Chapter 79.16 Croatia

Seismology in Croatia National Centennial Report to IASPEI

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Abstract

Seismology in Croatia has deep roots that extend well into the 19th century. It developed at first almost exclusively as the result of efforts being made by Andrija Mohorovičić. In later years, the number of active seismologists varied, but never exceeded twelve, who were all affiliated with the Geophysical Institute in Zagreb. This small seismological community bore the responsibility to maintain high standards in seismological research and education, and to keep Croatian seismology recognizable in the world of geophysical science.

Early Croatian seismology developed under strong influence of world-wide, especially European, achievements in that field. It was also strongly affected by the occurrence of several strong earthquakes on its territory, most notably the Zagreb earthquake of 1880, and the Pokupsko one of 1909. Studying the seismograms of the Pokupsko earthquake, Mohorovičić was able to prove the existence of the boundary layer – the Mohorovičić discontinuity – between the Earth's crust and the mantle. Mohorovičić's other contributions are also important (Mohorovičić's epicentrals, Mohorovičić's seismograph, Mohorovičić's travel-time curves (hodochrones)).

After Mohorovičić retired the seismological research lost most of it's momentum, and for 20 years no seismological papers were published. After the World War II the Geophysical Institute was incorporated into the Faculty of Science and Mathematics of the Zagreb University, and the seismologists became more active. Most of the efforts were dedicated to construction of local travel-time curves based on empirical data, and to the problems related to locations of the earthquakes.

In the second half of the century, especially in the last three decades, the scientific interest of Croatian seismologists broadens, and international cooperation is intensified. The research topics are no longer limited to investigations of local seismicity, new techniques and methods are introduced, and instrumentation is substantially improved. The most important subjects of study include improvement of earthquake location techniques, revision and updating of the Croatian Earthquake Catalog, quantification of earthquakes (especially Ms), seismotectonical considerations, historical seismology, determination of velocity distribution including anisotropy studies, attenuation of seismic waves (coda Q), earthquake statistics and prediction (CN algorithm), earthquake hazard and risk employing novel approaches to the subjects, and seismic zonation of Croatia.

1 Introduction

Seismology in Croatia has deep roots that extend well into the 19th century. It developed at first almost exclusively as the result of efforts being made by Andrija Mohorovičić. In later years, the number of active seismologists varied, but never exceeded twelve, who were all affiliated with the Geophysical Institute in Zagreb. This small seismological community bore the responsibility to maintain high standards in seismological research and education, and to keep Croatian seismology recognizable in the world of geophysical science.

2 Seismology in Croatia until 1960

Early Croatian seismology developed under strong influence of world-wide, especially European, achievements in that field. It was also strongly affected by the occurrence of several strong earthquakes on its territory.

One such event was the great Zagreb earthquake of 9 November 1880, with the hypocenter below the Zagreb Mt., after which the sporadic earthquake research efforts evolved into systematic ones. Immediately after the earthquake, the Yugoslav Academy of Science and Arts in Zagreb established the "Committee for observation of earthquake-related phenomena" with the task to study Croatian earthquakes and methodically collect all related data. In the first volume of its Papers, the Academy published the extensive report on the Zagreb earthquake (Torbar, 1882), where the phenomena related to that event are not only described, but also explained. The Academy's Committee later also collected and published all available information on Croatian earthquakes from the period 361–1906 which was used as solid basis for scientific study of the natural phenomenon (Kišpatić 1895, Kišpatić 1907).

In January 1892, Andrija Mohorovičić became the director of the Meteorological Observatory in Zagreb (later the Geophysical Institute). In 1893 he initiated systematic collection of earthquake related data, which have been regularly published since 1906 in the Seismic reports. Following the strong earthquake of 17 December 1901 near Zagreb, Kišpatić and Mohorovičić made every effort to have a seismic station set up in Zagreb. After the first seismoscopes and seismographs were obtained in the beginning of the 20th century, Mohorovičić realized the importance of accurate time-keeping. He therefore initiated regular observation of times of passage of stars through the local meridian, thus founding the Croatian time service.

The strong earthquake in the Kupa Valley (Pokupsko) on 8 October 1909 entered into the history of seismology. Studying its seismograms, Mohorovičić was able to prove the existence of the boundary layer, the Mohorovičić discontinuity, between the Earth's crust and the mantle (Mohorovičić, 1910), thus establishing himself as one of the greatest and most renowned Croatian scientists of all times. His studies of the Pokupsko earthquake also yielded the procedure of unique location of earthquake focus and the analytical expression for the increase of elastic wave velocity with depth (Mohorovičić's law). Based on theoretical considerations, Mohorovičić also predicted the distribution of deep-focus earthquakes, which was confirmed by Wadati in 1928. Mohorovičić's other contributions are also important (Mohorovičić's epicentrals, Mohorovičić's seismograph, Mohorovičić's travel-time curves (hodochrones)). He worked actively until the late 1920's.

After Mohorovičić retired, the seismological research lost most of it's momentum, and for 20 years no seismological papers were published. The reasons for that should be searched for in the political turmoil and in the changes the country went through in those times. The seismographic observations in Zagreb, however, continued with practically no interruptions, and all seismograms are still available in the archive of the Geophysical Institute. After the World War II the Geophysical Institute was incorporated into the Faculty of Science and Mathematics of the Zagreb University, and the seismologists became more active. Most of the efforts are dedicated to construction of local travel-time curves based on empirical data, and to the problems related to locations of the earthquakes.

3 Seismology in Croatia, 1961–1999

Following the damaging Makarska-Hvar earthquake of 1962, seismological research was intensified again. Croatian seismologists published papers in cooperation with foreign colleagues that deal with location of earthquakes, seismicity of Central Adriatic and other Croatian regions, and analyzed the problem of optimum distribution of seismic stations. The first seismic maps of Croatian territory were published, as well as studies dealing with microzonation of cities and larger urban areas. Inclusion of Yugoslavia (and thus also Croatia) into the UNESCO project "Survey of the seismicity of the Balkan region" in 1970's provided Croatian seismologists with the opportunity to widen their scientific interest, and actively participate in international teams

studying all aspects of seismicity of the countries in the southeastern Europe. At that time instrumentation was significantly modernized (see below) and new seismic stations were opened. One of the main outcomes of that project is most certainly the Catalog of earthquakes and the collection of macroseismic maps from the investigated area, which served as basis for later compilation of Croatian earthquake catalog and the Croatian macroseismic digital database. In this period papers were also published on the seismotectonics of the Croatian region. The relation between magnitude, intensity and maximal acceleration is also investigated. The increased seismic activity of the Friuli region (northern Italy) in 1976, as well as the great Montenegro earthquake of 1979 prompted macroseismic and neotectonic studies, analyses of the aftershock sequences, investigations of temporal and spatial variation of seismicity, research involving estimation of parameters of seismic forces, strong-motion analyses, etc.

The Croatian seismology in the last two decades of the 20th century is characterized by notable broadening of research subjects, which was aided by the advent of affordable computers. In 1985 the Croatian Seismological Survey was founded. It is responsible for collection, analysis and archiving of all kinds of seismological data. Topics related to seismicity research and microzonation studies are now accompanied by subjects of the more general nature: theoretical considerations of earthquake statistics, analyses of surface-wave dispersion, numerical algorithms for the earthquake location, etc. Seismological methods are used to infer geological and elastic properties of the crust and uppermost mantle of the Croatian territory, including anisotropy and vertical as well as lateral distribution of seismic velocities and coda-Q measurements. In the field of earthquake quantification, it has been shown that standard calibrating functions for Ms yield distance-dependent magnitudes, the depth correction for Ms is proposed, while local magnitudes were related to maximum observed intensities and strong-motion records. It has been shown that anomalous seismicity existed prior to several significant earthquakes in Croatia, and the CN algorithm for intermediate term earthquake prediction was successfully applied to the Dinarides area. Fault-plane solution analyses provided the insight into the properties of the tectonic stress field. Historical seismograms (e.g. Vicentini record of the San Francisco event of 1906 from Zagreb) were studied in some detail, and modern methods were used to infer the fine details of the magnification curves of the old mechanical seismographs. Based on the seismic zoning of the Croatian territory, seismic hazard elements were estimated also by deterministic modeling using synthetic accelerograms.

Croatian seismologists actively participated in a number of bilateral and multilateral international seismological projects.

4 Seismological Instrumentation

The first seismological station on Croatian territory was opened in Pula in 1900, equipped at first with a Vicentini, and afterwards also with Conrad and Wiechert seismographs. The station was closed in 1918, after the collapse of the Austro-Hungarian empire, and it is not known what happened to the instruments and the seismogram archive. Besides Pula, the following stations also operated in the first half of the 20th century: Rijeka (1901–1918, seismograph Vicentini), Sinj (1914–1924, seismograph Conrad), Šibenik (1926–1940, seismograph Conrad, temporary operation), Dubrovnik (1927–1929, seismograph Conrad), Zagreb (1906–).

The Zagreb (ZAG) seismological station was founded when the first seismological instrument, the Agamemnone electrical seismoscope, was acquired by the Academy in 1901. At the conference of directors of meteorological institutes, held in Innsbruck in 1905, Mohorovičić asked Dr. Konkoly from Budapest to lend him one of the Vicentini seismographs, which was installed in basement of the Geophysical Institute in Zagreb on April 6, 1906. The instrument was operational for 18 years. Dissatisfied with the instrument's performance, Mohorovičić purchased

the Wiechert seismograph with a mass of 80 kg that recorded horizontal ground motion and installed it in Zagreb in 1908. Soon afterwards, in 1909, a new horizontal instrument was obtained with a mass of 1000 kg. The vertical Wiechert instrument (1200 kg) was acquired in 1932. These seismographs operated with almost no interruptions until 1983 when they were moved to the Institute's new location on Horvatovac, Zagreb. These seismographs were restored and are now in an operating condition.

Electromagnetic seismographs (Sprengnether, SKM-3, Vegik) were obtained in early 1970's, in the framework of the UNESCO project "Survey of the seismicity of the Balkan region". At that time, the strong-motion network was installed too. The new instruments were used to open new permanent stations Puntijarka (PTJ, 1972) and Hvar (HVAR, 1973), and later also Dubrovnik (DBK, 1986) and Rijeka (RIY, 1988). In addition to permanent stations, a number of temporary ones were installed all over Croatian territory, some of which are still active.

The first 16-bit digital instrument was installed in Zagreb in 1989. The modern Croatian seismic network will be based on seven broad-band seismometers with 24-bit digitizers, which were obtained in 1999.

5 Seismological Education

Seismology is taught at the Department of Geophysics of the Faculty of Science and Mathematics, University of Zagreb, at both the undergraduate and postgraduate levels. Students wishing to obtain seismological education study physics for the initial two years, general geophysics (including courses in meteorology, oceanography, seismology and other geophysical disciplines) during their third study year, while more specialized seismological subjects are parts of the curriculum of the fourth year. The undergraduate study is concluded by defense of the B.Sc. thesis. Good students normally continue their education at the postgraduate study, which ends with a M.Sc. or a Ph.D. degree.

