SnT 2019
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Atmospheric Dispersion Assessment of Radioxenon after North Korea's 6th Nuclear Test using LADAS Model

T2.4-P6

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Introduction

North Korea conducted the sixth underground nuclear test on 3 September 2017 at Punggye-ri Neclear Test Site (NTS). After the nuclear test, there were several induced earthquakes occurred around the NTS and they might influence to some leakages of radioxenon from the site. The RUX58 station, one of the International Monitoring System (IMS) stations operated by the Comprehensive nuclear Test-Ban-Treaty Organization (CTBTO), was expected as a strong candidate for detection of radioxenon but unfortunately it was not on normal operation at that time.

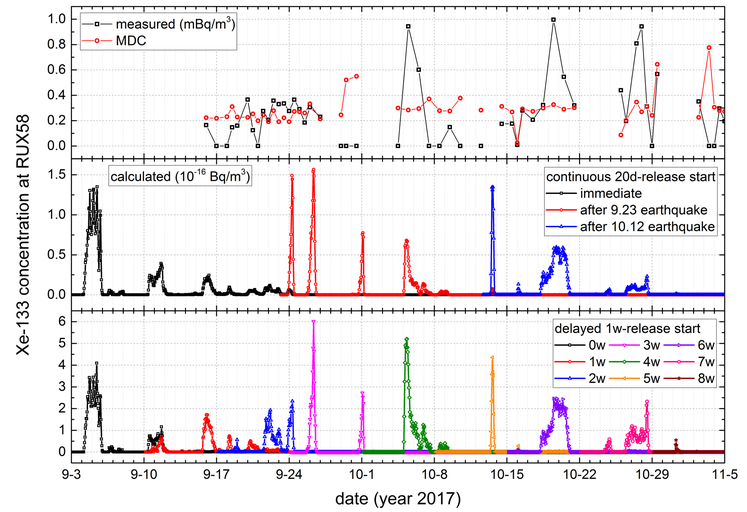
Occurred time (UTC)	Latitude	Longitude	Magnitude (M_L)	Depth	Distance from NTS
2017.09.03 03:29:58	41.302° N	129.080° E	5.7 (m_b)	-	-
2017.09.03 03:38:32	41.252° N	129.123° E	4.4	-	7 km
2017.09.23 04:43:00	41.35° N	129.06° E	2.6	2km	6 km
2017.09.23 08:29:16	41.35° N	129.06° E	3.2	-	6 km
2017.10.12 16:41:08	41.39° N	129.03° E	2.7	3 km	10 km

Radioxenon Emission Scenarios

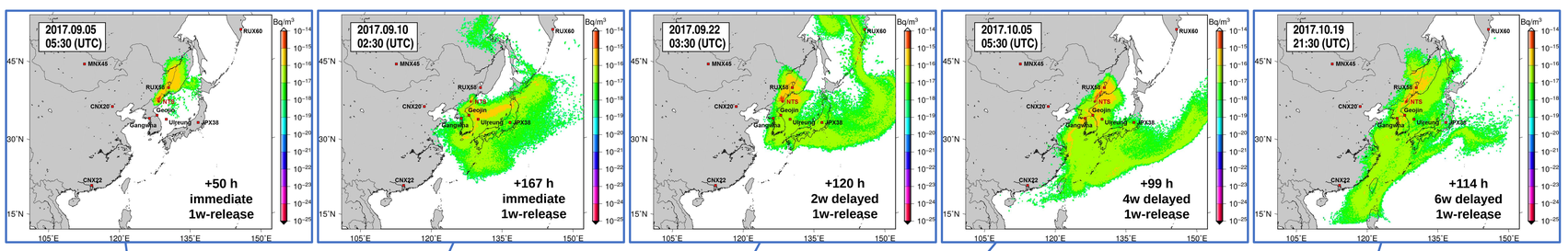
With considering reported earthquakes after the 6th nuclear test, we performed atmospheric dispersion simulations on some radioxenon emission scenarios for this event using our Lagrangian Atmospheric Dose Assessment System (LADAS) model utilizing Numerical Weather Prediction (NWP) data based on the Unified Model (UM) produced by the Korea Meteorological Administration (KMA). To find out possible detection locations and times, we combined not only weekly-based delayed releases but also leakages after reported earthquakes around the NTS into the emission scenarios.

