MODELLING THE FATE OF WATER AND SUSPENDED MATTER FROM THE PRECIPITATION TO THE WATERSHED AND TO THE SEA: THE CASE OF FLASH FLOODS IN THE GULF OF LION

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Abstract

The objective is to study in an integrated way Mediterranean flash floods and the associated suspended particulate matter transport during heavy precipitation events, from the watershed to the sea. The atmosphere, continental hydrology, and the ocean are modelled using a coupled numerical approach to take into account feedbacks and to achieve a real continuity of forcing throughout the brief but intense events. Comparisons between models results will be shown concerning the precipitation rate and the river discharge during the flash floods as well as the oceanic current and the variations of the sea level during the storm.

Keywords: Coastal processes, Air-sea interactions, Gulf of Lyon, Precipitation regime, Sediment transport

A watershed-scale hydrologic model, SWAT [1], receives precipitation from the atmospheric model MESO-NH [2] which feeds the second runoff model, MARINE [3], focusing on the flash flood events. The ocean circulation model SYMPHONIE [4] redistributes freshwater and suspended matter in the marine environment. Simultaneously, the coupling of SYMPHONIE with the sea state model WAVEWATCH III [5] produces a feedback from the storm-increased sea level on the river discharge and hence on the flooding of the coastal plain. The simulation of several intense events will be presented and illustrated by comparisons with observations taken along the water continuum of the Têt river (~1400 km²), a French Mediterranean coastal basin and in the coastal ocean of the Gulf of Lion (Fig 1). Attention will be paid to the simulation of chronology of the river discharge and to the different factors (wind, waves, tide, atmospheric pressure) affecting the sea level at the river mouth potentially responsible of the coastal plain flooding.

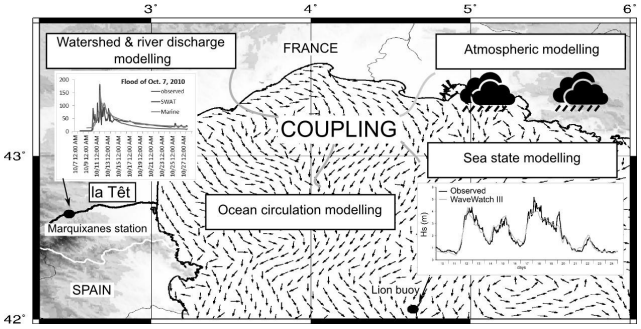

Fig. 1. Map of the Gulf of Lion with the models layout and illustrations of model results

References

1 - Jeong, J., Kannan, N., Arnold, J.G., Glick, R., Gosselink, L., Srinivasan, R., Harmel, R.D., 2011. Development of sub-daily erosion and sediment transport algorithms for SWAT. Trans. ASABE 54, 1685–1691.

2 - Lafore, J. P., J. Stein, N. Asencio, P. Bougeault, V. Ducrocq, J. Duron, C. Fischer, P. Hereil, P. Mascart, J. P. Pinty, J. L. Redelsperger, E. Richard, and J. Vila-Guerau de Arellano, 1998. The Meso-NH Atmospheric Simulation System. Part I: Adiabatic formulation and control simulations. Annales Geophysicae, 16, 90-109.

3 - Roux, H., Labat, D., Garambois, P.-A., Maubourguet, M.-M., Chorda, J., Dartus, D., 2011. A physically-based parsimonious hydrological model for flash floods in Mediterranean catchments. Nat. Hazards Earth Syst. Sci. 11, 2567–2582.

4 - P. Marsaleix, F. Auclair, and C. Estournel, 2006. Considerations on open boundary conditions for regional and coastal ocean models. Journal of Atmospheric and Oceanic Technology, 23:1604–1613

5 - Tolman, H., 2015. User manual and system documentation of WAVEWATCH-III version 5.08,Tech. rep. NOAA/NWS/NCEP/MMAB.