6 Selected Bibliography of Croatian Seismology

Torbar J. (1882): Report on Zagreb earthquake of November 9, 1880 (in Croatian). JAZU, Knjiga I, Zagreb, 1-144.

Kišpatić M. (1894): Eleventh earthquake report for the year 1893 (jedanaesto potresno izviješće za godinu 1893), RAD JAZU, 120, Zagreb (in Croatian).

Kišpatić M. (1895): Earthquakes in Croatia II (in Croatian). Rad JAZU, 122, 1-94.

Kišpatić M. (1907): Twentyfourth earthquake report for the first quarte of 1906 (in Croatian). Rad JAZU, 169, 1-54.

Mohorovičić A. (1908): Epicenters of earthquakes in Croatia and Slavonia (Epicentra potresa u Hrvatskoj i Slavoniji). Godišnje izvješće Zagrebačkog meteorološkog opservatorija za godinu 1906. Part IV. Introduction (Uvod) 15-19 (in Croatian).

Mohorovičić A. (1910): Earthquake of 8 October 1909 (Potres od 8. X 1909; Das Beben vom 8. X. 1909.). Yearly report of the Zagreb meteorological observatory for the year 1909 (Godišnje izvješće zagrebačkog meteorološkog opservatorija za godinu 1909), Zagreb, 63 pp. Reprint edition: Školska knjiga, Zagreb, 1977 (in Croatian and German); English translation : Geofizika, 9, 3-55 (1992).

Mohorovičić A. (1911): The effects of earthquake on buildings (Djelovanje potresa na zgrade). Vijesti hrv. društva inž. i arh., Zagreb (in Croatian).

Mohorovičić A. (1913): Developments in seismology in the last fifty years (Razvoj seizmologije posljednjih pedeset godina). Ljetopis JAZU, 27, Zagreb (in Croatian).

Mohorovičić A. (1914): Hodograph der normalen P-Wellen fur eine mittlere Herdtiefe. Beilage zu den Seismischen Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb. Litographed.

Mohorovičić A. (1915): Hodograph of the first longitudinal earthquake waves (emersio undarum primarum) (Hodograf prvih longitudinalnih valova potresa (emersio undarum primarum)). Rad JAZU 204,1-20.
Mohorovičić A. (1914); Hodograph der ersten longitudinalen Wellen eines Bebens (emersio undarum primarum). Bulletin des travaux de 1'Academie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathematiques et naturelles 2,139-157.
Mohorovičić A. (1915): New phases in the onset of an earthquake (Nove faze u slici početka potresa). Rad JAZU 208, 89-109.
Mohorovičić A. (1915): Neue Phasen im Anfange des Bildes eines Bebens. Bulletin des travaux de 1'Academie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathématiques et naturelles 4, 65-86.
Mohorovičić A. (1915): Zu dem mittelitalienischen Beben vom 13. Jänner 1915. 2. Beilage zu den Seismischen Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb, 5 pp. Litographed.
Mohorovičić A. (1915): Zur Frage der Emergenzgeschwindigkeit. 1. Beilage zu den Seismischen Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb, 4 pp. Litographed.
Mohorovičić A. (1916): Die Bestimmung des Epizentrums eines Nahbebens. Gerlands Beitrage zur Geophysik 14,199-205.
Mohorovičić A. (1916): Vorlaufige Mitteilung uber das Beben vom 12. III. 1916. Berichte uber seismische Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb. No pagination
Mohorovičić A. (1917): Principles and construction of a seismograph, and a proposal for construction of a new seismograph for recording of horizontal component of ground motion (Principi konstrukcije sismografa i prijedlog za konstrukciju nova sismografa za horizontalne komponente gibanja zemlje). Rad JAZU 217, 114-150 (in Croatian).
Mohorovičić A. (1918): Prinzipien fur die Konstruktion eines neuen Seismographen. Bulletin des travaux de 1'Academie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathematiques et naturelles 9/10, 6-20.
Mohorovičić A., Mohorovičić S. (1922): Hodographs of the longitudinal and transversal earthquake waves (undae primae et undae secundae) (Hodografi longitudinalnih i transversalnih valova potresa (undae primae et undae secundae)). Part 1. Hodographs. Written by A. Mohorovičić. Rad JAZU 226, 94-190 (in Croatian).
Mohorovičić A. (1923): Hodographen der longitudinalen und transversalen Wellen eines Bebens (undae primae et undae secundae). 1. Hodographen. Bulletin des travaux de 1'Académie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathematiques et naturelles 15/18, 1-16.
Gilić A. (1923): Seismic activity in Croatia, Slavonia and Međimurje in 1922 (Seizmička djelatnost u Hrvatskoj, Slavoniji i Međimurju godine 1922). Rad Geofizičkog zavoda u Zagrebu I/l, 1-7 (in Croatian).
Mohorovičić A. (1924): A critical review of the seismic instruments used today and of the organisation of seismic service. Bulletin of Seismological Society of America I, 38-59.
Mohorovičić A. (1925): Hodographes des ondes normales P et S soulignees (Pn, P*, S*) et des deux premieres reflexions pour les profondeurs de 1'hypocentre de 0, 25, 45, 57 kms. UGGI, Section de Seismologie, A. Travaux Scientifique 3, Paris,1-60.
Mohorovičić A. (1926): Zur Frage der wahren Empfindlichkeit eines Seismographen. Gerlands Beitrage zur Geophysik 15, 201-214.
Mokrović J. (1947): Earthquakes at great depths (Potresi u velikim dubinama). Glasnik matematičko-fizički i astronomski II/2,104-119 (in Croatian).
Marković B. (1948): Microseismic noise in Zagreb (Mikroseizmički nemir u Zagrebu). Rad Geofizičkog zavoda u Zagrebu II/l, 87 pp (in Croatian).
Mokrović J. (1950): Earthquakes in Zagreb (Potresi u Zagrebu). Rad Geofizičkog zavoda u Zagrebu ll/3, 25-77.
Mokrović J. (1952): Zagreb body waves travel-time curves for the erathquakes at normal depths (Zagrebačke hodohrone prostornih seizmičkih valova za potrese normalnih dubina). Radovi Geofizičkog instituta u Zagrebu III/2, 50 pp.
Mokrović J. (1955): Les hodochrones pour tremblements de Terre a foyers normaux deduites des observations de Zagreb. Comptes rendus 11, UGGI, Association de seismologie et physique de 1'interieur de la Terre, Strassbourg, 60-62.

Gilić A. (1957): Graphische Lokalisierung des Epizentrums eines Fernbebens aus den Ankunftszeiten. Glasnik matematičko-fizički i astronomski II/12; 75-119 i Radovi Geofizičkog instituta u Zagrebu III/8, 44 pp.

Gilić A. (1959): The geographical location of a distant earthquake. Bulletin of the Seismological Society of America 49, 221-226.

Mokrović J. (1960): Mathematical derivation of the Mohorovičić's theory on spreading of seismic waves in the upper-most parts of the Earth (Matematički izvod Mohorovičićeve teorije o rasprostiranju seizmičkih valova u najgornjim slojevima Zemlje). Radovi Geofizičkog instituta u Zagrebu III/6, 13 pp. i Bošković, almanah Hrvatskoga prirodoslovnog društva 1959/60, 187-200 (in Croatian).

Kasumović M. (1963): Seismic activity of the central Adriatic and the recent earthquakes near Makarska (Seizmička aktivnost srednjeg Jadrana i posljednji potresi u makarskom primorju). Geološki vjesnik 16, 227-232 (in Croatian).

Sato Y., Skoko D. (1965): Optimum distribution of seismic observation points, II. Buletin of the Earthquake Research Institute 45, 451-457.

Skoko D., Sato Y., Ochi I. (1965): Reduction and analysis of seismograms consisting of only maxima and minima. Journal of Physics of the Earth 13/l, 5-9.

Cvijanović D. (1966): Strong earthquakes in SR Croatia (I≥VI °MCS) (Jači potresi (I≥VI °MCS) u SR Hrvatskoj). Geološki vjesnik 19, 139-167 i Radovi Geofizičkog zavoda u Zagrebu III/17, 28 pp (in Croatian).

Skoko D., Sato Y. (1966): Optimum distribution of seismic observation points, III. Buletin of the Earthquake Research Institute 14,13-22.

Skoko D., Sato Y., Ochi I., Dutta T. K. (1966): Accuracy of the determination of earthquake source parameters as determined by Monte Carlo method – Observation on Indian network. Bulletin of the Earthquake Research Institute 44, 893-900.

Skoko D., Sato Y., Ochi I. (1967): Optimum distribution of seismic observation points, IV – Desirable location of a new station in Yugoslavia. Bulletin of the Earthquake Research Institute 45, 289-298.

Skoko D., Kotake Y., Sato Y. (1968): Optimum distribution of seismic observation points, V – Desirable location of new stations in Yugoslavia. Bulletin of the Earthquake Research Institute 46, 821-840.

Bubnov, S., Cvijanović D., Jurak V., Magdalenić A., Skoko D., Vukovojac D. (1970): Seismic zoning of Zagreb. Proc. of the third European Symposium on earthquake engineering, Sofia,Sept.14-171970. Bulg. Acad. of Sci., Sofia, 95-102.

Cvijanović D. (1969/70): Seismicity of Slavonia (Seizmičnost Slavonije). Vesnik Zavoda za geološka i geofizička istraživanja C, 10/1 l, 71-102 (in Croatian).

Cvijanović; D. (1970): Seismic maps with epicenters of earthquakes and isolines of the highest intensity on the territory of SR Croatia (Seizmičke karte s označenim epicentrima i izolinijama najvećeg intenziteta potresa za područje SR Hrvatske). In: Savezni geološki zavod, Inženjersko geološka karta SFR Jugoslavije i Tumač inženjersko geološke karte SFR Jugoslavije, Beograd.

Bubnov S., Cvijanović D., Jurak V., Magdalenić A., Skoko D. (1971): Map of preliminary seismic microzonation of the city of Zagreb (Preliminarna karta seizmičke mikrorajonizacije grada Zagreba). Problemi hidrologije i inženjerske geologije 2, 67-73 (in Croatian).

Cvijanović D. (1971): Earthquakes of the intensity Io ≥ IX °MCS up to 1800 with epicenters on the territory of SR Croatia (Potresi intenziteta Io ≥ IX °MCS do 1800. godine s epicentrom na području SR Hrvatske). Acta seismologica Iugoslavica l, 23-29 (in Croatian).

Cvijanović D. (1971): Seismicity of the Dubrovnik area (Seizmičnost dubrovačkog područja). Acta seismologica Iugoslavica l, 31-56 (in Croatian).

Iosif, T., Skoko D., Y. Sato (1972): Optimum distribution of seismic stations in Romania. Bulletin of International Institute of Seismology and Earthquake Engineering 9,121-136.

