

# Newsletter Vol 1 2023

# Newsletters

Vol. 1 No.1 August 1, 2023

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## **This issue**

**JWG NDSHA reports at the ASC EC Meeting in Berlin**

**Scope of JWG for discussion and revision**

editorial: Let's act

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## **JWG NDSHA reports at the ASC EC Meeting in Berlin**

In the recent IUGG General Assembly in Berlin, the Asian Seismological Commission (ASC) held its executive committee meeting on July 17, 2023. JWG NDSHA report to the meeting the proposal and on-going work, presented by Dr. Yan Zhang, the secretary of JWG (Asian side). Prof. G. F. Panza was invited to attend the meeting and gave a 20 minutes explanatory talk.

The agenda of this ASC meeting included nomination for new EC, discussion on the venue of 15th ASC GA in 2024, and other miscellaneous issues. 'Recent progress of the AfSC-ASC Joint WG on Neo-Deterministic Seismic Hazard Assessment' was an important agenda in this meeting.

ASC preliminarily decided that the 15th GA is to be held the next year in Turkey.

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## **Scope of JWG for discussion and revision**

As a joint working group of the ASC and the AfSC, JWG devotes its endeavor to the internationally cooperative research on the fundamental physical problems associated with seismic hazard assessment (SHA), promoting the implementation and improvements of neo-deterministic SHA (NDSHA) in Asia and Africa and related comparative studies. In a long-term JWG is working towards an interactive toolbox for NDSHA, an open access database of NDSHA, and a unified regional/global NDSHA, as well as related international standards. JWG promotes the contribution of seismic disaster reduction towards integration of NDSHA in standard procedures of seismic risk assessment (Hazard x Vulnerability x Exposure) through communication with end users such as insurance companies and governmental agencies.

Slogan of JWG is thus **More physics in seismic hazard assessment for disaster risk reduction** ('More physics in SHA for DRR' in short).

Suggestions for the revision is called for with deadline September 30, 2023.

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### **Editorial: Let's act**

African Seismological Commission (AfSC, since 2011) and Asian Seismological Commission (ASC, since 1995) are two active regional commissions of the International Association of Seismology and Physics of the Earth's Interior (IASPEI), playing an important role for the development of seismology and reduction of seismic disaster risk. Joint Working Group on Neo-Deterministic Seismic Hazard Assessment (JWG NDSHA) was proposed two years ago and has been gradually recognized by the two commissions. This newsletter is a platform for members of the JWG to exchange information, scientific ideas, and discuss on future developments. It is to be circulated among the present members of JWG, copying to the secretaries of ASC and AfSC. New readers can be added gradually with the introduction of the JWG members. Readers of this newsletter and all scientists involved with JWG-NDSHA are invited to send refined contributions to it. And JWG is open to new members. The newsletter is monthly circulated, containing at most 3 pieces of information. That is, to be as simple as possible, and as specific as possible. Accordingly, the editorial work is as small as possible, and as smart as possible. This 'S4 principle' may lead to the sustainability of the newsletter, as well as the JWG itself.

The newsletter is edited by the secretaries of JWG, Dr. Yan Zhang (Asian side) and Prof. M. El Gabry (African side). Contact address: Yan Zhang: [zhangyan@cea-igp.ac.cn](mailto:zhangyan@cea-igp.ac.cn) | Mohamed El Gabry: [elgabry@nriag.sci.eg](mailto:elgabry@nriag.sci.eg)

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# Newsletters

Vol. 1 No.2 September 1, 2023

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[More reliable physics in seismic hazard assessment \(SHA\) for disaster risk reduction \(DRR\)](#)  
[\(More reliable physics in SHA for DRR\)](#)

## **This issue**

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## **[JWG attended the AfSC meeting](#)**

On July 16, 2023, JWG members attended the meeting of AfSC. Prof. G. F. Panza, Prof. M. El Gabry, Prof. A. Peresan, and Dr. Yan Zhang participated in the meeting. Attendees of the meeting included leaders of the AfSC and IASPEI, e.g., Prof. Johannes Schweitzer, secretary general of IASPEI, and Prof. Michelle Grobbelaar, president elected of IASPEI and secretary general of AfSC.

Dr. Yan Zhang presented the background of the proposed joint ASC and AfSC working group on Neo-Deterministic Seismic Hazard Assessment (JWG-NDSHA). It was agreed that the next step would be to share the information with the AfSC Execom and engage with the ASC Execom to discuss how to take the proposal further.

It was also announced that the next AfSC GA is planned to be held with the Southern African Geophysical Association (SAGA) in 2024.

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## **[JWG prepares for the 2024 ASC GA](#)**

The 15<sup>th</sup> General Assembly of Asian Seismological Commission (ASC) is going to be held the next year, with its sessions in preparation. JWG is planning to propose a session 'Physics-based seismic hazard assessment: recent progress and scientific debate'.

Since recent years physics-based seismic hazard assessment has attracted wide spreading attention in

seismological and engineering communities. The developments of neo-deterministic seismic hazard assessment (NDSHA) as a new generation of deterministic seismic hazard assessment well captures the tensor nature of strong ground motion based on the up-to-date seismology, data science, and computational technology, and has been applied to several places. This led to the necessity of comparative studies, testing of the results by earthquake cases with data intensive observations, and communicating with engineering and emergency management communities for its application. The research and its application play an important role in the endeavor of disaster risk reduction (DRR). The proposed session includes but is not limited to the theoretical, computational, and application aspects of NDSHA (for a recent review see *Earthquakes and Sustainable Infrastructure Neo-deterministic (NDSHA) Approach Guarantees Prevention Rather Than Cure*, 1st Edition - May 21, 2021, Editors: Giuliano Panza, Vladimir G. Kossobokov, Efraim Laor, Benedetto DeVivo), with comparison with other approaches, and related scientific discussion.

Suggestions for the revision of the session scope and volunteers to act as or to recommend conveners (and key speakers) please contact the secretaries of the JWG.

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#### Editorial: JWG and BRI

A few members of JWG might also be the members of the Initiative of Seismic Disaster Risk Reduction within the framework of the Belt and Road Initiative (BRI), in which 'Belt and Road' stands for the Silk Road Economic Belt and the 21<sup>st</sup> Century Maritime Silk Road (started since 2013, just a decade ago). In a seismological perspective, the Belt and Road region overlaps with the Eurasian seismic belt and the Pacific seismic belt, which calls for the cooperative research and application of seismic hazard assessment for the reduction of seismic disaster risk. Failures of some of the competing approaches as shown in some destructive earthquakes further highlights the importance of NDSHA. JWG-NDSHA, as well as its close relation with the BRI, has had long lasting roots since the beginning of the 21<sup>st</sup> century. In 2005 Prof. Giuliano Panza was conferred the honorary professorship of the Institute of Geophysics, China Earthquake Administration, Beijing. In the ceremony he was called as the 'Marco Polo in seismology'. It is well known that Marco Polo played an important role in the transmission of knowledge along the Silk Road. Indeed, this is the case considering the many students of Giuliano Panza in Asian and African countries (some of whom are members of the current JWG) and the cooperative studies performed in different regions which can be traced back as early as the 1980s.

In recent years, along with rapid urbanization and fast development of economy, the population in earthquake-prone areas has significantly increased (e.g., Environ. Res. Lett. 11 (2016) 074028 doi:10.1088/1748-9326/11/7/074028), which indicates that more reliable physics in SHA for DRR is an urgent agenda in sustainable development, especially for the Belt and Road regions. In 2021 Prof. Panza was invited to write an editorial in the *BRI Newsletters*, advocating the cooperation in the BRI regions on NDSHA. Publication of the book *Earthquakes and Sustainable Infrastructure Neo-deterministic (NDSHA) Approach Guarantees Prevention Rather Than Cure* in 2021 was a milestone event which paved the systematic theoretical basis for such cooperation.

Communicating with African Seismological Commission (AfSC) and Asian Seismological Commission (ASC),

respectively, the proposal of JWG obtained active responses, both from the colleagues in the African countries and Asian countries, and from the international organizations. The history is still going on, which calls for your contribution.

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### Response from readers

Yan,

Slogan Suggestion: "Reliability" is more informative (and positive) than "physics". Also, PSHA method is to: (a) use "physics"; and then (b) input the synthetic ground motion into a PSHA anyway.

It is always preferable to send pdf format, rather than word. Pdf can be read on any device (computer or mobile phone, etc.), and also probably more secure.

Best regards,  
James Bela

James,

Please clarify which physics is used by PSHA; GMPE have nothing to do with physics, it is "educated" numerology. At present I would like to propose in the slogan to replace "physics" with "reliable physics". I let editors' final decision, accounting for possible additional suggestions.

I absolutely agree with your suggestion that it is always preferable to send pdf format, rather than word.

