Press Release

Simulation of Radioactivity Concentrations in the Sea Area (the 5th report）

May 24, 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 22, based on the current velocity pattern as of May 19, 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 20.

(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 20, 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 20 was present until May 22.
- The half-lives of radioactive substances (cesium-134: approx. 2 years, cesium-137: approx. 30 years) are taken into consideration.

3. Results

Due to the Japan Kuroshio Current, 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 in June, the radioactive substances diffuse and dilute gradually in the sea area at northern latitudes of 35 to 40 degrees, and slowly move eastward. [Figure 3-1 to Figure 3-4]

In actual measurement approximately 30 km off the coast of the NPP, radioactive cesium was observed in slight excess of the detection limit value (the current measurement method has the detection limit value of approximately 6Bq/L and 9Bq/L for Cs134 and Cs137, respectively). However, analysis results which were obtained at 37 other sampling points by May 24 were all below detection limit values.

The simulation provided results that both cesium-134 and cesium-137 will fall below the detection value under the current measurement method by the end of May in all sea areas, showing consistency with actual measurement. Note that this simulation provides results calculated for the scenario above in 2. under various assumptions. In addition, it does not necessarily assure what the actual measurements will be.

4. Discrepancies with the fourth 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 20 were incorporated (the fourth report showed observation data up to May 3).

-The current pattern as of May 19 was used as the initial value (the initial value of the current pattern in the fourth report was as of May 3).

- As for the forecasting of wind conditions which affect the sea surface, the forecast as of May 19 was used (the relevant data in the fourth report was that as of May 3).

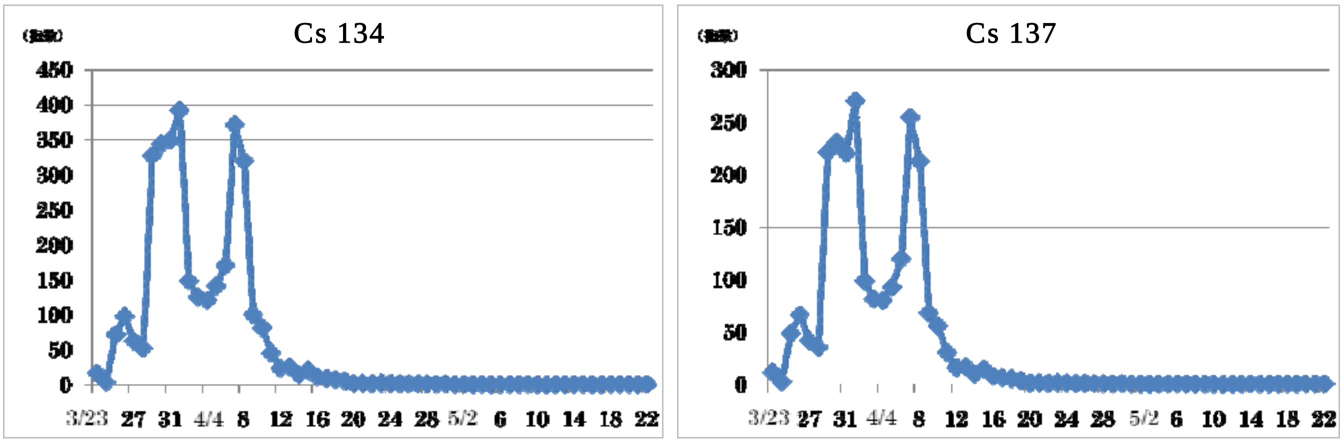
These conditions make a difference to the initial values in the result of the simulation.

