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Surface Deformation and Source Model at Semisopchnoi Volcano from InSAR and Seismic Analysis During the 2014 and 2015 Seismic Swarms

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During the summer of 2014 and the early spring of 2015 two notable increases in seismic activity at Semisopchnoi volcano in the western Aleutian islands were recorded on AVO seismometers on Semisopchnoi and neighboring islands. These seismic swarms did not lead to an eruption. This study employs differential SAR techniques using TerraSAR-X images in conjunction with more accurately relocating the recorded seismic events through simultaneous inversion of event travel times and a three-dimensional velocity model using tomoDD. The interferograms created from the SAR images exhibit surprising coherence and an island wide spatial distribution of inflation that is then used in a Mogi model in order to define the three-dimensional location and volume change required for a source at Semisopchnoi to produce the observed surface deformation. The tomoDD relocations provide a more accurate and realistic three-dimensional velocity model as well as a tighter clustering of events for both swarms that clearly outline a linear seismic void within the larger group of shallow (<10 km) seismicity. While no direct conclusions as to the relationship of these seismic events and the observed surface deformation can be made at this time, these techniques are both complimentary and efficient forms of remotely monitoring volcanic activity that provide much deeper insights into the processes involved without having to risk hazardous or costly field work.