

The Surface Oceanic Circulation and Ocean litters prediction of the Japan/East East Sea

Jong-Hwan Yoon

RIAM, Kyushu University

The JES as “a Mini Ocean”
A unique
Natural Laboratory

· The end of “**the Cold War**” has activated the study of the JES (numerical model studies hydrographic surveys)

· The **Earth Simulator** has enabled us to run a very fine resolution RIAM Ocean Model (**RIAMOM**).

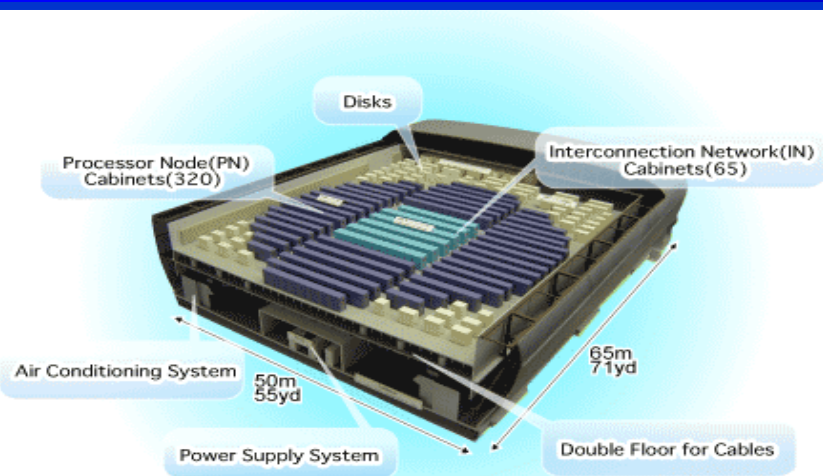
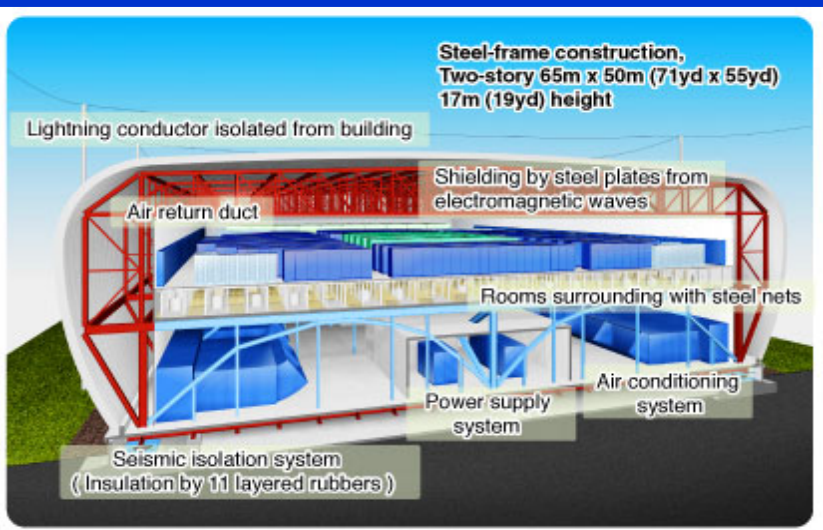
· The **RIAMOM** with $1/36^\circ$ horizontal resolution successfully highlighted detailed structure of the JES circulation.

Today’s my talk refers mainly to the results of this model

Earth Simulator (Yokohama)

March, 2002

- ◆ 640 nodes (5120 cpu)
total peak performance
40 Tflops
total main memory
10 TB
- ◆ 1 node (8 cpu)
64 Gflops, 16GB



- ◆ Total 20 years integration using
20 (160 CPUs) nodes
needs 100 hours computation using
2 D MPI

RIAM Ocean Model (RIAMOM)

- A primitive, z-coordinate, free-surface ocean general circulation model
- Grid resolution.
 - horizontal grid spacing of $1/36^\circ$
 - 46 vertical levels
- Climatological atmospheric and inflow forcing
- Integration using the Earth Simulator
 - Starting from a state of rest
 - 20 years integration

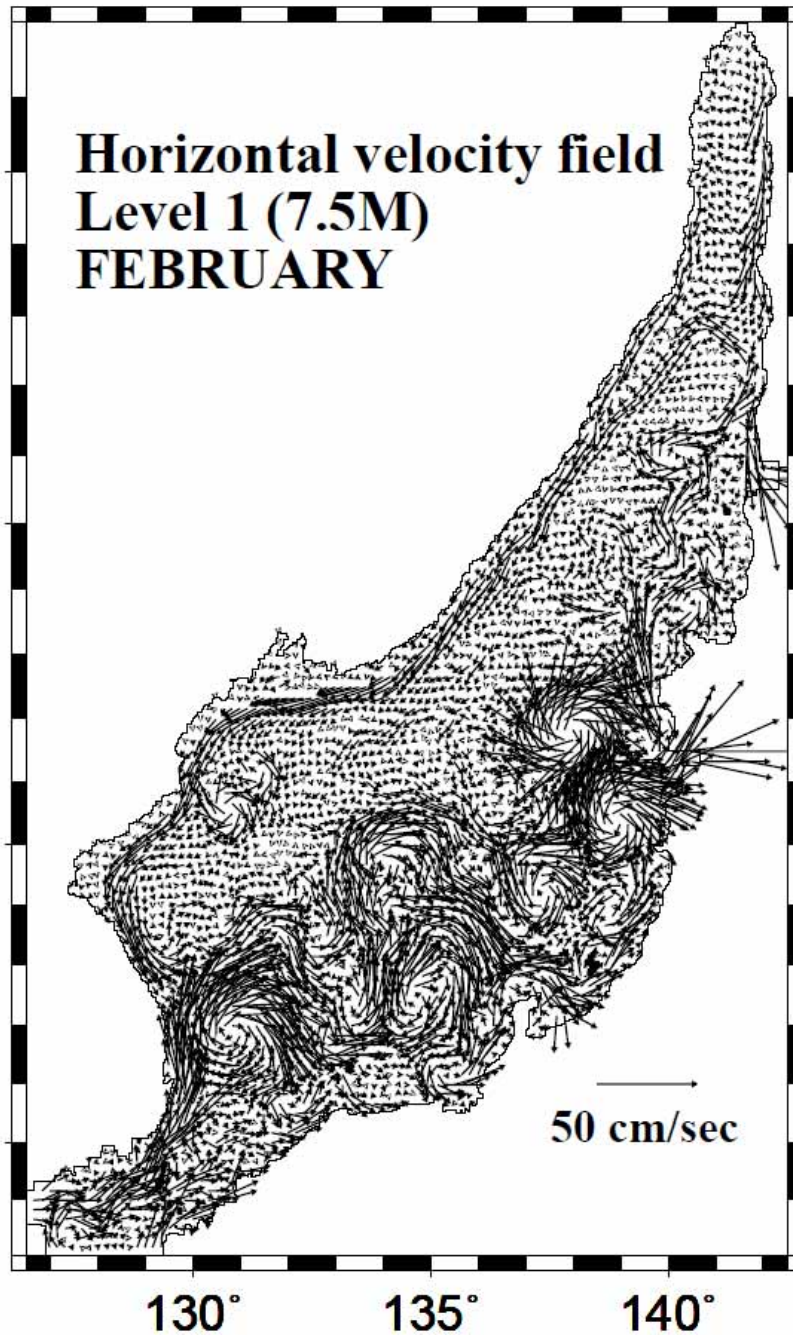
**Horizontal velocity field
Level 1 (7.5M)
FEBRUARY**

