EVALUATION OF INLAND WATER VULNERABILITY BASED ON RADAR DATA

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ABSTRACT

The Carpathian Basin (including Hungary) is characterized by various hydrological extremes, both in space and time. One of these hydrological extreme is inland water, which can become more frequent in the future, especially in the lowland regions and can cause damages in agricultiural production. Increasing the frequency of extreme weather events. Monitoring of the risk of inland water is a complex water management problem, however evaluating radar data could be a good solution for this, because it can provide accurate, timely and easily accessible information to improve the management of the environment, including water management.

The aim of this study was to evalute Sentinel 1 radar data to monitoring inland water inundation one of sample area in

the Great Hungarian Pain. During in our research, monthly radar data processing was made in the year of 2015 to examine the flooded parts in the vicinity of the Lake Tisza (Figure 1).

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INTRODUCTION

The traditional surveys of hydrological situations are increasingly being supplemented by the analysis of satellite imagery, which plays an important role in the Copernicus program (Westerhoff, 2013).

One of the most up-to-date radar applications is (satellite) radar interferometry. By this method, the earth's surface can be seen in very small magnitudes (even millimeters), vertical displacements. Extensive surveys allow any part of the Earth to be applied, cost-effective and time-efficient (no fieldwork required). It can be used to predict natural disasters.

The European Space Agency (ESA), within the framework of the Copernicus Program, has undertaken to develop the European Radar Observatory, which includes the development of service and application of two satellite SAR (Synthetic Aperture Radar) systems. Sentinel 1 data may be suitable for catheter repair support, marine observation, ice observation and interferometric applications, such as landslide detection (Ruiz et al., 2012).

OBJECTIVES

The aim of the study was to evaluate the pooling and flow conditions of inland waters by using time-based radar remote sensing data, as one of the possible solutions could be the evaluation of radar images for the monitoring of inland waterway phenomena and the characterization of their occurrence risk.

Sentinel 1 data from the site was downloaded from the website of the European Space Agency (ESA) (https://scihub.copernicus.eu/). The Sentinel-1 is a satellite-based satellite tracking system (I3) that operates in a corner around the corner and is designed to continue the InSAR missions.

MATERIAL AND METHODS

During the research, radar recordings were processed in the ESA Sentinel Application Platform (SNAP) 2.0 software environment. The steps for processing are shown in Figure 7. The program supports all major SAR data formats, so I could open downloaded compressed files as zip files. All polarizations are fixed in 2 bands (amplitude and intensity). During the research, I worked on amplitude values (1). As a first step in the preprocessing, the calibration of the recording was carried out in which I selected the polarization (VV) to be processed, resulting in the Sigma0_VV channel (2), and then a single product speckle filtering (3). This was followed by a Range Doppler terrain correction (4). Finally, a binary transformation was carried out in which the waters and non-waters were separated according to the channel histogram (5).

In the histogram, the reflection coefficient is visible in logarithmic scale. Low values correspond to water, while high values show non-wet areas. Based on the histogram, I selected a threshold that I can separate from each other. This limit was 2.21E-2.

During the segmentation, I applied the following relationship:

$255 * (Sigma0\_VV < 2.21E\text{-}2)$

The term Sigma0_VV <2.21E-2 was a logical value. A value less than 2.21E-2 will be the true (ie value 1), whereas the higher values will be false (i.e., 0 values). So I separated the wet and non-wet areas from January to December 2015 in the area of Szolnok-Túri Plane.

RESULTS

For the year 2015, the wetlands were defined and compared them with the inland water section boundaries used in the Kvassay Plan (Figure 2) to compare and evaluate their territorial relationships (Figure 3 A, B).

