Impact of initial soil moisture on the hydrological response: Application for flood forecasting in the Mediterranean mountainous watershed.

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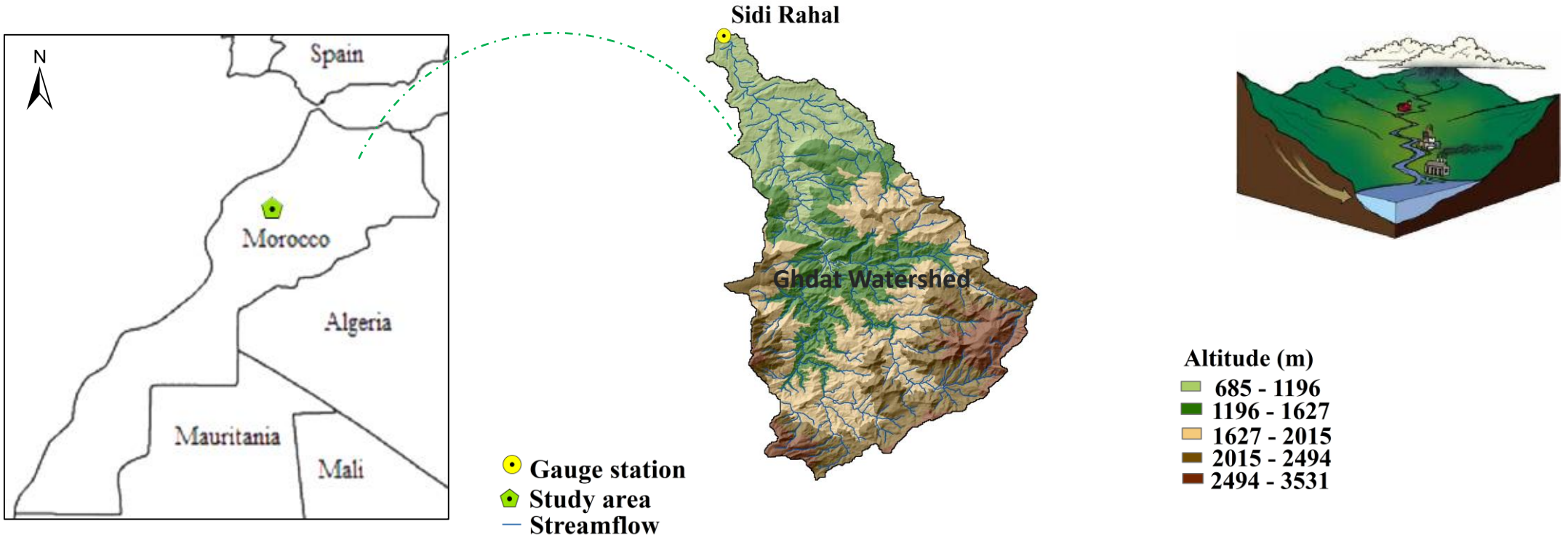
24-05-2022

Flash floods are the most destructive natural hazards that occur in the Mediterranean region.
Rainfall–runoff models can be very useful for flash flood forecasting and prediction.

