

Hydraulic Performance Evaluation of Rainwater Harvesting Techniques to face climate changes in dry environments

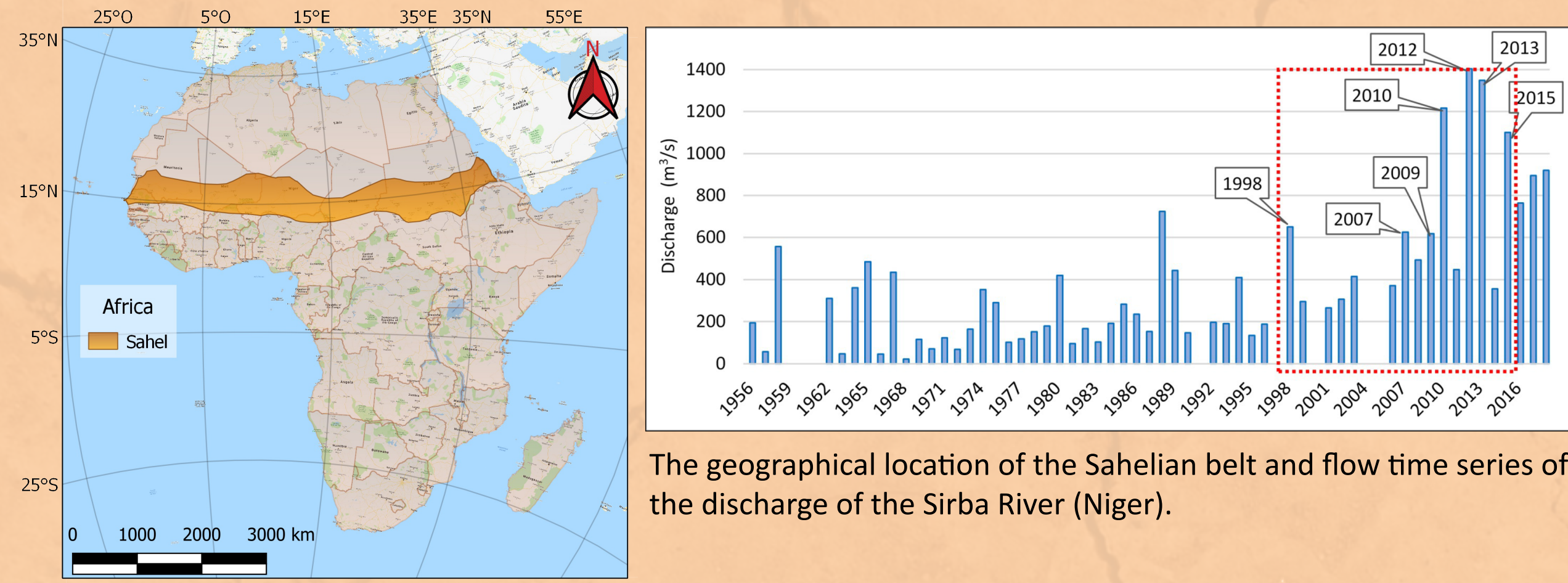
Paolo Tamagnone¹, Elena Comino¹ and Maurizio Rosso¹

¹Department of Environment, Land and Infrastructure Engineering, Politecnico di Torino, 10129 Torino, Italy

