

EGU21-3475

<https://doi.org/10.5194/egusphere-egu21-3475>

EGU General Assembly 2021

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Flank motion detected between 2010 and 2014 through InSAR time-series analysis at Pacaya Volcano, Guatemala

Judit Gonzalez Santana¹ and Christelle Wauthier^{1,2}

¹The Pennsylvania State University, Department of Geosciences, University Park, United States of America

(jmg6885@psu.edu)

²The Pennsylvania State University, Institute for Computational and Data Sciences, University Park, United States of America

Volcanic flank collapse has caused over 20,000 casualties in the past 400 years, and is one of the most dangerous hazards affecting communities and infrastructure near volcanoes. Flank instability has mostly been investigated at ocean volcanoes, due to their ability to trigger deadly tsunamis, however, these collapses are prevalent across volcanic settings, with all but one volcano in Guatemala with elevation over 2000m having experienced flank collapse, like Pacaya Volcano. At Pacaya, there is evidence for at least one past collapse, and transient SW flank motion has been identified accompanying vigorous eruptions in 2010 and 2014. We use InSAR time-series analysis to reveal, for the first time, long-term displacement of the SW flank of Pacaya during a period of volcanic quiescence from 2011-2013. This motion extended into 2014, with increased displacement rate attributed to dike intrusion during a major eruption. Subsequent static stress change analyses investigated the interactions between the modeled dike intrusion and detachment slip. Our research highlights that long-term flank motion might be more prevalent than currently recognized and that an awareness of existing structural weaknesses such as detachment faults and of possible magma-faulting interactions is vital when assessing the likelihood and style of volcanic flank collapse.