

Submarine gas flow monitoring at Panarea volcano, Italy

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Long-term records of submarine gas exhalations are rarely presented in literature. Long-term recording of submarine gas exhalations at shallow depths are difficult due to harsh conditions, highly corrosive water, impact of waves, tidal currents, fisher nets, anchors, and vandalism attacks. Low power consumption is a must since any external power supply would increase the risk of fail functioning. A robust device based on indirect gas flow monitoring by means of acoustic noise recording emitted during the gas emission was developed. This kind of acoustic “bubble counting” utilises acoustic oscillations generated during the bubble forming at the vent’s nozzle and the bubble stream knocking at the device. A self designed circuit consist of a microphone, preamplifier, counter, and data logger. The main advantages of this device are high acoustic (gas flow) sensitivity combined with low power consumption. A temperature probe inside of the sensor box gives further information about the fluid temperature variation. The recorded values are relative information about the gas flow variation, which is sensitive enough for the most geophysical purposes. The unit of gas flow is in that case an especially kind of frequency. A conversion into litre/min is not possible without individual calibration because the results depend on the physical conditions on each site (water depth, size of the vent, etc). The geophysical interpretation utilises the temporal variations of the recorded signal and in comparison with neighbouring stations. The time interval of each record is free selectable. For a monitoring period of three months, we prefer a 10 min logging interval. First laboratory tests showed logarithmic dependences between gas flow rate and acoustic noise records. That means the installation on vents should be preferred on low to medium strong gas emission sites to record in the optimum range of the instrument’s sensitivity. A first application at Panarea provides an important insight into different gas flow variations. Besides well-known influences by earth tides, also unpredicted fluctuations are shown by long term records. The correlation with recent tectonic and volcanic processes will be discussed.