About Regional Standard "Macroseismic Scale"

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15 WCEE
LISBOA 2012

SUMMARY:
The improvement of Macroseismic Scales MSK and EMS has been undertaken. The previous Soviet standard #6249-52 was developed 60 years ago, and is no longer used. Valid in Europe, macroseismic scale was adopted in 1998. The suggested project of modernizing the EMS standard (ModEMS-10110), maintaining its original framework, has achieved the following: the goals, tasks and application of macroseismic scale have been increased; the list of sensors of the built environment has been extended due to road & transportation structures being classified according to their vulnerability; 1st , 2nd and 3rd range of information reliability is given to each sensor (people and their artificial and natural surroundings); quantity categories and terms have been extended and defined more specifically; the intensity assigning procedure has been realized in a few stages by informants, inspectors, analysts and experts consistently; conformity assessment of assignment intensity has been added. The Standard has been supplemented with large commentaries for better understanding and practical application.

Key words: earthquake, intensity, Macroseismic effects, sensors, scale

1. INTRODUCTION

The Macroseismic scale (MS), along with the seismic code, is a basic technical document for designers and specialists in risk analysis in urban planning and construction activities. At the same time, the previous Standard 6249-52 "Scale for determining the strength of EQs in the range from 6.0 to 9.0" was developed over 60 years ago. Despite numerous proposals, this standard was not changed and was canceled without being replaced. The lack of a modern standard for seismic intensity constrains the development of both seismology and EQ engineering (EQE). The following is a description of the modernized European MS ModEMS-10, which is the result of the author's work over the past 20 years.

2. BACKGROUND

The basic research of the Centre on EQE & NDR (CENDR) was to investigate the problem and develop a new generation MS. This was completed by CENDR in 2000 under the Special Federal Program "Seismic safety of the Buryat Republic". The results were presented, discussed and endorsed at a meeting of the Interagency Commission on seismic zoning and EQE of the Russian Government in 2001.

In 2002, Dr. Mark Klyachko developed the first version of the draft of an MS called IMSK (enhanced MSK-64) and a questionnaire composed of 48 items, which was distributed among experts from Russia and other CIS countries. By 2004, the concept, new basic approaches and the content of IMSK were unanimously approved, and the draft of the scale was discussed and recommended for further submission to the seismological and engineering community as a national standard on November 15, 2004 at an expanded meeting of the Scientific and Technical Council for EQE and Natural Disaster Reduction.

Unfortunately, over the next five years the draft of the IMSK scale was not adopted as a standard. It was only after the decision of June 10-11, 2010 of the 29th session of the Intergovernmental Council for Cooperation in the Construction Activity of the CIS Countries that the MS draft was revived as an interstate (regional) standard.

At this new stage, Dr. Mark Klyachko was joined by Prof. Herman Shestoperov, who prepared proposals for transport facilities, and Dr. Alexander Strom with his proposals regarding the effects of EQs observed in the natural environment. Represented below as an interstate standard for the countries of EAC/CIS is a scale called ModEMS-10, which was discussed and approved by the Scientific and Technical Council for EQE and Natural Disaster Reduction on March 1, 2011.

Positive reviews of leading organizations in Armenia, Georgia, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan were obtained over the next three months, after which the second version of the standard was submitted to the Technical Commission No 465 for examination and approval.

3. BASIC PROVISIONS

The ModEMS-10 scale is a modified standard developed based on the European Macroseismic Scale (EMS-98) with due account for the MSK-64 scale and its subsequent modifications designed to replace Standard 6249-52.
The standard is interstate (regional) and has been developed for use in the CIS countries.
The object of standardization is the strength of an EQ as measured by its intensity.

3.1. Goals and objectives/field of application

MS should be used in the following cases:

- when assigning the intensity of EQs based on the results of engineering investigation of their consequences;
- when zoning areas in terms of their seismic hazard;
- when determining the estimated seismic hazard of construction sites and when setting seismic loads for designing buildings and structures in cases when seismic hazard is represented in points of intensity;
- when developing scenarios of likely consequences of EQs set by their intensity, and for assessing corresponding seismic risk in urban and industrial areas.

