The National Data Centre Preparedness Exercise NPE 2019
Scenario design and expert technical analyses

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The National Data Centre Preparedness Exercise NPE 2019
Scenario design and expert technical analyses

NPE scenarios are partially simulated potentially CTBT relevant cases (often real waveform events combined with simulated RN Evidence)

NPE shall improve

- Analysis procedures
- Data products
- Communication routines between experts
- Merging of different kind of information
- … and scientists from various disciplines

Scenario Design NPE 2019 – An Italian-German collaboration

- Storyline and radionuclide scenario invented by colleagues from ENEA, Bologna
- Several meetings (at margins of SnT, WGB, INGE) to develop details
- Forward ATM for RN concentrations by German NDC
- Organizational issues and website managed by German NDC
- First request of Expert Technical Analysis during NPE 2019

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The details of the scenario storyline of NPE 2019 are still confidential!

Toledo, Spain, designated venue of NDC Workshop 2020

The original plan was to disclose the NPE scenario and to discuss results at the NDC Workshop to be held 14-17 April in Toledo Spain…

…because of the Covid-19 situation the Workshop was cancelled.

Together with our Italian colleagues and the CBT section at the PTS we will consider a suitable occasion for exchange on the NPE 2019 results.

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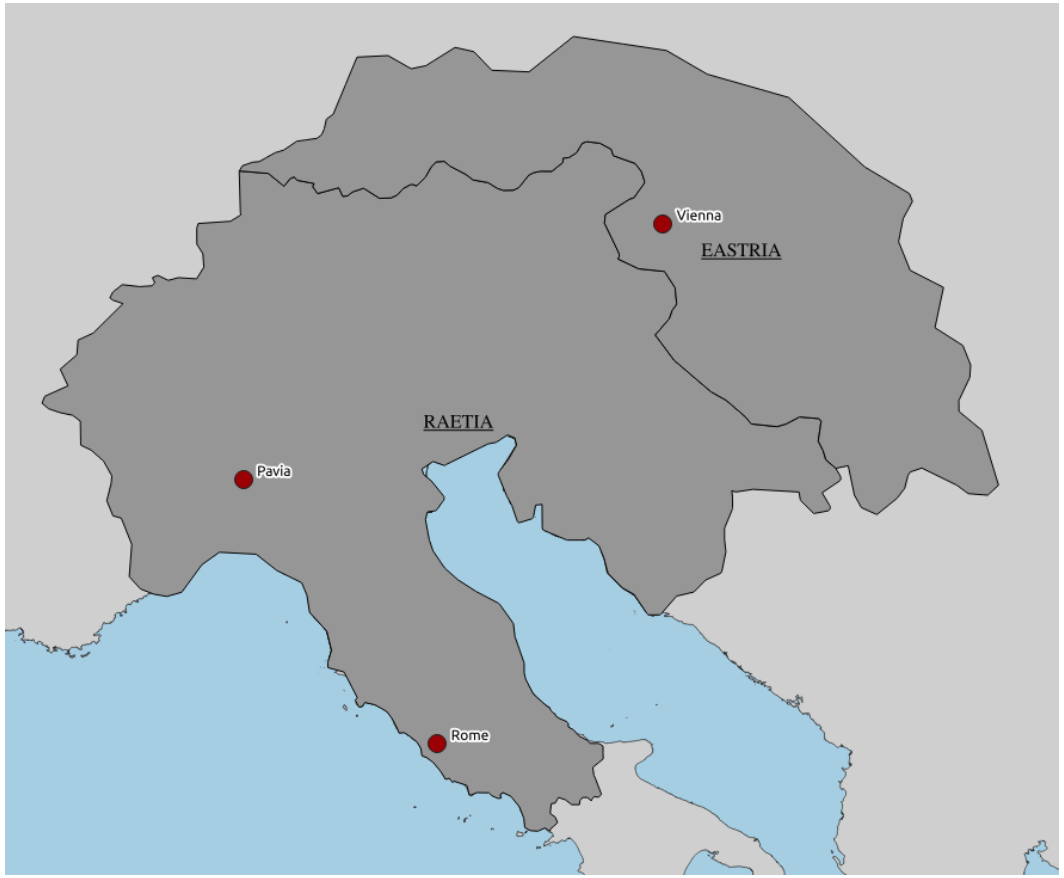
ANNOUNCEMENT 30 July 2019:

The national nuclear safety authority of the state of RAETIA released the following public announcement.

"An accident at TRIGA reactor facility located in Pavia, RAETIA, has occurred this morning 30th July 2019.

We are expecting some small release of radioactive isotopes, but well below the hazardous limit for human health. A dedicated monitoring system has been activated around the facility and in the neighbouring in order to monitor the radioactivity in the air.

