Press Release

Simulation of Radioactivity Concentrations in the Sea Area (the fourth report)

May 9, 2011
Ministry of Education, Culture, Sports, Science and Technology

1. Outline

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has been conducting a monitoring study in the sea area off the coast of the Fukushima Dai-ichi NPP since March 23, 2011. It has used the JCOPE2(Note) numerical ocean forecasting system to simulate the distribution of radioactivity concentrations off the coast of the Fukushima Dai-ichi NPP.

This simulation was calculated by using the supercomputer system of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) on May 6, based on the current velocity pattern as of May 3, which was simulated by JCOPE2, and by incorporating the actual measurements of radioactivity concentrations on the sea surface released by MEXT and TEPCO through monitoring up to May 4.

(Note) JCOPE2: A model for forecasting path variations, including meander events, and movements of meso-scale eddies, etc. with regard to oceanic current systems such as Kuroshio and Oyashio, which substantially affect the oceanic conditions, in addition to forecasting water temperature and salinity variations in waters close to Japan. Developed by the JAMSTEC. (Reproduction grid size: 8 × 8 km)

2. Method

In this simulation, only the diffusion of radioactive substances on the sea surface was simulated using the scenario and hypotheses shown below, since insufficient data is available on the amount of radioactive substances discharged from the NPP.

- A scenario is developed conservatively based on the data on radioactivity concentrations in the sea water at the coast up to May 4, which have been published by Tokyo Electric Power Company (TEPCO). [Figure 1]
- The above-mentioned radioactivity concentrations in the sea water are conservatively hypothesized to be diffused only on the sea surface of 8 × 8 km at 1/100 of the concentrations observed at the coast.
- The concentrations of radioactive substances are expressed as indices showing how many times they are higher than the effluent concentration limits for nuclear facilities.
- The fallout of radioactive substances discharged into the air from the NPP onto the sea surface is not taken into consideration.
- The diffusion of radioactive substances to subsurface sea water is not taken into consideration.
- As for the water near an outlet at the Fukushima Dai-ichi NPP, it is hypothesized that water of the same radioactivity concentration as that observed on May 4 was present until May 6.
- The half-lives of radioactive substances (iodine-131: approx. 8 days, cesium-134: approx. 2 years, cesium-137: approx. 30 years) are taken into consideration.

3. Results

Due to Japan Current Kuroshio, Tsushima Current (Tsugaru warm current) and Chishima Current (Oyashio), the oceanic current of the southern Tohoku offing, including Fukushima offing, flows intricately and slowly. [Figure 2]

In line with those complicated currents, the radioactive water near the NPP diffuses toward the offshore direction. In particular, the radioactive substances diffuse gradually and move slightly

northward in the sea area off the coast of Fukushima Dai-ichi NPP in mid-May. [Figure 3-1 to Figure 3-4]

In actual measurement in the sea area approximately 30 km off the coast of the NPP, cesium was observed in excess of the detection limit value at one or two sampling points in the southern sea area, while the substance was not detected at other observation points (the current measurement method has a detection limit value of approximately 10Bq/L).

The cases in which the calculated values fall below the detected limit values in all of the sea areas in the simulation are as follows: iodine-131 around late-April, cesium-134 and cesium-137 around mid-May.

Note that this simulation provides results calculated for the conservative scenario above in 2., under various assumptions. In addition, it does not necessarily assure what the actual measurements will be.

4. Discrepancies with the third report

There are discrepancies between the third report on radioactivity concentration distribution, because the first day of the forecast was different. The simulation conditions were changed as follows in this report:

-Observation data up to May 3 were incorporated (the third report showed observation data up to April 22).

-The current pattern as of May 3 was used as the initial value (the initial value of the current pattern in the third report was as of April 23).

