Supplement

Ground-based ULF electrical emissions during the Wenchuan $M_s=8.0$ earthquake.

The Hebei ULF (0.01–10 Hz) electromagnetic observation network was constructed at the beginning of 1980s after the occurrence of the July 28, 1976, Tangshan $M_s 7.8$ EQ with the aim of monitoring fluctuations in the electromagnetic radiations before seismic activities mainly around Beijing. More details of the observation system can be found in Zhuang et al. (2005) and Li et al (2013).

The system measures electrical signals and a DJ-1 recorder is employed to record the potential difference between two electrodes (SN, South-North and EW, East-West). The recording method uses an analog automatic real-time continuous pen recorder with a speed of 1 mm/s. In general, only parallel lines with perpendicular automatic clock marked signals on the record paper around a drum and six lines are left per hour. A blank record paper replaces the recorded one at 9:00 AM (local time) everyday (seen Figure S1).

During the period from January 2007 to December 2008, electrical emissions were recorded at three among four (only four stations run normally during this time) stations (Figure 1 in the paper) and the recording at Gaobeidian station shows a typical fluctuation character. Anomalous emissions first appeared at the end of October 2007 and the information was not recorded everyday but it is mainly accumulated in SN direction.

On 2 November 2007, our work team went to Gaobeidian station to check observing environment and eliminate probable interferences (Figure S2).
This kind of situation lasted till the beginning of April, 2008, from when relative high frequency and large amplitude signals were recorded almost every day with a persistent time. On May 9, 2008, 3 days before the Wenchuan $M_S$ 8.0 EQ, the amplitudes of signals were suddenly subjected to an abrupt enhancement at the same time, between 5:00 AM and 7:00 AM, both in the SN and EW directions and the abnormity reached to the climax stage (~1.3 mV/m for electric field) till on 17 May, 2008.

During this period, the work team went to all running stations to check related recordings (See Figure S3 at Gaobeidian station and Figure S4 at Ningjin station) and their observing environment. And we were right at Sanhe station when the Wenchuan earthquake took place.
After May 18, the total signal amount decreases sharply and the character of the signals at this stage is more like that before April 2008. The SN information lasted till the end of September 2008 except for high emissions appearing before several powerful aftershocks. It is the first time that the abnormality is with such a large amplitude and such a long duration in the observation history of this network although several strong EQs were recorded before (Li et al., 2013).

Fortunately, our research team traced this kind of obvious emissions during all this period and went to the stations several times to check observing environment and search probable interferences but found none. While the large Wenchuan $M_S=8.0$ earthquake took place during this period. So this obvious ULF emissions probably are related to this event.

In addition, figures S5–8 attached also are some ULF real-time recordings at Gaobeidian station:

Figure S5 Picture of real-time recordings from 9:00 AM, 13 to 9:00 AM, 14, February, 2008 at Gaobeidian station.
Figure S6 Picture of real-time recordings from 9:00 AM, 8 to 9:00 AM, 9, May, 2008 at Gaobeidian station.

Figure S7 Picture of real-time recordings from 9:00 AM, 12 to 9:00 AM, 13, May, 2008 at Gaobeidian station.

Figure S8 Picture of real-time recordings from 9:00 AM, 20 to 9:00 AM, 21, May, 2008 at Gaobeidian station.

Please also refer to:
