



**Introduction**

The Noble Gas (NG) component of the IMS has considerably grown and improved since the certification of the first noble gas system. Since then, additional noble gas systems were certified in the IMS and are continuously sampling and measuring radioxenon in the atmosphere. During the operation of these systems, a worldwide radioxenon background originating from civilian facilities has been observed, which is composed especially of Xe-133.

This worldwide civilian radioxenon background makes the CTBT verification work of NDCs very challenging. In some regions of the world, the noble gas systems are detecting Xe-133 almost every day. This high radioxenon background is blurring and limiting the detection capability of the noble gas component of the IMS, and thus of CTBT related events. It is thus crucial to understand the radioxenon background observed by each NG station as to allow a better discrimination between potentially CTBT related detections and the detections from the civilian background.

In this study, the radioxenon background detections at CAX17 are used as a benchmark case to test different alternative approaches to the current use of the operational SRS fields provided by the IDC. These approaches are then applied to specific detections at GBX66 for which the radioxenon background source is not well known.

**Methodology**

**Input data**

- Xe-133 observations in the IMS
- Operational SRS fields from the IDC (1° x 1°, 3h for 14 days)

**Fraction of detections explained by specific source term**

- Maximum threshold source term: 10<sup>15</sup> Bq/3h
- For all detections
  - If SRS ≥ Measured concentration / threshold → 1
  - If SRS < Measured concentration / threshold → 0
- Average on all detections
- Maximum on all backward time steps

**Required source term at a specific location**

- Minimum source term for all backward time steps
- Distribution of required source term

**Results CAX17**

- High Xe-133 background (until end of 2016)
- Xe-133 background at CAX17 relatively well-known
- Major Xe-133 contributor was a Medical Isotope Production Facility (MIPF) located about 2000 km west of the system

**1. Observations**

The CAX17 system has been regularly measuring Xe-133 since its installation. The detection rate has since the end of operation of the CRL reactor, at the end of November 2016, significantly decreased. The measurement history for Xe-133 at CAX17 is shown in Figure 1.