Ciao,  
Giuliano Panza

I am not totally sure what they are doing; but I think they are viewing synthetic earthquakes (for Magnitudes and locations not in earthquake catalogs) as additional data points in their probabilistic PSHA (GMPE dependent) paradigm. A synthetic "time history" (physics-based) could be used in design standards where it would have a response spectrum that *matches* the PSHA (GMPE driven) probabilistic spectrum. The Endgame is always *project approval* within probabilistic design standards, not deterministic applications to consider *what is possible* (not just probable). Zhenming Wang keeps assuring me there are wiser practitioners out there who are using deterministic maximum design values for California San Andreas fault. But there is not the technoscience application/appreciation now that the "new" physics-based ground motions represent *a new model that makes the existing PSHA model obsolete*. And they are (they tell themselves) still *comfortable with the possibility of a bad outcome* per our Table 1 in Seismic Rigoletto (of which there have been many).

Best,  
James Bela

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### **JWG Library (1)**

To facilitate the exchange and discussion within the JWG, each newsletter will be attaching an important paper for the group to study. This issue we attach the paper Giuliano F. Panza, Antonella Peresan and Cristina La Mura (2013) Seismic hazard and strong ground motion: an operational neo-deterministic approach from national to local scale, in *Geophysics and Geochemistry*, [Eds.UNESCO-EOLSS Joint Committee] *Encyclopedia of Life Support Systems(EOLSS)*, Developed under the Auspices of the UNESCO, EOLSS Publishers, Oxford ,UK, [<http://www.eolss.net>]. If you have any paper recommended, please contact us.

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# Newsletters

Vol. 1 No.3 October 1, 2023

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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## This issue

Suggestion for a Webinar: 2023 Morocco  $M_s$ 6.8 Earthquake and Seismic Hazard Assessment

The Morocco earthquake highlighted the importance of NDSHA

SEE9

Collection of published results of NDSHA as a start of the regional/global unified NDSHA map

JWG Library (2)

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## Suggestion for a Webinar: 2023 Morocco $M_s$ 6.8 Earthquake and Seismic Hazard Assessment

On September 9, 2023, a  $M_s$ 6.8 earthquake struck Marrakesh, Morocco, and caused severe casualties and economic losses in the area. The year 2023 is the first year of JWG actions, it is important to organize a webinar for this destructive earthquake. In this webinar, all researches and ideas about the Morocco earthquake as well as other events are welcome. The date will be announced once the preparation work is done. If you have any suggestion about the date for this webinar, please contact the two executive secretaries.

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## The Morocco earthquake highlighted the importance of NDSHA

Mohamed ElGabry\*, Hany Hassan , Aboubakr Chaaraoui and Mimoun Chourak\*

African Disaster Mitigation Research Center, ADMiR, Cairo, Egypt

\*African Seismological Commission

Before the recent Morocco earthquake, seismic hazard assessment in North Africa, based on the neo-deterministic methodology (NDSHA), was performed. The NDSHA was implemented by calculating synthetic seismograms through the modal summation technique. The assessment was conducted on a regular grid of  $0.2^\circ \times 0.2^\circ$  degrees, as demonstrated in Mourabit et al., (2014). The study marks the first attempt to develop NDSHA maps for North Africa, encompassing Morocco, Algeria, Tunisia, Libya, and



Egypt. The standard NDSHA algorithm relies on earthquake sources, seismotectonic zonation, and structural models as crucial input data. The estimated design ground acceleration at epicenter of 2023 Morocco  $M_s6.8$  event, with a shear wave velocity ( $V_s$ ) of 1800 m/s, falls within the 0.01-0.02g range.

The Global Seismic Hazard Map released by Global Earthquake Model (GEM) provides information about the world-widely geographic distribution of seismic hazard. The map indicates that the epicentral area of the 8th September 2023 Morocco earthquake, with a magnitude of  $M_s6.8$ , has a PGA value of 0.13g. It's important to note that the PGA value provided in the GEM Global Seismic Hazard Map represents the level of ground shaking with a 10% probability of being exceeded in a 50-year time span. It is computed for reference rock conditions, assuming a shear wave velocity ( $V_{s30}$ ) range of 760-800 m/s.

According to Moroccan Seismic Building Code 2000 (version 2011), the PGA for this epicentral area is 0.1g. However, Moroccan authorities reported a recorded maximum intensity of VIII during the 2023 earthquake, where there were no records for acceleration near the source but on 35 Km away from the epicentre, the acceleration exceeded 0.19g recorded in an accelograph, indicating a significant deviation from the model's prediction. This discrepancy underscores the importance of considering and improving the quality of input data, particularly information related to active fault lines, paleoseismological evidence, morphostructural zonation and historical seismic data.

The case of the 2023 Morocco earthquake serves as a stark reminder of the need to priorities not only sophisticated models and intensive calculations but also the accuracy and completeness of input data. The Morocco earthquake is a red alarm for all of us; we have to pay more attention not only to sophisticated models and intensive calculations but also to realistic input data.

According to Prof. G. F. Panza, apart from input data completeness,  $M_{\text{design}}$  could be a dynamic parameter for updating seismic hazard maps based on NDSHA. Considering  $M_{\text{design}}$ , in agreement with Rugarli et al (2019), from the values of Agadir quake in 1960,  $M=5.7-5.8$  we obtain  $M_{\text{design}}=6.4-6.5$  for the area, a value not so different, within global error estimate 0.2-0.3 (e.g. Båth, M. (1973); Bormann et al. (2007)), from the one observed for the 2023  $M=6.8-6.9$  earthquake. This fact should encourage the timely updating of the, about 10 years old, maps published in the paper Neo-deterministic seismic hazard assessment in North Africa by Mourabit et al. (2014). The obvious reason is to evidence that  $M_{\text{design}}$  value for the area was available since 2019 and that the easy computation considering  $M_{\text{design}}$  all over Morocco is natural with NDSHA, and not in the reach of PSHA. Same applies to entire North-Africa.

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Rugarli, P., Vaccari, F., Panza, G. F., 2019. Seismogenic nodes as a viable alternative to seismogenic zones and observed seismicity for the definition of seismic hazard at regional scale. *Vietnam Journal of Earth Sciences*, 41, 289–304. DOI: 10.15625/0866-7187/41/4/14233.

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### SEE9

International Institute of Earthquake Engineering and Seismology (IIEES) after organizing 8 successful International Conferences on Seismology and Earthquake Engineering in past 34 years, now making the first announcement and calls for papers for the SEE9 to be held at 6-8 May of 2024 in Tehran, Iran. SEE9 builds on the strength of its predecessor conferences, and features a broad scope of topics on (1) Seismology and Early Warning System; (2) Geotechnical Earthquake Engineering; (3) Structural Earthquake Engineering; (4) Earthquake Risk Management. More details could be found in the SEE9 conferences website: <http://www.seeconferences.ir/>.

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### Collection of published results of NDSHA as a start of the regional/global unified NDSHA map

As a start of the regional/global unified NDSHA map, JWG is calling for the collection of published results about NDSHA. Members of JWG are invited to provide the published papers/books/open files and a short description of the regions as well as some of the technical details. The information sheet includes the following 8 items:

1. Latitude/longitude range of the region, and abstract description, e.g., Iranian plateau
  2. Tectonic keywords of the region, e.g., subduction zone
  3. Institutions conducting the related work
  4. Technic details (1): structure model, 1 D model, or 3-D model?
  5. Technic details (2): methods to select controlling earthquakes, from zonation data, by seismogenic nodes?
  6. Technic details (3): site effects, averaged, or site specific?
  7. Technic details (4): tested by real earthquake cases?
  8. Related publications, in the same form as the reference of the papers published
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### JWG Library (2)

To facilitate the exchange and discussion within the JWG, our newsletter will be attaching an important paper for the group to study. In this issue, in response to the recent earthquake in Morocco, we attach the paper Neo-deterministic seismic hazard assessment in North Africa by T. Mourabit et al., published in *Journal of Seismology*. (2014) 18: 301–318, DOI: 10.1007/s10950-013-9375-2. If you have any paper recommended, please contact us.

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# Newsletters

Vol. 1 No.4 November 1, 2023

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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## This issue

NDSHA helps earthquake early warning (EEW)

The  $M_{\text{design}}$

Deadly earthquakes of 2023

JWG Library (3)

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## NDSHA helps earthquake early warning (EEW)

Implementation of effective Earthquake Early Warning System (EEWS) may contribute protecting lives and properties. In a paper published this year, it is shown that integrating information provided by physically sound, reliable seismic hazard assessment (NDSHA) can significantly improve performances of current EEWS. Specifically, in this study it is demonstrated that EEWS empowered by NDSHA allows reducing the size of 'blind zone', which is one of the challenges affecting performance of these systems. The paper suggests a practical approach, exploiting information from time-dependent seismic hazard assessment to indicate when and where the number of stations should be temporarily increased. Accordingly, when in a region a temporary increase of seismic hazard is declared, the corresponding ground shaking scenarios provided by NDSHA are used to optimally select, based on costs/benefits analysis, the sites where additional stations should be deployed, in such a way that the 'blind zone' could be temporarily reduced. The work ultimately demonstrates how basic studies in earthquake science, including studies on the physics of seismic waves propagation and the knowledge of the Earth interior, could contribute directly to the engineering endeavor towards reduction of seismic disaster risk.