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

5. Point to note

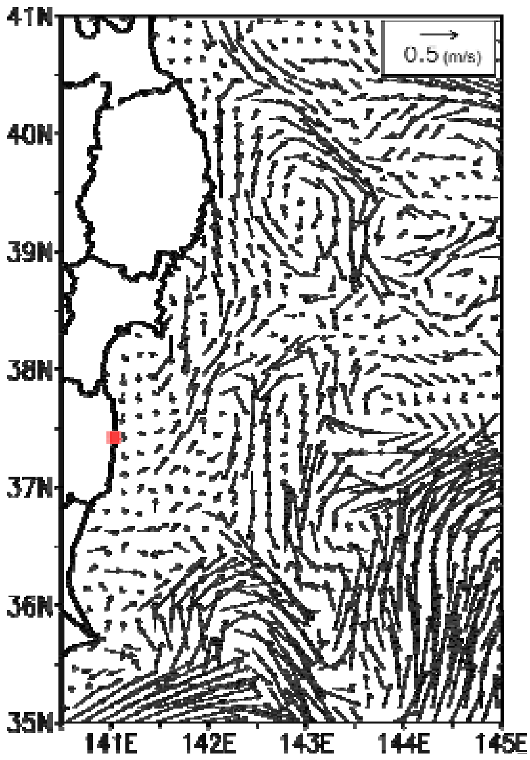
This simulation does not necessarily assure what the actual measurements will be. Even if observed values are incorporated into the model, there may be discrepancies with actual measurement, because of several uncertainties involved in forecasting calculation, including as follows: (1) simulations do 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 forecast period is used, causing a possible margin of error, (3) the deposition process of radioactive nuclides on the seabed is not taken into consideration. In particular, the longer the forecast period is, the larger the range of margin. It is necessary to undertake ceaseless revision, checking the actual measurements provided by the latest monitoring results and with mutual evaluation in comparison with simulations according to other calculation programs.

Although radioactivity concentrations are now below the detection limit value under the current measurement method, it is evident that radioactive water will diffuse slowly across the Pacific. From now on, it is necessary to forecast the diffusion and dilution of radioactivity concentrations across the Pacific, taking into consideration radioactive substances descending through the atmosphere (fallout) 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 20) released by TEPCO, and the same level of discharge as that as of May 20 continues until May 22. 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.

