High spatial and temporal resolution flood monitoring through integration of multisensor remotely sensed data and Google Earth Engine processing

Rosa Colacicco[1], Alberto Refice[2], Raffaele Nutricato[3], Annarita D'Addabbo[2], Davide Oscar Nitti[3], and Domenico Capolongo[1]
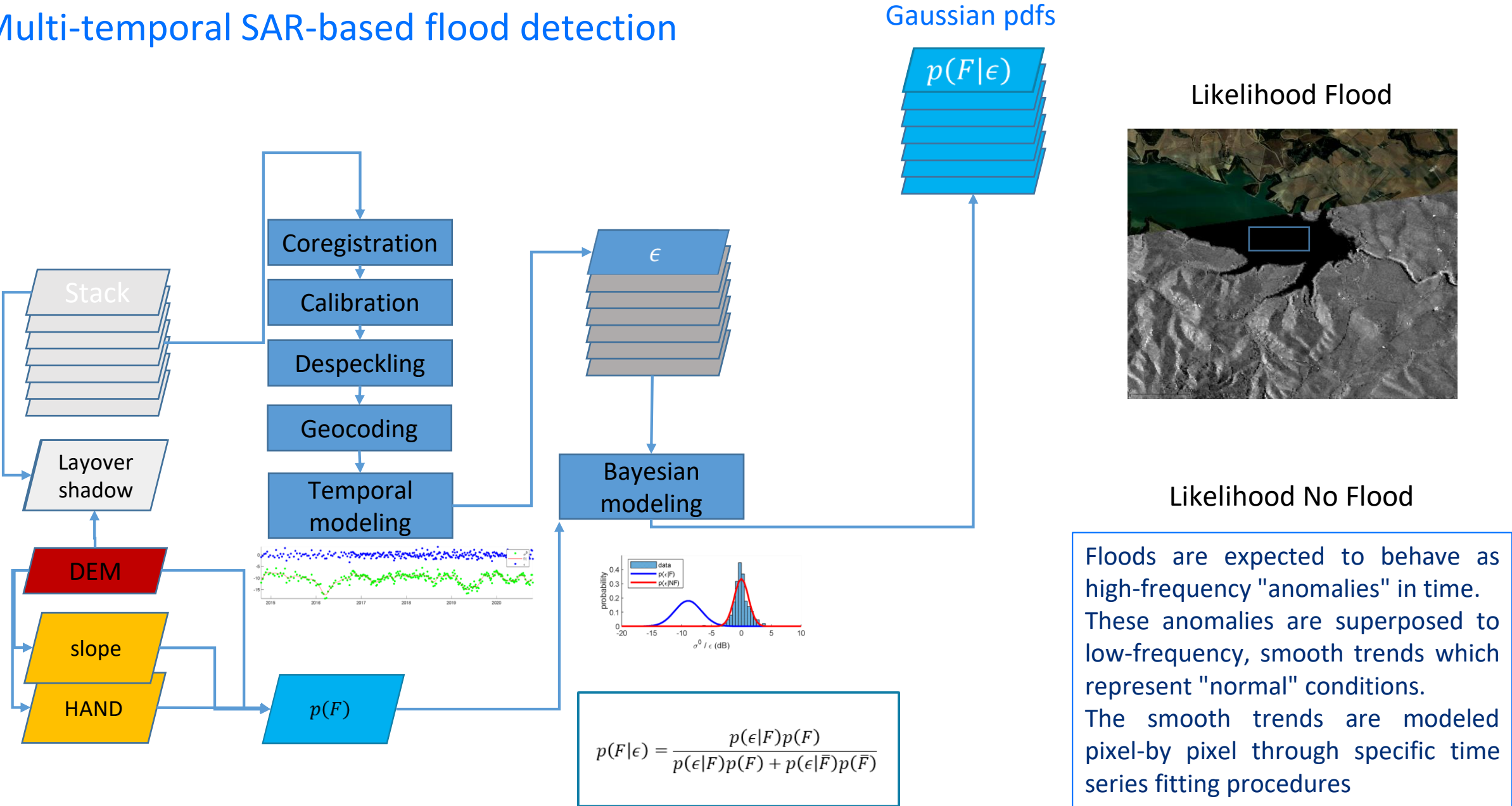
[1]University of Bari, Department of Earth and Geoenvironmental Sciences, Bari, Italy (rosa.colacicco@uniba.it)
[2]CNR - IREA, Bari, Italy (alberto.refice@cnr.it)
[3]GAP srl c/o Department of Physics "M. Merlin", University of Bari, Bari, Italy (raffaele.nutricato@gapsrl.eu)

