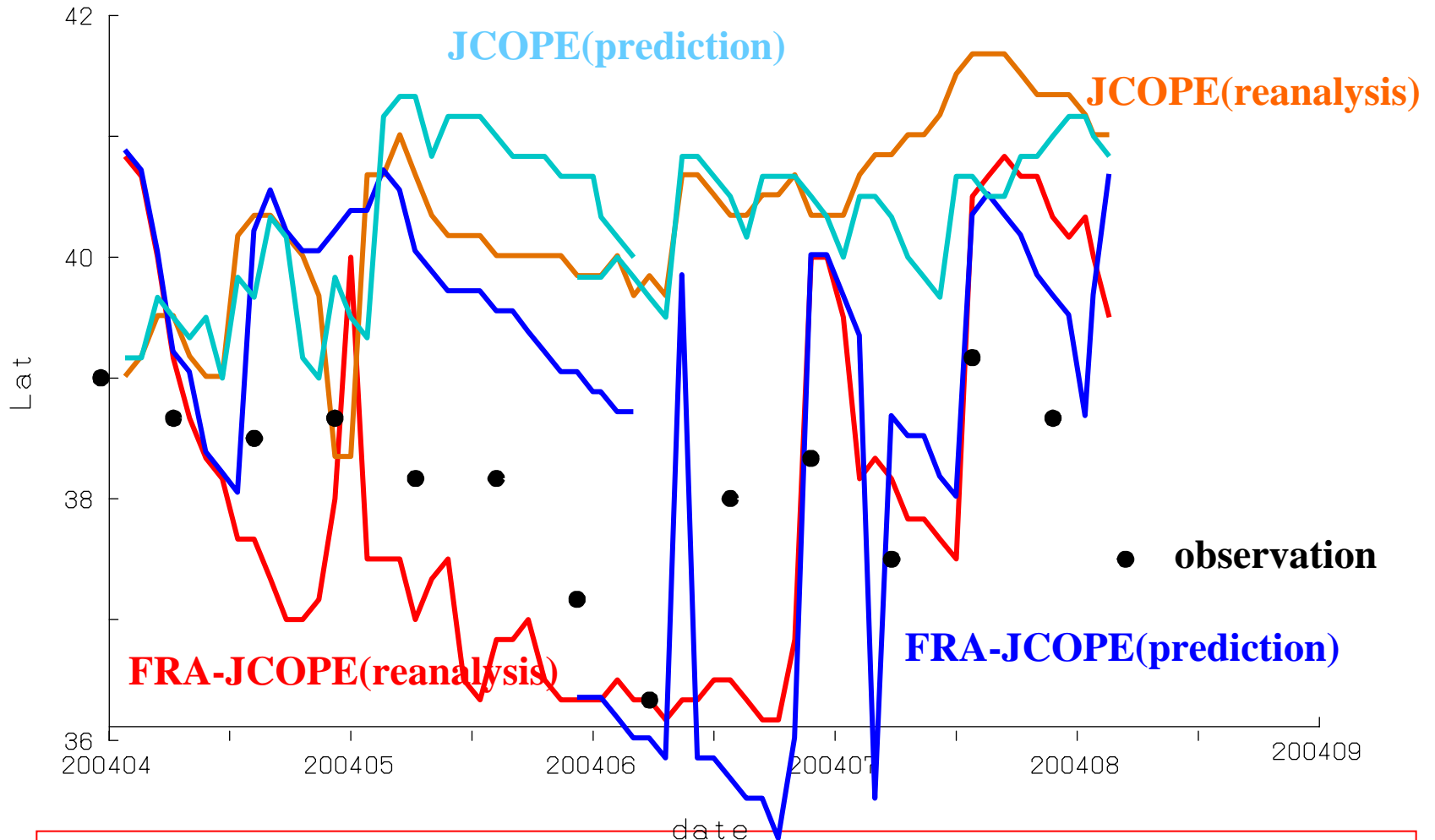| Observation	FRA-JCOPE (data added)	JCOPE
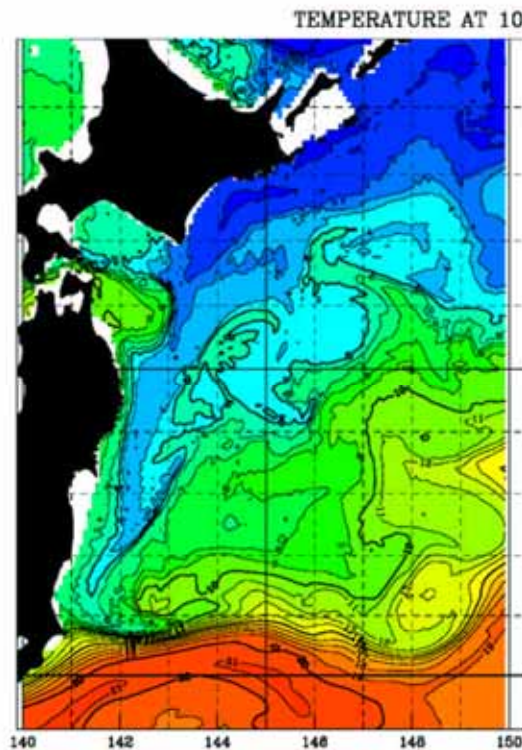
The position of the Oyashio First Branch was fairly improved by the addition of the coastal hydrographic lines data.

