New insights on temporal and spatial evolution of Yellowstone earthquake swarms: a multidisciplinary geological-seismological approach

Luca Carbone$^{1}$, Elena Russo$^{2,3}$, Rita de Nardis$^{1,3}$, Giuseppina Lavecchia$^{1,3}$, Alessandro Tibaldi$^{2,3}$, and Fabio Bonali$^{2,3}$

$^{1}$DiSPuTer, University of Chieti-Pescara 'G. d'Annunzio', Chieti, Italy
$^{2}$Department of Earth and Environmental Sciences, University of Milan-Bicocca, Milan, Italy
$^{3}$CRUST- Interuniversity Center for 3D Seismotectonics with Territorial Applications, Italy

The Yellowstone volcanic field, in western United States, is well known for intense seismic activity, abundant geothermal features and a violent volcanic history that includes a caldera-forming eruption 640 ka ago. Even though the recentmost eruption dates back to 70 ka ago, a very high seismicity, quasi-continuous surficial deformation through uplift and subsidence stages (at rates of up to 70 mm/yr) and intense hydrothermal activity are clear evidences of a still very active volcanic field. Thanks to a recently improved seismic network, here we analyze the rate of occurrence of 19'538 relocated earthquakes belonging to the temporal window between 1988 and 2016. Starting from this dataset, we identify and characterize the seismic swarm activity occurring in the study area after 2007. We also evaluate the analogies and differences of their seismic behavior through the analysis of frequency-magnitude distribution of seismic events. We investigate the identified seismic swarms clustered in space and time, their relation with active volcanic and tectonic processes and stress field variations caused by the migration of magmatic and hydrothermal fluids. Calculated b-values associated with the recentmost seismic swarms have been related to past swarms that occurred in the area, thus revealing the temporal and spatial evolution of such phenomena. Our study gives new crucial insights to understand the relation between seismic and magmatic activity in the Yellowstone volcanic plateau, with important implications for a better comprehension of the local seismic and volcanic hazards.