Caution

Coordinated efforts among ocean science expertise to explore and solve marine pollutions caused by M9 Earthquake

Oceanographic Society of Japan,
Earthquake Disaster Working Group
Moto Ikeda (Hokkaido Univ., JAMSTEC)

Components of radionuclide

(1) Atmospheric fallout to the ocean
Quickly (in a week) spread in mid-March to the Eastern Pacific Ocean, large amount but low concentration

(2) Polluted water flowing out
In April flowing southward due to northerly winds and northward due to southerly winds, in May entrained into the Kuroshio

(3) River & ground water (underground of power plant)
Accumulating on the ocean floor? Pollutant fish in June?

Main questions

- Distribution of radio-active materials (radionuclide)
- Processes of the materials emitted to the atmosphere falling out to the ocean
- Processes of the polluted water flowing into the ocean
- Ocean currents and mixing around Fukushima-I
- Interactions with plankton, behavior in food web, sedimentation
- Impacts of the materials on marine ecosystem

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Objectives

- Promote monitoring of coastal regions
- Promote observations of North Pacific and fulfill responsibility for neighborhood countries
- Transmit information of marine environ.
- Prepare suggestions for policy makers
- Collaborate with foreign res. groups

Collaborate and exchange information with

Related disciplines
Atmos., Limnology, Soil, Radiology, Nuclear physics, Atomic Energy・・・

Research organizations
JAMSTEC, MRI, Fisheries, Universities, Local Gov. Inst., WHOI, NOAA・・

National and local government

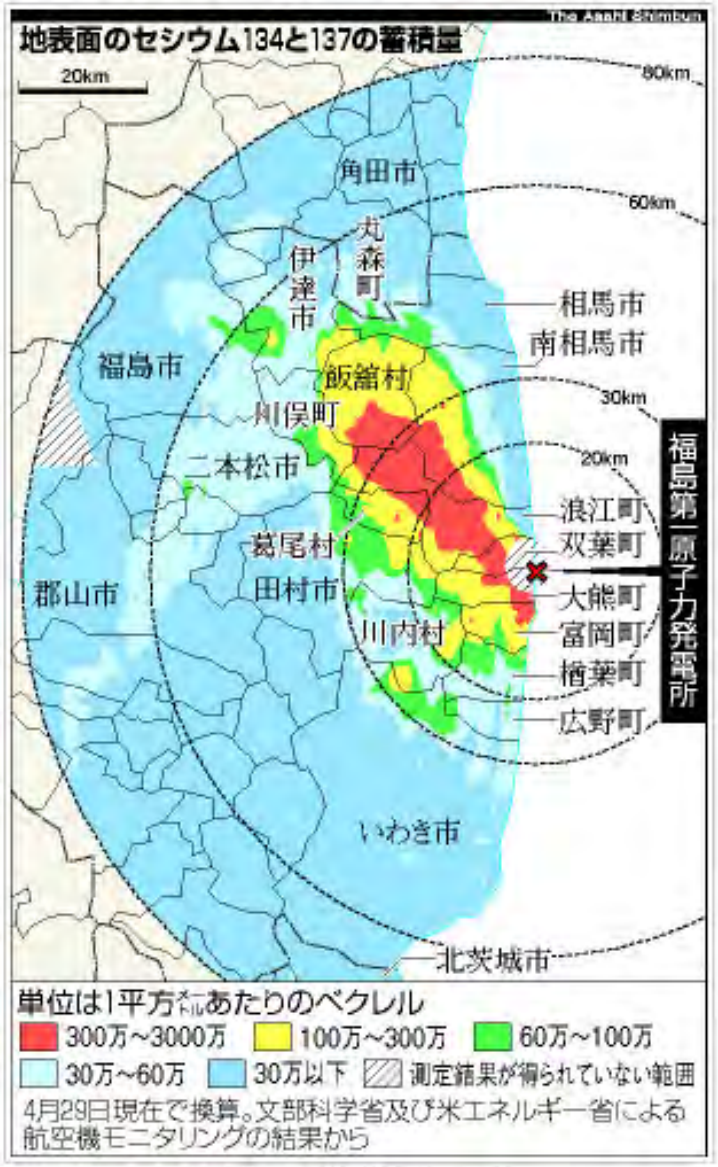
Private sectors and citizens

Observation Monitoring	Sampling Analysis	Modeling Simulation	Ecosystem	Public info. Outreach
Suggest and coordinate • Cruise plans • Observation lines and Argo float deployment • Collection items	Suggest and coordinate • Sampling protocol • Analysis team	Suggest and coordinate • Model and Key mechanisms • Model inter-comparison • Prepare and describe model results	Coordinate research plans for • Impact of Tsunami wash away • Food-web condensation of radionuclide	• Verify new information • Collect existing information • Talk to citizen • Prepare web • Organize symposium

