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Modelling the slip potential fault activity in the Horseshoe Abyssal Plain (Gulf of Cadiz): implications for seismic hazard

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Understanding the stress field which drives active fault systems is a fundamental component of seismic hazard assessment. This study explores the relation between the stress field and the fault network system in the Gulf of Cadiz giving particular emphasis to the region of the Horseshoe Abyssal Plain. This is a critical region in terms of seismic activity, being a candidate source for the great 1755 Lisbon earthquake and tsunami, and the place of two large earthquakes registered in modern times (28.12.1969 and 12.2.2007). We first compile the most up to date published seismic moment tensors, strain and strain rate estimates in the region. A 3D model of the fault network system is then built based on the joint interpretation of multibeam bathymetry and multichannel seismic reflection lines. We developed an interactive graphic tool to perform slip tendency analysis, that is, to evaluate if the pre-existing faults will be reactivated under the calculated stress field. The application is written in MATLAB and is a plug-in for the open-source software COULOMB. In addition to identify the faults most prone to be reactivated we compute and plot synthetic focal mechanisms from the direction and sense of likely slip and compare it with the observed focal mechanism solutions and strain data. This allows us to verify the compatibility of geologic structures and seismic data. Finally, possible fault interactions are analyzed using the elastic dislocation theory in a consistent tectonic framework. With this approach our aim is to identify the most dangerous faults from the seismic activity point of view and recognize areas of enhanced Coulomb stress changes which can be regarded as

candidates for future events.