Makjanić B. (1972): A contribution to the statistical analysis of Zagreb earthquakes in the years 1869-1968. Pure and Applied Geophysics 95 III, 80-88.

Mokrović J. (1972): Probleme über die Natur der Diskontinuität von A. Mohorovičić, Symposium on the Mohorovičić discontinuity, JAZU, Zagreb, 26-30 March 1968.

Mokrović J. (1972): Andrija Mohorovičić – sein Leben und Werk, Symposium on the Mohorovičić discontinuity, JAZU, Zagreb, 26-30 March 1968.

Skoko D. (1972): Some characteristics of seismograms in near earthquakes. Simpozium on the Mohorovičić discontinuity – Zagreb, 26–30 March 1968, JAZU, Zagreb,161-168 (in Croatian).

Gupta H. K., Skoko D., Sato Y. (1973): Accuracy of determination of epicenter and origin time of small-magnitude earthquakes in the Indian subcontinent. Bulletin of the Seismological Society of America 63, 1901-1912.

Skoko D., Sato Y. (1973): Strong motion seismogramme of off-Boso earthquake on November 26, 1953. Bulletin of International Institute of Seismology and Earthquake Engineering 1l, 43-46.

Bašović R., Cvijanović D., Hadžievski D., Janković M., Metović M., Ribarič V., Skoko D., Vučinić S. (1974): Map of distribution of maximum macroseismic intensities. Proc. of the Seminar on the Seismotectonic Map of the Balkan Region, Dubrovnik, April 17-261973. UNESCO/UNDP, Skopje,196-208.

Bašović R., Cvijanović D., Hadžievski D., Janković M., Milenković D., Milosavljević R., Nedeljković S., Ribarič V., Skoko D. (1974): Epicentral Map of Yugoslavia. Proc. of the Seminar on the Seismotectonic Map of the Balkan Region, Dubrovnik, April 17-261973. UNESCO/UNDP, Skopje,190-195.

Cvijanović D., Makjanić B., Mokrović J., Skoko D. (1974): Contributions to N. V. Shebalin, V. Karnik, Hadžievski D. (editors), Catalogue of earthquakes I-III, UNDP/UNESCO Survey of the Seismicity of the Balkan Region, Skopje.

Biondić B., Cvijanović D., Skoko D., Vučić Ž. (1975): Seismotectonic map of the Rijeka area (Seizmotektonska karta područja Rijeke). Yugoslav simposium on the seismic microregionalization, Plitvička jezera 16-17. X 1975. Jug. društvo za seizmičko građevinarstvo, Jug. koordinacioni odbor za seizmologiju, Institut građevinarstva Hrvatske, Zagreb 19, 5 pp (in Croatian).

Prelogović E., Cvijanović D., (1975): Die jungsten tektonischen Bewegungen und seismische Aktivitat im Gebiete Kroatiens. Bulletin scientifique A 20/3-4, 67-68.

Skoko D., Hadžievski D., Arsovski M. (1975): On the determination of the possible earthquake origin zones on the Yugoslav territory (O određivanju zona mogućih žarišta potresa u području Jugoslavije). Yugoslav simposium on the seismic microregionalization, Plitvička jezera 16-17. X 1975. Jug. društvo za seizmičko građevinarstvo, Jug. koordinacioni odbor za seizmologiju, Institut građevinarstva Hrvatske, Zagreb 4, 7pp (in Croatian).

Skoko D., Arsovski M., Hadžievski D. (1976): Determination of possible earthquake origin zone on the territory of Yugoslavia. Proc. of the Seminar on Seismic Zoning Maps, Skopje, October 27-November 4,1975. UNDP/UNESCO, Skopje l, 116- 131.

Skoko D., Arsovski M., Hadžievski D. (1976): Determination of possible earthquake origin zone on the territory of Yugoslavia (Određivanje mogućih žarišta potresa na području Jugoslavije). Acta seismologica Iugoslavica 4, 7-14 (in Croatian).

Arsovski M., Mihailov V., Cvijanović D., Kuk V. (1976): The relation between seismological and neotectonic characteristics of Friuli and neighbouring areas. Bolletino di Geofisica Teorica ed Applicata 19/72, 285-298.

Cvijanović D., Prelogović E., Skoko D. (1976): Seismotectonic characteristics of the Croatian region. Proc. of the Seminar on Seismic Zoning Maps, Skopje, October 27-November 4,1975. UNDP/UNESCO, Skopje l, 52-68.

Cvijanović D., Prelogović E., Skoko D. (1976): Seismotectonic map of SR Croatia (Seizmotektonska karta SR Hrvatske). Acta seismologica Iugoslavica 4,19-23 (in Croatian).

Karnik, V., Prochazkova D., Ruprechtova L., Schenkova Z.; Dudek A., Drimmel J., Schmedes E., Leydecker G., Rothe J. P., Guterch B., Lewandowska H., Mayer-Rosa D., Cvijanović D. (1976): Macroseismic effects of the Friuli earthquake of May 6, 1976 in Austria, Czechoslovakia, F.G.R., France, Poland and Yugoslavia. Bolletino di Geofisica Teorica ed Applicata 19/72, 729-737.

Prelogović E., Cvijanović D. (1976): Quarternary tectonic deformation and seismogenetic zones of Croatia (Kvartarne tektonske deformacije i seizmogene zone Hrvatske). 8. Yugoslav geological congress, Bled 1–5. October 1974. Geotehnika geofizika, Ljubljana, 3, 175-190.

Prelogović E., Cvijanović D. (1976): Vertical neotectonic movements and strong earthquakes on the territory of SR Croatia (Vertikalni neotektonski pokreti i pojave jačih potresa na području SR Hrvatske). Geološki vjesnik 29,151-157.

Cvijanović D. (1977): Function s(D) for earthquake magnitude for short distances according to the data of the seismological station Zagreb. Publications of the Institute of Geophysics, Polish Academy of Sciences 116/A-5, 65-72.

Cvijanović D. (1977): Maximal ground accelerations and velocities caused by earthquakes on the territory of SR Croatia (Maksimalni iznosi akceleracija i brzina oscilacija čestica tla izazvanih potresom na

području SR Hrvatske). Savetovanje Planiranje, projektovanje i izgradnja objekata na seizmičkim područjima, Cavtat 14-16 December 1977. Savez gradevinskih inženjera i tehničara Jugoslavije, Jugoslovensko društvo za seizmičko građevinarstvo, Savez građevnih inženjera i tehničara SR Srbije, Beograd, 384-392 (in Croatian).

Cvijanović D. (1977): Relations between magnitude, intensity and acceleration of earthquakes. Publication, Institute of Earthquake Engineering and Engineering Seismology, Univ. of Skopje 51, 1-6.

Cvijanović D., Prelogović E. (1977): Seismicity and neotectonic movements of the Croatian region (SFR Yugoslavia). Publications of the Institue of Geophysics, Polish Academy of Sciences I 16/A-5, 281-290.

Cvijanović D., Mihailov V. (1978): Correlation between the seismological data and the accelerograms obtained in Yugoslavia. Sixth European Conference on Earthquake Engineering, Sept. 18-22, 1978, Dubrovnik-Yugoslavia. Yugoslav association for earthquake engineering, Ljubljana, I; 33-37.

Cvijanović D., Oluić M., Kuk V. (1978): Seismicity of Friuli and the neighboring areas (Seizmičnost Furlanije i susjednih područja): Publikacija, Institut za zemljotresno inženerstvo i inženerska seizmologija Univerziteta Skopje, 58, 21-34. (in Croatian).

Cvijanović D., Prelogović E. (1978): The great Dubrovnik earthquake 1667. Sixth European Conference on Earthquake Engineering, Sept. 18-22, 1978, Dubrovnik-Yugoslavia. Yugoslav association for earthquake engineering, Ljubljana, 6, 9-16.

Karnik V., Prochazkova D., Schenkova Z., Drimmel J., Mayer-Rosa D., Cvijanović D., Kuk V., Milošević A., Giorgetti F. (1978): Isoseismals of the strongest Friuli aftershocks of September 1976. Studia Geophysica et geodaetica 22, 411-414.

Karnik V., Prochazkova D., Schenkova Z., Ruprechtova L., Dudek A., Drimmel J., Schmedes E., Leydecker G., Rothe J. P., Guterch B., Lewandowska H., Mayer-Rosa D., Cvijanović D., Kuk V. Giorgetti F., Grunthal G., Hurtig E. (1978): Map of the isoseismals of the main Friuli earthquake of 6 may 1976. Pure and Applied Geophysics 116, 1307-1313.

Makjanić B. (1978): On the maximum annual earthquake at Dubrovnik. Sixth European Conference on Earthquake Engineering, Sept. 18-22, 1978, Dubrovnik-Yugoslavia. Yugoslav association for earthquake engineering, Ljubljana, 1, 25-31.

Oluić M., Cvijanović D., Kuk V. (1978): Tectonic and seismic activity of northwestern Yugoslavia and part of Italy (Tektonska i seizmička aktivnost sjeverozapadne Jugoslavije i dijela Italije). Zbornik radova 9. kongresa geologa Jugoslavije (2. X 1978), Geološki zavod BiH, Sarajevo, 242-249 (in Croatian).

Prelogović E., Cvijanović D., Kranjec V., Skoko D., Fritz F., Bojanić L., Zagorac Ž., Hernitz Z., Velić J., Ivšić D., Marić K. (1978): Examples of definitions of project parameters of seismic forces effects related to geological structures in SR Croatia (Primjeri definiranja projektnih parametara učinka seizmičkih sila povezani s geološkom građom u SR Hrvatskoj). Zbornik radova 5. jugoslovenskog simpozijuma o hidrogeologiji i inženjerskoj geologiji, Beograd, 18-20. IV 1978. Jug. komitet za hidrogeologiju, inženjersku geologiju i geofiziku, Beograd, 2, 215-234 (in Croatian).

Prelogović E., Cvijanović D., Skoko D. (1978): On the causative relation between neotectonic movements and seismic activity in SR Croatia (O uzročnoj vezi neotektonskih gibanja i seizmičke aktivnosti u SR Hrvatskoj). Geološki vjesnik 30, 745-755 (in Croatian).

Skoko D. (1978): Structure response to earthquake analysis done by Mohorovičić A. in 1910. Sixth European Conference on Earthquake Engineering, Sept. 18-22 1978, Dubrovnik – Yugoslavia. Yugoslav association for earthquake engineering, Ljubljana, 2, 1-5.

Skoko D., Cvijanović D., Prelogović E. (1978): Seismic activity based on neotectonics. Proc. of the Symposium on the Analysis of Seismicity and on Seismic Risk, Liblice, Czechoslovakia, October 17-22, 1977. Czechoslovak Academy of Sciences, Geo- physical Institute, Prague, 81-91.

Cvijanović D., Prelogović E. (1979): Seismotectonic processes in the area of northern Dalmatia (Seizmotektonski procesi u području sjeverne Dalmacije). Acta seismologica Iugoslavica 5, 37-51 (in Croatian).

