«Influence of meteorological parameters on the temporal variability of bismuth-214 (^{214}Bi) on atmospheric aerosols»

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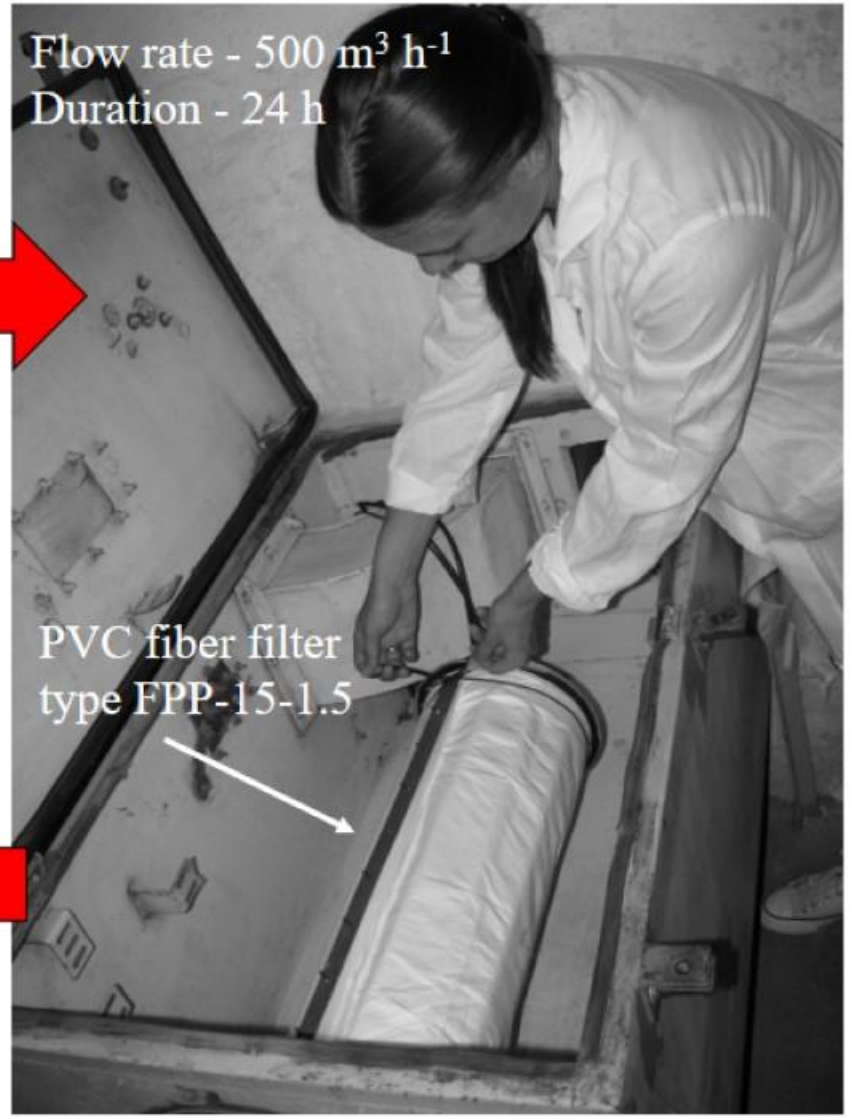
Background

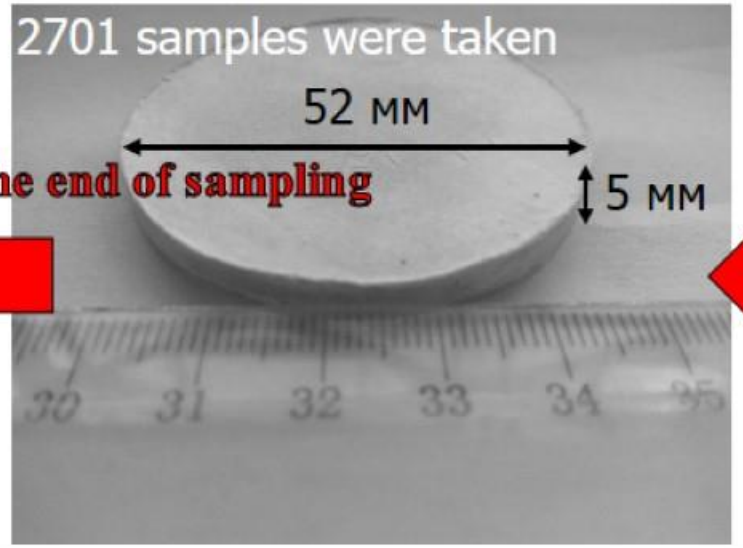
Bismuth-214 (^{214}Bi) is a naturally occurring radionuclide with a half-life of 19.9 min. Bismuth-214 is a daughter product of the radon-222 (^{222}Rn) decay. It is one of the main radionuclides that form the natural gamma background of the surface atmosphere.