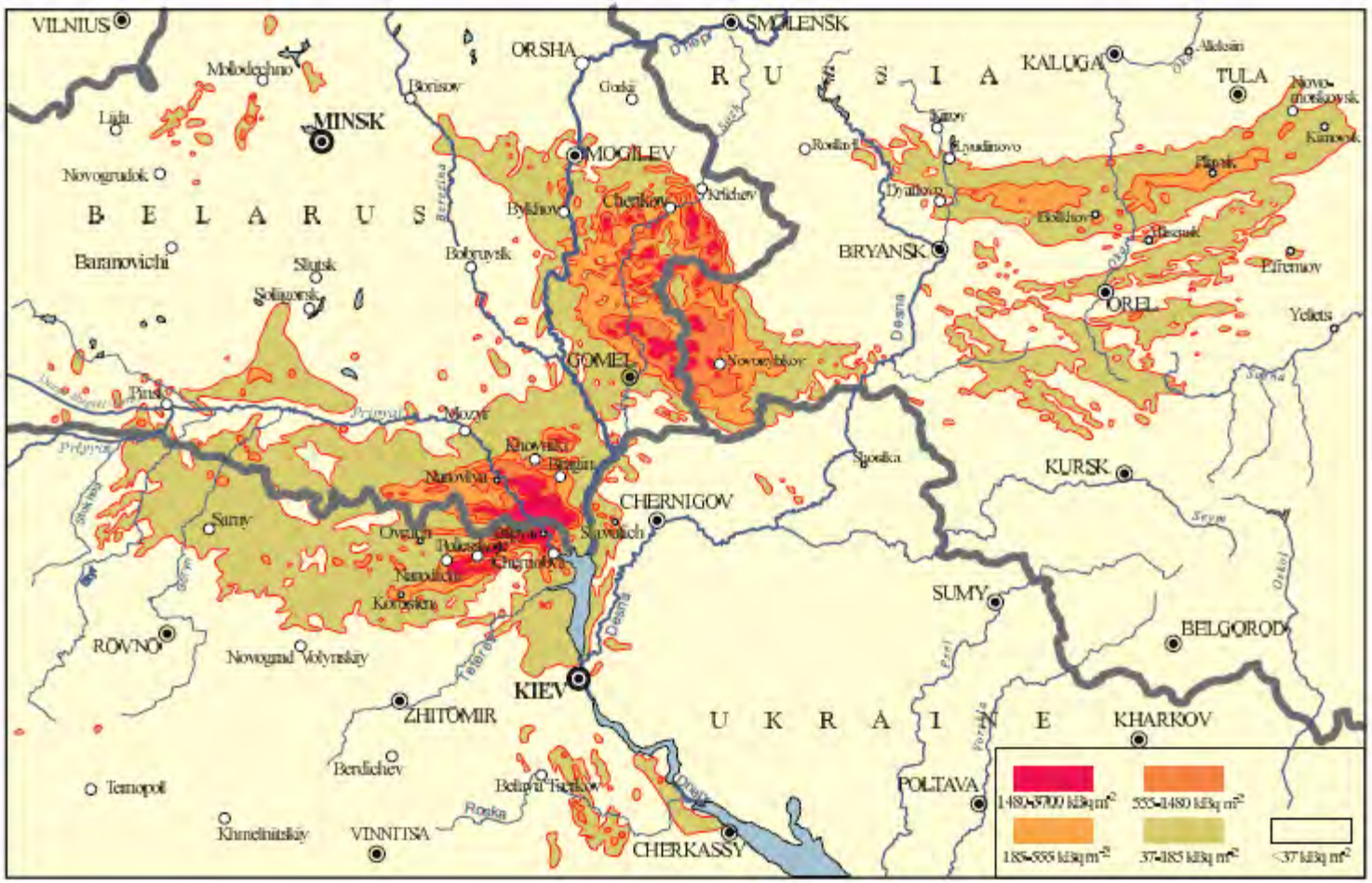
Radionuclide emitted to air, and fallout