This presentation participates in OSPP

C EGU

Outstanding Student & PhD candidate Presentation contest

METHODOLOGY

Multi-temporal SAR-based flood detection

Gaussian pdfs

$p(F|\epsilon)$

Likelihood Flood

Likelihood No Flood

Stack

Coregistration

Calibration

Despeckling

Geocoding

Temporal modeling

ϵ

Bayesian modeling

Layover shadow

DEM

slope

HAND

$p(F)$

$$p(F|\epsilon) = \frac{p(\epsilon|F)p(F)}{p(\epsilon|F)p(F) + p(\epsilon|\bar{F})p(\bar{F})}$$

Floods are expected to behave as high-frequency "anomalies" in time. These anomalies are superposed to low-frequency, smooth trends which represent "normal" conditions. The smooth trends are modeled pixel-by pixel through specific time series fitting procedures

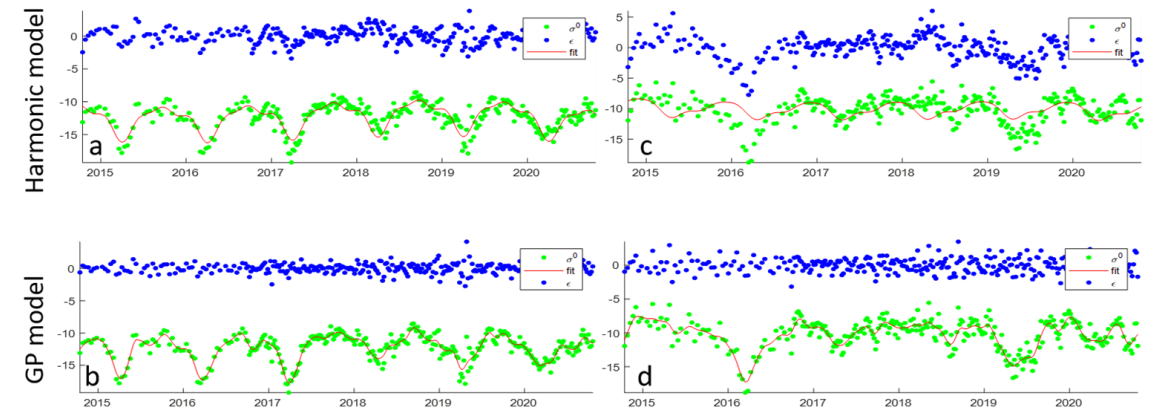# AREAS OF INTEREST

(Qgis)