50°

45°

40°

35°



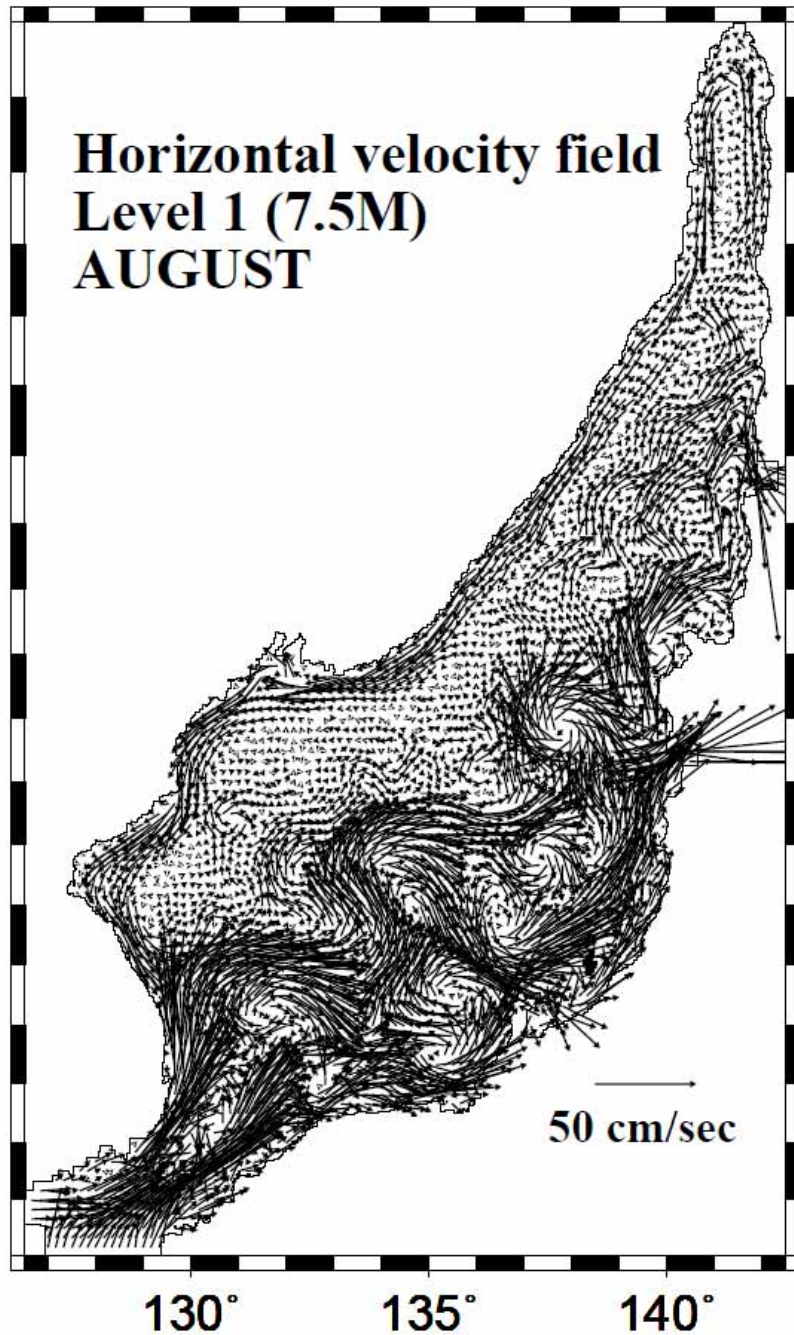
**Horizontal velocity field
Level 1 (7.5M)
AUGUST**