There is no need to activate any emergency procedures for the population neither any closure of schools and public areas is required"



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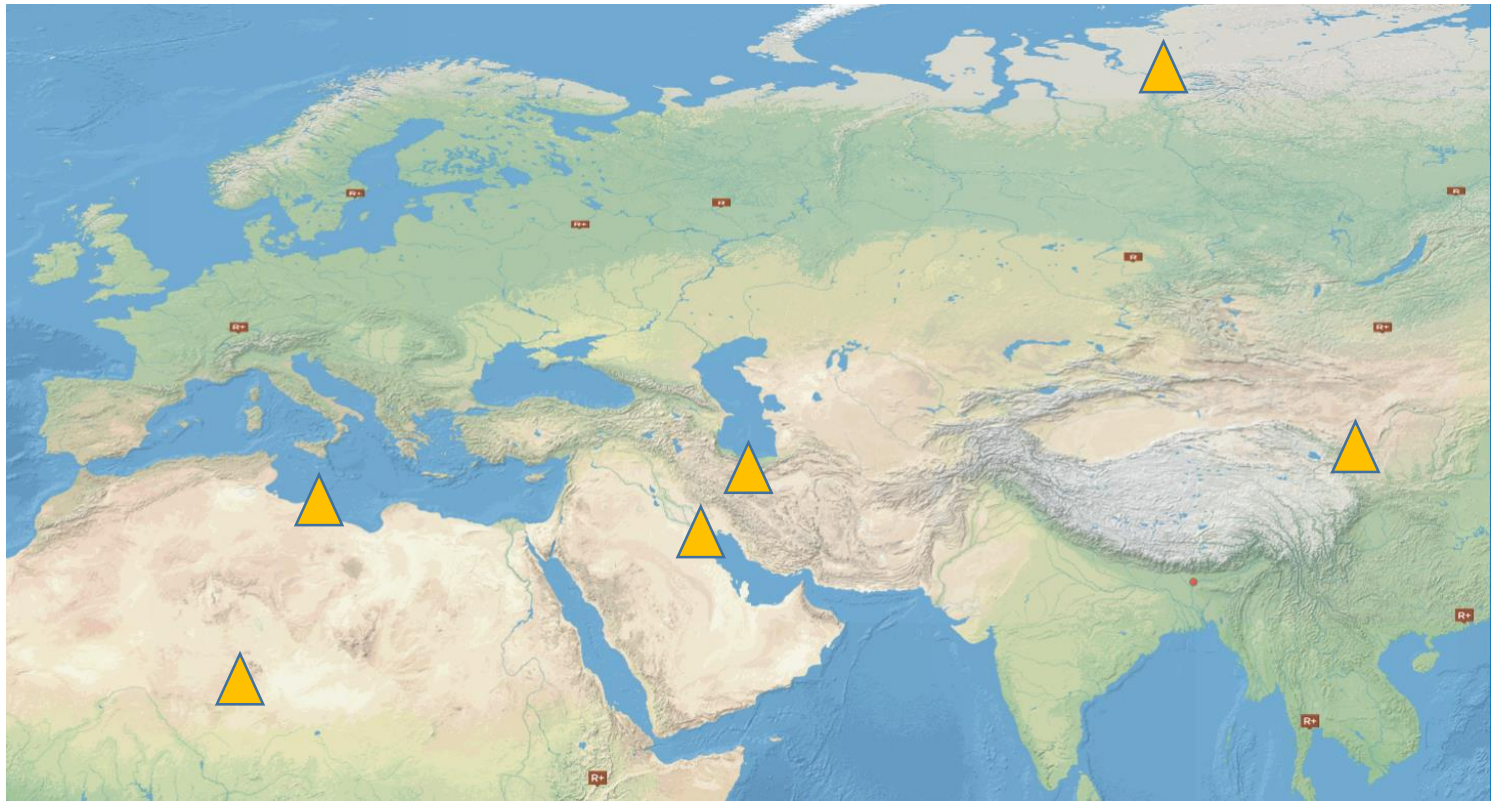
Particulate RN detections

After the announced reactor accident there were widespread particulate radionuclide detections reported of

Ba-140
La-140
Cs-134
Cs-137

At stations

RN 41, 40, 48, 36, 55, 21



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There were noble gas measurements at DEX33 Schauinsland of

Xe-133
Xe-135
Xe-131m

With kind of ambigouus isotopic ratios

And a tiny fraction of Xe-133 at RN 48

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Only few events in central Europe in the SEL For 29-31 July 2019

Additional regional seismic exercise data for further event surch and discrimination was provided in February 2020 as last stage of the exercise.

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Expert Technical Analysis (ETA) Request

Eastria has provided national NPE2019 radionuclide measurements to the IDC and requests assistance with an Expert Technical Analysis to identify potential sources. Within the request

1. Backward Atmospheric transport modelling for the given samples
2. Search for (real) waveform events in the region of potential origin including events not yet included in IDC SEL/REB products.
3. Characterisation of the isotopic composition and assessment of possible connection to other scenario samples

+++EXERCISE SCENARIO, SIMULATED CONCENTRATIONS BASED ON FICTITIOUS FORWARD ATM +++

The virtual sampling was performed in the city of Vienna, EASTRIA, at 48.24 degree northern latitude and 16.42 degree eastern longitude. Sampling time is 24 hours for all samples.

The national particulate sampling system has a MDC of about 50 microBq/m³ The national experimental noble gas system has MDC values about 1 mBq/m³.

