Variations of atmospheric Radon-222 concentration observed at JMA stations

*Kentaro Ishijima[1], Kazuhiro Tsuboi[1], Hidekazu Matsueda[1], Yousuke Sawa[1], Yosuke Niwa[2,1], Takashi Maki[1], Takashi Nakamura[3]

1. Meteorological Research Institute, 2. National Institute for Environmental Studies, 3. Japan Meteorological Agency

Japan Meteorological Agency (JMA) has been operating several stations to monitor atmospheric greenhouse gases since the late 1980s under the Global Atmosphere Watch programme of the World Meteorological Organization (WMO/GAW). They show synoptic, seasonal, interannual variations, and trends due to changes in atmospheric transport and source/sink strength. To know their transport from land regions, we started the monitoring of atmospheric Radon-222 (^{222}Rn) in the 2000s at the JMA stations. Because ^{222}Rn is emitted from almost only lands and chemically inert, it is useful to identify temporal variability of atmospheric greenhouse gases due to sources/sinks on land. ^{222}Rn also radioactively decays with the half-life of 3.8 days, so is widely utilized to validate regional transport of atmospheric transport model through the model-observation comparisons. Understanding such transport process is also supported by using an atmospheric transport model. We have just started to use a newly developed on-line atmospheric tracer transport model (GSAM-TM). The tracer transport process is driven by a low-resolution version (TL95) of JMA's operational global numerical weather prediction model (GSAM).
In this study, we analyze the observed and model simulated atmospheric ^{222}Rn concentration, to understand the transport process of land-origin atmospheric tracer as well as to validate the GSAM-TM. For example, the model well reproduces high ^{222}Rn peaks, which are frequently observed at Minamitorishima (MNM; 24.28˚N, 153.98˚E) and Chichijima (CCJ; 27.09˚N, 142.19˚E) in winter to spring. Especially in winter, there are many cases that a high peak is first observed at CCJ and one day after at MNM. They are mainly produced by a cold front moving eastward with dense ^{222}Rn behind the frontal line. The peak height at MNM is about two-thirds of that at CCJ. It is slightly smaller than that expected from decay by the 3.8 days half-life (about four-fifths), because dense ^{222}Rn trapped by the front is diluted mainly by diffusion while transported. The model also well reproduces such peak attenuation degree. More details and results of ^{222}Rn-age tracer simulations as well as of other JMA station will also be discussed in our presentation.

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