

Seismotectonic of the South-East France : from the Jura mountains to Corsica

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Supplementary data :

Locations_GoogleEarth : KMZ locations of the geographical sites and the geological objects.

Shapefiles_zones : geographical boundary and seismicity for Jura massif-Bresse graben, SE basin and Provence, western Alpine belt and Ligurian sea and Corsica areas.

Figure A-S : Historical évolution of the seismological networks in the SE France.

Figure B-S : Focal depths of earthquakes in the SE France.

SE-France_seismicity-maps : Figures 1, 5, 7, 8, 9, 10, 11, 12, 13, 14, high-resolution.

Table_A-S : CEA seismological catalog 1996-2019 (id | date | hh:mm:ss | lat | lon | depth | ML).

Table_B-S : List of the 43 earthquakes ($M_L \geq 4.5$ and/or $M_w \geq 4.0$) and references for the period 1963-2019.

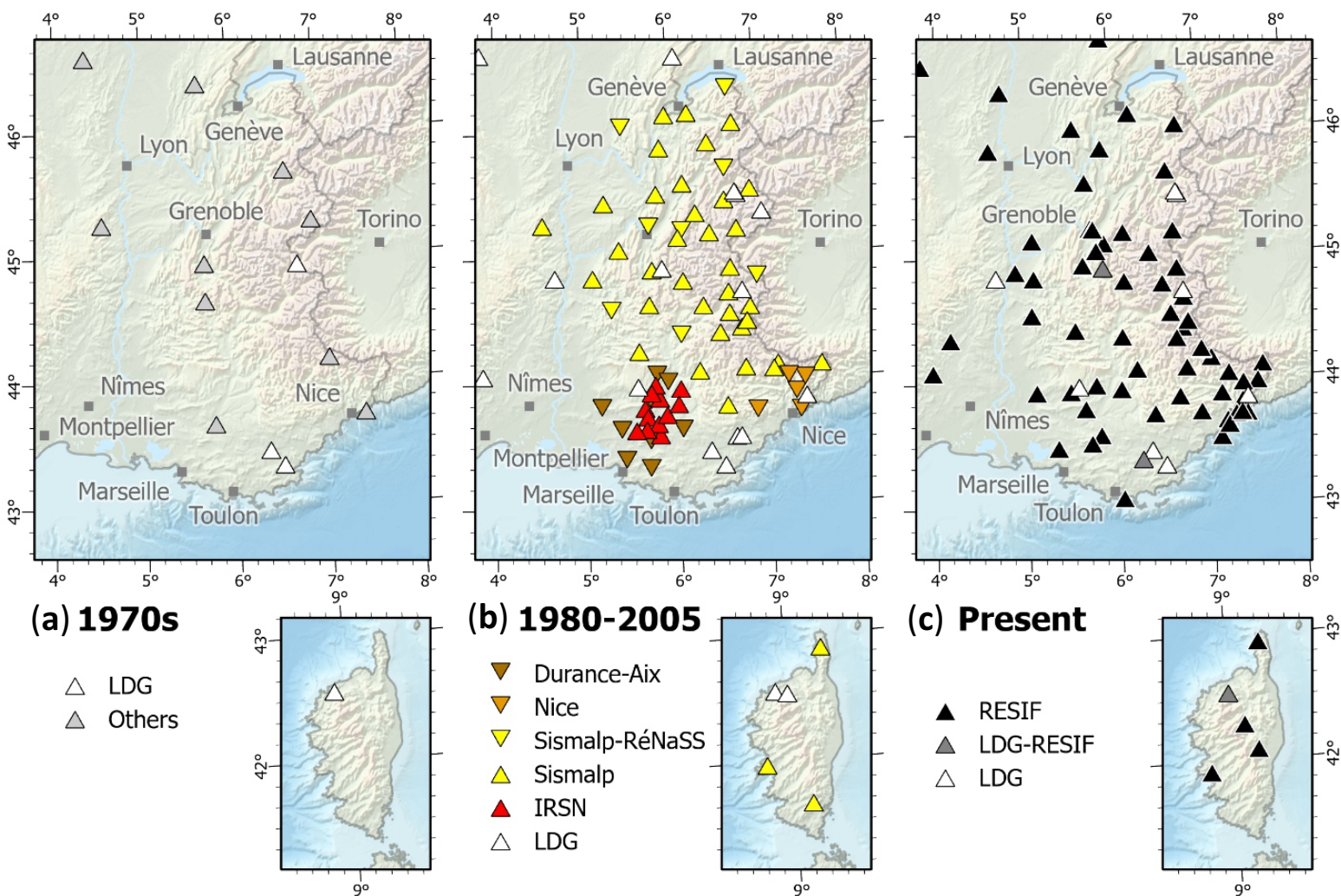


Figure A-S : A simplified evolution of the seismological networks in the South-East France. Only the velocimetric stations are represented on these pictures. The spatial distribution allows the understanding of the evolution of the microseismicity location uncertainties and magnitude completeness of catalogues. Accelerometric stations are not considered. Part of them are co-located with several velocimetric stations and globally their contribution to microseismicity location is reduced.

(a) An early period for French seismology : LDG-CEA runs the French metropolitan network and provide catalogue and bulletins. Other stations are run by different institutions [Institut de Physique du Globe de Strasbourg (IPGS), de Clermont-Ferrand, de Paris, Monaco, Commissariat à l’Energie atomique (CEA-Cadarache, CEA-Fontenay-aux-Roses)]. Arrival time are collected at IPGS to built the BCSF catalogue published in Annales de l’Institut de Physique du Globe*. The represented state is described in BCSF (1983) for years 1971-1977.

(b) At the end of the XXth century, the interest for microseismicity, and the instrumental developments allowing digital recording, lead to the installation, in parallel to the LDG-CEA network, of local/regional networks operated by IPGS [Nice (1979-2012) : short period, 7 one component, 1 three components ; Provence (1981-2009) : 8 short period, one component and Grenoble (Sismalp, 1989-2015) : 35 short period 1 or 3 components)]. ReNaSS catalogue is built considering Nice, Provence and part of Sismalp data (labelled Sismalp-ReNaSS) and integrated to the BCSF catalogue. A Middle-Durance network was installed and operated by IRSN from 1996 to 2008 with 12 short period three components sensors.

(c) The present state of RESIF mainly broad band velocimetric network, with the contribution of LDG-CEA. All stations are connected and signal is freely distributed in real time. The data flux are analysed at IPGS, Sismalp center and at Géoazur (more focussed on South France, Ligurian Sea and Corsica). Some short period LDG-CEA stations are still of reduced diffusion.