In the particulate sample with collection stop August 2nd 2019 - 9:00 UTC among others (natural background) the following isotopic activity concentrations were detected:

Cs-137	Cs-134	I-131	La-140	Ba-140
0.5 mBq/m³	2.1 mBq/m³	0.06 mBq/m³	1.2 mBq/m³	1 mBq³

The noble gas system obtained the following measurements, all activity concentration values are given in mBq/m³:

Collection stop	Xe-133	Xe-135	Xe-133m	Xe-131m
2019/08/02 6 UTC	52	15	3.5	1.5
2019/08/03 6 UTC	121	7	6.6	
2019/08/04 6 UTC	24			
2019/08/05 6 UTC	6.4			
2019/08/06 6 UTC	6.7			
2019/08/07 6 UTC	93		2.5	1.6
2019/08/08 6 UTC	22			

+++EXERCISE SCENARIO, SIMULATED CONCENTRATIONS BASED ON FICTITIOUS FORWARD ATM +++

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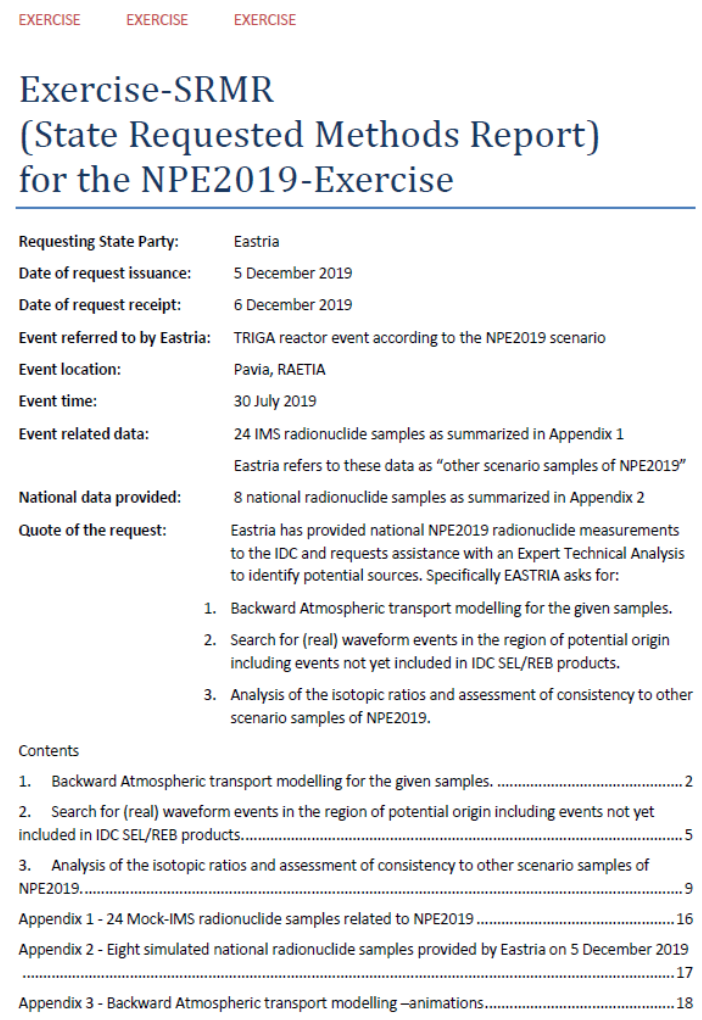

EXERCISE EXERCISE EXERCISE

Exercise-SRMR
(State Requested Methods Report)
for the NPE2019-Exercise

Requesting State Party:	Eastria
Date of request issuance:	5 December 2019
Date of request receipt:	6 December 2019
Event referred to by Eastria:	TRIGA reactor event according to the NPE2019 scenario
Event location:	Pavia, RAETIA
Event time:	30 July 2019
Event related data:	24 IMS radionuclide samples as summarized in Appendix 1 Eastria refers to these data as "other scenario samples of NPE2019"
National data provided:	8 national radionuclide samples as summarized in Appendix 2
Quote of the request:	Eastria has provided national NPE2019 radionuclide measurements to the IDC and requests assistance with an Expert Technical Analysis to identify potential sources. Specifically EASTRIA asks for: 1. Backward Atmospheric transport modelling for the given samples. 2. Search for (real) waveform events in the region of potential origin including events not yet included in IDC SEL/REB products. 3. Analysis of the isotopic ratios and assessment of consistency to other scenario samples of NPE2019.

Contents

IDC results on ETA request

- Quick response (within 14 days) with an „Exercise States Requested Methods Report“
- Sticked closely to the specific questions given in the request
- Performed suitable ATM for the additonal radionuclide data from Vienna
- Radionuclide analysis difficult (partially due to some flaws in the RN scenario data)
- Considered waveform events listed in IDC products

