AGA 4: Nuclear Weapons and the Atmosphere

Time: Thursday 14:00–15:25 Location: HSZ/0002

Invited Talk AGA 4.1 Thu 14:00 HSZ/0002

Mass Starvation? Impacts of Nuclear War on Climate Change and Food Security — •Lili Xia — Rutgers University

The direct effects of nuclear war would be horrific, with blast, fires, and radiation killing and injuring many people. But in 1983, United States and Soviet Union scientists showed that a nuclear war could also produce a nuclear winter, with catastrophic consequences for global food supplies for people far removed from the conflict. Smoke from fires ignited by nuclear weapons exploded on cities and industrial targets would block out sunlight, causing dark, cold, and dry surface conditions, producing a nuclear winter, with surface temperatures below freezing even in summer for years. Climate change caused by smoke from fires ignited by nuclear weapons would limit the amount of food that could be grown on land our caught at sea. After stored food was consumed there would be mass food shortages in almost all countries. We used one climate model, one crop model, and one fishery model climate to estimate the impacts from six scenarios of stratospheric soot injection, predicting the total food calories available in each nation post-war after stored food was consumed. We estimated that more than 2*billion people could die from nuclear war between India and Pakistan, and more than 5*billion could die from a war between the United States and Russia.

AGA 4.2 Thu 14:45 HSZ/0002

Multi-technological analysis of the January 2022 Hunga Volcano explosive eruption from the perspective of CTBT monitoring — •Jens Ole Ross, Patrick Hupe, Andreas Steinberg, Stefanie Donner, Peter Gaebler, Johanna Lehr, Christoph Pilger, Thomas Plenefisch, and Lars Ceranna — Bundesanstalt für Geowissenschaften und Rohstoffe, BGR, B4.3 Erdbebendienst des Bundes / Kernwaffenteststopp, Hannover

For the detection of potential non-compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT), the International Monitoring System (IMS) with 321 stations is nearly complete.

The huge explosive eruption of the Hunga Volcano (Tonga) on 15th January 2022 and its global observations were record-breaking in many aspects. All IMS infrasound stations measured the atmospheric Lamb wave and the following infrasound generated by the main eruption, which circumnavigated the globe several times. We also analysed the seismic and hydroacoustic signatures of the event series to characterize source processes and focused on methods for discriminating between earthquakes and explosions as demanded in the CTBT context. Atmospheric Transport Modelling assessed the sensitivity to the eruption for nearby radionuclide stations to estimate the detectability of hypothetical radionuclide releases in a fictitious nuclear explosion scenario.

The results show again the readiness of the CTBT-IMS and strengthen the value of the IMS data for scientific and civilian applications.

AGA 4.3 Thu 15:05 HSZ/0002

Test of a new radioxenon monitoring system for verification of the Comprehensive Nuclear-Test-Ban Treaty - What can be gained from higher sensitivities and shorter sampling periods? — •Sofia Brander[1], Sandra Baur[1], Roman Krais[1], J. Ole Ross[2], and Andreas Bollhöfer[1] — [1]Federal Office for Radiation Protection, Rosastr. 9, 79098 Freiburg — [2]Federal Institute for Geosciences and Natural Resources, GeoZentrum Hannover, Stilleweg 2, 30655 Hannover

For the verification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) an international monitoring system (IMS) of radioxenon measurement stations has been established. 26 of 40 planned noble gas stations now accommodate systems that automatically collect and analyze a minimum of 1 air sample per day for the nuclides Xe-133, Xe-131m, Xe-133m and Xe-135 in order to detect a possible nuclear weapons test. A new generation of systems, capable of shorter sampling cycles and lower detection limits, is being tested and implemented into the IMS. The German Federal Office for Radiation Protection tested one of these systems, Xenon International, from July 2021 to April 2022 at radionuclide station RN33 on Mount Schauinsland near Freiburg. The obtained activity concentrations are consistent with data from the current operational IMS system SPALAX at RN33, with sensitivities up to one order of magnitude higher for Xe-131m, Xe-133m and Xe-135.

In this talk, I will investigate multiple isotope detections and unusual single detections and explore the benefits of 6h time resolution considering source location capabilities via atmospheric transport modeling.