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EXTREMELY HIGH BERYLLIUM-7 SURFACE CONCENTRATIONS IN EUROPE: A CASE STUDY

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Beryllium-7 is a cosmogenic radionuclide that, due to its maximum production in the stratosphere and upper troposphere, has often been used as a tracer of vertical transport processes in the atmosphere. In particular, high concentrations of surface airborne beryllium-7 could be a result of an uncommonly fast descent of air masses from the stratosphere into the troposphere. Hence, our aim is to investigate the maxima in the beryllium-7 surface concentrations to better understand the processes associated with the downward transport from the stratosphere to the troposphere.

Fourteen locations in Europe, with latitudes ranging between 37 °N and 69 °N, and longitudes between 6 °W and 28 °E, are analysed in our study. Over the 2001–2010 period, the beryllium-7 surface concentration measurements in the chosen sites were performed mostly once a week, giving a total of about 500 data points per each site. The data are contained within the online Radioactivity Environmental Monitoring (REM) Database.

We define the beryllium-7 maxima as values exceeding the 95th percentile calculated for each site. Over 2001–2010, 345 maxima are identified for the investigated 14 sites, out of which 61 maxima (18 %) occurred during three consecutive months: May, June and July 2006. Over this period, i.e. summer 2006, the contribution of detected maxima to the total number of maxima for each site ranged between 4 % and 32 %, with six sites showing a contribution of 20 % or larger. This number of extremely high beryllium-7 specific activities concentrated over only three months marks this period as unique.

In an attempt to identify underlying mechanisms that are associated with this exceptional episode of high beryllium-7 surface concentrations, we look into the potential vorticity, surface temperature and pressure, and precipitation maps over the region of interest during the time window when the extremes were observed.

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