O3.6-547

# Radioxenon Source Localization: A Comparison of the Swedish Radioxenon Array and the CTBT International Monitoring System

Sofie Liljegren[1], Sofia Brander[2], Ole Ross[3]

[1]Swedish Defence Research Agency (FOI)
[2]Federal Office for Radiation Protection (BFS)
[3]Federal Institute for Geosciences and Natural Resources (BGR)

09 September 2025

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O2.4-123

## INTRODUCTION

- Large release of xenon in November and December 2022.
- Seen both in IMS stations and the Swedish Qb array.
- Some of the highest xenon levels measured in the Qb array.

## AIM

- Identify source site candidates.
- Estimate source term.
- Difference between IMS and array for source site identification.

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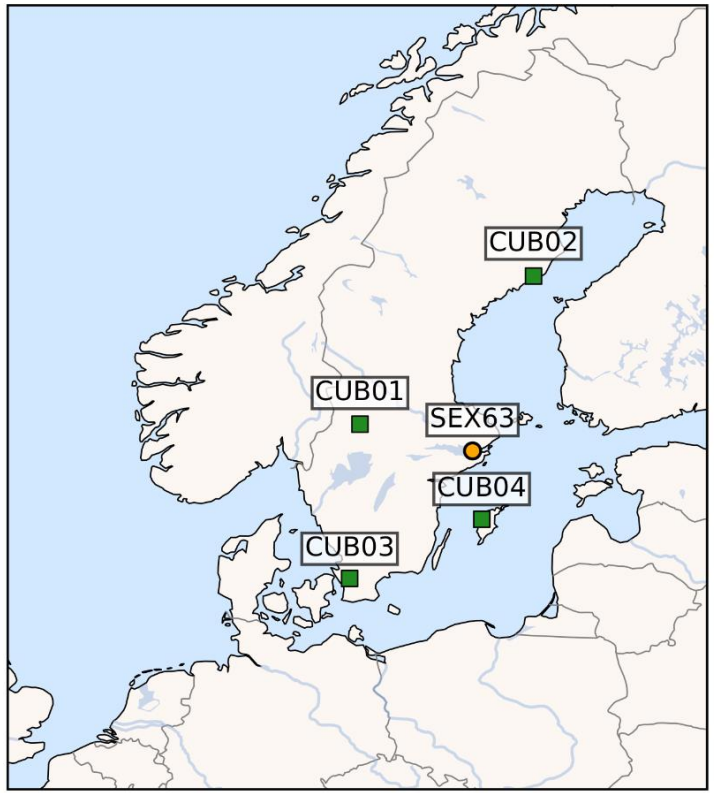
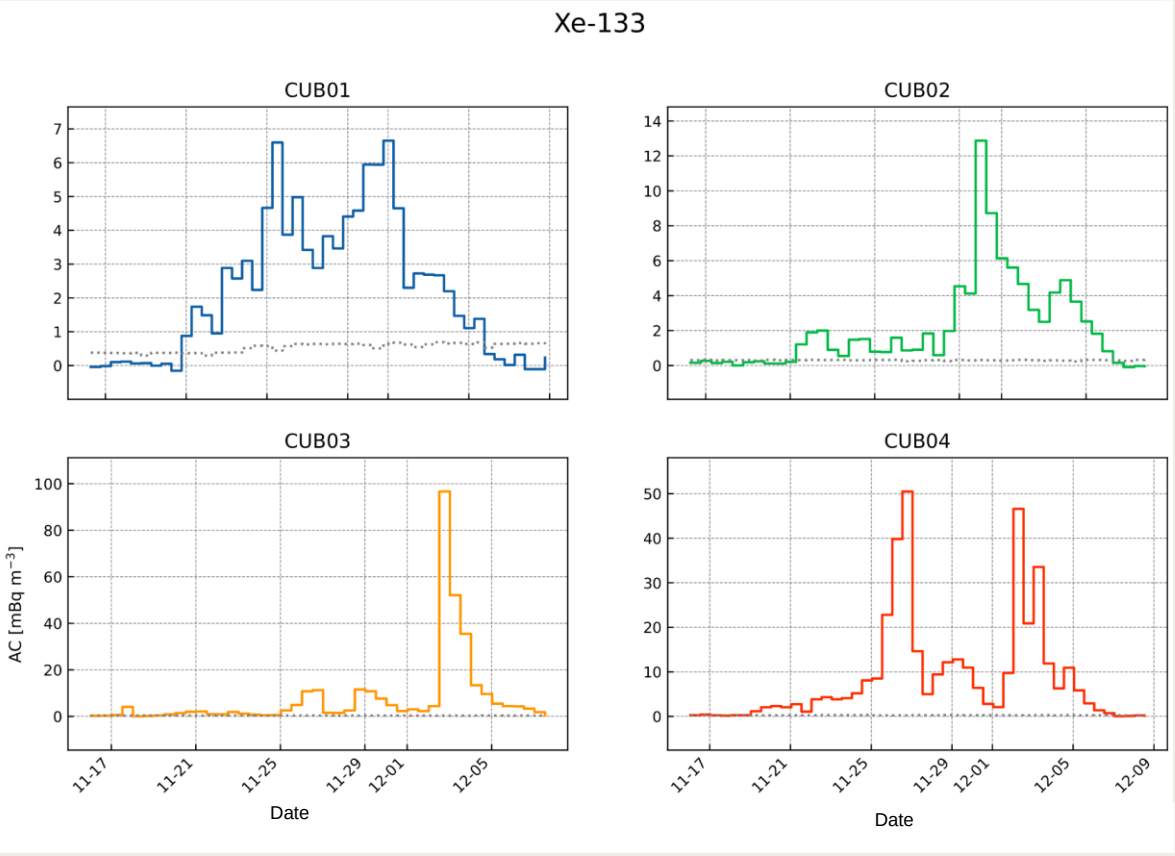
## Qb ARRAY OBSERVATIONS