3.2. Key requirements for MS

The general requirements for MS are listed in M. Klyachko, 2003. Among them are the following:
Consistency; balance; continuity (i.e. classification of previous estimates should not be reviewed and estimates of the intensity of past EQs should not be changed. Thus, the internal logical balance of the scale should not be violated); operational reliability (i.e., small differences in diagnosis should not cause significant changes in the evaluation of I); simplicity (clarity, unambiguity) of use, scale – compromise solution – implementation of a compromise approach, i.e. understanding that no intensity scale can encompass and take into account all the discrepancies in the diagnosis of the evaluation of I (including scientific, cultural, etc.); waiving the revision of the evaluation of I due to the following:

- Soil conditions;
- Demographic conditions, because macro seismic survey should be a tool for the study of such reinforcing effects.

I - is not a point value (for a house, etc.) but a represented value for a village, town, or part of a city.
Assumption - consequence of laws.

The form of the scale is the classic 12 degrees adopted in order to avoid confusion and loss of continuity.

3.3. Structure of the standard and construction of the scale

The MoDEMs-10 scale consists of the main text, appendices A, B, C, D, comments and appendices E, F to them. Appendices:

A. Sample vulnerability assessments of some structural types of buildings (required).
B. Classification of structural damage to some buildings-sensors of the 1st rank (recommended).
C. Classification of damage to transportation structures (recommended).
D. Damageability of buildings of different vulnerability categories in case of EQs I_{ms} from VI to X (recommended).
F. Examples of damageability of buildings of different vulnerability categories in recent EQs.
E. Examples of damageability of engineering structures of different vulnerability categories in recent EQs in the CIS.

Construction of the ModEMS-10 scale corresponds to EMS-98 both in quantitative and qualitative characteristics. Macroseismic intensity (I_{ms}) is represented in whole numbers. Despite computer problems, it is recommended to use Roman numerals for designating I_{ms}, which distinguishes it from instrumental intensity (I_{in}), commonly used in conjunction with I_{ms}. The additional importance of such difference in designation follows from the recommendations contained in item 6.20 of the standard concerned with joint consideration of I_{ms} and I_{in}.

The scale is divided into three parts: the upper one with points I-IV called "obvious", where I_{ms} is differentiated by perceptibility/visibility of the EQ, the middle part, "engineering" with points V-X, and the geological one with points XI and XII, in which I_{ms} varies in terms of destructiveness of consequences.

This type of construction is more and more global, absorbing the growing experience and lessons of EQs, and thus increasingly reliable MS and intensity will be used by engineers for quick and simple solutions, which will become more and more reliable overall.

3.4. Sensors and aspects of standardization

Sensors are classified according to the sensitivity threshold and the degree of information reliability. Sensors are divided into 4 groups arranged in the order of reduction of the sensitivity of these facilities to EQs: humans (α_1) and animals ($\alpha_{2;\,3;\,4}$…); household items (β_1) and ritual objects (β_2); buildings (γ) and a new groups – structures (δ) and objects of the environment (ε, total of 9 types).

Priority order of using sensors in the appointment of various intensities is adopted in different parts of the scale.

A list of human sensations expected and discussed in the present standard, as well as a list of sensors-household items and ritual objects should be developed taking into account national, religious, as well as cultural and domestic peculiarities of the region by means of special questionnaires prepared and circulated in the region beforehand.

The basic aspects of standardization are sensors, their vulnerability and EQ effects observed in them.

The scale uses the following specially arranged/classified basic and secondary aspects of standardization:

- sensors and their characteristics;
- sensitivity of sensors;
- vulnerability of sensors (including regularity and quality);
- rank of information reliability (RIR) of sensors;
- EQ effects including:
- feelings and behavior of humans and animals;
- reaction of household items;
- damage of buildings and structures;
- changes of environmental objects;
- Quantitative parameters.