Cvijanović D., Prelogović E., Skoko D., Kapelj J. (1979): Seismotectonic activity along the pipeline section Omišalj – Sisak (Seizmotektonska istraživanja duž trase naftovoda na dionici Omišalj – Sisak). Građevinar 31, 211-218 (in Croatian).

Skoko D., Jorgić M. (1979): Choosing the magnification of the SKM-3 seismograph (Odabiranje povećanja seizmografa SKM-3). Radovi Geofizičkog zavoda u Zagrebu III/19, 24 pp (in Croatian).

Cvijanović D. (1980): Estimation of seismic activity development after the catastrofic earthquake of 15 April 1979 in Montenegro (Procjena razvoja seizmičke aktivnosti u Crnogorskom primorju nakon

katastrofalnog potresa od 15. travnja 1979. godine). Zbornik radova, Simpozijum o zemljotresu na Crnogorskom primorju od 15. IV 1979. godine, Herceg Novi 15-17. april 1980. Zajednica za seizmologiju SFRJ i Rep. seizmološki zavod, Titograd,157-175 (in Croatian).

Cvijanović D. (1980): Estimation of seismic forces in the Montenegro coast area (Proračun parametara djelovanja seizmičkih sila na području Crnogorskog primorja). Zbornik radova – Simpozijum o zemljotresu na Cmogorskom primorju od 15. IV 1979. godine, Herceg Novi 15-17. april 1980. Zajednica za seizmologiju SFRJ i Rep. seizmološki zavod, Titograd, 379-40 (in Croatian).

Cvijanović D., Kuk V., Marić K. (1980): Temporal and spatial variations of seismic activity in the Montenegro coastal area in 1979 (Vremenske i prostorne varijacije seizmičke aktivnosti u području Crnogorskog primorja 1979. godine). Zbornik radova – Simpozijum o zemljotresu na Crnogorskom primorju od 15. IV 1979. godine, Herceg Novi 15-17. april 1980. Zajednica za seizmologiju SFRJ i Rep. seizmološki zavod, Titograd, 141-147 (in Croatian).

Cvijanović D., Prelogović E., Skoko D., Marić K., Mišković D. (1980): Seismotectonic regionalization of Medvednica (Seizmotektonska rajonizacija Medvednice). Zbornik referatov 6. jugoslovanskega simpozija o hidrogeologiji in inženirski geologiji, Portorož 12-16. V 1980. Jugoslovanski komitet za hidrogeologijo in inženirsko geologijo, Slovensko geološko društvo, Ljubljana 2, 13-25.

Cvijanović D., Živčić M., Prelogović E., Oluić M. (1980): Catalog of earthquakes in the Montenegro coastal area in 1979 (Katalog potresa Crnogorskog primorja 1979. godine). Zbornik radova – Simpozijum o zemljotresu na Crnogorskom primorju od I5. IV 1979. godine, Herceg Novi IS-17. april 1980. Zajednica za seizmologiju SFRJ i Rep. seizmološki zavod, Titograd,101-122 (in Croatian).

Makjanić B. (1980): On the frequency distribution of earthquake magnitude and intensity. Bulletin of the Seismological Society of America 70, 2253-2260.

Mihailov V., Cvijanović D. (1980): Earthquakes in Montenegro in 1979: some observations on the correlation of maximal ground accelerations and the strength of earthquakes (Zemljotres u Crnoj Gori 1979. godine: neka zapažanja o korelaciji maksimalnih amplituda ubrzanja tla i jačine zemljotresa). Zbornik radova – Simpozijum o zemljotresu na Crnogorskom primorju od 15. IV 1979. godine, Herceg Novi 15-17. april 1980. Zajednica za seizmologiju SFRJ i Rep. seizmološki zavod, Titograd,177-185 (in Croatian).

Milošević A. (1980): Seismic activity of the Rijeka area in 1979 (Seizmička aktivnost riječkog područja u 1977. godini). Acta seismologica Iugoslavica 6, 17-27 (in Croatian).

Oluić M., Cvijanović D., Prelogović E. (1980): Some new data on the tectonic activity in the Montenegro coastal region (Yugoslavia) based on the Landsat imagery XXXI Congress International Astronautical Federation, IAF-80., Tokyo, Japan, September 21-28.

Prelogović E., Cvijanović D., Aljinović B., Kranjec V., Skoko D., Zagorac Ž. (1980): Seismotectonic activity of the coastal part of Yugoslavia, 26 Congr. Geol. Intern., Geološki vjesnik, 35, Zagreb, 195-207.

Prelogović E., Fritz F., Cvijanović D., Milošević A. (1980): Seismotectonic activity in the Zrmanja valley area (Seizmotektonska aktivnost u području doline Zrmanje). Geološki vjesnik 31, 123-136 (in Croatian).

Živčić M., D. Mišković, Skoko D. (1980): Earthquakes of 25 July 1979 in the Imotsko Polje (Potresi 25. VII 1979. g. u Imotskom polju). Acta seismologica Iugoslavica 6, 29-38 (in Croatian).

Živčić M., D. Mišković, Skoko D. (1980): Seismic activity of the Monenegro coastal area in the period 01 Jan. 1978 -15 Apr. 1979 (Seizmička aktivnost na području Crnogorskog primorja u vremenu od 01.01.1978 -15. 04.1979. godine). Zbornik radova – Simpozijum o zemljotresu na Crnogorskom primorju od 15. IV 1979. godine, Herceg Novi 15-17. april 1980. Zajednica za seizmologiju SFRJ i Rep. seizmološki zavod, Titograd, 79-84 (in Croatian).

Aljinović B., Blašković I., Cvijanović D., Prelogović E. (1982): Geophysical and geological interpretaion of the deep profiles in the Adriatic and Dinarides. International symposium on the Hellenic arc and trench (H.E.A.T.), April 8-10, 1981. Athens, 1982, Athens, Proceedings, Volume 1, 1-18.

Cvijanović D., Arsovski M., Mihailov V. (1981): Characteristics of seismic activity in the greater Biokovo area (Karakteristike seizmičke aktivnosti u širem području Biokova). Acta Biocovica 1, 23-34 (in Croatian).

Cvijanović D., Klein. V. (1981): Seismo-morpho-structural relationships in Friuli and hinterlands (Seizmo-morfo-strukturni odnosi Furlanije i njezinog gorskog zaleđa), Seizmološki glasnik, 4, 259-269.

Cvijanović D., Kuk V., Marić K., Prelogović E. (1981): Migration of the seismic activity in Montenegro area of the year 1979. Proceedings of the 2nd International Symposium on the Analysis of Seismicity

and Seismic Hazard, Liblice, Czechoslovakia, May 18-23, 1981. Czechoslovak Academy of Sciences – Geophysical Institute, Prague l, 20S-211.
Cvijanović D., Prelogović E., Živčić M. (1981): The earthquake of April I5, 1979 in the Montenegro coastal region and the disastrous earthquakes on the Balkan peninsula and the western part of Asia Minor. Proceedings of the Research Conference on Intra-continental Earthquakes, Ohrid -Yugoslavia, September 17-21, 1979. Institut za zemljotresno inženerstvo i inženerska seizmologija Univerziteta, Skopje,
Mišković D., Živčić M., Skoko D. (1981): Catalog of earthquakes in the Montenegro coastal area and its surroundings in the period 1 Jan. 1978 untill 15 April 1979 (Katalog potresa s epicentrima na području Crnogorskog primorja i njegove okolice u razdoblju od 01. I 1978. do 15. IV 1979). Acta seismologica Iugoslavica 7, 1-59 (in Croatian).
Mišković D., Živčić M., D.Skoko (1981): Seismic activity on the Montenegro coastal territory during the period: January 1, 1978 – December 31, 1979. Proceedings of the 2nd International Symposium on the Analysis of Seismicity and on Seismic Hazard, Liblice-Czechoslovakia, May 18-23 1981. Czechoslovak Academy of Sciences – Geophysical Institute, Prague, l, 194-204.
Oluić M. Cvijanović D., Prelogović E. (1981): Some new data on the tectonic activity in the Montenegro coastal region (Yugoslavia) based on the landsat imagery. Acta astronautica 9, 27-33.
Prelogović E., Blašković I. Cvijanović D., Skoko D., B. Aljinović (1981): Seismotectonic characteristics of the Vinodol area (Seizmotektonske značajke vinodolskog područja). Geološki vjesnik 34, 75-93 (in Croatian).
Prelogović E., Cvijanović D. (1981): The earthquake in Medvednica in 1880 (Potres u Medvednici 1880. godine). Geološki vjesnik 34, 137-145 (in Croatian).
Skoko D. (1981): Earthquake studies in Croatia in the beginning of the 20th century (Istraživanje potresa u Hrvatskoj početkom 20. stoljeća), Zbornik radova trećeg simpozija iz povijesti znanosti, Prirodne znanost i njihove primjene krajem 19. i početkom 20. stoljeća u Hrvatskoj, Zagreb, 8-10. listopada 1979, Hrvatsko prirodoslovno društvo, Zagreb, 37-46, (in Croatian).
Allegretti I., Mišković D. (1982): Report on the earthquake of 27 Dec. 1981, 13:25 GMT (Izvješće o potresu 27. prosinca 1981. godine u 13h 25m GMT). Acta seismologica Iugoslavica 8, 33-37 (in Croatian).
Herak M., Skoko D., Mišković D. (1982): Adaptation of the Geiger method for earthquake location (Prilagodba Geigerovog postupka za lociranje hipocentra potresa). Acta seismologica Iugoslavica 8, 1-13 (in Croatian).
Makjanić B. (1982): On the generalized exponential distribution of earthquake intensity and magnitude. Bulletin of the Seismological Society of America 72, 981-986.
Mišković, D., Mastnak-Car I., Živčić M., Skoko D., Herak M. (1982): Catalog of earthquakes in Yugoslavia in 1979 (Katalog potresa s epicentrima na području Jugoslavije u godini 1979), Radovi, III ser., br. 25, 100 pp (in Croatian).
Mokrović J. (1982): Seismic waves on land and sea (Seizmički valovi kopnom i morem). Acta seismologica Iugoslavica 8, 15-20 (in Croatian).
Mokrović J: (1982): Variability of the vl/vt quotient (Varijabilnost kvocijenta vl/vt). Acta seismologica Iugoslavica 8, 21-32 (in Croatian).
Oluić M., Cvijanović D., Prelogović E. (1982): Some new data on the tectonic activity in the Montenegro coastal region (Yugoslavia) based on the landsat imagery, Acta Astronautica, 9, 27-33.
Oluić M., Cvijanović D. (1982): Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning. Actes du Symposium International de la Commission VII de la Societe Internationale de Photogrametrie et teledetection, Toulouse, 13-17 Septembre 1982. International archives of ISPRS, Volume 24-VI/1, 567-574.
Prelogović E., Cvijanović D., Aljinović B., Kranjec V., Skoko D., Blašković I., Zagorac Ž. (1982): Seismotectonic activity along the coastal part of Yugoslavia (Seizmotektonska aktivnost duž priobalnog dijela Jugoslavije). Geološki vjesnik 35, 195-207 (in Croatian).
Prelogović E., Cvijanović D., Aljinović B., Skoko D., Blašković I., Kranjec V. (1982): Earthquakes in the Adriatic area (Potresi u jadranskom području). Pomorski zbornik 20, 413-431 (in Croatian).
Benematić D., Cvijanović D., Kožinec S., Kuk V., Skoko D., Raljević B. (1983): Seismic microregionalization of the Babin Kuk are near Dubrovnik (Seizmička mikrorajonizacija područja Babin Kuk kod Dubrovnika). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u

svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb, 145-159 (in Croatian).