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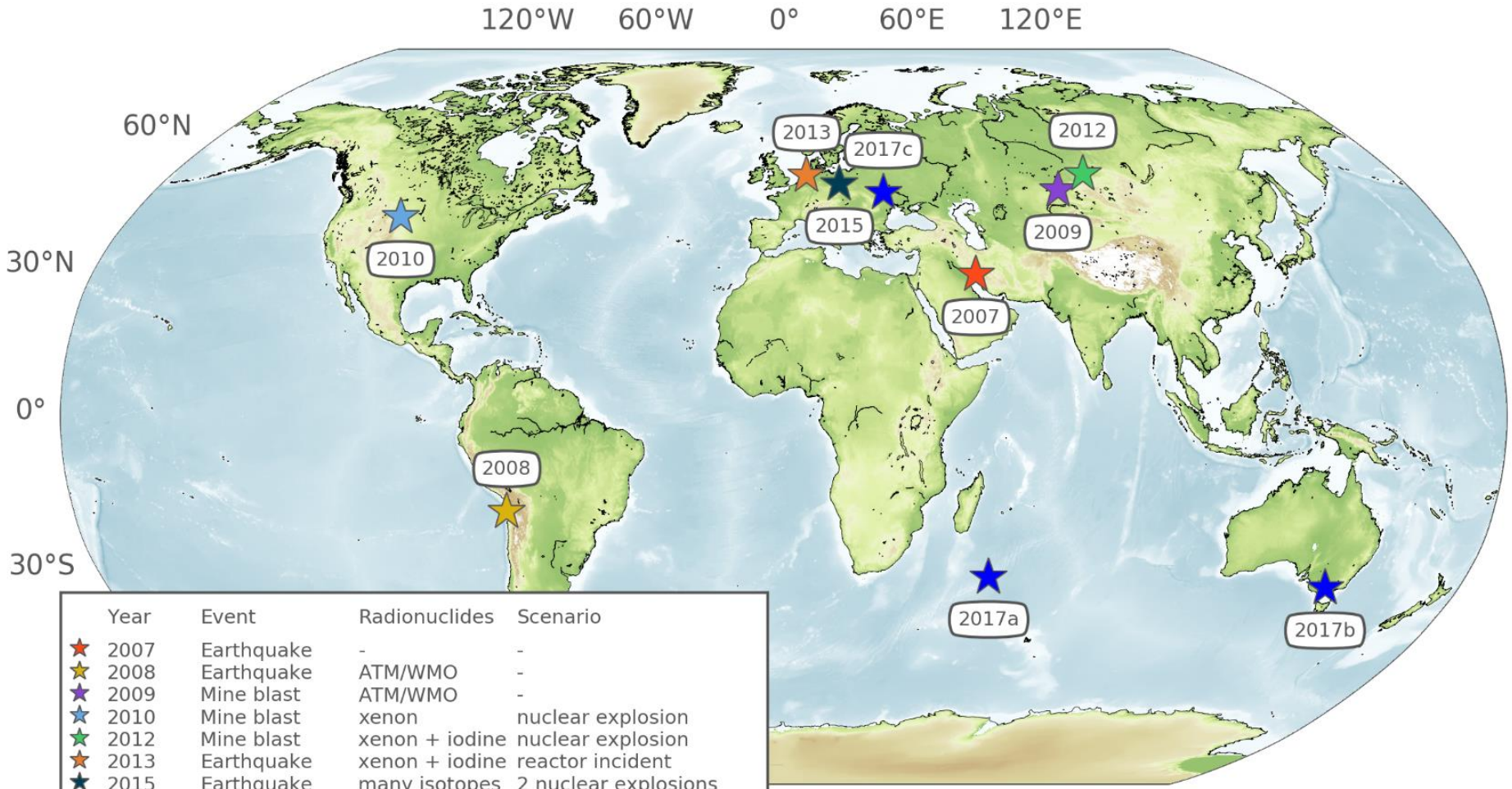

	Year	Event	Radionuclides	Scenario
★	2007	Earthquake	-	-
★	2008	Earthquake	ATM/WMO	-
★	2009	Mine blast	ATM/WMO	-
★	2010	Mine blast	xenon	nuclear explosion
★	2012	Mine blast	xenon + iodine	nuclear explosion
★	2013	Earthquake	xenon + iodine	reactor incident
★	2015	Earthquake	many isotopes	2 nuclear explosions
★	2017a	Earthquake	xenon (γ)	-
★	2017b	-	xenon (β/γ)	-
★	2017c	Explosion	particulate	-

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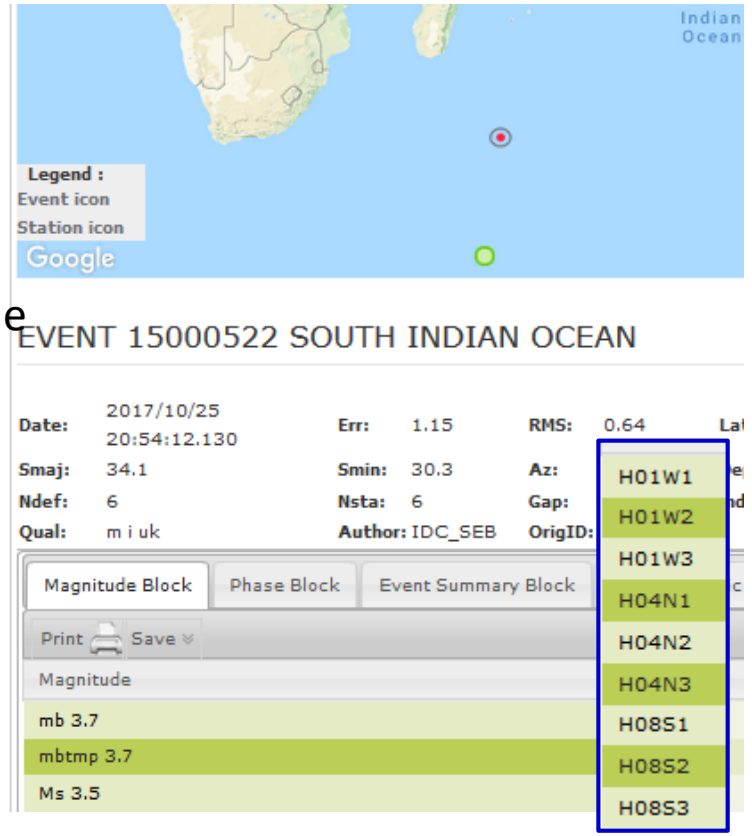
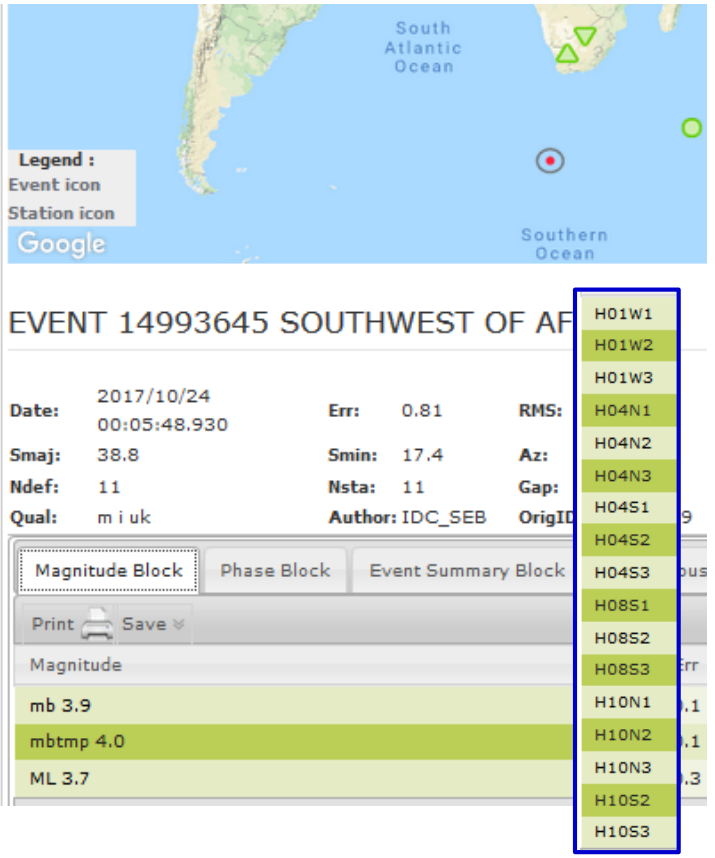
NPE 2017 - Task A – candidate SHI Events