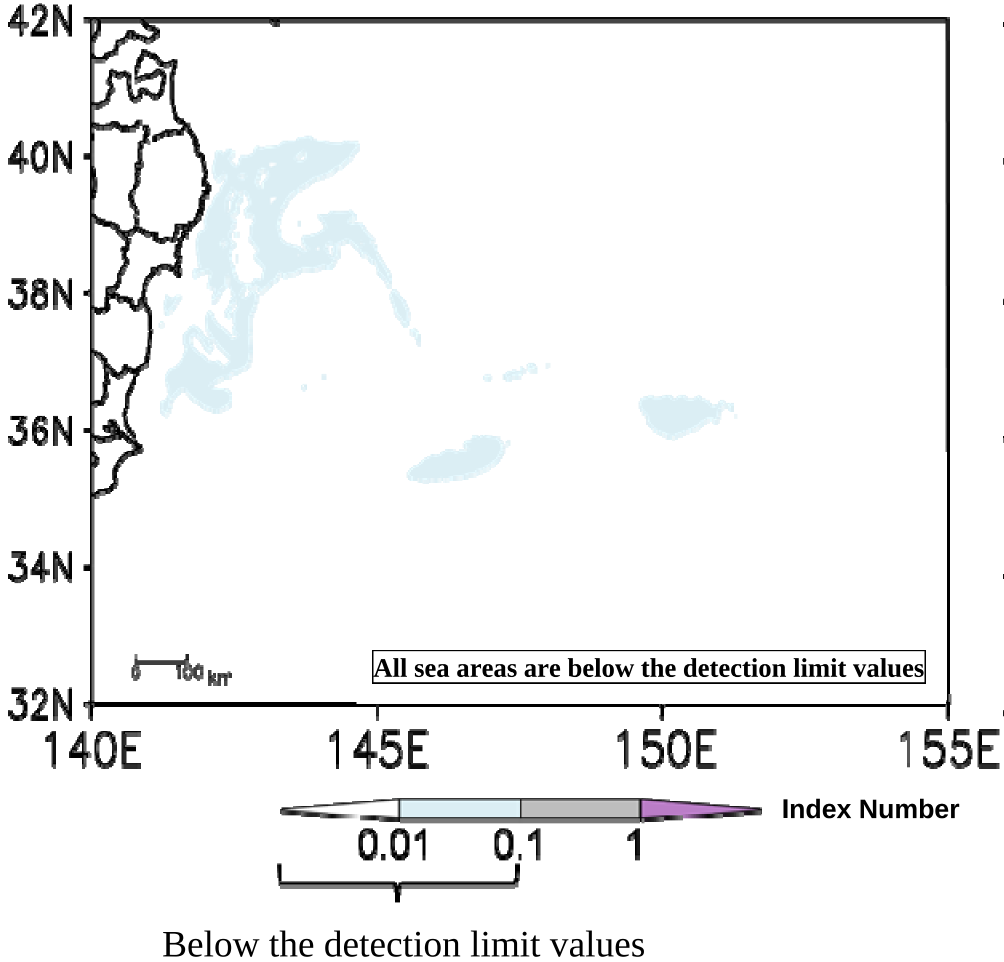


[Figure 2] Current Velocity Pattern Simulated by JCOPE2 (as of May 3)

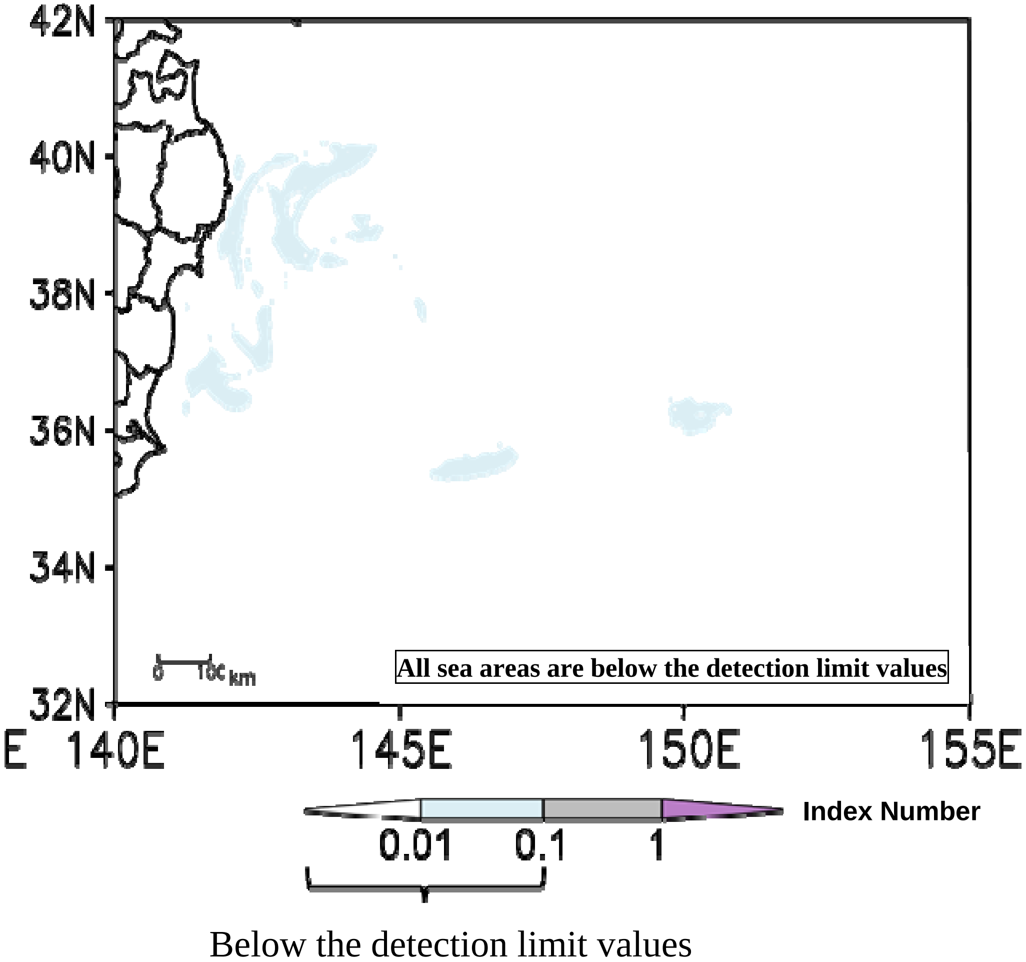
The current velocity pattern simulated by JCOPE2 incorporates the on-site observation data and satellite observation data up to May 19. The half-lives of radioactive substances (cesium-134: approx. 2 years, cesium-137: approx. 30 years) are taken into consideration in the simulation.