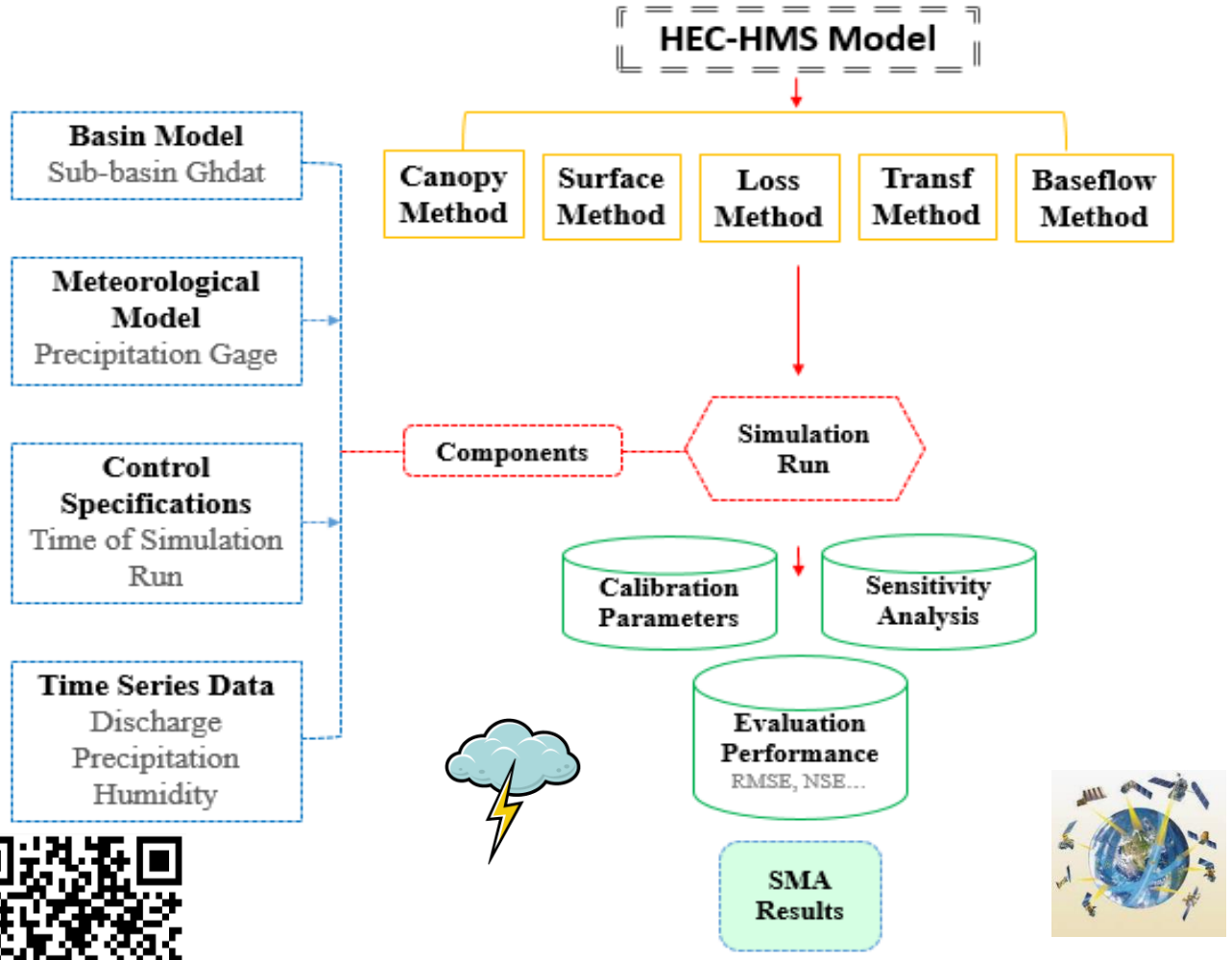


The aim of this study is to achieve a better understanding of floods behaviors of the Ghdat basin.

1- By exploiting the **strong relation between SM and precipitation**, using daily measurements of satellite SM data, to improve the quality of precipitation estimation during floods.

2- Also by using the **Soil Moisture Accounting (SMA) module of HEC-HMS** model to **simulate the continuous flow** of the Ghdat basin, especially in the outlet, and be able to assesses the availability of water in this catchment.

The Soil Moisture Loss Accounting (SMA) method included in HEC-HMS was used in this study.
This method includes five layers to represent the dynamics of water movement above and within the soil.