* <http://www.franceseisme.fr/donnees/historiques.html>
and
<http://www.franceseisme.fr/donnees/publications.php?rubrique=2>

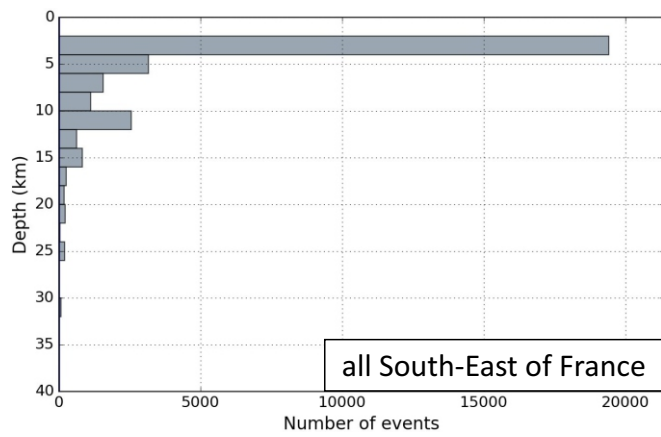
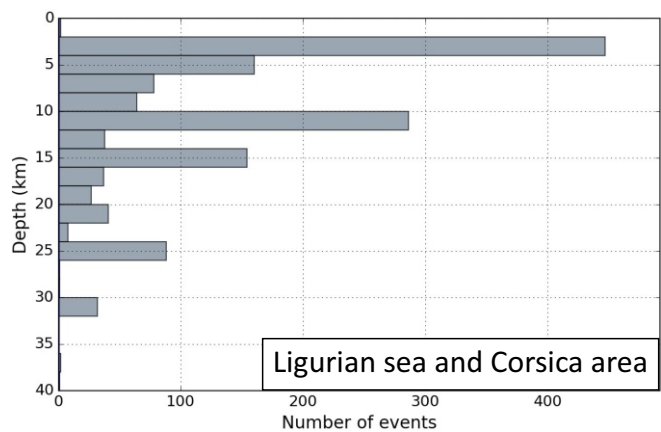
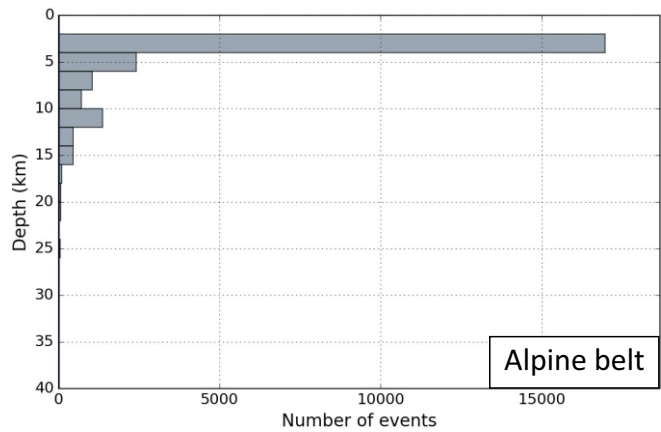
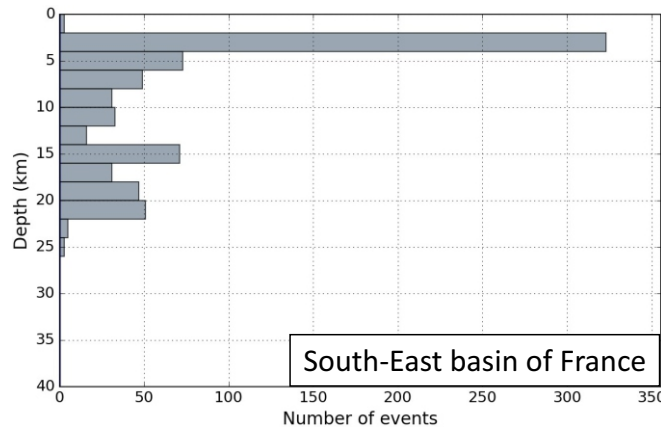
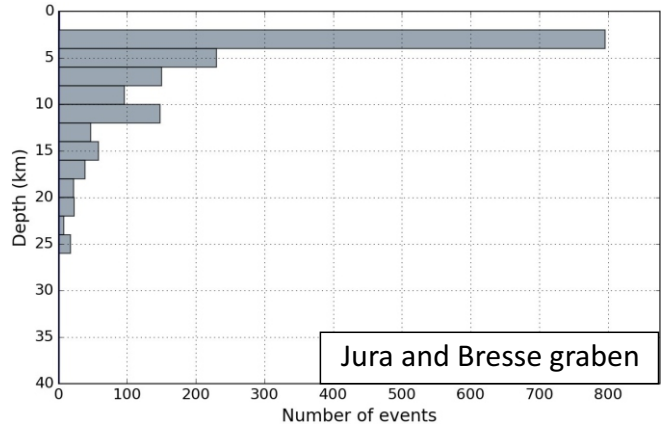


Figure B-S : Focal depths of earthquakes from the LDG catalog 1996-2019.