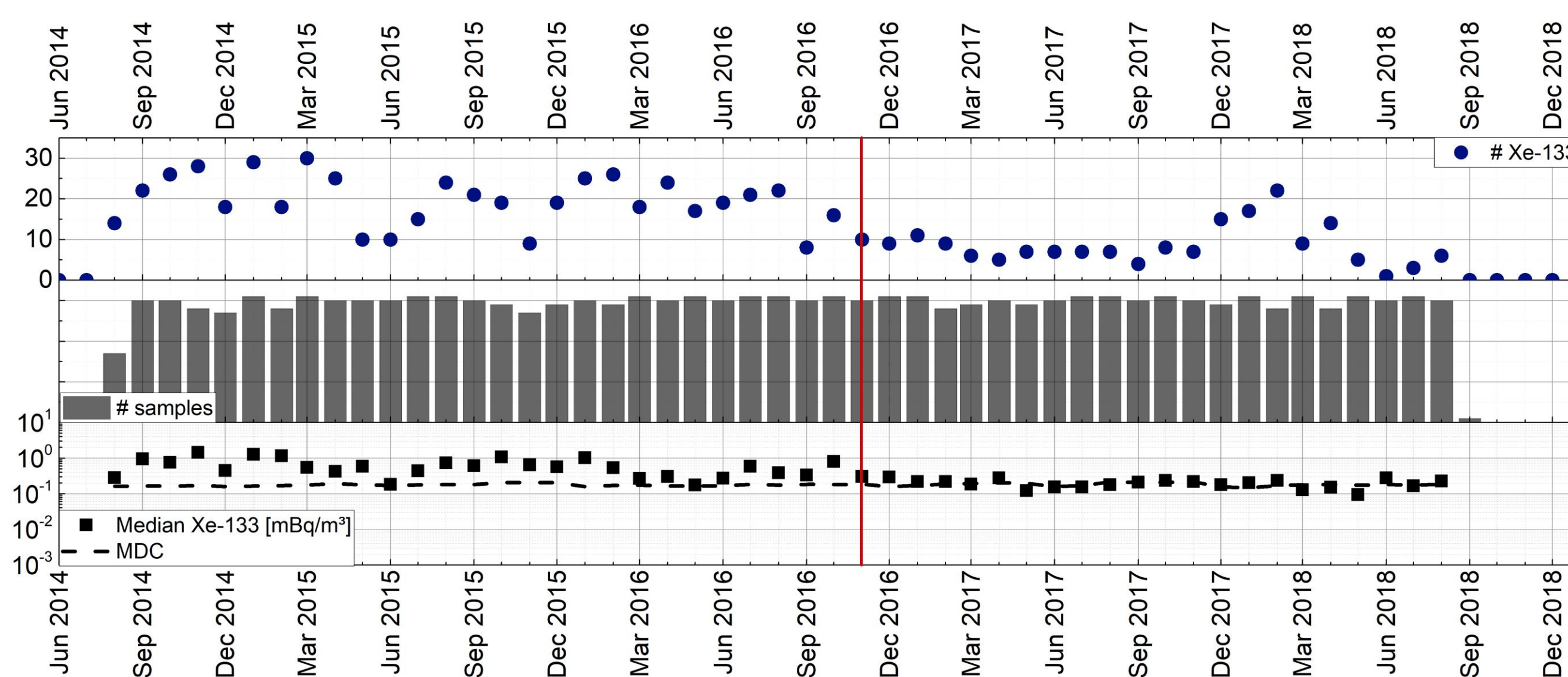


Figure 1 – Monthly history of the CAX17 system: the amount of Xe-133 detection (top), the amount of samples collected (middle) and the median Xe-133 and MDC (bottom).

**2. SRS analysis**

The fraction of detections, in 2015, that can be explained by the previously defined source term is shown for each grid cell in Figure 2. The distribution of the required source term for CRL and the NPPs in Canada are shown in Figure 3. The values are compared to the baseline Xe-133 emissions from Gueibe et al (red dots).

