

**Title: The use of satellite imagery to multi-event and event-specific flood hazard mapping**

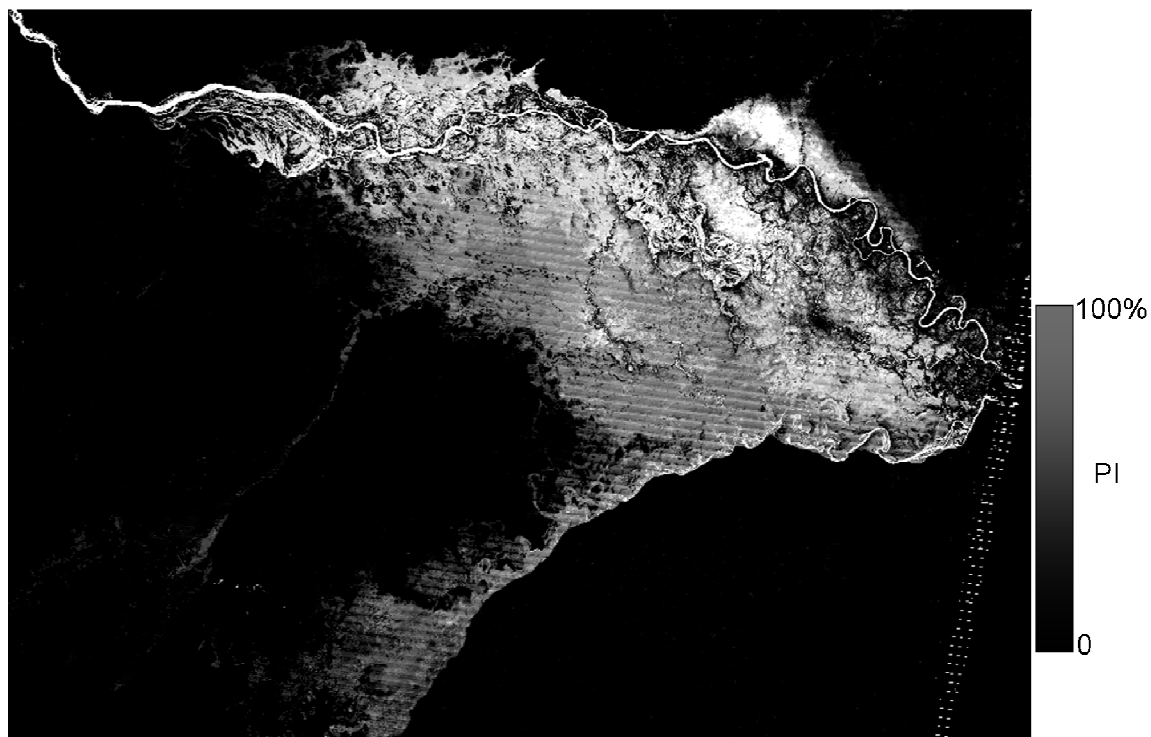
Authors: N. Kussul, A. Shelestov, S. Skakun, *Space Research Institute NASU-NSAU, UN-SPIDER Regional Support Office in Ukraine*

In recent years flood management has shifted from protection against floods to managing the risks of floods (European Flood risk directive). Corresponding flood hazard and flood risk maps should be provided to enable flood risk assessment, and flood probability density is to be estimated in order to produce flood hazard maps. Usually, this is done through hydraulic modeling of peak flow. But running such models faces many uncertainties due to the lack of hydrological and other required data, their incompleteness and imperfection. The use of space-borne remote sensing data to flood risk mapping is a complement approach to the existing flood modeling techniques.

