

Latitudinal Impact on Spatial and Temporal Variability of ^7Be Activity Concentrations in Surface Air along Europe

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Abstract : This study analyses the latitudinal impact of the spatial and temporal distribution on the cosmogenic isotope ^7Be in surface air along Europe. The long-term database of the 6 sampling sites (Ivalo, Helsinki, Berlin, Freiburg, Sevilla and La Laguna), that regularly provide data to the Radioactivity Environmental Monitoring (REM) network managed by the Joint Research Centre (JRC) in Ispra, were used. The selection of the stations was performed attending to different factors, such as 1) heterogeneity in terms of latitude and altitude, and 2) long database coverage. The combination of these two parameters ensures a high degree of representativeness of the results. In the later, the temporal coverage varies between stations, being used in the present study sampling stations with a database more or less continuously from 1984 to 2011. The mean values of ^7Be activity concentration presented a spatial distribution value ranging from $2.0 \pm 0.9 \text{ mBq/m}^3$ (Ivalo, north) to $4.8 \pm 1.5 \text{ mBq/m}^3$ (La Laguna, south). An increasing gradient with latitude was observed from the north to the south, 0.06 mBq/m^3 . However, there was no correlation with altitude, since all stations are sited within the atmospheric boundary layer. The analyses of the data indicated a dynamic range of ^7Be activity for solar cycle and phase (maximum or minimum), having been observed different impact on stations according to their location. The results indicated a significant seasonal behavior, with the maximum concentrations occurring in the summer and minimum in the winter, although with differences in the values reached and in the month registered. Due to the large heterogeneity in the temporal pattern with which the individual radionuclide analyses were performed in each station, the ^7Be monthly index was calculated to normalize the measurements and perform the direct comparison of monthly evolution among stations. Different intensity and evolution of the mean monthly index were observed. The knowledge of the spatial and temporal distribution of this natural radionuclide in the atmosphere is a key parameter for modeling studies of atmospheric processes, which are important phenomena to be taken into account in the case of a nuclear accident.

Keywords : Berilium-7, latitudinal impact in Europe, seasonal and monthly variability, solar cycle

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