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An integrated atmospheric-hydrological model for high-resolution climate projections in the Adriatic Sea basin

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AdriaClim is a project funded by the Italy-Croatia CBC Programme aimed at improving climate change information and providing monitoring and management tools for adaptation strategies in Adriatic coastal areas. Among the innovative tools planned, an integrated online coupled (Hydro-Meteo-Ocean-Wave-Biogeochemistry) model for the Adriatic Sea will be developed, which will run high-resolution simulations for the present/past time and future newly developed scenarios. The concept behind the integrated model is a comprehensive high-resolution representation of the hydrological cycle at the regional (Adriatic basin) level, overcoming classical approaches partitioning the description of the main physical processes into different compartments (i.e., ocean, atmosphere and terrestrial hydrology) interacting poorly each other and possibly missing crucial feedback, especially for long-term (climate) analyses.

This note presents the coupling approach for the atmospheric-hydrological component, introducing the main features that will be developed and the pilot areas used as test cases. The modelling system will be based on the WRF-Hydro architecture, which provides an extensible, multi-scale and multi-physics modelling capability for land-atmosphere coupling studies. WRF-Hydro modelling system will be applied over the whole Adriatic Basin, encompassing many catchments extending over six countries. A single 6 km-resolution domain will be used concerning atmospheric processes, with a further downscaling until 600 m-resolution for hydrological modelling. The hydrological model will be preliminary calibrated against multiple discharge observations in river sections as close to the rivers' mouths as possible with one full year simulation. Later, climatic simulations will be executed in fully coupled fashion for the historical period 2001-2020 and the future period 2031-2050 using the available EUROCORDEX ensembles as regional climate forcings.

First results of the ongoing activities will be presented, highlighting both the main outcomes in terms of modelling performance and the potential of further coupling to ocean, waves and biogeochemistry modelling components. The complete modelling system will be used for addressing a wide range of issues, including inundation/storm surge, salt wedge intrusion, sediment transport, transport and diffusion of E. coli, deterioration of transitional and coastal waters.