

## **Catalogue of seismicity 1962-2009 (SI-Hex, version 2014)**

The “SI-Hex 2014” catalogue concerns instrumental seismicity of metropolitan France for the period 1962-2009 . It is the main result of a collaborative project conducted between 2009 and 2013 by BCSF (Bureau Central Sismologique Français) acting for seven academic institutions belonging to CNRS and Universities, together with LDG (Laboratoire de Détection et de Géophysique) acting for CEA/DAM/DASE. The project was run through the agreements MEDDE-CNRS-CEA n° 2100474508 and MEDDE-CNRS n°0007147. The following French academic institutions are concerned: EOST (Strasbourg), IUEM (Brest), OCA (Nice – Sophia-Antipolis), OMP (Toulouse), OPGC (Clermont Ferrand), OSUG (Grenoble), and OSUNA (Nantes). The project has benefited from a MEDDE/DGPR financial support.

This seismicity catalogue is extracted from the database BCSF- LDG, built for the SI-Hex project, as of February 1<sup>st</sup> 2014. This database should be upgraded on a regular basis in order to prepare further version of the catalogue.

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## Content of the catalogue

The catalogue concerns the “SI-Hex zone” which encompass the French metropolitan territory and the marine Exclusive Economic Zone (EEZ), with an enlargement of 20 km in order to take into account the largest possible uncertainty in epicentre location.

The catalogue results from the processing of a series of arrival times coming from the seismic stations monitored by the SI-Hex partner institutions together with stations belonging to several foreign laboratories of the neighbouring countries. The hypocentres reported in the catalogue are the most accurate available in the multi-origin database associated with the project.

They come:

- either from the homogeneous processing of the data with a unique 1D velocity model for the whole SI-Hex zone,
- or from processing made by the regional observatory using adapted regional 1D velocity models and specific procedure of data selection.

Identified anthropogenic events are withdrawn from the catalogue (quarry blasts, explosions, and mine events...). However, and mainly for the oldest parts of the catalogue, it was not possible to apply the discrimination procedures in a systematic way, so that anthropogenic events may remain in the catalogue.

Seismic moment magnitude  $M_w$  is computed through a uniform procedure for the whole catalogue: i.e. as a general rule from the amplitude of the coda waves recorded by LDG stations for  $M_w > 3.4$ , and from conversion from local magnitudes for  $M_w \leq 3.4$ .

### Catalogue parameters

IDENTIFIER, DATE, TIME, LATITUDE, LONGITUDE, DEPTH, AUTHOR, TYPE,  $M_w$

|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IDENTIFIER | Unique number attached to each seismic event after the merge of all seismic arrival time data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| DATE       | Day/month/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| TIME       | Origin time of the earthquake (UTC) as “hour, minute, second”                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| LATITUDE   | Northern latitude in decimal degree                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| LONGITUDE  | Eastern longitude in decimal degree                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| DEPTH      | Hypocentral depth in kilometres relative to 0NGF (French reference zero level). Depth results either from the localization computation, or it is set by the analyst when the computational convergence process fails                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| AUTHOR     | Institution or laboratories author of the parameters “Date, Time, Latitude, Longitude, Depth”: SI-Hex for the initial location resulting from the merge of all data; LDG, GRN, OCA, OMP, LPG, EOST for the preferential locations produced by these institutions or laboratories.<br>LDG = Laboratoire de Détection et de Géophysique (CEA, Arpajon)<br>GRN = Sismalp, réseau sismologique des Alpes, (OSUG, Grenoble)<br>OCA = Observatoire de la Côte d’Azur (Nice-Sophia Antipolis)<br>OMP = Observatoire Midi-Pyrénées (CNRS/UPS, Toulouse)<br>LPG = Laboratoire de Planétologie et de Géodynamique (OSUNA, Nantes)<br>EOST = Ecole et Observatoire des Sciences de la Terre (Strasbourg) |
| TYPE       | “ke” for the known earthquakes, “se” for suspected earthquakes, which are likely to be of tectonic origin.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| $M_w$      | Seismic moment magnitude computed through a uniform procedure over the whole catalogue, <ul style="list-style-type: none"><li>- either in general rule from the amplitude of coda-wave signals recorded by LDG stations when <math>M_w &gt; 3.4</math>,</li><li>- or from local magnitude conversion when <math>M_w \leq 3.4</math>.</li></ul>                                                                                                                                                                                                                                                                                                                                                |