Benematić, D., Čorko D., Horvat V., Kuk V., Marić K., Šaban B., Vulić Ž. (1983): Contribution to the methodology of geotechnical research and building in the karst areas (Prilog prijedlogu metodologije geotehničkih istraživanja za projektiranje i izvođenje objekata u području krša). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb, 295-306 (in Croatian).

Biondić B., Cvijanović D., Skoko D., Sviben D., Šaban B., Vulić Ž. (1983): Seismic microzonation of Rijeka (Seizmička mikrorajonizacija Rijeke). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb, 107-121 (in Croatian)

Cvijanović D., R Mavar., Skoko D., Kuk V., Raljević B., Hrelić D., Jakovljević S., Aljinović B., Prelogović E. (1983): Seismic and geotechnical microregionalization of the old city core of Dubrovnik (Seizmička i geotehnička mikrorajonizacija stare gradske jezgre Dubrovnika). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb, 327-343 (in Croatian).

Dujmić N. D., Cvijanović D., Prelogović E., Skoko D., Šikić V., Kožinec S., Muhavec I. (1983): Seismic microzoning of the urban area of the city of Sisak (Seizmička mikrorajonizacija urbanističkog područja grada Siska). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb,123-144 (in Croatian).

Dusparić S., Tusić V., Cvijanović D., Kuk V., Prelogović E., Šikić V., Viljevac Ž., Dujmić N. D, Novosel T. (1983): Geotectonic studies related to the urban planning of the Novi Osijek area on the left bank of the Drava river (Geotehnička istraživanja za potrebe prostornog planiranja područja Novi Osijek na lijevoj obali Drave). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb,177-199 (in Croatian).

Herak M., Herak D. (1983): Determination of the Rayleigh waves dispersion on several paths to Skopje (Određivanje disperzije Rayleighevih valova na nekoliko putanja do Skopja). Acta seismologica Iugoslavica 9, 33-43 (in Croatian).

Novosel T., Cvijanović D., Garašić M., Mavar R., Višić I., Skoko D., Marić K., Prelogović E., Babić Ž., Marković S., Fritz F., Urli M. (1983): Contribution of the seismic and geotechinical microzonation to urban planning – example of the city of Zadar (Doprinos seizmičke i geotehničke mikrorajonizacije prostornom planiranju na primjeru Zadra). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb, 345-369. (in Croatian).

Oluić M., Cvijanović D. (1983): Tectonic elements recorded on satellite images and seismic activity in the western part of Yugoslavia (Tektonski elementi registrirani na satelitski snimcima i seismička aktivnost u yapadnom dijelu Jugoslavije s posebnim osvrtom na okolicu Zagreba), Bilten Savjeta ya daljinska istraživanja JAZU, 4, 12-20.

Prelogović E., Cvijanović D. (1983): Neotectonic activity of part of Slavonia, Baranja and Bačka (Prikaz neotektonske aktivnosti dijela Slavonije, Baranje i Bačke), Geološki vjesnik, 36,241-254.

Višić I., Cvijanović D., Mavar R., Šikić V., Biondić B., Vulić Ž., Andrić M., N. D. Dujmić, Grubić N., Kuk V. (1983): Program of unique studies of urban units for the purpose of seismic microzonation (Program jedinstvenih istraživanja urbanih cjelina u svrhu seizmičke i geotehničke mikrorajonizacije). Savjetovanje Jedinstvena geotehnička istraživanja urbanih cjelina u svrhu geotehničke i seizmičke mikrorajonizacije, Zadar 11-13. svibnja 1983. Republički komitet za građevinarstvo SRH, Zagreb, 307-312 (in Croatian)

Živčić M.(1983): Numerical determination of epicentral coordinates using the method epicentral distances intersection (Numeričko odredivanje koordinata epicentra potresa postupkom presijecanja epicentralnih udaljenosti). Acta seismologica Iugoslavica 9, 1-8 (in Croatian).

Živčić M., Allegretti I. (1983): Earthquake series in the Kvarner Bay in May and Juen 1979 (Niz potresa u Kvarnerskom zaljevu u svibnju – lipnju 1979. godine). Acta seismologica Iugoslavica 9, 9-25 (in Croatian).

Allegretti I., Skoko D., Živčić M. (1984): Earthquake hypocentre determination by analytical presentation of the Wadati's graphical method (four seismological stations) (Određivanje osnovnih parametara potresa zamjenom grafičkog postupka K. Wadatija analitičkim (četiri postaje)). Geofizika 1, 169-191 (in Croatian).

Aljinović B., Blašković I., Cvijanović D., Prelogović E., Skoko D., Brdarević N. (1984): Correlation of geophysical, geological and seismological data in the coastal part of Yugoslavia. Bollettino di oceanologia teorica ed applicata 2, 77-90.

Aljinović B., Blašković J., Cvijanović D., Prelogović E. (1984): Model of tectonics in the Adriatic area, 10th annual meeting at the Catholic University, European Geophysical Society, Louvain-la-Neuve, Belgium, July-August 1984, Terra Cognita, 4, 374-375.

Cvijanović D., Paskalov T., Prelogović E., Ortolan Ž., Šestanović S. (1984): Definition des parametres sismiques pour le barrage de Sidi Yacoub en Algerie, Conference internationale sur la microzonation sismique, Actes de la conference, Tome 2, 89-106, Ech Cheliff, Algerie.

Herak D., Herak M. (1984): Influence of parameters of an earth's crust and upper mantle model on Rayleigh waves dispersion (Utjecaj parametara jednog modela Zemljine kore i gornjeg plašta na disperziju Rayleighevih valova). Geofizika 1, 203-215 (in Croatian).

Herak M., Herak D. (1984): Analysis of dispersive waveforms (Analiza disperzivnih valnih oblika). Zbornik radova sa 6. međunarodnog simpozija Projektiranje i praćenje proizvodnje pomoću računala, Zagreb, 10-11. listopada, 1984., 473-478 (in Croatian).

Milošević A., Prelogović E., Herak D. (1984): Seismicity of the Dinara region (Seizmičnost područja Dinare). Geološki vjesnik 37, 205-215 (in Croatian).

Živčić M. (1984): Focal depth determination using macroseismic data (Odredivanje dubine žarišta potresa na osnovi makroseizmičkih podataka). Geofizika l, 217-211 (in Croatian).

Živčić M. (1984): Extension of Geiger's method for earthquake hypocentre location (Proširenje Geigerove metode određivanja položaja žarišta potresa). Geofizika l, 223-228 (in Croatian).

Živčić M., Allegretti I., Skoko D. (1984): Generalization of the analytical form of Wadati's method for near earthquake hypocentre determination (Poopćenje analitičkog oblika Wadatijeve metode lociranja žarišta blizih potresa). Geofizika l, 193-201 (in Croatian).

Aljinović B., Blašković I., Prelogović E. and Skoko D. (1985): Deformations of the Mohorovičić Discontinuity and the Global Tectonic Movements in the Area of Yugoslavia, EUG 4 Symposia, Strasbourg, 1-4 April 1997, Abstracts, 479.

Borković A., Cvijanović D., Aničić D. (1985): The town of Dubrovnik before and after the disastrous earthquake in 1667. Proceedings of the International conference on reconstruction, restauration and urban planning of towns and regions in seismic prone areas, pp. 143-152, November 5-9, 1985, Skopje, Yugoslavia.

Cvijanović D. (1985): Attenuation functions of earthquakes intensity for western part of Yugoslavia. Proceedings of Third symposium on analysis of seismicity and seismic risk. Liblice, 17-22, June 1985, pp. 313-320.

Cvijanović D. (1985): The strongest earthquakes (M>5.5; Io>VIII °MCS) with epicenters on the territory of SFR Yugoslavia (Najjači potresi (M>5,5; Io>VIII °MCS) s epicentrom na području SFR Jugoslavije), Građevinar, 37, 175-184, (in Croatian).

Živčić M., Allegretti I., Hržič M., Vidrih R., Deterding M. (1985): Earthquakes near Kostanjevica on Krka (Potresi kod Kostanjevice na Krki), Acta Seismologica Iugoslavica, 11,43-54 (in Croatian).

Garašić M., Cvijanović D. (1986): Speleological phenomena and seismic activity in Dinaric karst area in Yugoslavia. 9th Congreso Internacional de Espeleologia, Barcelona del 1 al 7 de agosto 1986, Volume I, 94-97.

Milošević A. (1986): Some properties of partial derivatives of the Love wave dispersion function. Geofizika, Vol. 3, 49-62.

Vidrih R., Šolc O., Živčić M., Allegretti I. (1986): Earthquake activity of Bela Krajina in 1985 (Potresna aktivnost Bele krajine v letu 1985), Rudarsko-metalurški zbornik (Mining and Metallurgy Quarterly), Vol.33, No.1-2, 35-52 (in Slovenian).

Aljinović B., Prelogović E. and Skoko D. (1987a): New data on the deep geological structures and seismotectonically active zones in Yugoslavia (Novi podaci o dubinskoj geološkoj građi i seizmotektonski aktivnim zonama u Jugoslaviji), Geološki vjesnik, 40, Zagreb, 255-263 (in Croatian).

Aljinović B., Prelogović E. and Skoko D. (1987b): Mechanism of Tectonic Movements in the most Active Seismic Zones in Yugoslava, EUG 4 Symposium, Strasbourg, 13-16 April 1987, TERRA cognita, Abstracts, Vol. 7, No. 2-3, Strasbourg, str. 297.

Herak D., Herak M., Živčić M. (1987): Appendix A in: Jordanovski R.J., Vincent W.L., Mandić M.I., Olumčeva T., Sinadinovski C., Todorovska M.I., Trifunac M.D.: Strong earthquake ground motion data in EQINFOS: Yugoslavia, Part 1. Report No. 87-05, IZIIS, Skopje and Department of Civil Engineering, University of Southern California, pp. 60-85.

Jašarević I., Matasović N., Bradvica I., Jurak V., Grubić N., Cvijanović D., Vulić Ž., Šaban B. (1987): The approach to geotechnical-seismic microzonation on the example of the Dubrovnik region. Proceedings of the international conference on design, construction and repair of building structures in earthquake zones, Dubrovnik, Yugoslavia, Sept. 28-Oct. 2, 1987. Eurobuild – The European organisation for the promotion of new techniques and methods in building, 309-318.

