Seismic monitoring at Deception Island volcano (Antarctica): the 2010-2011 survey

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As an example of the recent advances introduced in seismic monitoring of Deception Island volcano (Antarctica) during recent years, we describe the instrumental network deployed during the 2010-2011 survey by the Instituto Andaluz de Geofísica of University of Granada, Spain (IAG-UGR). The period of operation extended from December 19, 2010 to March 5, 2011. We deployed a wireless seismic network composed by four three-component seismic stations. These stations are based on 24-bit SL04 SARA dataloggers sampling at 100 sps. They use a PC with embedded linux and SEISLOG data acquisition software. We use two types of three-component seismometers: short-period Mark L4C with natural frequency of 1 Hz and medium-period Lennartz3D/5s with natural frequency of 0.2 Hz. The network was designed for an optimum spatial coverage of the northern half of Deception, where a magma chamber has been reported. Station locations include the vicinity of the Spanish base "Gabriel de Castilla" (GdC), Obsidianas Beach, a zone near the craters from the 1970 eruptions, and the Chilean Shelter located south of Pendulum Cove. Continuous data from the local seismic network are received in real-time in the base by wifi transmission. We used Ubiquiti Networks Nanostation2 antennas with 2.4 GHz, dual-polarity, 10 dBi gain, and 54 Mbps transmission rate. They have shown a great robustness and speed for real-time applications. To prioritize data acquisition when the battery level is low, we have designed a circuit that allows independent power management for the seismic station and wireless transmission system. The reception antenna located at GdC is connected to a computer running SEISCOMP. This software supports several transmission protocols and manages the visualization and recording of seismic data, including the generation of summary plots to show the seismic activity. These twelve data channels are stored in miniseed format and displayed in real time, which allows for a rapid evaluation of the seismic activity and an efficient seismo-volcanic surveillance. The data are processed and analyzed using the SEISAN database management software. In addition to the seismic network, we deployed a small-aperture seismic array south of Fumarole Bay. It is composed by 9 vertical and 1 three-component short-period stations. The 24-bit data acquisition system samples these 12 channels at 100 sps. There is also a permanent seismic station operating since 2008 and located near GdC, that is very useful for the preliminary evaluation of the seismicity at the start of the survey. This station is composed by a 16-s electrolytic seismometer (Eentec SP400) and a 24-bit datalogger (Eentec DR4000) sampling at 100 sps. During the 2010-2011 survey we identified 33 regional earthquakes, 80 volcano-tectonic (VT) earthquakes, and 929 long-period (LP) events. The volcanic alert system has remained green (the lowest level) at all times. The seismic activity has been similar to previous surveys and remained within limits that are normal for the island.