4. IMPROVEMENTS

The structure of the standard has been modified with respect to the basic regional standard (RS) EMS-98 designed for use in the countries of the Eurasian community. The following improvements were introduced when modifying EMS-98:

4.1. Terms and definitions

The standard uses the terms and definitions adopted in the Russian Federation in compliance with applicable laws and corresponding to international practices, in particular, to the norms of the European Community. Specifically, the intensity classification fully complies with the one adopted in EMS-98, where "strong EQ" corresponds to I = 5.

4.2. Concerning structural vulnerability

Types of buildings and structures as primary sensors are classified only and strictly according to a single key aspect, i.e. their structural vulnerability, in which during classification are included, in contrast to EMS-98, all of its defining characteristics including regularity, quality, design and construction, number of floors, physical and operational condition, etc. For example, buildings of the same structural type may differ in class of structural vulnerability depending on their size and configuration, and even buildings of the same design, shape and number of floors can be assessed by vulnerability of different classes if they have, for example, different degrees of wear. ModEMS-10 considers and analyzes only the direct structural vulnerability of buildings and structures. In Appendix A, the characteristic of vulnerability conventionally includes the average regularity level and low quality level.
Usually, the hard-to-achieve level rh is characterized by the following:
-enhanced yield of the structural system
-actively controlled mechanism of plasticization as a result of special anti-seismic measures.

In ModEMS-10, the lowest and the highest vulnerability classes are divided into two sub-classes, resulting in a sub-class A1 with corresponding very high vulnerability, as well as a sub-class F2 with very high seismic resistance (low vulnerability). The appearance of the sub-class A1 is caused, for example, by a survey of the consequences of the EQs in Bam (Iran 2002) and the erection of such buildings, which are destroyed even during EQs with an intensity VI. One example is a building with a steel skeleton filled with brick walls and brick ceilings.

4.3. Damage grades and serviceability

Classification of damage grades to buildings (Annex B) makes it easier to implement expert approach and expand representation of sensors in structures intended for assigning intensity. In this case, a more refined, properly arranged classification (Klyachko M., 1994a,) was used. The table of damage to buildings with stone and cast-in-place reinforced concrete walls, respecting continuity, was transferred from EMS-98 as the most-tested category of buildings-sensors having the 1st RIR. Appendices to the standard may be extended by adding the observed failure rate of new building sensors of different RIRs. Assessment of damage to constructed facilities must be performed immediately after the seismic impact, so that the interval between the time of the survey and the moment of impact is minimal. At the same time, it is necessary to know the results of the preliminary technical survey of the physical state of the considered construction facility, which must be performed not later than at the time of previous seismic loads and impacts, which damaged it in any arbitrarily small degree.
Using a modified (Klyachko M., 2000b) MART scale, which sets correspond between damage grade (structural reliability determining the physical performance) and serviceability level (operational suitability\operation performance), we can extend our engineering understanding of EQs' complex effects on various buildings (see Table 4.1).

Table 4.1. Damage grades to buildings and structures

Extent of damage, d	Description of damage		Operational and physical state
	Load-bearing components	Non-bearing components	
0	No damage	No damage	Normal operation. Full performance.
1	No damage	Slight negligible damage	As a rule, normal operation and full performance.
2	Slight damage	Moderate damage	Limited operational condition of the 1st type. Reduction of performance and general load-bearing capacity of the construction facility.
3	Moderate damage	Severe damage	Limited operational condition of the 2nd type. Noticeable reduction of performance and overall load-bearing capacity of the structures.
4	Severe damage. Destruction of certain structural elements. Collapse of minor parts of the construction facility.	Highly severe damage. Failure of most components	Non-operational status. Emergency operational condition. Physical condition close to the extreme limit state. Load-bearing capacity almost completely exhausted. Collapse of part of the structures. Unacceptable risk of injury and death of humans.
5	Loss of bearing capacity of most elements, resulting in collapse of the construction facility.	Collapse of most components	Completely non-operational status and collapse of the structures.