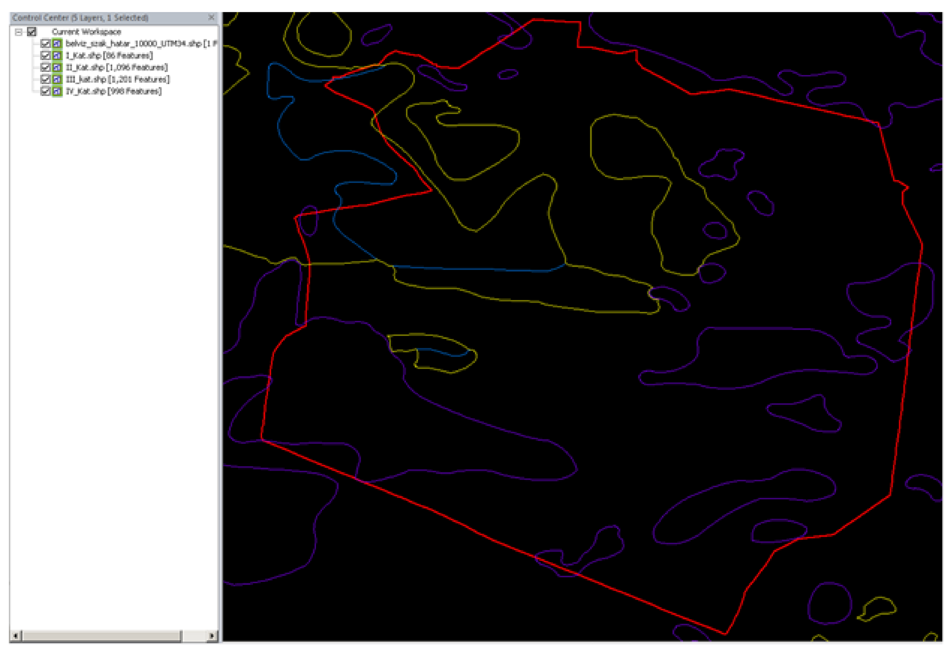

Figure 2: the inland water section boundaries used in the Kvassay Plan

As can be seen in the above figure, there are 3 phase ranges in the reference area (Figure 2), which are: yellow, purple, blue. The red color indicates the boundary of the sample area.

Figures 3 show the wet water cover sorted by the Sentinel 1 radar data and are depicted along with the section boundaries.

Based on the Corine Land Cover 2006 database, was determined the land use categories in our survey area (Figure 4).

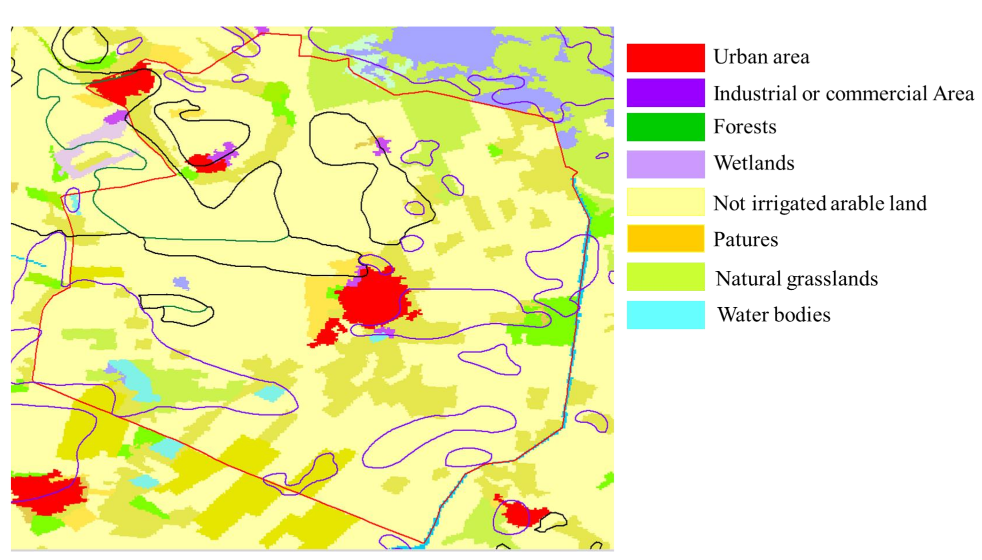

Figure 4: Land use categories in the sample area based on Corine Land Cover 2006

After that, were compared the April recordings with the Corine database data (Figure 5), so we were able to check the accuracy of the radar recordings, as we can clearly see the water areas (water bodies) clearly outlined in Figure 5, as well as Kvassay Plan defined by the Sentinel 1 data does not accurately indicate inland water areas.

DISCUSSION AND CONCLUSION

My aim was to evaluate the pooling and flow conditions of inland waters by using time-based radar remote sensing data, as one of the possible solutions could be the evaluation of radar images for the monitoring of inland waterway phenomena and the characterization of their occurrence risk.

Based on Corine Land Cover, I determined the land use categories in the survey area, which determined that the domestic overflow demarcation can be refined by Sentinel 1 radar data.