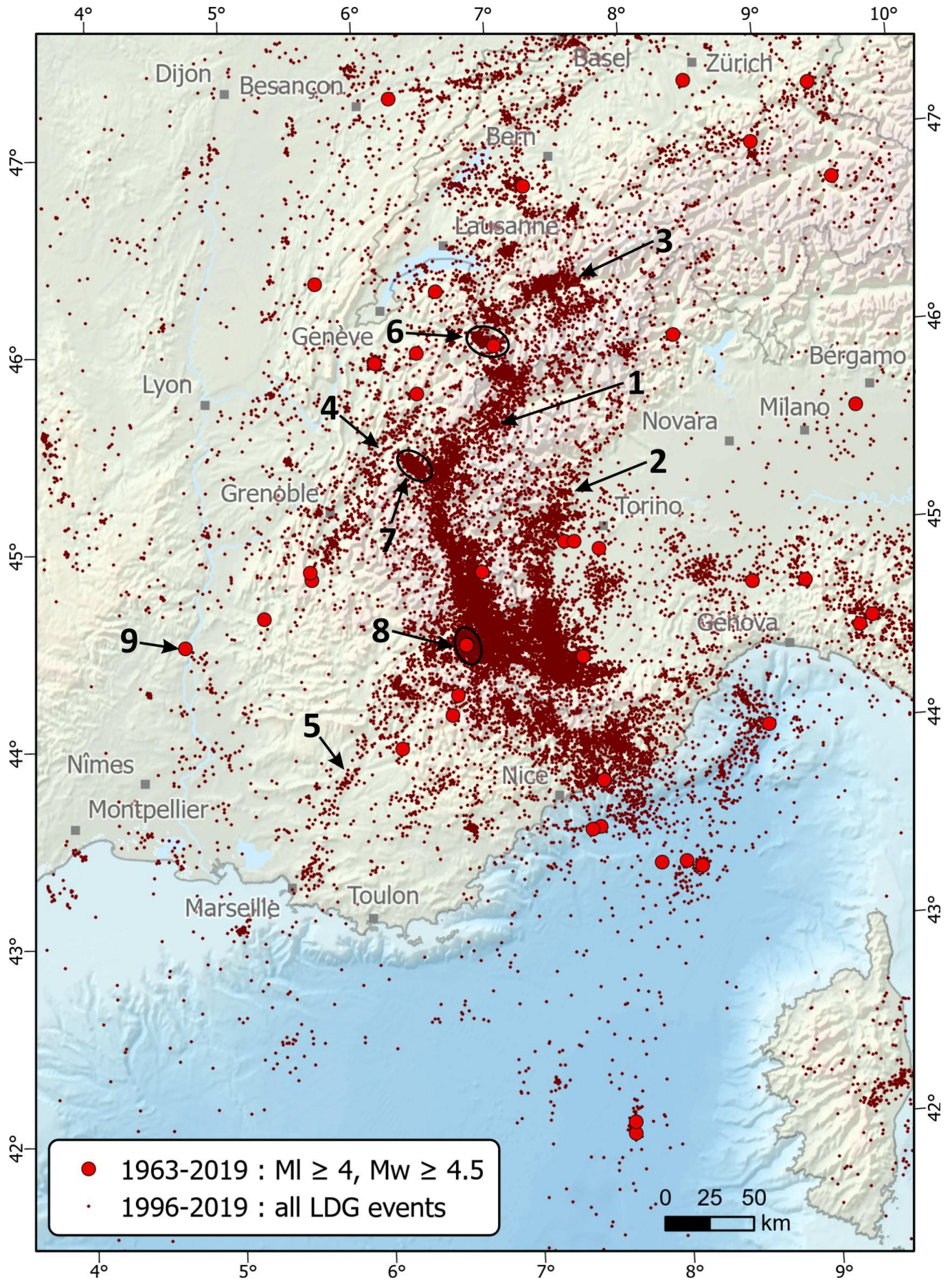


Figure 1 : Seismicity map from the LDG_1996-2019 catalog supplemented by earthquakes of $M_L \geq 4.5$ or $M_w \geq 4.0$ from the LDG and the Sihex catalogs for the period 1963-1996.

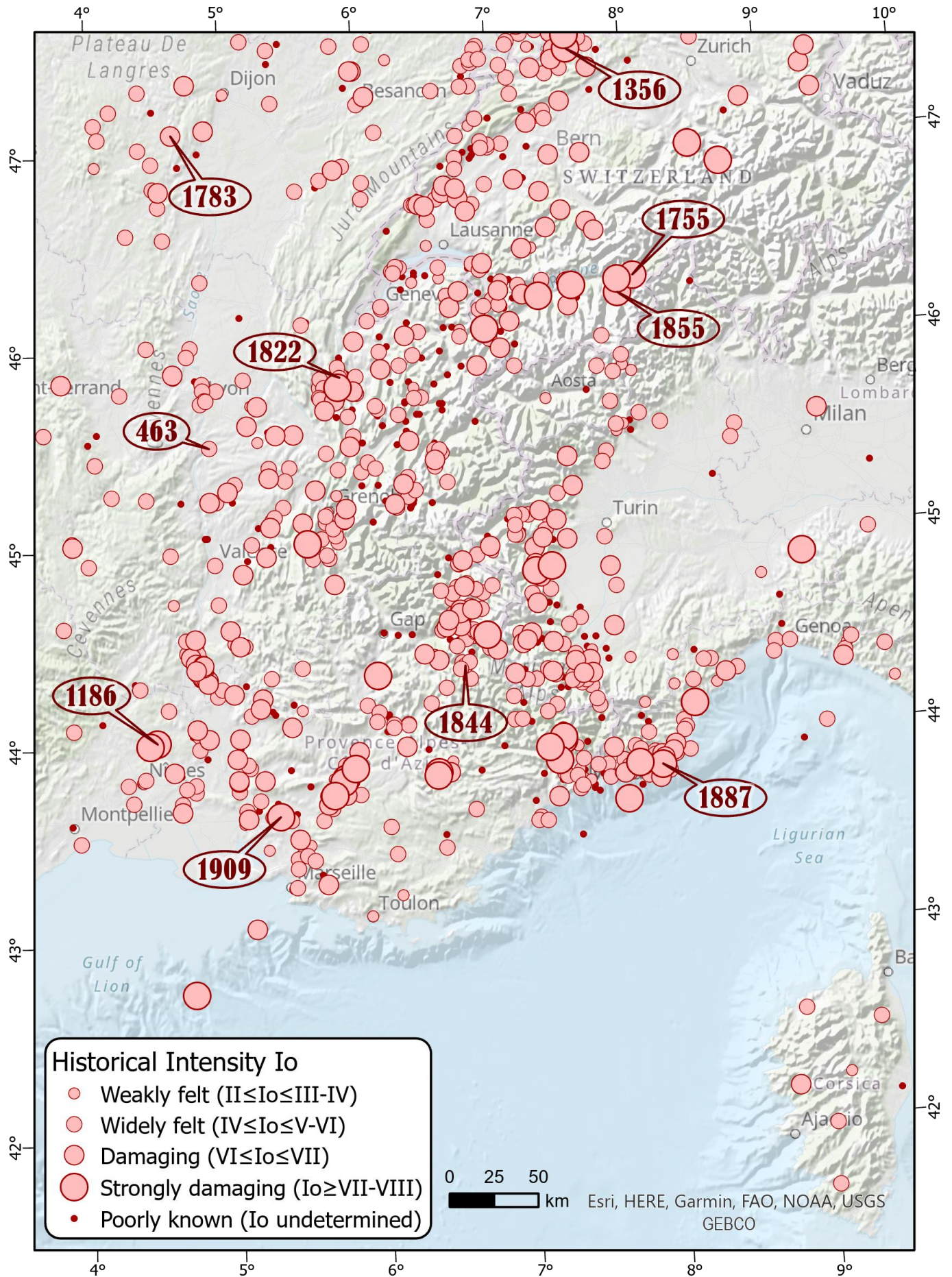


Figure 5 : Historical seismicity map in the SE France from SISFRANCE (I_o MSK64).