Observations seen in the local Swedish Qb array, which had 4 operational cubes at the time



SnT 2025 CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE

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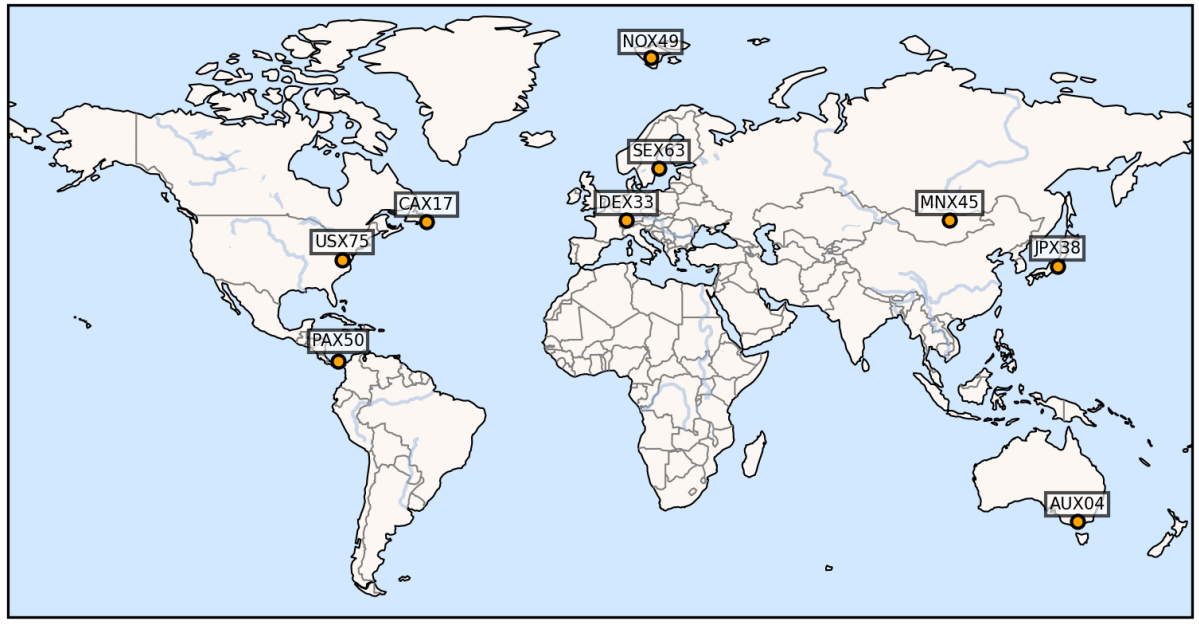
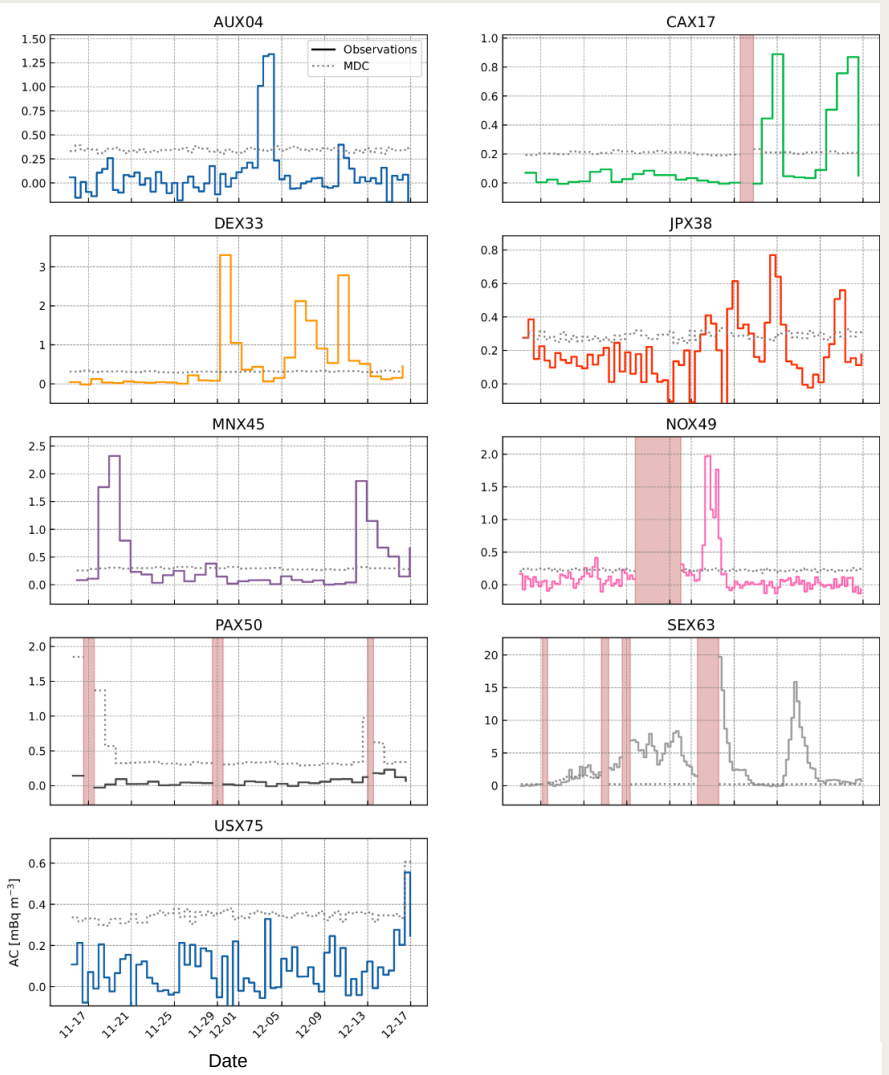
## IMS OBSERVATIONS