Data

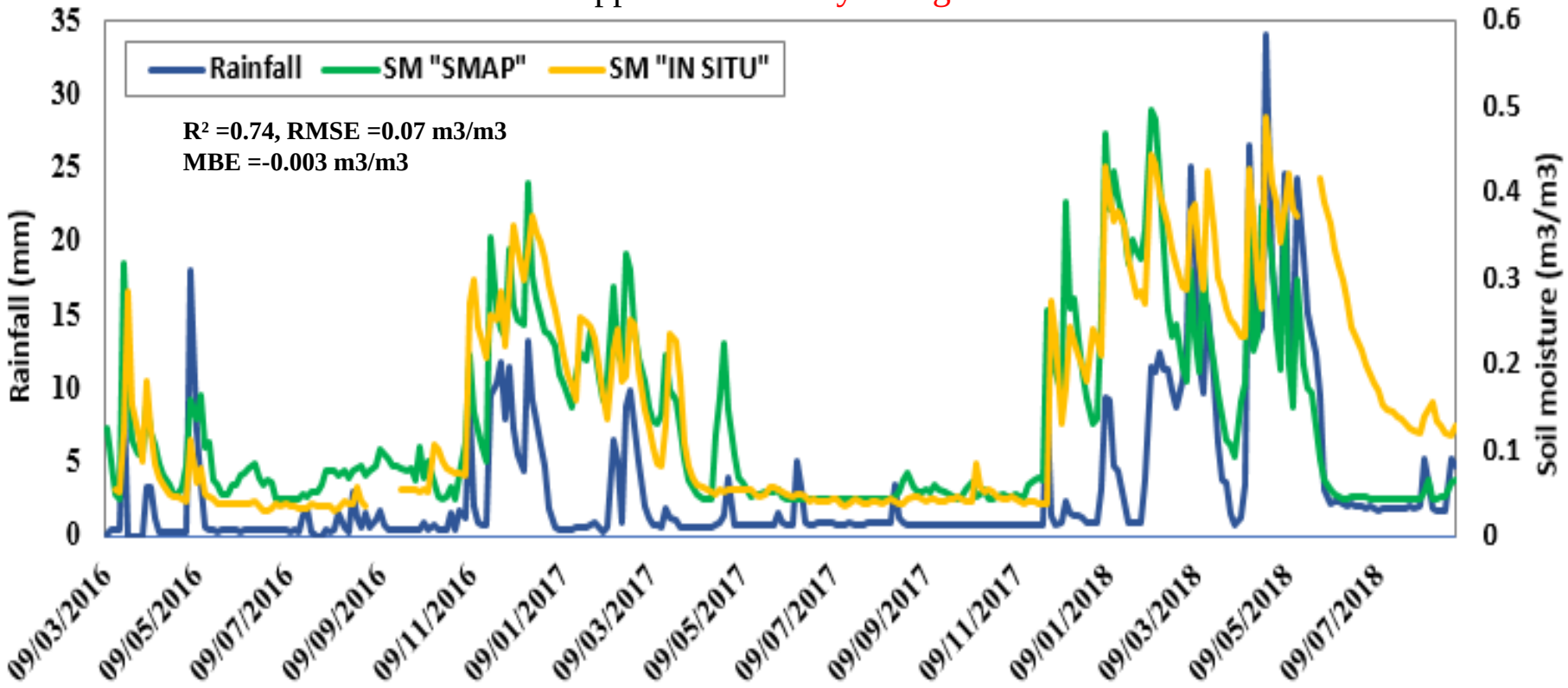
This study used spatial and temporal data acquired from different sources satellite and in situ data.

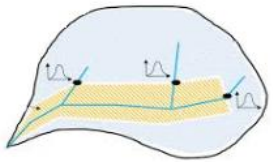
Data type	Source	Description
Rainfall, Runoff, Soil Moisture (TDR)	ABHT / LMI TREMA	Meteorological data from 2012 to 2018 at Sidi Rahal Station
Soil data	Ghdat soil map Laboratory fields sample analysis results	The soil map was made by (Benkirane & Gourfi 2022)
SETM-DEM	https://earthexplorer.usgs.gov/	Spatial resolution 30 m
Land use	Satellite image (Landsat) Vegetation cover map	Extracted from satellite image and vegetation cover map
SMAP Soil Moisture	https://nsidc.org/data/smap/smap-data.html	Spatial resolution 36km / 3 Days

All calibration values were obtained through preliminary GIS results, from land use and soil maps, then implanted into HEC-HMS model.

Soil Moisture SMAP & TDR

The consideration of the initial soil condition and the antecedent state of the soil are key parameter to achieve good results in the application of a hydrological model.



