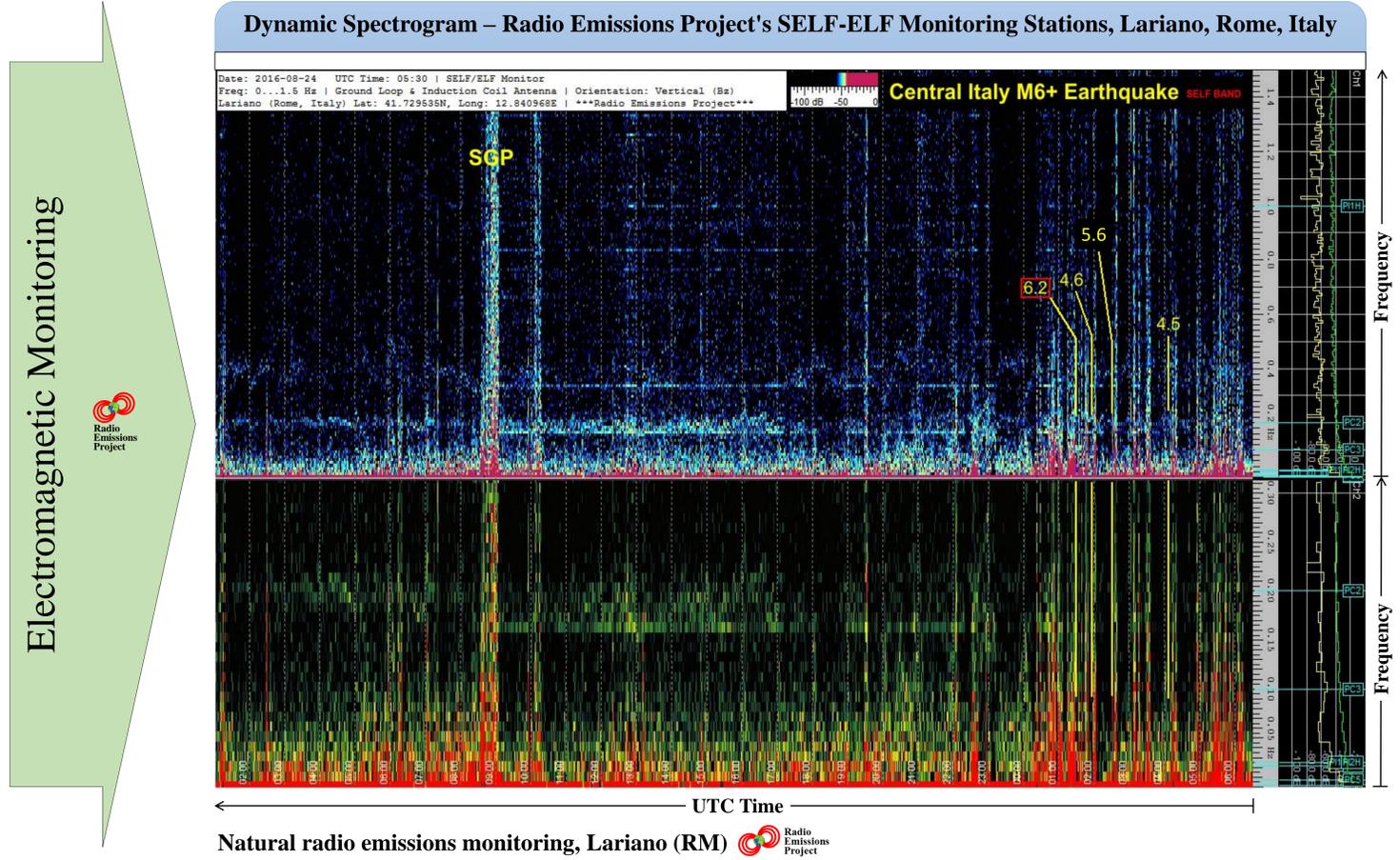


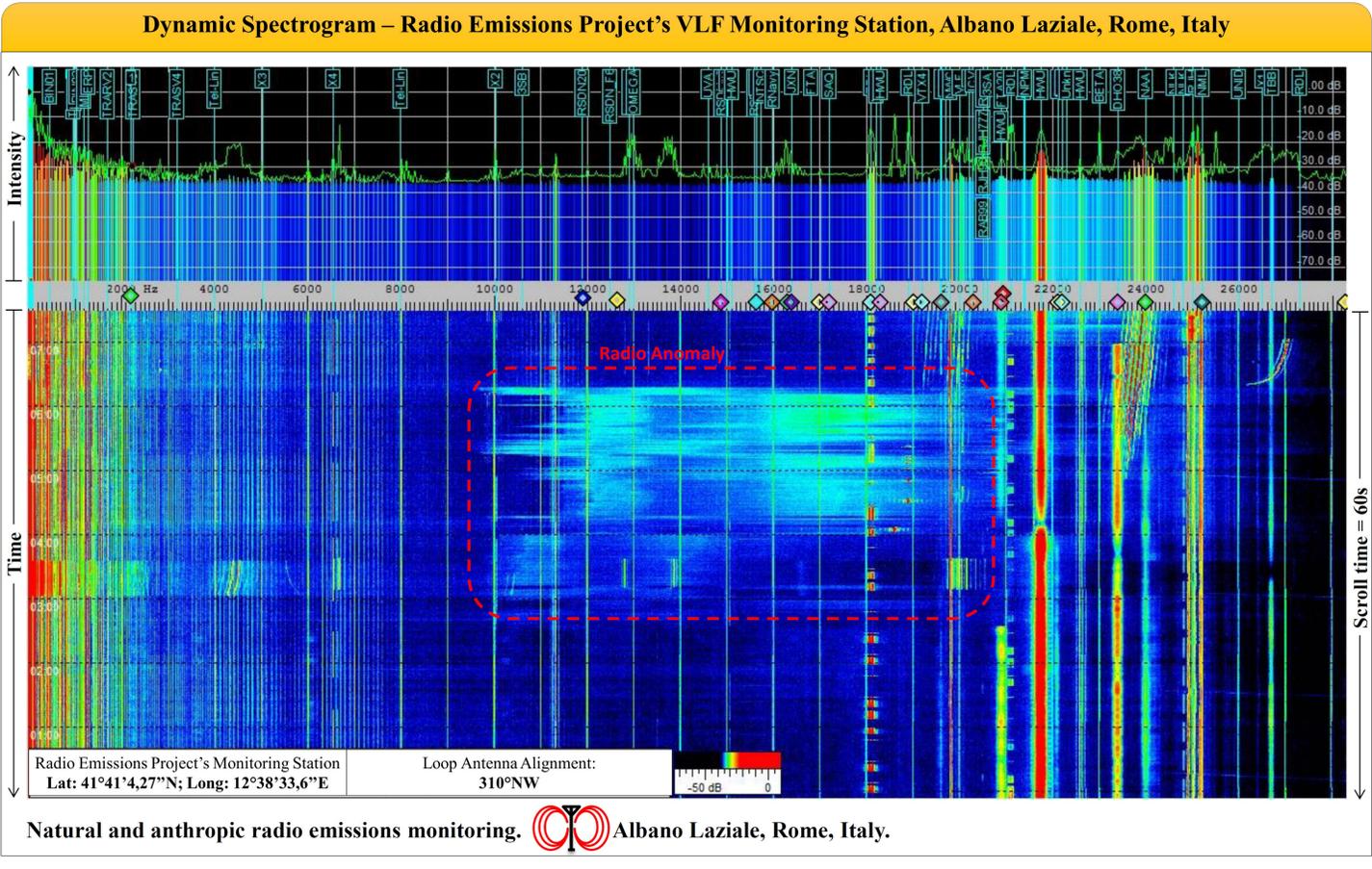


On August 24, 2016 at 01:36:32 UTC a destructive earthquake hit Central Italy with a magnitude of M6.2 and to a depth of 8 km. The greatest damage were recorded in the city of Accumoli (RI) (also identified as the earthquake epicenter: Lat: 42°42'50.4"N; Long: 13°10'19.2"E), in the city of Amatrice (RI), in the city of Norcia (PG) and other 59 towns, for a total of 299 victims. In this study the authors present the results of the electromagnetic monitoring conducted in the month of August 2016 by the monitoring stations located in the city of Albano Laziale (RM) and in the town of Lariano (RM). The monitoring stations are an integral part of the research project called "Radio Emissions Project", founded in 2008 and designed to search radio emissions that have seismic predictive characteristics: the so-called "Seismic Electromagnetic Precursor" (SGP) and Seismic Electromagnetic Precursor (SEP). On Italian territory Radio Emissions Project is the largest scientific project dedicated to the study of pre-seismic radio signals.

On August 18, 2016 the electromagnetic monitoring station located in Albano Laziale (RM) recorded the anomaly visible in the VLF spectrogram: this electromagnetic anomaly that has been recorded between 02:47 UTC and 06:21 UTC, thus remained visible for about 3 hours and 34 minutes between 9.63 kHz and 23kHz, with greater intensity between 9.63 kHz and 20,5kHz and preceded the Italian M6.2 earthquake of the August 24, 2016 of 142 hours and 49 minutes (almost 6 days). This was the first radio signal with these characteristics that