Assessment of Anthropogenic Radionuclides detected by the International Monitoring System (IMS) in the West African Sahelian band

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INTRODUCTION AND MAIN RESULTS

In this work, we considered the activity concentrations Cs-137 detected in the International Monitoring System (IMS) from January 2024 to December 2024.
The main objective is to determine the activity concentrations of anthropogenic radionuclides detected by the IMS stations (NEP48 and MRP43).
This information could be used for future assessment if any radionuclide contamination is detected in this area.

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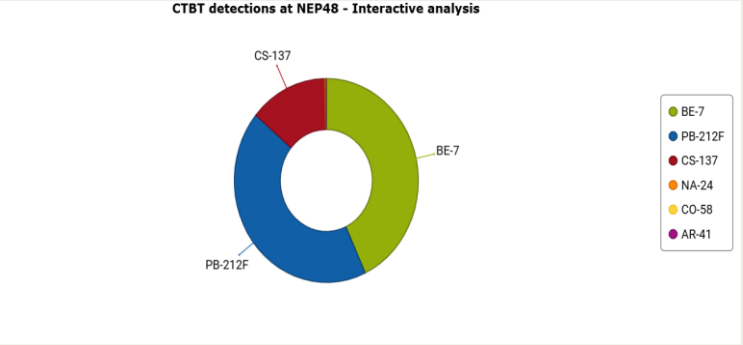
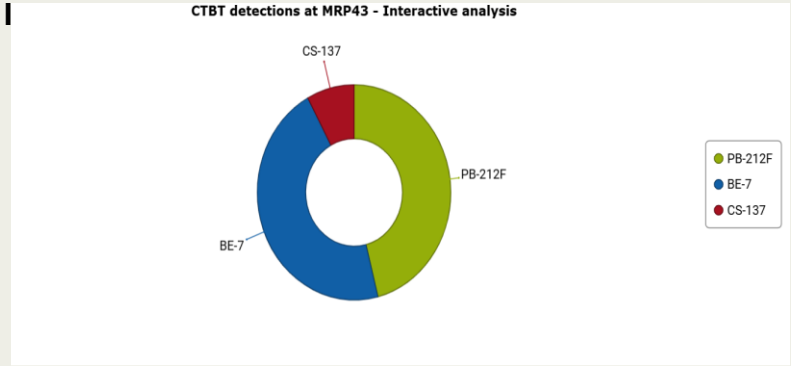
1. Material and methods

1.1. Sampling data

The measurements of ^{137}Cs activity concentrations were conducted using a high-volume of at least 500 m^3/h and often reaching around 900–1000 m^3/h. The air is forced through a filter, aerosol-bound particulates are sampled for a period of 24 h. After sampling, a 24 h day period is passed to reduce interfering activity from radon progenies. Finally, the samples are measured using HPGe detector system with a minimum detectable concentration (MDC) of a few µBq/m^3, an acquisition time of the sample gamma-spectrum over approximately 24h.The gamma ray spectra are sent to the International Data Centre (IDC) in Vienna for analysis.

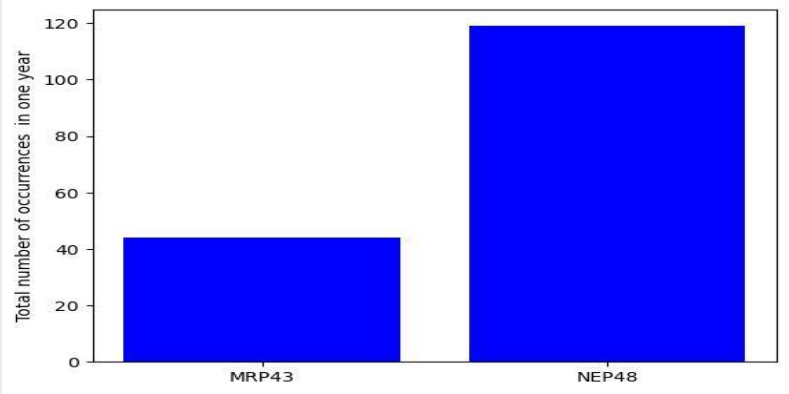
Data were downloaded via the RN toolkit software (V.0.3.5) from the CTBTO website. RN toolkit is a web software tool to provide CTBTO authorized users fast and easy access to radionuclide detections of the IMS network based on IDC analysis. As an illustration, we present in below the radionuclides detected at NEP48 and MARP43





2. Results and discussion

Figure in below shows the different occurrence frequencies of ^{137}Cs at the two IMS stations during one year. The station in Mauritania has the lowest frequency of detections.



The radionuclides seem to be influenced differently by atmospheric conditions in different ways, leading to variations in activity concentrations from one station to another.

The relationship between activity concentrations of ^{137}Cs detected in the MRP43 and NEP48 IMS station were investigated using Pearson Correlation. Pearson Correlation value is -0.23. This indicates a weak inverse relationship, with a p-value of 0.472 suggesting that the correlation is not statistically significant. In this area there are no nuclear power plant or radiopharmaceutical production facilities. The detected cesium-137 may have come from the resuspension of cesium deposited by fallout from nuclear weapon conducted by France above-ground and underground nuclear tests in the south of Algeria at the Reggane and In Ekker sites or from radionuclides released by the Fukushima accident

3. Conclusion

This study assessed the spatial and temporal variation of the anthropogenic radionuclide Cs-137 in air samples collected by IMS Stations located in Niger and Mauritania. Despite the absence of nuclear reactors in this area its geographical distance from nuclear weapon states such as South Africa and Morocco. Cs-137 was detected by both IMS stations. It is important to understand the observed background levels of CTBT relevant radionuclides for effective nuclear explosion monitoring..

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