C-level samples (anomalously high levels according to CTBT ranking) during this time. NOX49, SEX63 are likely connected to the event, and DEX33, CAX17, JPX38, and MNX45 are potentially connected to the event.

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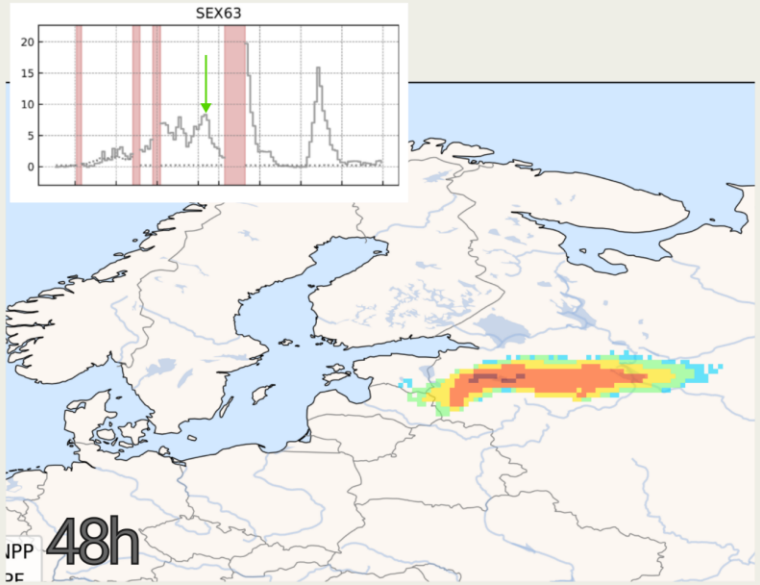
## INITIAL INVESTIGATION



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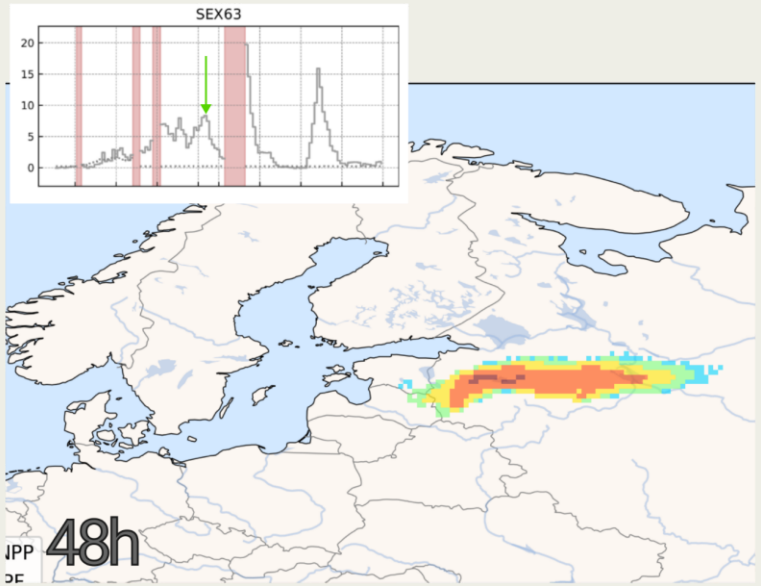