Cs-134 & 137 fallout to land surface

Exploded, carried in air and fell out with rain



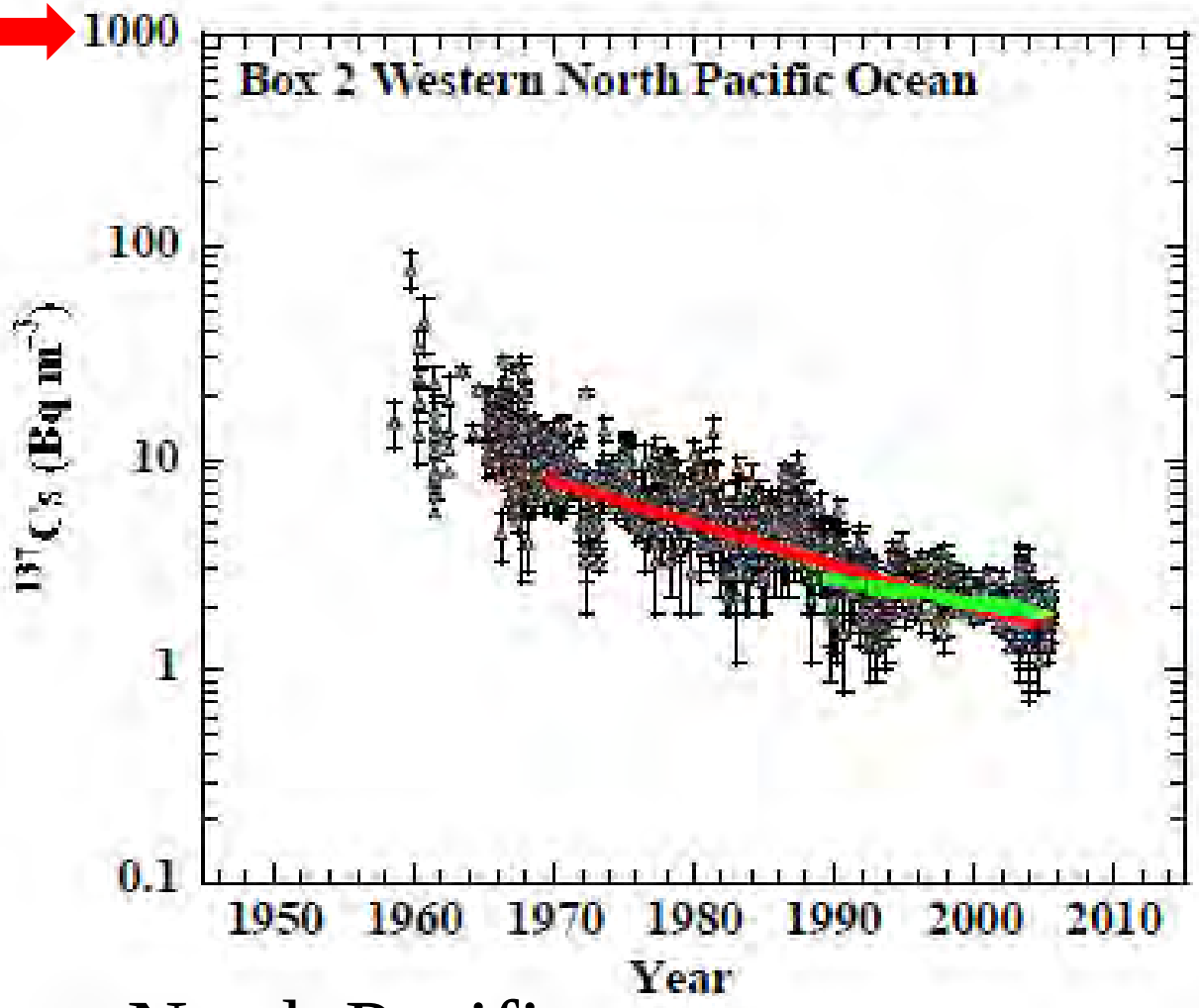
In the case of Chernobyl



