DOCUMENTATION OF STATION/AGENCY MAGNITUDE PROCEDURES

(Modified from the SUMMARY OF IASPEI MAGNITUDE WORKING GROUP RECOMMENDATIONS ON DETERMINING EARTHQUAKE MAGNITUDES FROM DIGITAL DATA, updated version 2011; see http://www.iaspei.org/commissions/CSOI/Summary_WG-Recommendations_20110909.pdf)

This document is to outline the procedures adopted by seismological agencies to compute magnitudes of seismic events.

Agency Name: **(National Observatory of Athens)**

Please list the magnitudes computed and corresponding phase type analyzed in the table below (example provided). Add as many rows as required.

Magnitude type (nomenclature used at the agency)	Full name	Wave type analyzed
mb	Short-period body-wave magnitude	P-waves
ml	Local (Wood Anderson Amplitude) Magnitude	S-waves
mw	Moment Magnitude	P-S waves

For each magnitude type computed at the agency, please specify:

1. The equations that are used for calculating each magnitude type and
   a: specify if distance is measured as epicentral distance or hypocentral distance;
   b: specify the distance range for which the equation is applied;
   c: specify restrictions on hypocentral focal-depth, if any.

ML equation: **-log Ao = 1.110 log(r/100) + 0.00189(r - 100) + 3.0 (Hutton and Boore 1987)**
a: r is hypocentral distance in kilometers.
b and c: equation is used with no restrictions on distance ranges or hypocentral focal-depth

Mw (for events Ml>4.0)

2. Is any signal-to-noise ratio criterion applied to the analyzed signal?

Ml magnitude is measured based on a signal to noise ratio 2/1

3. Specify the software used (such as SeisComp, Antelope, Seismic Handler, Seisan, SAC, in-house developed programs) to perform the analyses for magnitude computation.

   SeisComp3 (Automatic location) for Ml
   Atlas (Nanometrics) for Ml
   Isola-GUI for Mw

4. If the agency is computing magnitudes not based on some amplitude/period measurement (e.g., moment magnitude Mw) please summarize the details of the technique used. For example, is Mw obtained with a centroid moment tensor, W-phase and/or spectral fitting technique?

   Magnitudes are based on amplitude/period measurement but for focal mechanisms we apply Mw: bodywave moment tensor inversion

5. Other restrictions on the calculation of a specific magnitude. For example, is the magnitude measured only for earthquakes of a certain size, as defined by an independent measure of earthquake size? Also, are specific magnitudes computed only for seismic events occurring in specific areas?

   There is only signal to noise restriction.
   Geographic area: Latitude 34° – 42°, Longitude 19° - 29°

Detailed questions on the magnitudes based on amplitude/period measurements:

6. How the network (event) magnitude and corresponding uncertainty is obtained? For example, is the network magnitude an arithmetic/trimmed mean, median value of the single station magnitudes?

   For number of station magnitudes values > 5: event mag is 20% trimmed mean
   for <=5: event mag is mean

7. Units of the reported amplitudes. Specify if amplitudes are reported in units of trace-amplitude motion instead of ground motion.

   Ground Motion

8. Time-window in which the amplitude measurement is made for the phase type analyzed. For example, for body wave magnitudes, is the time window a flexible time-interval between the P onset and the PP onset or a fixed time window after the first P onset (e.g. 5 s, 10 s or other)? Similarly, for the surface wave magnitudes, is the time window considered a time-interval spanned by waves having group-velocities between, e.g., 3.2 and 4.0 km/s or is always the maximum velocity amplitude, respectively (A/T)max in the whole surface-wave train in a wide range of periods be measured? If so, give the range of periods.

Cheking for the maximum velocity amplitude using a flexible time-interval after the S onset

9. Orientation of seismograph (horizontal or vertical) from which the measurement is made. For example, is Ms computed using both horizontal and vertical components? Specify also if, as for example might be the case for ML, data from each of the two horizontal components at a single station are used, are data from each component treated as a separate observation in the network magnitude computation, or are the two components first averaged into a station magnitude, which is then treated as a single observation in the network magnitude computation?

Ml: data from each of the two horizontal components at a single station are used (each component treated as a separate observation in the network magnitude computation)

10. Describe the amplitude-response, filter characteristics, or transfer-function of the seismograph or simulated seismograph through which the amplitude measurement is made. For example, is the IASPEI recommended standard Wood-Anderson seismometer simulation filter with the parameters according to Uhrhammer and Collins (1990) used to compute ML?

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Wood Anderson response has a period of Ts = 0.8s, damping constant of 0.7, and a static magnification of 2080, as obtained from Uhrhammer and Collins, 1990. The static magnification value used here is also the constant used by hyp2000 as stated in the hyp2000 manual.

This instrument's true output units is "mm on paper Wood-Anderson record" (2080 * mm for sufficiently high frequencies). For the purposes of using this response for instrument simulation in Atlas,

its input units are specified as M and its output units as mm.
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ulRespKey unique response ID : 1
szDescription description : Wood Anderson (mm)
usNumStages number of stages in File : 1

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usStageNumber response list stage number : 1
szName 43/4.4 Unique identifying name : Wood Anderson
szInputUnits 43/4.6 input units description : M
szOutputUnits 43/4.7 output units description : mm
rInSamSec 47.5 input sampling rate : 0
usDecimation 47.6 Sampling decimation factor : 1
usDecimationOffset 47.7 decimation offset : 0
rGainOrSensitivity 48.5 stage sensitivity or gain : 2080E3
rGainFreq 48.6 frequency of stage gain : 4
usType NMX response type 0 through 8 : 1
usNumTerms number of zeros or numerators : 2
usDenTerms number of poles or denominators : 2
Coefficients - as specified above : 0.000000,0.000000,
0.000000,0.000000,
-5.49779,5.60886,
-5.49779,-5.60886

11. Details of measuring amplitude:

a: For example, does the amplitude correspond to 0.5*(peak-to-trough amplitude), where “peak-to-trough amplitude” corresponds to difference between a maximum positive excursion and a maximum negative excursion of the trace, or is the amplitude instead measured as the maximum absolute excursion from the “zero” position of the seismograph trace?

0.5*(peak-to-trough amplitude)

b: for example, if the amplitude corresponds to 0.5*(peak-to-trough amplitude), are the “peak” and “trough” respectively the absolute maximum and absolute minimum values of the entire wave-group, or are they the adjacent peak and trough corresponding to the maximum trace excursion that is associated with a single zero-crossing?

The adjacent peak and trough corresponding to the maximum trace excursion that is associated with a single zero-crossing

c: for example, are displacement amplitude(A) and period(T) measured at

the time of maximum A or at the time of the maximum of the quotient (A/T)?

At the time of maximum A

12. Details of measuring period. For example, is it the time between the neighboring peaks, respectively troughs or twice the time span measured between the largest peak and adjacent trough at which the double amplitude has been measured?

It is twice the time span measured between the largest peak and adjacent trough at which the double amplitude has been measured

13. To what part of a phase the amplitude-measurement time refers. For example, is the amplitude-measurement time the time of the zero-crossing associated with a peak-to-adjacent trough measurement or is it the time of an absolute maximum or absolute minimum?

It is the time of the zero-crossing associated with a peak-to-adjacent trough measurement

Finally, please add publications as well as internal reports or web links that can be quoted to describe the magnitude procedures adopted at the agency and/or any other relevant information which may not have been included in the questions above.

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http://seismo.geology.upatras.gr/isola/

ftp://geophysics.geo.auth.gr/pub/users/costas/nmx/documentation/Atlas/Atlas_UserGuide_14389R5.pdf

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