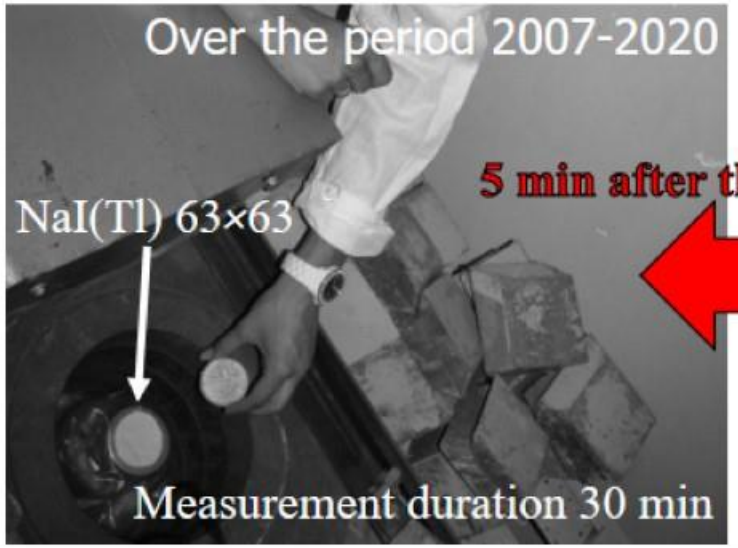
This study aims to obtain quantitative estimates of the influence of meteorological parameters on the temporal variability of atmospheric ^{214}Bi activity concentration.

Materials and methods

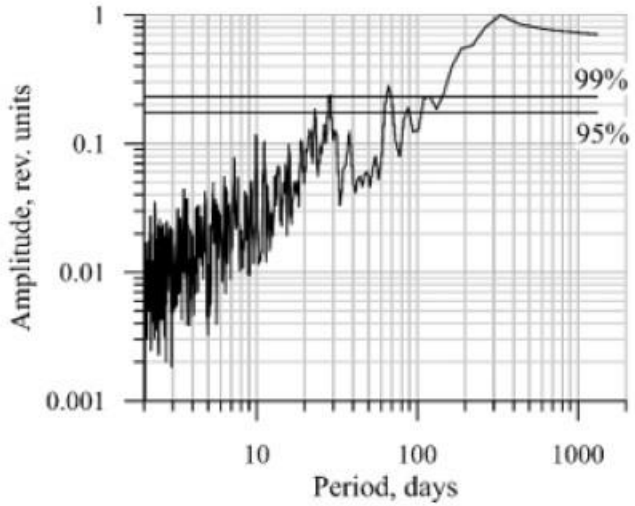
The samples of atmospheric aerosols were collected from the roof of the Marine Hydrophysical Institute of RAS (~12 m above ground level and ~20 m above sea level).



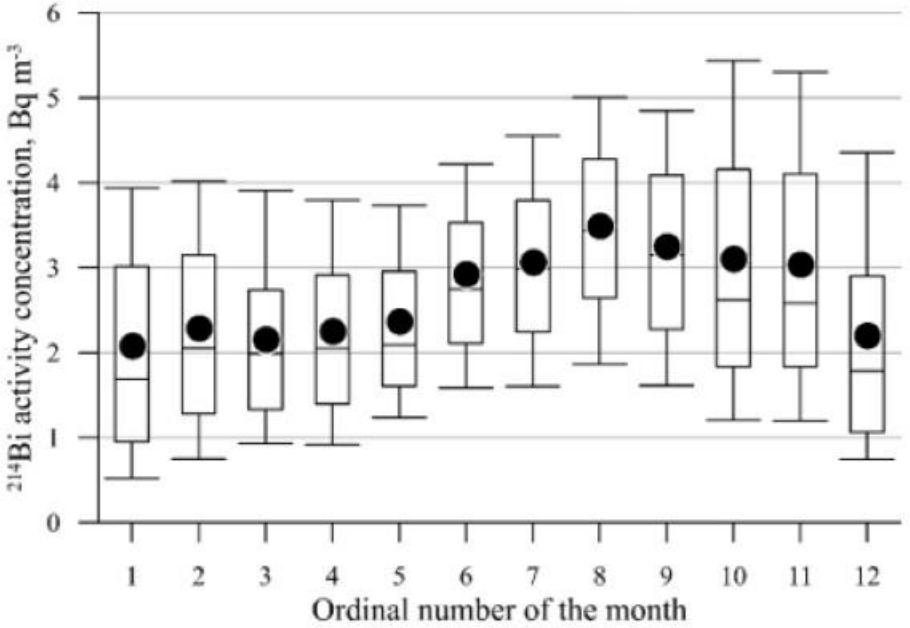




1. Throughout 2007-2020, the ^{214}Bi activity concentration varied from 0.1 to 11.4 Bq m^{-3} and averaged 2.7±1.5 Bq m^{-3}. Spectral analysis results indicate the frequencies of 29 days, 66 days, 110 days, and 1 year.



2. High values of ^{214}Bi activity concentration were typical for the period July–October (3.1–3.5 Bq m^{-3}) and low values for the period December–April (2.1–2.2 Bq m^{-3}).



3. It was found that such a seasonal pattern is due to seasonal variability in the air masses passage arriving in the study region: air masses come from the seaside in the winter season and from the continent in the summer.

On the synoptic time scale, the intensity of vertical mixing in the troposphere also plays an important role, as evidenced by the presence of statistically significant correlations with air temperature, solar radiation flux and atmospheric boundary layer height.

On the diurnal time scale, air humidity, which determines the rate of coagulation and removal of atmospheric aerosol from the atmosphere, is also essential.

Soil moisture, which determines the influx of radon into the atmosphere, plays an important role at all time scales considered.

4. Based on the ^{222}Rn to ^{214}Bi ratio data in the atmosphere, quantitative estimates of the effective dose due to exposure to outdoor radon have been obtained. It amounted to 0.042 mSv $year^{-1}$.

THANK YOU FOR YOUR ATTENTION!

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