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Unrest episodes at Alcedo and Cerro Azul (Galapagos) revealed by InSAR data and geodetic modelling

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Western Galápagos calderas experienced repeated eruptive and non-eruptive unrest in the last decades, only partially studied. Here we investigated, using the Synthetic Aperture Radar Interferometry (InSAR) and geodetic modelling, the eruptive and the non-eruptive unrest episodes occurred in two of the less studied calderas of the western Galápagos: Alcedo and Cerro Azul. Alcedo underwent repeated non-eruptive unrest from 2007 to 2011, while Cerro Azul experienced an unrest, from 2007 to 2008, culminated in two eruptive phases from May 29th to June 11th 2008. Results highlight how Alcedo experienced two episodes of uplift due to new magma injections in its shallow magma reservoir, separated by an episode with a limited lateral propagation of magma, probably interrupted for the lack of new magma supply in the magma reservoir. Results also hint to a possible relationship between these short-term unrest episodes and the longer-term process of resurgence at Alcedo. As for Cerro Azul, we overcame unwrapping errors affecting some of the InSAR data of Cerro Azul by proposing a new method, based on the wrapped phase differences among nearby pixels, to invert the wrapped phase directly. Our results highlight how the eruption was preceded by long-term pre-eruptive inflation (October 2007 – April 2008). During the first eruptive phase, most of the magma responsible for the inflation fed the lateral propagation of a radial dike, which caused a first deflation of the magmatic reservoir. During the second eruptive phase, the further lateral propagation of the dike fed a radial eruptive fissure at the base of the edifice, causing further deflation of the magmatic reservoir. From the first to the second eruptive phase, the radial dike changed its strike propagating towards a topographic low between Cerro Azul and Sierra Negra. An increase in magma supply from the reservoir to the dike promoted the further lateral propagation of the dike, confirming the importance of a continuous supply of magma in the propagation of a dike.