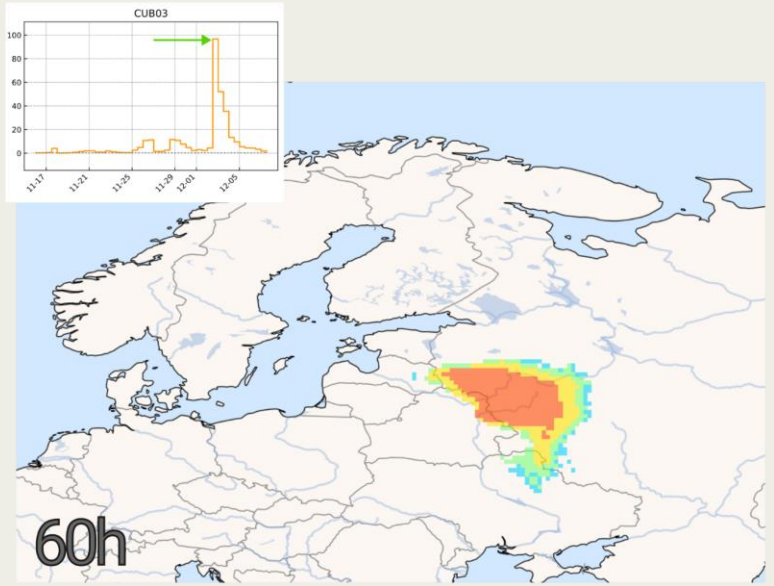


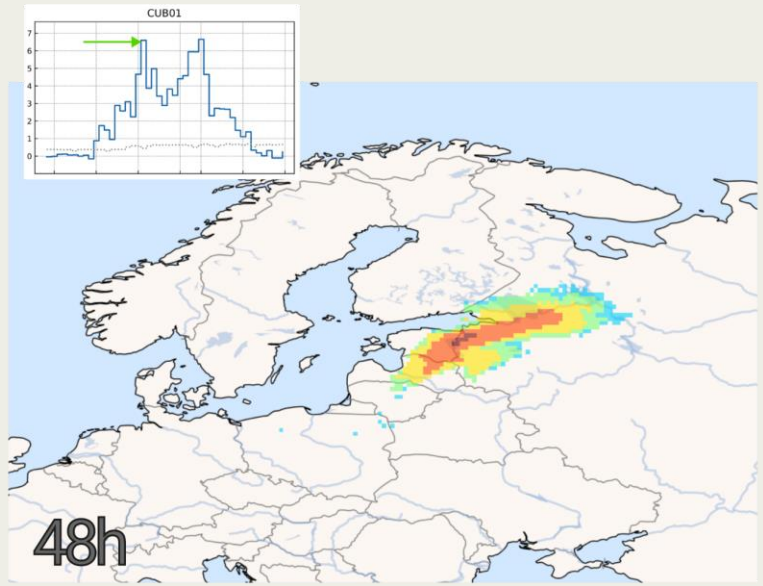


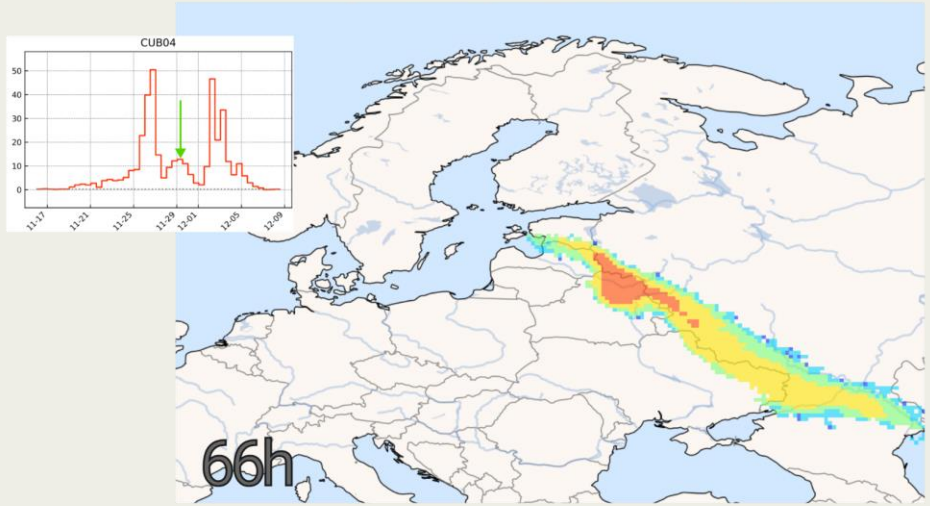


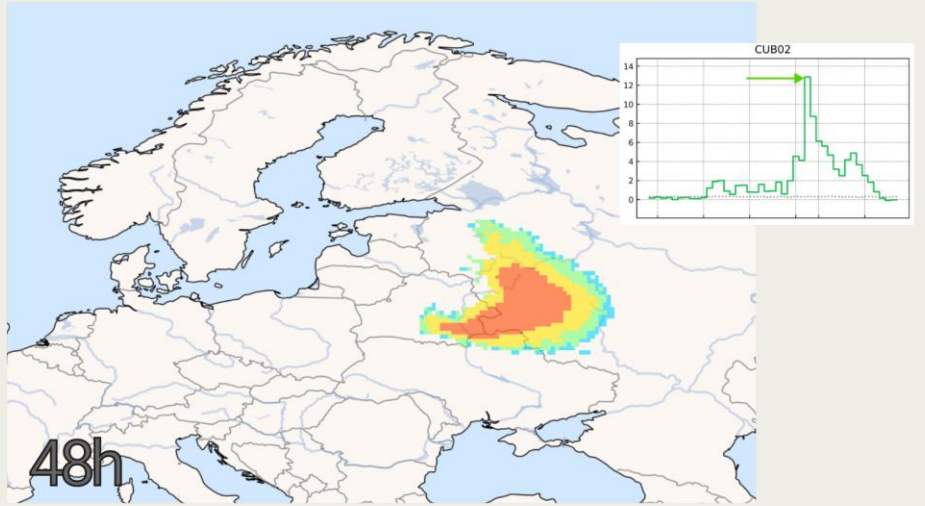


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## INITIAL INVESTIGATION

- All SRS fields from same direction.
- East of Sweden.
- Large release.
- Extended release.
- Plausible that it was one source.

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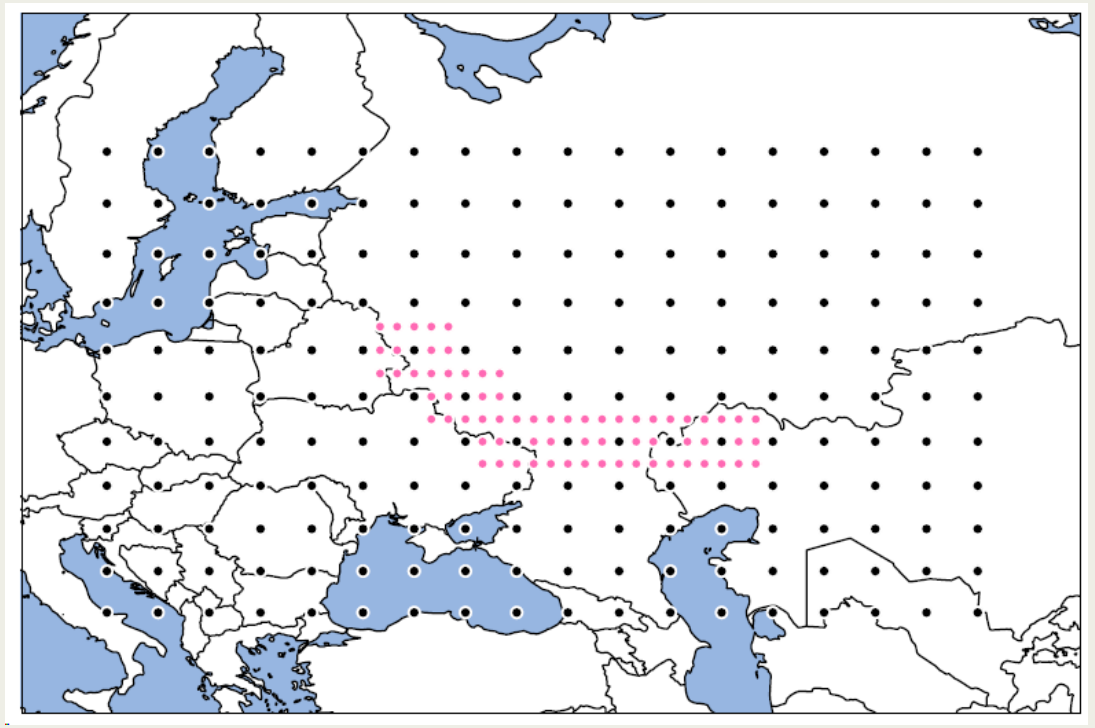
## GRID SETUP

- Constructed a grid over likely source sites.
- Each grid point:
  - 1 forward model per day
  - 24 hour release
  - Find the estimated source term that best reproduce the observations

$$\mathbf{J}(\sigma) = \frac{1}{2}\sum_{i=1}^{d}\left(\ln(\mu_i+\theta) - \ln((\mathbf{H}\sigma)_i+\theta)\right)^2 + \lambda^2\sum_{j=1}^{N}(\sigma_j)^2$$

  - Compare model predictions to measurements
- Find area that might contain the source site.



