Environmental radiation monitoring in the Arctic

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1. Foreword

The group has been engaged for several years in the continuous monitoring of the *Environmental Radiation* (ER: cosmic rays and airborne radioactivity with energy higher than 50 keV) in locations at several latitudes and altitudes. The instrument utilized is a NaI(T1) scintillation detector of large dimensions (10 x 20 ∅ cms.). During these years the acquisition system has been enhanced in order to separate the two components and to identify the various radionuclides, on time scales chosen at will beginning from 1 min. The system allows to inspect rapidly and in real time (quick-look) the pulses recorded for selected energy bands.
In September 1998 one of such detectors has been taken at the Italian Station *Dirigibile Italia* at Ny-Ålesund (Svalbard Islands). During a second visit (April 1999) the acquisition card was replaced and the data retrieved. Furthermore, various locations along the coast have been visited in order to explore the possibility of housing a second detector at great distances (> 2km) from the first. Unfortunately the plastic housing which should have been installed on the roof of the adjacent institute was received very late and the work could not be performed. Nevertheless the utilization of our detector in the outside is a fundamental requirement for a comparison of the data collected in other locations and, as it emerged from the monitoring carried out in Bologna during the end of the year 2000, with detectors installed on the roofs of two buildings ab. 2 kms one another.

2. Collected data

Only on the occasion of the two visits the authors have personally withdrawn the data. On other occasions the Base personnel have kindly cooperated to the retrieval of the data on Zip mode and its forwarding to the group. The data collected so far from the detector installed in a room – laboratory of the Italian Base, with sampling time of 15 min., refer to the following periods:

1998 – Sept. (a few days) / Oct. (in full) / Nov. (a few days are lacking) / Dec. (in full)
1999 – Jan. (in full) / Febr. (in full) / May (1-6) and (11-20) (31) / June (1-9)
2000 – from Febr. 29 to Sept. 30.

3. Preliminary analysis of data

At the moment the analysis of the data collected so far is under way. A first preliminary and not systematic examination of data pertaining to different periods has evidenced:

- the presence of rapid variations of the Radon daughters in air (see Figure 1): similar fluctuations of these radionuclides, transported by air masses also over long distances, have been observed by our instruments on several occasions and several environments (Antarctica, high mountain, at sea);
- the contribution of natural radionuclides of the earth surface (^{40}K, ^{238}U, ^{232}Th) dominates the spectrum between 80 keV and 2.6 MeV. It has also been noted the presence of ^{137}Cs, which appears in a more evident manner than in other locations (for instance, on the roofs of the buildings in Bologna). However, since the detector is installed in the interior of the Base building, it cannot be ascertained whether the Cesium is contained in the materials of the building itself or is airborne, too. For this reason it is extremely important to install the detector in the outside and at a n upper position.

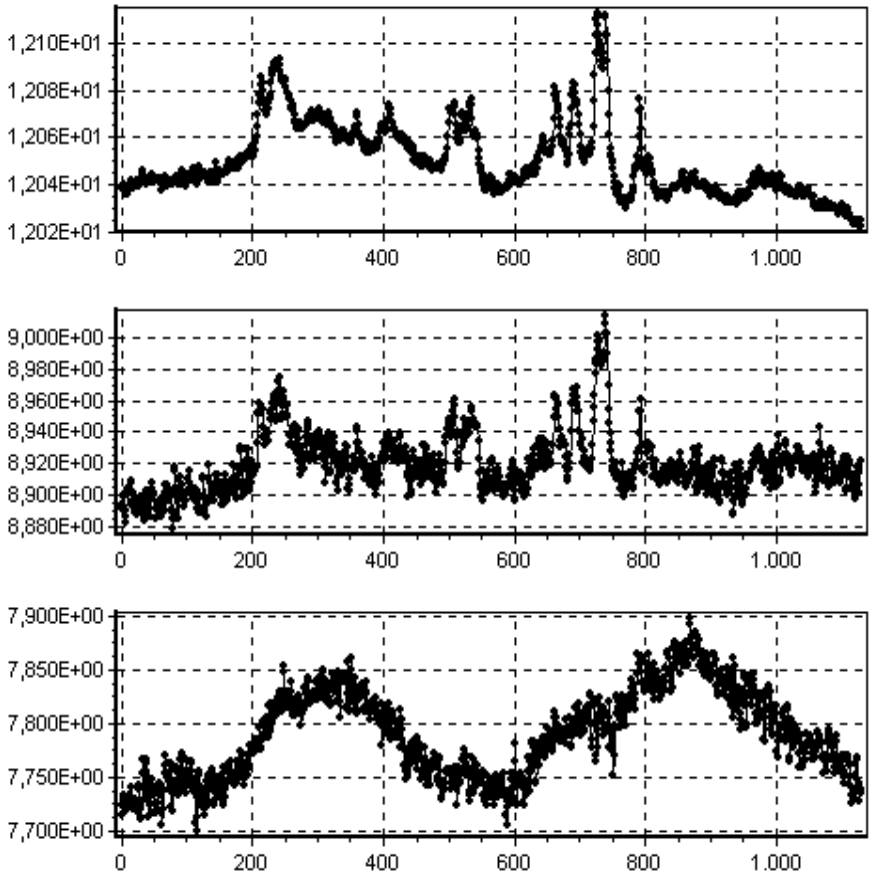

Fig. 1. Diagram of the acquisitions with sampling time at 15 minutes during the period 11/03/2000 (7:32 UT) – 23/03/2000 (4:11 UT) at Ny-Ålesund. In this case there are shown the logarithms temporal series of the computations over three energy bands: higher curve – computations in the band; half-computations related to the ^{214}Bi of the band 550-640 keV; lower curve – component of cosmic rays in the band 3-10 MeV. In the last series long duration variations (>4 days) are evident, due to atmospheric pressure changes. Other variations, due to geomagnetic phenomena seem to be present, for instance that recorded between the measurements 50 and 100.

4. Future activities

It is intended to continue the recording of the two components of the Environmental Radiation, due to the its interest regarding the possible correlations with the atmospheric variables (pressure, temperature, winds and precipitations) and with geomagnetic phenomena. For this reason it is intended to proceed as soon as possible to the displacement of the detector presently at Ny-Ålesund in the outside in a specially constructed housing. At the moment it appears extremely interesting the possibility of putting into acquisition, also for a brief period (min. 6 months), another detector in order to study the remote correlations and spot the source of the airborne radionuclides. In the mean time the analysis of the data collected to this date will be completed.