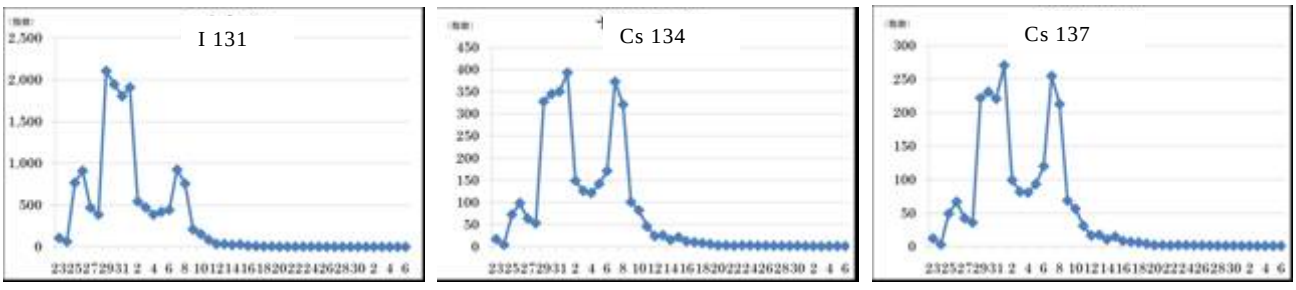
- As for the forecasting of wind conditions which affect the sea surface, the forecast as of May 3 was used (the relevant data in the third report was that as of April 23).

These conditions make a difference to the initial values in the result of the simulation.

Consequently, the discrepancies caused by use of new observation data, latest current patterns, etc. cannot be avoided.

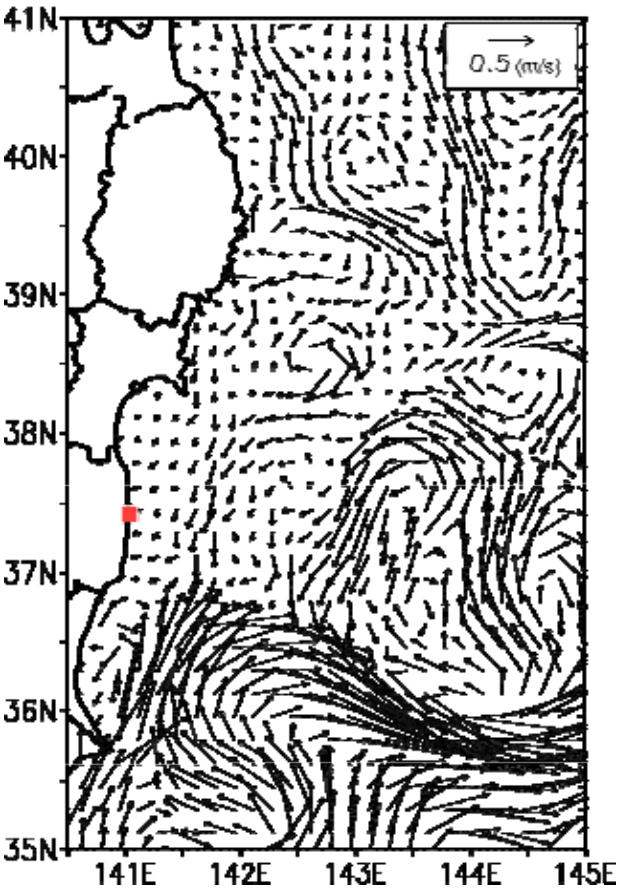
5. Point to note

This simulation does not necessarily assure what the actual measurements will be. Even if observed values are incorporated into the model, there may be discrepancies with actual measurement, because of several restrictions, including the following: (1) simulations do not completely reproduce real current patterns, (2) wind data used for this forecast is that collected for about a week, and then average wind data for the season is used, causing a possible margin of error, (3) the deposition process of radioactive nuclides on the seabed is not taken into consideration. It is necessary to undertake ceaseless revision to achieve a forecast which is closer to reality, by checking the actual measurements provided by the latest monitoring results and by mutual evaluation in comparison with simulations according to other calculation programs as well.



[Figure 1] Scenario of Radioactivity Concentrations in the Effluent Discharged from the Fukushima Dai-ichi NPP

The scenario assumes that radioactive substances diffuse on the sea surface of 8 × 8 km at 1/100 of the concentrations observed at the coast based on “Results of Nuclide Analysis of Seawater” (March 21-May 4) released by TEPCO, and the same level of discharge as that as of May 4 continues until May 6. The vertical axis indicates the assumed radioactivity concentration as an index showing how many times it is higher than the effluent concentration limit for nuclear facilities.



