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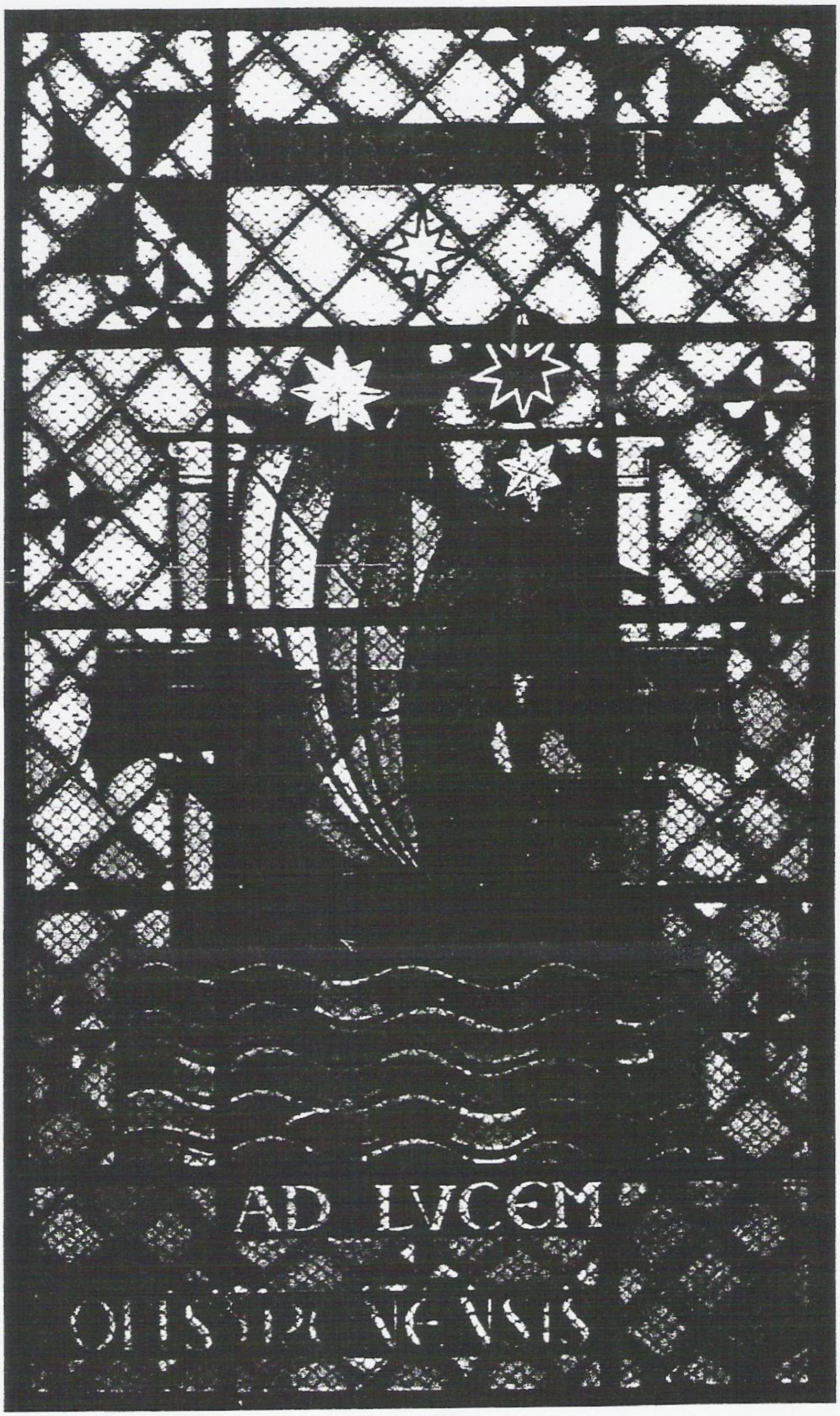

BOOK OF ABSTRACTS AND PAPERS

LISBON UNIVERSITY, LISBON, PORTUGAL

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Convener: Kostas Makropoulos.
Rectorate Galleries
September 12-15

SCA – 01

CYCLIC MIGRATION OF EARTHQUAKES AS A RESULT OF UNSTABLE STRESS STATE OF CRUSTAL ROCKS.

R. Di Giovambattista (1), Yu.Tyupkin (2)
(1) Istituto Nazionale di Geofisica, Roma, Italy
(2) Geophysical Center, RAS, Moscow, Russia

ABSTRACT
The cyclic migration of weak earthquakes ($M \geq 2.2$) was observed during one year before the October 15, 1996 (M=4.9) Reggio Emilia earthquake in a relatively small area of Northern Italy. Earthquakes migrate along the transversal fault zones and sometimes jump from one fault to another. We discuss the hypothesis that the analyzed area is in a state of stress approaching the limit of the long-term durability of crustal rocks and that the observed cyclic migration is a result of a combination of a more or less regular evolution of the tectonic stress and tidal variations. A correlation of tidal variations with earthquakes of cyclic series is used as a test of instability of stress state of studied area.

