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Seismic Response of the Near Surface Quaternary Deposits in an Area between the Venetian Pre-Alps and the Lagoon of Venice (Northeastern Italy)

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A series of geophysical campaign mostly focused on the acquisition of shear wave velocities for earthquake hazard mitigation resulted in the construction of a unique database with more than 1000 records in an area of about 4500 square kilometers from the Alpine foothills to the Venetian lagoon. Data have been collected in about 8 years and each site record includes several Refraction Microtremors (ReMi) measurements and almost often long-time ambient vibrations.

The Venetian plain is comprised of Pleistocene glacial deposits (the glacial amphitheater of Vittorio Veneto and the system of Gai-Tarzo, formed by the Piave Glacier), colluvial and gravitational deposits and mostly alluvial deposits. The latter are both the infills of the narrow valleys incising the Pre-Alps and the Sub-Alpine hills and the large plain formed by Brenta, Piave and Tagliamento Rivers. A large part of the Venetian coastal plain, including the Lagoon of Venice, was also part of this study.

Data processing was carried out very consistently and the same procedure was applied to data collected with different instruments at different times. The standardization of the processing procedure along with the design of a geology-based data acquisition network were the keys to generate large scale shear wave velocity maps very sensitive to subtle changes in the texture of the uppermost deposits.

At the same time we carried out detailed geological and geomorphological surveys and mapping, including the use of LIDAR data, aerial photographs and hyperspectral images.

The information on the sedimentary settings stem from relatively poor availability of core drillings and penetration tests. The analysis of seismic mapping derived from geophysical campaigns allowed us to obtain an extremely detailed profile of the elasto-acoustic properties of the surficial Quaternary deposits that can be easily correlated with the physical and sedimentary characteristics of the terrain.

The integrated interpretation of the geological, geomorphological and geophysical data set experienced a close to one-to-one correspondence with the sedimentary framework. In many cases, the shear wave field allowed to gain a new and unexpected insight into the sedimentary coverage and the underling bedrock.