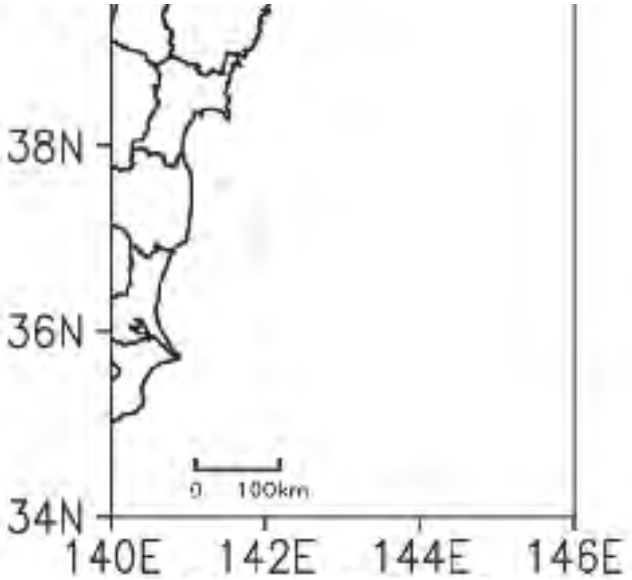
[Figure 2] Current Velocity Pattern Simulated by JCOPE2 (as of May 3)

The current velocity pattern simulated by JCOPE2 incorporates the on-site observation data and satellite observation data up to May 3. The half-lives of radioactive substances (iodine-131: approx. 8 days, cesium-134: approx. 2 years, cesium-137: approx. 30 years) are taken into consideration in the simulation.

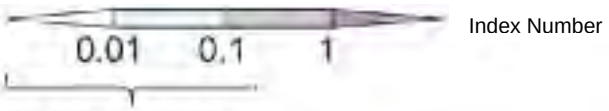
[Figure 3-1] Simulation of Radioactivity Concentrations by JCOPE2 (May 15)

(based on data up to May 3)

JCOPE2 Predicted figures (I 134) 2011/05/15

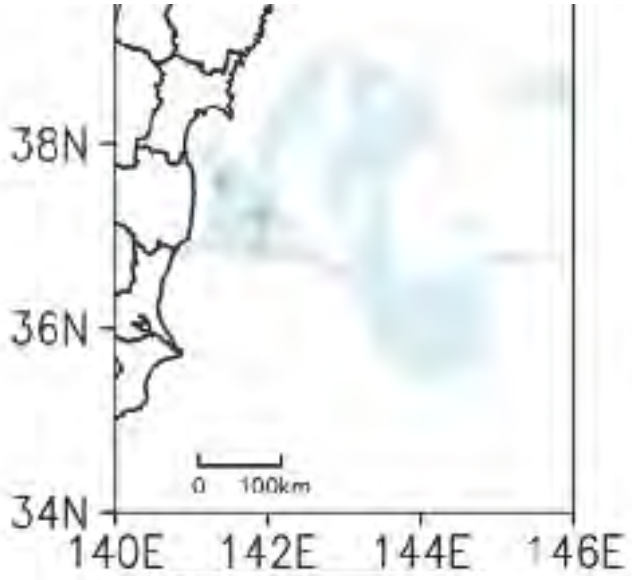


All sea areas are below the detection limit values



Below the detection limit values

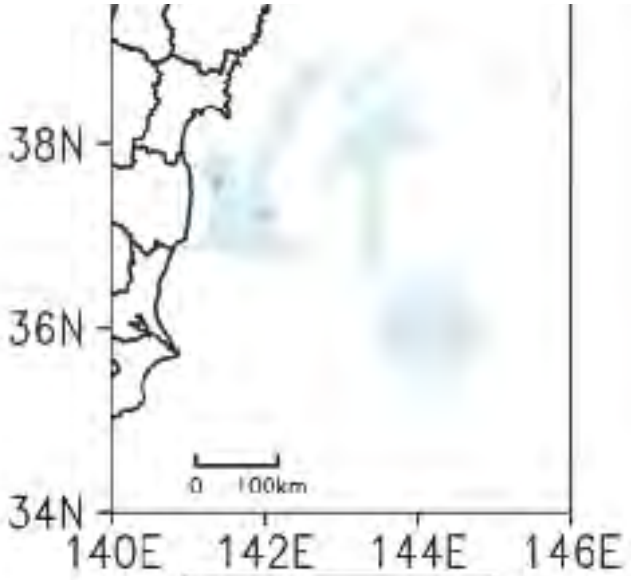
JCOPE2 Predicted figures (Cs 134) 2011/05/15



