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## A data fusion strategy for reanalysis and climate model winds

**Silvio Davison**<sup>1</sup>, Francesco Barbariol<sup>1</sup>, Alvisè Benetazzo<sup>1</sup>, Luigi Cavaleri<sup>1</sup>, and Paola Mercogliano<sup>2</sup>

<sup>1</sup>ISMAR Institute of Marine Sciences, Italian National Research Council, Venice, Italy

<sup>2</sup>CMCC Euro-Mediterranean Center on Climate Change, Capua, Italy

Over the past decade, model reanalysis data products have found widespread application in many areas of research and have often been used for the assessment of the past and present atmospheric climate. They produce reliable fields at high temporal resolution (1 hour), albeit generally at low-to-mid spatial resolution (0.25°-1.00°). On the other hand, climatological analyses, quite often down-scaled (up to few km) to represent conditions also in enclosed basins, lack the actual historical sequence of events and are often provided at poor temporal resolution (6 hours or daily).

In this context, we investigated the possibility of using climate model data to scale ERA5 reanalysis wind (25-km and 1-hour resolution data) to assess the Mediterranean Sea wind and wave climate. We propose a statistical strategy to fuse ERA5 wind speeds over the sea with the past and future wind speeds produced by the COSMO-CLM (8-km and daily-mean data) climatological model. In the method, the probability density function of the ERA5 wind speed at each grid point is adjusted to match that of COSMO-CLM using a histogram equalization strategy. In this way, past ERA5 data are corrected to account for the COSMO-CLM wind distribution, while ERA5 scaled wind sequence can be also projected in the future with COSMO-CLM scenarios. Comparison with past observations of wind and waves confirms the validity of the adopted method.

We have tested this strategy for the assessment of the changing wind and, after WAVEWATCH III model runs, also the wave climate in the northern Adriatic Sea, especially in front of Venice and the MOSE barriers. In general, this data fusion strategy may be applied to produce a scaled wind dataset in enclosed basins and improve past and scenario wave modeling applications based on any reanalysis wind data.