*Exception for  $M_w$  : no coda amplitude information can be extracted from LDG records for the double-source Ligurian sea earthquake of July 7<sup>th</sup>, 1963. The first event location is from LDG. The second event location is from EOST, after Augliera et al., (1994). Magnitude of the second event,  $M_w=6.0$  is from Rovida et al. (2011) and Fracassi et al. (2012). The differences in epicentre locations and magnitudes of the two events are in agreement with Augliera et al., (1994).*

*Augliera, P., Béthoux, N., Deverchère, J., and C. Eva, 1994. The Ligurian sea : new tectonic evidence, Boll. Geofis. Teorica ed Appl., 36, 141-144.*

*Fracassi, U., Di Bucci, D., Ridente, D., Trincardi, F., and G. Valensise, 2012. Recasting historical earthquakes in coastal areas (Gargano promontory, Italy) : insights from marine paleoseismology, Bull. seismol. Soc. Am., 102, 1-17.*

*Rovida, A., Camassi, R., Gasperini, P., and M. Stucchi (eds.), 2011. CPTI11, the 2011 version of the Parametric Catalogue of Italian Earthquakes. Milano, Bologna, <http://emidius.mi.ingv.it/CPTI>.*

## Information related to the Map

The map associated with the catalogue shows the epicentres and magnitudes  $M_w$ . Coloured symbols: epicentres of natural earthquakes within the SI-Hex zone (metropolitan France and the marine Exclusive Economic Zone (EEZ) with an enlargement of 20 km), as well as earthquakes felt in France with an EMS-98 intensity  $\geq$  IV (BCSF). Grey symbols: epicentres outside SI-Hex area but for which  $M_w$  has been calculated in the frame of the SI-Hex project.

Cartographic software : ArcGIS® by ©Esri. ArcGIS Desktop version 9.3.1. Redlands, California: Environmental Systems Research Institute (ESRI). Projection : Lambert-93

Topography : NASA Shuttle Radar Topography Mission (SRTM); Jarvis A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled seamless SRTM data V4, International Centre for Tropical Agriculture (CIAT), available from <http://srtm.csi.cgiar.org>

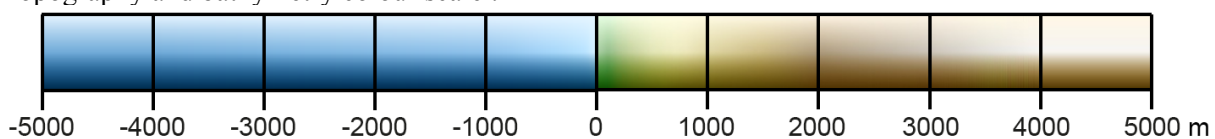
Bathymetry : NGDC ETOPO1; Amante, C. and B. W. Eakins, ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis. NOAA Technical Memorandum NESDIS NGDC-24, 19 pp, March 2009. Data available from <http://www.ngdc.noaa.gov/mgg/global/global.html>.

The data are oversampled at 10" arc length and then smoothed.

State boundaries/rivers and lakes : ESRI Data & Maps 9.3 [CD-ROM]- AND Data Solutions, B. V.

Boundaries of the EEZ: VLIZ (2012). Maritime Boundaries Geodatabase, version 7. Available online at <http://www.marineregions.org/>.