Kuk V. (1987): Seismological map of Yugoslavia – part for the Republic of Croatia, Zajednica za seizmologiju SFRJ, Beograd.

Skoko D., Prelogović E., Aljinović B. (1987): Geological structure of the Earth's crust above the Moho discontinuity in Yugoslavia. Geophysical Journal of the Royal Astronomical Society, 89/1, 379-382.

Cvijanović D., Krstulović B. (1988): Relationship between acceleration and earthquake intensity attenuation functions (Odnos između atenuacionih funkcija akceleracije i intenziteta potresa), Geofizika, 5, 133-137, (in Croatian).

Cvijanović D., Mihailov V., Roje-Bonacci T. (1988): Geotechnical-seismic microzoning of Ston with a special emphasis on the old town core. Proceedings of the 1st International seminar on modern principles in conservation and restoration of urban and rural cultural heritage in seismic-prone regions, Skopje, October 1988, IEEES, Yugoslavia and International Centre for the study of the preservation and restoration of cultural properties, Rome. Italy, 251-258.

Herak D., Herak M., Markušić S. (1988): Some properties of seismicity and the earthquake catalog of the greater Dinara region for the period 1979-1987 (Neka obilježja seizmičnosti i katalog potresa šireg područja Dinare za razdoblje 1979-1987). Acta seismologica Iugoslavica, 14, 27-59 (in Croatian).

Herak D., Herak M., Prelogović E., Cabor S. (1988): Some characteristics of the Adriatic Sea earthquake sequence (January-February 1986). Bolletino di Geofisica Teorica ed Applicata, XXX, No. 119-120, 385-394.

Ortolan Ž., Stanić B., Tušar, Z., Cvijanović D., Čukvas, N. (1988): Condition des fondations degradations et mode de reflection des batiments du monastere Savina a Herceg Novi, Yugoslavie, The Engineering Geology of Ancient Works, Monuments and Historical sites, Preservation and Protection, Proceedings of international symposium organised by the Greek National Group of IAEG, Athens 19-23 September 1988, 469-477.

Skoko D., Prelogović E. (1988): Seismic potential of Yugoslavia territory. Proc. Ninth World Conference on Earthquake Engineering, Aug. 2-9, Tokyo-Kyoto, Vol. II, 163 – 168.

Cvijanović D., Breška Z. (1989): Seismic hazard analysis on the territory of Yugoslavia. Proceedings of the 4th International symposium on the analysis of seismicity and seismic risk, Bechine Castle, Czechoslovakia, September 4-9, 1989.

Cvijanović D., Živčić M., Krstulović B. (1989): Parameters of the macroseismic field of the Knin earthquake of 25 November 1986 (Parametri makroseizmičkog polja kninskog potresa od 25. studenog 1986. godine), Acta seismologica Iugoslavica , 15, 512-516 (in Croatian).

Herak M. (1989): HYPOSEARCH – An earthquake location program. Computers & Geosciences, 15, No. 7, 1157-1162.

Herak M. (1989): The magnitude-intensity-focal depth relation for the earthquakes in the wider Dinara region. Geofizika, 6, 13-21.

Panza G. F., Duda S. J., Cernobori L., Herak M. (1989): Surface-wave magnitude calibrating function: theoretical basis from synthetic seismograms. Tectonophysics, 166, 35-43.

Skoko D. and Prelogović E. (1989): Geological and seismological data needed for determination of maximum possible earthquakes (Geološki i seizmološki podaci potrebni za određivanje maksimalnih magnituda potresa), Geološki vjesnik, Vol. 42, Zagreb, 287-299 (in Croatian).

Skoko D. and Prelogović E. (1989): Seismic Potential of Yugoslav Territory, Proceedings of Ninth World Conference on Earthquake Engineering, Japan, Tokyo-Kyoto, August 2-9, 1988, 9WCEE Org. Committee, Tokyo, Vol. II, 163-168.

Skoko D. (1989): Seismicity of the Dubrovnik region (Seizmičnost dubrovačkog područja), Simpozij "Otok Lokrum", Dubrovnik, 8-11.9.1987, Hrvatsko ekološko društvo, Ekološke monografije, knjiga 1, Zagreb, 113-138 (in Croatian).

Skoko D., Prelogović E. and Aljinović E. (1989): Seismotectonic Activity of Northern Adriatic Sea Area, The 25th General Assembly of IASPEI, Istanbul, August 21 - September 1, 1989, IASPEI Abstracts, Istanbul, str. 192.

Aljinović B., Prelogović E. and Skoko D. (1990): Tectonic processes on the contact of the Adriatic platform and the Dinarides in the area of the Northern Dalmatia – Yugoslavia, Proceedings of the International conference on Mechanics of jointed and faulted rock, Vienna, 18-20 April 1990, Technical University of Vienna, Institute of Mechanics, Rossmanith (ed.), Balkema, Rotterdam, 179-182.

Herak M. (1990): Velocities of body waves in the Adriatic region. Bolletino di Geofisica Teorica ed Applicata, XXXII, No. 125, 11-18.

Herak D., Herak M. (1990): Focal depth distribution in the Dinara Mt. region. Gerlands Beiträge zur Geophysik, 99, No. 6, 505-511.

Herak M., Herak D. (1990): Anomalous seismicity of the Knin area prior to the M=5.5 earthquake of 1986. Tectonophysics, 172, 323-329.

Lee V., Trifunac M., Herak M., Živčić M., Herak D. (1990):M_L^{SM} computed from strong motion accelerograms recorded in Yugoslavia. Earthquake Engineering and Structural Dynamics, 19, 1167-1179.

Markušić S., Sović I., Herak D. (1990): Seismicity of Croatia and surrounding areas in 1988, Geofizika, 7, 121-134.

Herak D., Herak M., Sović I., Markušić S. (1991): Seismicity of Croatia in 1989 and the Kamešnica Mt. earthquake, Geofizika, 8, 83-99.

Herak M. (1991): Lapse time dependent Qc-spectra observed in the Dinarides region. Physics of the Earth and Planetary Interiors, 67, 303-312

Markušić, S. (1991): Determination of velocities of refracted longitudinal Pn waves in the Dinarides (Određivanje brzina refraktiranih longitudinalnih Pn valova na području Dinarida). Geofizika, Vol. 8, 101-113 (in Croatian).

Sović I. (1992): On the difficulies in determination of the macroseismic intensity in the Dalmatian hinterlands and sothwestern Herzegovina (O teškoćama pri određivanju stupnja makroseizmičkog intenziteta u Dalmatinskoj zagori i jugozapadnoj Hercegovini), Second AB workshop on macroseismic methods, Ljubljana, 15.-18.10.1990., Zbornik radova, 105 – 108. (in Croatian).

Herak M., M. Jukić (1993): Fault-plane solution for the earthquake of 25 November 1986 near Knin, Croatia, Geofizika, 10, 61-68.

Herak M., Herak D. (1993): Distance dependence of Ms and calibrating function for 20 second Rayleigh waves, Bulletin of the Seismological Society of America, 83, No. 6, 1881-1892.

Herak M., Kuk V., Herak D. (1993): Seismological investigations after the Peruća dam explosion of January 28, 1993. International Water Power and Dam Construction, 45, 41-46.

Markušić S., Herak D.. Sović I., Herak M. (1993): Seismicity of Croatia in the period 1990-1992, Geofizika, 10, 19-34.

Sović I. (1993): Interferometer as seismometer displacement transducer, Geofizika, 10, 47 – 59.

Vidrih R. Godec M., Cecić I., Sović I. (1994): Earthquake of the 1 June 1993 in the Ludbreg area, Croatia, and its effects in Slovenia (Potres 1. junija 1993 na območju Ludbrega na Hrvaškem in njegovi učinki v Sloveniji), Ujma, Vol. 8, 52 – 56 (in Slovenian).

Albini P., Cecić I., Morelli G., Sović I., Živčić M. (1994): A preliminary investigation of the January 4th, 1802 earthquake, Materials of the CEC Project "Review of Historical Seismicity in Europe", 2, CNR, Milano, 205-214.

Skoko D., Prelogović E. (1994): The significance of the Pilar's contribution to scientific explanation of earthquakes (Značenje Pilarovog doprinosa prirodoznanstvenom tumačenju potresa), Zbornik znanstvenog skupa o Gjuri Pilaru (1846.-1893.), Znanstveni skup o Gjuri Pilaru (1846.-1893.), Zagreb, 1. 10. 1993., 117-133.

Grabrovec D., Allegretti I. (1995): : On the digitizing of historical seismograms, Geofizika, Vol. 11, 27-31.

Herak D., Herak M. (1995): Body-wave velocities in the circum-Adriatic region, Tectonophysics, 241, 121-141

