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Steady subsidence of a repeatedly erupting caldera through InSAR observations: Aso, Japan

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The relation between unrest and eruption at calderas is still poorly understood. During the last 25 years, Aso caldera, Japan, shows minor episodic eruptions, mainly phreatic, associated with steady subsidence (∼1cm/yr) highlighted by levelling and GPS data. Here we analyse the ground deformations at Aso using InSAR data from different satellites (ERS 1-2, Envisat and ALOS) covering the period between 1993 - 2011 and compare it with the eruptive activity. Although the dataset suffers from limitations (e.g. coherence loss, atmospheric artefacts, low signal to noise ratio), we observe a clear subsidence signal from 1996 to 1998. We invert this signal with analytical models to evaluate the deformations source. Results suggest an overall contraction of a magmatic source between 4 and 5 km below the caldera centre. Available geophysical and and geochemical data suggest similar volumes of the contracting source and erupted material. The contraction may have been induced by the release of magmatic fluids, transferring a minor amount of magma and feeding the eruptions. If confirmed by further data, this hypothesis suggests that degassing processes play a crucial role in triggering minor eruptions within open conduit calderas, such as at Aso.