Y. Zhang, Z. Wu, F. Romanelli, F. Vaccari, A. Peresan, J. Li and G. F. Panza, 2023. Earthquake Early Warning System (EEWS) empowered by Time-Dependent Neo-Deterministic Seismic Hazard Assessment (TD-NDSHA). *Terra Nova*, 35, 230-239. DOI: 10.1111/ter.12647.

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## The $M_{\text{design}}$

$M_{\text{design}}$  is an important issue in SHA (Rugarli et al. 2019). As commented by Prof. Giuliano Panza, most of the data about earthquake size is based on macroseismic Intensity. Reliable magnitude estimates are limited to the last 150 years or so. The existence of many different macroseismic Intensity scales is a demonstration of the complexity of the problem of describing earthquake effects. The multiplicity of scales generates some problems in practical applications, that must therefore rely upon very conservative assumptions. Caution is necessary since many magnitude scales exist, as well. The magnitude value given for a single event is a mathematical result (usually average of different estimations) with very limited physical meaning. This justifies the common use in catalogues to omit error for single event estimations, but makes it compulsory to consider what is estimated at global level, accounting for different reporting agencies (different catalogues). Generally, error in magnitude determination at global scale is about 1/4 (Båth, 1973; Bormann et al. 2007).  $\Delta M_W = 1/4$  is consistent with the variation that may affect the seismic moment,  $M_0$ , as determined, for the same event, by different agencies and methods (e.g., Panza and Saraò, 2000; Saraò et al., 2001; Guidarelli and Panza, 2006; Chu et al., 2009; Rugarli et al. 2019).  $M_{\text{design}}$  can be defined accounting for error in magnitude determination at global level, not only for recorded events, but also for each potentially discovered seismogenic node (Gelfand, et al., 1972; 1976). In this way  $M_{\text{design}}$  represents, in each study area, the maximum physically possible magnitude of the scenario event consistent with both the observed magnitude values and those estimated by pattern recognition. Therefore,  $M_{\text{design}}$  can be considered a formal definition of the maximum credible earthquake (MCE) magnitude. The implementation of  $M_{\text{design}}$  makes it possible to promptly update existing seismic hazard maps if, within standard errors, the defined  $M_{\text{design}}$  value is exceeded.

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Saraò, A., Panza, G. F., Privitera, E., Cocina, O., 2001. Non-double couple mechanisms in the seismicity preceding 1991–1993 Etna volcano eruption. *Geophysical Journal International*, 145, 319–335. DOI: 10.1046/j.0956-540X.2001.01375.x.

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### Deadly earthquakes of 2023

*“Earthquakes don’t kill people, buildings do!”*

The first of the recent 06 February 2023 earthquakes in Turkey of magnitude  $M_w7.8$  occurred at 01:17 UTC followed by the  $M_w7.5$  event at 10:24:48 UTC with epicentres located at 27 km E of Nurdağı and at 4 km SSE of Ekinözü (Turkey), respectively. This Kahramanmaraş earthquake sequence (Dal Zilio and Ampuero, 2023) resulted in widespread damage in an area of about 350,000 km<sup>2</sup> and about sixty thousands of fatalities in Turkey and Syria; both earthquakes share tied the 5-6<sup>th</sup> deadliest quake since 2000 (Table 1). Different agencies reported the extreme macroseismic intensity up to XII (in MMI scale) around the first major shock epicentre and in Antakya, as well the maximum peak ground acceleration (PGA) of 2.2 g recorded at Pazarçık Belediyesi Park and some higher magnitude determinations of the two major earthquakes, e.g. GEOSCOPE estimated  $M_w8.0$  and 7.7 and Geological Survey of Russian Academy of Science provided  $M_s8.0$  and 7.8, respectively, with  $I_0 = \text{XI-XII}$  in MMI scale for both shocks (which is by no means a fractional part of the qualitative assessment of ground shaking, but reflects the natural uncertainty in determining macroseismic class). The observed ground shaking was much larger than the maximum PGA estimates with 10% probability of exceedance in 50 years at their sites of either the Global Seismic Hazard Assessment Program (GSHAP, 1999) or Global Earthquake Model (GEM, 2018) final hazard maps. On the other hand, the occurrence of devastating earthquakes was expected in the disjunctive D-node of the morphostructural zonation of Anatolia pattern recognized by Gelfand et al. in 1973 and 1974 (Figure 1) and within the only two out of 262 circles of investigation that spread over most of the global seismic belts where Time of Increased Probability starting from July 2021 was determined in the on-going real-time Global Testing of the M8 algorithm (Healy et al., 1992; Ismail-Zadeh and Kossobokov, 2021; Kossobokov and Soloviev, 2021) aimed at magnitude range  $M8.0+$  (Figure 2) and confirmed in the next semi-annual updates, most recently in January 2023.

The September 8<sup>th</sup>, 2023,  $M6.8$  - 54 km WSW of Oukaimedene, Morocco, resulted in widespread destruction in the Marrakech-Safi region and the death of at least 2,946 people. According to measurements at 452 stations, the maximums are  $I_0 = \text{IX}$  and  $\text{PGA} = 1.23\text{g}$  (<https://earthquake.usgs.gov/earthquakes/eventpage/us7000kufc/shakemap/stations>), which is 9 times larger than on the latest GEM’s map (Pagani et al., 2018). Ground shaking intensity VI was felt at distances of up to 300 km from epicenter.

The four strong M6.3 on October 7<sup>th</sup>, 11<sup>th</sup>, and 15<sup>th</sup> in northwestern Afghanistan caused the death toll of at least 2,445 fatalities according to the Taliban official release as of the 10<sup>th</sup> of October (while the United Nations reported 1,294 deaths on the same date); eventually the death toll raised after the third and the fourth M6.3 earthquakes located nearer to the city of Herāt (pop. 574,300) than the earlier destructive shocks of October 7<sup>th</sup>. The ground shaking effects are in agreement with GEM and GSHAP, while showing that the exceedance (so-called, "10% poe in 50 years") does not wait for 50 years and may repeat in an hour or less, as it did happen on October 7th at 06:41:03 and 07:12:50 (UTC). Apparently, we evidence a swarm of M6+ earthquakes in the western Afghanistan, which occurrences in the past have been forerunners for a few cases of the great M8+ earthquakes (Kossobokov and Shebalin, 2003).

**TABLE 1.** Top deadliest earthquakes since 2000. Notes: at least 1,000+ fatalities including victims of tsunami and other associated effects. The ratio  $R_{PGA} = mPGA_{GEM}/mPGA_{GSHAP}$  (\* from GEM interactive map); increments  $\Delta I_0 = I_{0\text{ EVENT}} - I_{0\text{ GSHAP}}$  and  $\Delta I_0' = I_{0\text{ EVENT}} - I_{0\text{ GEM}}$  are computed as in (Kossobokov and Nekrasova, 2011; 2012) rounded to the closest integer.

Region	Date	M	Fatalities	$\Delta I_0$	$\Delta I_0'$	$R_{PGA}$
Sumatra-Andaman Islands	26 Dec 2004	9.0	227,898	4	4	1.20*
Port-au-Prince (Haiti)	12 Jan 2010	7.3	222,570	2	1	3.10
Wenchuan (Sichuan, China)	12 May 2008	8.1	87,587	3	3	1.60
Kashmir (northern border	8 Oct 2005	7.7	87,351	2	2	2.06
<b>Nurdağı (Turkey)</b>	<b>6 Feb 2023</b>	<b>7.8(8.0)</b>	<b>59,359+</b>	<b>1(2)</b>	<b>2</b>	<b>1.08</b>
<b>Ekinözü (Turkey)</b>		<b>7.5(7.7)</b>		<b>1(2)</b>	<b>2</b>	<b>1.11</b>
Bam (Iran)	26 Dec 2003	6.6	26,271	0	1	0.86
Bhuj (Gujarat, India)	26 Jan 2001	8.0	20,085	3	2	2.30
Off the Pacific coast of Tōhoku	11Mar 2011	9.0	19,759+	3	3	1.22*
Bharatpur (Nepal)	25 Apr 2015	7.8	8,964	2	2	1.01
Yogyakarta (Java, Indonesia)	26 May 2006	6.3	5,782	0	0	1.57
Sulawesi Island (Indonesia)	28 Sep 2018	7.5	4,340	2	2	1.62
Southern Qinghai (China)	13 Apr 2010	7.0	2,968	2	1	1.68
<b>Oukaïmedene (Morocco)</b>	<b>8 Sep 2023</b>	<b>6.8</b>	<b>2,946+</b>	<b>3</b>	<b>2</b>	<b>2.09</b>
<b>Zindah Jān (Afghanistan)</b>	<b>7 Oct 2023</b>	<b>6.3, 6.3</b>	<b>2,445 ?</b>	<b>0</b>	<b>0</b>	<b>1.22</b>
Boumerdes (Algeria)	21 May 2003	6.8	2,266	2	0	3.75
Nippes (Haiti)	14 Aug 2021	7.2	2,248	2	1	3.39
Nias Island (Indonesia)	28 Mar 2005	8.6	1,313	3	3	2.22
Padang (Southern Sumatra,	30 Sep 2009	7.5	1,117	1	1	1.38
Hindu Kush (Afghanistan)	25 Mar 2002	6.1	1,000+	-1	-1	0.74
<b>Herāt (Afghanistan)</b>	<b>11, 15 Oct 2023</b>	<b>6.3</b>	<b>1000+</b>	<b>0</b>	<b>0</b>	<b>1.22</b>

