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Bio-geographic classification of the Caspian Sea

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Like other inland seas, the Caspian Sea (CS) has been influenced by climate change and anthropogenic disturbance during the last few decades. However, due to the lack of a comprehensive archive of environmental observations for this area, the scientific understanding of this water body remains poor. In this study, an ecogeographical classification of the CS based on physical and biological information derived from space is developed. We applied self-organizing maps (SOMs) to satellite-derived physical data sets for sea surface temperature, wind speed, sea ice, photosynthetically active radiation and total suspended matter together with bathymetry and sea surface salinity data for clustering. As many of these variables are collinear, a subset of four independent variables was selected as input for the algorithm, including sea surface temperature, bathymetry, sea ice and the seasonal variation of sea surface salinity. Derived physically-based ecoregions were then compared with the annual mean climatology of remotely-sensed chlorophyll a, validated against a limited set of in situ chlorophyll data, as a means of cross validating the physically-based classifications. A good agreement between the physically-based and chlorophyll-based regimes was observed. The classification results showed a robust separation between the northern and the middle/southern basins. This differentiation can be seen in all of the individual physical variables as well as in the chlorophyll a distribution pattern and can be attributed to the great influence of the Volga River inflow. The second major pattern obtained was the separation of the shallow near-shore waters from the off-shore waters of the CS. The obtained classes also parallel the surrounding land biomes and climatic zones such as the continental climate, sub-tropical climate and the steppe zones. These results can assist policy makers and managers with a general outlook on the different major ecosystems of the surface pelagic waters of the CS. Researchers can benefit applying the result for different purposes such as ecosystem conservation, sampling area selection and ecosystem modeling.

Keywords: Ecosystem classification, Ecoregions, Self Organizing Maps, Surface pelagic, Caspian Sea