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Seismological monitoring of exploited hydrothermal systems

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Hydrothermal systems offer a non-polluting long-term alternative for energy supply. Drilling costs prevent us from extensively using this alternative source of energy. BRGM has been involved for many years in the study of two geothermal systems: Soultz-sous-Forêt Hot Dry Rock (Alsace, Eastern France) and Bouillante hydrothermal system (Guadeloupe, West Indies). The French Geothermal Company (CFG) has been exploiting the Bouillante hydrothermal system for several years for local power supply. In October 2004, CFG increased the extraction rate of the hydrothermal fluids to reach 10% of the electrical power supply needs of Guadeloupe.

Bouillante is, therefore, an ideal natural observatory to test, validate and improve geophysical and geochemical techniques for a better understanding of both structural and dynamical behaviour of hydrothermal systems under controlled depressurisation (there is no re-injection of cold fluid). Marine seismic and terrestrial electrical surveys allowed BRGM to improve the knowledge of the 3D structure of the Bouillante hydrothermal system. In order to observe potential changes in the hydrothermal activity due to pressure decrease within the fractured system, BRGM installed in July 2004 a network of six Güralp CMG-40T broadband stations at Bouillante. We present the network setup, observed signals and the methodology for processing the data. Records mainly show signals associated to tectonic earthquakes, especially aftershocks of the M_w 6.3 earthquake near the islands of Les Saintes (21st November 2004). We show evidence for seismic events linked to the hydrothermal system activity.