Proceedings of the 5th International Conference on Civil Engineering Fundamentals and Applications (ICCEFA 2024)
Lisbon, Portugal- November 18 - 20, 2024
Paper No.108
DOI: 10.11159/iccefa24.108

Flood Mapping Using Sentinel-1 Data. Case Study: Buna River

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Extended Abstract

One of the disasters that results in significant loss of life and property is flooding. In Albania, times of intense rainfall are typically linked to floods. The limits of optical pictures have been eliminated by Synthetic Aperture Radar (SAR) sensors, which have become more and more popular in recent years. In this work, Sentinel-1 SAR data was used to map a single flood event that happened in the Buna River basin in January 2021.

Sentinel-1A and Sentinel-1B European Space Agency (ESA) SAR images of the study area were acquired. Flood detection relies heavily on SAR polarization. Several earlier research [1, 2] have concluded that VV polarized pictures are more suitable than VH for the detection of floods and water bodies. VV polarized pictures have been used in this study as a result. The free program SNAP (Sentinel Application Platform) Tool [3], developed especially by ESA for the examination of the data collected by Sentinel satellites, was used to pre-process the images.

The quality of images is impacted by thermal noise, particularly in low backscatter areas like lakes and calm oceans. As a result, the SNAP Toolbox was used in this step to eliminate thermal noise. Because the orbit file offers precise information on the position and velocity of the satellite, it was used. Quantitative analysis of SAR images from many sensors, or from the same sensor at different periods, requires calibration. Consequently, σ0 (sigma zero) values have been derived in decibels (dB) with the application of radiometric calibration. In comparison to other features, the pixels that depict water bodies have a lower backscattering coefficient (σ0) [4].

Speckle noise from the random effects of the many backscatters that occur within each resolution cell is one of the issues with SAR images [1]. The Lee filter with a window size of 7 m x 7 m was determined to be the most suitable for the investigation considering the polarization and the requirement to demarcate those areas with lower intensity values.

Terrain correction and orthorectification are typically the final common steps in the pre-processing of images. The digital elevation model (DEM)–SRTM-3Sec and range Doppler terrain correction were employed in this work as the geometric calibration methods.

Non-permanent water surfaces have been identified and detected from SAR Sentinel-1 photos using two different techniques.

The first approach of RGB composition uses a combination of bands to identify the changes as visually noteworthy based on differences between the photographs taken before and after the occurrence. The threshold technique uses backscatter measurements in standing waters and flooded areas to distinguish flooded areas quickly and easily from non-flooded areas based on a characteristic polarization histogram. Realizing that the following radiometric values brought on by other physical changes differ noticeably from the backscatter values in permanent seas and flooded areas, which are typically the most negative [5]. Realization of inundation maps from Sentinel-1 SAR images is the last step, following the analysis of the Sentinel-1 satellite's SAR images in which we have identified the flooded areas.

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