PAPER: SCA-01

SCA – 02

ANISOTROPY STUDY USING AFTERSHOCKS OF THE SEPTEMBER 7, 1999 ATHENS EARTHQUAKE

P. Papadimitriou, G. Kaviris, N. Voulgaris and I. Kassaras
Department of Geophysics, University of Athens, Zografou 157 84, Athens, Greece. e-mail: ppapadim@geol.uoa.gr

ABSTRACT
A moderate earthquake of magnitude MS=5.9 occurred on 7 September 1999 south of the mountain Parnitha, in the vicinity of the city of Athens. During the analysis of the aftershocks, that were recorded and located by a temporary network installed by the University of Athens, the existence of shear-wave splitting was revealed and attributed to the presence of anisotropy. The events selected for the present study are located well within the shear-wave window, close to at least two stations of the temporary network and fulfill the selection criteria. Polarigrams and hodograms plotted for the horizontal components were used in order to determine the polarization direction of the fast shear wave and the time delay between the two split shear waves. After correcting the time delay and rerotating the waveforms to their initial directions, the polarization of the source is also measured. A clear, linear and almost constant polarization of the fast shear wave is observed at each station, independent of the azimuth of the earthquake. The mean direction of the fast shear wave polarization at Neok station is N97°, at Mago station N98°, at Fili station N99°, at Psar station N103° and at Zofr station N91°. The calculated time delays between the two split shear waves at all the stations vary between 0.025s and 0.100s. The mean Sfast polarization directions calculated at each station are similar and almost parallel to the azimuth of the main fault that was determined by body wave modeling, since no surface breaks were observed. The observed anisotropy is in agreement with the stress field of the area and can be explained by the presence of fluid-filled cracks preferentially oriented parallel to the local maximum compressive stress as proposed by the extensive dilatancy anisotropy (EDA) model. These results are compared with the ones calculated at the eastern Gulf of Corinth using recordings of the Cornet network. A similar direction of anisotropy, close to N100°, was observed at the Sofi station that is located southern of the epicentral area. The other stations, located very close to the Gulf of Corinth, presented an anisotropy direction approximately equal to N140°. Thus, a differentiation of the deformation pattern in the two Gulfs can be distinguished.

SCA – 03

MAGNITUDES OF INTERMEDIATE DEPTH EARTHQUAKES IN SOUTHERN AEGEAN SEA (GREECE)

A. B. Baba, E. E. Papadimitriou and B. C. Papazachos
Laboratory of Geophysics, University of Thessaloniki, GR54006 Thessaloniki, Greece, baba@lemnos.geo.auth.gr, ritsa@geo.auth.gr, basil@lemnos.geo.auth.gr

ABSTRACT
Body wave magnitudes, mb, estimated by the International Seismological Center (ISC) and the National Earthquake Information Center (NEIC) for intermediate depth earthquakes that occurred in southern Aegean area during 1971-1997, were compared and found to be almost identical. They have been used as one data set in order to define scaling laws between this magnitude and the local magnitudes, ML, estimated by the Greek seismological centers (ATH and THE). The same mb data set is used to define the relation that gives mb as a function of the mean values of the maximum amplitudes recorded on Wood-Anderson horizontal seismometer of the Geodynamic Institute of National Observatory of Athens, and the distance from the focus to the station of Athens. A second relation is obtained connecting mb with the maximum amplitude recorded by the short period seismometer of the seismological station of Thessaloniki and the distance from the focus to the station of Thessaloniki. Based on the above relations mb magnitudes were estimated for all the events included in our data set.

PAPER: SCA-03

SCA – 04

THE ATHENS (GREECE) SEPTEMBER 7, 1999 Ms=5.9 EARTHQUAKE

I. Kassaras, P. Papadimitriou, N. Voulgaris, V. Kouskouna, G. Kaviris, D. Diagourtas, N. Delibasis, K. Makropoulos
Department of Geophysics-Geothermics, University of Athens, Zografou, 15784, Athens, Greece. email: kassaras@geol.uoa.gr

