Non-hydrostatic hydro-meteorological atmospheric simulations of extreme weather events: WRF and WRF-Hydro models applications to a case study in central Italy

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Abstract. There is an important need to gain high resolution and reliable precipitation data both for climate and weather applications and to improve precipitation predictability of extreme meteorological events, especially over complex topography areas and for convective events. Historically, the atmosphere and the hydrological branches have been maintained separate, with a sort of cause (precipitation) and effect (runoff) relation, relating each other. Recently the exigency of improving hydro-meteorological predictions for flood, droughts and water resources has promoted a fully two-way coupled atmospheric-hydrologic approach. Fully coupled high-resolution models, such as WRF-Hydro, are new generation tools designed to link multi scale processes of the atmosphere and terrestrial hydrology and to perform coupled and uncoupled multi-physics simulation at wide range of spatial and temporal scales. In this contest, the use of WRF-Hydro fully coupled model is compared to the classical WRF stand alone meteorological approach and the possible role of runoff lateral redistribution and infiltration and exfiltration processes in improving the representation of moist and heat fluxes is analyzed. In addition to that, the two model approaches are explored for different temporal scales (from event to seasonal scales) and spatial resolutions. In this talk a series of WRF stand-alone and WRF-Hydro fully coupled applications are shown and compared. In particular the main experiment is applied to one of the most important basins in central Italy (the Tiber catchment), characterized by complex topography and typical Apennine regime (annual precipitation characterized more by liquid precipitation, than by snow accumulation). Simulations are performed both at the event scale and annual scale at 12 km and 4 km atmospheric resolution, with a particular focus on warm season convection.