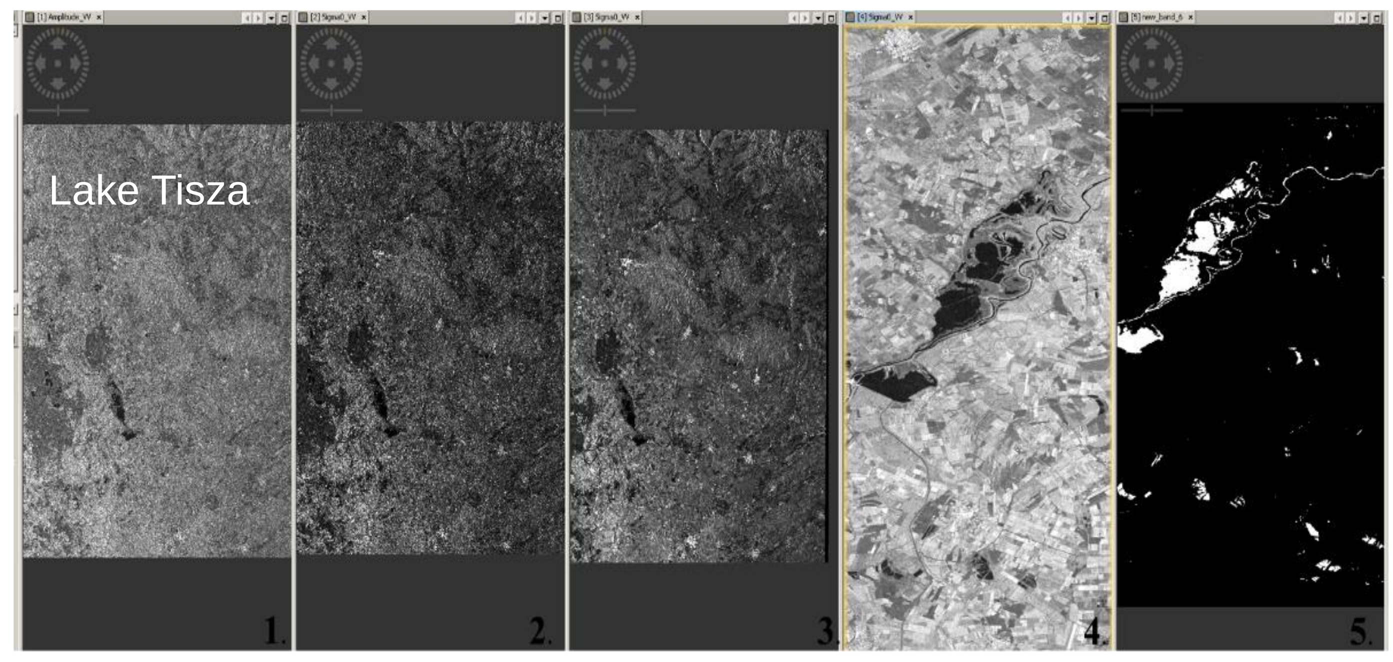

Figure 1: Processing steps

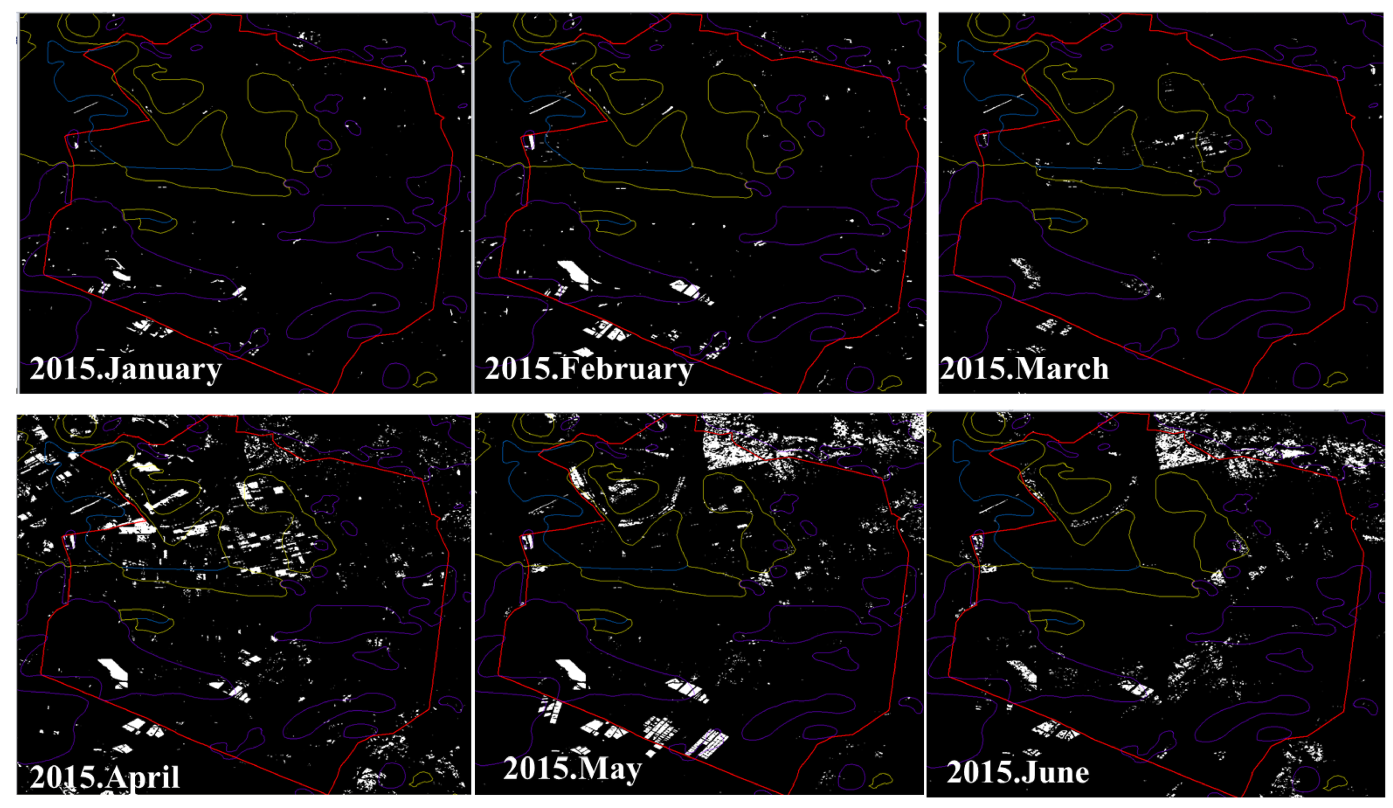

Figure 3 (A): Sentinel 1 data collected by inland water from January to June