All sea areas are below the detection limit values

Below the detection limit values

JCOPE2 Predicted figures (Cs 137) 2011/05/15



All sea areas are below the detection limit values

Below the detection limit values

{Note: The index numbers in the figure show how many times the maximum radioactivity concentrations predicted at each point are higher than the effluent concentration limits for nuclear facilities determined by regulations (I131: 40Bq/L, Cs134: 60Bq/L, Cs137: 90Bq/L).}

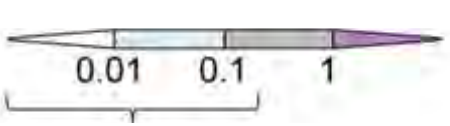
*Currently, detection limit values are approximately 10Bq/L in monitoring of sea areas near Fukushima Dai-Ichi NPP by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In the monitoring based on the “Sea Area Monitoring in Wider Areas” announced by the MEXT and the Fisheries Agency on May 6, analyses will be conducted with detection limit values lowered.

[Figure 3-2] Simulation of Radioactivity Concentrations by JCOPE2 (May 31)

(based on data up to May 3)

JCOPE2 Predicted figures (I 131) 2011/05/31

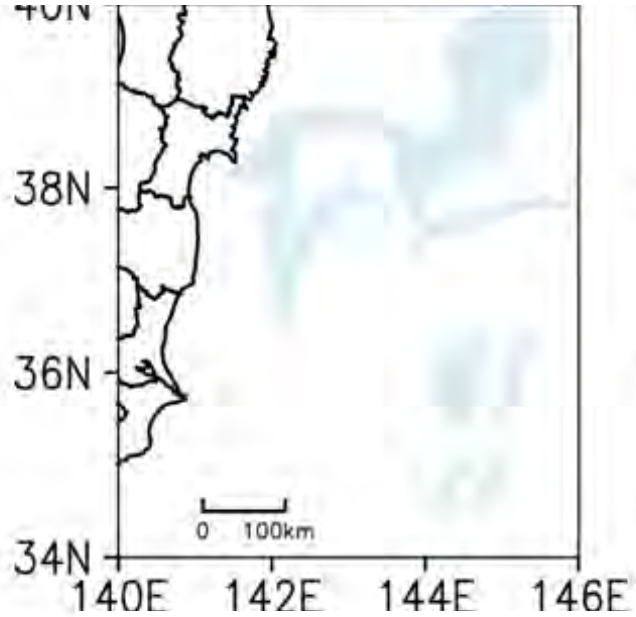
The index number is below 0.01 (0.4Bq/L) in all sea areas.



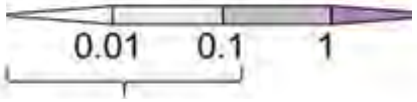
Index Number

Below the detection limit values

JCOPE2 Predicted figures (Cs 134) 2011/05/31



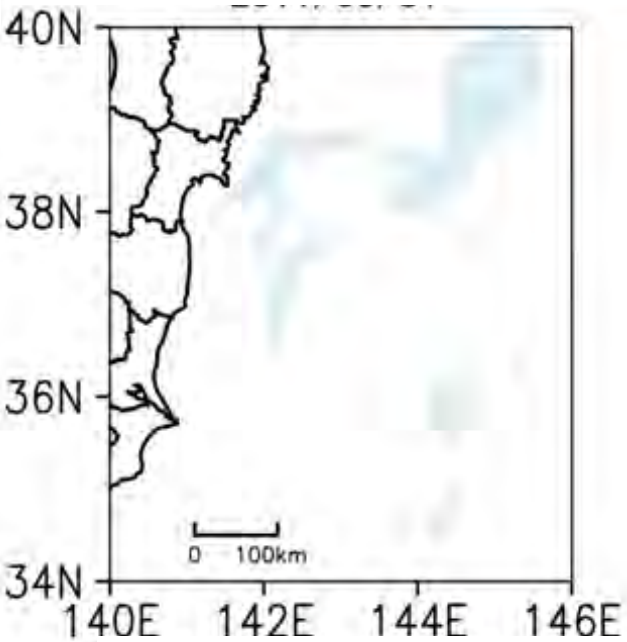
All sea areas are below the detection limit values