4.4. Rank of informative reliability

In the standard ModEMS-10, sensors and effects observed in them are normally classified as per RIR as follows:
First RIR – proven/reliable (well-studied structural types of buildings of large-scale construction and other aspects of standardization used in previous generations of MS).
Second RIR – experimental/relatively reliable (adopted as sensors being studied and possibly intended for transfer to the first RIR).
Third RIR – doubtful/unreliable (not adopted but considered as sensors possibly intended for transfer to the first RIR).
A) The following items belong to the first RIR:
-unfixed household items located on the ground floors of buildings and their reactions;
-ritual objects and their reaction;
-buildings of structural types described in items 1-7, 9-13 of Appendix A and their damage;
-single-span stone bridges and their damage;
-some environmental objects, their documented and described changes
B) The following items belong to the second RIR:
-people, their sensations and reaction (behavior);
-unfixed household items located above the ground floor and their reaction;
-buildings of structural types described in items 8, 14, 15, 18 of Appendix A and their damage;
-everything listed in the present standard road (δ1) and transport (δ2) facilities and their damage (except for those indicated in item A);
C) The following items belong to the third RIR:
-buildings of structural types described in items 16, 17 of Appendix A to the present standard and those not included in this Appendix.

4.5. Categories and terms of quantitative classification

Thanks to the introduction of this, an opportunity appeared to introduce section 8, concerned with conformity assessment, and section 9, concerned with further development of the scale, which is also a novelty. The objects and aspects of the second rank should in many respects be refined and further

developed, as well as further differentiated and classified before they can partially or fully receive the 1st RIR; these sensors and their aspects cannot be removed from the scale or even transferred to the 3rd rank during the development of the scale. Objects and aspects of the 3rd category of reliability, along with the accumulation of a database and improvement of the scale, can be left in this rank as long as necessary, transferred to a higher second rank or even be removed from the scale altogether.
Quantitative categories of sensors are supplemented in relation to the aspects of standardization (seismic effects) by a similar classification of probabilistic categories (see Table 4.2), which is used in alternative to the quantitative one, in particular when describing effects in the natural and geological environments.

Table 4.2. Categories and terms of quantitative classification

Category	Quantitative term of assessment			Range	Medial value
	As part of the overall number of observed objects and effects	Probabilities of manifestation of effects	Values (rate) of effect		
1	Very few	Extremely rare	Extremely low	0-3%	2%
2	Several	Rare	Low/weak	0-10%	5%
3	Some	Unlikely/never	Considerable	5-30%	15%
4	Many	Likely/quite often	Strong	20-65%	50%
5	Majority	Highly probable/often	Very strong	50-100%	75%

4.6. Sensations and behavior of people.

The sensitivity of people as sensors is not classified in the present standard. Effects during EQs observed in humans should be described with the obligatory indication of the location and state of these sensors (the specific floor of a building of a certain structural type, asleep or awake, lying, sitting or walking condition, in the street or in a vehicle of a certain type, motionless, low activity or active state, etc.). In multistoried buildings human sensation should be recorded and described, first of all, on the ground floors. In the description of human sensations it is necessary to indicate without exception all effects and abnormal signs perceived by the senses during and immediately after an EQ, as well as note the absence of all or any sensations.
The observed effects are recommended to be arranged as per identical characteristics designating them as α_1, $\alpha_{1.2}$.... $\alpha_{1\cdot n}$. In addition, it is necessary to improve the knowledge of humans as sensors. The consideration and classification of the seismic vulnerability of humans and the population in general, differing in health, age, education, training, fitness and readiness for emergencies, must take into account their national, cultural and religious backgrounds, etc., which are entered in questionnaires, which are uniform but specific to each area, and which must be filled in immediately after each perceptible, strong, damaging and destructive EQ.

4.7. Assigning the intensity of the main EQ event and aftershocks

The scale implies an expert approach to assigning intensity, which is far more explicit than that used in EMS-98. In this case, modern expert approaches are implied, which recourse to mathematical apparatus of the theory of uncertain sets, “eroded images”, as well as intellectual technologies. In the procedure of assigning the $I_{ms,}$ informants, auditors, analysts and experts realize the intellectual approach jointly and step by step.
The ModEMS-10 scale provides an opportunity to assess not only the main shock, but also strong aftershocks, avoiding re-evaluation of I_{ms} due to faulty summation of the observed seismic effects in sensors (primarily in structures).