the station has recorded since 2012. The Lariano's monitoring station has registered an increase of electromagnetic background prevalently between 0 and 0.7 Hz (SELF band) that preceded the Italian M6.2 earthquake of about 2 hours (the magnitude of the main earthquake is indicated by the red square and the yellow vertical line represents the temporal marker). The main peak, indicated by the large red arrow, preceded the M6.2 earthquake of 01:36 UTC of about 70 minutes and then gradually fade and disappear around 02:00 UTC. During this time frame have been recorded some impulsive increases of electromagnetic background that also preceded the three strongest earthquakes occurred after the main one (M6.2), whose magnitude and whose temporal markers are indicated in yellow color. The emission peak identified by the acronym SGP (Seismic Geomagnetic Precursor) represents an intense geomagnetic emission which lasted about 40 minutes and that preceded the M6.2 earthquake of 17 hours.



Electromagnetic Monitoring



The image above represents the dynamic spectrogram of the Earth's electromagnetic field registered between August 23, 2016 at 02:00 UTC and August 24, 2016 at 06:30 UTC by environmental electromagnetic monitoring station of the Radio Emissions Project, located in Lariano (RM), Italy, which monitors the SELF band and ELF band with a resolution of 10,1mHz. The upper portion of the spectrogram is centered on the SELF band between 0 and 1,5Hz, while the lower portion is centered in the SELF band between 0 and SELF 0,31Hz. The spectrogram is acquired through a radio receiver prototype developed by Dr. Gabriele Cataldi designed to