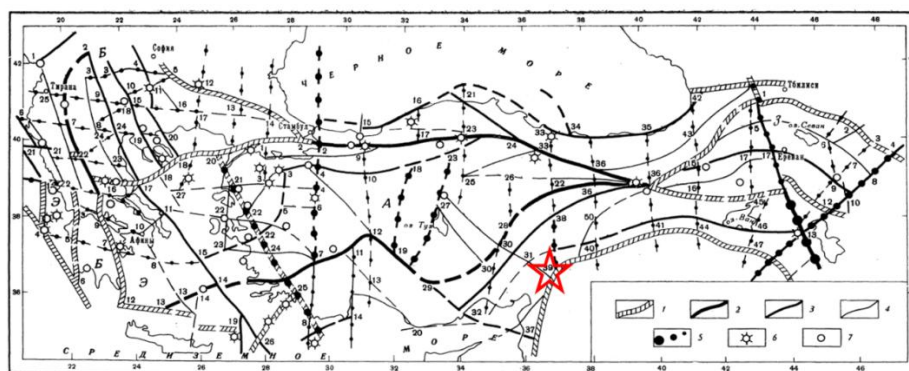
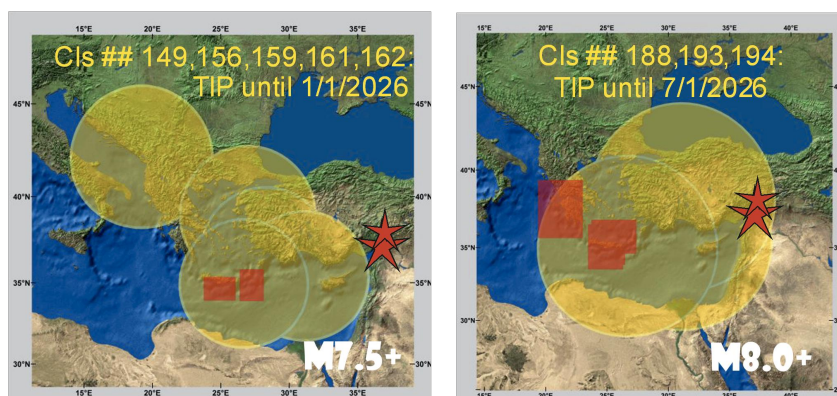


Рис. 1. Морфоструктурная схема Юго-Восточной Европы и Малой Азии. 1–5 – морфоструктурные границы (1–4 – продольные, 5 – поперечные к пространству основных форм рельефа); 1 – регионов; 2 – морфоструктурных стран; 3 – областей; 4 – районов. 6–7 – эпицентры сильных землетрясений с магнитудой  $6,5 \leq M \leq 6,9$  (7),  $M \geq 7$  (6); цифры – номера дизъюнктивных узлов

**Figure 1.** Morphostructural scheme after (Gelfand et al., 1973) and the epicenter of the 06 February 2023 major main shock (red star).



**Figure 2.** Global Test the M8-MSc predictions: Time of Increased Probability (TIP) diagnostics in Circles of Investigation (CIs) according to M8 algorithm for January–June 2023 and epicenters of the two major shocks of the 2023 Kahramanmaraş earthquake sequence (stars). Notes: (1) Forecasts refer exclusively to seismically active areas within 180 and 262 CI's with a radius of 427 and 667 km, focused on global monitoring of the occurrence of the M7.5+ and M8.0+ events, respectively. (2) Both earthquakes occurred outside the territory of the 180 CI's for monitoring in the M7.5+ range (left) and within the cluster of three out of 262 CI's alerted for TIP of M8.0+ earthquake (right). (3) Erroneous refinement of forecasts using the MSc algorithm (Kossobokov et al., 1990) (red polygons) is due to the incompleteness of the catalog of earthquakes in the M4+ range used in the Global Test.



After the deadly 2010 Haiti earthquake, a systematic comparison of the Global Seismic Hazard Assessment Program (GSHAP) final map of the maximum PGA estimates with 10% probability of exceedance in 50 years (10% poe in 50 years) at the sites of actual earthquakes disclosed gross inadequacy of this “probabilistic” product (Kossobokov, 2010); for 50% of 1320 strong ( $M \geq 6.0$ ) earthquakes, the PGA values on the GSHAP PGA map were surpassed by 0.17 g or more within 10 years of publication in (Giardini, 1999), which fact evidently contradicts the predicted 10% poe in 50 years. After the 2011 mega-earthquake off the Pacific coast of Tōhoku (Japan) a comprehensive analysis have shown that inadequacy of their final map could have been discovered by the participants of GSHAP based on the earthquake statistics for the period of 1990–1999 (Kossobokov & Nekrasova, 2011; 2012). A decade ago Wyss et al. (2012) have shown “that earthquake mitigation measures in areas where large earthquakes are possible may not be based on GSHAP maps” and urged “that the international project Global Earthquake Model (<http://www.globalquakemodel.org/>) is on the wrong track, if it continues to base seismic risk estimates on the standard method to assess seismic hazard”. Apparently, the contributors to GEM keep misleading interested parties by providing erroneous seismic hazard maps (Pagani et al., 2018). It should be noted, however, that, as a matter of fact, the GEM’s Disclaimer does characterize the Model as absolutely useless:

“The information included in this map must not be used for the design of earthquake-resistant structures or to support any important decision involving human life, capital and movable and immovable properties.”

On the contrary, the achieved statistics of testing the term-less predictions (for decades) of the “dangerous” D-nodes and/or D-intersections of the regional schemes of morphostructures [Gorshkov and Novikova, 2018], as well as the intermediate-term middle-range diagnoses of the Times of Increased Probability (for years and a few sources of target earthquakes) for the occurrence of the largest earthquakes worldwide (Ismail-Zadeh and Kossobokov, 2021; Kossobokov and Soloviev, 2021) confirm the evident reliability and usefulness of the pattern recognition approach in step-by-step resolving the issues of operational earthquake forecasting (Kossobokov et al., 2015). It is notable that D-node A39 where the catastrophic earthquakes occurred on February 6, 2023 was characterized already in 1973 by 10 out of 11 class D (“dangerous”) features in the absence of those of class N (“not dangerous”) transferred from Central Asia to Anatolia and adjacent regions (Gelfand et al., 1973). In Anatolia, features of D-nodes are formed mainly from indicators of tectonic fragmentation of the Earth’s crust: the length of the main lineament, the complexity of the node, the proximity of lineaments of the first rank, and the closeness of lineaments.

The last three columns in Table 1 show up the differences between the macroseismic intensity at epicenter of the observed earthquake ( $I_0$  EVENT) and that predicted by the GSHAP and GEM Maps ( $I_0$  GSHAP and  $I_0$  GEM ) followed by the ratio RPGA between the predicted maximum PGA values with 10% poe in 50 years on the GEM versus GSHAP maps. Most of the macroseismic intensity differences, sampled by deadliest earthquakes of the 21<sup>st</sup> century, are positive with their average and median of 2 units on MMI scale, which underestimation of 2 or more units of MMI corresponds, at best, to a transition from STRONG (VI MMI) – light damage to poorly constructed buildings, cracks and a few instances of fallen plaster occur – to SEVERE (VIII MMI) – moderate or heavy damage to ordinary substantial buildings with partial collapse, large cracks in the walls, falling cornices and chimneys.

The values of RPGA (in the last column of Table 1) indicate an apparent upgrade of the GEM Seismic Hazard map in respect to the one of GSHAP; the sampled values with the average of 1.7 and median of 1.6 disclose a tendency to increase maximum PGA values with 10% poe in 50 years at the sites of the occurred (in our case, deadliest) earthquakes. Interestingly, in comparison to GSHAP the seismic hazard at sites of the 2003 Bam and 2002 Hindu Kush earthquakes is downgraded by 14% and 26%, respectively, while is about the same at locations of the 2015 Nepal and 2023 Kahramanmaras earthquakes.