(Web)
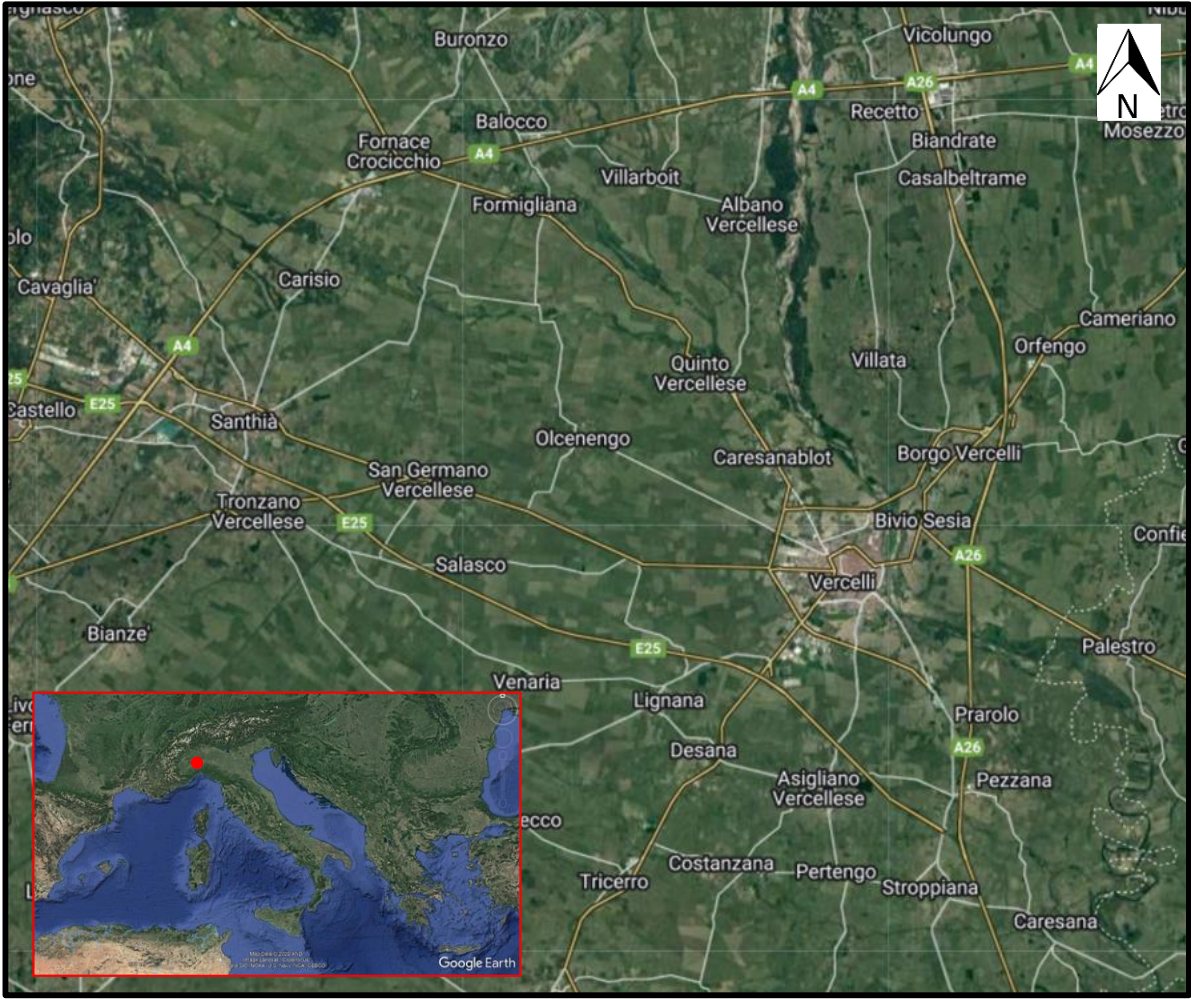
(Web)

