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Ten years of data reveals the contrasted response of a metastable volcanic edifice to external forcing

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The seismic network of the Piton de la Fournaise volcano (La Réunion Island) is very well appropriate to study seismic signals generated by rockfalls in the Dolomieu crater. In particular, seismic data make it possible to precisely locate the rockfalls and recover the volume of each rockfall. In April 2007, an eruption caused the collapse of the crater floor. We processed ten years of data, from after the collapse to June 2017, ending up with a catalog of precise time, location and volume of rockfalls. These ten years show three different periods, in term of volcanic activity. From April 2007 to December 2010, four eruptions occurred. They are followed by a quiet period, with four years with no eruption. Then, the eruptive activity started again in June 2014, with eight eruptions in three years. It allows us to study three regimes of rockfall activity. First, the activity linked to the rearrangement of the crater slopes following the collapse. Then, the activity during a quiet period, with only climatic excitation. Finally, the activity linked to the recovery of the eruptive activity, on stable slopes. We first observe a strong relaxation phase of the crater slopes after the 2007 collapse. Then, we observe a large-scale stabilization of the crater through time. Comparing the spatio-temporal evolution of rockfalls during these three periods enables us to have an insight into the relative influence of the rain and the seismicity associated to the eruptive activity on the slope stability. It shows that the dominant triggering factor is the seismicity, rain having an obvious influence only when the seismic activity is low. During the quiet period, with few external forcings, we observe a progressive destabilization of the slopes, potentially leading to large events. On another hand, the presence of seismic activity seems to help draining the slopes with medium size rockfalls, thus reducing the potential maximal volume that can be generated.