Oyashio 1st Branch (prediction)

JCOPE(prediction)

JCOPE(reanalysis)

observation

FRA-JCOPE(reanalysis)

FRA-JCOPE(prediction)

Lat

date

Reanalysis is improved by adding the data.
Prediction tends to follow the assimilation.
**Predictability was much improved by adding the data.**
To improve more, assimilation seems to be improved.

Conclusion

1. We developed realtime data transfer system which send TESAC message of hydrographic data observed by fisheries institutions.
2. Fishery community data contributed to improve both initial condition and prediction.   (**FRA-JCOPE**)

Numerous number of parameter studies showed that
   for further improvement of the initial condition,
   following 2 items are needed.

1. OI should be improved to represent mesoscale phenomenon.
2. The MOI parameters should be modified appropriately. Now the estimation of subsurface T&S from SSH is defined by model outputs. This enhances model bias.
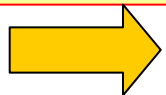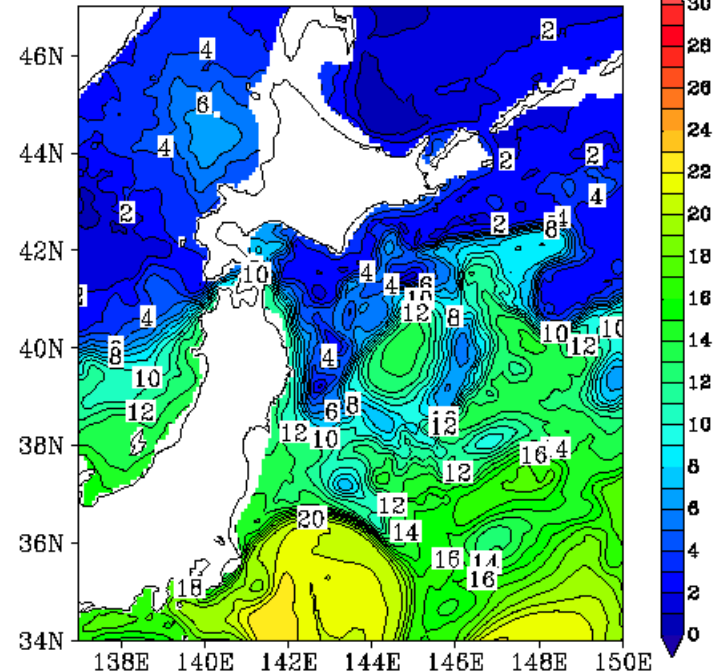
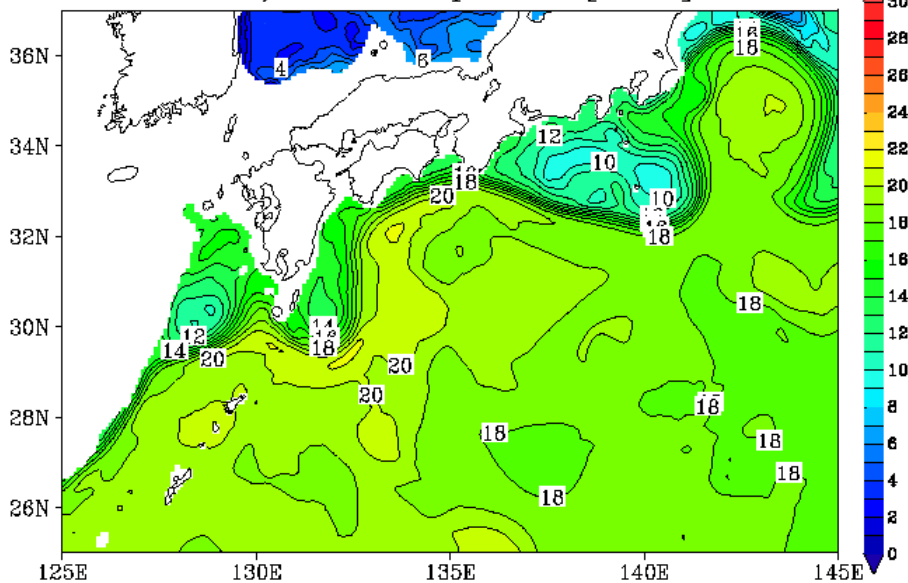⮕ JCOPE2 (next presentation by Dr. Miyazawa)

FRA-JCOPE Web

http://ben.nrifs.affrc.go.jp/web_IIsys/index.html

2007/12/20
FRA/JCOPE Temperature[100m]

2007/12/20
FRA/JCOPE Temperature[200m]

FRA-JCOPE started operational prediction since Apr. 2007

FRA-JCOPE

now applied to predictions of jellyfish, anchovy, etc.

Nemopilema nom...

weight:15...