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USING NUMERICAL MODELS TO CONSTRAIN THE RELATIONSHIP BETWEEN SURFACE DEFORMATION AND MAGMA STORAGE AT AXIAL SEAMOUNT, JUAN DE FUCA RIDGE

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Axial Seamount is an active shield volcano located at the intersection of the Juan de Fuca Ridge (JdFR) and Cobb hotspot in the northeast Pacific Ocean (45°57′N, 130°01′W). Axial is one of the most active and extensively studied volcanoes on Earth with recorded eruptions in 1998, 2011, and 2015. Between eruptions, the magma reservoir undergoes inflation as molten rock is supplied from both the Cobb hotspot and JdFR. Continuously recording bottom pressure recorders (BPRs) were installed on Axial’s seafloor in the early 1990’s to monitor vertical seafloor movement as magma enters and exits the underlying reservoir. Additionally, campaign-style pressure surveys using a remotely operated vehicle and a mobile pressure recorder (MPR) have been conducted every 1 – 2 years to gather a time-series of long-term deformation data. Arnulf et al. (2014; 2018) employed reflection seismic techniques to map Axial's magma storage system with a spatial resolution of tens of meters and identified the upper surface of the magma reservoir located 1.1 – 2.7 kilometers below the seafloor. However, there is a discrepancy between the region with the highest melt percentage from Arnulf et al. and the location of maximum surface uplift recorded by the geodetic instruments. While seismic data indicates the highest melt concentration and shallowest portion of the reservoir occur in the southeast portion of the caldera, the geodetic data consistently show maximum surface uplift occurs at the center of the caldera. To establish a better connection between the underlying magmatic system and observed deformation, we utilize the geometry of the magma reservoir upper surface as determined by Arnulf et al. to construct a model with distributed independent inflation sources. The model consists of a grid of Mogi point sources that mimic the seismically imaged magma reservoir from Arnulf et al. Each inflation source can activate independently, allowing us to investigate how the geometry of the magma reservoir surface influences surface deformation and determine which regions of the magma storage zone experience active magma intrusion or withdrawl. This work serves as a starting point for reconciling the disparities between the geometry of the underlying magma storage system and location of maximum seafloor uplift.

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