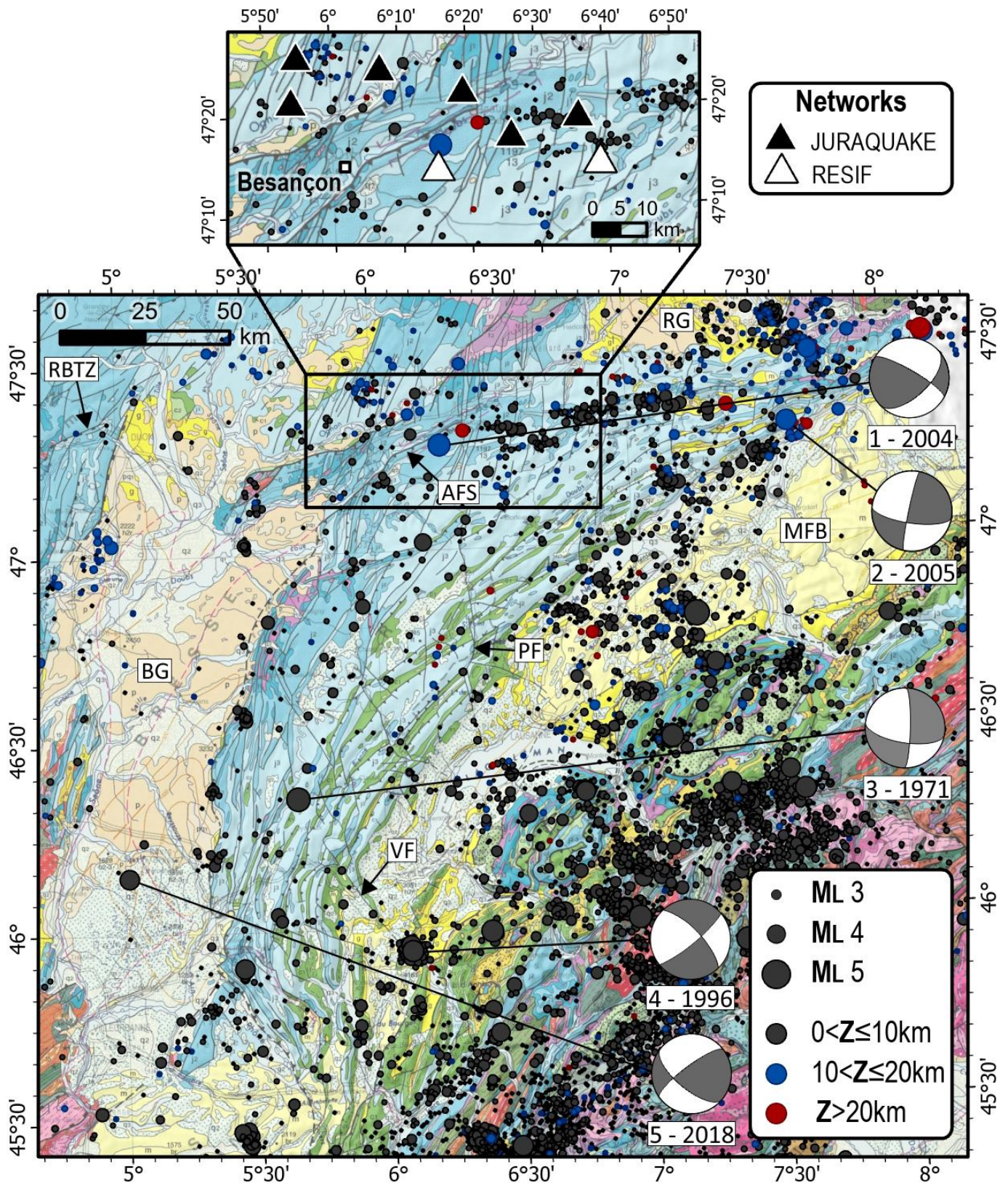


Figure 7 : Seismicity and geological map of the Bresse-Jura area from the LDG catalog (1996-2019, all magnitudes) and Chanteraine et al. (2003). AFS : Avant-Monts Faults system ; BG : Bresse graben ; MFB : Molasse foreland basin ; PF : Pontarlier fault ; RBTZ : Rhine graben transfert zone ; RG : Rhine graben ; VF : Vuache fault.

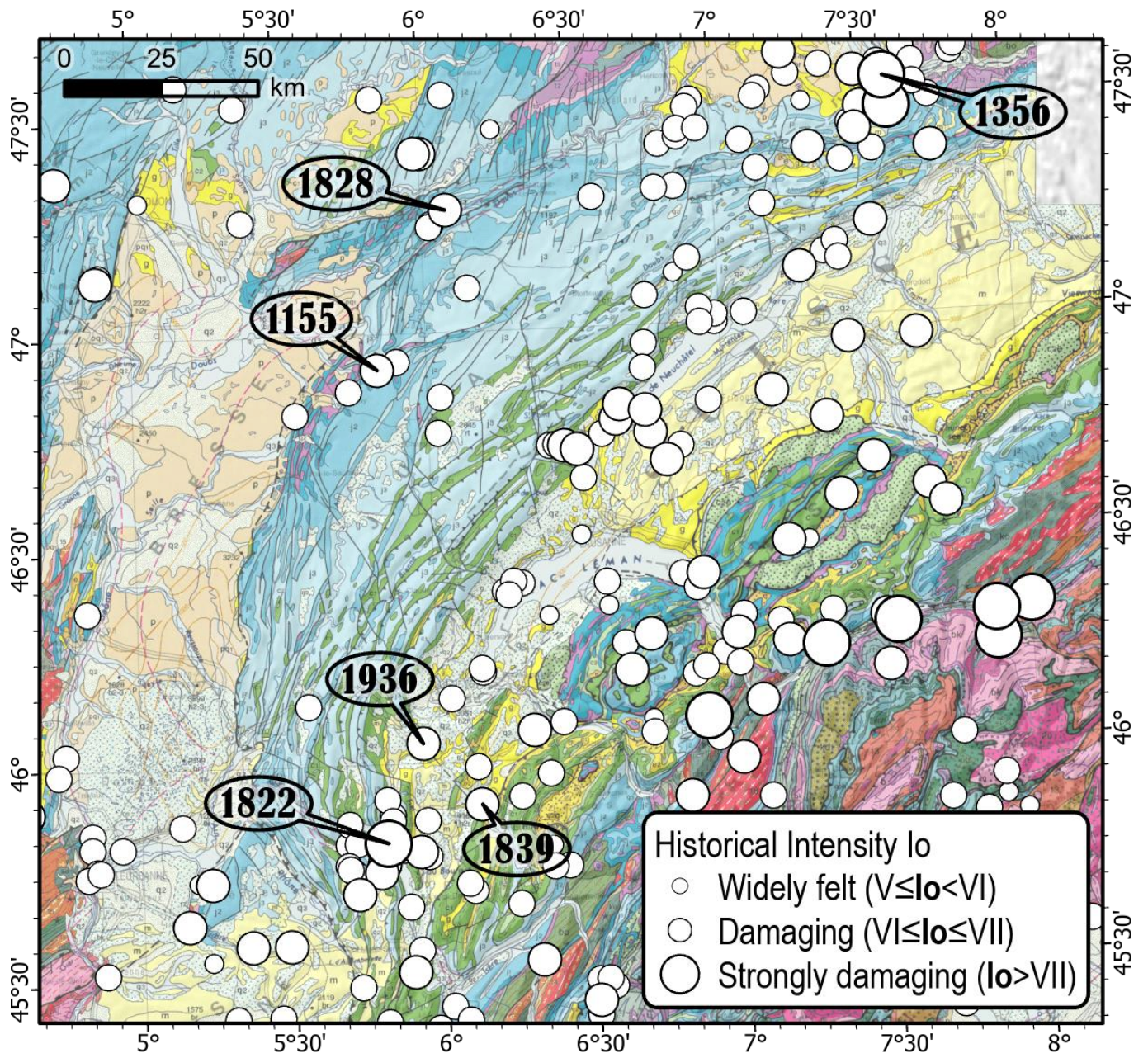


Figure 8 : Historical seismicity map of the Jura-Bresse area from SISFRANCE.