4 Level C detections at FRX29 end of Oct 2017.

Task to search for an SHI Event with H-phase arrivals at at least three hydroacoustic stations in the source region.

As the connection of SHI-Event and FRX29 xenon detection is hypothetical,
there is no *correct* solution which event to chose…





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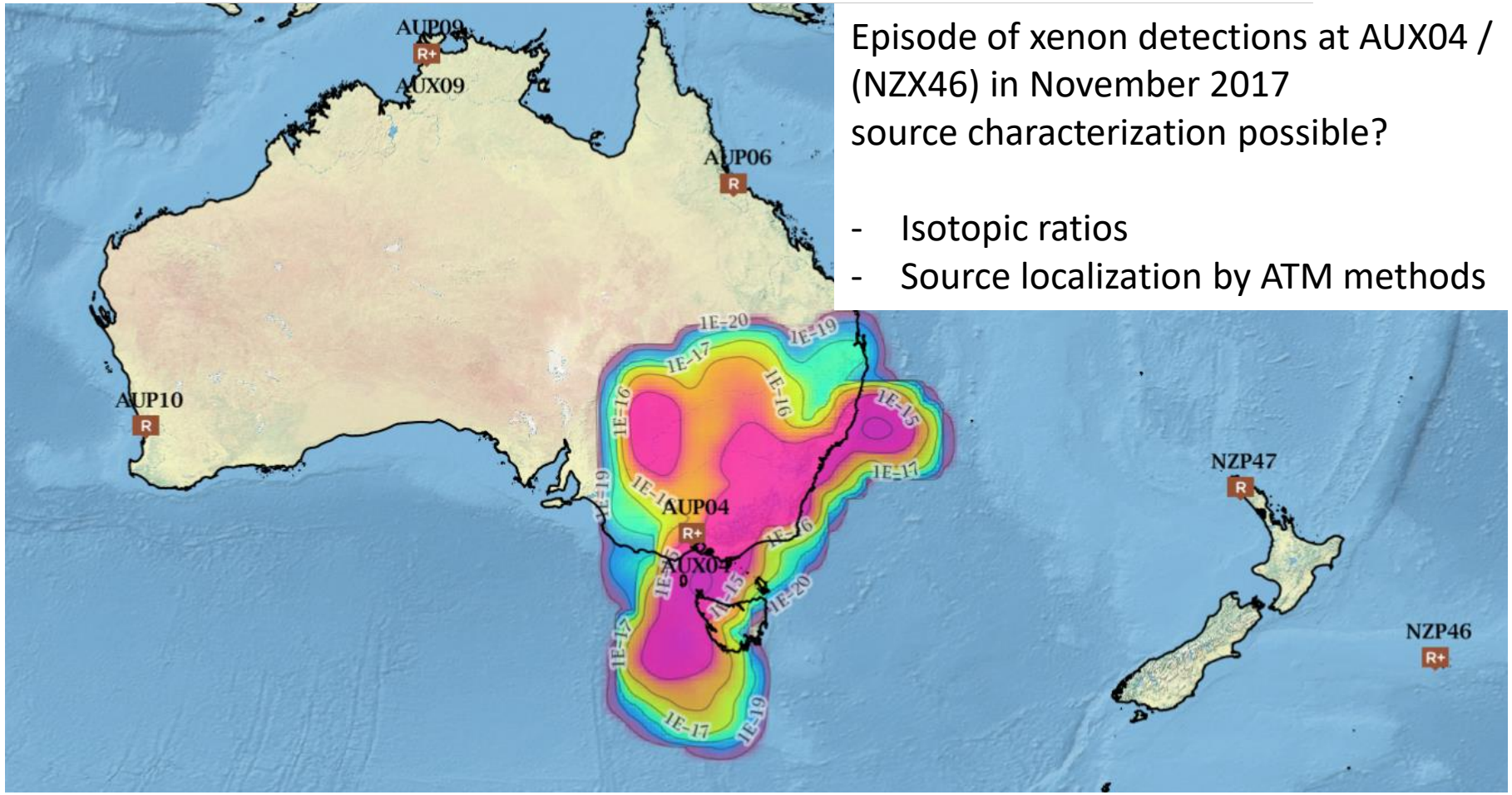
NPE 2017 - Task B – Xenon background characterization



Episode of xenon detections at AUX04 / (NZX46) in November 2017
source characterization possible?