Herak M., Herak D. (1995): Reply to Comment on "Distance dependence of MS and calibrating function for 20 s Rayleigh waves" by J. Vanek, Bull. Seismol. Soc. Am., 85, 962.
Herak M., Herak D., Markušić S. (1995): Fault plane solutions for earthquakes (1956-1995) in Croatia and neighbouring regions, Geofizika, 12, 43-56 Peruća
Kuk V., Prelogović E. (1995): Seismological and seismotectonic studies of the Peruća dam (Seizmološka i seizmotektonska istraživanja lokacije brane Peruća), Zbornik radova međunarodne konferencije o sanaciji brane Peruća, Međunarodna konferencija o sanaciji brane Peruća, Brela, 18.09.95 – 21.09.95, 177 do 193 (in Croatian).
Skoko D., Kuk V. (1995): Seismic properties of the Makarska area (Seizmičke značajke makarskog područja), Zbornik radova sa kongresa Prirodoslovna istraživanja biokovskoga područja, Zagreb, 11.10.93 do 16.10.93, 41 do 62.
Herak M., Herak D., Markušić S. (1996): Revision of the earthquake catalogue and seismicity of Croatia, 1908-1992, Terra Nova, 8, 86-94.
Herak M., Allegretti I., Duda S. J. (1996): Magnification of undamped seismographs and the analysis of the 1906 San Francisco earthquake record obtained on the Vicentini seismograph in Zagreb (Croatia). Terra Nova, 8, 286-292.
Herak M., Allegretti I., Herak D., Duda S. J. (1996): Calibration of the Wiechert seismographs relative to a reference seismometer, Geofizika, 13, 31-59.
Kuk V., Skoko D. (1996): Seismological properties of the Palagruža island area (Seizmološke značajke područja otoka), Hrvatska pomorska meteorološka služba, Zbornik radova, Hrvatska pomorska meteorološka služba, 365-369.
Herak M., Allegretti I., Duda S. J. (1997): Calibration of Vicentini seismographs and magnitude determination for the 1906 San Francisco earthquake on the basis of Zagreb seismogram, Cahier du Centre Européen de Géodynamique at de Séismologie, 13, 177-184.
Prelogović E., Skoko D. (1997): Convergence of the Northern Dinarides Margin, Terra Nova, 9, Abstract Supplement No. 33/4P16.
Vaccari F., Bus Z., Markušić S., Orozova I., Radulian M., Živčić M. (1997): Quantitative Seismic Zoning of the Circum Pannonian Region, IASPEI 1997, Thessaloniki, Greece, 290.
Cecić I., Sović I., Živčić M. (1998): The Zagreb 1502 earthquake – doubtful or even fake?, Annales Geophysicae / EGS, C136.
Herak D., Herak M., Kuk V., Prelogović E. (1998): The Ston-Slano (Croatia) earthquake sequence of 1996, Annales Geophysicae, Vol 16, Part I / EGS, C116.
Herak M., Allegretti I., Herak D., Duda S. J. (1998): Numerical modeling of the observed Wiechert seismograph magnification. PAGEOPH, 152, 539-550.
Jurak V., Matković I., Miklin Ž., Cvijanović D. (1998): Landslide hazard in the Medvednica submountain area under dynamic conditions. Proceedings of the Xth Danube-European conference on soil mechanics and geotechnical engineering, Poreč, Croatia, May 25-29, 1998, 827-834.
Markušić S., Herak D., Ivančić I., Sović I., Herak M., Prelogović E. (1998): Seismicity of Croatia in the period 1993–1996 and the Ston-Slano earthquake of 1996, Geofizika, 15, 83-102.
Prelogović E., Saftić B., Kuk V., Velić J., Dragaš M, Lučić D. (1998): Tectonic activity in the Croatian part of the Pannonian basin, Tectonophysics, 297, 283-293.
Prelogović E., Kuk V., Buljan R. (1998): The structural fabric and seismotectonic activity of Northern Velebit: some new observation. Rudarsko-geološko-naftni zbornik, 10, 39-42.
Skoko D. and Mokrović J. (1998): Andrija Mohorovičić (1857-1936), monograph, Državni hidrometeo-rološki zavod, Školska knjiga, Zagreb, 112 p., (Bilingual, Croatian-English).
Herak D., Herak M., Panza G. F., Costa G. (1999): Application of the CN intermadiate term earthquake prediction algorithm to the area of the Southern External Dinarides. In print in PAGEOPH.
Lokmer I. and Herak M. (1999): Anisotropy of P-wave velocity in the upper crust of the central External Dinarides, In print in Studia Geophysica et Geodaetica.
Markušić S., Herak M. (1999): Seismic zoning of Croatia, Natural Hazards, 18, 269-285.
Markušić S., Suhadolc P., Herak M., Vaccari F. (1999): Seismic hazard elements in Croatia based on deterministic modelling. In print in PAGEOPH.
Prelogović E., Kuk V., Buljan R., Tomljenović B. and Skoko D. (1999): Recent tectonic movements and earthquakes in Croatia, Proc. 2nd Intern. Symp., Geodymanics of the Alps-Adria area by means of terrestrial and satellite methods, Dubrovnik, Sept. 28 - Oct. 2, 1998, (Čolić K. and Moritz H. eds.), Zagreb and Graz, 255-260.

Prelogović E., Skoko D., Herak M. (1999): Contributions to cognition of relation between recent tectonic movements and seismic activity of Dinarides in Croatia, in EUG 10, Journal of Conference, Abstracts, Vol. 4/1 (ISSN 1362-0886), EUG, 450.
Sović I. (1999): Croatian macroseismic database, Phys. Chem. Earth (A), 24, No. 6, 501-503.

Appendix 1. Biography of Andrija Mohorovičić (1857–1936)

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Andrija Mohorovičić was a prominent Croatian scientist in the field of seismology and meteorology at the end of the nineteenth and in the early twentieth century.

He was born on 23 January 1857 in Volosko near Opatija, where he attended the elementary school. He continued the education in the grammar school in Rijeka. By the age of 15 he spoke fluent Italian, English and French, followed by German, Czech, Latin and ancient Greek. In 1875 he enrolled in the department of mathematics and physics at the Faculty of Philosophy in Prague. After graduating, Mohorovičić was appointed teacher at the grammar school in Zagreb (1879–1880) and then in the secondary school in Osijek. On 1 November 1882 he began to teach at the Nautical School in Bakar, where he remained for 9 years. In 1883 he married Silvija Vernić, who gave birth to three sons. In 1891 he was transferred to the secondary school in Zagreb at his own request, and on 1 January 1892 became the director of the Meteorological Observatory. In 1893 Andrija Mohorovičić was awarded the doctorate of philosophy at the Zagreb University. Soon afterwards he was habilitated as the private docent, and in 1910 became the titular associate university professor. From 1893 to 1917/18 he taught subjects in the fields of geophysics and astronomy at the Faculty of Philosophy in Zagreb. As early as 1893 he had become an associate member, and in 1898 a full member of the Yugoslav Academy of Sciences and Arts in Zagreb. At the end of 1921 he retired. He died on 18 December 1936 and was buried at the Mirogoj Cemetery in Zagreb.

The period spent at the Nautical School in Bakar was crucial for the beginning of Andrija Mohorovičić's scientific work. This is where he first came into direct contact with meteorology, which he taught at the Nautical School, and which absorbed him to such a degree that he founded a meteorological station in Bakar in 1887.

After becoming the head of the Meteorological Observatory in Zagreb (1892) he gave a scientific interpretation of some meteorological phenomena. In 1901 Mohorovičić was appointed head of the complete meteorological service of Croatia and Slavonia, which he raised to a European level in personnel and equipment. Gradually, he extended the activities of the observatory to other fields of geophysics: seismology, geomagnetism and gravity.

In March 1892 Mohorovičić began the astronomical observation of stars passing through the local meridian to establish the accurate time. At the beginning of April 1893 he founded a network of stations for thunderstorm observation, and in 1899 he set-up hail-defense stations in the Jaska District. A. Mohorovičić also showed interest in extraordinary meteorological phenomena like the tornado near Novska in 1892, and the whirlwind near Čazma in 1898. He studied the climate in Zagreb, and in his last paper in meteorology (1901) he discussed the decrease in atmospheric temperature with height.

After the turn of the century Mohorovičić's scientific interest focused exclusively on the problems of seismology. The Wiechert seismographs installed at the Zagreb observatory by him in 1908 and 1909 soon became his chief scientific concern. He did not have long to wait for the seismographs to record two strong events – the Messina earthquake of 20 December 1908, and

the Pokupsko (Kupa Valley) one of 8 October 1909. Mohorovičić was engrossed by both events. Extensive destruction in Messina prompted him to theoretical consideration of buildings' behavior during earthquakes. Analyzing the seismograms of the Pokupsko earthquake, he advanced insight into the spreading of elastic seismic waves through the Earth's interior. In these studies he was the first to establish the existence of the surface of velocity discontinuity that separates the crust of the Earth from the mantle and which was named the Mohorovičić Discontinuity in his honor. Soon afterwards, scientists confirmed the existence of this discontinuity under all the continents and oceans. His studies of the Pokupsko earthquake also yielded the procedure of unique location of earthquake focus and the analytical expression for the increase of elastic wave velocity with depth (Mohorovičić's law). Based on theoretical considerations, Mohorovičić also predicted the shape of deep-focus earthquakes, which was confirmed by Wadati in 1928. Mohorovičić's other contributions are also important (Mohorovičić's epicentrals, Mohorovičić's seismograph, Mohorovičić's travel-time curves (hodochrones)).

Many of the Mohorovičić's thoughts and ideas were truly visionary. The well-known Swedish seismologist M. Bath included Andrija Mohorovičić among the 13 most outstanding seismological researchers in the period from 1900 to 1936.

On 19 December 1936, a day after the death of Andrija Mohorovičić, the Zagreb paper Novosti published the following article: "The scientist Professor Andrija Mohorovičić, member of the Yugoslav Academy of Sciences and Arts, one of the founders of modern seismology, has died. He was a well-known and respected figure in Zagreb, and his scientific work in the field of seismology gained him world recognition. He is today considered one of the founders of modern seismology in the world. Doctor Mohorovičić raised the meteorological observatory in Zagreb from modest beginnings to a completely equipped modern institute that enjoyed world renown, especially in seismic measurements. He also organized the meteorological service in Croatia and Slavonia. At the beginning of his scientific career Doctor Mohorovičić devoted most of his energy to meteorology, but he had most success in the field of seismology and he founded the so-called Zagreb School of world recognition in this field of science."

Most important papers by Andrija Mohorovičić

Mohorovičić A. (1908): Epicenters of earthquakes in Croatia and Slavonia (Epicentra potresa u Hrvatskoj i Slavoniji). Godišnje izvješće Zagrebačkog meteorološkog opservatorija za godinu 1906. Part IV. Introduction (Uvod) 15-19. In Croatian.

Mohorovičić A. (1910): Earthquake of 8 October 1909 (Potres od 8. X 1909; Das Beben vom 8. X. 1909.). Yearly report of the Zagreb meteorological observatory for the year 1909 (Godišnje izvješće zagrebačkog meteorološkog opservatorija za godinu 1909), Zagreb, 63 pp. Reprint edition: Školska knjiga, Zagreb, 1977 (in Croatian and German); English translation : Geofizika, 9, 3-55 (1992).

Mohorovičić A. (1911): The effects of earthquakes on buildings (Djelovanje potresa na zgrade). Vijesti hrv. društva inž. i arh., Zagreb (in Croatian).

Mohorovičić A. (1913): Developments in seismology in the last fifty years (Razvoj seizmologije posljednjih pedeset godina). Ljetopis JAZU, 27, Zagreb (in Croatian).

Mohorovičić A. (1914): Hodograph der normalen P-Wellen fur eine mittlere Herdtiefe. Beilage zu den Seismischen Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb. Litographed.

Mohorovičić A. (1915): Hodograph of the first longitudinal earthquake waves (emersio undarum primarum) (Hodograf prvih longitudinalnih valova potresa (emersio undarum primarum)). Rad JAZU 204,1-20.

Mohorovičić A. (1914); Hodograph der ersten longitudinalen Wellen eines Bebens (emersio undarum primarum). Bulletin des travaux de 1'Academie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathematiques et naturelles 2,139-157.

Mohorovičić A. (1915): New phases in the onset of an earthquake (Nove faze u slici početka potresa). Rad JAZU 208, 89-109.