50°

45°

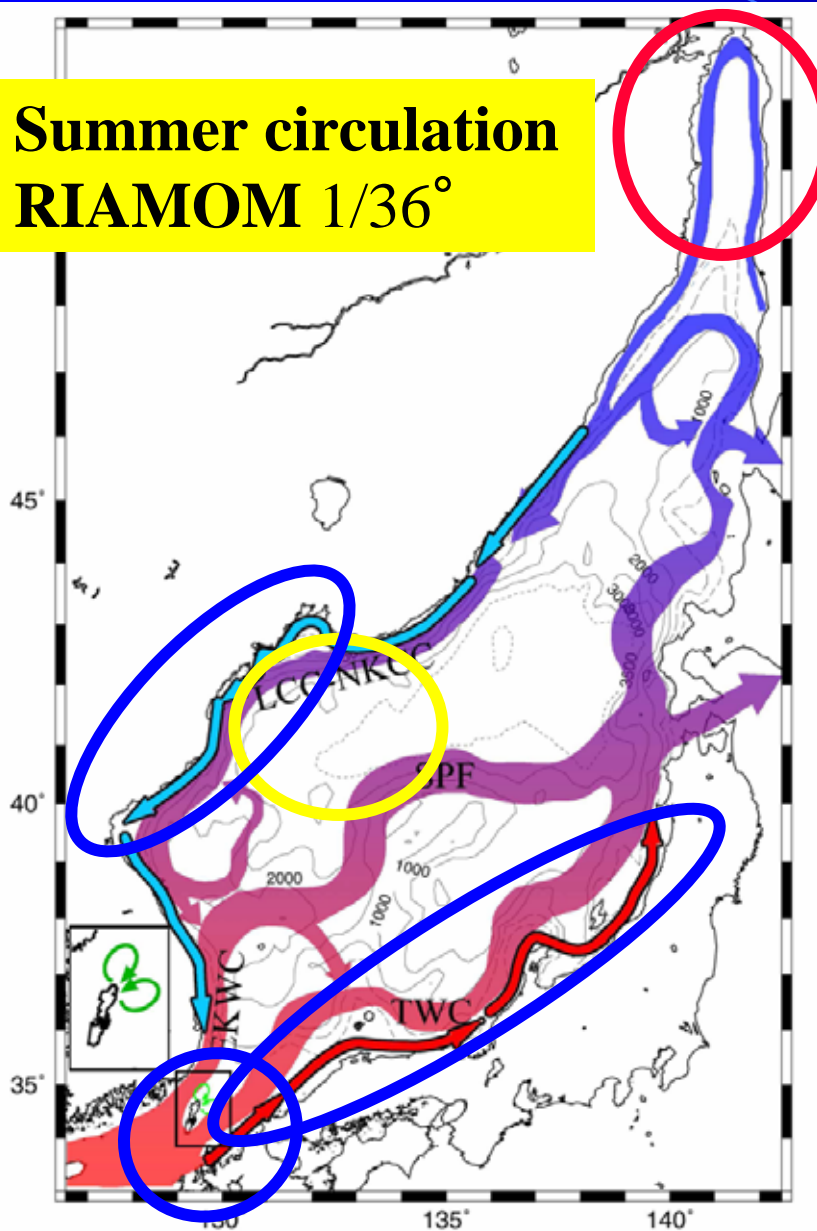
40°

35°

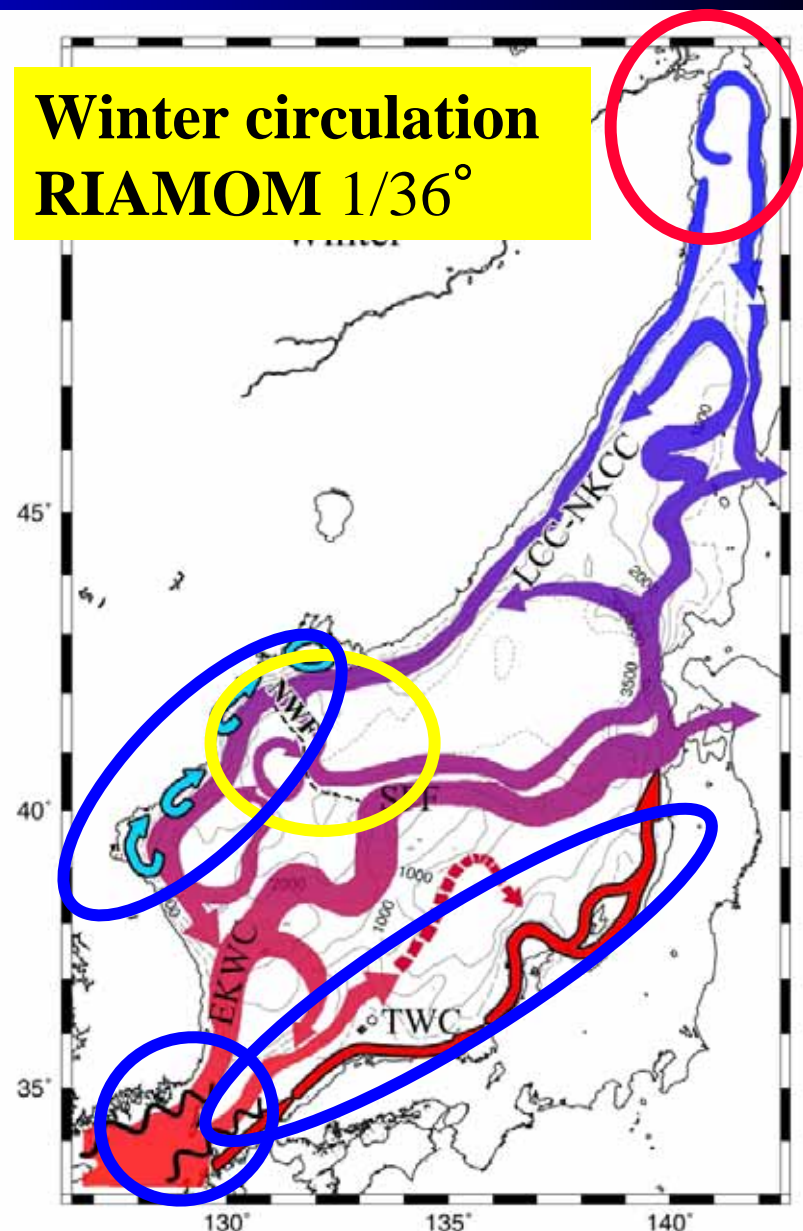


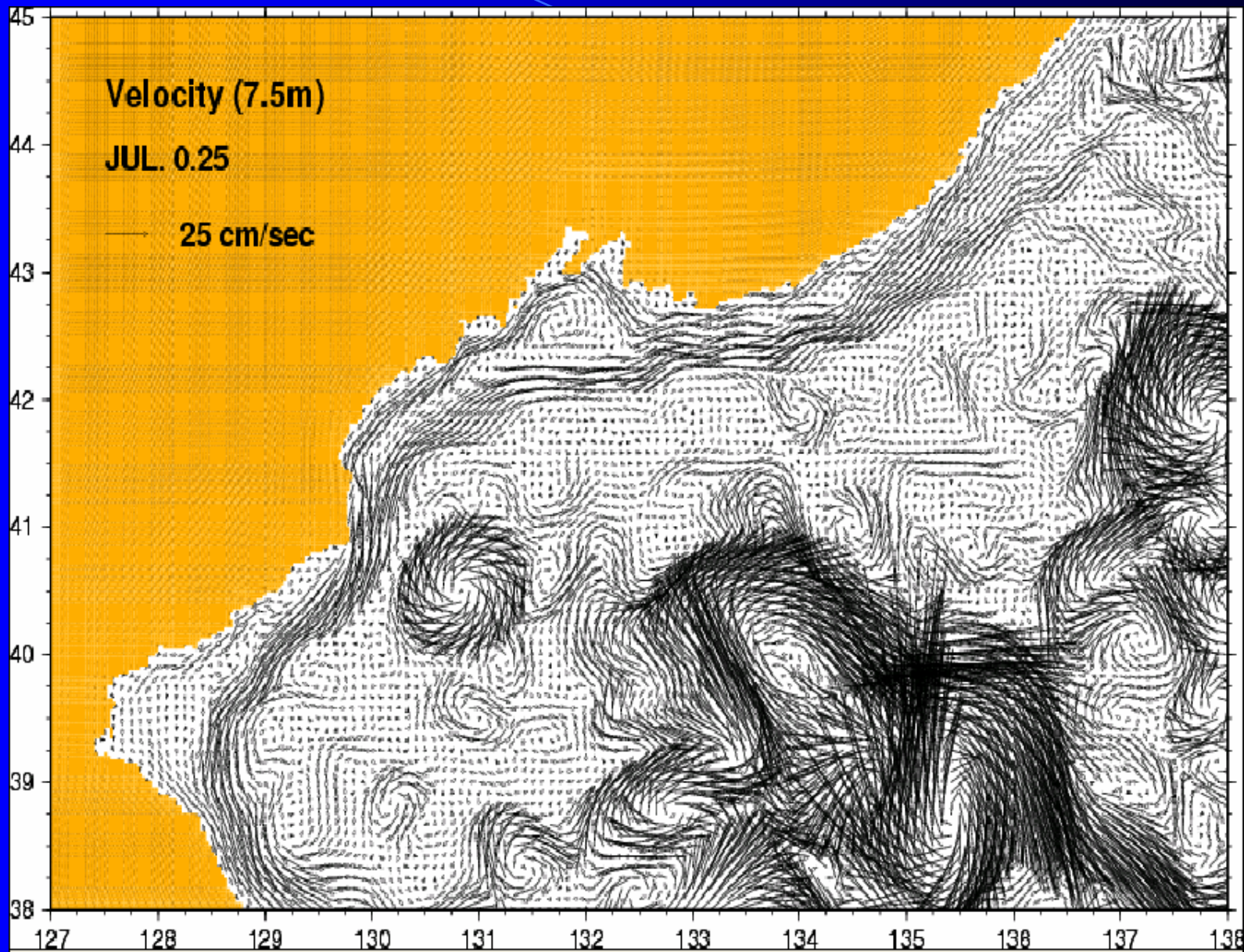
Winter Surface Circulation

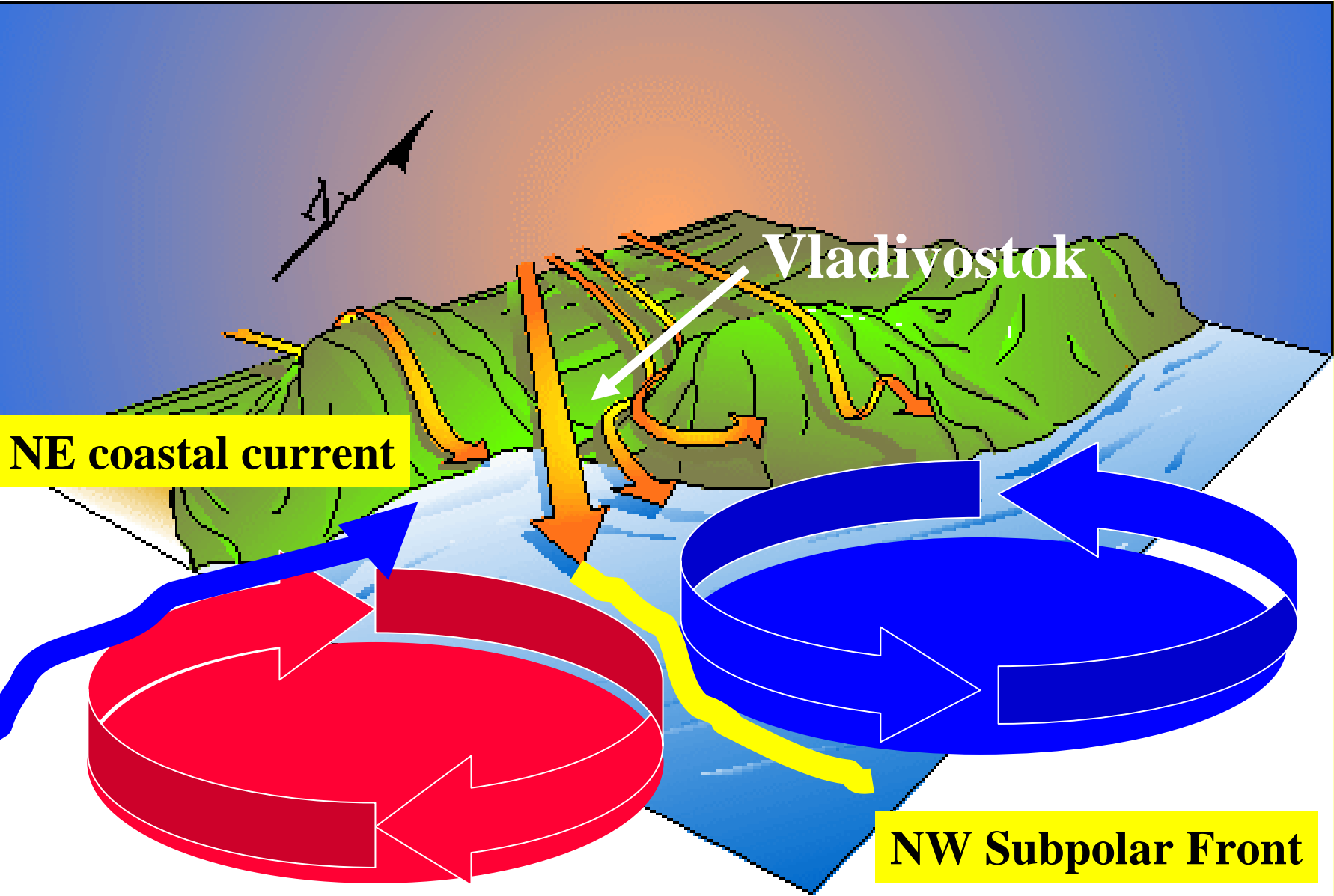
Summer circulation
RIAMOM 1/36°



