MODULATE: ANR project for the modeling of long period ground motions and the assessment of their effects on large-scale infrastructures

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Large-scale infrastructures are increasingly used in urban areas to meet the demands of continuously evolving societies. Recent seismic events showed remarkably that the construction of infrastructures with adequate seismic performance is the main factor in minimizing economic loss and long-term consequences to the communities. The modern design of large-scale structures, through the framework of performance-based earthquake engineering, requires consideration of the unique features of those structures, such as long natural period (> 2 seconds), interaction with the supporting soil, interaction with contained liquid, multi-support excitation, *etc*. In this project, we are concerned with the analysis, estimation and modeling of long period ground motions and their effects on the response of large-scale infrastructures such as high-rise buildings, liquid-storage tanks and long-span bridges. Intense long-period ground motions are usually generated at large distances from the source by large subduction-zone earthquakes and moderate-to-large crustal earthquakes. Such motions consist primarily of surface waves that arise when seismic waves encounter sedimentary deposits. One of the main objectives of the project is the development of a methodology based on the physics of surface waves, to describe the evolution of the spectral content of the ground motion for a site located in a sedimentary basin, and exposed to potential seismic sources, using relatively easily accessible input data. Furthermore, the stochastic description of ground motion will provide broadband realistic time histories that include basin-generated surface waves and which will be the means for practical assessment of the structural reliability and integrity of the considered large infrastructures. Realistic 3D numerical geological models will be implemented to study the physics of surface wave generation and propagation in sedimentary basins. The project is based on an inter-disciplinary effort with the synergy of Earthquake and Structural Engineers, together with Seismological and Numerical Modelling experts. The ultimate goal of the project is the development of novel, efficient and reliable tools and methods to be used by the earthquake engineering community for more robust and resilient designs of large-scale infrastructures.