It deserves mentioning that GEM's map appears to ignore ground shaking resulted by many earthquakes with epicenters off shore, including the 26 December 2004 Indian Ocean Disaster and the 11 March 2011 Great Tōhoku earthquake and tsunami; as a matter of fact, only six out of 24 magnitude 8 or larger earthquakes since the year 2000 have GEM's determination of PGA nearby their epicenters.

Evidently, a comprehensive analysis similar to (Kossobokov and Nekrasova, 2012; Wyss et al., 2012) is needed to confirm that, same as GSHAP, the GEM poe product's "inconsistency is inadmissible for any type of responsible evaluation of seismic risk and making decisions concerning earthquake disaster prevention". An indirect confirmation of this claim is the GEM's Disclaimer cited above.

It deserves noting that the "standard method" of Probabilistic Seismic Hazard Analysis of GSHAP and GEM is challenged by methodology of Neo-Deterministic Seismic Hazard Assessment (Panza et al., 2021). This new multi-disciplinary scenario- and physics-based approach for evaluation of seismic hazard that takes advantage of the results of pattern recognition of earthquake prone areas and intermediate-term earthquake prediction of different spatial accuracy, which are tested to be reliable, realistic, and useful evaluation and mapping of apparently time-dependent seismic hazard and associated risks.

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by Kossobokov V. G. and Nekrasova A.  
(E-mails: volodya@mitp.ru;nastia@mitp.ru)

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### JWG Library (3)

To facilitate the exchange and discussion within the JWG, some of the newsletters will be attaching an important paper for the group to study. In this issue, we attach the paper 'NDSHA: a new paradigm for reliable seismic hazard assessment' by G. F., Panza and J. Bela published in *Engineering Geology* (2020) 275, 105403, DOI 10.1016/j.enggeo.2019.105403. If you have any paper recommended, please contact us.

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# Newsletters

Supplementary issue 1 to Vol. 1 No.4 November 1, 2023

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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## pJWG NDSHA as co-sponsor for StatSeis13

Statistical seismology international conference series (StatSeis13: <http://www.statsei13.org.cn/>) is going to be held in Shenzhen, China, from March 16 to 24, 2024. Starting in 1998, the meeting was held in China (1998 and 2013), New Zealand (2001 and 2017), Mexico (2003), Japan (2006 and 2019), Italy (2007), the United States of America (2009), Greece (2011), Germany (2015) and France (2022). Sessions include: 1. Development of statistical models and methodologies for seismicity analysis; 2. Earthquake physics; 3. Earthquake forecasts and testing, ground shaking simulation, disaster mitigation; 4. Extending statistical seismology beyond seismicity, such as seismic inversion, tremor, slow earthquakes, icequakes, etc.; 5. Recent developments of Bayesian and machine learning methodologies in seismology; 6. Recent advances of China Seismic Experiment Site (CSES) and Collaboratory for the Study of Earthquake Predictability (CSEP). The scope of the JWG fits well with StatSeis13 Session 3, while other sessions are connected to varying degrees. Abstract submission system will be closed at Nov. 30, 2023.

JWG is invited to be as co-sponsor of the organizational committee of this meeting. Comments and suggestions on this issue is welcome.

### SPONSORS

- National Natural Science Foundation of China
- Geophysical Society of China
- Southern University of Science and Technology
- Peking University
- University of Chinese Academy of Sciences
- The Institute of Geophysics, China Earthquake Administration
- The Institute of Earthquake Forecasting, China Earthquake Administration
- China Seismic Experimental Site
- Northwestern Polytechnical University
- Preparatory Joint Working Group on Neo-Deterministic Seismic Hazard Assessment (pJWG NDSHA)
- (Updating)

## Newsletters

Supplementary issue 2 to Vol. 1 No.4 November 1, 2023

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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### Webinar: 2023 Morocco $M_s$ 6.8 Earthquake and Seismic Hazard Assessment

On September 9, 2023, a  $M_s$ 6.8 earthquake struck in Marrakesh, Morocco, and caused severe casualties and economic losses. 2023 is the first year of JWG actions, it is important and necessary to organize a webinar for this destructive earthquake. In this webinar, Prof. Panza is planning to participate in and comment about seismic hazard and its assessment performed in 2014. All researches, ideas about Morocco earthquake are welcome.



**Date:** 29 November 2023

**Time:** 13:00~15:00 (GMT + 1), 15:00~17:00 (GMT + 3), 20:00~22:00 (GMT + 8)

**Format:** ZOOM (Meeting ID: 323 774 9800; Passcode: 3FtMh3)

For any enquiry, please contact Yan Zhang (zhangyan@cea-igp.ac.cn) and Mohamed El Gabry (elgabry@nriag.sci.eg). If you plan to attend the meeting, please respond to us before Nov. 28.

# Newsletters

Vol. 1 No.5 December 1, 2023

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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## This issue

The 2023 Best Paper Award

Preparatory Meeting for the preparatory JWG: a review

JWG members and advisors

$M_{\text{design}}$  at the Northern border between Afghanistan and Iran

Content of Vol. 1

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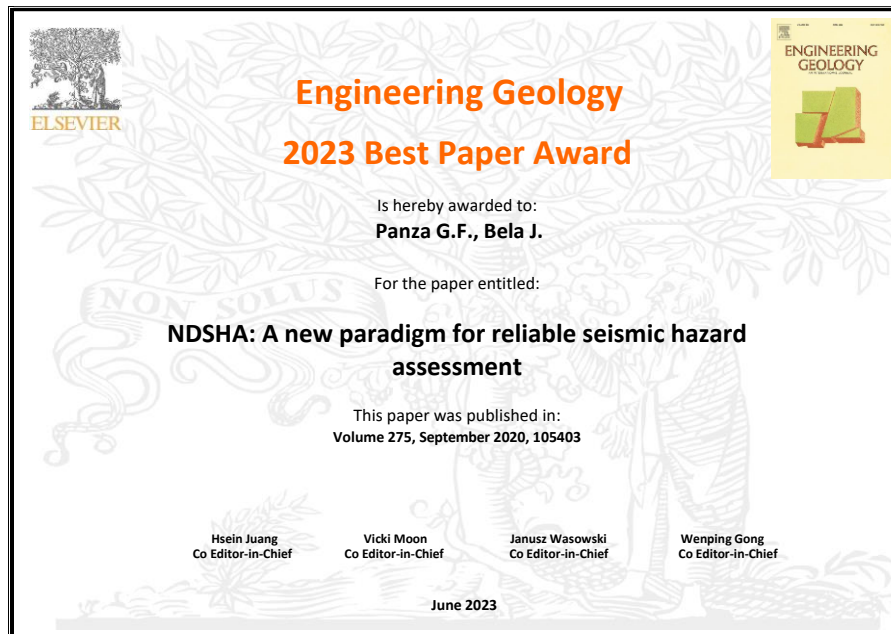
## The 2023 Best Paper Award

The 2023 Best Paper Award was awarded to Profs. G. F. Panza and J. Bela. This paper was published in Volume 275, September 2020, in Engineering Geology (Panza and Bela, 2000). As Prof. A. Peresan commented, the success of the ENGEO paper by Panza and Bela (Best paper award) indicates that people are now looking for new alternative approaches to seismic hazard assessment. This likely indicates an increasing awareness of the limits of standard approach (PSHA). Numerical modeling is getting more and more popular, routinely at the local, regional and national scale; we need to confront with PSHA models and clearly show the advantages of NDSHA (e.g. reliability and robustness). Focusing on risk assessment performance (e.g., loss predictions) rather than on hazard assessment and taking PSHA estimates for granted has been highly popular in recent years. However, risk assessment requires considering the vulnerability and exposure layers on top of hazard assessment; as these elements (i.e. vulnerability and exposure) have their own significant uncertainties, it gets very hard to understand if the used underlying hazard assessment is adequate or not.

Prof. Panza commented the conferred award as follows: At global level, the value of PSHA, on account of the precision given, may seem close to that of diamonds; on the same scale NDSHA value could be compared to *Swarovski* crystals (<https://www.swarovski.com/en-IT/>; <https://en.wikipedia.org/wiki/Swarovski>), but the real practical value is reversed. The awarded paper is a tangible contribution to the necessary “revolution”.

Panza, G. F., Bela, J., 2020. NDSHA: A new paradigm for reliable seismic hazard assessment. Engineering Geology, 275, 105403. <https://doi.org/10.1016/j.enggeo.2019.105403>. (now open access as 2023 Best

Paper Awarded)



Congratulations, Giuliano and James!

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### Preparatory Meeting for the preparatory JWG: a review

The preparatory meeting on July 10<sup>th</sup>, 2023, played an important role in the organization of the preparatory JWG. Attendees of the online meeting included Giuliano Panza, Fabio Romanelli, Antonella Peresan, Mohamed El Gabry, Irwandi Nurdin, Pallabee Choudury, Farhana Sarwar, Hany Hassan, and Yan Zhang.

