



APAT

Agenzia per la protezione dell'ambiente e per i servizi tecnici

WHAT IS NEW IN THE ESI 2007 INTENSITY SCALE

The ESI 2007 intensity scale (Michetti et al., 2007) has been ratified at the XVII INQUA Congress (Cairns, 28 July – 3 August 2007).

The ESI 2007 scale updates the former INQUA EEE 2004 intensity scale (Michetti et al., 2004), based on the results of the four years trial period during which the INQUA scale has been applied to historical and instrumental case studies worldwide, in the frame of the INQUA TERPRO SubCommission on Paleoseismicity project “*An innovative approach for assessing earthquake intensities: the INQUA Scale based on seismically-induced ground effects in the environment*”.

The following tables summarize the relevant documents and the main changes introduced with the ESI 2007 scale.

Reference Documents	
<i>INQUA EEE 2004</i> (Michetti et al., 2004)	<i>ESI 2007</i> (Michetti et al., 2007)
1) Definition of intensity degrees 2) EEE Form	1) Definition of intensity degrees 2) Guidelines 3) EEE Form 4) Synoptic Table
<p><i>The need of Guidelines came out in the trial period of the former scale, for a proper use, alone or integrated with the other macroseismic scales.</i></p> <p><i>A Synoptic Table of Intensity Degrees has been added basically with the aim to facilitate the intensity assessment.</i></p>	

Definition of intensity Degrees

	<i>INQUA EEE 2004</i>	<i>ESI 2007</i>
Diagnostic initial degree of environmental effects for intensity assessment	<ul style="list-style-type: none"> • I, II, III, IV: No perceptible environmental effects, effects are always extremely rare or very rare. • V. Marginal effects on the environment 	<ul style="list-style-type: none"> • I, II and III: there are no environmental effects that can be used as diagnostic. • First unequivocal effects in the environment start from IV.
<p><i>Several references indicate that hydrological changes in some cases may occur even for intensity degrees lower than IV. However it is currently not possible to use these effects as diagnostic features.</i></p>		
Structure of the degree title	<p>Degree number (in roman style) + relevance of environmental effects:</p> <p><i>Example: XII – Enviromental Effects are now the only tool enabling intensity to be assessed</i></p>	<p>Degree number (in roman style) + destructive potential of the earthquake (in uppercase) + role of environmental effects for intensity assessment (in normal).</p> <p><i>Example: XII COMPLETELY DEVASTATING – Effects in the environment are the only tool for intensity assessment</i></p>
<p><i>In the former version, wording of the degree title reflects increasing importance of natural effects for intensity assessment but not their size. In the new version the “strength” of the earthquake has been highlighted.</i></p>		

Classes of environmental effects	1 class for primary effects + 11 classes of secondary effects	1 class for primary effects + 8 classes of secondary effects, listed according to the degree of initial occurrence.
<p><i>Hydrological anomalies (a) include changes in water flow-rate and chemical/physical properties of springs and river streams (former c, d and i of INQUA EEE 2004).</i></p> <p><i>Tsunami have been described in an independent class, separated from hydrological anomalies.</i></p> <p><i>Slope movements include also submarine landslides (former h).</i></p> <p><i>Karst collapses and sinkholes (former g) appear to be not yet adequately diagnostic for a specific intensity degree.</i></p>		
Primary effects	No remarkable changes (only minor modifications in wording)	
Total area of secondary effects	No remarkable changes (only minor modifications in wording)	

<h2>Guidelines</h2>
<p><i>Guidelines are aimed at clarifying:</i></p> <ul style="list-style-type: none"> - <i>background and rationale of the ESI 2007, with particular focus on the added value for intensity assessment;</i> - <i>how to use the ESI 2007, alone or integrated with traditional macroseismic scales based on damages.</i> <p><i>Two tables summarize for each intensity degrees:</i></p> <ul style="list-style-type: none"> - <i>typical ranges of surface faulting parameters and total area of secondary effects;</i> - <i>diagnostic ranges of intensity degrees for each class of secondary effects.</i>

EEE Form	
<i>INQUA EEE 2004</i>	<i>ESI 2007</i>
<p>Two pages designed as a tool for the description of environmental effects both in the field and in historical documents.</p>	<p>The two page format has been maintained, however the following modifications have been introduced:</p> <ul style="list-style-type: none"> • Earthquake level (for epicentral intensity assessment) and local level (for local intensity assessment) are separated. • Some fields have been added (e.g. Authors & Institutions) • It is a perfect mirror of the EEE database, designed for electronic archiving • A Guide for Compilation has been added.

References

MICHETTI A.M., ESPOSITO E., GUERRIERI L., PORFIDO S., SERVA L., TATEVOSSIAN R., VITTORI E., AUDEMARD F., AZUMA T., CLAGUE J., COMERCI V., GURPINAR A., MC CALPIN J., MOHAMMADIOUN B., MÖRNER N.A., OTA Y. & ROGHOZIN E. (2007) – *Intensity Scale ESI 2007*. In. GUERRIERI L. & VITTORI E. (Eds.): Mem. Descr. Carta Geol. d'Italia., vol. **74**, Servizio Geologico d'Italia – Dipartimento Difesa del Suolo, APAT, Rome, Italy.

MICHETTI A.M., ESPOSITO E., GURPINAR A., MOHAMMADIOUN B., MOHAMMADIOUN J., PORFIDO S., ROGHOZIN E., SERVA L., TATEVOSSIAN R., VITTORI E., AUDEMARD F., COMERCI V., MARCO S., MC CALPIN J. & MÖRNER N.A. (2004) – *The INQUA scale: an innovative approach for assessing earthquake intensities based on seismically-induced ground effects in natural environment*. In VITTORI E. & COMERCI V. (Eds.): Mem. Descr. Carta Geol. d'Italia, vol. **67**, Servizio Geologico d'Italia - Dipartimento Difesa del Suolo, APAT, Rome, Italy.

Aggiornamento: 1 ottobre 2007