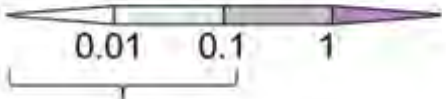
Index Number

Below the detection limit values

JCOPE2 Predicted figures (Cs 137) 2011/05/31



All sea areas are below the detection limit values



Index Number

Below the detection limit values

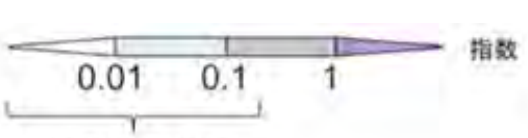
{Note: The index numbers in the figure show how many times the maximum radioactivity concentrations predicted at each point are higher than the effluent concentration limits for nuclear facilities determined by regulations (I131: 40Bq/L, Cs134: 60Bq/L, Cs137: 90Bq/L).}

*Currently, detection limit values are approximately 10Bq/L in monitoring of sea areas near Fukushima Dai-Ichi NPP by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In the monitoring based on the “Sea Area Monitoring in Wider Areas” announced by the MEXT and the Fisheries Agency on May 6, analyses will be conducted with detection limit values lowered.

[Figure 3-3] Simulation of Radioactivity Concentrations by JCOPE2 (June 15)
(based on data up to May 3)

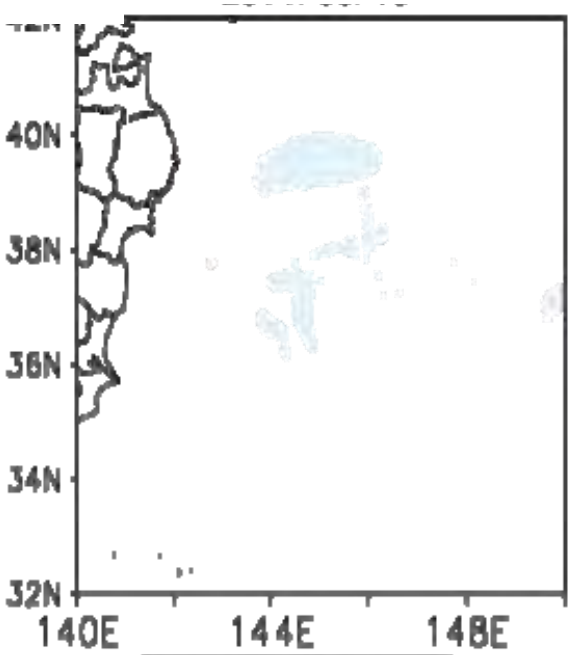
JOPE2 Predicted figures (I 131)
2011/06/15

The index number is below 0.01 (0.4Bq/L) in all sea areas.

