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Long-term structural monitoring of multi-story RC structures, based on data extracted from ambient noise and earthquake vibrations

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The impact of natural hazards on structures and infrastructures is a critical issue that needs to be properly addressed by both public and private entities. To better cope with seismic hazard and to mitigate the risk, long-term multi-sensor infrastructure monitoring represents a useful tool for acquiring information on their condition and vulnerability. However, the current increasing data volume collected using sensors is not suitable to be processed with classical standalone methods. Thus, automatic algorithms and decision-making frameworks should be developed to use this data, with minimum intervention from human operators. A case-study for the application of advanced methods is focused on the headquarters of the Institute for Atomic Physics, a 11-story reinforced concrete building, located near Bucharest, Romania. The instrumentation scheme consists of accelerometers installed at the basement, at an intermediate floor and at the top of the structure. The data were continuously recorded, starting with December 2013. More than 80 seismic events with moment magnitude, M_w , larger than 3.8 were recorded during the monitoring period. The current study covers the long-term evolution and variation of dynamic parameters (one value per hour), based on both ambient noise sources and small and medium magnitude seismic events. The seasonal variation of these parameters will be determined, as well as their daily variation and the differences between values obtained from ambient noise and from earthquake-induced vibrations. Other atmospheric parameters (e.g. temperature, precipitation, wind speed) will be considered in future studies. The goal of the PREVENT project, in the framework of which the research is performed, is to collect multi-disciplinary data and to integrate them into a complex monitoring system. The current study achieved the first step, focusing on data from the seismic sensors and setting up the premises for a multi-sensor, multi-parameter, more reliable infrastructure monitoring system.