On February 6, 2023, two great earthquakes ( $M_w7.8$  and  $M_w7.6$ ) occurred in Turkey-Syria region, and caused unpredictable losses and casualties. These deadly events strongly demonstrate the necessity and urgency to intensify the work of JWG-NDSHA in Asia and Africa and utilize the knowledge that is already available to the fullest.

In the meeting, some primary 'definitions' of the working group were discussed and concluded. The meeting discussed the scope and long-term goals, planned activities, financial issues, organization and governance of JWG, and proposed the scientific/technical advisory board, group members, and executive secretaries.

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### JWG members and advisors

Based on communications since the last year, the list of members and advisors of the JWG is now:

#### Scientific/Technical Advisory Board

- Vladimir G. Kossobokov (volodya@mitp.ru)
- Mustapha Meghraoui (m.meghraoui@unistra.fr)
- Giuliano F. Panza (giulianof.panza@lincei.it)
- Antonella Peresan (aperesan@ogs.it)
- Fabio Romanelli (romanel@units.it)
- Franco Vaccari (vaccari@units.it)
- Zhongliang Wu (wuzl@cea-igp.ac.cn)

#### JWG members

- Algeria: Djillali Benouar (dbenouar@gmail.com), Amel Benali (benali.amel1992@gmail.com)
- Bangladesh: Tahmeed M. Al-Hussaini (htahmeed@yahoo.com)
- China: Yan Zhang, *Executive Secretary* (zhangyan@cea-igp.ac.cn)
- Congo: Georges Mavonga Tuluka (mavotulu@gmail.com)
- Egypt: Hany Hassan (hany\_hassan@nriag.sci.eg), Mohamed El Gabry, *Executive Secretary* (elgabry@nriag.sci.eg)
- Ethiopia: Atalay Ayele (atalayaye@gmail.com)
- Ghana: Paulina Amponsah (pekua2@yahoo.com)
- India: Imtiyaz A. Parvez (parvez@csir4pi.in), Sima Ghosh (sima.civil@nita.ac.in), Pallabee Choudhury (pallabee.ch@gmail.com)
- Indonesia: Irwandi Nurdin (irwandi@usk.ac.id)
- Iran: Medhi Zare (mzare@iiees.ac.ir), Mehdi Rastgoo (rastgoo.mehdi@gmail.com)
- Morocco: Mimoun Chourak (ml.chourak@gmail.com)
- Pakistan: Farhana Sarwar (f\_saleem10@yahoo.com)
- Sudan: Nada Ahmed (eng.nada.ibr@eng.asu.edu.eg)
- Tunisia: Ahmed Ksentini (ahmedksentini@yahoo.fr)

Following the formula of silent consent, the list compiled on the base of available information will be considered valid from now (December 2023) on. New participants are encouraged. To join, prospective members need only send an application to the JWG's executive secretaries, Yan Zhang and M. El Gabry, stating their interest in the JWG-NDSHA goals. The secretaries in consultation with the advisory committee will decide on acceptance and inform applicants. Please get in touch with the executive secretaries if you do not want to be a part of the JWG and ask that your name be taken off the list above.

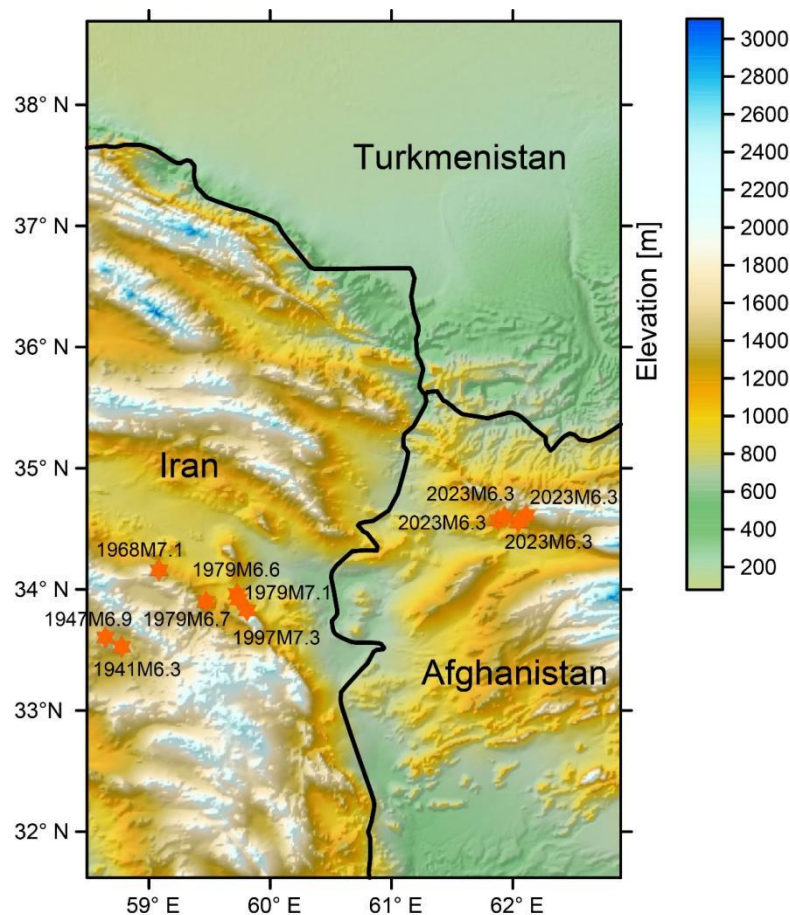
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### **$M_{\text{design}}$ at the Northern border between Afghanistan and Iran**

What recorded since 1900 up to now (15 October 2023) (<https://earthquake.usgs.gov/earthquakes/map/>) it is certainly not the MCE (Maximum Credible Earthquake) for the area (e.g. Bela and Panza, 2021). From the definition of  $M_{\text{design}}$  (Rugarli et al. 2019) MCE at the Northern border Iran-Afghanistan can be formally defined in the range 7.6-7.8, until proven otherwise.

Time (UTC)	Latitude	Longitude	Depth	M	Location
2023-10-15 T 03:36:00	34.6094	62.1115	6	6.3	30 km NNW of Herāt, Afghanistan
2023-10-11 T 00:41:56	34.5565	62.0449	9	6.3	
2023-10-07 T 07:12:50	34.5718	61.8816	10	6.3	western Afghanistan
2023-10-07 T 06:41:03	34.5989	61.9313	14	6.3	33 km NNE of Zindah Jān, Afghanistan
1997-05-10 T 07:57:29	33.825	59.809	10	7.3	58 km E of Qaen, Iran
1979-11-27 T 17:10:32	33.962	59.726	10	7.1	56 km ENE of Qaen, Iran
1979-11-1 T 02:21:22	33.918	59.741	33	6.6	55 km ENE of Qaen, Iran
1979-01-16 T 09:50:10	33.897	59.472	33	6.7	32 km NE of Qaen, Iran
1968-08-31 T 10:47:43	34.158	59.083	10	7.1	42 km ESE of Dasht-e Bayaz, Iran
1947-09-23 T 12:28:15	33.604	58.642	15	6.9	52 km WSW of Qaen, Iran
1941-02-16 T 16:39:03	33.527	58.776	15	6.3	43 km WSW of Qaen, Iran



## References

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- Rugarli, P., Vaccari, F., Panza, G. F., 2019. Seismogenic nodes as a viable alternative to seismogenic zones and observed seismicity for the definition of seismic hazard at regional scale. *Vietnam Journal of Earth Sciences*, 41, 289-304. DOI: 10.15625/0866-7187/41/4/14233.

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JWG NDSHA reports at the ASC EC Meeting in Berlin  
 Scope of JWG for discussion and revision  
 editorial: Let's act

### Issue 2

JWG attended the AfSC meeting  
 JWG prepares for the 2024 ASC GA

Editorial: JWG and BRI  
Response from readers  
JWG Library (1)

### Issue 3

Suggestion for a Webinar: 2023 Morocco  $M_s$ 6.8 Earthquake and Seismic Hazard Assessment  
The Morocco earthquake highlighted the importance of NDSHA  
SEEG  
Collection of published results of NDSHA as a start of the regional/global unified NDSHA map  
JWG Library (2)

### Issue 4

NDSHA helps earthquake early warning (EEW)  
The  $M_{\text{design}}$   
Deadly earthquakes of 2023  
JWG Library (3)

### Issue 4-S1

pJWG NDSHA as co-sponsor for StatSeis13

### Issue 4-S2

Webinar: 2023 Morocco  $M_s$ 6.8 Earthquake and Seismic Hazard Assessment

### Issue 5

The 2023 Best Paper Award  
Preparatory Meeting for the preparatory JWG: a review  
JWG members and advisors  
 $M_{\text{design}}$  at the Northern border between Afghanistan and Iran  
Content of Vol. 1

We sincerely thank the supports from our readers, and herewith convey our best wishes, somehow earlier of schedule, to the readers of this Newsletter for a merry holiday season and a prosperous new year.