Winter circulation
RIAMOM 1/36°







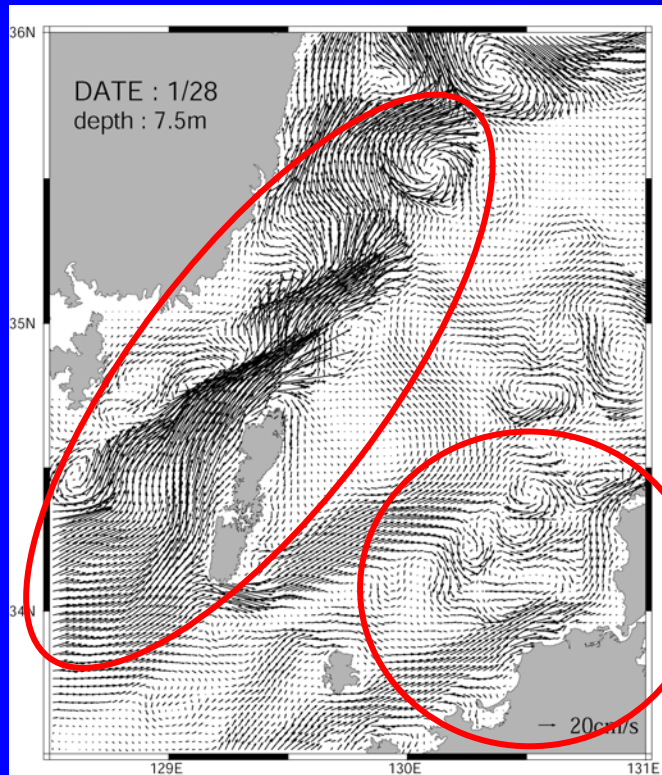
Vladivostok

NE coastal current

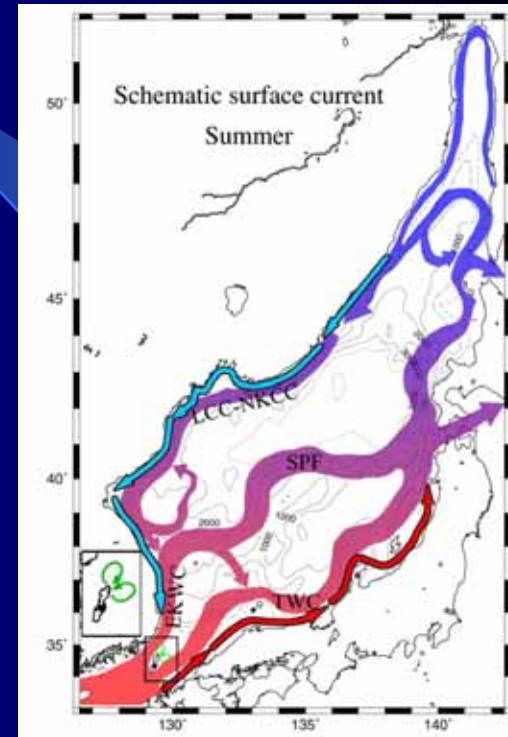
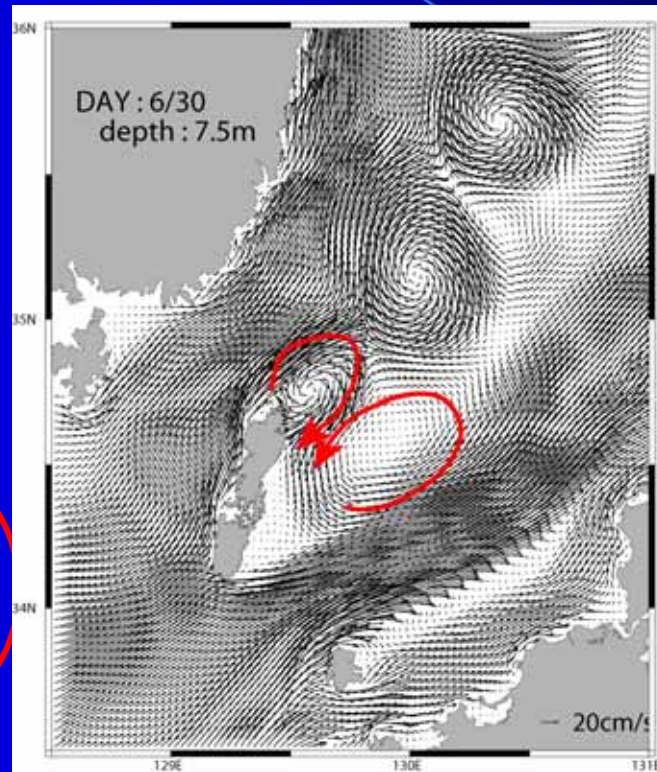
NW Subpolar Front

Short term variations appeared in the Tsushima Straits