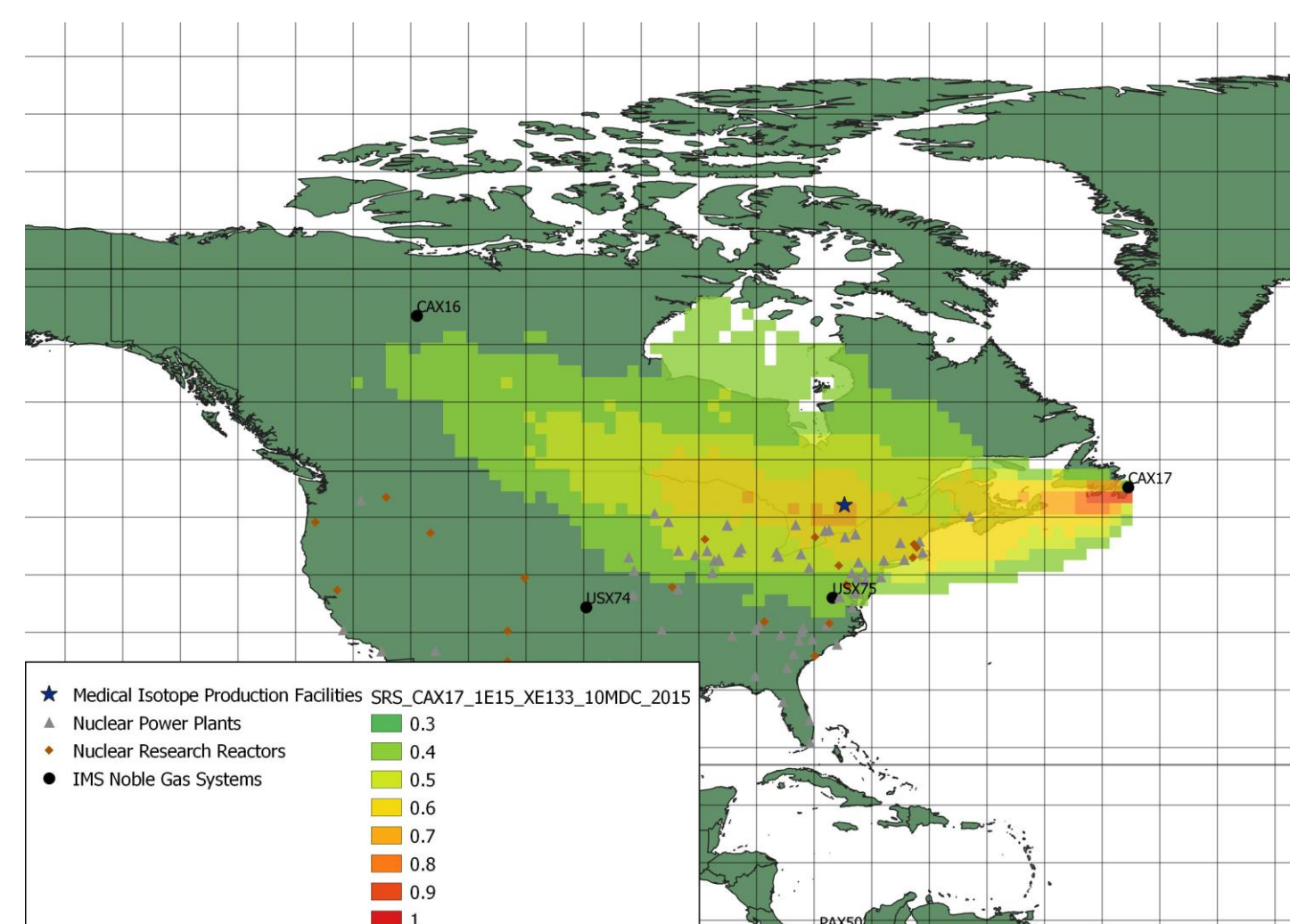


Figure 2 – Fraction of detections explained by a 10<sup>15</sup> Bq/3h source term.