METHODOLOGY

Temporal Modeling

Parametric (harmonic) model vs. non parametric Gaussian Process fit – with assigned Kernel
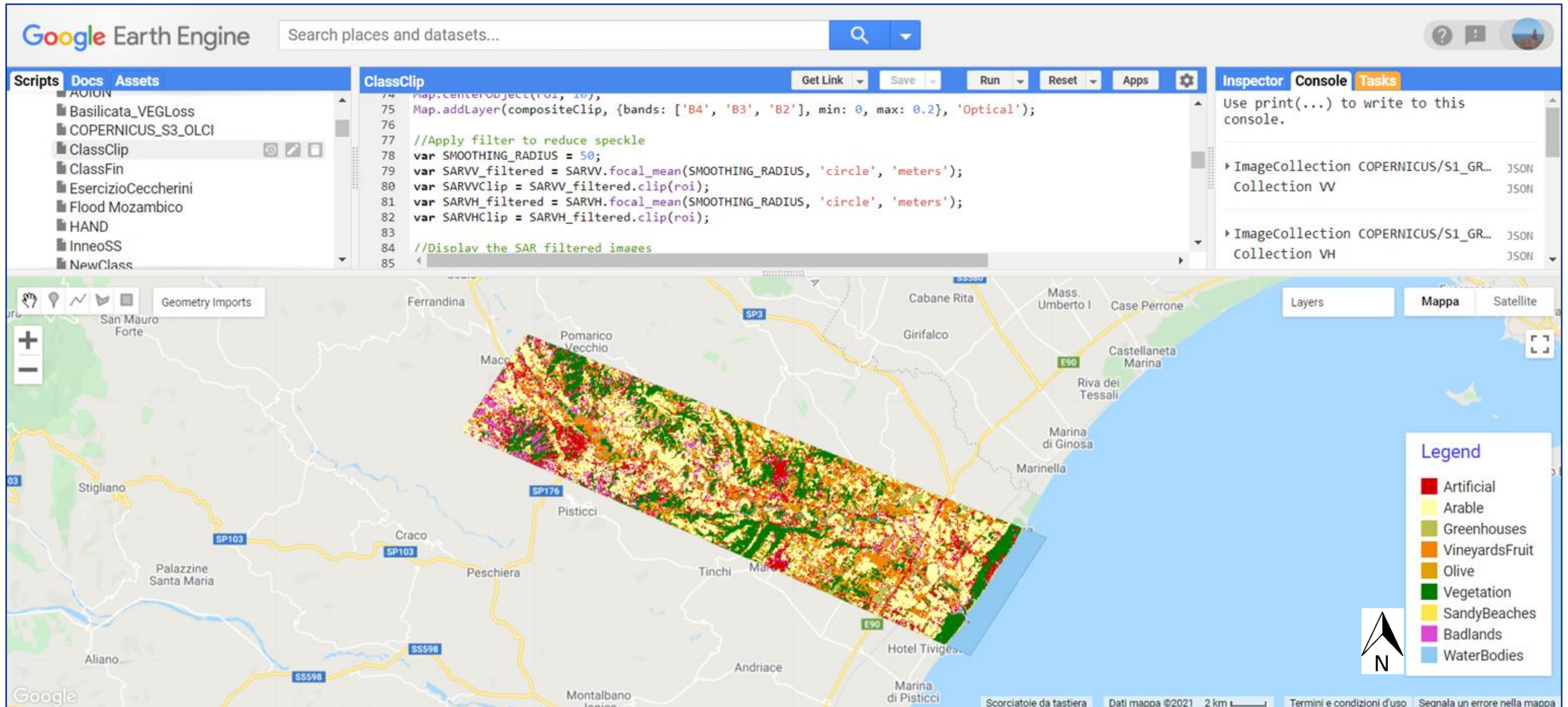