winter



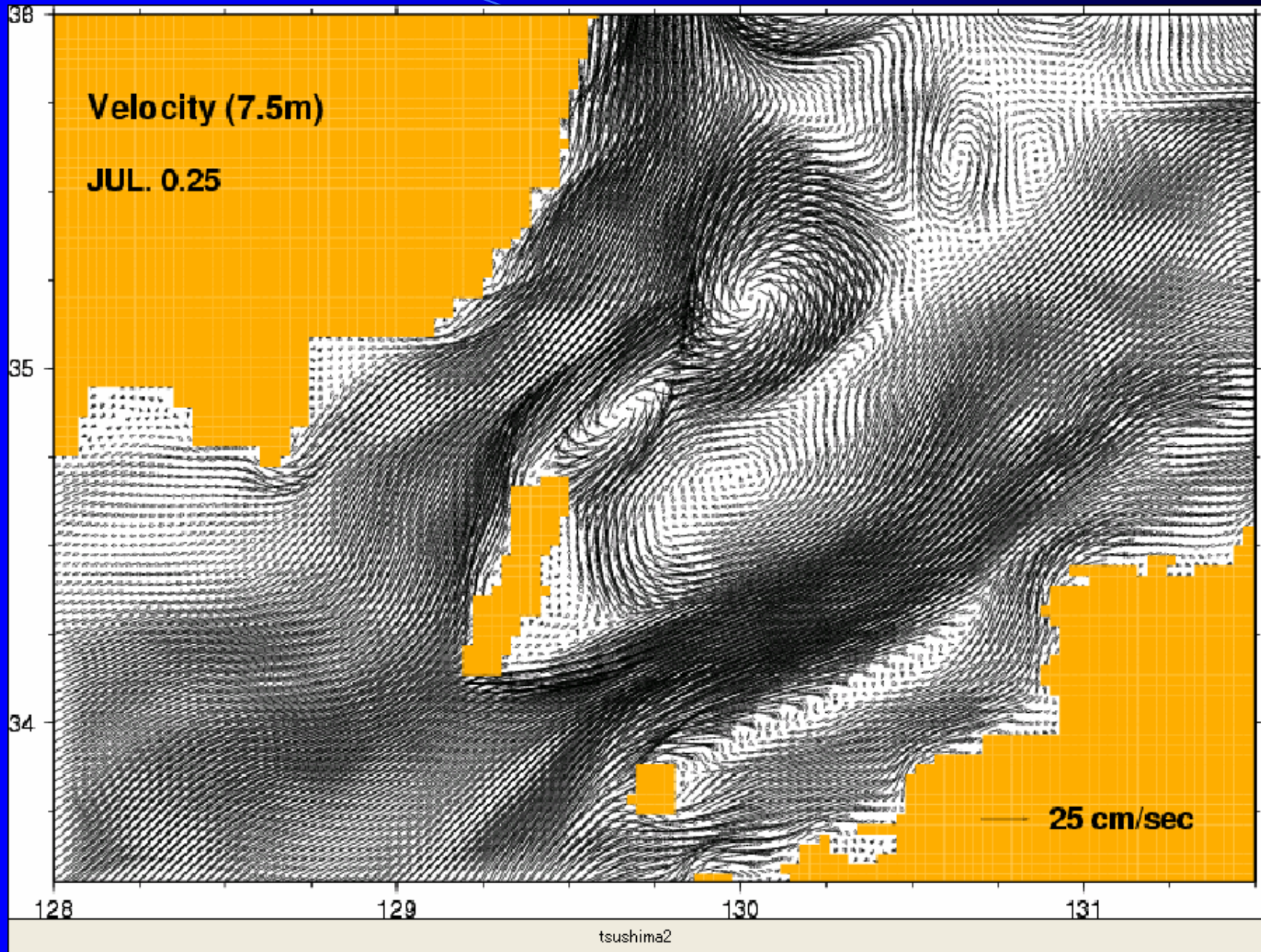
summer



Time scale : 3 -10 days
Length scale : 20 - 80 km

Anticyclonic 5 - 10 days , 50-80km
Cyclonic 30 days , 80-120 km

During the warm period



ADCP monitoring by a ferryboat "Camellia"



