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Near-source ground motion estimation for assessing the seismic hazard of critical facilities in central Italy

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We apply the Probabilistic Seismic Hazard Analysis (PSHA) and compute Physics-Based Simulations (PBS) of ground motion for three dams in the Campotosto area (Central Italy). The dams, which confine an artificial water reservoir feeding hydroelectric power plants, are located in an active seismic zone between the areas that experienced the 2009 L'Aquila and 2016–2017 Central Italy seismic sequences. The probabilistic disaggregation estimated for a return period of 2475 years, corresponding to the collapse limit state for critical facilities, indicates that the most dangerous fault is associated with a maximum magnitude of 6.75±0.25 within a distance of 10 km. This fault is used in PBS to emulate the Maximum Credible Earthquake scenario. To capture the ground motion variability, we input a pseudo-dynamic source model to encompass spatial and temporal variations in the slip, rise time and rupture propagation, heavily affecting the near-source ground motion. Indeed, the ground motion above the rupture volume is mainly influenced by the epistemic uncertainties of rupture nucleation and slip distribution. The computed broadband seismograms are consistent with the near-source shaking recorded during the 2016 MW 6.6 Norcia earthquake and constrain the upper bound of the simulated ground motion at specific sites. Our modelling reinforces the importance of considering vertical ground motion near the source in seismic design. It could reach shaking values comparable to or larger than those of the horizontal components. This approach can be applied in other areas with high seismic hazard to evaluate the seismic safety of existing critical facilities. back to programme

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