EGU21-3200, updated on 20 Jan 2022
https://doi.org/10.5194/egusphere-egu21-3200
EGU General Assembly 2021

Using minimal spanning tree based ICA optimization for volcanic unrest determination

Binayak Ghosh[1], Mahdi Motagh[1], Mahmud Haghshenas Haghshenas[2], and Thomas Walter[1]
[1]GFZ Potsdam, Germany, Remote Sensing and Geoinformatics, Germany (bghosh@gfz-potsdam.de)
[2]Institut für Photogrammetrie und GeoInformation (IPI) Leibniz Universität Hannover, Germany

Over the years, various satellites like ERS-1, ERS-2 and Envisat has been in use for the interferometric capability for a wide range of geophysical and environmental applications. With the launches of Sentinel-1A and 1B satellites in 2014 and 2016 respectively, the availability of SAR data from every part of the world has been increased many folds. With short revisit times of 1-6 days, the Sentinel-1 and the planned Tandem-Land NISAR missions provide an unprecedented wealth of topography and surface change data using InSAR technique. Utilizing these Synthetic Aperture Radar (SAR) acquisitions, repeated approximately from the same point in space at different times, it is possible to produce measurements of ground deformations at some of the world's active volcanoes and can be used to detect signs of volcanic unrest. Most of the existing traditional algorithms like Permanent Scatterer (PS) analysis and Small Baseline Subset (SBAS) technique are computationally extensive and cannot be applied in near real time to detect precursory deformation and transient deformations. To overcome this problem, we have adapted a minimum spanning tree (MST) based spatial independent component analysis (ICA) method to automatically detect deformation signals of volcanic unrest. We utilize the algorithm's capability to isolate signals of geophysical interest from atmospheric artifacts, topography and other noise signals, before monitoring the evolution of these signals through time in order to detect the onset of a period of volcanic unrest, in near real time. We demonstrate our approach on synthetic datasets having different signal strengths, varying temporally. We also present the results of our approach on the volcanic unrest of Mt. Thorbjörn in Iceland on 2020 and also the volcanic unrest of a volcano in Mexico from 2017 to 2019.