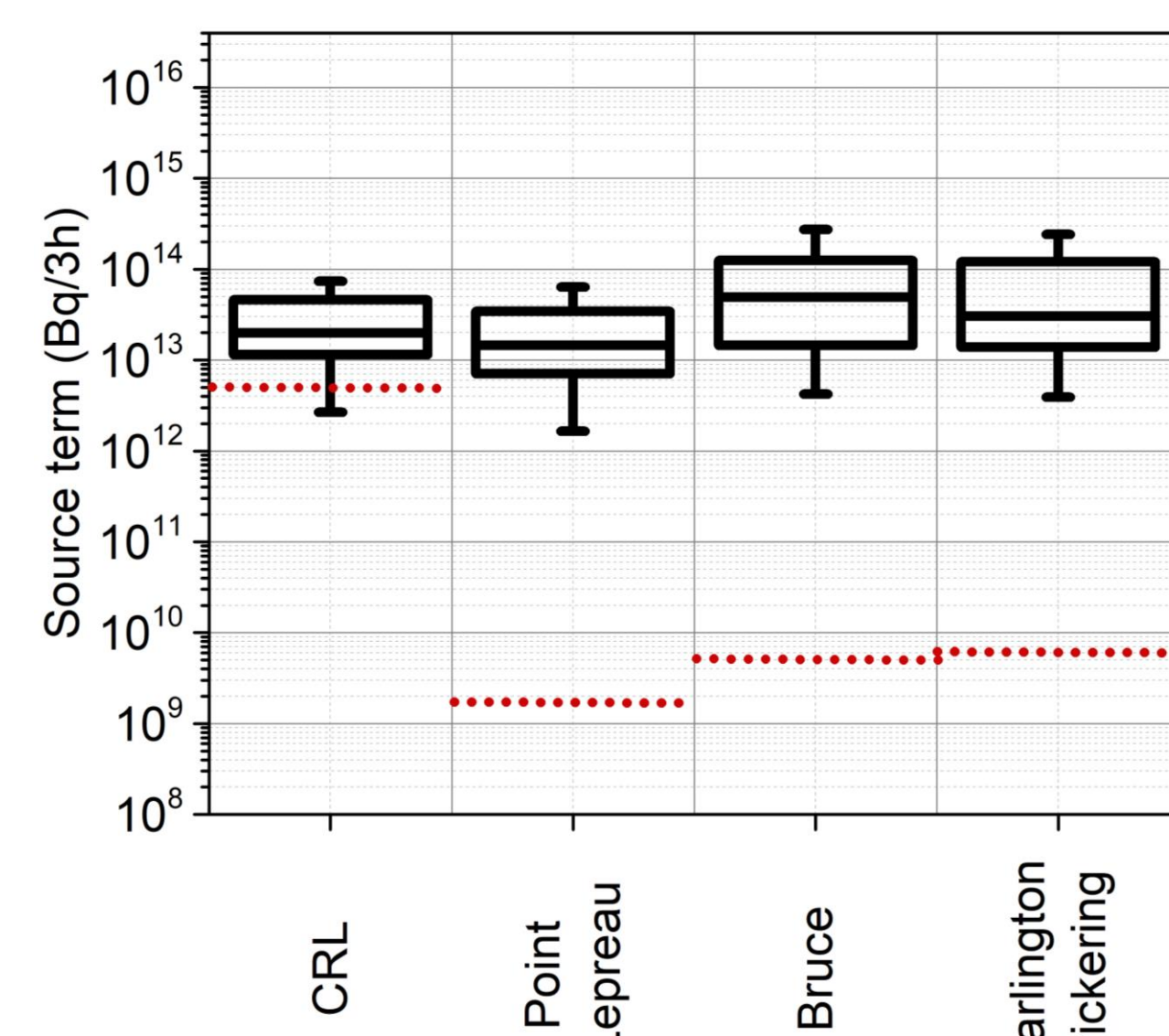


Figure 3 – Distribution of the required source term (red dots are the source terms derived from Gueibe et al.).

**Results GBX66**

- Xe-133 background not well-known

**1. Observations**

The GBX66 system has a relatively low Xe-133 background. However, a period of higher detection rate was observed during 2012. The measurement history for Xe-133 at GBX66 is shown in Figure 4.

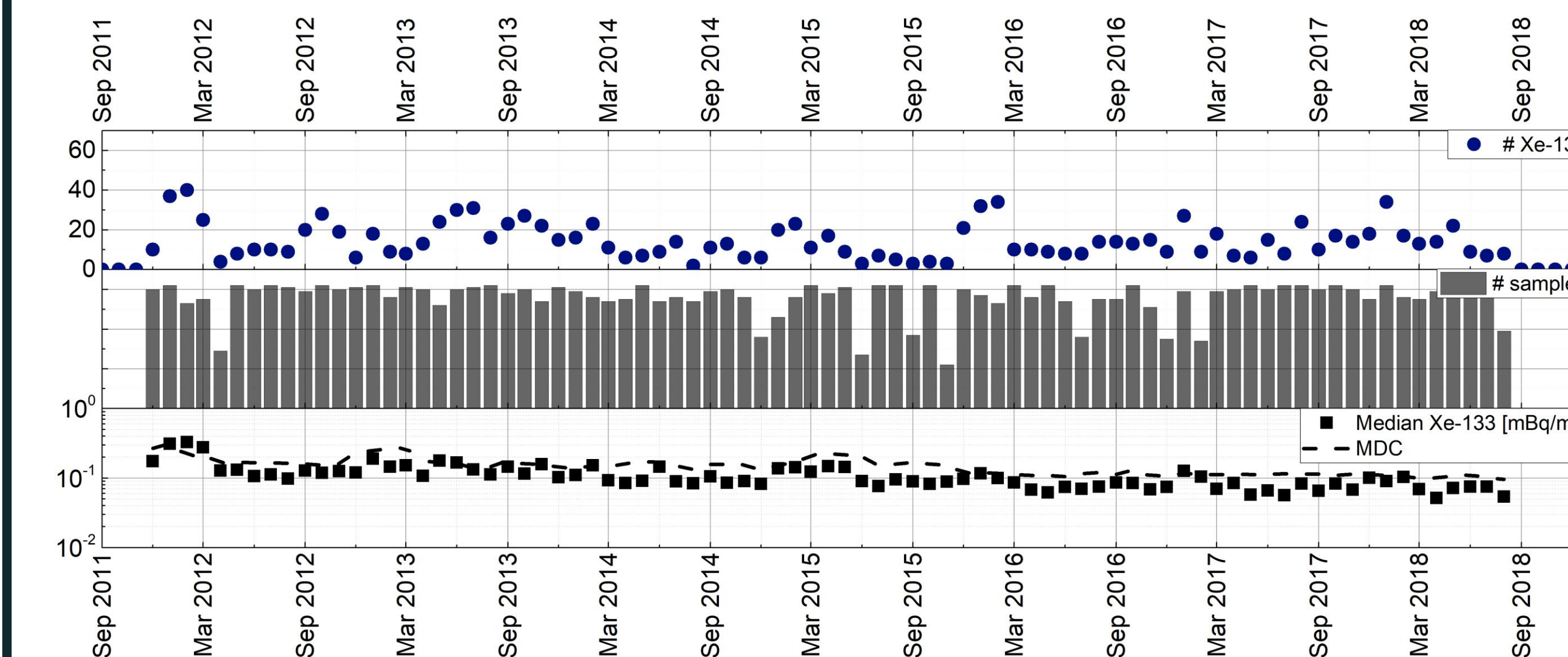


Figure 4 – Monthly history of the GBX66 system: the amount of Xe-133 detection (top), the amount of samples collected (middle) and the median Xe-133 and MDC (bottom).

