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Evaluation of the dispersion of marine pollutants associated with a river discharge by means of numerical simulations and satellite analysis

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The aim of the present work is the estimate of passive pollutant dispersion associated with the Tiber discharge in the Tyrrhenian Sea using numerical marine circulation models, lagrangian dispersion models and satellite data analysis. Numerical results obtained in different key-studies are compared with the corresponding temporal evolution of the observed chlorophyll and K490 diffuse light attenuation coefficient fields observed by the MODIS TERRA and AQUA satellites, which prove to be suitable tracers for riverine discharge and coastal water tracking, given their much higher values in the coastal area with respect to the open sea. The numerical simulations are made using the Princeton Ocean Model forced by two different kinds of boundary conditions, i.e. climatological and dynamical. The climatological BC are imposed on the water fluxes at the boundaries and are kept constant in time, while the dynamical forcing is obtained by nesting the regional-scale POM within the basin-scale Mediterranean Forecasting System daily analysis fields. The former (static) implementation is easier to implement but has severe operational limitations, especially with respect to the selection of the simulation domain and the season. The latter method, on the other hand, allows to apply the model in almost every part of the Mediterranean Sea and in all seasons. Local dynamical effects on the circulation and on the water density due to the river outflow are accounted for in a simple but effective way, by considering the sub-grid river discharge as a buoyant jet-like feature (Oey, 1996). A lagrangian particle dispersion model is then applied in order to reproduce the effect of turbulent transport of passive tracers within the discharged riverine waters. The simulations are made during significant river discharge episodes in both winter and summer conditions, such as the December 2008 Tiber peak discharge event. The results are discussed with respect to the physical properties of coastal sea waters in the Tiber estuary area considered.