Completeness period analysis of SisFrance macroseismic database and interpretation in the light of historical context

José BONNET (1), Thibault FRADET (2), Paola TRAVERSA (3), Christine TULEAU-MALOT (1), Patricia REYNAUD-BOURET (1), Thomas LALOE (1), and Kevin MANCHUEL (3)

(1) Université de Nice Sophia-Antipolis, Parc Valrose, 06108 NICE Cedex 02, France , (2) Université de Versailles Saint-Quentin-en-Yveline, 78000 Versailles, France, (3) EDF-CEIDRE-TEGG, 905 avenue du camp de Menthe, 13097 Aix en Provence Cedex 02, France

In metropolitan France the deformation rates are slow, implying low to moderate seismic activity. Therefore, earthquakes observed during the instrumental period (since 1962), and associated catalogs, cannot be representative of the seismic cycle for the French metropolitan territory. In such context it is necessary, when performing seismic hazard studies, to consider historical seismic data in order to extend the observation period and to be more representative of the seismogenic behavior of geological structures. The French macroseismic database SisFrance is jointly developed by EDF (Electricité de France), BRGM (Bureau de Recherche Géologique et Minière) and IRSN (Institut de Radioprotection et Sureté Nucléaire). It contains more than 6,000 events inventoried between 217 BC and 2007 and more than 100,000 macroseismic observations. SisFrance is the reference macroseismic database for metropolitan France. The aim of this study is to determine, over the whole catalog, the completeness periods for different epicentral intensity (I_{epc}) classes$\geq$IV. Two methods have been used: 1) the method of Albarello et al. [2001], which has been adapted to best suit the French catalog, and 2) a mathematical method based on change points estimation, proposed by Muggeo et al. [2003], which has been adapted to the analysis of seismic datasets. After a brief theoretical description, both methods are tested and validated using synthetic catalogs, before being applied to the French catalog. The results show that completeness periods estimated using these two methods are coherent with each other for events with $I_{epc} \geq$IV (1876 using Albarello et al. [2001] method and 1872 using Muggeo et al. [2003] method) and events with $I_{epc} \geq$V (1852 using Albarello et al. [2001] method and 1855 using Muggeo et al. [2003] method). Larger differences in estimated completeness period appear when considering events with $I_{epc} \geq$VI (around 30 years difference) and events with $I_{epc} \geq$VII (around 50 years difference). These could be explained (1) by the differences in the way each method approaches the data; Muggeo et al. [2003] method estimates all change points within data series, whereas the method of Albarello et al. [2001] focus on the last one, and (2) by a more limited number of data for these epicentral intensity classes (2056 events with $I_{epc} \geq$IV and 1252 events with $I_{epc} \geq$V vs. 486 events with $I_{epc} \geq$VI and 199 events with $I_{epc} \geq$VII). Results obtained for epicentral intensity classes greater than VIII are considered not reliable due to the short number of existing data (around 30 events). The completeness periods determined in this study are discussed in the light of their contemporary historical context, and in particular of the evolution of the information available from historical archives since the 17th century.