- Isotopic ratios
- Source localization by ATM methods

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NPE 2017 – Task C – Particulate RN / seismo-acoustic

Level 5 Detection at SEP63 early Oct 2017

SHI Event with Infrasound phases (and some seismic phases) in the source region

I26DE	2017/09/26 19:02:31.050	49.4058	28.4999	5	0.0	
I31KZ	2017/09/26 19:43:43.830	49.4414	28.4631	5	0.0	
I37NO	2017/09/26 19:59:27.970	49.4201	28.4961	9	0.0	mb 3.2 mbtmp 3.4
I43RU	2017/09/26 21:39:57.820	49.4701	28.5323	4	0.0	
I46RU	2017/09/26 22:14:43.930	49.4972	28.6031	9	0.0	ML 2.5 mb 2.9 mbtmp 3.2 Ms 3.6
I48TN	2017/09/27 02:31:06.640	49.4298	28.5576	8	0.0	ML 2.5 mbtmp 3.5
	2017/09/27 05:08:33.370	49.4259	28.5622	6	0.0	

ATM for other ruthenium detections at other IMS stations and in (national) networks in South-East Europe excluded the explosions as real source.

Signals from strongest explosion at 26 Sep 19:59 were registered at 6 IMS Infrasound stations.

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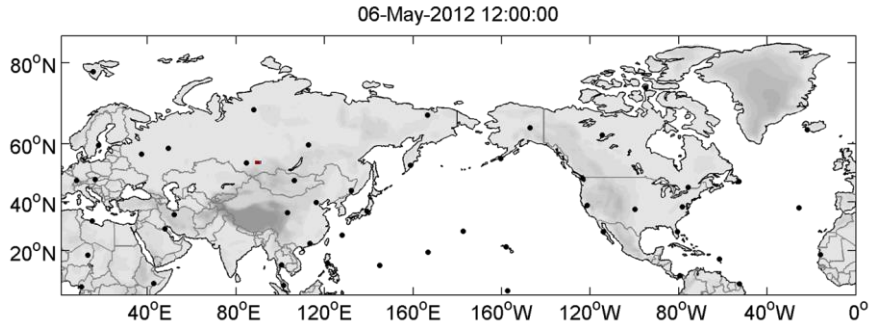
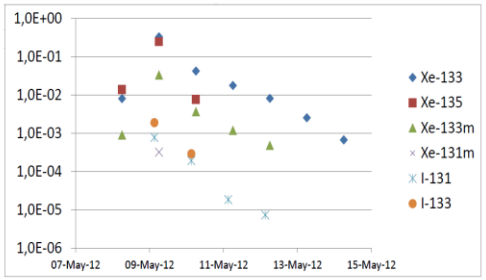
NPE2012

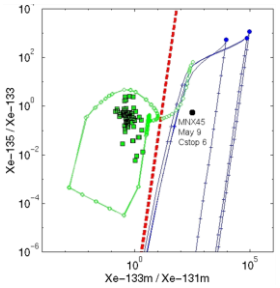
Scenario

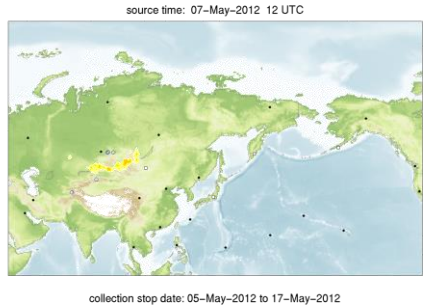


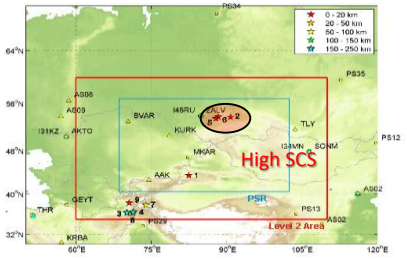
- event selection
- forward ATM
- concentrations