ABSTRACT
The September 7, 1999 earthquake was the strongest event, at least during the instrumental era, in the vicinity of the city of Athens, Greece, resulting to a death toll of 143, hundreds of injured and homeless people. More than 6500 buildings collapsed and 90.000 suffered heavy, but reparable, damage. Macroseismic intensity was assessed at 8-9 (EMS 98) and reached 9 at several sites. In this study a multidisciplinary approach, aiming at an insight of the geodynamics of the area, is presented.
The epicenter of the mainshock was relocated at 38.105°N, 23.565°E, using recordings of the Cornet local permanent network. The focal mechanism of the main shock, obtained from body wave modeling, represents almost pure north-south extension with a focal depth of 8 km. The analysis of the aftershock sequence, monitored by a digital seismological network, indicated that the seismic activity extends along the southern foothills of Mt Parnes. The depth distribution of the well-located aftershocks ranges from 3 to 10 km. The focal mechanisms of the aftershocks suggest a main southwards dipping fault zone, which indicates that the actual fault trace is located well within mountain Parnes, if the fault geometry, inferred from the spatial distribution of the aftershocks, is extrapolated to the surface.
Shear-wave splitting existence was revealed during the analysis of aftershocks, attributed to the presence of anisotropy. The mean polariza-tion directions of the fast shear wave are similar at all stations, approximately N100° and almost parallel to the azimuth of the main fault.
The near field strong ground motion of the main event has been simulated initially at the sites that recorded the earthquake, for various rupture scenarios. The comparison between the observed and simulated data, in time and frequency domain as well, reveals that the largest part of the rupture propagated towards the eastern part of the fault. Moreover, the simulation of the main event in the seismogenic area, using the resulting rupture model, provides relatively large PGA values (up to 0.6g) and 5 sec strong motion duration, thus emphasizing the influence of rupture directivity to the damage distribution.

SCA – 05

3-D CRUSTAL VELOCITY STRUCTURE IN ATHENS REGION (GREECE) USING MICROEARTHQUAKE DATA

G. Drakatos, N. Melis, V. Karastathis, G. Papadopoulos, D. Papanastassiou, and G. Stavrakakis
National Observatory of Athens – Institute of Geodynamics, P.O. Box 20048 – 118 18 Greece, E-mail : g.drakat@egelados.gein.noa.gr

The Aegean Sea region and the surrounding areas lie on the boundary zone between the Eurasian and the African plates. It is a zone of widespread extensive deformation and therefore, reveals a high level of seismicity. On September 7, 1999 a moderate earthquake (M=5.9) occurred, just 18 km from the historical center of Athens (Greece). This earthquake has been already characterized as the most catastrophic event of the last century in Greece. Immediately after the earthquake, the Institute of Geodynamics installed a seismological network in the Athens broader region, consisting of ten stations. To investigate the 3-D crustal velocity structure of the region, a tomographic procedure has been applied. The data set consists of travel time residuals of P- and S-waves of 240 well-located earthquakes, recorded by at least seven stations. Almost 5000P- and 3.500 S-waves travel time residuals are inverted. The results show that in general low velocities are predominant in the investigated region. The velocity at shallow depths seems to be affected by the surface geology. A remarkable low velocity zone is determined, which coincides with the WNW – ESE direction of the seismogenic fault as well as with the long axis of the aftershock area.

SCA – 06

STATISTICAL MODELS OF THE WEAK AND MODERATE-SIZE EARTHQUAKE SEQUENCES OF VRANCEA REGION, ROMANIA

Luminita Ardeleanu, National Institute for Earth Physics, P.O. Box MG-2, 76900 Bucharest, Romania, email: ardel@infp.infp.ro

The study of the space, time and energy distribution of Vrancea earthquakes emphasized three segments, with distinct characteristics: (i) a crustal seismic zone, characterized by events with maximum magnitude 5.2, (ii) a significant gap in the earthquake activity in the depth range 40 to 60 km, and (iii) the intermediate depth zone, down to around 210 km, the seismogenic area of the major Vrancea events.
The space-time distribution of the weak events is investigated using a method based on the analysis of two-dimensional point patterns. The local magnitude threshold is set at 2.0 for the crustal earthquakes, and at 2.5 for the intermediate depth events, as indicated the completeness tests performed using the frequency - magnitude distribution. The seismic regime is analysed in space-time windows of various sizes; a special attention is paid to the problem of detecting spatial and/or temporal changes in the local seismicity patterns. The study emphasizes some regularities, which characterize the shallow and sub-crustal earthquake sequences: the earthquake occurrence in space and time shows a significant clustering tendency in the crustal seismogenic area, while the intermediate depth seismicity is modelled by a completely random pattern.
A parameterization derived from the Weibull distribution is considered, to analyse the time distribution of the moderate and strong intermediate depth earthquakes. Only the events with magnitude greater than 5, which occurred during the last century, are considered. The results point out that the time series of subcrustal moderate-size earthquake are also modelled by a completely random pattern.

SCA – 07