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# Newsletters

Supplementary issue to Vol. 1 No.5

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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## **Abstract to StatSei13: Towards an operational combination of the annual consultation, time-dependent NDSHA and EEWS**

We propose an interdisciplinary approach to time-dependent neo-deterministic seismic hazard assessment (TD-NDSHA) for the China Seismic Experimental Site (CSES) at one year time scale (Zhang et al., 2022; 2023), and we show that it provides statistically significant results. The proposed approach is based on the NDSHA (Bela and Panza, 2021), with the ‘controlling’ earthquakes defined by the Annual Consultation on the Likelihood of Earthquakes. Considering the alert regions provided by the Annual Consultation, the expected strong ground motion parameters and the macroseismic intensities are mapped by the NDSHA algorithms. The estimated intensities are then subject to comparison with the intensities produced by the actual earthquakes. Evaluation of the performance performed using confusion matrix and Molchan error diagram, respectively, indicating that the combination outperforms random forecasting.

The TD-NDSHA may also contribute addressing the ‘blind zone’ of the network-based on-site EEWS. We suggest a practical approach according to which, when in a region a temporary increase of seismic hazard is declared, additional stations are deployed in such a way that the ‘blind zone’ is temporarily reduced. We propose that the ‘blind zone’ can be reduced in the identified areas of interest (e.g.,  $\text{MMI} \geq \text{VI}$ ), by 1) Deploying a limited number of additional seismic stations, according to information provided by TD-NDSHA; 2) Switching of the EEW from multi-station mode to single sensor mode and even skipping the process of location and magnitude-determination/prediction procedures; and 3) Using the stations within the ‘blind zone’ for reducing the size of the ‘blind zone’, that is, if a station detects destructive S waves, it sends out the message via electromagnetic signal to another station with larger epicentral distance.

Statistical seismology plays an important role in the application and validation of all elements of the proposed approach, namely the annual consultation, TD-NDSHA, and EEW. Here we propose an operational combination of these three fields, with the aim to reduce the impact of earthquake disasters, well conscious of the fact probabilistic seismic hazard analysis has been debunked in the geophysical literature (e.g. Stark, 2022).

### **Main references**

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Please feel free to contact Yan Zhang (zhangyan@cea-igp.ac.cn) if you have problems when you submit your abstract. The abstract submission of StatSei13 will be closed on Dec. 22, 2023. We appreciate your contribution and support to the meeting, in which pJWG acts as co-sponsor.

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# Newsletter Vol 2 2024

# Newsletters

Vol. 2 No.1 January 1, 2024

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More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

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## This issue

Important events of JWG

Experiment with GPT4.0

Future Directions: Physics-based ground motion modeling, Vancouver, Canada, October, 10-13, 2023

Minute: the Webinar on 2023 Morocco  $M_s6.8$  earthquake

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## Important events of JWG

**January 24, 2022:** Prof. G. F. Panza was invited to write an editorial in the *BRI Newsletter* (Vol.2, No.1) 'NDSHA along the B&R region: a research initiative'.

**October 10-13, 2022:** Joint General Assembly of ASC and AfSC held in Kairo. Prof. Panza proposed to set up the Joint Working Group on Neo-deterministic Seismic Hazard Assessment (JWG-NDSHA), and obtained active response.

**February 6, 2023:** Two earthquakes ( $M_w7.8$  and  $M_w7.6$ ) occurred in Turkey-Syria region, invoking discussions among the JWG.

**June, 2023:** The 2023 Best Paper Award awarded to Profs. G. F. Panza and J. Bela for the paper published in Volume 275, September 2020, in *Engineering Geology*.

**July 10, 2023:** Preparatory meeting of JWG-NDSHA held online.

**July 15, 2023:** JWG member took part in the meeting of AfSC. Prof. Michelle Grobbelaar, secretary general of AfSC, replied to JWG with encouraging message.

**July 17, 2023:** JWG reported in the ASC EC meeting, with the endorsement of Prof. Li Li, secretary general of ASC.

**August 1, 2023:** First issue of JWG newsletter distributed.



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## Experiment with GPT4.0

On March 14, 2023, OpenAI released its new deep learning model GPT-4.0, after two years of the birth of GPT-3.5. It is said that GPT-4.0 is more close to a human. Deep learning is showing its great power for helping people to deal with natural problems (e.g., Wilson et al., 2023; Xue et al., 2023). Here, we did a experiment with GPT4.0 about neo-deterministic seismic hazard assessment (NDSHA).

**Question: Can you say something about difference between Neo-deterministic Seismic Hazard Assessment and Deterministic Seismic Hazard Assessment?**

**GPT4.0:** The difference between Neo-deterministic Seismic Hazard Assessment (NDSHA) and Deterministic Seismic Hazard Assessment (DSHA) can be understood in the context of their approaches to evaluating seismic hazard.

Deterministic Seismic Hazard Assessment (DSHA) focuses on identifying the maximum credible earthquake for a given location based on geological and seismic data. It considers the largest earthquake that is likely to occur at a site and uses this to determine the potential ground motion. This approach does not statistically consider the probability of different earthquake scenarios occurring but instead uses a worst-case scenario based on historical seismicity and active faults.

Neo-deterministic Seismic Hazard Assessment (NDSHA), on the other hand, is a scenario-based approach that expands upon the deterministic method by considering a wide range of possible earthquake sources and constructing scenarios using full waveform modeling. This method does not rely on empirical attenuation models and aims to supply realistic time series of ground shaking. NDSHA provides envelope estimates of maximum seismic ground motion from a set of possible scenario earthquakes, which include the largest deterministically or historically defined credible earthquakes. It allows for the generation of ground shaking maps at specified long-term return times, facilitating a direct comparison with probabilistic seismic hazard assessment (PSHA) maps in terms of average rates of exceedance for specified time windows.

In essence, while both DSHA and NDSHA focus on the physical modeling of seismic waves to assess seismic hazard, NDSHA provides a more flexible and comprehensive approach by incorporating a broader range of scenarios and not being dependent on empirical ground motion prediction equations. The NDSHA method also enables the assessment of seismic hazard over longer time windows and can be compared with probabilistic estimates for validation purposes

## References

- [1] Wilson, M. P., G. R. Foulger, M. W. Wilkinson, J. G. Gluyas, N. Mhana, and T. Tezel, 2023. Artificial intelligence and human-induced seismicity: initial observations of ChatGPT, *Seismol. Res. Lett.*, doi: 10.1785/0220230112.
- [2] Xue, Zhiwen, Chong Xu, and Xiwei Xu, 2023. Application of ChatGPT in natural disaster prevention and reduction. *Natural Hazards Research*, <https://doi.org/10.1016/j.nhres.2023.07.005>

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**Future Directions: Physics-based ground motion modeling,  
Vancouver, Canada, October, 10-13, 2023**

On October, 10-13, a poster titled as NDSHA Scenario Seismic Hazard Map, Vancouver, b.c. Area - XeRis Methodology was presented in the international meeting, Future Directions: Physics-based ground motion modeling, hold in Vancouver, Canada. In the poster, James Bela, Giuliano Panza, Yan Zhang, and Zhiwei Ji shown an interactive tools XeRis of NDSHA, and computed seismic hazard maps around Vancouver area. They also present some preliminary results based on Maximum Credible Seismic Input (MCSI) in Vancouver city. Please feel free to contact Yan Zhang if you need its PDF version with higher quality.

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**Minute: The 2023 Morocco  $M_s6.8$  Earthquake and Seismic Hazard Assessment**

In response to the September 8, 2023,  $M_s6.8$  earthquake in Marrakesh, Morocco, pJWG organized a Webinar on November 29, 2023, with participation of the AfSC leader Prof. Paulina Amponsah. Secretary general of ASC Prof. Li Li who was in the field work sent her warm words to the Webinar. Attendees of the Webinar include: Alexander Gorshkov, Antonella Peresan, Djillali Benouar, Giuliano Panza, Imtiyaz Parvez, Irwandi Nurdin, Paulina Amponsah, Vladimir Kossobokov, Yan Zhang.

