



Comprehensive Nuclear Test Ban Treaty Organization Radioactive Noble Gas Monitoring System Data for Nuclear Detonation Characterization

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Introduction and Motivation

- Monitoring is required to ensure compliance with the CTBT.
- CTBTO International Monitoring System (IMS) contains seismic, hydroacoustic, infrasound, and radionuclide (with noble gas) monitors.
- Radio-noble gas (RNG) production is the only signature non-existent without Anthropogenic nuclear activities.
- Improved atmospheric transport models (ATM) can enable IMS RNG data to be used for detonation localization and characterization, improving international abilities to verify violations of the CTBTO and evaluate adversarial capabilities

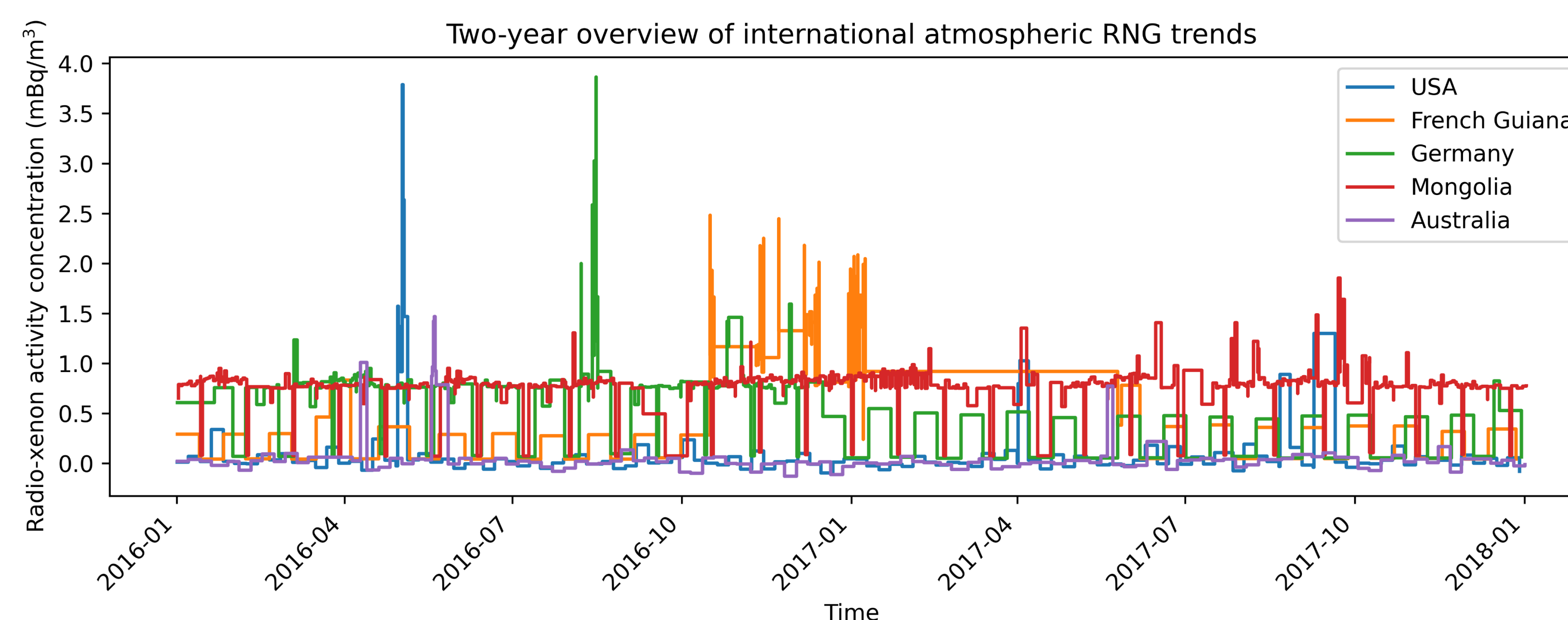
Mission Relevance

- Nonproliferation: in addition to detonations, reactor operation, uranium enrichment, and other nuclear activities will release RNGs
- Verification: determining if Treaty violations have occurred and the nature of such.

Technical Approach

- Find systematic noise
- Machine learning-based improvement of existing forward-modeling. Source terms: US Nevada Test Site legacy test data.
 - Utilize high-performance computing resource at Lawrence Livermore National Laboratory
- Backwards modeling to localize detonation. Source terms: IMS data.

Results



Expected Impact

- Improve atmospheric modeling capabilities beyond hemisphere-scale
- Forward modeling of RNG spread from known source term
- Backwards modeling with IMS data to improve accuracy of detonation location, time, and yield estimates.

MTV Impact

- MTV created connections with National Laboratory Scientist
 - Completing internship with LLNL National Atmospheric Release Advisory Center.
- Stakeholders: CTBTO, USA National Laboratories Global Security Divisions, and international arms reduction community.

Conclusion

- Evaluating systematic noise and periodic trends ongoing.
- This research will enable better monitoring of international nuclear activities of all types and improve knowledge of clandestine nuclear tests.

Next Steps

- Forward-model development with machine learning and legacy Nevada Test Site data.
- Determine how to properly integrate IMS data.

This work was funded in-part by the Consortium for Monitoring, Technology, and Verification under DOE-NSA award number DE-NA0003920. We thank the CTBTO for making available the virtual Data Exploitation Center (vDEC, <https://www.ctbto.org/specials/vdec/>) for distributing data to the authors.

