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Operational surface drift prediction using linear and non-linear hyper-ensembles of atmospheric, ocean and wave models in the Adriatic

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The Adriatic is an ideal natural laboratory and test bed to conduct oceanographic research, with a strong concentration of observational and modeling operational effort and expertise, and the area has been already extensively investigated and documented.

The basin exhibits a wide range of competing processes. The bathymetric relief is relatively simple and gentle on the western side, but complex and steep on the eastern side. Regional and local circulation can be strongly constrained by topography and subsequently released in mesoscale activity through barotropic and baroclinic instabilities, filament detachments, eddy generation, etc. The wind regime can be very calm, can be very strong from the northeast with strong lateral shear ("bora winds"), inducing deep water production in winter, or very strong from the southeast with little lateral shear ("sirocco winds").

The forecast of surface velocities, which usually results from a complex combination of ocean, atmospheric and wave forcing, has always been very challenging in the basin. However, our current monitoring and operational predictive capabilities do not allow yet inferring accurate surface drift velocities despite high resolution modeling and extensive surface drifter data sets in the basin. It appears that an entirely different approach is warranted for a definitive significant improvement in surface drift forecast skills.

Multimodel superensemble forecasts, which exploit the power of an optimal local combination of individual models usually show superior forecasting skills when compared to individual models because they allow for local correction and/or bias removal. Here we apply linear and non-linear statistical methods to generate optimal

superensembles combinations from atmospheric, ocean and wave operational models and available local drifter observations to investigate the Adriatic Sea Dynamics in the Gulf of Manfredonia. Optimisation methods are based on a training/forecast cycle and include simple least-square methods, neural networks and genetic algorithms. The performance and the limitations of the superensembles and standard surface drift methods are illustrated and discussed.