SOURCE OF MODERATE SIZE EVENTS DURING THE 1997 UMBRIA-MARCHE SEISMIC CRISIS

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The temporal network that operated from Sept. 28th to Oct. 24th during the Umbria-Marche crisis recorded more than 2000 earthquakes on 3-component digital stations. We focused on the events of magnitude larger than 3.7 and applied different techniques to retrieve the main parameters of their source. We first considered a point-source approximation and applied a simple source inversion technique at short distances in an homogeneous medium. Theoretical seismograms used in the inversion included intermediate and near field contributions. A grid search was performed to determine the focal mechanism and the seismic moment which minimize the error between the observed and the synthetic seismograms. This procedure gave fast and quite robust estimation of source parameters when the point source approximation hypothesis could be considered as valid.
For the largest earthquakes, an extended source definition was necessary to fit the waveform recorded. We applied a trial and error approach to retrieve the main parameters of the rupture (directivity, fault dimensions). Green's functions were obtained by Empirical Green's function technique when possible, or were computed by a reflectivity method in an heterogeneous media.

A DETAILED IMAGE OF THE SEISMIC STRAIN RELEASED BY THE AFTERSHOCKS OF THE UMBRIA-MARCHE 1997 SEQUENCE.

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The Umbria-Marche 1997 seismic sequence consists of several moderate magnitude ($5.0 \leq M \leq 6.0$) earthquakes which ruptured on low angle normal faults. CMT fault plane solutions show a dominant extension perpendicular to the Apenninic chain. First motion polarity focal mechanisms have been computed for a selected subset of 650 aftershocks, which provide an evolutive picture of the released seismic strain both in time and space. Although the P and T axes for most of the aftershocks are similar to those of the largest magnitude events, a systematic change of about 90° in the direction of T axes is observed in the southernmost part of the activated area, where the earthquake of October 14 is located. Moreover, an evident deviation from a nearly vertical P axis is observed in that area. In order to verify if such rotations of the principal axes might be an artifact due to network coverage, we attempt to constrain the most representative fault plane solutions by analysing the S-wave polarization. The solution of this ambiguity is important to interpret the observed rotations in terms of mainshock induced stress changes.

SE25 The 1997-1998 earthquakes in Umbria-Marche (central Italy): multidisciplinary studies - Poster Session

Convener: Amato, A.
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THREE-DIMENSIONAL VE ITY STRUCTURE AND EARTHQUAKE LOCATIONS OF COLFIORITO FAULT ZONE (UMBRIA-MARCHE, ITALY)

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Following the onset of the Umbria Marche seismic sequence on Septembe a seismic array consisting of up to 30 three-component seismic stations a us to collect an original and formidable data set of P- and S-waves thour sampling the source region. In this study, we have inverted about 26,(rival times from selected afteshocks to define the three-dimensional V Vp/Vs models in the upper crust of the fault region by using the Si technique. About 2000 aftershocks of the sequence have been relocate the 3-D model, finding a significant improvement in the locations w heterogeneous model. The high number of crossing rays permits to ol resolution of the upper crustal velocity structure which was never achie other normal faults. Tomographic images are used to infer the role pla pre-existing structures and ambient fluid pressure in the control of ruptu lution and propagation. Relatively low Vp/Vs regions are found within t ruptured by the large shocks, while an increase of Vp/Vs is observed in per portion of the faults and it could be responsible for the upward term of the large shocks rupture.

FAULT INTERACTION AND EARTHQUAKE TRIGG DUE TO FLUID FLOW AND STATIC STRESS CHANGE

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We interpret the spatial and temporal pattern of seismicity during Umbria-Marche seismic sequence in terms of static stress changes flow in a fractured medium. We calculate the coseismic stress changes c shear dislocations on low angle normal faults which ruptured during tl magnitude earthquakes (M> 5). The results show that some but not a events can be explained in terms of earthquake induced stress changes that volumetric and normal stress changes yield a better correlation location of the large magnitude earthquakes. We therefore suggest t volumetric stress perturbations might have promoted fluid flow which the seismic events. This mechanism provides an explanation for th triggering and the temporal evolution of seismicity. We model the se events having magnitudes larger than 4.0 in terms of triggering by pr of a critical pore pressure wave in a compressible fluid through a medium. We estimate the macroscopic fluid diffusion tensor **D** in an a medium. The principal eigenvector strikes $N165°$ with a value of dif $D \simeq 4 \cdot 10^6 cm^2/s$, which agrees quite well with values resulting fron studies. The direction of the principal eigenvector is slightly differen average strike of the activated faults ($N145°$); this can be due to a of seismicity at depths shallower than those of the mainshocks.

SPATIAL AND TEMPORAL DISTRIBUTION OF SEISMICITY BE THE UMBRIA-MARCHE 1997 EARTHQUAKE

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Spatial and temporal peculiarities of seismicity before Umbria-Marche ear September 26, 1997 are studied. Quiescence stage followed by foreshock is observed before the Umbria-Marche earthquake. This prognostic a seismicity is indicated by the RTL prognostic parameter. The mainshoc soon after the RTL parameter recovery to the level of its perennial backg area where the quiescence phase and the phase of foreshock activation several times longer than the ruptures calculated from empirical relatio the source size and magnitude.
The process of clustering of earthquakes with M≥3.5 is observed since area of the epicenter of the Umbria-Marche earthquake. The analysis of a the area of ruptures accumulated during last year before the Umb earthquake in comparison to the perennial background of the previ demonstrated the concentration of this process in the vicinity of th mainshock. Some results of application of the time-to-failure model to before Umbria-Marche mainshock is discussed.