Ground Motion Prediction Equations for shallow, small-magnitude events: application to the Mirandola-Cavone oil field

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Ground motion prediction equations (GMPEs) based on data collected on hydrocarbon extraction areas have to deal with lower magnitude and smaller distances compared to the natural seismicity. This study focuses on the Mirandola-Cavone oil field located in the Po Plain (Northern Italy), an area that has been struck by the Emilia earthquake sequence in 2012. We start with the compilation of a new homogeneous seismic catalogue, in terms of locations and moment magnitudes. The data come from the local network run by the industrial operator, integrated by the closest stations of the Italian seismic network managed by Istituto Nazionale di Geofisica e Vulcanologia. Subsequently, we calculate the intensity parameters of interest (e.g., Peak Ground Acceleration, Peak Ground Velocity and spectral values) for the available set of about 250 earthquakes. Lastly, we develop a functional form for the GMPE using software tools available at IS-EPOS Platform, derived for the geometrical mean of the horizontal components of seismograms. The resulting attenuation curve is calibrated for magnitudes higher than 0.1 and distances up to 50 km, appropriate for monitoring local seismicity. This work represents the first attempt to construct the GMPEs for an oil field in Italy, starting from the raw data, in support to the Italian Guidelines for monitoring seismicity, deformation and pore pressure in hydrocarbon extraction areas.