Mapping Pluvial Flood-Induced Damages with Multi-Sensor Optical Remote Sensing: A Transferable Approach

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Detection maps for pluvial flood deteriorations at pixel level using the FuSVIPR method for three Mediterranean events in France + one event in South Africa

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Raster files at 0.5 m spatial resolution containing ID clusters of pluvial flood damages as determined with the FuSVIPR detection method (Cerbelaud et al., 2023).

These rasters can be used for the evaluation of intense surface runoff susceptibility models (see for instance Cerbelaud et al., 2022 for evaluation with another type of impact maps).

The four coupled files (two .tif) correspond to the following studied events:

- *Aude 1*: the floods of 15 Oct. 2018, in the Aude department, France (proj in WGS84 UTM zone 31N)
- *Aude 2*: the floods of 11 May, 2020, in the Aude department, France (proj in WGS84 UTM zone 31N)
- *AM*: the floods of 2-3 Oct., 2020, in the Alpes-Maritimes department, France (proj in WGS84 UTM zone 32N)
- *Durban*: the floods of 11-12 April, 2022, near Durban in the KwaZulu-Natal province, South Africa (proj in WGS84 UTM zone 36S)

The FuSVIPR method is a pixel-based supervised classification method based on two approaches that were implemented separately: the Random Forest (RF) algorithm and the U-net CNN. FuSVIPR uses open-source Sentinel-2 (S-2) closest cloud-free pre and post event optical products at 10 m spatial resolution along with post event very high spatial resolution (VHR) images at 0.5 m. For the VHR acquisitions, Pléiades satellite images were retrieved in Aude 1, Aude 2 and Durban, while airborne orthophotos were used for AM. The predictors are based on the fusion of vegetation-/water-based spectral indices derived from S-2 change images in addition to the visible bands of the VHR images. The maps given here were produced from a uniquely trained classifier, where learning was only performed on the Aude 1 event (for RF) or on the AM event (for U-net). This method uses various types of ground truth information (geo-referencing and labeling of areas affected by intense overland flow, see Cerbelaud et al. 2023).

Detection rates greater than or equal to ~75% and false positives mostly below 2% were obtained on all four events using the simple NDVI and NDWI spectral indices (VNIR-based) from Sentinel-2 change images as well as the red (R), green (G) and blue (B) bands of the VHR post event products (see Table 4 of Cerbelaud et al., 2023).

The maps are in .tif format with the following legend: **ID > 0 for all damaged clusters found with FuSVIPR, 0 otherwise.** The 'affected' pixels are determined by a simple thresholding

technique in the original probability maps from the RF or U-net classifiers. Extended information about the method and its validation are available here:

Cerbelaud, A., Blanchet, G., Roupioz, L., Breil, P., Briottet, X., 2023. Mapping Pluvial Flood-Induced Damages with Multi-Sensor Optical Remote Sensing: A Transferable Approach. Remote Sens. 15 (9), 2361. https://doi.org/10.3390/rs15092361