



Aftershocks Series Monitoring of the September 18, 2004 4.6 Lg Earthquake at the Western Pyrenees: a case of reservoir-triggered seismicity?

M. Ruiz (1), O. Gaspà (1), J. Gallart (1), J. Díaz (1), J.A. Pulgar (2), J. García-Sansegundo

(1)Dep. Geofísica i Tectònica, Institut de Ciències de la Terra ' Jaume Almera' IJA-CSIC, Solé i Sabaris s/n. 08028 Barcelona, Spain. (mruiz@ija.csic.es), (2) Dpt. Geología. Universidad de Oviedo, Arias de Velasco s/n 33005 Oviedo, Spain.

On September 18, 2004 a 4.6 Lg earthquake was widely felt in the region around Pamplona, at the Western Pyrenees. Preliminary locations reported an epicentre less than 20 km ESE of Pamplona, not far from the Itoiz reservoir. The area has been apparently devoid of significant seismotectonic activity. The present-day seismicity rather concentrates N of Pamplona, associated with the North Pyrenean Fault and its westward prolongation along the Leiza Fault, and SW of it, at the central segment of the Pamplona Fault. After the main shock, which was preceded by series of foreshocks reaching magnitudes of 3.3 Lg, a dense temporal network of 13 seismic stations was deployed there to monitor the aftershocks series and to constrain the hypocentral area. Aftershock determinations obtained with a double-difference algorithm define a narrow epicentral zone of less than 10 km², ESE-WNW oriented. The events, distributed between 4 and 8 km depth, are mainly concentrated at 6 km depth. Focal solutions were computed for 12 aftershocks, showing mainly normal faulting with some strike-slip component. The main event and the highest secondary one of 3.8 Lg show the same normal fault solution, with one of the nodal planes oriented N100E. Cross-correlation techniques applied to detect and associate events with similar waveforms, provided up to 33 families relating the 67% of the 326 relocated aftershocks. Families show relevant distributions in space and time, as event clusters are grouped by periods and they migrate from the NW to the SE. Interestingly, the narrow epicentral zone inferred here is located less than 3 km away from the 111 m high Itoiz dam, which started impounding in January 2004. These hypocentral results, and the correla-

tion observed between fluctuations of the reservoir water level and the seismic activity favour the explanation of this foreshock-aftershock series as a rapid response case of reservoir triggered seismicity, burst by the first impoundment of the Itoiz reservoir. The region is heavily folded and affected by shallow dipping thrusts. The Itoiz reservoir is located on the hanging wall of a low angle southward verging thrust, which might be a case sensible to water level fluctuations. Continued seismic monitoring is needed in this area to infer more reliable seismotectonic and hazard assessments.