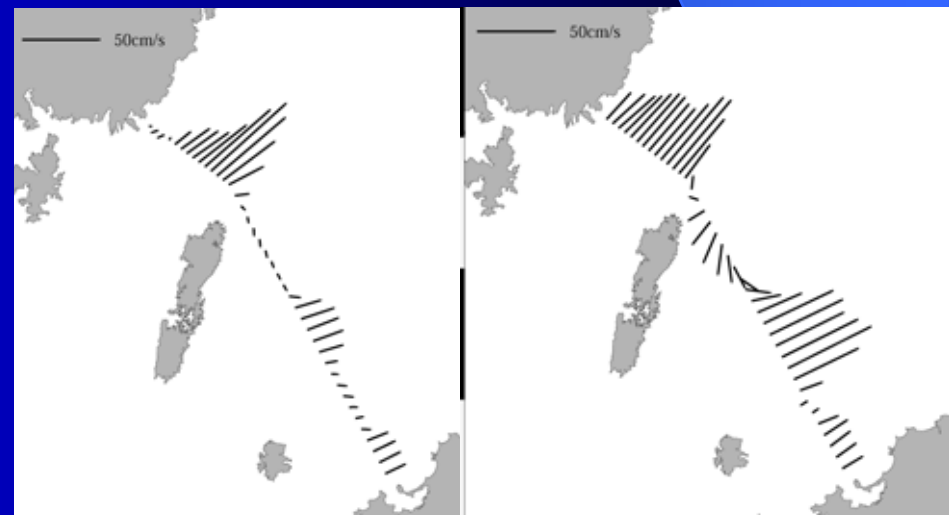
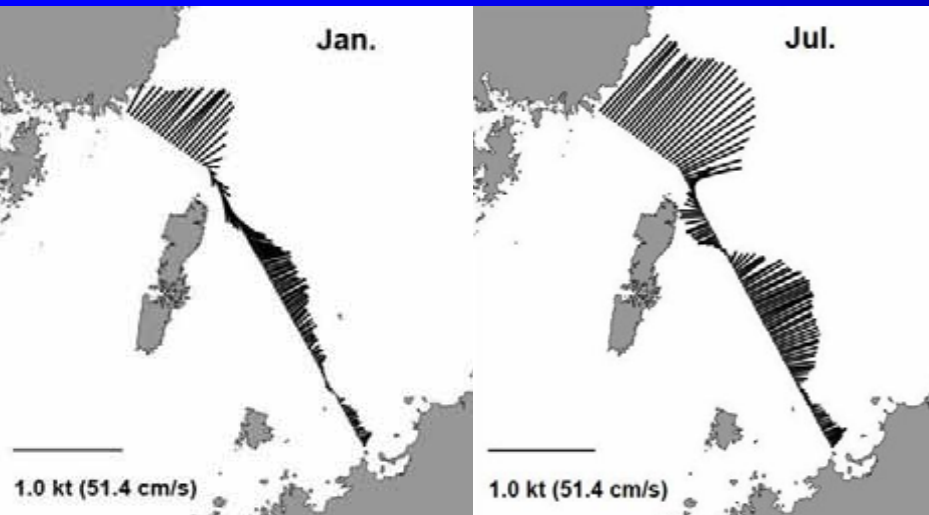
A joint research with PNU and NFDRI
in Korea since 1997



ADCP

(depth : 18m)

MODEL



JES Forecasting System

RIAM, Kyushu University

In-situ data:
CTD, XBT, pCO₂, mooring, etc.

Remote sensing data:
SSH, SST, floats, radar, etc.

T/K St. monitoring:
T, S, U, V, Chl, etc.

Surface forcing:
JMA, NOGAPS, etc.

Initial and boundary conditions, Assimilation

Material tracer:
Oil spill simulation

1/12° JES RIAMOM
+local nesting

Biochemical model

JES forecast and reanalysis
database

Distribution through the internet

Environment
Pollutant

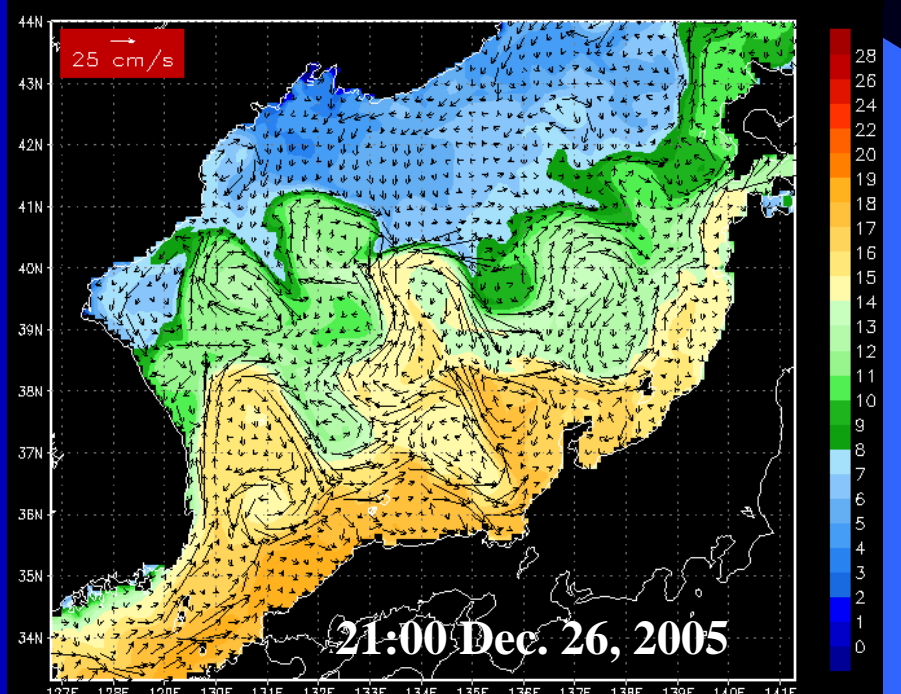
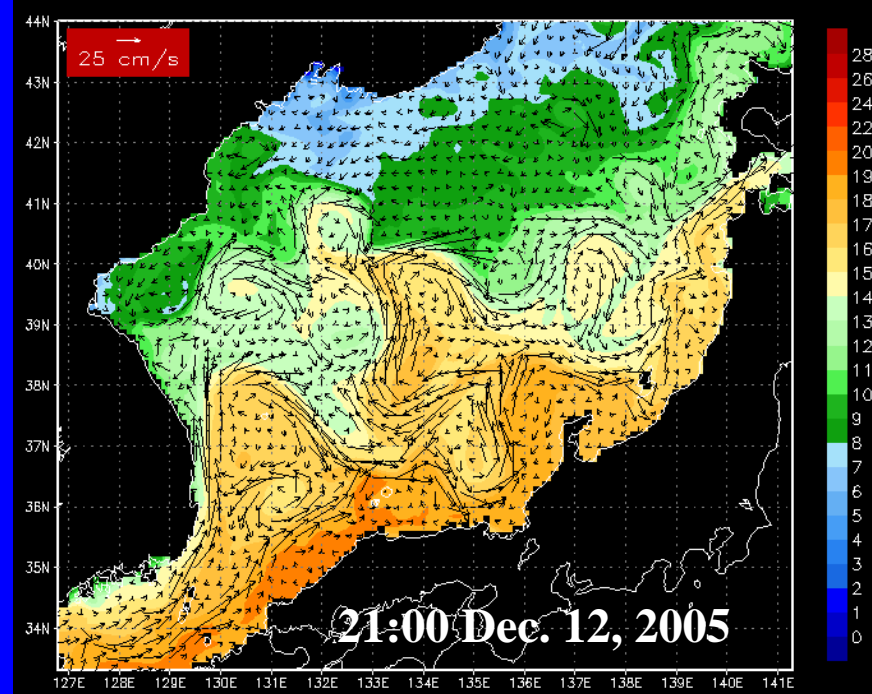
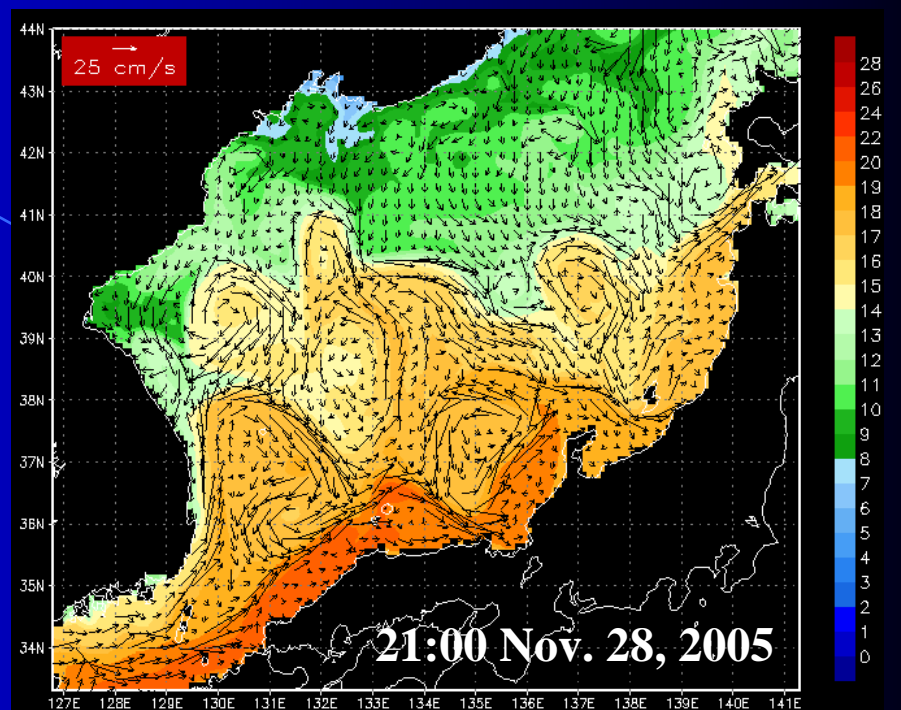
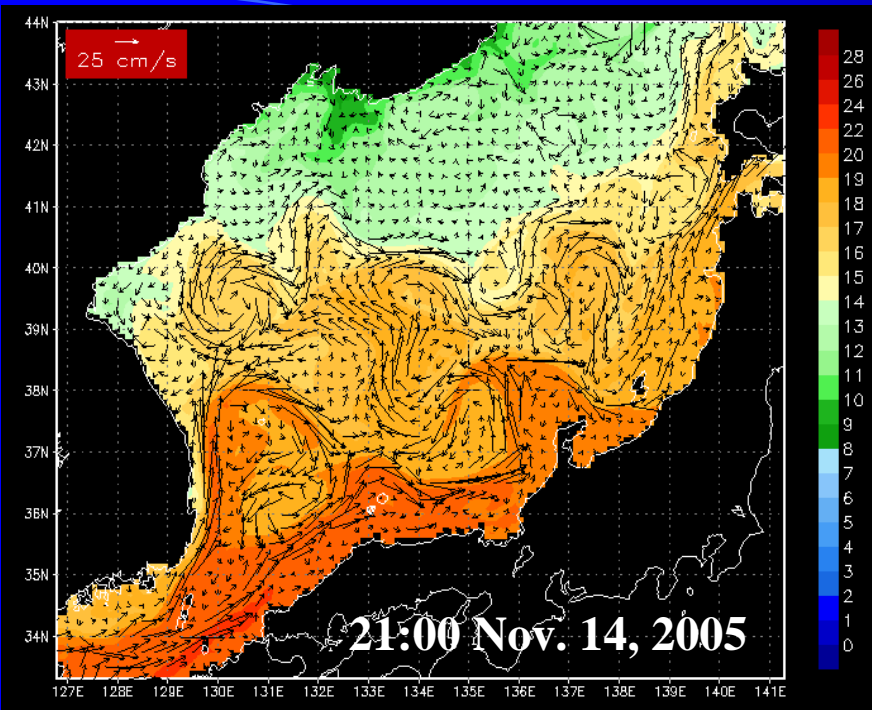
Aquiculture
Fishery

Ocean science

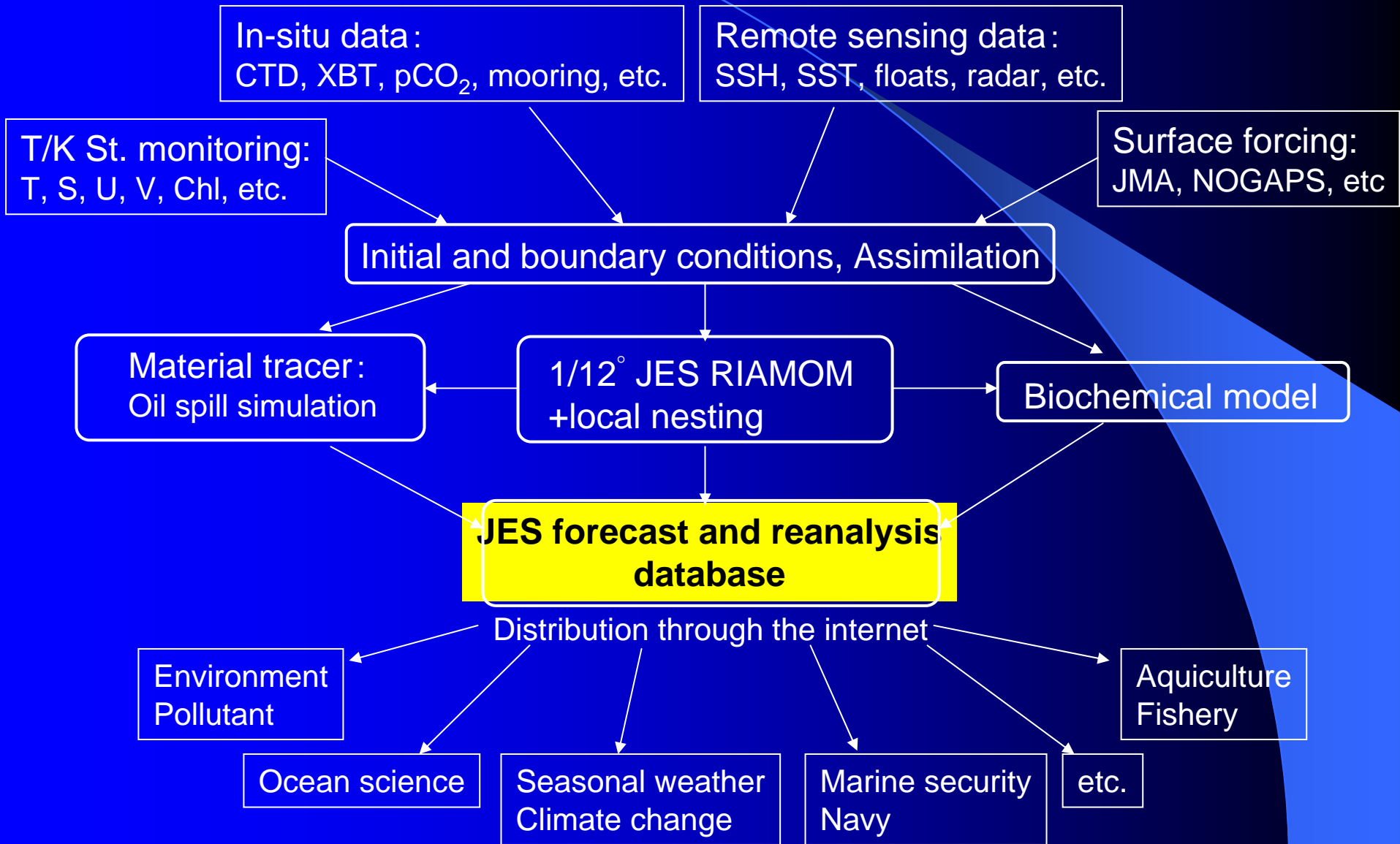
Seasonal weather
Climate change

Marine security
Navy

etc.



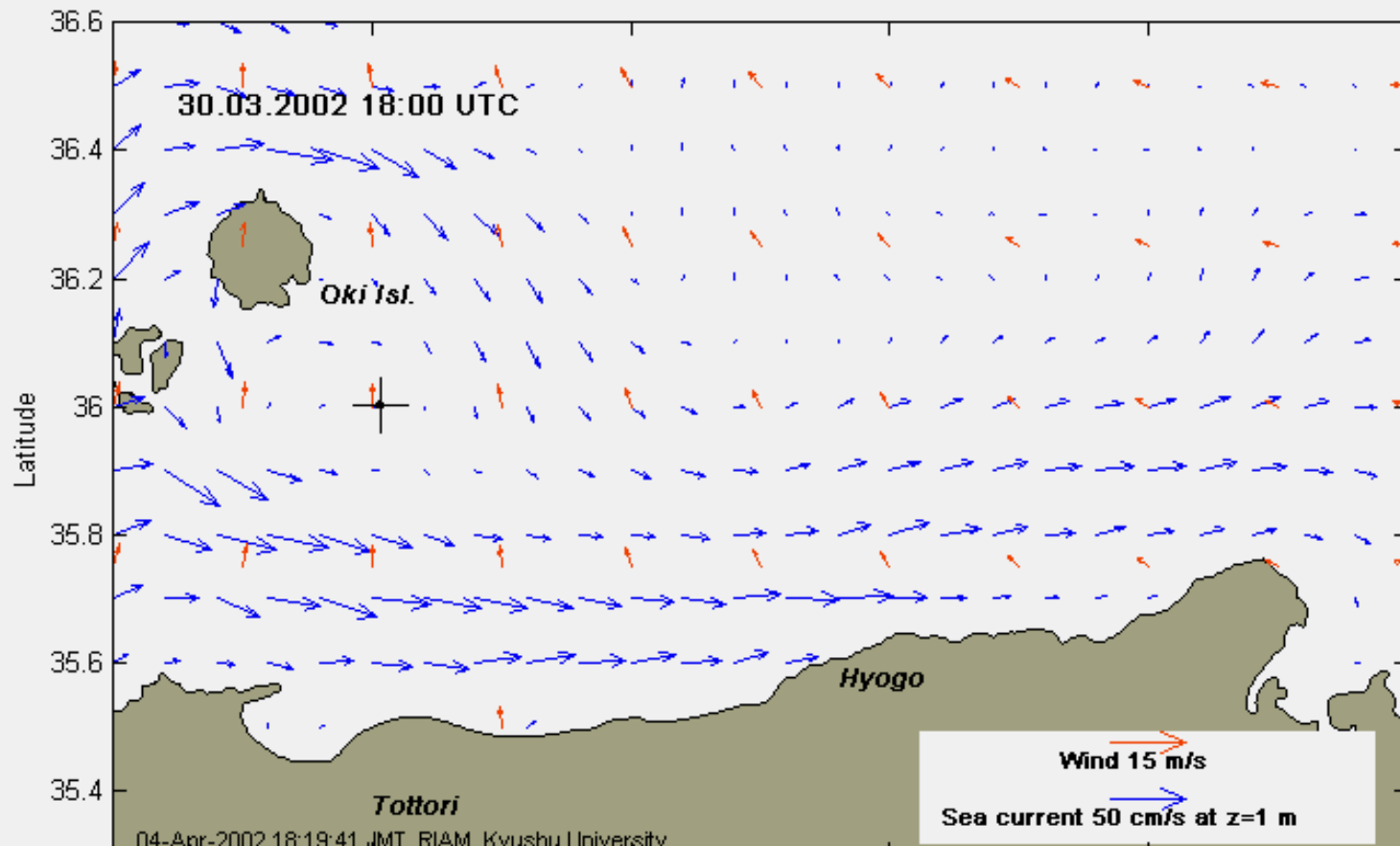
RIAM JES Forecasting System



Oil spill accident of ta tanker AIGE at 03:21, Mar. 31, 2002.

- 1) 60% from 160 kiloliters of oil was spilled immediately after the incident
- 2) Oil left in the tanker is assumed to leak continuously.

Red points represent the observed floating oil (April 4, 6 AM, 7 AM, 15 AM)



Ocean Litters Forecasting System

Litter property
Wind data

Future and Past
Litter position

Advection-diffusion
model of ocean litter
(Particle tracking method)

Current data

Ocean surface layer
current profile model

Current data
Hindcast, nowcast, forecast

Forecasting System of the Circulation
E-China Sea, Yellow Sea, Japan/East Sea

● Ocean litters prediction system

- The prediction system consists of two prediction systems. One is the prediction system for the advection-diffusion of floating litters (PSADFL) and the other is the prediction system of ocean circulation (PSOC). Actually, the oil spill simulation system already established at the DSRC/RIAM in Kyushu University can be transformed to the PSADFL with some corrections. The current data utilized by the PSADFL are provided by the prediction system of the JES circulation which has been already established, providing the short-term and long-term JES simulation and nowcast every 12h and one month.
- Since the behavior of ocean litters depends greatly on the size, material, buoyancy and so on, many statistics of ocean litters are necessary to be studied in the research area. as well as the improvement of the prediction model.