paolo.tamagnone@polito.it

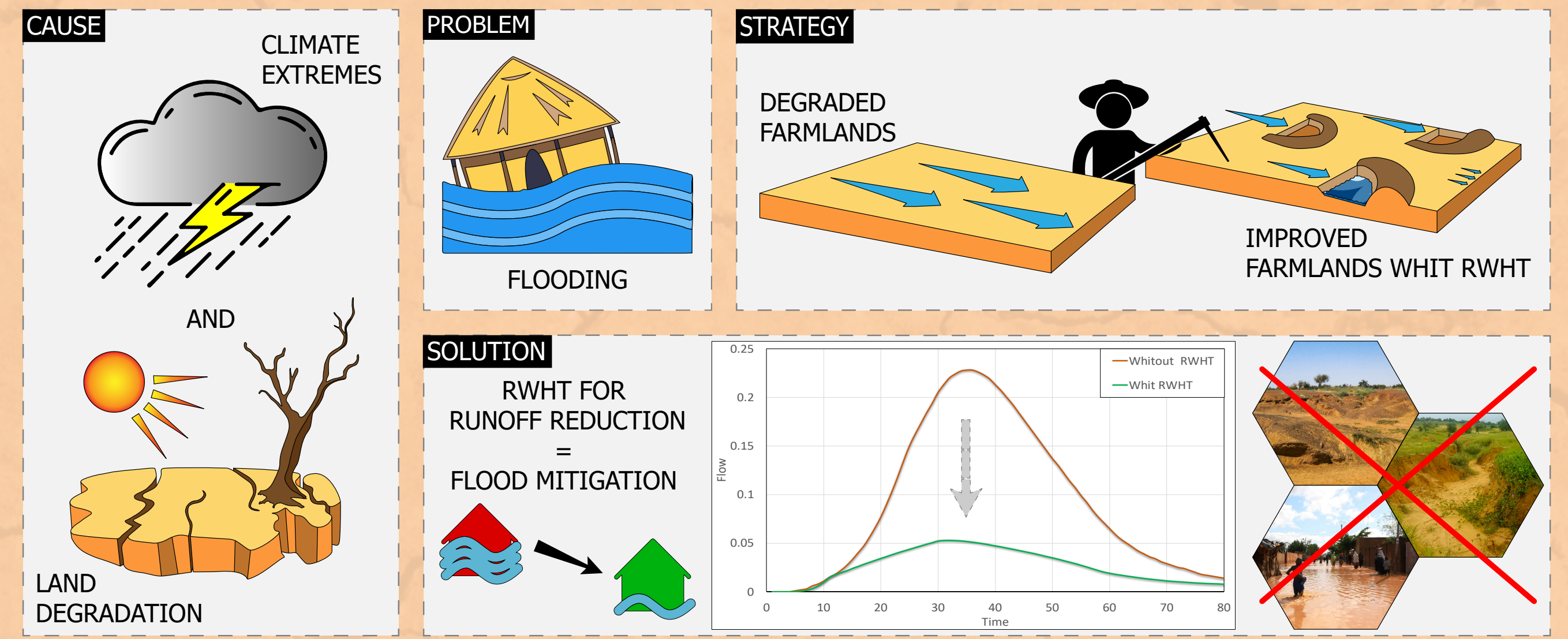
Context and problematics

In sub-Saharan Africa, climate and land use/land cover changes are strongly affecting the hydrological behaviour of land surface enhancing runoff and decreasing water holding capacity [1]. In recent years, Sahelian rivers are showing an alarming increase in the frequency and magnitude of flooding events [2]. These catastrophic events severely impact on local populations already hit by the harsh arid climate [3].



Objectives of the study

This study examines the capabilities of indigenous Rainwater Harvesting Techniques (RWHT) to be used as flood mitigation approach. The study analyses the hydraulic performance of the most used micro-catchment RWHT in sub-Saharan regions, in terms of runoff reduction at the field and basin scale.



Materials and Methods

Conceptual model

- Half-moon
- Trenches
- Planting Pits
- Vallerani System

Real topography

Village of Touré, Niger

DSM elevation m a.s.l.

- 208.4
- 208.2
- 209.7
- 210.6
- 211.3
- 212.1
- 213
- 213.8
- 214.7
- 224.8

Hydrodynamic simulation

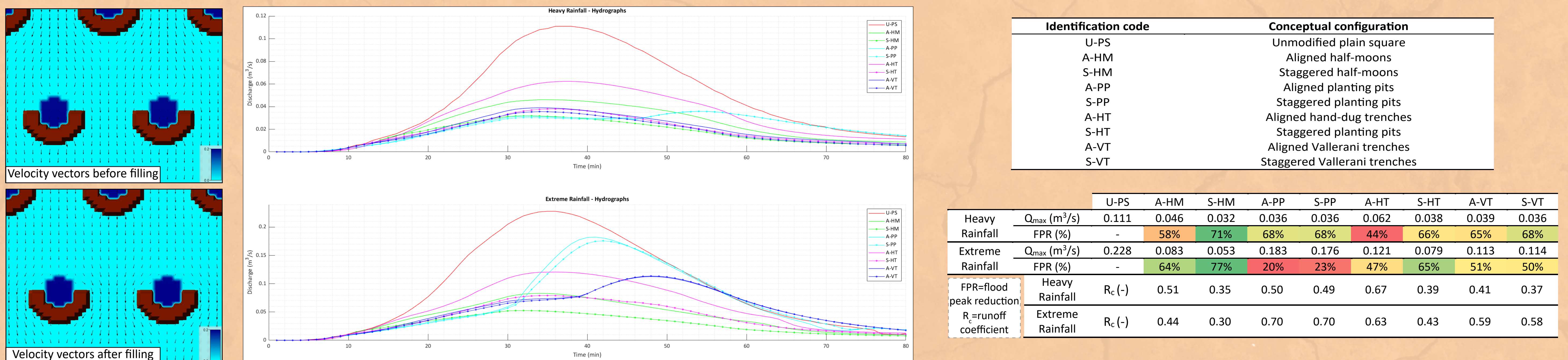
Rainfall-Runoff model HEC-RAS 5.0.6 rain-on-grid configuration

