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Employment of broadband seismometers to conduct micro-gravity monitoring surveys on active volcanoes

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Micro-gravity monitoring through discrete measurements can be used at active volcanoes to identify and model processes within the volcanic system. Mass redistributions occurring over a wide range of depths can be detected. However, the lack of information on the rate at which volcanic processes occur (due to time lapse between successive surveys) limits considerably this method.
Continuous gravity changes in volcanic environments can constrain fluid and gas transport at depth. This method does, nevertheless, have some drawbacks. The high cost of gravity meters prevents observatories deploying arrays of these instruments. Thus the temporal advantage of continuous gravity measurements is outweighed by the spatial disadvantage of this type of monitoring compared with traditional micro-gravity.
Apart from conventional gravimeters, good quality gravity data can also be retrieved from digital records of the output of broadband seismometers. In this work, we analyse several constituents of the geophysical noise affecting the signal. Factors such as the oceanic loading and subsequent tilt can have an important effect on the record, especially for coastal stations. These disturbances are registered by the two horizontal components of tri-axial broadband seismometers, which can be used to identify the contribution of different observable noise sources, allowing application of various corrections to the data and removal from the signal obtained from vertical sensors. Finally, the possibility of continuously measuring micro-gravity changes using broadband seismometers in the field is discussed, with a special emphasis on the complex multi-parameter settings that we find in active volcanoes. The relatively low cost and portability of these devices may make them suitable for the deployment of networks investigating gravitational effect produced by volcanic and magmatic processes.

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