Topography and bathymetry colour scale :



Scientific coordinators:

Y. Cansi<sup>2</sup>, M. Cara<sup>1</sup>, A. Schlupp<sup>1</sup>

Contributors :

N. Béthoux<sup>3</sup>, E. Beucler<sup>4</sup>, S. Bruno<sup>2</sup>, M. Calvet<sup>5</sup>, S. Chevrot<sup>6</sup>, A. Deboissy<sup>1</sup>, B. Delouis<sup>3</sup>, M. Denieul<sup>1</sup>, A. Deschamps<sup>7</sup>, C. Doubre<sup>1</sup>, J. Fréchet<sup>8</sup>, S. Godey<sup>9</sup>, O. Golle<sup>4</sup>, M. Grunberg<sup>1</sup>, J. Guilbert<sup>2</sup>, M. Haugmard<sup>4</sup>, L. Jenatton<sup>10</sup>, S. Lambotte<sup>1</sup>, D. Leobald<sup>2</sup>, A. Mignan<sup>1</sup>, V. Mendel<sup>8</sup>, S. Merrer<sup>2</sup>, M. Macquet<sup>4</sup>, A. Mocquet<sup>4</sup>, M. Nicolas<sup>2</sup>, J. Perrot<sup>12</sup>, B. Potin<sup>10</sup>, O. Sanchez<sup>11</sup>, J.P. Santoire<sup>2</sup>, O. Sèbe<sup>2</sup>, C. Sira<sup>8</sup>, M. Sylvander<sup>5</sup>, F. Thouvenot<sup>11</sup>, J. Van der Woerd<sup>1</sup>, K. Van der Woerd<sup>1</sup>.

<sup>1</sup> EOST/BCSF-Université de Strasbourg ; <sup>2</sup> Commissariat à l'énergie atomique et aux énergies alternatives, Arpajon ; <sup>3</sup> UNS, Université de Nice - Sophia Antipolis ; <sup>4</sup> UN, Université de Nantes ; <sup>5</sup> UPS, Université Paul Sabatier, Toulouse ; <sup>6</sup> CNRS, Toulouse ; <sup>7</sup> CNRS, Nice ; <sup>8</sup> CNRS, Strasbourg ; <sup>9</sup> CSEM, Centre sismologique euro-méditerranéen Arpajon ; <sup>10</sup> CNRS, Grenoble ; <sup>11</sup> UJF, Université Joseph Fourier Grenoble ; <sup>12</sup> UBO, Université de Bretagne occidentale, Brest.



## Acronyms

|       |                                                                                    |
|-------|------------------------------------------------------------------------------------|
| BCSF  | Bureau central sismologique français                                               |
| CEA   | Commissariat à l'énergie atomique et aux énergies alternatives                     |
| CNRS  | Centre national de la recherche scientifique                                       |
| DAM   | Direction des applications militaires (CEA)                                        |
| DASE  | Département analyse, surveillance, environnement (CEA/DAM)                         |
| DGPR  | Direction générale de la prévention des risques                                    |
| EOST  | Ecole et observatoire des sciences de la Terre, Strasbourg (Université- CNRS)      |
| INSU  | Institut national des sciences de l'univers (CNRS)                                 |
| IUEM  | Institut universitaire européen de la mer, Brest (Université- CNRS)                |
| LDG   | Laboratoire de détection et de géophysique (CEA/DAM/DASE)                          |
| MEDDE | Ministère de l'écologie, du développement durable et de l'énergie                  |
| OCA   | Observatoire de la Côte d'Azur (rattaché à l'Université de Nice Sophia Antipolis). |
| OMP   | Observatoire Midi-Pyrénées, Toulouse (Université- CNRS)                            |
| OPGC  | Observatoire de physique du globe de Clermont-Ferrand (Université- CNRS)           |
| OSUG  | Observatoire des sciences de l'univers de Grenoble (Université- CNRS)              |
| OSUNA | Observatoire des sciences de l'univers Nantes Atlantique (Université-CNRS)         |