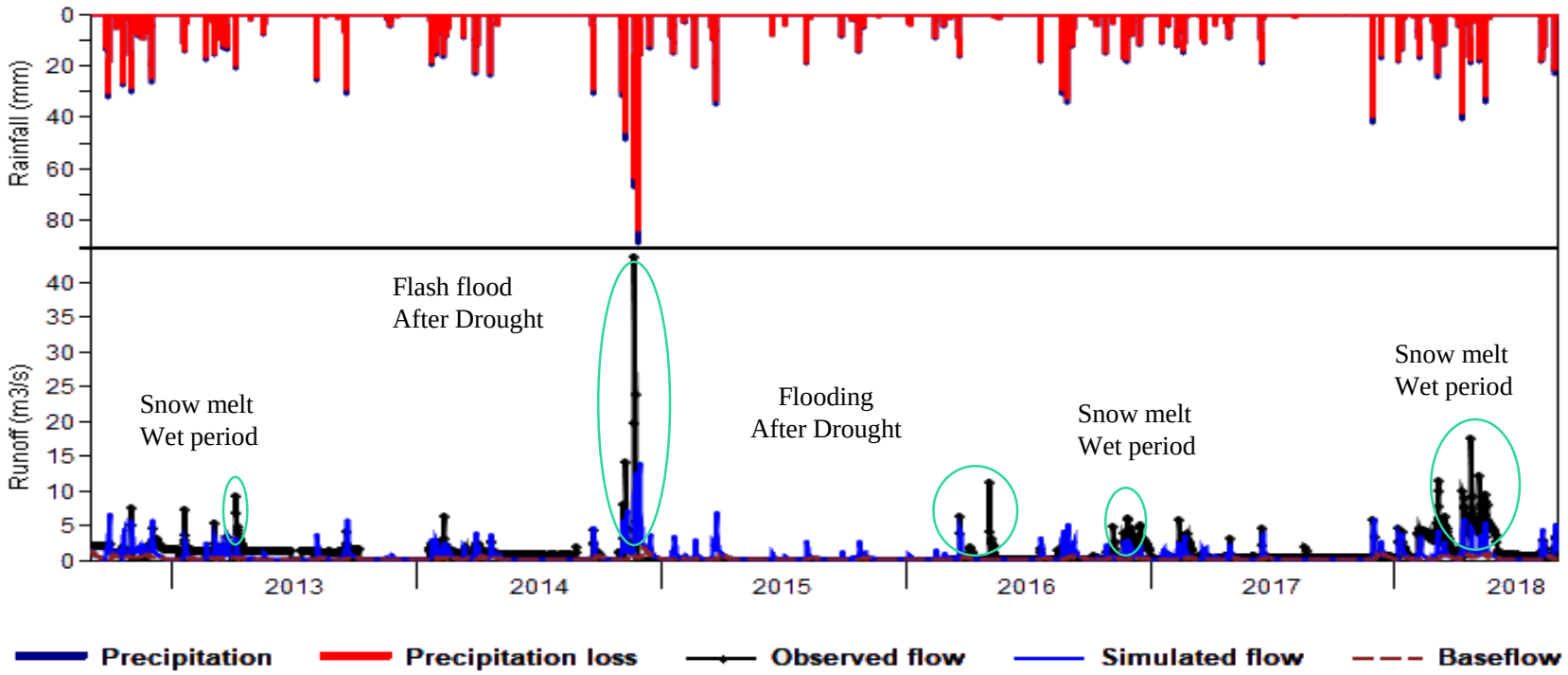


SMAP and TDR Soil Moisture where compared, and we obtained a good correlation between both products with an R^2 = 75%, and an RMSE of 0. 07 M^3/M^3.

SMAP and TDR Soil Moisture where simulated with observed precipitation, and we obtained a satisfactory reproduced the rainfall continuous events, with an R^2 of 80%.

Model Calibration

By comparing the daily calibration results between the simulated flow and the observed flow, we notice that the model reproduces well the precipitation events, moderately well the snowmelt flood events in wet periods, and underestimates the extreme flows after a long period of drought.



The continuous evaluation of the model performance was conducted over the simulation period from 2012 to 2018, the statistical parameters yield an RMSE of 0.5, and an NSE of 0.78 which are indicators of good model performances.

1. The HEC-HMS conceptual model was successfully calibrated over the Ghdat watershed for continuous modeling.

2. Based on these results, it can be concluded that the SMA algorithm, can be used successfully to model the continuous streamflow of the Ghdat watershed.

3. The global Nash-Sutcliffe criteria was 78%, indicating a good fit with the model.

4. As a future step, this approach could be extrapolated to other catchments with similar contexts, both in Morocco and in other Mediterranean regions.

THANK YOU FOR YOUR ATTENTION

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