**EXTENDING SURFACE BIO-OPTICAL PROPERTIES TO DEPTH: A NEURAL NETWORK FOR MERGING OCEAN COLOR AND ARGO DATA**

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The present study examines the potential of coupling ocean color observations with Argo (temperature/salinity) profiles to infer the vertical distribution of chlorophyll *a* concentration (Chla), phytoplankton community size indices (PCSIs) and particulate backscattering coefficient (bbp). Two artificial neural networks (ANNs) are developed: one to retrieve Chla and PCSIs and the second for bbp. These ANNs are trained and validated using databases of vertical profiles of temperature, salinity, and bio-optical properties collected by Bio-Argo floats, and concomitant satellite-derived products. Two main input components are needed to retrieve the vertical distribution of the bio-optical parameters: (1) a surface component, i.e. satellite-based estimates computed from 9-km, 8-day MODIS Aqua composites and (2) vertically-resolved physical properties derived from temperature and salinity profiles measured by Argo floats. Both ANNs are validated using 20% of the entire database (chosen randomly). The accuracy of the estimated bio-optical properties is very promising (i.e. median absolute percent difference comprised between 40 and 55% for Chla and PCSIs retrievals and of 18% for bbp retrieval). A second validation is presented and based on a dataset acquired by four Bio-Argo floats not integrated in the MLP training and validation databases and chosen in four major oceanic basins. Again, the retrieval of the bio-optical properties is very consistent and the accuracy is very satisfactory (i.e. median absolute percent difference of 18%). The *in situ* data collected for training the ANNs are representative of the global open-ocean in terms of trophic and oceanographic conditions, making the proposed methods applicable to most open-ocean waters.