【[Figure 3-1] Simulation of Radioactivity Concentrations by JCOPE2 (May 31)
(based on data up to May 20)

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



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

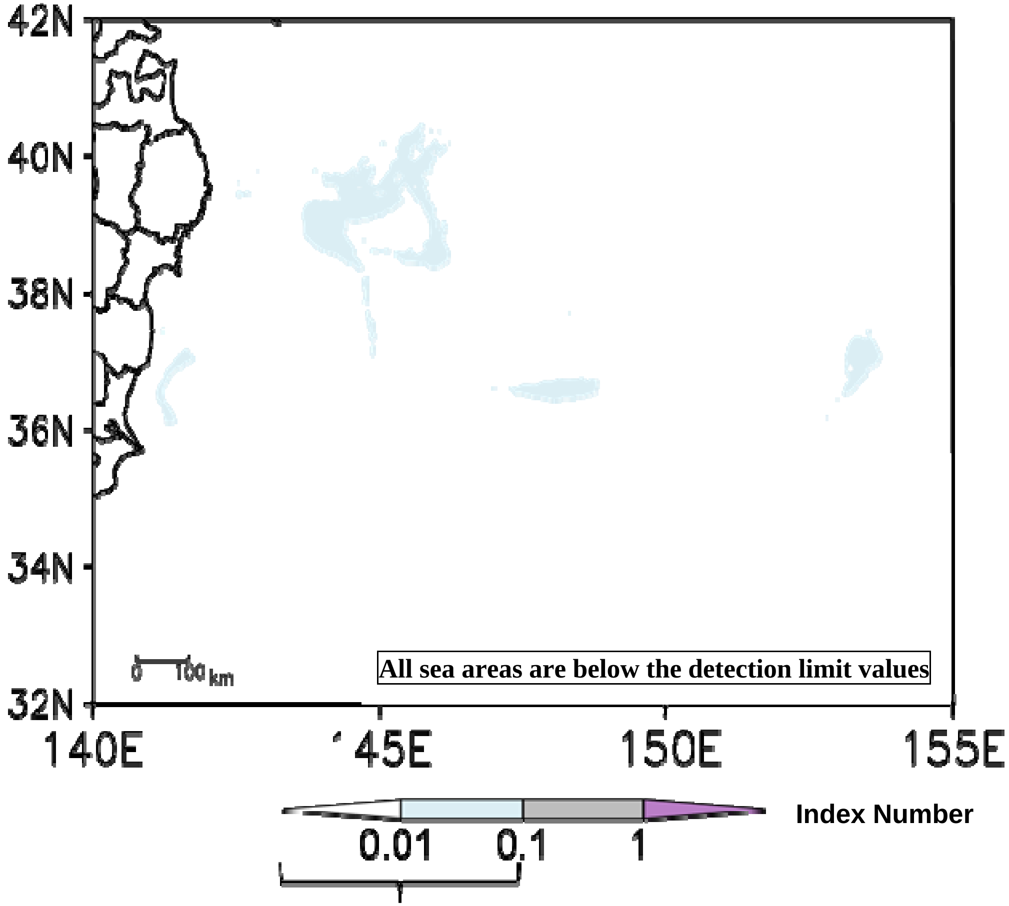


{Note: The index numbers in the figure show how many times the maximum radioactivity concentrations predicted at each point are higher than the effluent concentration limits for nuclear facilities determined by regulations (Cs134: 60Bq/L, Cs137: 90Bq/L).}

*Currently, detection limit values are 6Bq/L(Cs134) and 9Bq/L(Cs137) in monitoring of sea areas near Fukushima Dai-Ichi NPP by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