Harmonic model

GP model

METHODOLOGY

Google Earth Engine

METHODOLOGY

MULTI-TEMPORAL PROBABILISTIC FLOOD MAP
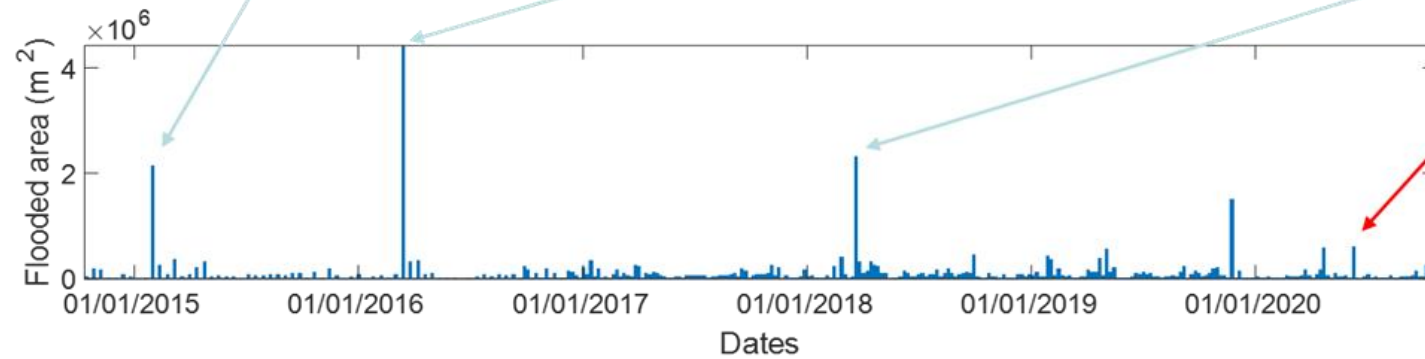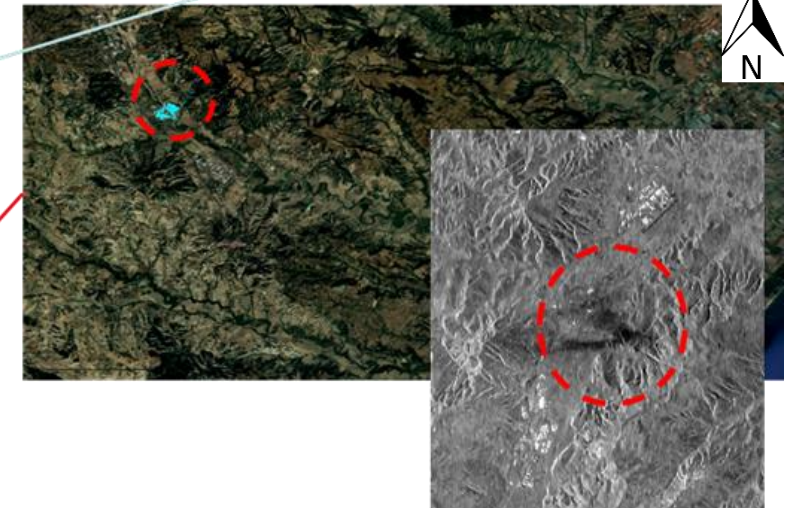

Im. # 09 – 31 Jan 2015
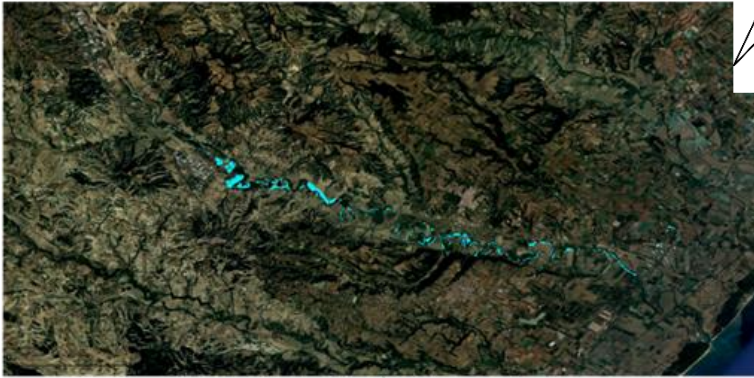
Im. # 42 – 14 Mar 2016

Im. # 148 – 22 Mar 2018

Im. # 282 – 09 Jun 2020

CONCLUSIONS and NEXT STEPS

- We propose a method for the detection of flood events in high temporal and spatial resolution stacks of SAR data (e.g. S1), integrated with ancillary datasets available at global scale
- Floods are defined as temporal statistical anomalies (spikes)
- Temporal modeling of "smooth" trends can be improved through use of non-parametric models (GP); temporal model parameters contain useful information for land characterization
- The method appears robust in mapping known events, and efficient in the detection of 'minor' events
- Land cover classification (through GEE) is helpful in determining local conditions for a priori probabilities

Next steps

- Validate small-scale events
- Study Sigma0 increase phenomena due to 'double bounce' with vegetation
- Determine accuracy of the classification on GEE
- Validation over a larger number of test sites
- Multitemporal probabilistic flood maps