Listening to Ambrym volcano (Vanuatu), by a triangular acoustic network: a precursor to a Strombolian episode

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Acoustic triangular network, installed between august and december 2008, on Ambrym volcano (Vanuatu) has proven to be suitable to monitor the volcanic activity of both Benbow and Marum, the two main active craters of Ambrym volcano with open vent system. Their volcanic activity vary between exhibiting weak to strong strombolian explosions. Both craters may also produce, although rarely, eruptive columns reaching a few kilometers in the atmosphere. Since all eruptive activity is driven by gas, we use continous acoustic measurements to estimate remotely the temporal evolution of gas volume and pressure at the vent.

More than hundred thousand acoustic events have been recorded within a 4 months period, indicating continuous magmatic events on Ambrym. Both Benbow and Marum have demonstrated the possibility to host strong magmatic activities with huge amount of gas released. The gas volume expelled by each crater is deduced from estimating the acoustic power in 4 frequency bands. It is also estimated on some specific signals by a series of 2 successive integrations of acoustic pressure and by waveform inversions whenever possible. The first period with strong explosions at Marum is preceded by an increase in number and amplitude of acoustic events in both craters. Several days before that Strombolian phase, the gas volume corresponding to the two lowest frequency bands, <0.8 Hz, of Benbow increase smoothly by more than a factor 2. After the Strombolian phase of october 2008, the degassing, which restarts immediately at Benbow but only after 12 days of quiescence at Marum, is characterised by a close series of small impulsive acoustic signals around 1 Hz, each corresponding to a bubble with a diameter of 7 m. The temporal evolution of the degassing (frequency, amplitude, number of events, ...) at Marum and Benbow suggests that these two active cones are connected to a unique magmatic reservoir with a sloping roof towards Marum. This subsurface configuration is responsible for the successive Strombolian phases that occurred only on Marum. This new approach in volcanic studies and monitoring appears to be a promising tool for volcanic monitoring as our acoustic network detects precursory events several days prior to major explosions.