4.099 Analysis of high radon-222 concentration events in winter using multi-horizontal-resolution NICAM simulations.

Presenting Author:

Kentaro ISHIJIMA, MRI-JMA, Japan, ishijima@jamstec.go.jp

Co-Authors:

Masayuki Takigawa, Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

Yousuke Yamashita, Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

Hisashi Yashiro, RIKEN Advanced Institute for Computational Science, Kobe, Japan

Chihiro Kodama, Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

Masaki Satoh, Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan

Kazuhiro Tsuboi, Meteorological Research Institute, Tsukuba, Japan

Hidekazu Matsueda, Meteorological Research Institute, Tsukuba, Japan

Yosuke Niwa, National Institute of Environmental Studies, Tsukuba, Japan

Shigekazu Hirao, Institute of Environmental Radioactivity at Fukushima University, Fukushima, Japan

Abstract:

Atmospheric radon-222 (^{222}Rn) variability is analyzed and compared with model simulations made by the Nonhydrostatic Icosahedral Atmospheric Model (NICAM), with three horizontal resolutions (223, 56, and 14 km), for remote observation stations in the northern hemisphere; Minamitorishima (24ºN, 154ºE) (by Meteorological Research Institute, Japan) and Bermuda (32ºN, 65ºW) (by National Urban Security Technology Laboratory, U.S.), in order to understand high ^{222}Rn events predominantly caused by frontal activities. Seasonal variations of event frequency are well reproduced by the model, with correlation coefficients of 0.79 (223 km) to 0.99 (14 km). The frequency tends to maximize in winter for both observation and models, reflecting the fact that cold fronts most frequently occur in winter. Based on these results, we analyze composite mean of high ^{222}Rn events in winter in this study. All of the three horizontal resolutions can reproduce general features of observed temporal variation of ^{222}Rn during high ^{222}Rn events. The fact is also supported by the temporal variation of equivalent potential temperature, whose change is widely used to locate fronts. Equivalent potential temperature shows maximum decreasing rate at the time of or just before the ^{222}Rn peak, indicating high ^{222}Rn air is located behind the cold front. Peak height and width of ^{222}Rn are well reproduced by the 56 km and 14 km resolution models, while the 223 km resolution model shows much lower and broader peaks compared to those observed due to insufficient resolution. As a consequence of this study, it seems that model, with horizontal resolution of 56 km or finer grid spacing, can well simulate spatiotemporal variations of atmospheric components driven by frontal activities, while 223 km

resolution is not enough to reproduce them.