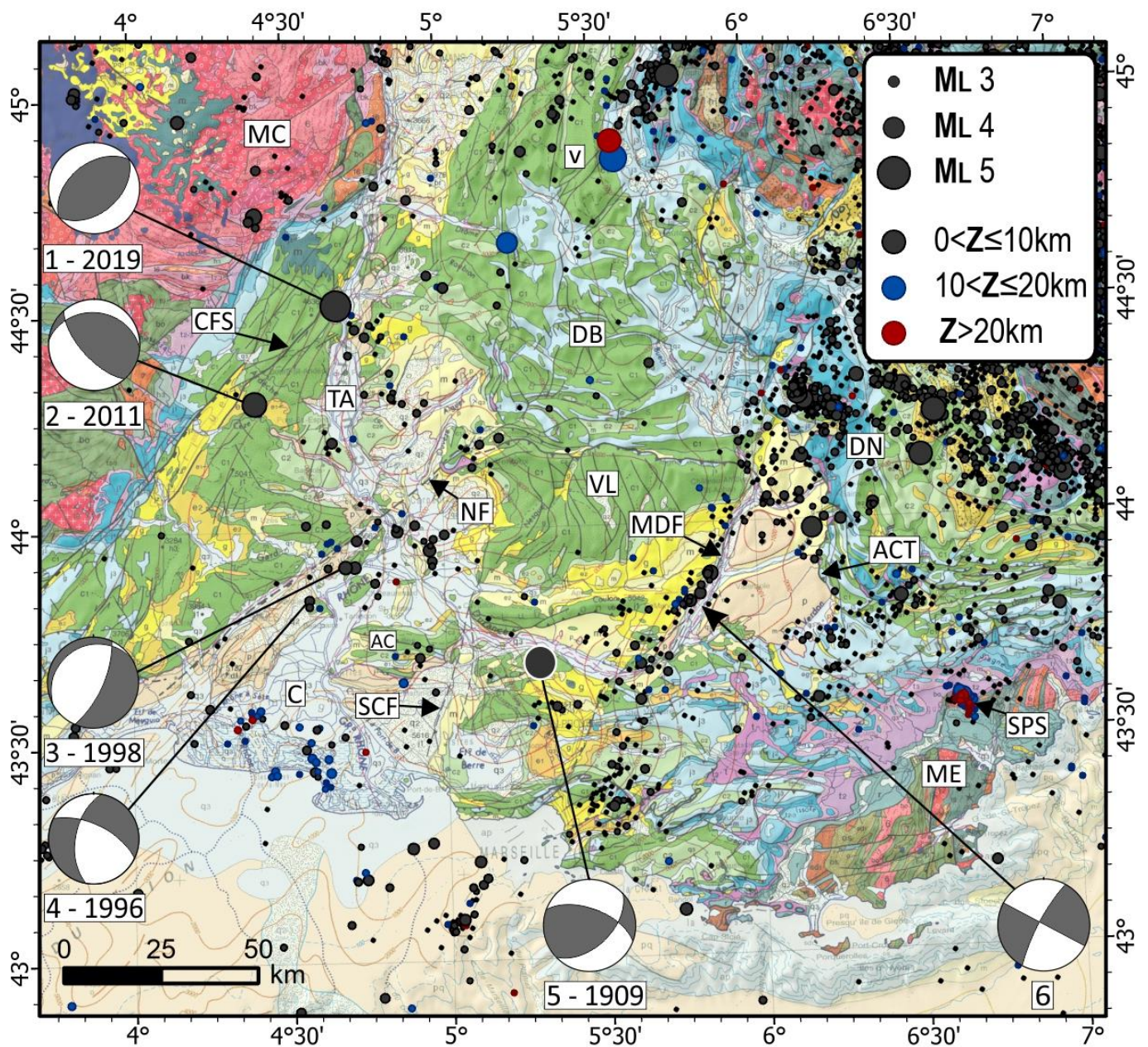


Figure 9 : Seismicity and geological map of the South-East basin from the LDG catalog (1996-2019, all magnitudes) and Chanteraine et al. (2003). AC : Alpilles chain, ACT : Arc de Castellane thrust front, C : Camargue, CFS : Cévennes faults system, DB : Diois-Baronnies, DN : Digne nappe, MC : Massif Central, MDF : middle Durance fault, ME : Maures-Esterel massif, NF : Nîmes fault, SCF : Salon-Cavaillon fault, SPS : Saint-Paul-en-Forêt swarm, TA : Tricastin area, V : Vercors, VL : Ventoux-Lure.