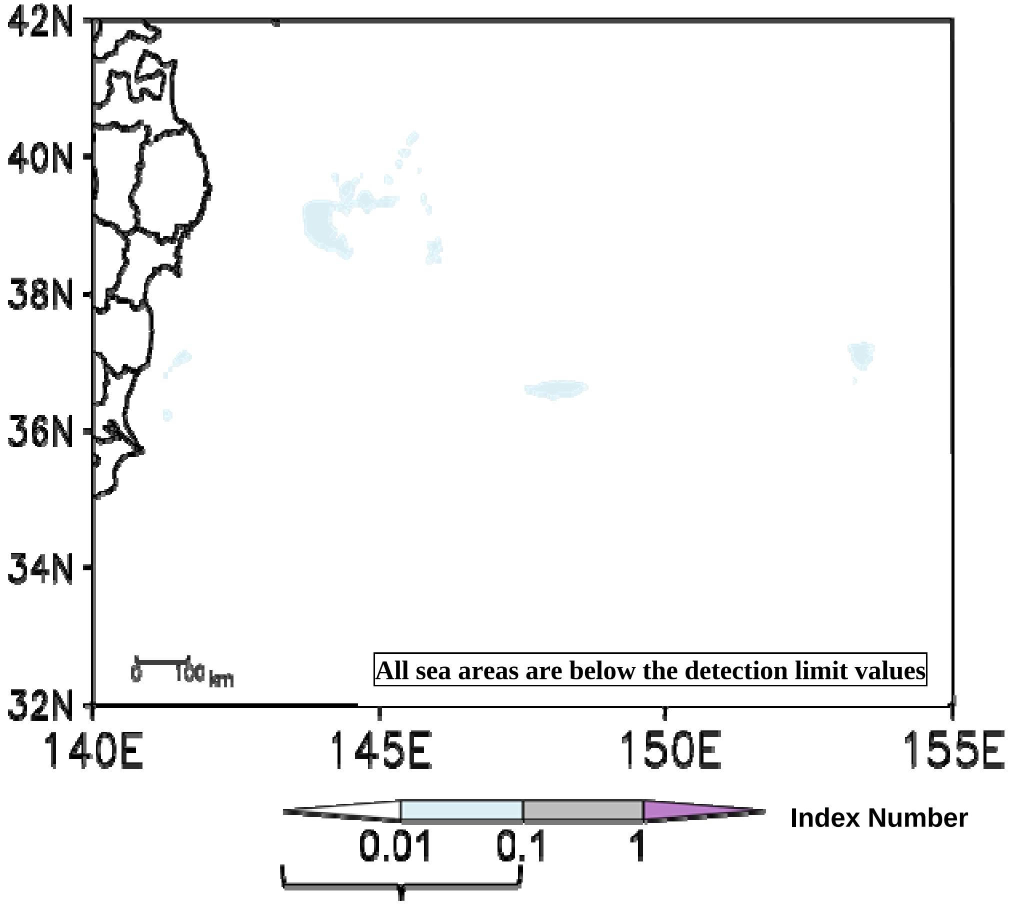
【[Figure 3-2] Simulation of Radioactivity Concentrations by JCOPE2 (June 15)
(based on data up to May 20)

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



Below the detection limit values

JCOPE2 Predicted figures (Cs137)
2011/06/15



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 (Cs134: 60Bq/L, Cs137: 90Bq/L).}