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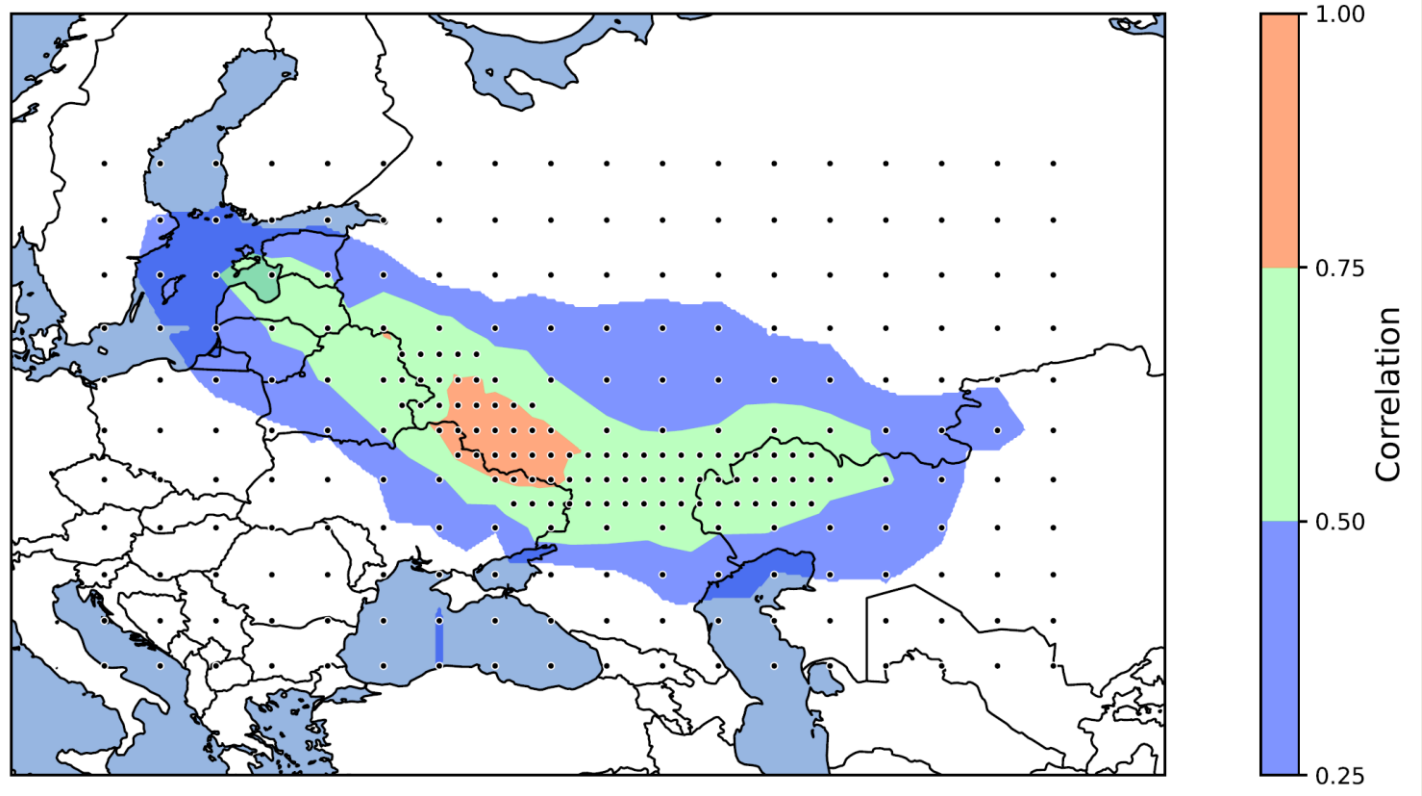
## Qb ARRAY RESULTS