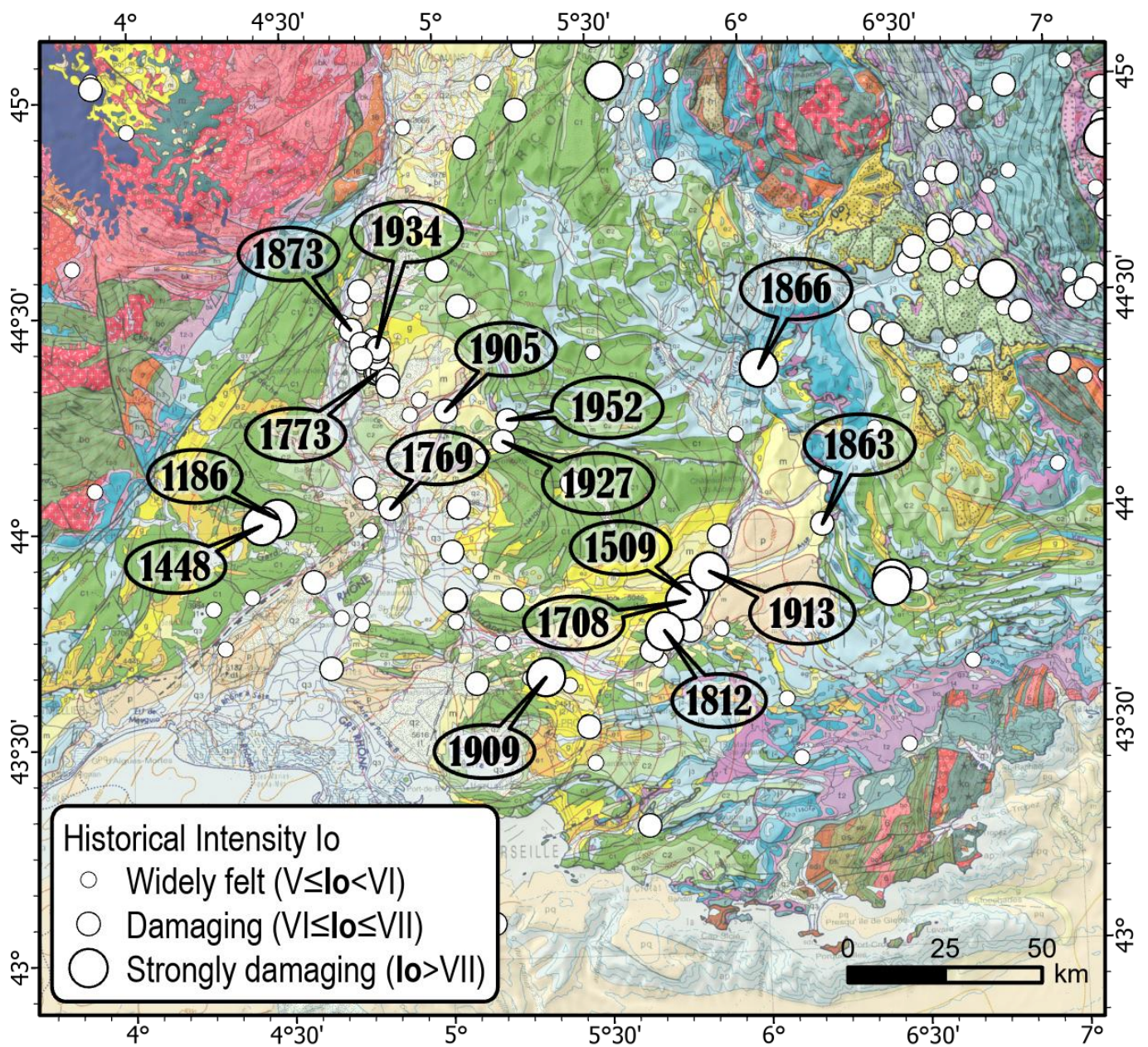


Figure 10 : Historical seismicity map of the South-East basin from SISFRANCE.

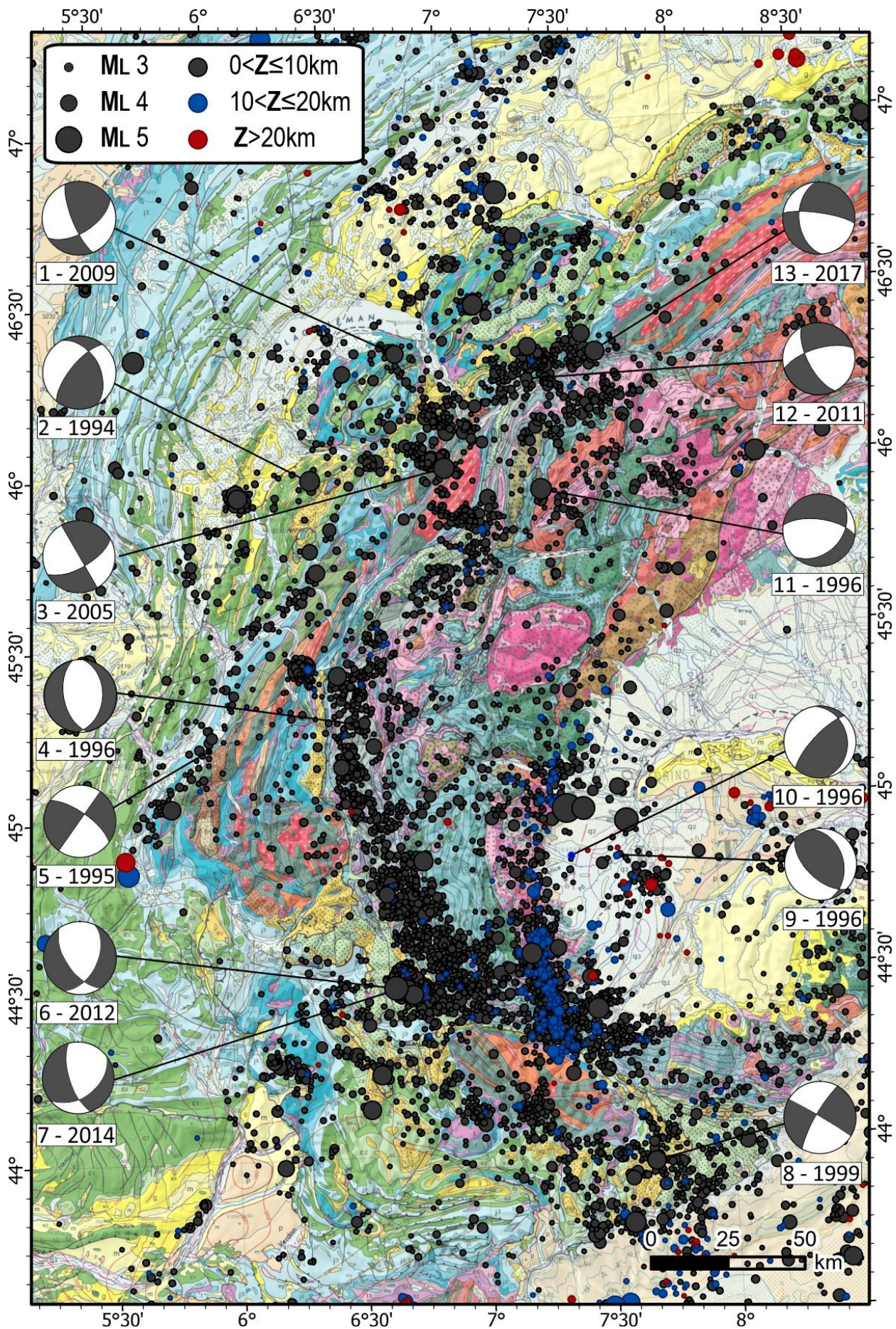


Figure 11 : Seismicity and geological map of the western Alpine belt from the LDG catalog (1996-2019, $M_L \geq 2$) and Chanteraine et al. (2003).