4.8. Interrelation of macroseismic and instrumental intensities

The principle of separate standardization and use of MS and instrumental scales is confirmed and even strengthened. The opposite nature of the trends of the development of MS as more and more global, and the instrumental scale as more and more local, is emphasized. At the same time, the standard

suggests parallel evaluation and comparison of I_{ms} and I_{in} in order to study and understand the reasons for the discrepancies in their evaluations, if such discrepancies are indeed available.
The field of application of the scale is expanded, in particular, for the purpose of the risk analysis of seismic disasters.

4.9. Comments to the standard

The standard of the ModEMS-10 scale is accompanied by comments that explain particular items of the standard, and provide methodological assistance in the reconnaissance of the consequences of EQs in the analysis of historical documents, etc. In addition, there is a plan to develop a new textbook on reconnaissance of the consequences of EQs because the current one is out of date.

5. ASSIGNMENT OF SEISMIC INTENSITY

In assigning the intensity of an EQ (seismic event), it is necessary to use a set of categorized effects fit for ranging and occurring in sensors due to the EQ(seismic event). The intensity I_{ms} is assigned to a sufficiently large, but limited area. At the same time, the area under consideration is recommended to be divided into separate parts, which differ from each other by engineering-geological conditions. However, when assigning I_{ms}, ground conditions, as well as demographic factors, are not taken into account.
Sensors and seismic effects observed in them and used for assigning I_{ms} are considered in the order specified in Table 5.1.

Table 5.1. Order of using sensors when assigning I_{ms} of the main shocks

Part of scale/ value of I_{ms}	Priority of sensors	
	Terms	Identification
Obvious	Humans, household items, natural phenomena (hydrological)	$\alpha \rightarrow \beta_1 \rightarrow \varepsilon_{1,7}$
Engineering/V - VI	Household items, buildings, structures, humans, natural phenomena (hydrological and slope)	$\beta_1 \rightarrow \gamma \rightarrow \delta \rightarrow \alpha \rightarrow \varepsilon_{1\text{-}4,7}$
Engineering /VII - X	Buildings, structures, items, natural phenomena, humans	$\gamma \rightarrow \delta \rightarrow \beta \rightarrow \varepsilon \rightarrow \alpha$
Geological	Natural phenomena, buildings and structures	$\varepsilon \rightarrow \gamma, \delta$

In each specific case of assigning $I_{ms,}$ the order of considering sensors and effects observed in them, listed in Table 3, should be verified by taking into account the RIR. At the same time, priority (order) of a sensor in the consideration of the main shock cannot be changed in terms of being increased, and when assigning the intensity of aftershocks, the priority of sensors is taken into account in accordance with Table 5.2.

Table 5.2. Order of using sensors when assigning I_{ms} of aftershocks

Part of scale/ value of I_{ms}	Priority of sensors	
	Terms	Terms
Obvious	Household items, humans, , natural phenomena (hydrological)	$\beta_1 \rightarrow \alpha \rightarrow \varepsilon_7$
Engineering/V - VI	Household items, humans, natural phenomena (hydrological)	$\beta_1 \rightarrow \alpha \rightarrow \varepsilon_{7,4}$
Engineering/VII - IX	Items, humans, natural phenomena	$\beta \rightarrow \alpha \rightarrow \varepsilon_7$