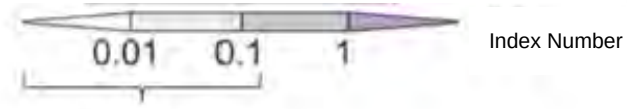


Below the detection limit values

JCOPE2 Predicted figures (Cs 134)
2011/06/15

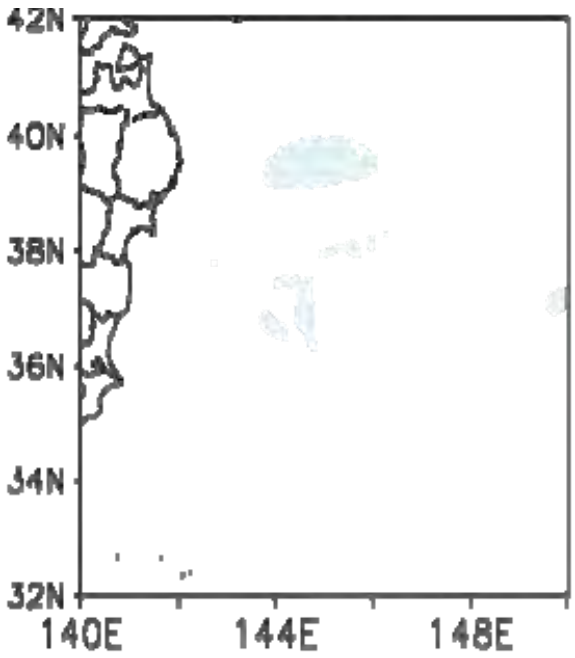


All sea areas are below the detection limit values

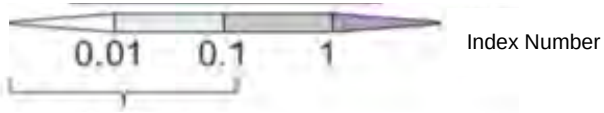


Below the detection limit values

JCOPE2 Predicted figures (Cs 137)
2011/06/15



All sea areas are below the detection limit values



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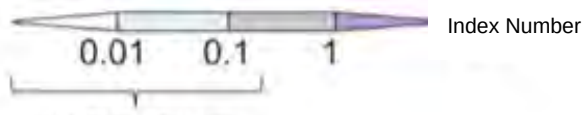
[Figure 3-4] Simulation of Radioactivity Concentrations by JCOPE2 (June 30)
(based on data up to May 3)

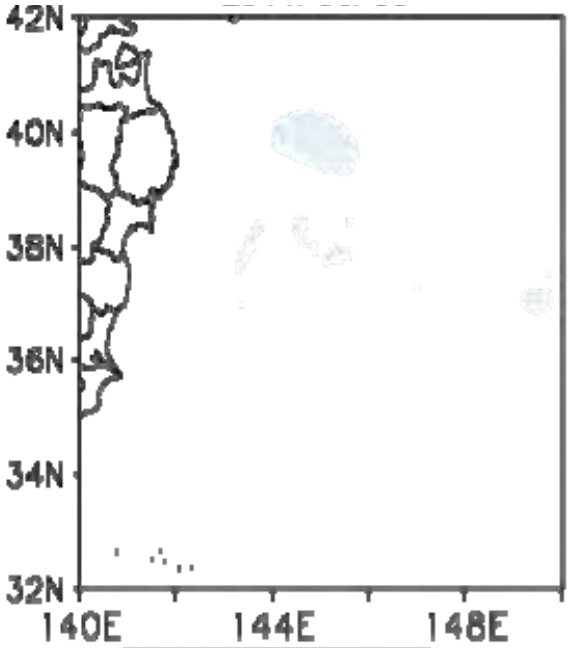
JCOPE2 Predicted figures (I 131) 2011/06/30

The index number is below 0.01 (0.4Bq/L) in all sea areas.



Below the detection limit values

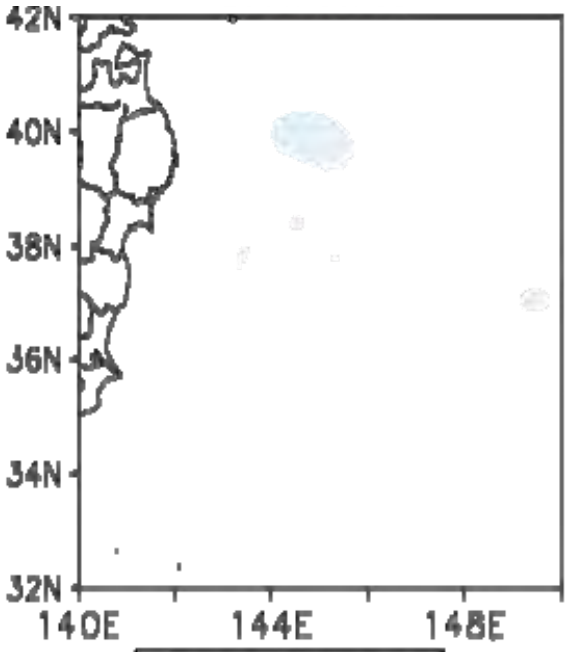
JCOPE2 Predicted figures (Cs 134) 2011/06/30



All sea areas are below the detection limit values

Below the detection limit values

JCOPE2 Predicted figures (Cs 137) 2011/06/30



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