Analysis







- isotopic ratio timing
- backward ATM
- event identification
- Mining explosion

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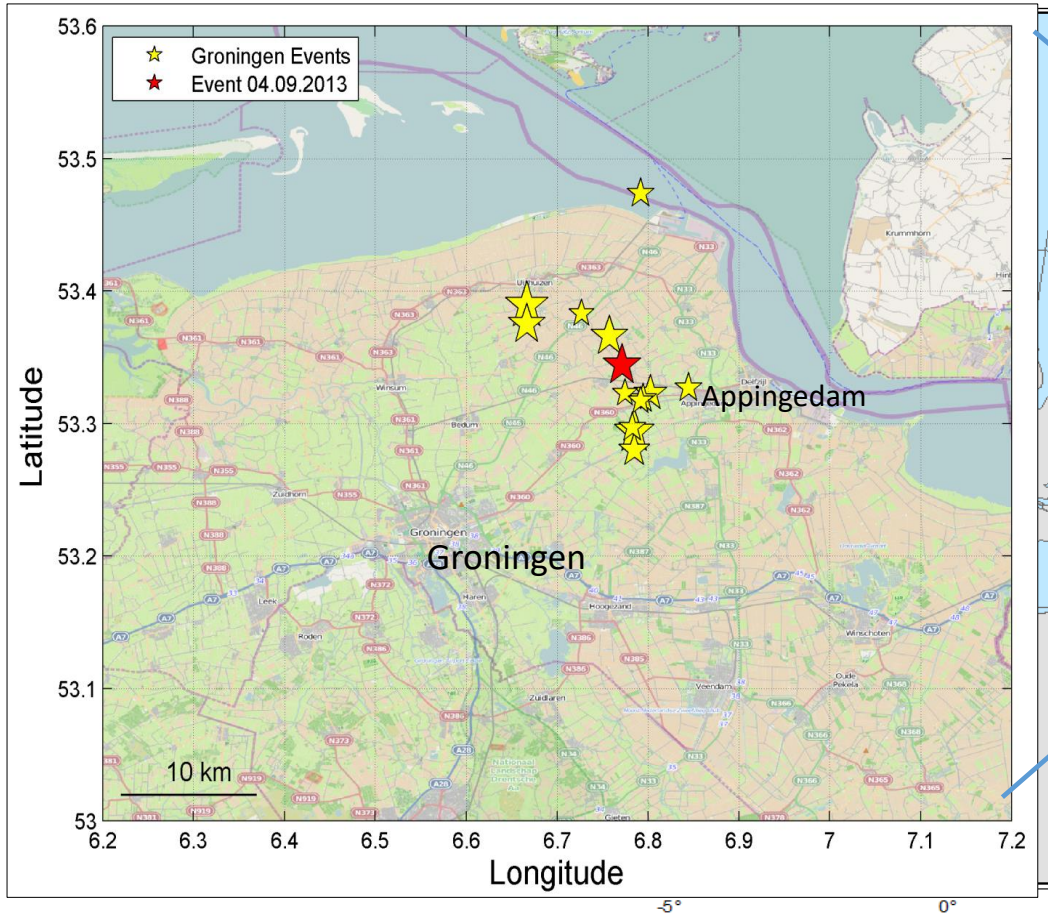
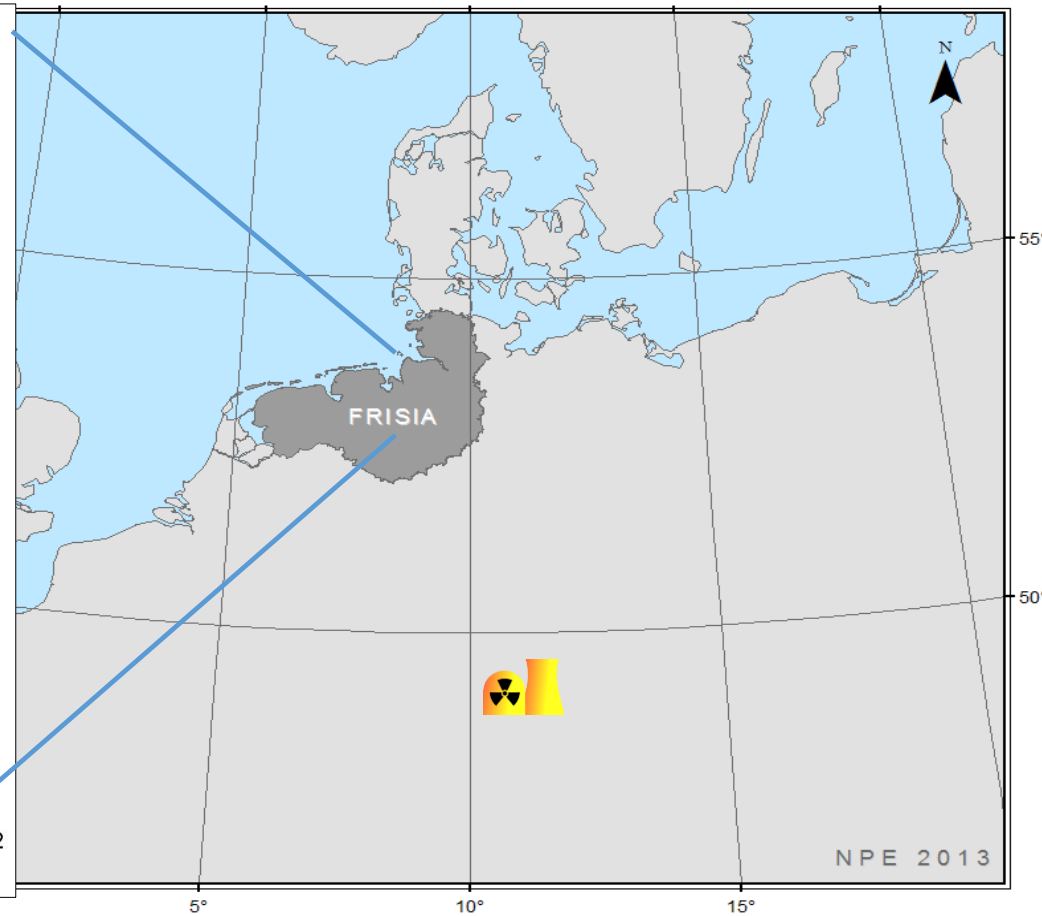
NPE 2013 - Challenging false positive scenario:
Induced earthquake in gas field in FRISIA, reactor incident in neighbour state





