

## TIDAL MODULATION OF SEISMIC NOISE AND VOLCANIC TREMOR IN FOGO ISLAND, CAPE VERDE

**S. Custodio<sup>1</sup>, J.F.B.D. Fonseca<sup>1</sup>, B.V.E. Faria<sup>1,2</sup>, N. d'Oreye<sup>3</sup>**

1) Earthquake Engineering and Seismology Division, ICIST, IST, Av Rovisco Pais 1, 1049-001 Lisbon, Portugal; susana.custodio@ist.utl.pt; jfonseca@ist.utl.pt

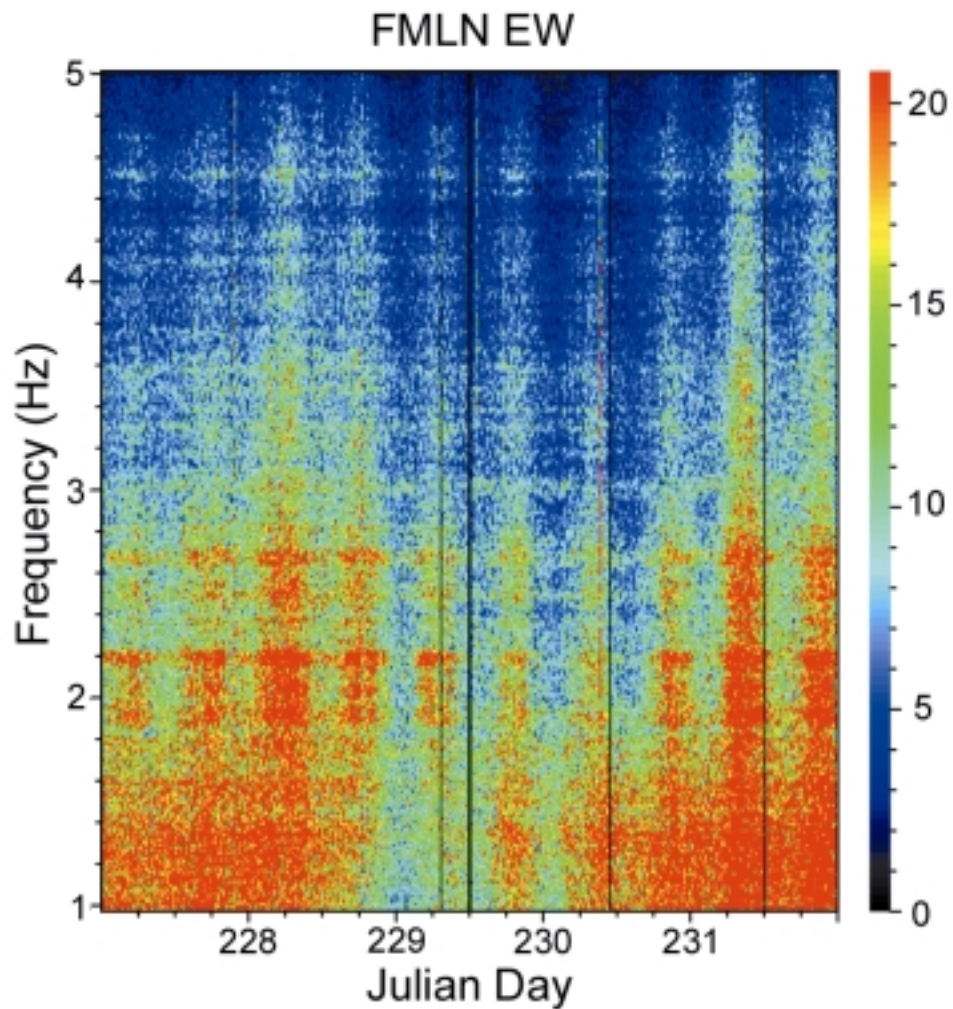
2) Instituto Nacional de Meteorologia e Geofísica, Monte CP15, Mindelo, Cabo Verde; vigil.isecmar@cvtelecom.cv

3) Natural History Museum of Luxembourg and European Centre for Geodynamics and Seismology, R. Josy Welter, 19, Walferdange, Luxembourg; nicolas.doreye@ecgs.lu

Background seismic noise recorded in some stations of the Fogo Volcano (VIGIL network) displays a semi-diurnal amplitude modulation that is strong enough to be observed by simple eye-inspection. Some frequencies, in the range 1-5 Hz, are specially modulated which we interpret as modulation of volcanic tremor. The modulation is stronger in the EW components.

Semi-diurnal and diurnal periodicities in volcanic and/or seismic activity are normally associated with either environmental or tidal influences. Fogo Island is instrumented to control a number of environmental parameters, such as air temperature and atmospheric pressure, and continuous tilt measurements are available close to some seismic sensors. Environmental parameters exhibit mainly solar periodicities (2.00 c.p.d. and 1.00 c.p.d). However, a spectral analysis of 40-days long seismic records indicates that the main periodicities of the seismic modulation are lunar (1.93 c.p.d. and 0.93 c.p.d). Lunar periodicities are normally associated with tidal influences. Ocean tide spectra for Palmeira harbour, located in Sal island, show a very good similarity with the seismic envelope spectra, which supports the conclusion that the modulation of seismic noise and volcanic tremor must be controlled by tides. It is in general difficult to prove the influence of tides on volcanic/seismic activity, because the solar and lunar periodicities are comparable and most studies involve analysis of discrete events. Because our investigation concerns a continuous time series sampled at 1-minute intervals, and continuous meteorological data is available, our results are not affected by such limitations.

Tremor is a well-known indicator of volcanic activity, which plays an important role in eruption forecasting. Since the effect of tides in the interior of the crust is minute when compared with tectonic stresses, this tide-related amplitude modulation of tremor seems to be driven by an extremely sensitive mechanism. Such sensitivity may provide an opportunity to monitor the internal state of the volcano.



*Spectrogram of a 5-days long seismic record from station FMLN, EW component, showing amplitude-modulated volcanic tremor in the frequency range 2Hz – 3Hz. A modulation of broadband seismic noise in the range 1Hz - 5Hz is also observed.*