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Secular variations of soil H2S efflux at Teide volcano, Tenerife, Canary Islands

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Teide volcano (3,718 m) is located in the central part of Tenerife, at the intersection of three major volcanic rift-zones. Low temperature fumaroles (81-85 ^{o}C) occur in the summit cone, where relatively intense diffuse degassing occurs. Spatial and secular variations of CO_2 and H_2S effluxes pattern provide important information about the active state of the volcanic-hydrothermal system. In order to improve Teide's volcanic surveillance, a geochemical station for continuous monitoring of diffuse degassing was installed at the southern flank of the summit cone (3,550 m) in April 1999. CO_2 and H_2S efflux together with CO_2 and H_2S concentration, soil temperature, soil water content, barometric pressure, air temperature, wind speed and direction, and air humidity are measured in an hourly basis and real-time radio-transmitted to ITER facilities, located at 25 Km distance from the observation site. Soil H_2S efflux values have been recorded since June 2001, ranged from non-detectable levels around 1000 mg $m^{-2}d^{-1}$, with a median value of 122 mg $m^{-2}d^{-1}$. H_2S efflux data show a non normal behavior with two different populations, with means about 40 mg $m^{-2}d^{-1}$ and 180 mg $m^{-2}d^{-1}$.

Two different sources for the observed variation on the H_2S emission can be distinguish: (1) due to external variables (environmental parameters) and (2) due to internal variables (endogenous signal). Most of the observed variance in the H_2S emission can be explain in terms of short and long frequencies using Fourier Transform Analysis (FTA). Secular variations on diffuse H_2S efflux show a linear dependence with the air relative humidity (R^2=-0.49), air temperature (R^2=+0.24), soil water content (R^2=-0.19) and wind speed (R^2=-0.27). FTA of H_2S time series show the following features:

(1) cycles of 6 months due to seasonal variations, cycles of 28 days due to earth tidal fluctuations variations and diurnal and semi-diurnal frequencies due to atmospheric variations. Multivariate Regression Analysis (MRA) was applied to eliminate the contribution of high frequencies due to meteorological variables. This contribution was estimated to be about 33 per cent of the total variance. Applying Integrated Autoregressive Moving Average analysis (ARIMA) to the residuals we were able to filter and quantify long trends in the H_2S time series. The new residuals obtained by ARIMA analysis show also frequencies associated to diurnal and semidiurnal variations, which might be related to other variables not integrated in the analysis or non-lineal link between H_2S efflux and meteorological variables. The occurrence of anomalous seismic activity in and around Tenerife Island in April 2004, could explain the temporal variations in the residual. López et al. (2004) showed that gravity forces are probably triggering seismic activity of Teide volcanic-hydrothermal system which is already unstable, generating variations in CO_2 confining pressure and producing a higher release of fluids to the surface. Further analysis of the correlation between the H_2S efflux and the observed seismic activity is necessary to understand the dynamics of diffuse H_2S emission at Teide volcano.