

PROGRESS REPORT 2007

IASPEI Commission on Seismological Observation and Interpretation (CoSOI)

Working Group (WG) on Magnitudes

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INTRODUCTION

The Working Group on Magnitudes (*Magnitude WG*) of the International Association of Seismology and Physics of the Earth's Interior (IASPEI) Commission on Seismological Observation and Interpretation (CoSOI) was established to recommend standard procedures for making measurements from digital data to be used in calculating several widely used types of earthquake magnitude. At the 2005 IASPEI meeting in Santiago, Chile, we proposed standard procedures for M_L , two types of M_S , m_b , m_B , $m_b(L_g)$, and M_w . The procedures were adopted by the CoSOI at the 2005 meeting and are now called the IASPEI Standard Procedures for Magnitude Determination. The IASPEI Standard Procedures may be viewed on-line at the IASPEI web-site (http://www.iaspei.org/commissions/CSOI/Summary_of_WG_recommendations.pdf).

In this report, we follow the magnitude nomenclature of the Bulletin of the Seismological Society of America, which is also that of Aki and Lee (Glossary of Interest to Earthquake and Engineering Seismologists, Appendix 1, International Handbook of Earthquake and Engineering Seismology, Part B, p. 1793-1856.) In general, because there may exist several widely used notations for magnitudes computed with the same procedure, and because the same notation may be used for several different procedures, it is essential that use of any magnitude notation in a publication or database be accompanied by a citation or metadata file that describes the specific procedure represented by the notation.

IMPLEMENTATION OF THE STANDARD PROCEDURES: ACCOMPLISHMENTS SINCE 2005, AND WORK YET TO BE DONE

In the aftermath of the adoption of the Standard Procedures at the 2005 IASPEI meeting, there remained several types of activity that were necessary to ensure implementation of the procedures. We summarize in this section accomplishments and work-yet-to-be-done in implementation activities. A significant part of the reported progress occurred as the result of work done outside of the framework of the Magnitude WG, sometimes by scientists who are not members of the Magnitude WG. We cite this work to illustrate general progress made towards the goals of standardizing and documenting magnitude determination procedures.

Advertising the Standard Procedures for Magnitude Determination

The International Seismological Centre (ISC) has notified the seismological community of its intent to implement the IASPEI Standard Procedures. Magnitude WG member Bormann and ISC director Avi Shapira made presentations at the 6th Asian Seismological Commission in Bangkok in 2006. Some research papers by WG

members and their colleagues have explicitly cited the IASPEI Standard Procedures: I am aware of such papers by Peter Bormann, Liu Riufeng, and their colleagues.

Important advertising not yet done includes publication of a technical paper on the Standard Procedures and a broadcast announcement by the USGS/NEIC of its intent to calculate magnitudes by the Standard Procedures.

Evaluating existing magnitude procedures in light of the IASPEI Standard Procedures

Because the IASPEI Standard Procedures were intended to conform as much as possible to previously existing procedures for widely computed magnitudes, some seismological centers are already “in compliance” with the standard procedures, in that their amplitudes, periods, or magnitudes are negligibly different from those produced by the Standard Procedures. For most magnitudes, an acceptable alternative procedure should produce magnitudes that agree with magnitudes produced by the Standard Procedure to within about 0.1 magnitude unit when both procedures are applied to the same large data set.

Some networks will recognize that their amplitudes, periods, or magnitudes are significantly biased with respect to those produced by a Standard Procedure, yet feel that their primary mission requires that they continue using their traditional magnitude procedures. For these situations it is important to ensure that the networks’ non-standard procedures are well documented. Nomenclature for the non-standard magnitudes should make clear that these magnitudes are not to be regarded as equivalent to magnitudes produced by the Standard Procedures.

An exemplary study is that of working group members Peter Bormann, Liu Ruifeng, and colleagues that recently appeared in the Bulletin of the Seismological Society of America (2007, “Chinese national network magnitudes, their relation to NEIC magnitudes, and recommendations for new IASPEI magnitude standards,” v. 97, p. 114-127).