- Much larger area received impacts
- Plutonium and Strontium as well

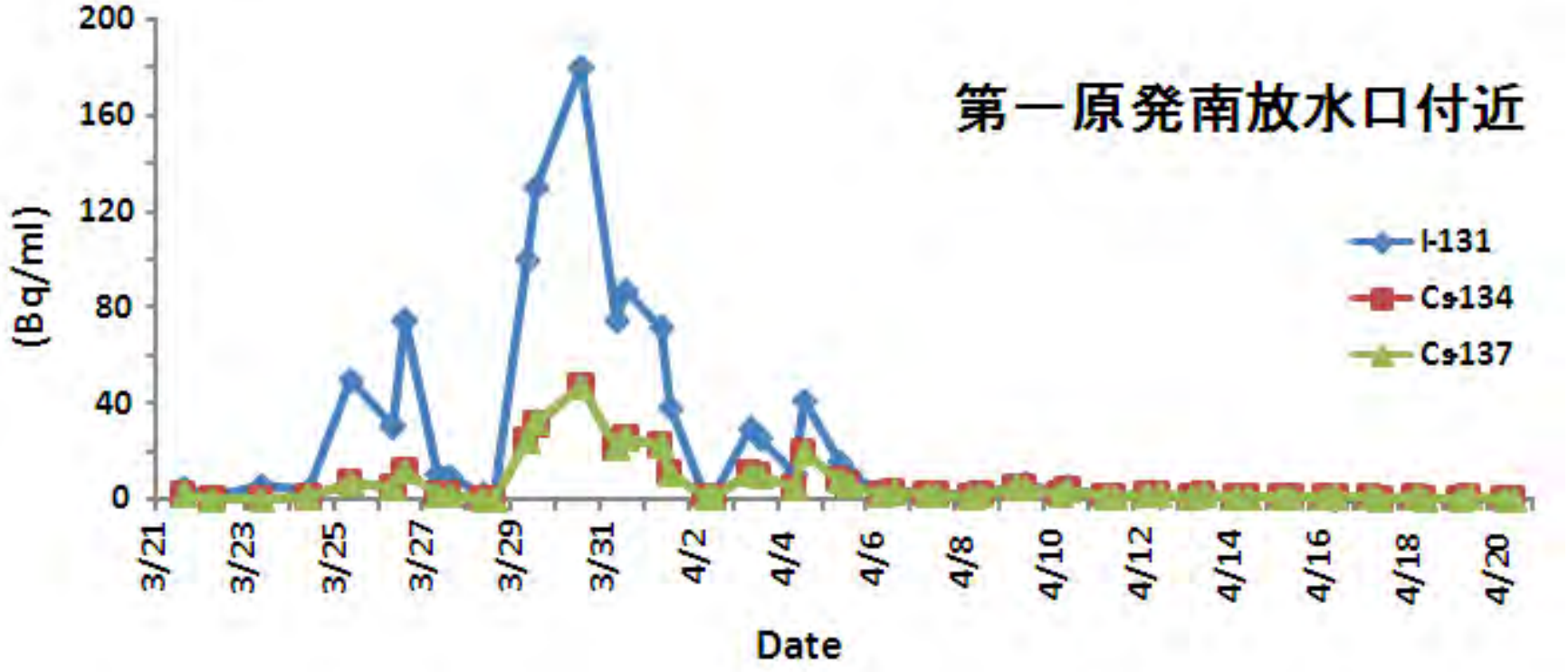
From the era of nuclear bomb experiments to the present

