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# A comparison of gap-filling methods for HF radar data in the gulf of Naples

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An HF radar has been operating in the Gulf of Naples (Southeastern Tyrrhenian Sea) since 2004. The system is a SeaSonde manufactured by CODAR Ocean Sensors Ltd. Three mono-static radar units working at about 25 Mhz ensure the surface current mapping over nearly the entire Gulf of Naples area. The grid resolution is 1 Km with a range of approximately 40 Km. Usually HF radar data present gaps, especially near the open boundary where the performances of the system are reduced. A regular coverage with no gaps is essential to utilize HF radar-derived surface velocities in a number of applications which go beyond the straightforward local dynamics investigations, such as pollutant transport studies, search and rescue situations etc. It is thus necessary to apply interpolation processes aimed at obtaining a regular grid without gaps, plausibly characterized by a resolution equal to that of the system. In this work, three techniques are applied to fill the gaps in the hourly surface current fields. The techniques are: self organizing maps (SOM), open boundary modal analyses (OMA) and data interpolating empirical orthogonal functions (DINEOF). To establish which one is the best, we evaluated the error associated with each method. The error is obtained subtracting the actual radial surface current measured in a grid point from the value derived by one of the three techniques in the same point, assuming there an absence of measurement. The gaps are artificially created over different areas, of different size and differently distributed over the Gulf of Naples, following two approaches: the first is based on a non-random gap generation with the intent of obtaining a gradually increasing gap area; the second is based on a completely random gap generation. In both cases the gap percentage ranges from 10% to 60% of the total gulf area with an increase of 10%. The SOM and DINEOF methods give a lower RMSE, both in direction and magnitude, in both scenarios . The performance of OMA worsen significantly if the gaps are concentrated in a subarea of the domain with at least 30% of holes.