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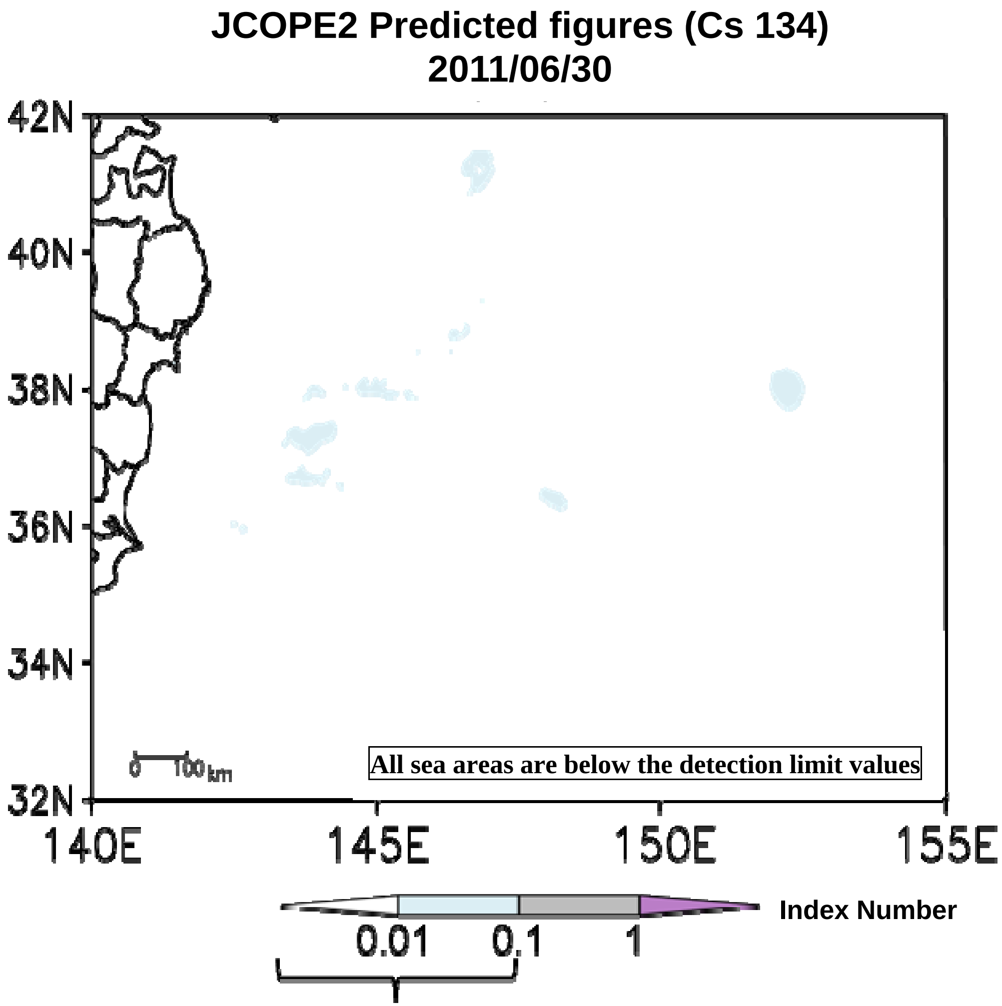
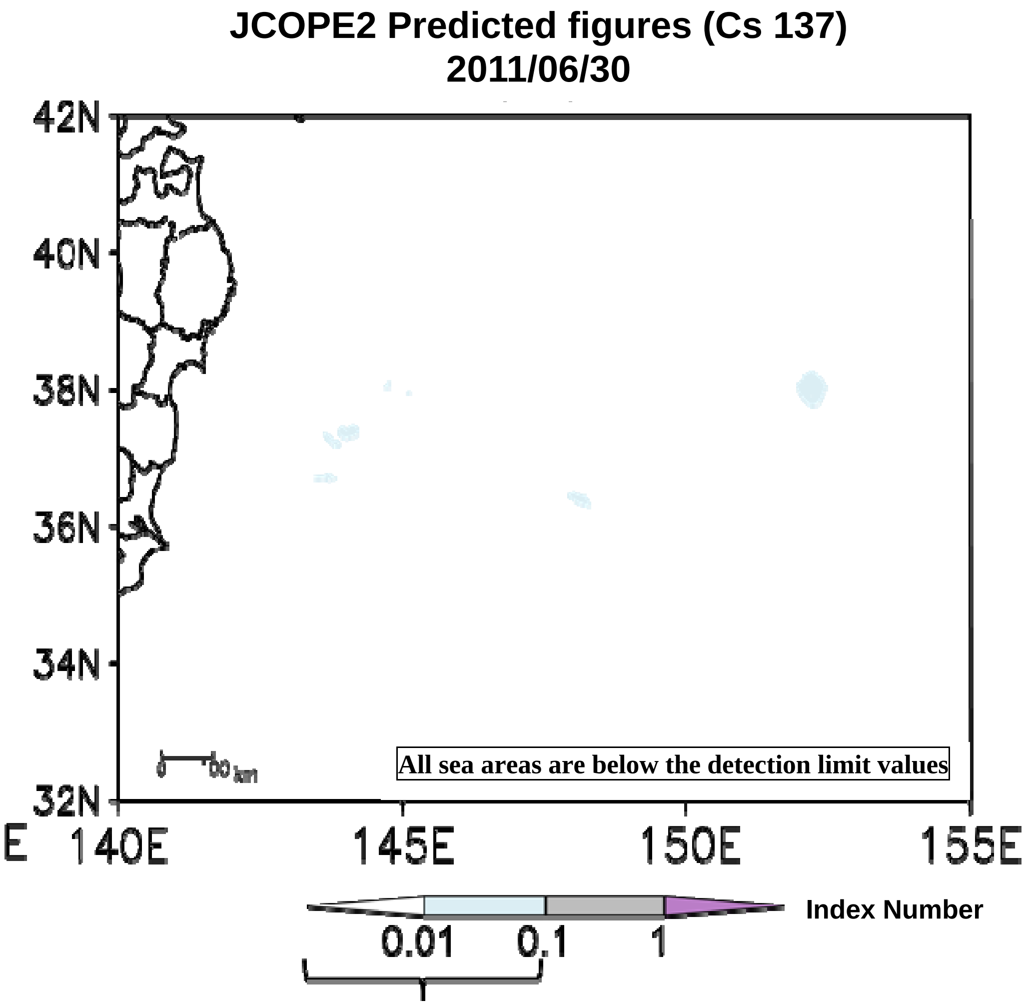
【[Figure 3-3] Simulation of Radioactivity Concentrations by JCOPE2 (June 30)
(based on data up to May 20)