1Bq/liter



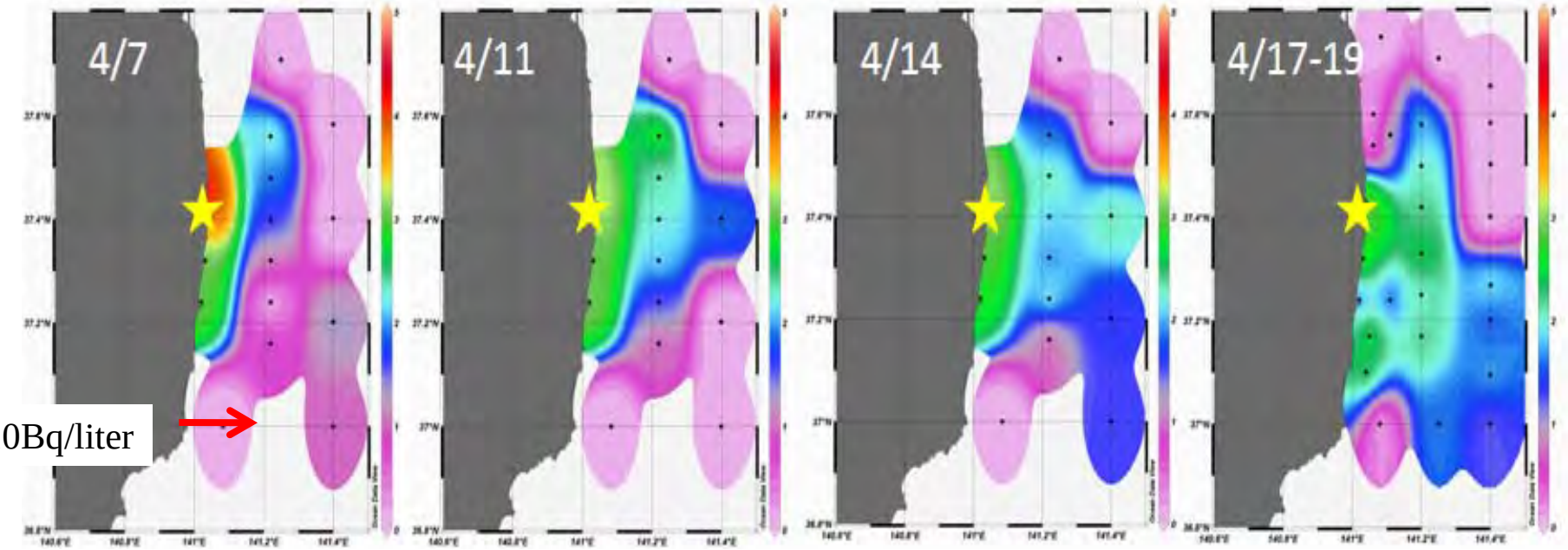
- Western North Pacific

Polluted water flowing into the ocean

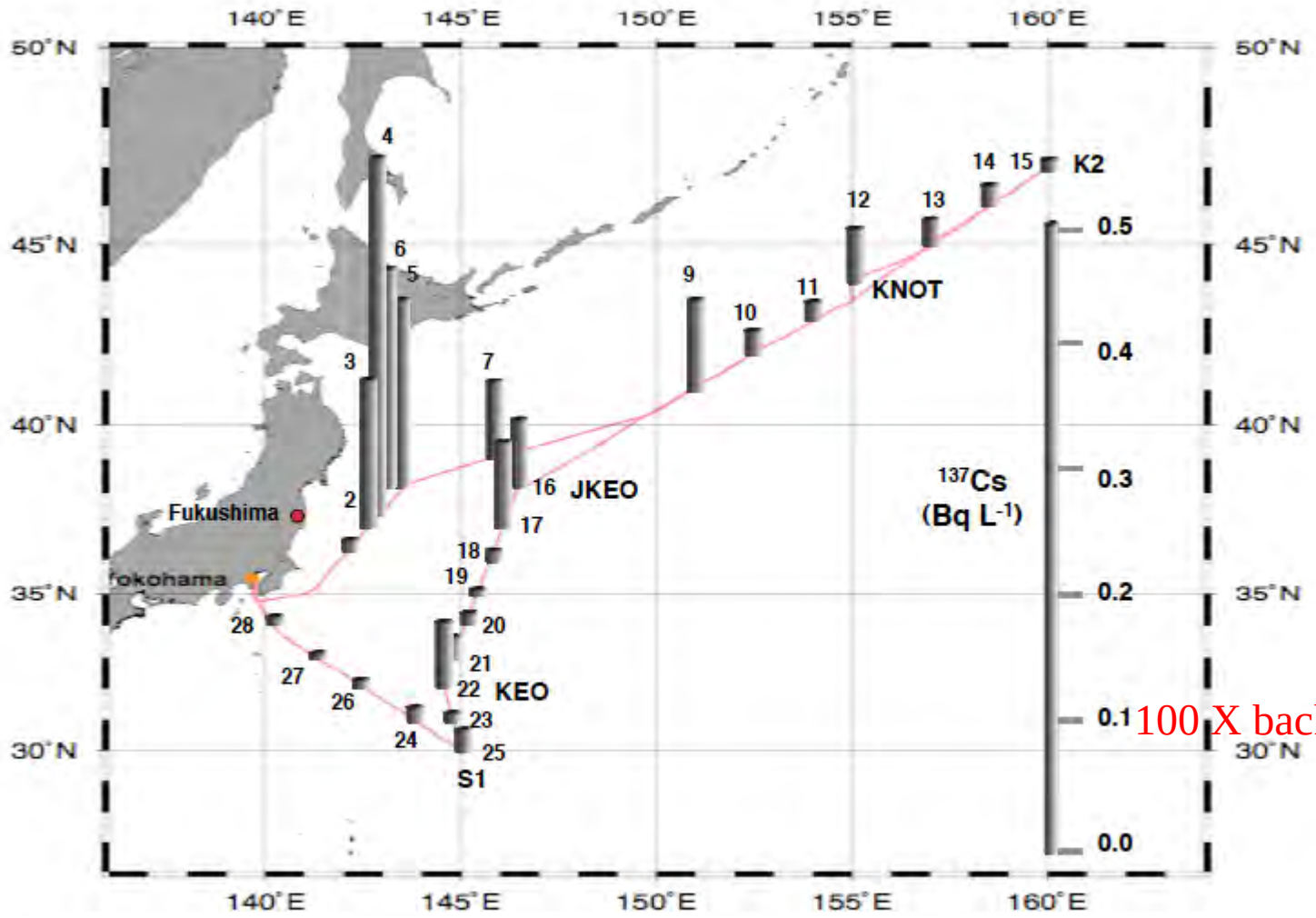


Contents of radio-active materials near the exit from Fukushima-I (Bq/ml vs. month/day)