**Spearman correlation** after fitting the grid to the **Qb array observations**.

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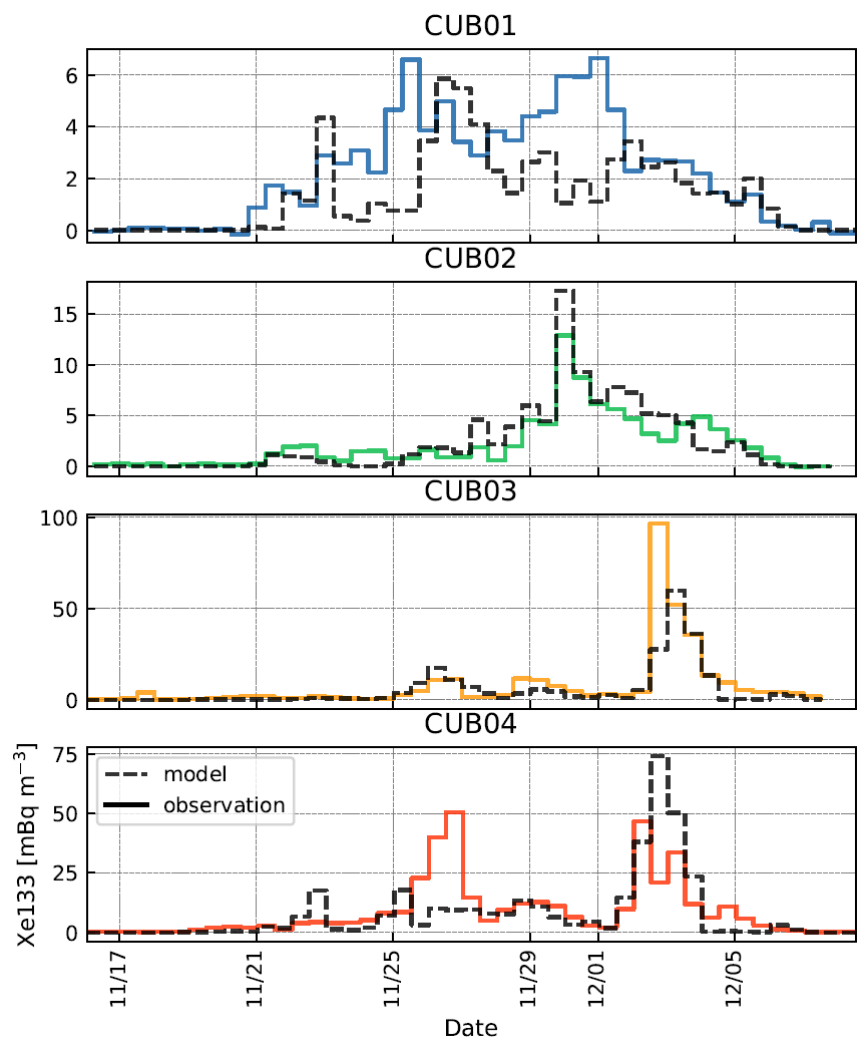
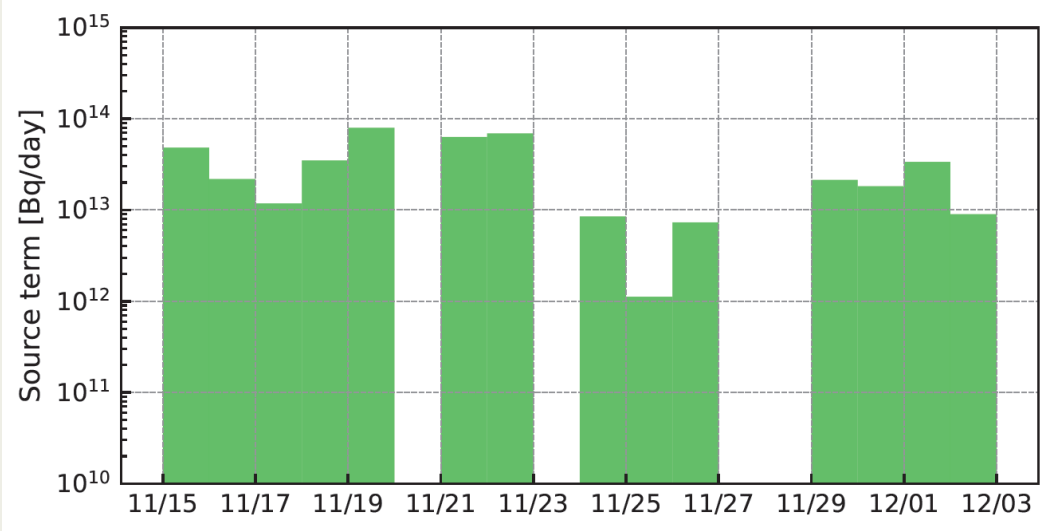
## Qb ARRAY RESULTS




Fit to observations using Kursk NPP as source site.