Below the detection limit values



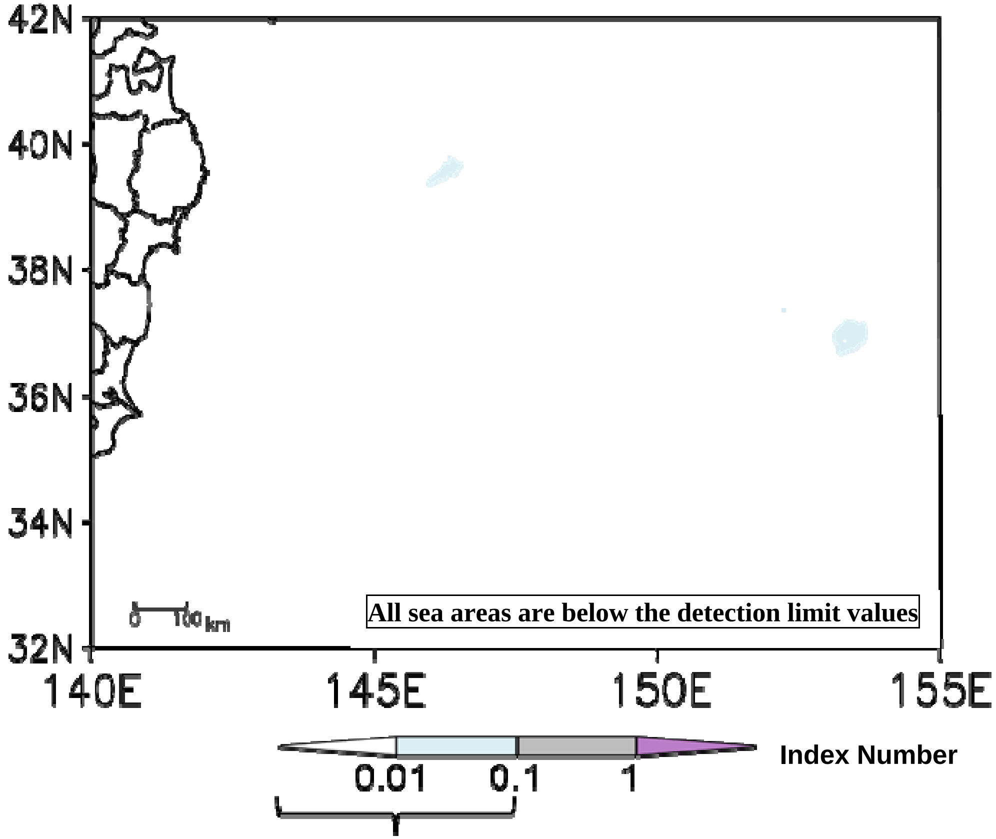
Below the detection limit values

{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 (Cs134: 60Bq/L, Cs137: 90Bq/L).}

*Currently, detection limit values are 6Bq/L(Cs134) and 9Bq/L(Cs137) in monitoring of sea areas near Fukushima Dai-Ichi NPP by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

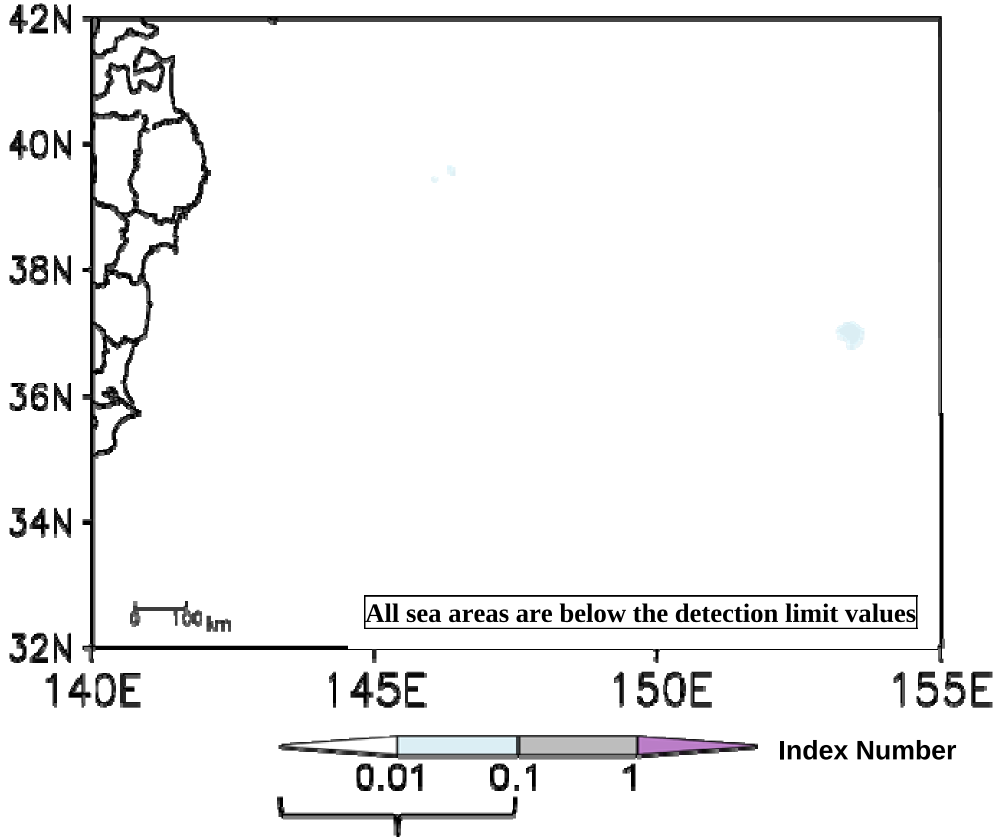
【[Figure 3-4] Simulation of Radioactivity Concentrations by JCOPE2 (July 15)
(based on data up to May 20)

JCOPE2 Predicted figures (Cs 134)
2011/07/15



Below the detection limit values

JCOPE2 Predicted figures (Cs 137)
2011/07/15



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 (Cs134: 60Bq/L, Cs137: 90Bq/L).}
*Currently, detection limit values are 6Bq/L(Cs134) and 9Bq/L(Cs137) in monitoring of sea areas near Fukushima Dai-Ichi NPP by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).