The ISC has invited contributing observatories to document their procedures. As of 22 June, 2007, the ISC web-site (http://www.isc.ac.uk/magnitude/mag_info.html) listed five centers that have contributed information on how they measure amplitudes or determine magnitudes. These centers are those denoted by the standard abbreviations of CLL, INMG, ISK, WAR, and WEL. In 2005, the WG specifically recognized the importance of seismological centers providing first-order descriptions of their magnitude procedures (magnitude formulas, filter responses, measurement time-windows) via the Internet. The ISC “Current Practice for Magnitude Determinations” web-site is a logical site for centers to document their procedures, but it needs to be used by more centers.

Adoption of IASPEI Standard Procedures by the USGS/NEIC, ISC, and IDC

The ISC has announced its intention to implement the IASPEI Standard Procedures and has developed standardized phase identifiers for contributed amplitudes that were measured with the IASPEI Standard Procedures. The ISC announcement may be viewed at “<http://www.isc.ac.uk/doc/analysis/2006p03/magletter.html>”.

The USGS/NEIC is testing an automatic implementation of the IASPEI Standard Procedures but has not made a general public announcement. Two major steps remain. First, the procedure has to be put into routine use – at present the IASPEI

magnitudes that are computed on the USGS/NEIC test platform do not enter the USGS/NEIC data-stream. Second, a scheme has to be developed for transmitting the data to the ISC. Probably both of these steps are more than a year in the future.

The WG formerly had a member who was affiliated with the International Data Centre (IDC) of the United Nations Comprehensive Nuclear Test Ban Organization, but the member is not longer affiliated with the IDC and the IDC is unrepresented in the WG. I have recently invited the IDC to appoint a new member to the WG, but I have not yet received a response to that invitation. In 2003, the WG received assurances from the previous director of the IDC that the IDC would be willing to compute m_b according to the IASPEI Standard Procedure, in addition to computing its own m_b . This would enable the IDC data to be more useful to the international earthquake hazards community.

Compilation of sample data-sets and special study data-sets

The Magnitude WG has recognized the value of having sample sets of digital seismographic data that could be used by seismological centers to test their implementations of the IASPEI Standard Procedures. In addition, at the 2005 IASPEI meeting it was proposed that the Magnitude WG help organize an international observational period for collecting magnitude data. Action has not been taken on either of these issues.

FUTURE OF THE MAGNITUDE WORKING GROUP

At the 2003 IUGG meeting, the Magnitude WG was asked to complete its job by the time of the 2005 IASPEI meeting. At the 2005 IASPEI meeting, with the Standard Procedures defined but not yet implemented, we asked that the Working Group's existence be extended until 2007, to insure that the Standard Procedures are in fact implemented. The extension was granted.

As summarized in the preceding section, 2007 finds us having made significant progress towards implementation of the Standard Procedures, but with several major tasks unfinished. We recognize that the Magnitude WG was not intended to be a permanent institution, and we also acknowledge that many of the remaining implementation tasks could, strictly speaking, be done by cooperation among current members of the Magnitude WG without requiring that the WG exist as a CoSOI entity past 2007. Nonetheless, we think the continued existence of an official "IASPEI Magnitude WG" will help with the ongoing implementation of the IASPEI Standard Procedures in a way that could not be accomplished by a grouping of cooperating former members of a former IASPEI WG. We accordingly recommend that the CoSOI Magnitude WG be extended at least until the IASPEI 2009 meeting.

Goals for the WG for the period 2007-2009 are: (1) completion of a technical paper on the Standard Procedures; (2) more complete on-line documentation of magnitude procedures by seismological observatories; (3) encouragement of studies that examine the existing magnitude procedures of seismological centers with respect to the IASPEI Standard Procedures; (4) encouragement of the IDC to calculate m_b according to the IASPEI standards, in addition to the traditional IDC m_b ; (5) compilation of sample data-sets for use by individual centers to test their magnitude procedures.