Source term estimate

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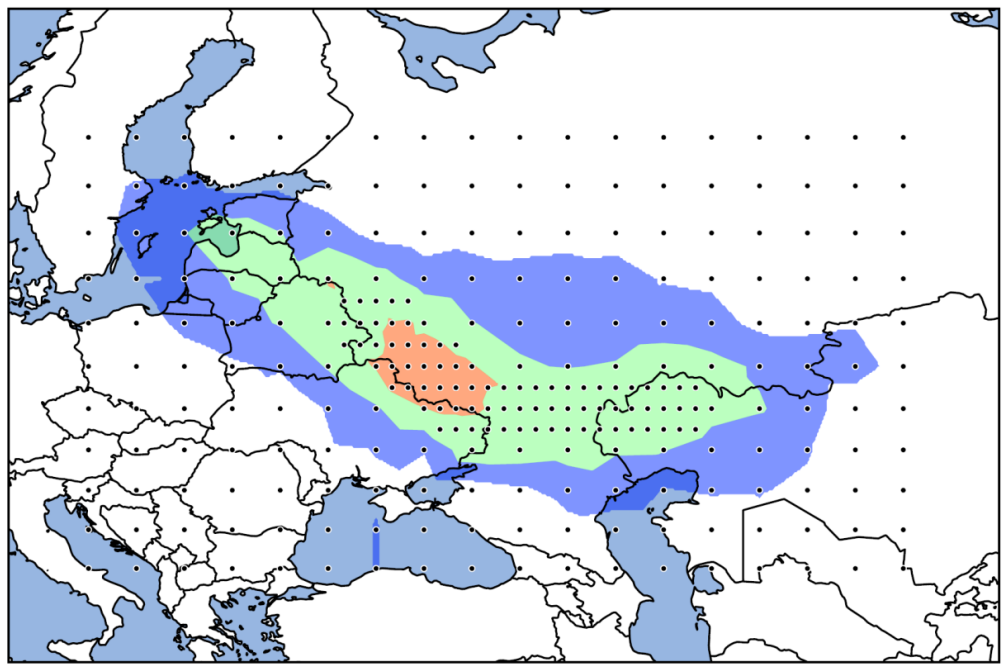
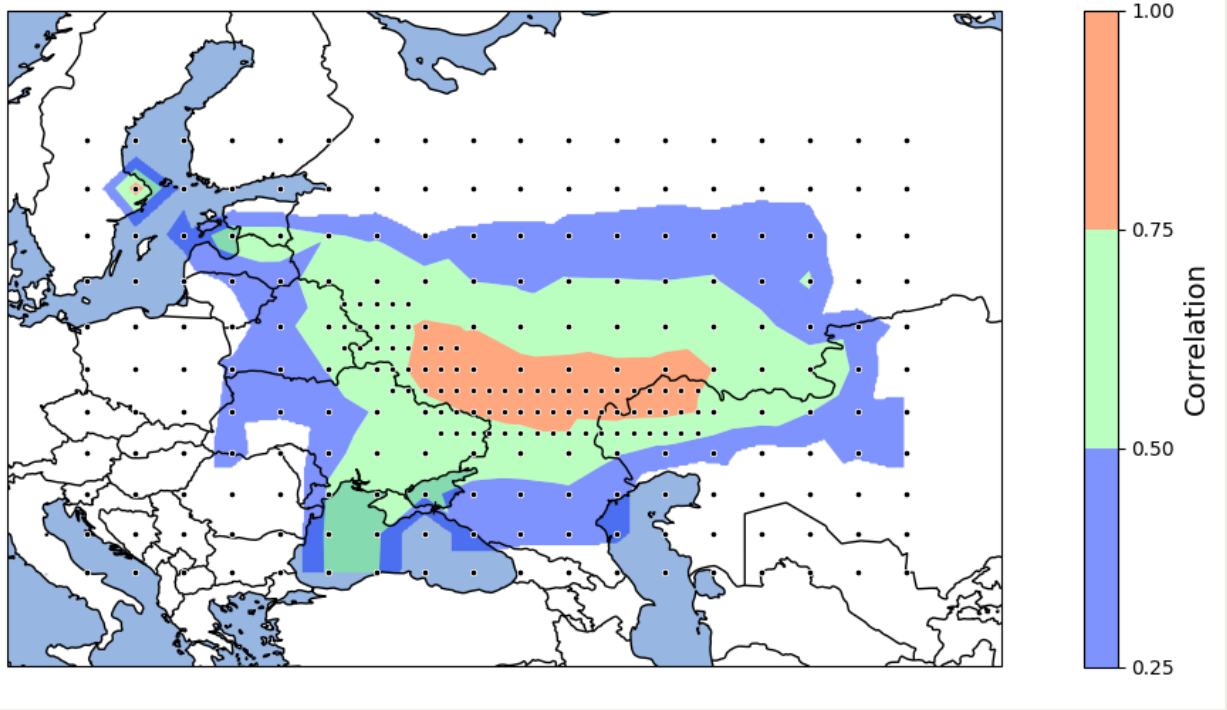
## Qb ARRAY vs IMS RESULTS



Fitting the grid to the
**Qb array observations**.




Fitting the grid to the
**SEX63 observations**.

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## CONCLUSION

- Large xenon release in Nov/Dec 22 seen in both IMS and the Swedish Qb array.
- Interesting case to understand the xenon background
- Showcase the strength of an array vs a single station
- Need high source term, ~1e13 Bq/day