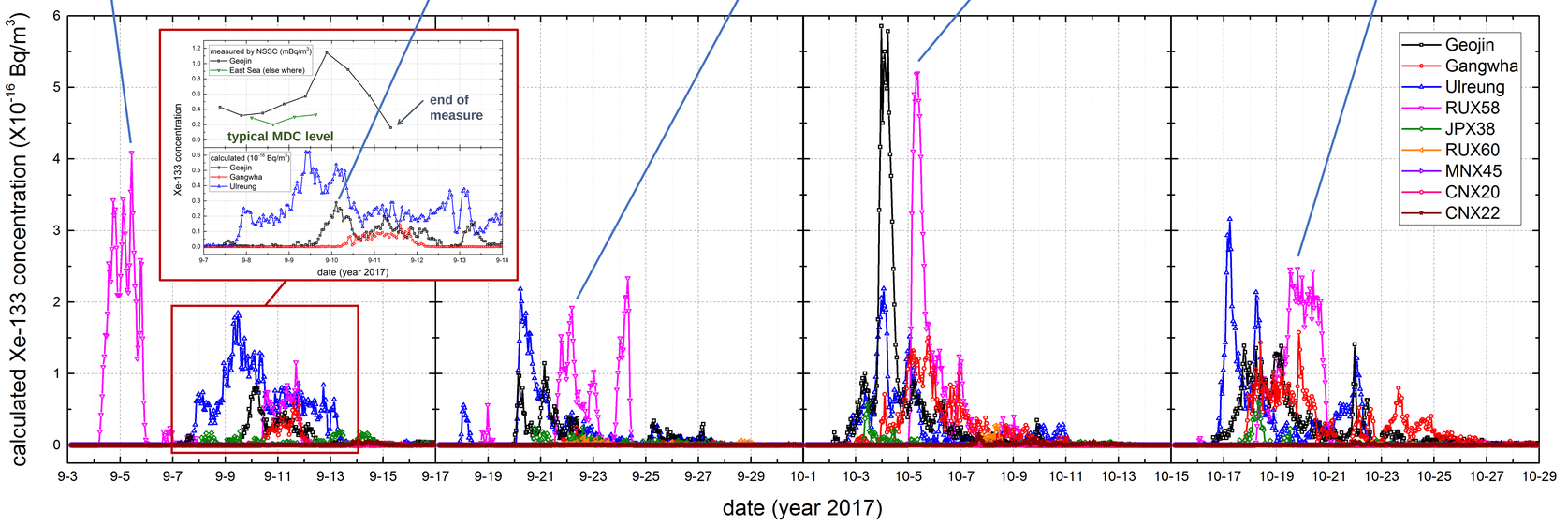
Simulation period	2017.09.03 ~ 2017.11.05
Meteorological data	KMA UM-RDAPS (12km-horizontal resolution)
Release start	1) *n*-week delayed after the nuclear test (0≤*n*≤8) 2) at the nuclear test, 9.23 1st and 10.12 earthquakes
Release amount	1 Bq (continuous release)
Duration of release	1) lasted 7 days (*n*-week delayed releases) 2) lasted 20 days (releases after earthquakes)
Number of particles	10^6 to 10^7

Radioxenon at RUX58: Comparison



Atmospheric Dispersion Simulations for *n*-Week Delayed Radioxenon Releases





Concluding Remarks

- **Some detections at the RUX58 (5, 19, and 26 October) and Geojin (10 September) consistent with the simulation results.**
- **Within first few days after the nuclear test, radioxenon was undetectable in South Korea and most area of Japan. (Only at the RUX58, it can be done but no data.)**
- **Few days later, some of released radioxenon might be flowed into Geojin of South Korea both directly from the NTS and indirectly via Yougbyon.**
- **There were possibilities of radioxenon detection around Ulreung island. RUX58, Geojin, Gangwha, and Ulreung were strong candidates for detection for this event.**
- **Detections in October at the RUX58 might be originated by leakage of radioxenon after the earthquakes of 23 September (5 October) and 12 October (19 Octorber). (Necessary to compare data at Geojin but no data.)**
- **The IMS stations, CNX20, CNX22, MNX45, RUX60, and JPX38 were almost not affected from the radioxenon plumes. (much less than MDC level)**

References

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Acknowlegements

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Ministry of Science and ICT (MSIT) of the Korean government (NRF-2017M2A8A4015253, NRF-2015M2A2B2034282). Also, we thank to the Korea Meteorological Administration (KMA) for providing real-time Numerical Weather Prediction data via the Korea Research Environment Open NETwork (KREONET).