AGA 5: North Korean Crisis 2

Time: Thursday 16:30–18:30 Location: B 0.014

Invited Talk AGA 5.1 Thu 16:30 B 0.014

Analysen zum Nachweis der nordkoreanischen Nukleartests — •Jens Ole Ross[1], Lars Ceranna[1], Michaela Frei[1], Peter Gaebler[1], Nicolai Gestermann[1], Ilona Grünberg[1], Gernot Hartmann[1], Christoph Pilger[1], Andreas Bollhöfer[2], Clemens Schlosser[2] und Andreas Barth[3] — [1]BGR, Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover — [2]BfS, Bundesamt für Strahlenschutz, Freiburg — [3]KIT, Karlsruher Institut für Technologie, Geophysikalisches Institut, Karlsruhe

Das internationale Überwachungsnetz für den umfassenden Kernwaffenteststoppvertrag (CTBT) registriert seismische und hydroakustische Wellen sowie Infraschall zur Detektion und Lokalisierung von Explosionen. Hochempfindliche Radionuklidstationen dienen der Messung von Spuren radioaktiver Spaltprodukte in der Atmosphäre. Numerische Modelle der atmosphärischen Ausbreitung helfen die örtlich-zeitliche Konsistenz von Radionuklidmessungen mit möglichen Explosionsquellen zu bewerten. Die fünf nordkoreanischen Nuklearexplosionen von 2006 bis 2016 zeigten eine steigende Sprengkraft von unter einer bis ca. 25 kt TNT äquivalent. Nach den Tests 2006 und 2013 gelang durch atmosphärische Messung von Xenon in spezifischen Isotopenverhältnissen der Nachweis des nuklearen Ursprungs der Explosion. Mittels Satelliten gestützter Radarinterferometrie wurden 2016 Bodenabsenkungen festgestellt. Die Explosion vom 3.9.2017 war um ein Vielfaches stärker und es wurden mehrere Nachbeben registriert. Am Beispiel von 2017 wird die Bandbreite der am Nationalen Datenzentrum für das CTBT-Monitoring eingesetzten Methoden demonstriert.

AGA 5.2 Thu 17:30 B 0.014

Disarming North Korea with physics: How can verification help resolve the nuclear crisis? — •Malte Göttsche — AICES Graduate School, RWTH Aachen, Germany

How to stop Kim Jong Un's nuclear path? Despite de-escalation hardly being in sight, concepts must be ready. Should the complete denuclearization be required for political and economic guarantees, or at first only a freeze of the nuclear programme? Either approach raises scientific challenges: How could inspectors verify North Korean compliance? Two key issues are quantifying how much fissile material was produced in the past to assess how many weapons could be built and must be dismantled, and determining the present non-production (under a freeze).

This talk introduces the North Korean fissile material production programme and inspections carried out in the past, as well as concepts for novel methods to quantify past production. This includes measurements in shut-down reactors to determine the neutron fluence and to distinguish past plutonium from tritium production, measurements of the isotopics and mass of radioactive waste, and analyzing operational records coupled with fuel cycle simulations. Beyond North Korea, such methods will be needed to verify global nuclear disarmament.

AGA 5.3 Thu 18:00 B 0.014

How many nuclear weapons does North Korea have? - Fissile material production estimates — •Matthias Englert — Institute for Applied Ecology - Öko-Institut e.V., Rheinstr. 95, 64295 Darmstadt

The question of how many weapons could North Korea possibly have depends on the amount of plutonium or highly enriched uranium North Korea has produced already and how much is used in one nuclear device. Much about its nuclear program is shrouded in secrecy and little reliable information is available, especially since the IAEA and international experts lost access to the fissile material production plants. This talk will give a summary of North Korean fissile material production capabilities based on estimates in the open literature and own calculations. Some detail is available about the plutonium production at the 5 MWe gas graphite reactor and the reprocessing plant at the Radiochemical Laboratory at Yongbyon.

After roughly 35 kg plutonium was produced in the 1990s and early 200s the reactor was restarted in 2013 but operated only intermittendly. North Korea also builds an experimental light water reactor with 100 MWth. In 2010 North Korea also revealed the existence of an uranium enrichment program and a seemingly operating 2000-centrifuge enrichment plant to US scientists. Estimating the separative work of the centrifuges based on information about technology transfers to and from North Korea it is possible to calculate a hypothetical production rate for Highly Enriched Uranium (HEU). However, such estimates are highly uncertain as it is not known if a second plant exists and since when the revealed plant is operating and at which capacity level. Additionally, estimating uranium enrichment production rates does depend heavily on the assumption about the enrichment and depletion level, the cascade scheme, on the amount of raw material available and on the timescale. Together with the uncertainties about the North Korean weapon design and the amount of fissile material used per weapon, estimates vary considerably from 10 up to 60 nuclear weapons in the North Korean arsenal. Some consideration will be also given to the availability of other nuclear weapon relevant materials such as tritium, lithium-6, and deuterium.