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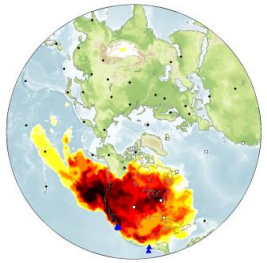
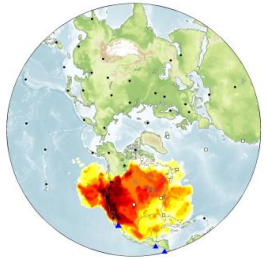
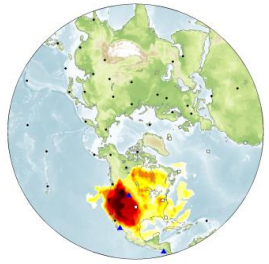
NPE 2010 – Focus „Multitechnology“



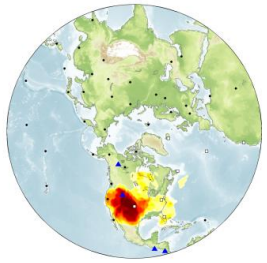
21 Oct



22 Oct



23 Oct

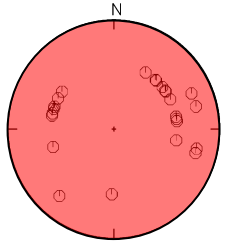


24 Oct

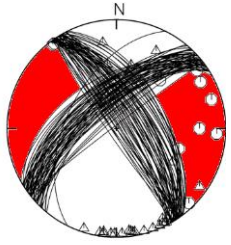
Open pitch mining explosion Wyoming, Noble gas release simulated

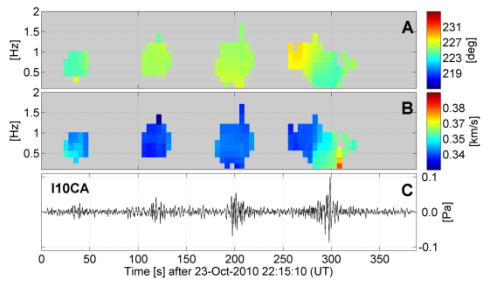
ATM

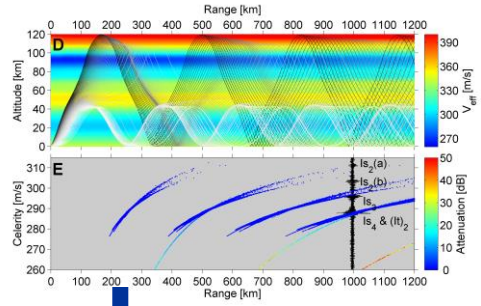
Explosion



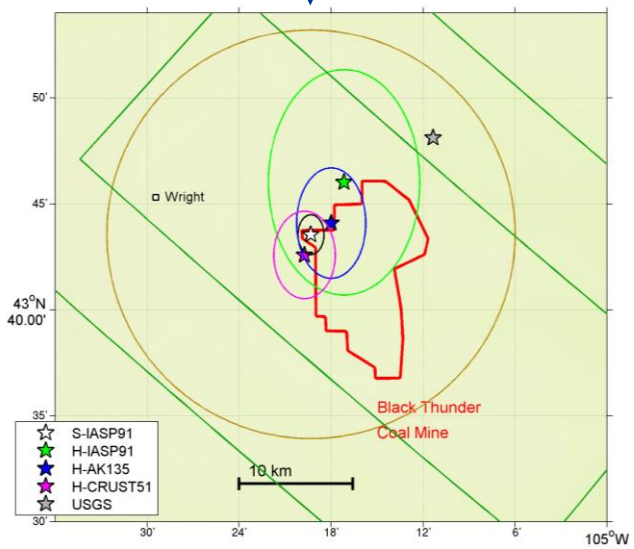
Earthquake







Infrasound



OSI inspection area

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Abstract

For detection of non-compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT) the global International Monitoring System (IMS) is being built up and nearly complete. The IMS is designed to detect and identify nuclear explosions through their seismic, hydroacoustic, infrasound, and radionuclide signature. The IMS data are collected, processed to analysis products, and distributed to the signatory states by the International Data Centre (IDC) in Vienna. The member states themselves may operate National Data Centers (NDC) giving technical advice concerning CTBT verification to their government. NDC Preparedness Exercises (NPE) are regularly performed to practice the verification procedures for the detection of nuclear explosions in the framework of CTBT monitoring. The NPE 2019 scenario was developed in close cooperation between the Italian NDC-RN (ENEA) and the German NDC (BGR). The fictitious state RAETIA announced a reactor incident with release of unspecified radionuclides into the atmosphere. Simulated concentrations of particulate and noble gas isotopes at IMS stations were given to the participants. The task was to check the consistency with the announcement and to serach for waveform events in the potential source region of the radioisotopes. In a next step, the fictitious neighbour state EASTRIA provided further national (synthetic) measurements and requested assistance from IDC with so called Expert Technical Analysis (ETA) about the origin of those traces. The presentation shows aspects of scenario design, event selection, and forward amospheric transport modelling as well as radionuclide and seismological analyses.

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