The main sources for assigning seismic intensity in the engineering part of the scale are the macro seismic data on damage to structures. At the same time, in order to evaluate the vulnerability of damaged and destroyed buildings in a given urban area, it is recommended to use catalogues of

vulnerability of basic structures of these areas (cities). The said catalogues are pre-designed and updated every 5-10 years (and after every EQ $I \geq 5$).
The term “intensity” used in the ModEMS-10 scale refers to a single seismic event. As a rule, using this standard for assigning the total intensity as per the combined effect of the loads and effects of several seismic shocks is not allowed. The effects of foreshocks are combined with the effect of the main shock only if they themselves are insignificant and occurred just before the main EQ, i.e. if evaluation of the intensity of these foreshocks is impractical and/or impossible.
Assigning the intensity for EQs that occurred a long time ago (historical EQs), which usually have a very limited base of initial data, is usually done by means of the documentary method. At the same time, the accuracy and reliability of these evaluations is inevitably lower, due to which the information reliability of the effects under consideration and obtained evaluations of intensity in comparative analysis should be referred to the second or third RIR.
Evaluations of I_{ms} are recommended to be compared with the evaluations of the intensity of the same events obtained by the instrumental method using the instrumental scale standard. ModEMS-10 allows for conformity assessment procedures.

6. PRACTICAL USE AND APPLICATION

The value of I_{ms} should be used to solve the following problems.
A. The problem of measuring shocks, which is solved by converting many of the observed effects of an EQ into a properly arranged, clear and unambiguous quantitative and qualitative characteristic of this EQ, i.e. intensity I_{ms}.
B. Assessment of the condition of structures and their structural vulnerability class after the main shock, and before and after every aftershock. This is necessary to enable one to perform design calculations for structures damaged by previous EQs.
C. The problem of the seismic zoning of frontiers as per the level of seismic hazard using the generalized characteristic - intensity of EQs, which may occur with a certain probability within the area under consideration, which is large enough, but limited, at a given interval. At the same time, depending on the level of detail and precision and scale of the problem, the numerical value of intensity can be used for general, detailed and microzoning of the seismic hazard.
D. To determine the estimated seismicity of built-up or to-be-built-up sites, and, above all, if these are to be built-up with buildings that are simple in terms of their architectural-planning and structural solutions, small in plan view and in height, as well as rather symmetrical, and built of traditional materials using well-tested construction techniques.
E. In all estimated situations in the process of setting estimated seismic loads represented by various seismic zoning maps in the form of the intensity of expected seismic events, which is primarily used for performing design calculations for the buildings listed in item 7.4, as well as for simplified and preliminary calculations of any structures.
F. In problems that are aimed at the evaluation, analysis, management, monitoring and control of seismic risk including the following:
- to develop scenarios of the most probable seismic events for this or that area (village, town, city) represented in terms of macro seismic intensity;
- to develop scenarios of probable disasters, when the consequences of EQs are assumed on the basis of the most expected effects corresponding to the set intensity of a given scenario of a seismic event. In this case in order to determine the expected damage to structures-sensors it is necessary to know their structural vulnerability class in advance;
- to assess individual, collective and economic risk in the event of EQs set by intensity;
- to map seismic risk on regional and urban (municipal) levels;
- to account for seismic risk when developing regional projects of economic and social development in terms of ensuring the mechanical safety of structures and sustainable safety in the area as a whole.
G. For educational purposes when developing manuals required for training personnel and the population in general to deal with EQs, as well as for proper understanding of the relative strength of EQs, which is expressed in the effects observed in sensors.