work efficiently between the SELF band (0<f<3 Hz) and the ELF band (3-30Hz). The used antenna is a coil and loop antenna aligned vertically. The word "SGP" (Seismic Geomagnetic Precursor) is an acronym coined by the authors that identifies the radio emission of geomagnetic nature that are observed to precede large earthquakes. On the X axis of the spectrogram indicates the UTC time of the registration; this proceeds from right to left at 1 vertical line every 1,5 minutes. On the Y axis is instead reported the emission frequency of the radio signals (the frequency increases going in the top): these are represented in different colors according to their intensity.

The image above shows the dynamic spectrogram of the Earth's electromagnetic field recorded on August 18, 2016 between 00:00 and 07:30 UTC through the ULF-VLF electromagnetic environment monitoring station of Radio Emissions Project, located in Albano Laziale (RM), Italy. At the center of the spectrogram, inside the red dotted line, is present the radio anomaly that has been recorded precede the M6.2 Italian earthquake occurred on August 24, 2016 at 01:36 UTC. The emission appeared at 02:47 UTC and disappeared at 06:21 UTC. The labels at the top of the spectrogram (in light blue) indicate known radio stations, prevalently of anthropic type. On the Y axis of the spectrogram indicates the UTC time of the registration: this proceeds from top to bottom at 1 horizontal line to minutes. On the X axis is instead reported the emission frequency of the radio signals (the frequency increases going to the right): these are represented in different colors according to their intensity.