Analysis of Pb-210 deposition distribution Characteristics based on high resolution atmospheric transport/deposition model calculation

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Abstract:

In order to evaluate the subsidence flux of Pb-210 in the surrounding area of Japan in detail, this study took Aomori as the research target area and used a 3km resolution grid to calculate the precipitation and deposition of Pb-210.

Keywords: radon-222, lead-210 deposition, atmospheric transport model, long range transport, tracer

1. Introduction

Rn-222 is a radioactive noble gas element. The Rn -222 decay products, Pb-210 and Po-210 enters the terrestrial and maritime environment through deposition, which eventually result in the largest contributor of internal dose to Japanese.

In order to understand the input of Pb-210 it is necessary to quantitatively analyze spatiotemporal distribution of Pb-210 deposition. However, due to the expected complexity of the distribution and the limitation on Pb-210 observation, it is a good method to use the atmospheric transport model for quantitative calculation. However, the previous model calculations were not able to depict the deposition pattern due to the coarse horizontal grid used.

2. Experiment

The model consists of the meteorological model WRF and the radon transport model HIRAT[1]. HIRAT was improved to include calculations for the radon progenies, Po-218, Pb-214, Bi-214, Po-214 and Pb-210[2]. The previous calculations with the 9km resolution underestimated the precipitation and Pb-210 deposition at Rokkasho-MURA. The reason is considered to be the coarse resolution of the complex terrain that causes the ascending motion of the air over the mountains and hence the precipitation. Therefore, the 3km resolution was used in the preset calculation. The result in Fig.1 shows that the grid with the resolution of 3km reproduces the terrain of the target area more accurately. The results shows that the monthly precipitation calculated with the 3km grid reproduced the measured value better than that of 9km. Differences between the windward slopes of mountains and the Pacific coast are clearly demonstrated (Fig.2). This means that 3km grid may reproduce the deposition more reasonably.

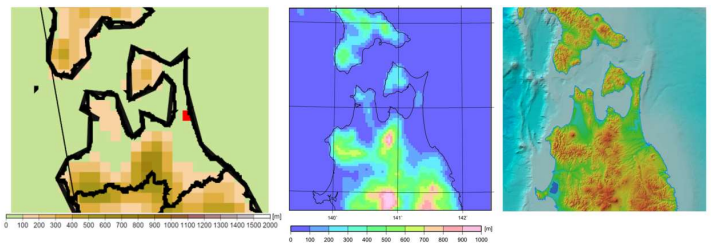

Fig.1 Terrain reproducibility in 9km(left),3km(middle), Topographic map from GSI(right)

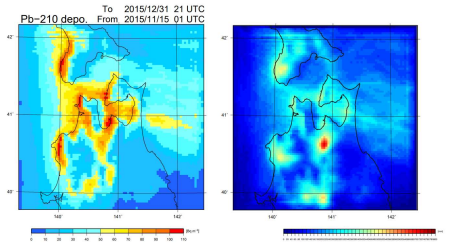

Fig.2 Deposition (left) and precipitation(right)

3. Conclusion

According to the calculation results, the 3km resolution is better than the 9km resolution to reproduce the characteristics of the target area, and we can expect to better reproduce the Pb-210 deposition.

References

[1] S. HIRAO et al. (2008) J. Nucl. Sci. Technol. Suppl., 166-172.

[2] S. Akamatsu (2020). Master's Thesis, Nagoya University

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