Observed distribution



Cs-137 for a couple of weeks, Log[Bq/L], with data collected at black dots



JAMSTEC cruise (Apr.-May) : Cs-137, atmospheric fallout

July samples under analysis

Taken from Honda et al. (submitted to Geochemical Journal

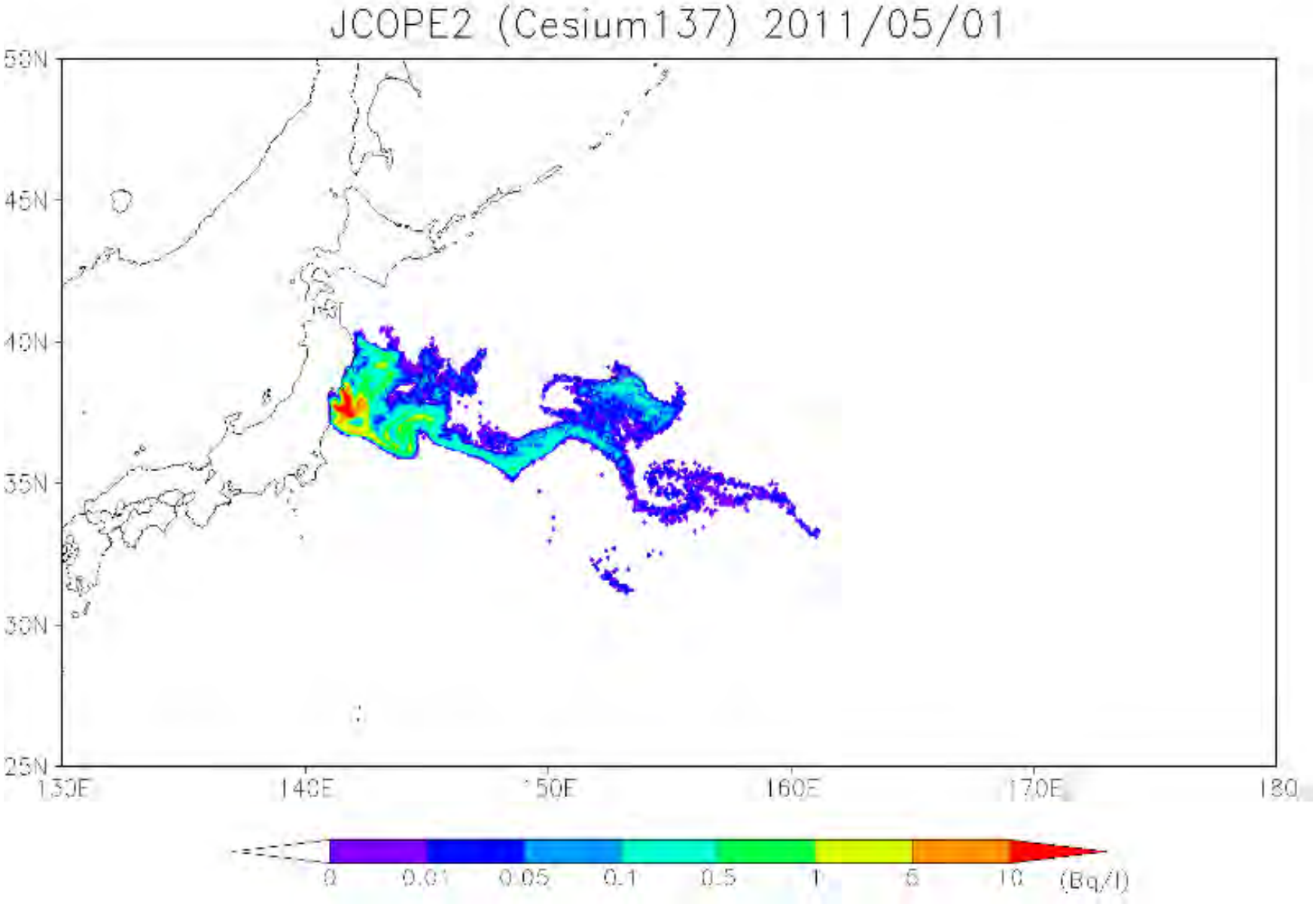
Model simulation

- Powerful tool for forecast, and also for better understanding of processes

★Use both coastal models and Kuroshio-Oyashio model

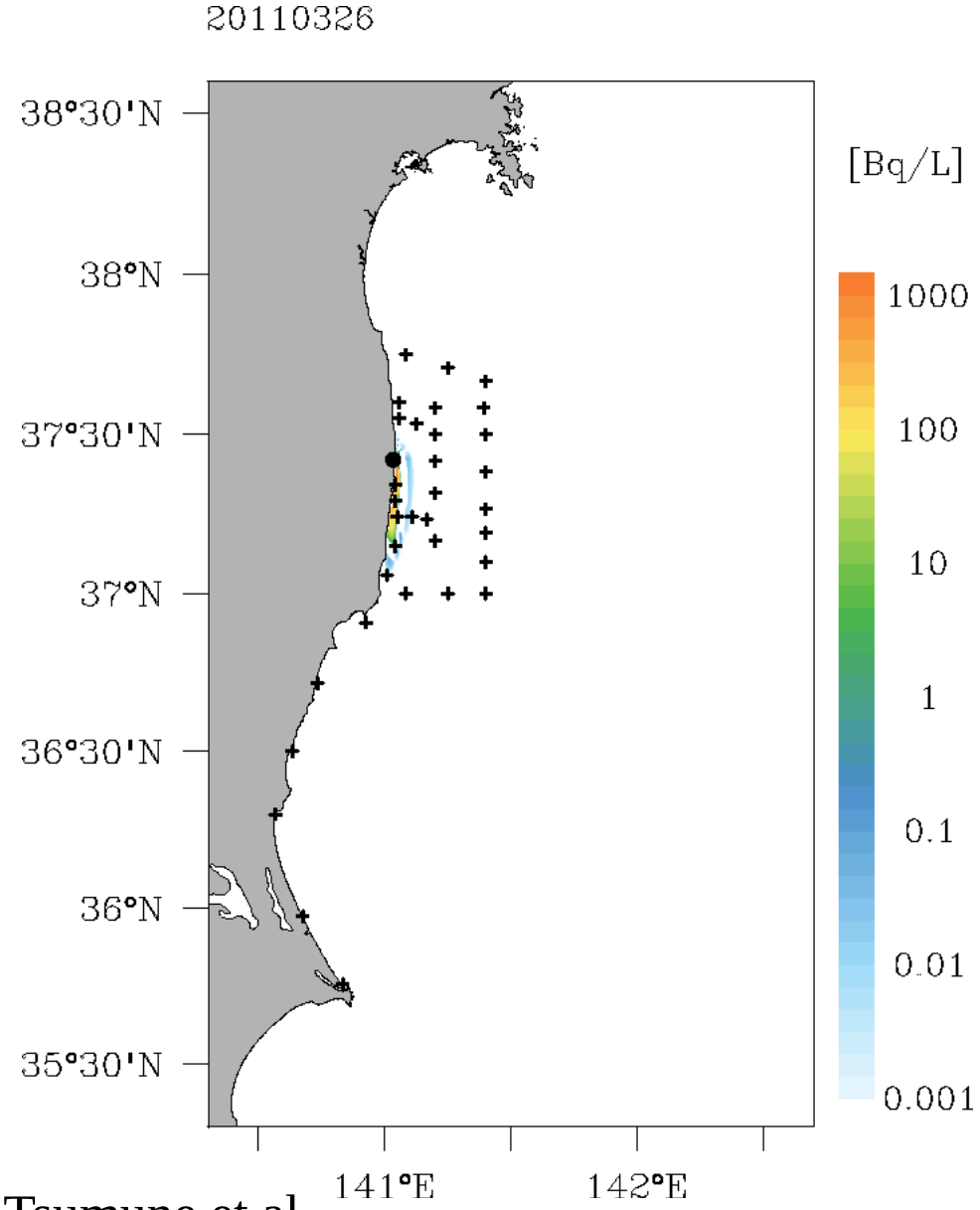
- Coastal currents forced by winds and river-induced buoyancy
- Kuroshio-Oyashio with mesoscale eddies

Kuroshio-Oyashio Model



Contribution by JAMSTEC

Coastal model nested with K-O models



Contribution from Tsumune et al.

Evaluation

- Upwelling and alongshore velocity are reproduced qualitatively.
- Radionuclide concentration variability is consistent with near-shore data.
- Kuroshio-Oyashio model is important to simulate the seaward flux.

Plans coming next

- Radionuclide: focus on Cs-137, and estimate adherence on phytoplankton, condensation through food webs and accumulation with sediments
- Estimate inflow of radionuclide through rivers and ground water
- Taking the information of atmospheric fallout, simulate radionuclide in the Pacific Ocean and explain pollution in fisheries products

Experts of ocean sciences ought to

- try to give more information beyond the non-regret policy,
- pursue to clarify mechanisms of behaviors and impacts of radionuclide,
- not try to oversell their own research areas and projects,
- give uncertainty in risk assessment,
- send accurate information in understandable words to citizens and rely on their decision.

Supplementary

If I receive questions, I could show the following slides.

