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Underground statistical measurements of the world-wide magnetic-background level in the millihertz frequency range with the [SQUID]^2 magnetometer

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The passive ground sensor system [SQUID]^2 (SQUID with Shielding QUalified for Ionosphere Detection) is a three-axis cryogenically cooled magnetometer installed within the LSBB (Laboratoire Souterrain à Bas Bruit) in the South-East of France. This permanent operating device is sheltered by a unique underground shielded cell buried under 518m of karstic rock in a low noise environment, leading to a noise level lower than 3 fT/$\sqrt{}$Hz above 40Hz. Various phenomena, mainly linked to earthquakes contributions, have been identified at the local scale through a magneto-hydrodynamic correlation or at the global ones, resulting from the Earth-ionosphere coupling. As standing waves altering the surface of the Earth, free oscillations of Earth consecutive to earthquake events can also contribute to the magnetic field variation. Because the ionosphere is a complex and nonlinear system affected by a large number of independent parameters, it appears obvious to constrain the number of sources. Investigation of the ULF magnetic pulsations detected by [SQUID]^2 over very quiet seismic and ionospheric conditions allows to defined a first experimental baseline of ionosphere magnetic noise [Marfaing et al. 2009]. Here, the analysis is performed to a set of 24 magnetically quiet days in order to establish a statistical baseline for the "global minimal magnetic level" in the site. The mean magnetic spectrum obtained in the millihertz range is characterized by several pulsations of noticeable amplitude above the flicker noise. An attempt of discrimination of the seismogenic contribution has been proposed through the polarization analysis proposed by Hayakawa et al. [2007]. Some frequencies coincide with the Earth's eigenmodes with less than 1% deviation; this includes the possibility of the superposition of several interplaying signals in the spectra of ionospheric or Earth's origin, assumed by the weak turbulence theory. These results provide complementary analysis to validate the various theoretical models of the free oscillations of Earth and extend the knowledge of the Earth-ionosphere coupling.