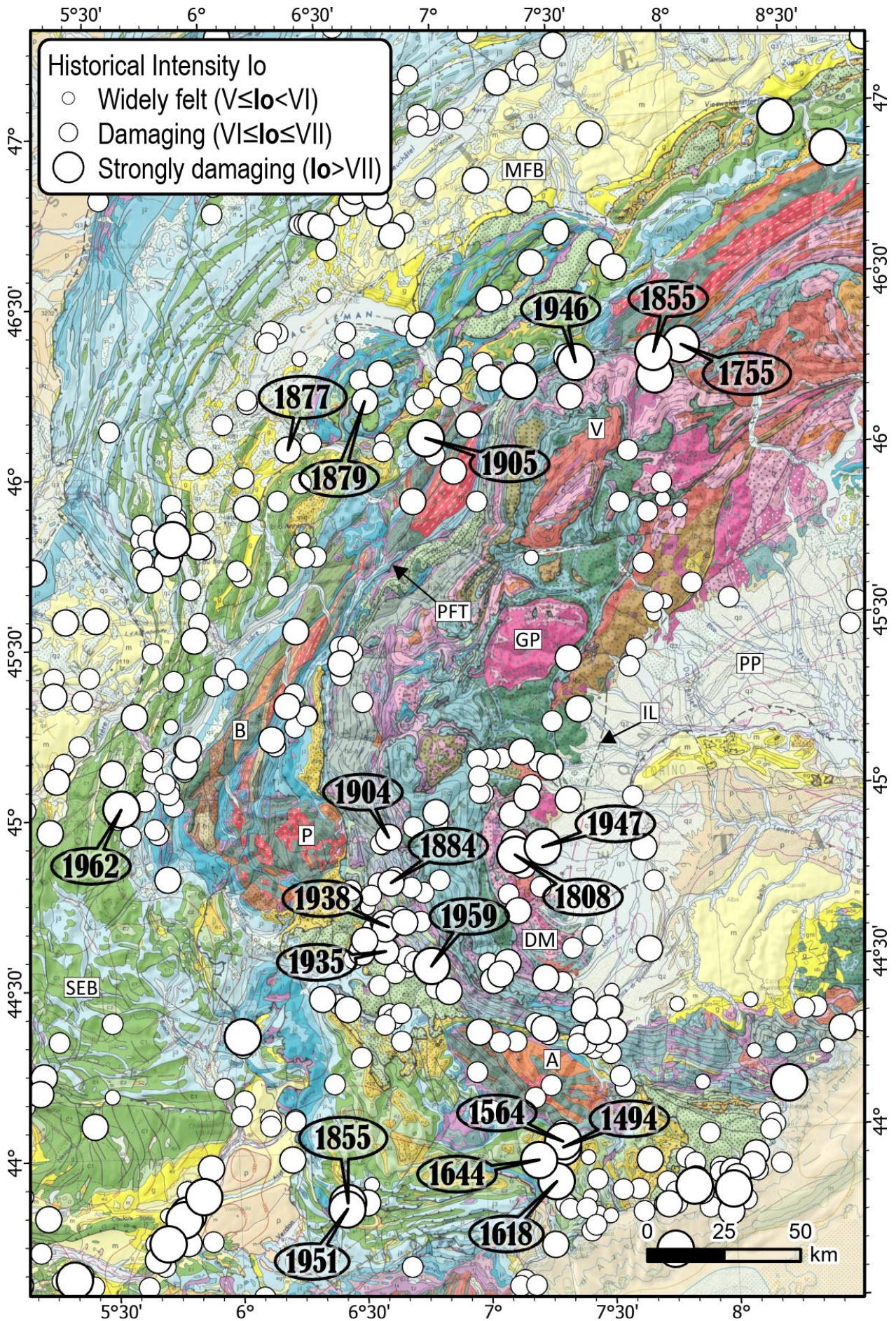


Figure 12 : Historical seismicity map of the western Alps from *SISFRANCE*. A : Argentera, B : Belledonne, DM : Dora Maira, GP : Gran Paradiso, IL : Insubric line, MFB : molasse foreland basin, P : Pelvoux, PFT : Penninic frontal thrust, PP : Po plain, SEB : South-East basin, V : Valais.

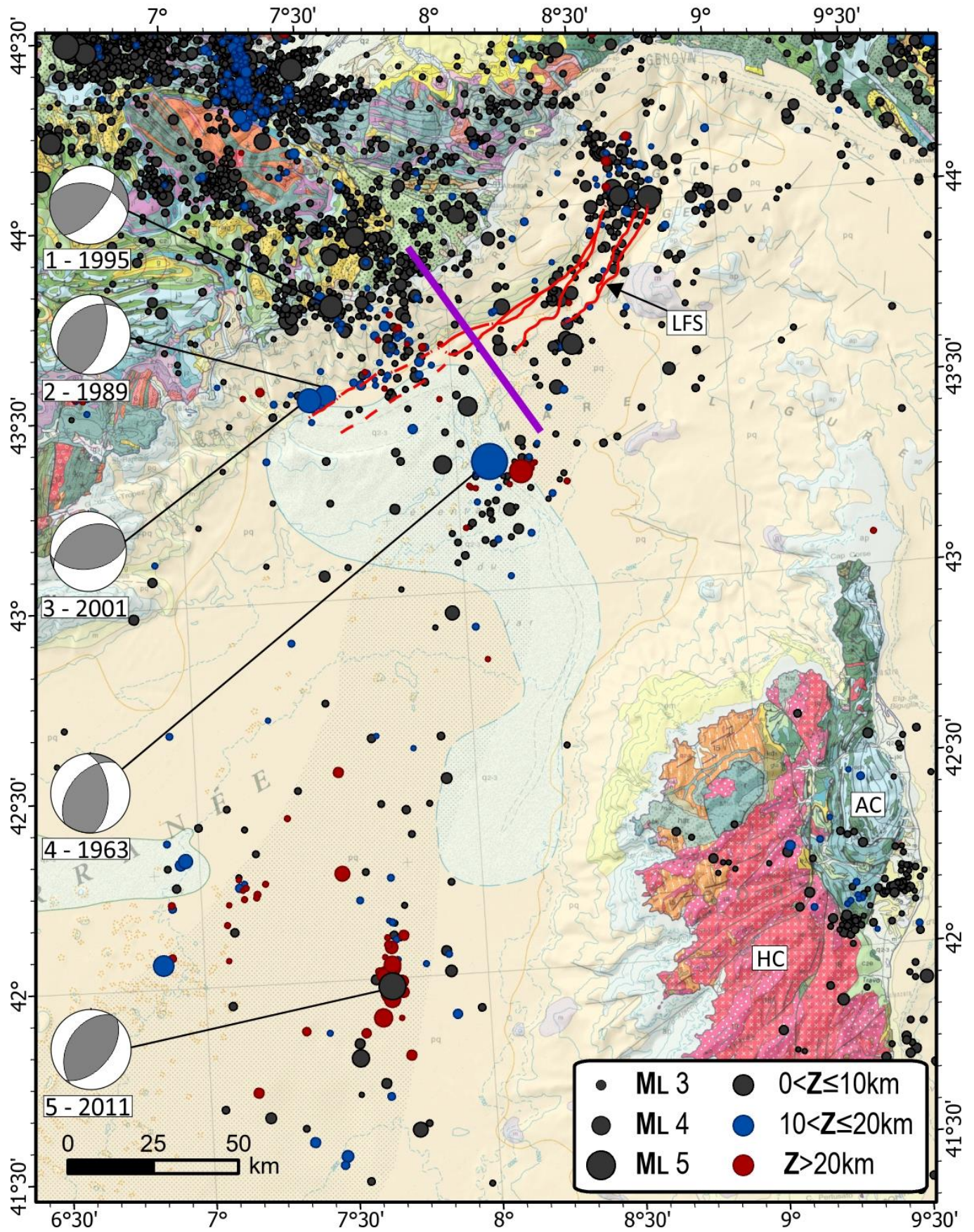


Figure 13 : Seismicity and geological map of the Ligurian sea and Corsica from the LDG catalog (1996-2019, $M_L \geq 2$) and Chanteraine et al. (2003). AC : Alpine Corsica, HC : Hercynian Corsica, LFS : Ligurian faults system.