7. EXPECTED EFFICIENCY OF USING THE STANDARD AND PERSPECTIVE.

The interstate standard “Macroseismic scale” (ModEMS-10), corresponding to the European scale, will achieve the following:
-better generalization and unification of the common procedure of reconnaissance for the purpose of assessing the consequences of EQs;
-wider and safer use of anti-seismic norms and the practice of EQ engineering worldwide, based on the experience and knowledge obtained from the results of reconnaissance of seismic disasters and the lessons learned from past EQs;
-create a unified practical method of detailed zoning and construction & assembly works;
-improve the design of seismic-safe buildings and structures (especially for mass construction);
-develop and use regional catalogues of structural vulnerability of mass construction buildings in all EAC/CIS countries;
-evaluate/clarify seismic risks in urban and industrial areas, organize their continuous analysis, monitoring and control in seismic regions of the CIS countries in order to ensure safe social and economic development;
-organize a system of seismic safety certification in EQ engineering, as well as development of incentives for seismic risk reduction (including insurance).
It is recommended to test the ModEMS-10 scale within 3 years from the date of its entry into force.
The ModEMS-10 scale will develop along with the accumulation and analysis of information on reconnaissance of the consequences of EQs in the following ways:
-clarification of structural vulnerability classification of buildings and structures included in the standard as sensors;
-clarification of seismic effects observed in sensors and, as a result, confirmation or modification (usually increase) of the RIR of standard sensors and other aspects of standardization (retaining walls of bridges, slopes of roads and railways, arched stone bridges, etc.);
-increase in the number of standard sensors from the building environment, including industrial smoke stacks, power transmission lines, pipelines and other facilities;
-review and classification of the quality of “sensor-population” and its seismic vulnerability, i.e., increasing RIR of humans as sensors and their sensations achieved by the development and improvement of the training procedure - repeated training, so that their correct and proper behavior in case of EQs is formed, and the range of their psycho-physical reactions is narrowed;
-expansion and clarification of quantitative and probabilistic attributes, when describing the observed effects, including increasing the RIR of the categories of “separate items” and “rare effects”.
Related research and development, through which the quality of the scale will be improved: the projects of the World Housing Encyclopedia in seismic areas (tall buildings, safe hospitals), the development of regional catalogues of vulnerability, the practice of preventive seismic retrofitting of buildings and their renovation after EQs, and, of course, new lessons of damaging destructive EQs.

8. CONCLUSIONS.

Looking forward to the coexistence and interaction of I_{ms} I_{in}, it is necessary to emphasize two main trends.
The MS will become increasingly global due to new lessons from EQs. Creation of a unified MS is ensured through the stability of its basic philosophy and concept, as well as through observing the principle of continuity. The present ModEMS-10 scale is, as the authors hope, yet another step in creating a global MS.
As for the instrumental seismic scale, its development is based on exactly the opposite trend: thanks to the accumulation of a variety of instrumental data on the EQs that occurred in different parts of the world, we are getting a better understanding of the influence of local peculiarities (site effects) .Thus, the trend of the future development of the instrumental scale is localization. That is why we should not try to combine I_{ms} and I_{in} in a single estimation. I_{ms} and I_{in} can and should co-exist for quite a long time in order to explore deeper and be able to explain more accurately the available possible discrepancies in their values. At the same time, we must not forget that, in contrast to I_{ms}, I_{in} exists in a particular

point where it is measured, and does not belong to a certain limited, but quite large area. The increase in density of seism metric observations facilitates the convergence of macro seismic and instrumental evaluations. This is especially important in Russia and other CIS countries, where the number and quality of the recordings of strong seismic motions is very low, whereas regional characteristics (Altai, Baikal, Central Asia, the Caucasus) vary significantly. It is through the simultaneous use of the globally developing MS and the instrumental scale evolving towards localization and clarification that we should expect further relationship and the use of macro seismic and instrumental data.

Both evaluations must exist independently, and we should not force them to be linked and coincide by forced mutual adjustment. In this case, their different nature is more apparent and clear, which is also important for future use.

The above-said explains why it seems appropriate to, having first developed an inter-MC standard, propose this scale on the European and global level. The use of a global database as aspects-analogues will allow each country that has adopted the said international standard on their respective level to significantly improve the understanding and the purpose of I_{ms}.

ACKNOWLEDGMENTS

The authors would like to extend their gratitude to the following people:
Dr. Felix Aptikaev, (Institute of Physics of the Earth, Russian Academy of Sciences, Moscow);
Dr. Yuri Berzhinsky and Prof. Semen Sherman (Institute of the Earth Crust, Russian Academy of Sciences, Irkutsk);
Dr. Theimo Mukhadze (Institute of Construction Mechanics and Seismic Stability, Tbilisi);
Dr. Alexander Kenzero and Dr. Bella Pustovitenko (Institute of Geophysics, Simferopol);
Emil Esenov (RND Institute of EQE, Ashgabat);
Nikolai Marjenkov and Alexander Khavkin (NIISK, Kiev);
Dr. Anvar Taubaev (Kaz NIISA, Almaty).

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