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Soil-structure interaction at different test sites: An application to Istanbul, Bishkek and Mexico City

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In recent years, interest has grown in studying building back-radiation and city-soil effects during seismic events within the engineering and seismological communities. The aim of such studies is the better understanding of the dynamic characteristics of structures, soil, and the manner in which the induced shaking in each effects the other, the so-called soil-structure interaction effects.

In this study, we applied a method proposed by Petrovic and Parolai (2016) based on the deconvolution interferometry technique, which is applied to recordings of sensors installed in buildings and nearby boreholes to investigate wave propagation through the building-soil-layers, and the soil-structure-interactions. The real seismic input and the part of the wavefield that is associated with the back-radiated waves from the building are separated by the use of the constrained deconvolution approach. Finally, the energy radiated back from the building to different soil depths is estimated by the application of this method.

Three test cases (the cities of Bishkek, Kyrgyzstan, Istanbul, Turkey, and Mexico City, Mexico) consisting of a borehole installation and an instrumented building which are located close to each other are investigated, considering different soil conditions and buildings that display different dynamic characteristics. In Istanbul, a 16 story tunnel formwork residential building built on soft sediments (with a similar S-wave velocity in the uppermost soil layer and the lowermost layer of the building), in Bishkek a 3 story reinforced masonry building constructed on Tertiary and Quaternary sediments (velocity of the uppermost layer of soil is higher than the velocity of the whole building) and in Mexico city a 14 story reinforced concrete building on a lake-bed consisting of soft clay sediments (velocity of the structure is higher than the velocity of the uppermost soil layer) are considered to better understand the different types of soil-structure interaction.