Parametrized hyetographs

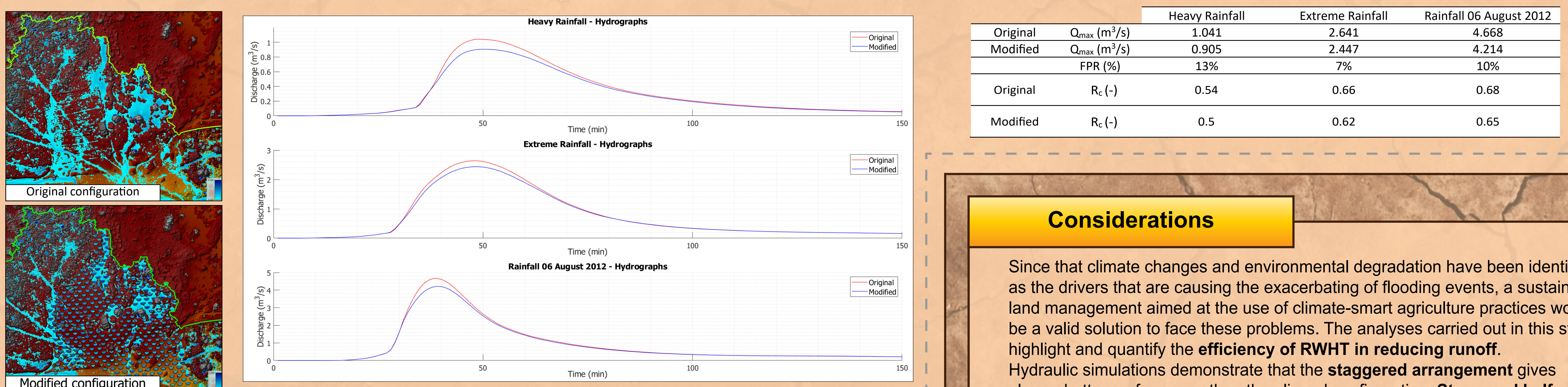
Rainfall event - 06 August 2012

Results

Conceptual model: RWHT performance evaluation



Real watershed: the village of Touré



Considerations

Since that climate changes and environmental degradation have been identified as the drivers that are causing the exacerbating of flooding events, a sustainable land management aimed at the use of climate-smart agriculture practices would be a valid solution to face these problems. The analyses carried out in this study highlight and quantify the **efficiency of RWHT in reducing runoff**. Hydraulic simulations demonstrate that the **staggered arrangement** gives always better performance than the aligned configuration. **Staggered half-moon** resulted in the most efficient RWHT in terms of runoff reduction.

References

- [1] Desroix, L.; Guichard, F.; Grippa, M.; Lambert, L.; Panthou, G.; Mahé, G.; Gal, L.; Dardel, C.; Quantin, G.; Kergoat, L.; et al. Evolution of Surface Hydrology in the Sahelo-Sudanian Strip: An Updated Review. *Water* 2018, 10, 748.
- [2] Tamagnone, P.; Massazza, G.; Pezzoli, A.; Rosso, M. Hydrology of the Sirba River: Updating and Analysis of Discharge Time Series. *Water* 2019, 11, 156.
- [3] Massazza, G.; Tamagnone, P.; Wilcox, C.; Belcore, E.; Pezzoli, A.; Viscel, T.; Panthou, G.; Housseini Ibrahim, M.; Tiepolo, M.; Tarchiani, V.; Rosso, M. Flood Hazard Scenarios of the Sirba River (Niger): Evaluation of the Hazard Thresholds and Flooding Areas. *Water* 2019, 11, 1018.