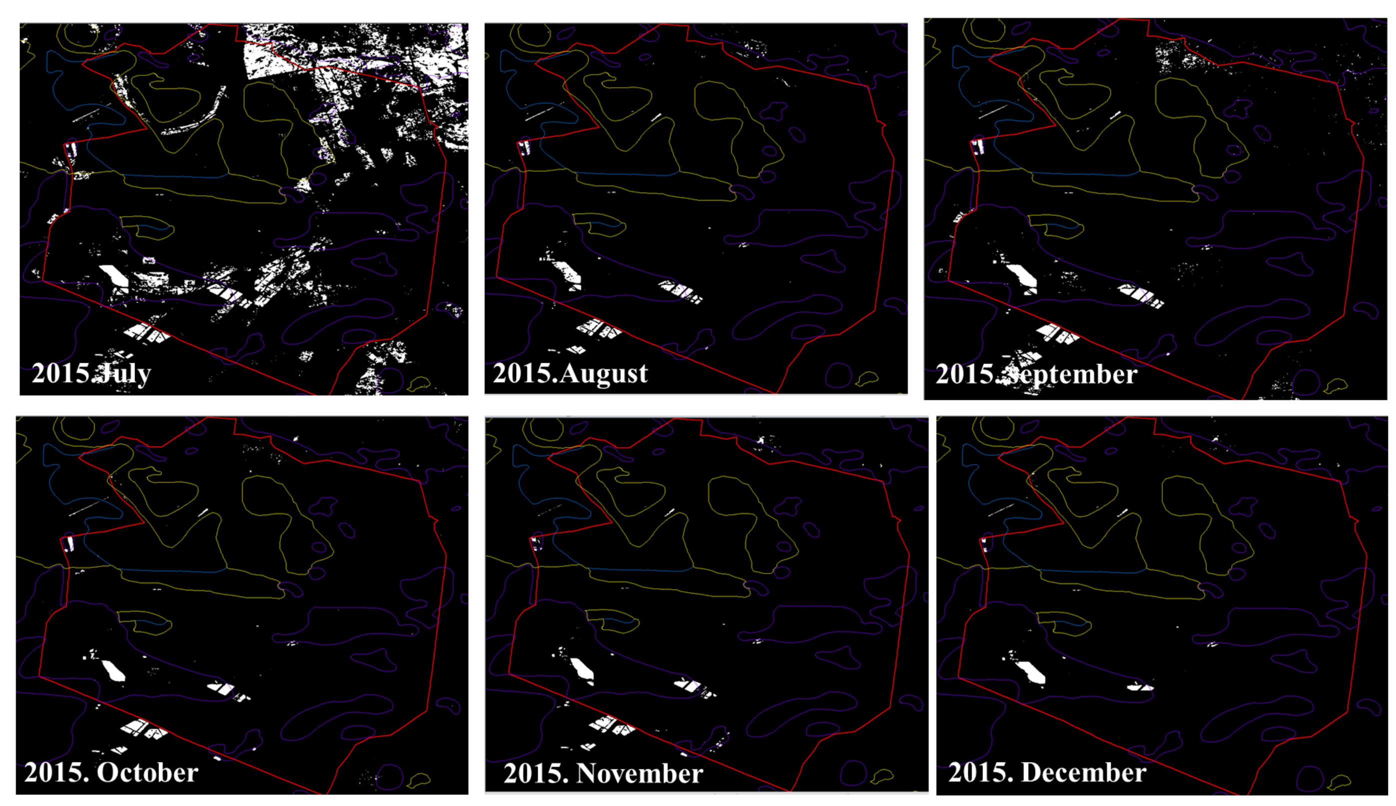

Figure 3 (B): Sentinel 1 data collected by inland water from June to December

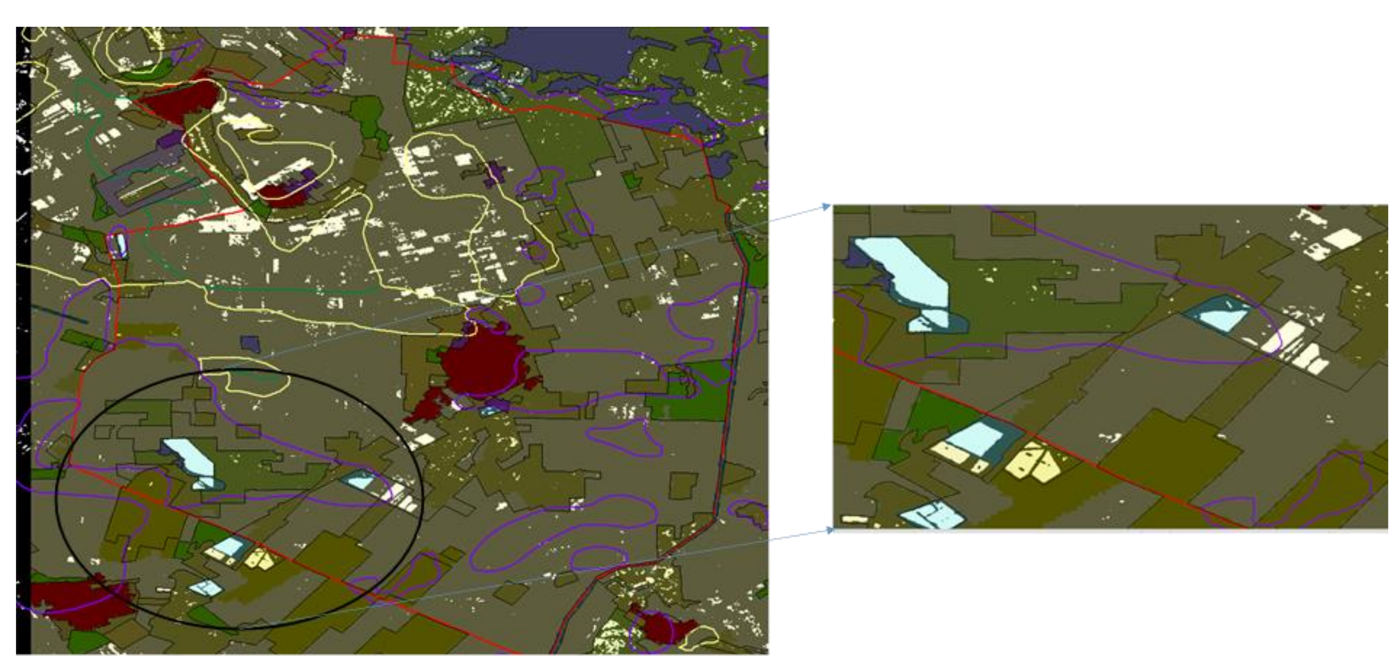

Figure 5: The precision of delineating the inland water in April based on Corine

MAJOS REFENRENCES

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