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River runoff and coastal dynamics behavior: daily variability versus monthly mean discharges.

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Coastal dynamics are highly influenced by fresh water discharges and play a fundamental role in driving hydrological, physical and biogeochemical characteristics on short and long scales both in time and space (i.e. from daily to inter-annual and decadal processes, from estuarine or coasts to open sea dynamics). Besides, the understanding of these processes is necessary to asses environmental impacts and to define management policies.
In order to correctly simulate coastal processes, hydrodynamical models need to be forced with adequate data. Inputs for riverine freshwater discharges are generally derived as monthly means from climatological or historical data sets. Their quality and temporal frequency can strongly influence the model results and skills in describing processes with a short time scale, or that are the results of the interaction with atmospheric fields usually imposed with short time scales.
The behaviour of the Adriatic sea in its northern shallow part is strongly affected by its numerous riverine inputs, the majority of them being located on the Italian western coast. Among them, the Po and the near Adige and Brenta rivers contribute up to 60% of the whole Adriatic freshwater. The effects of the Po river plume (defined as water with salinity lower than 32) determine the coastal primary production (and indirectly basin wide), affect the rising of hypoxic and anoxic bottom water condition, cause the development of strong lateral gradients that influence both the coastal and basin circulation and drives processes that can lead to the formation of the Northern Adriatic Dense Waters (NadDW). River discharge interaction with atmospheric forcing result in two major patterns of evolution of the plume: southward along the Italian coasts in a narrow filament or across the northern part of the basin spreading toward the Istrian coasts.
To study the effects of different riverine inputs on the skill of a model two 8 year runs (from 2003 to 2010) of the Regional Ocean Modelling System were implemented over the Adriatic Sea. The two simulations were run on the same 2 km orthogonal grid with 20 sigma vertical levels; both atmospheric forcing fields are derived from the COSMO I7 model run at SMR-ARPA-EMR that has a 7 km horizontal grid and a time step of 3h. Riverine discharges instead are, in the first numerical experiment (EXP0), climatological monthly means while in the second experiment (EXP1), daily streamflow averages collected by Italian Regional Environmental Protection Agencies (ARPA).
We will focus on the 2006 due to its high streamflow and wind regime that guarantee to cover most of the possible combinations of forcing. Results show that the yearly and seasonal mean plume areas are 50% smaller in EXP1 compared to EXP0 and the former better represent the plume daily fluctuations.