**2. SRS analysis**

The fraction of detections, in 2012, that can be explained by the threshold source term is shown in Figure 5. The distribution of the required source term for the NPPs in India are shown in Figure 6.

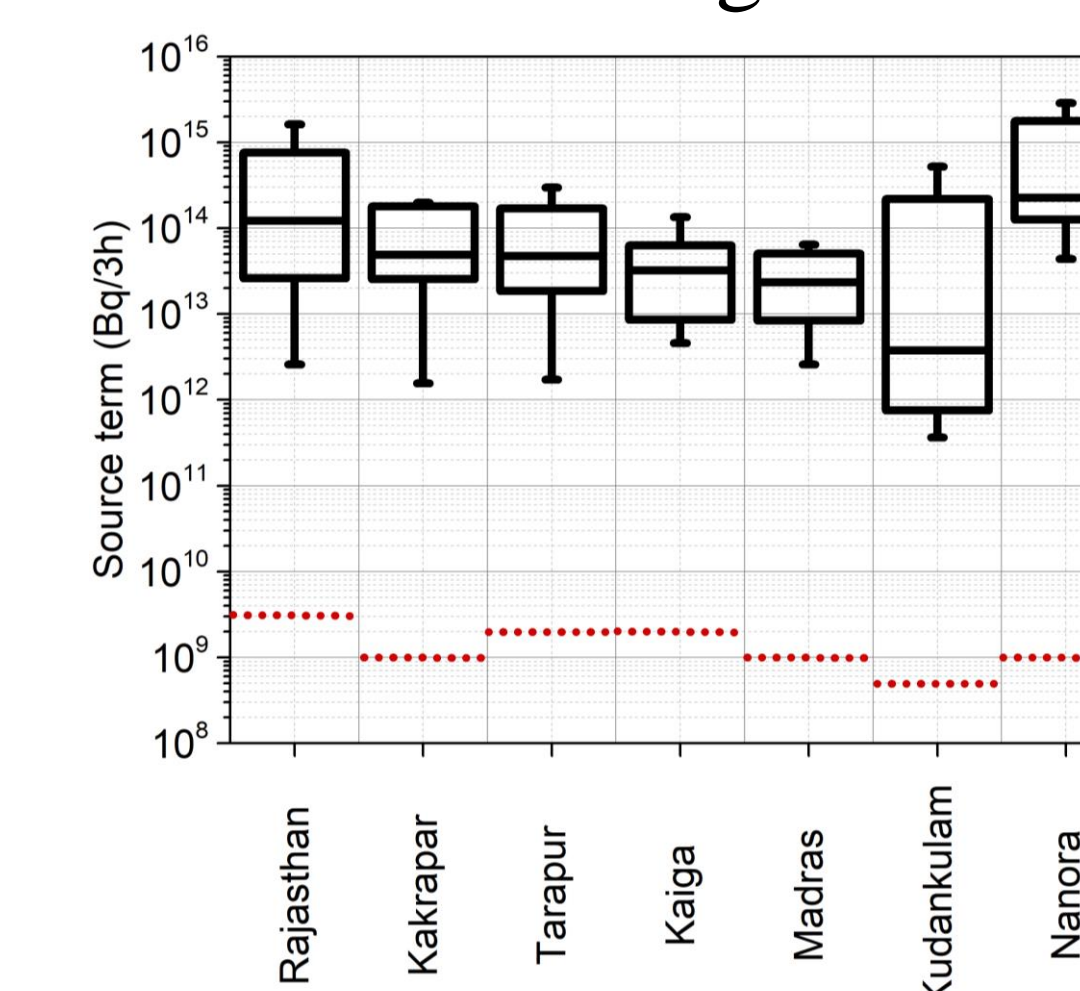
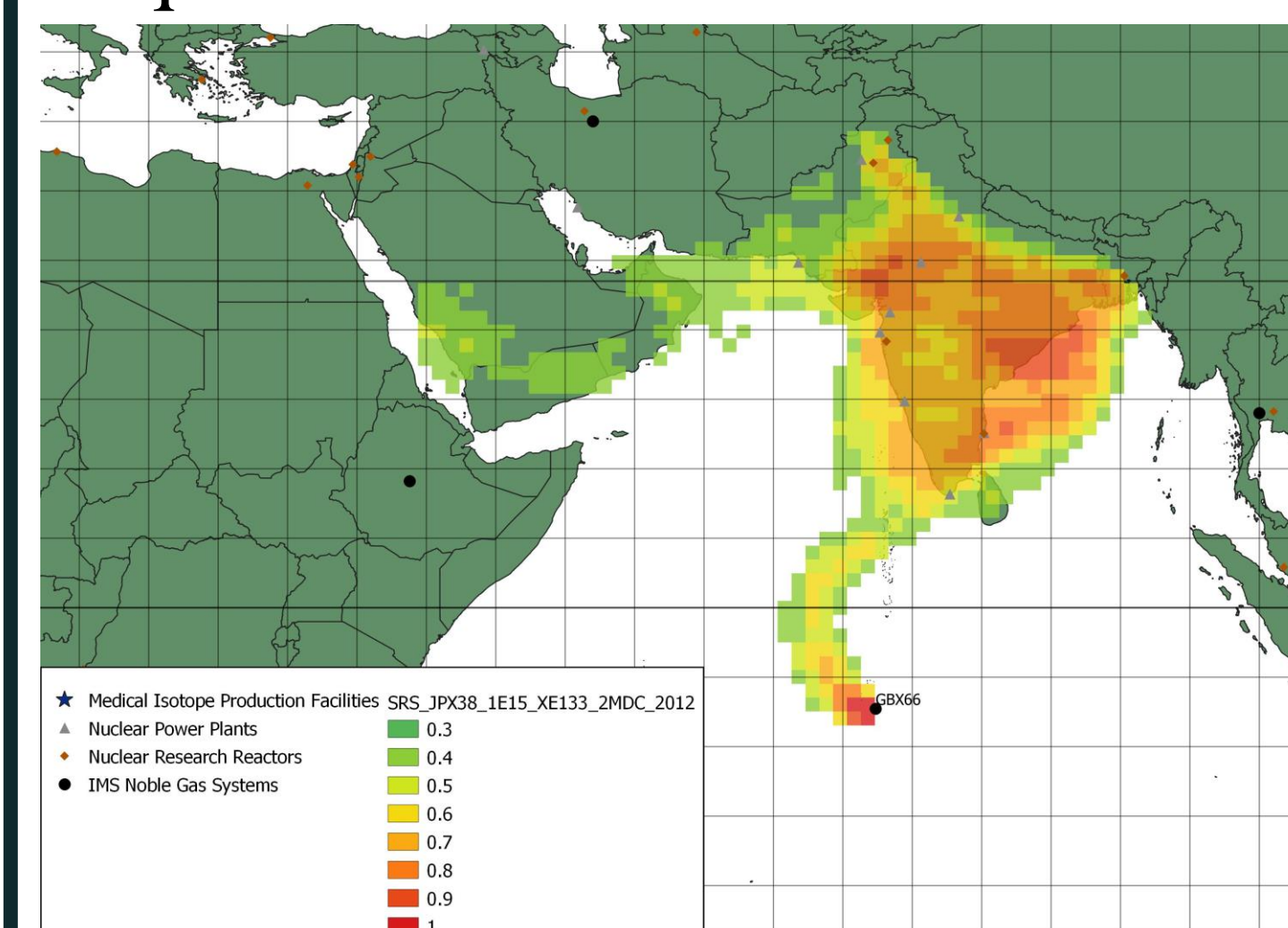


Figure 5 – Fraction of detections explained by a 10<sup>15</sup> Bq/3h source term. Figure 6 – Distribution of the required source term (red dots are the source terms derived from Gueibe et al.).

**Conclusions**

- CRL is clearly a major contributor to the Xe-133 detections at CAX17 and good agreement with the required source term
- No clear indication on the possible source for the Xe-133 detections at GBX66 → Further work required !

**References**

Gueibe et al., Journal of Environmental Radioactivity, Vol. 178-179, pp. 297-314, 2017