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An application of Self-Organising Maps method in recent Adriatic environmental studies and its perspectives

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Self-Organising Maps (SOM) method, a kind of neural networks capable of recognizing patterns in various types of datasets, has been recently introduced to different oceanographic studies, from mapping of satellite-based data (e.g., SST, Chl_a, SSH, winds) to in situ and ground-based datasets (e.g., currents from HF radars and ADCPs, various combinations of sampled environmental parameters). Herein we present three recent research studies performed in the Adriatic Sea which applied the SOM method to various environmental data. The first study applied the SOM method to a long (50 yrs) series of thermohaline, dissolved oxygen and nutrient data measured over a deep (1200 m) Southern Adriatic Pit, in order to extract characteristic deep water mass patterns and their variability. Among other issues, a redefinition and sensitivity of deep water masses to different attributive parameters has been reached. The second study encompassed the classification of surface current patterns measured by HF radars over the northernmost part of the Adriatic, by applying the SOM method to the HF radar data and operational mesoscale meteorological model surface wind fields. The major output from this study was a resemblance between characteristic ocean current distribution patterns with and without wind data introduced to the SOM, implying the dominant wind driven dynamics over a local scale. That nominates the SOM method feasible and a basis for generation of very fast real-time forecast models over limited domains, based just on the existing atmospheric forecasts and basin-oriented ocean experiments. The third study is attempting to find the connection between underwater sound intensity and the distribution of bottlenose dolphins over their natural habitat in coastal eastern Adriatic waters. SOM-based mapping of characteristic sound and bottlenose dolphin distributions over a habitat is trying to prove or reject the hypothesis that the man-made underwater sound is affecting the behaviour of the dolphins, and have negative implications to those marine animals that use sound as their primary sense to communicate, identify objects of interest, locate prey and orientate underwater. Altogether, a usefulness of the SOM method has been recognized in different aspects of ocean environmental studies (mapping of characteristic environmental profiles, operational oceanography, evaluation of an anthropogenic impact to a marine organism and habitat), and may be a useful tool in future investigations of understanding of the multi-disciplinary dynamics over a basin, including the creation of operational environmental forecasting systems.