In the webinar, **Prof. Alexander Gorshkov** talked about the current results on identifying seismogenic nodes in North Africa (without Morocco). He also proposed a pilot project to identify seismogenic nodes in this region. The experience of working with Prof. Panza has shown that information about such nodes is very useful for calculating seismic hazard using the NDSHA approach. If there is the possibility of some kind of funding for this project, young scientists from North African countries, for example from Egypt, could undergo an internship at Institute of Earthquake Prediction Theory and Mathematical Geophysics. In the second talk **Prof. Vladimir Kossobokov** reviewed the deadliest earthquakes of 2023, asking whether they are unexpected surprises. He commented that GEM's map appears to ignore ground shaking resulted by many earthquakes with epicenters off shore. **Prof. Giuliano Panza** commented that 'The main contribution of GSHAP and GEM is to have supplied the proof that PSHA method is totally unreliable and wrong, not only formally but also on the base of Occam razor'. He said that 'Considering that the  $M_{design}$  obtained by NDSHA approach has been in agreement with the real situation, and has been further confirmed by the Morocco earthquake, it should encourage the timely updating of the, about 10 years old, maps published of the neo-deterministic seismic hazard assessment in North Africa. The obvious reason is to evidence that  $M_{design}$  value for the area was available since 2019 and that the easy computation considering  $M_{design}$  all over Morocco is natural with NDSHA, and not in the reach of PSHA. Same applies to entire North-Africa, and not only.'

Dr. Mohamed ElGabry, the African side secretary of pJWG, who could not attend this meeting due to schedule conflict, chatted with Dr. Zhang Yan via the web and discussed the agenda of this meeting. He especially mentioned that he is going to attend a meeting about 2023 Morocco  $M_s6.8$  earthquake the next

week. In the free discussion stage, attendees discussed the importance of earthquake disaster reduction in Morocco, which extended to the importance of disaster reduction work in Asia and Africa, especially in underdeveloped areas. It is agreed that pJWG has opened up new platforms and opportunities for cooperation, information exchange, and academic exploration, which will greatly promote the application and promotion of NDSHA methods, and also contribute to pJWG's continuous and greater role as a platform for information exchange and cooperation promotion. Prof. Zhongliang Wu who could not attend the webinar sent his encouraging words regarding to the functioning of pJWG.

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# Newsletters

Vol. 2 No.2 February 1, 2024

More reliable physics in seismic hazard assessment (SHA) for disaster risk reduction (DRR)  
(More reliable physics in SHA for DRR)

## This issue

15th General Assembly of Asian Seismological Commission (ASC)

2024 Noto Peninsula, Japan  $M_w$ 7.5 earthquake

2024 Wushi, Aksu Prefecture, Xinjiang, China  $M_w$ 7.0 earthquake

Warm encouragements from Prof. Zhongliang Wu

Warm regards from Prof. Li Li

## 15th General Assembly of Asian Seismological Commission (ASC)

The 15<sup>th</sup> General Assembly of Asian Seismological Commission (ASC) is going to be held in Antalya, Turkey, Nov 03-07, 2024, with its sessions being revised and expanded. JWG has submitted a session 'Physics-based seismic hazard assessment: recent progress and scientific debate'. Prof. Li Li, the ASC secretary, has approved it. It will be updated in the upcoming promotional poster and website.



**Session scope:** Since recent years physics-based seismic hazard assessment has attracted wide spreading attention in seismological and engineering communities. The developments of neo-deterministic seismic hazard assessment (NDSHA) as a new generation of deterministic seismic hazard assessment well captures the tensor nature of strong ground motion based on the up-to-date seismology, data science, and computational technology, and has been applied to several places. This led to the necessity of comparative studies, testing of the results by earthquake cases with data intensive observations, and communicating with engineering and emergency management communities for its application. The research and its application play an important role in the endeavor of disaster risk reduction (DRR). The proposed session includes but is

not limited to the theoretical, computational, and application aspects of NDSHA, with comparison with other approaches, and related scientific discussion.

The text above is the original version of the scope of the session. Suggestions for its further revision are welcome. Please contact the secretaries of the JWG and formulate suggestions for volunteers to act as conveners or recommend conveners (and key speakers).

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### 2024 Noto Peninsula, Japan $M_w7.5$ earthquake

MCE size, using  $M_{design}$ , is formally defined as the largest so far observed magnitude plus 2 or 3 times the global  $\sigma_M$  value (for details see earlier Newsletters, e.g. Vol. 1 No.5 December 1, 2023). Thus,  $M_{design}$  supplies a quite natural lower bound of MCE magnitude for any study area. The Japan quake is a clear example of the capability of NDSHA to assess MCE in a quick and reliable way. In fact, in the area of Noto Peninsula, past seismicity (since 1900) gives  $M_{design}=(6.7-6.8)+0.7=7.4-7.5$ , not so different from the  $M_w7.5$  of the quake occurred on 2024-01-01 07:10:09 (UTC) (location 37.498°N 137.242°E, depth 10 km). In other words, since the 1984 and 2007 events ( $M$  6.7-6.8),  $M$  about 7.5 could have been expeditiously “PREDICTED” for the MCE of the area. Geller (2011) points out that the national seismic hazard map published yearly by the Japanese government failed to predict seismic hazard since 1979: deadly earthquakes that have caused 10 or more fatalities in Japan have occurred in places where seismic risk is designated to be low.

#### References:

Geller, R. J., 2011. Shake-up time for Japanese seismology. *Nature*, 472, 407-409. DOI: 10.1038/nature10105.

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### 2024 Wushi, Aksu Prefecture, Xinjiang, China $M_w7.0$ earthquake

Reported by China Earthquake Networks Center (CENC), a  $M_w7.0$  earthquake struck Wushi County, Aksu Prefecture, Xinjiang, China at 18:09:04 (UTC) on 2024-01-22. The epicenter is estimated to be at 41.26°N 78.63°E with focal depth at 22 km. The maximum event in this area before the Wushi  $M_w7.0$  quake is a  $M6.4$  event in 1987 (41.26°N 79.17°E). Accordingly,  $M_{design}=6.4+0.7=7.1$  can be immediately defined, thus the Wushi  $M_w7.0$  within ~45 km from the epicenter of the 1987  $M6.4$  event in the Wushi County is enveloped by the expeditious prediction of MCE for the area. The value  $M=7.1$  for MCE should be considered both at the stage of rescue and reconstruction.

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### Warm encouragements from Prof. Zhongliang Wu

It's nice to see that the preparatory joint working group (pJWG) is on track, as represented by its Monthly Newsletters since August, plus 2 supplementary issues. In the whole process we would like to thank the

guidance of Prof. Panza as well as other scientific advisors.

Facilitating the organization of the pJWG while promoting the preparatory work in the framework of the ASC and the AfSC will be the focus of work at present time. It is hoped that sometimes the word 'preparatory' be removed from the present title of our working group, and JWG be a formal member of ASC and AfSC.

It is worth mentioning the forthcoming JWG activities in preparation. The first is the conference on statistical seismology next March in which JWG acts as its co-sponsor, and the second is the Assembly of the Asian Seismological Commission next November in which JWG is preparing its session, somehow the first JWG session in the ASC Assembly. To my knowledge ASC is also discussing with Yan for inviting him to assist the maintenance of the ASC website, that is a good thing for the working group. On the African side, the newly founded African Disaster Mitigation Research Center listed the work of JWG among its program in 2024, reflecting the endorsement to the works of JWG from the AfSC and local institutions. And I am sure that in the next AfSC Assembly JWG will also play an active role.

Earthquakes don't wait for our research to be finished. Therefore, we must keep an 'interactive mode' with earthquakes. This webinar, although with limited participation due to various reasons (for me, ironically it is the problem of the connection), reflects the working status of JWG. Indeed, through the continuous exchange and cooperation, innovative outcomes are attainable and will lower the risk of seismic disasters for society.

Thank you.

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**Warm regards from Prof. Li Li**

On behalf of the Asian Seismological Commission (ASC), taking the opportunity of the Webinar on the 2023 Morocco  $M_s 6.8$  Earthquake and Seismic Hazard Assessment, I would like to convey my warm regards to the Joint Working Group on Neo-deterministic Seismic Hazard Assessment (JWG NDSHA), and express my thanks to the African Seismological Commission (AfSC) for cooperation in supporting the works of this joint working group. Reduction of seismic disaster risk has been one of the research focuses of the ASC as well as the AfSC. I hope that with the international and interdisciplinary cooperation we may be doing a better and better job in this field. I hope to meet you the next year in the Assembly of ASC in which the JWG is going to have its first technical session. Thank you.

Li Li, secretary general of Asian Seismological Commission and vice president of the International Association of Seismology and Physics of the Earth's Interior (IASPEI)

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**Correction: the last picture in the Newsletter Vol 2, issue 1**

The GPT4.0 experiment distributed with Newsletter Vol 2, issue 1 is an example of misleading apparently

correct statements. It could be nice if you send your comments. One can easily find that GPT4.0 has difficulties in producing the figure with texts, although revised by natural intelligence. Accordingly, we just remove the figure produced by GPT4.0. The final reply of GPT4.0 for this problem follows: I apologize for the continued errors in the text of the generated images. Unfortunately, the current technology may not always accurately reflect complex text requirements in image generation. I recommend using professional image editing software or services to ensure the accuracy of the text. If you need assistance in any other matters, please let me know. I apologize again for not being able to meet your request.

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