Flood Generation in Semi-Arid Data-Scarce Basins: What Can We Learn from Satellite Products and AI?
(Oral)

EL KHALKI El Mahdi (1) (*), RACHDANE Mariame (1), AIT NACEUR Khaoula (1), SAIDI Mohammed Elmehdi (2), MASSARI Christian (3), BROCCA Luca (3), SIMONNEAUX Vincent (4), GASCOIN Simon (4), & TRAMBLAY Yves (5)

First Author[1]*, Second Author[2]

(1) International Water Research Institute, Mohammed VI Polytechnic University, Ben Guerir, Morocco

(2) L3G Laboratory, Cadi Ayyad University, Marrakesh Morocco

(3) Research Institute for Geo-Hydrological Protection, National Research Council, Perugia, 06100, Italy

(4) Centre d'Etudes Spatiales de la Biosphère (UPS/CNRS/IRD/CNES), Toulouse, 31401, France

(5) ESPACE-DEV, Montpellier, 34000, France

**Corresponding author: elmahdi.elkhalki@um6p.ma*

ABSTRACT

Understanding flood generation in semi-arid and data-scarce regions such as Morocco remains challenging due to limited in situ observations. This work synthesizes insights from multiple studies exploring the use of satellite precipitation and soil moisture products for hydrological analysis across Moroccan basins. Our findings show that satellite precipitation products can serve as reliable alternatives to ground observations, with the ability to capture major flood events across diverse contexts. In addition, soil moisture emerges as a key control on flood generation, influencing catchment response and event magnitude. Satellite and reanalysis datasets, particularly SMOS-IC and ERA5, demonstrate strong potential to represent pre-event conditions, especially when high temporal resolution data are used.Importantly, recent advances in artificial intelligence offer new opportunities to overcome data scarcity by estimating missing hydrological variables. By leveraging soil moisture information, AI-enhanced modeling frameworks can improve runoff simulation and support flood analysis even in poorly gauged basins. These insights highlight the value of combining satellite observations and data-driven approaches to better understand and anticipate floods in ungauged regions.

Keywords: Floods, Flood forecasting, Satellite products, Modeling