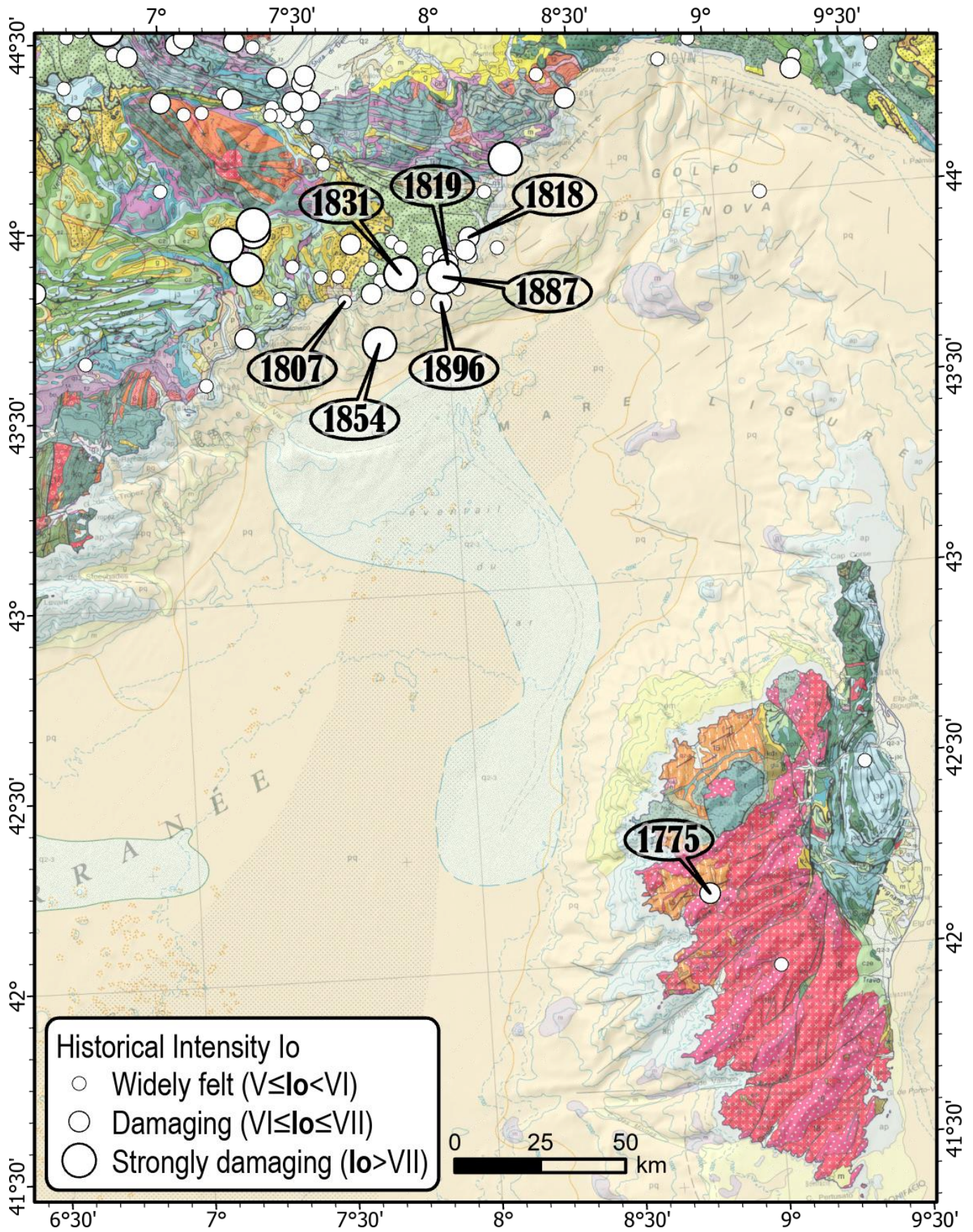


Figure 14 : Historical seismicity map of the Liguria sea and Corsica from SISFRANCE.

Date	hh:mm	lat	lon	Z (km)	M _L	M _w	reference
1963/07/19	05:45	43.34	8.12	20	-	5.6	
1963/07/19	05:46	43.34	8.12	-	-	6.0	
1963/07/19	11:43	43.34	7.95	3	-	4.0	
1963/04/25	13:36	44.85	5.58	13	-	4.6	
1963/04/27	05:28	44.89	5.57	24	-	4.2	
1968/08/19	00:36	46.29	6.55	10	-	4.0	
1971/06/21	07:25	46.35	5.67	3	4.4	4.6	Sambeth and Pavoni (1988)
1974/02/08	20:12	44.14	6.54	6	-	4.2	
1976/08/22	02:49	44.518	9.549	10	4.5	-	
1979/04/16	12:27	44.66	5.23	12	4.34	4.0	
1979/09/02	14:44	45.587	9.552	2	4.92	-	
1980/01/05	14:32	44.993	7.394	2	5.31	-	
1980/12/02	05:58	45.776	6.382	2	4.7	3.9	
1980/12/23	12:01	44.713	9.919	2	4.75	-	
1981/04/22	04:26	43.31	8.23	25	4.5	-	
1984/06/19	11:40	43.98	6.18	10	4.06	4.0	
1984/09/05	05:16	47.291	8.468	4	4.56	-	
1989/12/26	19:59	43.54	7.54	7-14	4.51	4.2	Béthoux et al. (1992)
1990/02/11	07:00	44.949	7.636	2	4.78	-	
1991/02/11	15:43	44.859	6.794	2	4.65	4.3	
1991/11/20	01:54	46.751	9.515	7	5.1	-	
1992/05/08	06:44	47.238	9.39	7	4.66	-	
1993/06/14	12:28	46.007	8.267	2	4.51	-	
1994/12/14	08:56	45.983	6.393	2	5.06	4.4	
1995/04/21	08:02	43.773	7.579	7.7	4.75	4.5	Courboux et al. (1998)
1996/07/15	00:13	45.938	6.088	2	5.3	4.3 - 5.3	Thouvenot et al. (1998)
1997/10/31	04:23	44.240	6.587	2	4.69	4.3	
1999/02/14	05:57	46.802	7.233	2	4.72	-	
2000/08/21	17:14	44.733	8.717	2	5.44	-	
2001/02/06	22:28	44.005	8.762	4	4.54	-	
2001/02/25	18:34	43.53	7.48	11	4.6	4.6	Courboux et al. (2007)
2003/04/11	09:26	44.720	9.092	10	5.33	-	
2004/02/23	17:31	47.277	6.263	17	5.54	4.4	Baer et al. (2005)
2005/09/08	11:27	46.003	6.958	4.3	4.9	4.5	Fréchet et al. (2010)
2008/10/24	03:06	44.404	7.4809	5	4.50	-	
2011/07/07	19:21	41.977	7.658	10	5.30	4.9	Larroque et al. (2016)
2011/07/25	12:31	44.991	7.462	8	4.71	-	
2011/10/20	06:11	44.474	9.454	10	4.52	-	
2012/02/26	22:37	44.496	6.664	7	4.77	4.15	Courboux et al. (2013)
2012/03/04	03:47	42.035	7.661	25	4.50	3.8	
2014/04/07	19:27	44.493	6.659	9.94	4.8	4.8	Thouvenot et al. (2016)
2017/03/06	20:12	46.956	8.937	5	4.73	-	
2019/11/11	11:52	44.522	4.667	1	5.4	4.9	Delouis et al., this issue

Table A-S. Seismicity in the South-East of France for 1963-2019 : 43 earthquakes with M_L ≥ 4.5 and/or M_w ≥ 4.0. Data from LDG catalog (in green), from Si-Hex catalog (in red) and from publication (in black).