From radionuclide experts

- Cs-137 is soluble, but stick on clay particles. They are dense and sink in coastal regions.
- Cs adheres to phytoplankton with a ratio of 20.
- Marine products accumulate Cs by 1000 times. Higher predators show accumulation later.
- Cs moves with clay particles in river flow, and is accumulated into benthic organisms.
- Is Cs in polluted water under plants carried in ground water into the ocean?

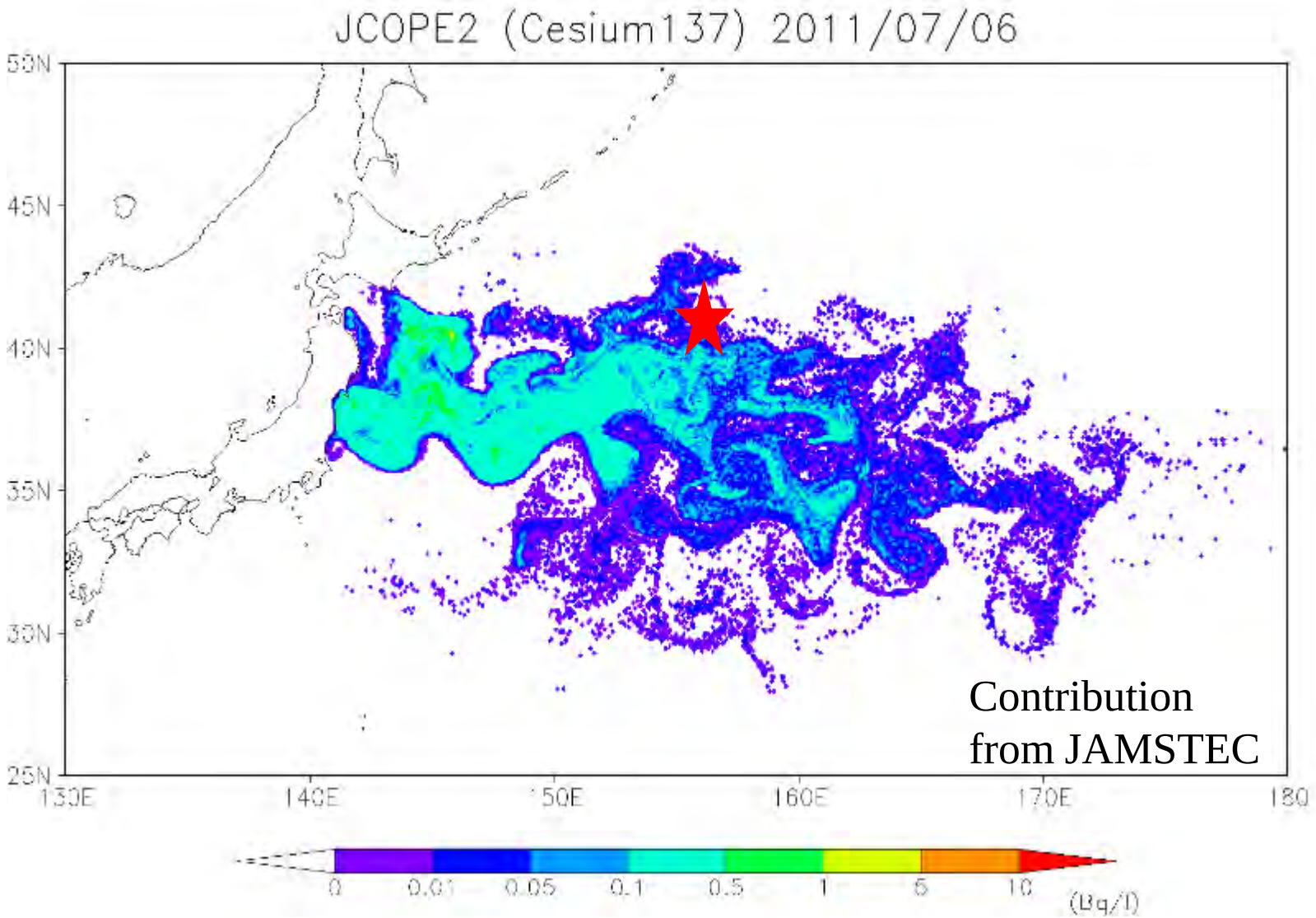
Impacts on fisheries

Cs-137 exceeded 500Bq/Kg along eastern shore.

How about Kuroshio extension?

Fish with 20Bq/Kg in the region with 0.2Bq/L.

We should report the fact to public, with logical explanation and correct meaning of the data.



Fish with 20Bq/Kg of Cs-137 ★

superimposed on K-O model simulation

How should we deal with nuclear power generation?

3 different opinions in Japan

- Improve technology of nuclear reactor
- Shift to renewable energy
- Forget about global warming

- Assess each and give correct information to public, avoiding conflict of interests