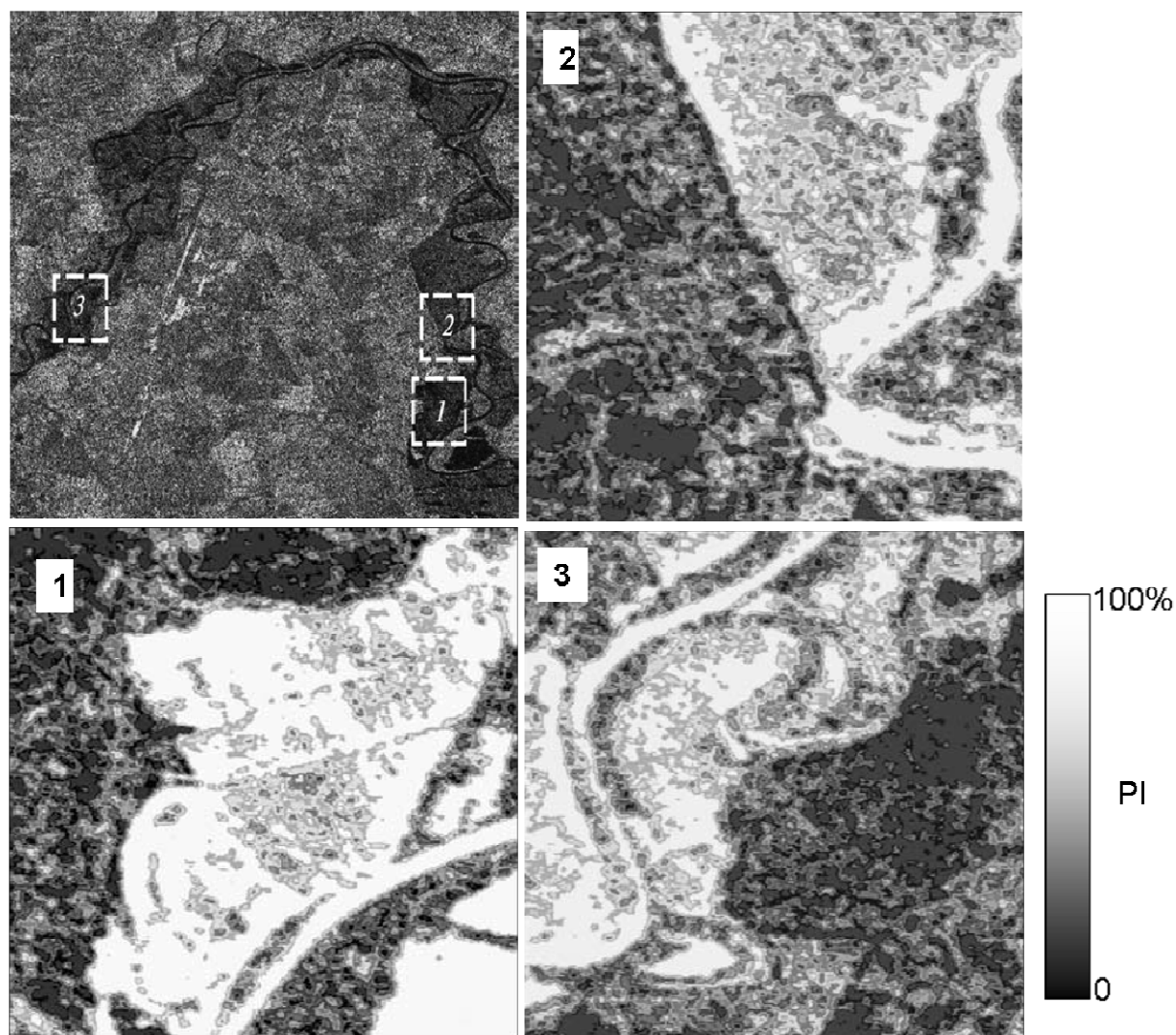
Within UN-SPIDER RSO in Ukraine, we have developed and tested two approaches to flood hazard mapping from satellite imagery. The first approach exploits a time-series of Landsat TM/ETM+ images to estimate flood probability density. At a first step, clouds, shadows and SLC-off pixels (for the ETM+ instrument) are identified on Landsat scenes, marked as “No Data” value, and removed from the further analysis. At a second step, water bodies are detected using a density sliding method. Therefore, each pixel in the image can get one of the following values: 0 - «No water», 1 - «Water», 2 - «No Data». All Landsat scenes are co-registered and aggregated to produce an image showing the probability of inundation (PI) value (Fig. 1).

The second approach is targeted for event-specific flood hazard mapping. The proposed approach is based on our neural network method for flood mapping from SAR images. This method is extended in such a way so the output of the neural network is probabilistic showing a posteriori probability of the area being inundated (Fig. 2).

The proposed approach should be further exploited in conjunction with flood models to decrease errors and uncertainties.



**Fig. 1.** PI for the Katimu Mulilo region, Namibia. The map is produced by integrating a time-series of Landsat TM/ETM+ scenes from 2000-2010. In total 44 scenes were processed.



**Fig. 2.** Event-specific flood hazard map derived from ESA's ERS/SAR image. The ERS image was acquired on 10.03.2001, and shows the flooding on Tisza river on the border of Ukraine and Hungary. Top left image is an original ERS image while three other images show PI for different regions.