Mohorovičić A. (1915): Neue Phasen im Anfange des Bildes eines Bebens. Bulletin des travaux de 1'Academie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathématiques et naturelles 4, 65-86.
Mohorovičić A. (1915): Zu dem mittelitalienischen Beben vom 13. Jänner 1915. 2. Beilage zu den Seismischen Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb, 5 pp. Litographed.
Mohorovičić A. (1915): Zur Frage der Emergenzgeschwindigkeit. 1. Beilage zu den Seismischen Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb, 4 pp. Litographed.
Mohorovičić A. (1916): Die Bestimmung des Epizentrums eines Nahbebens. Gerlands Beitrage zur Geophysik 14,199-205.
Mohorovičić A. (1916): Vorlaufige Mitteilung uber das Beben vom 12. III. 1916. Berichte uber seismische Aufzeichnungen. Kr. zem. zavod za meteorologiju i geodinamiku, Zagreb. No pagination
Mohorovičić A. (1917): Principles and construction of a seismograph, and a proposal for construction of a new seismograph for recording of horizontal component of ground motion (Principi konstrukcije sismografa i prijedlog za konstrukciju nova sismografa za horizontalne komponente gibanja zemlje). Rad JAZU 217, 114-150 (in Croatian).
Mohorovičić A. (1918): Prinzipien fur die Konstruktion eines neuen Seismographen. Bulletin des travaux de 1'Academie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathematiques et naturelles 9/10, 6-20.
Mohorovičić A., Mohorovičić S. (1922): Hodographs of the longitudinal and transversal earthquake waves (undae primae et undae secundae) (Hodografi longitudinalnih i transversalnih valova potresa (undae primae et undae secundae)). Part 1. Hodographs. Written by A. Mohorovičić. Rad JAZU 226, 94-190 (in Croatian).
Mohorovičić A. (1923): Hodographen der longitudinalen und transversalen Wellen eines Bebens (undae primae et undae secundae). 1. Hodographen. Bulletin des travaux de 1'Académie Yougoslave des Sciences et des Beaux-arts, Classe des sciences mathematiques et naturelles 15/18, 1-16.
Mohorovičić A. (1924): A critical review of the seismic instruments used today and of the organisation of seismic service. Bulletin of Seismological Society of America I, 38-59.
Mohorovičić A. (1925): Hodographes des ondes normales P et S soulignees (Pn, P*, S*) et des deux premieres reflexions pour les profondeurs de 1'hypocentre de 0, 25, 45, 57 kms. UGGI, Section de Seismologie, A. Travaux Scientifique 3, Paris,1-60.
Mohorovičić A. (1926): Zur Frage der wahren Empfindlichkeit eines Seismographen. Gerlands Beitrage zur Geophysik 15, 201-214.

Appendix 2. Biographical Sketches

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EDUCATION:

Graduate Secondary school in Karlovac (1949)

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ADDRESS:

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POSITIONS HELD:

Assistant, Department of Geophysics, Faculty of Science, University of Zagreb (1958-1969).

Assistant professor, Department of Geophysics, Faculty of Science, University of Zagreb (1958-1969).

Associate professor, Department of Geophysics, Faculty of Science, University of Zagreb (1969-1975).

Professor, Department of Geophysics, Faculty of Science, University of Zagreb (1975-).

Associate member of the Croatian Academy of Sciences and Arts, Zagreb (1975-1991).

Full member of the Croatian Academy of Sciences and Arts, Zagreb (1991-).

SEISMOLOGICAL CONTRIBUTIONS:

Studies related to Croatian seismicity, optimum distribution of seismic observation points (Monte Carlo method), reduction and analysis of seismogram consisting of only maxima and minima, relations between seismic and neotectonic characteristics, possible earthquake origin zones, seismotectonic map of Croatia.

Undergraduate teaching of courses in Seismology and Physics of the Earth's interior.

Postgraduate teaching of courses in Seismology and Physics of the Earth's interior.

President of the National Committee for Geodesy and Geophysics.

SELECTED PUBLICATIONS:

Sato Y. and D. Skoko (1965): Optimum distribution of seismic observation points, II. Bulletin of the Earthquake Research Institute 45, 451-457.

Skoko D., Y. Sato and I. Ochi (1965): Reduction and analysis of seismograms consisting of only maxima and minima. Journal of Physics of the Earth 13/1, 5-9.

Skoko D., Y. Kotake and Y. Sato (1968): Optimum distribution of seismic observation points, V – Desirable location of new stations in Yugoslavia. Bulletin of the Earthquake Research Institute 46, 821-840.

Gupta H. K., D. Skoko and Y. Sato (1973): Accuracy of determination of epicenter and origin time of small-magnitude earthquakes in the Indian subcontinent. Bulletin of the Seismological Society of America 26, 1901-1912.

Skoko D., M. Arsovski and D. Hadžievski (1976): Determination of possible earthquake origin zone on the territory of Yugoslavia (Određivanje mogućih žarišta potresa na području Jugoslavije). Acta Sesimologica Iugoslavica 4, 7-14 (in Croatian).

Cvijanović D., E. Prelogović and D. Skoko (1976); Seismotectonic map of SR Croatia (Seizmotektonska karta SR Hrvatske). Acta Seismologica Iugoslavica 4, 19-23 (in Croatian).

Skoko D., D. Cvijanović and E. Prelogović (1978): Seismic activity based on neotectonic. Proc. of the Symposium on the Analysis of seismicity and on seismic Risk, Liblice, Czechoslovakia, October 17-22, 1977. Czechoslovak Academy of Sciences, Geophysical Institute, Prague, 81-91.

Aljinović B., I. Blašković, D. Cvijanović, E. Prelogović, D. Skoko and N. Brdarević (1984): Correlation of geophysical, geological and seismological data in the coastal part of Yugoslavia. Bolletino di oceanologia teorica ed applicata 2, 77-90.

Skoko D., E. Prelogović and B. Aljinović (1987): Geological structure of the Earth's crust above the Moho discontinuity in Yugoslavia. Geological Journal of the Royal Astronomical Society 89/1, 379-382.

Skoko D. and E. Prelogović (1988): Seismic potential of Yugoslav territory. Proc. Ninth World Conference on Earthquake Engineering, Aug. 2-9, Tokyo-Kyoto, Vol. II, 163-168.

Aljinović B., E. Prelogović and D. Skoko (1990): Tectonic processes on the contact of the Adriatic platform and the Dinarides in the area of the Northern Dalmatia - Yugoslavia. Proc. of the Int. Conference on Mechanics of jointed and faulted rock, Vienna, 18-20 April 1990, Tech. Univ. of Vienna, Inst. of Mechanics, Rossmanith (ed.), Balkema, Rotterdam, 179-182.

Skoko D. and J. Mokrović (1998): Andrija Mohorovičić (1857-1936). Državni hidrometeorološki zavod, Školska knjiga, Zagreb, 112.

Prelogović E., V. Kuk, R. Buljan, B. Tomljenović and D. Skoko (1999): Recent tectonic movements and earthquakes in Croatia. Proc. 2nd Intern. Symp., Geodymanics of the Alps-Adria area by

means of terrestrial and satellite methods, Dubrovnik, Sept. 28 - Oct. 2, 1998, Čolić K. and Moritz H. ed., Zagreb and Graz, 255-260.

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Secretary of the *Geofizika* journal (1990–).

SEISMOLOGICAL CONTRIBUTIONS:

Studies related to Croatian seismicity, revision and updating of the Croatian Earthquake Catalog, quantification of earthquakes, historical seismology, determination of velocity distribution, earthquake statistics and prediction, (with co-authors, see the list of publications).

Undergraduate teaching of courses in Seismology.

SELECTED PUBLICATIONS:

Herak, M. and D. Herak (1990): Anomalous seismicity of the Knin area prior to the M=5.5 earthquake of 1986. Tectonophysics, **172**, 323-329.

Herak, M. and D. Herak (1993): Distance dependence of M_s and calibrating function for 20 second Rayleigh waves. Bulletin of the Seismological Society of America, **83**, No. 6, 1881-1892.

Herak, D. and M. Herak (1995): Body-wave velocities in the circum-Adriatic region. Tectonophysics, **241**, 121-141

Herak, M., D. Herak and S. Markušić (1996): Revision of the earthquake catalogue and seismicity of Croatia, 1908–1992. Terra Nova, **8**, 86-94.

Herak, M., I. Allegretti, D. Herak and S. J. Duda (1998): Numerical modeling of the observed Wiechert seismograph magnification. PAGEOPH, **152**, 539-550.

Herak, D., M. Herak, G. F. Panza and G. Costa (1999): Application of the CN intermadiate term earthquake prediction algorithm to the area of the Southern External Dinarides. PAGEOPH, **156**, 689-699.

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Coordinator of the postgraduate courses in Geophysics, University of Zagreb (1998–).

Editor of the *Geofizika* journal (1984–).

Secretary of the National Committee for Geodesy and Geophysics (1992–2000).

SEISMOLOGICAL CONTRIBUTIONS:

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Principal investigator of the national scientific seismological project "Seismicity of Croatia".

Undergraduate teaching of courses in Seismology, Engineering seismology, Statistical methods in geophysics.

Postgraduate teaching, Seismology and Physics of the Earth interior.

SELECTED PUBLICATIONS:

Herak, M. (1989): HYPOSEARCH – An earthquake location program. Computers & Geosciences, **15**, No. 7, 1157-1162.

Panza, G. F., Duda, S. J., Cernobori, L. and M. Herak (1989): Surface-wave magnitude calibrating function: theoretical basis from synthetic seismograms. Tectonophysics, **166**, 35-43.

Herak, M. and D. Herak (1990): Anomalous seismicity of the Knin area prior to the M=5.5 earthquake of 1986. Tectonophysics, **172**, 323-329.

Herak, M. (1991): Lapse time dependent Qc-spectra observed in the Dinarides region. Physics of the Earth and Planetary Interiors, **67**, 303-312

Herak, M. and D. Herak (1993): Distance dependence of M_s and calibrating function for 20 second Rayleigh waves. Bulletin of the Seismological Society of America, **83**, No. 6, 1881-1892.

Herak, D. and M. Herak (1995): Body-wave velocities in the circum-Adriatic region. Tectonophysics, **241**, 121-141

Herak, M., D. Herak and S. Markušić (1996): Revision of the earthquake catalogue and seismicity of Croatia, 1908-1992. Terra Nova, **8**, 86-94.

Herak, M., Allegretti, I. and S. J. Duda (1996): Magnification of undamped seismographs and the analysis of the 1906 San Francisco earthquake record obtained on the Vicentini seismograph in Zagreb (Croatia). Terra Nova, **8**, 286-292.

Herak, M., I. Allegretti, D. Herak and S. J. Duda (1998): Numerical modeling of the observed Wiechert seismograph magnification. PAGEOPH, **152**, 539-550.

Markušić S. and M. Herak (1999): Seismic zoning of Croatia. Natural Hazards, **18**, 269-285.

Markušić S., P. Suhadolc, M. Herak and F. Vaccari (1999): A contribution to seismic hazard assessment in Croatia from deterministic modeling. PAGEOPH, **157**, 1/2, 185-204.

Herak, D., M. Herak, G. F. Panza and G. Costa (1999): Application of the CN intermadiate term earthquake prediction algorithm to the area of the Southern External Dinarides. PAGEOPH, , **156**, 689-699.

Lokmer, I. and M. Herak (1999): Anisotropy of P-wave velocity in the upper crust of the central External Dinarides, Studia Geophysica et Geodaetica, **43**, 345-356.

Herak, M., G. F. Panza and G. Costa (2001): Theoretical and observed depth correction for M_S, PAGEOPH, **158**, 1517-1530..