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Numerical analysis of seismic site effects in 2D & 3D alluvial basins with various geometries

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In this analysis, various numerical models based on the boundary element method are considered to analyze seismic wave amplification in 2D and 3D alluvial basins. The integral formulation is made in frequency domain with a specific analytical regularization method [1,2]. The amplification of the seismic motion is analysed considering the following parameters: dimension of the basin model (2D & 3D), velocity contrast, aspect ratio of the basin and shape of the interface. We have considered both P & S incident waves.

The amplification is larger in the 3D configuration, because of the stronger focusing effects of the incident wavefield. The scattering issues for such models are characterized by a greater complexity than for the 2D model and lead to a stronger trapping effect in the basin. As also shown by other authors [3], our numerical results lead to surface motion features strongly depending on the material properties of the basin and its geometry. Furthermore, this analysis also gives evidences of two different types of amplification processes: for small aspect ratios, the 2D or 3D resonance of the basin itself prevails; for large aspect ratios, the surface waves trapping mainly controls the amplification level and features. These two different phenomena lead to various results for 2D and 3D basin models.

The comparison between 2D & 3D model of such theoretical basins shows the importance and complexity of the scattered and trapped wavefields in 3D. Even if the 2D approach is often suitable to recover actual in-situ amplification levels due to basin effects [4,5], 3D analysis generally leads to larger amplification levels and/or longer time duration for more complex basin geometries. Time domain computations are also proposed to illustrate this point. The final aim of such an analysis is to investigate seis-

mic site effects in actual 3D basins. The key point is then to have detailed and reliable geophysical data from the site.

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