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Dependence of the diffuse attenuation coefficient for underwater photosynthetically active radiation on chlorophyll-a and colored dissolved organic matter in Peter the Great Bay

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Abstract. The study is devoted to solving the problem of determining regional relationships between the characteristics of the underwater light field and the bio-optical characteristics of the seawater column. The aim of the study is to determine the influence of chlorophyll-a (Chl-a) (*C*) and colored dissolved organic matter (CDOM) (*D*) concentrations on the variability of underwater photosynthetically active radiation (PAR) for certain areas of Peter the Great Bay in the Sea of Japan (Amur Bay, Ussuri Bay, and Posyet Bay). To this end, the dependence of the diffuse attenuation coefficient (*KPAR*) of the underwater PAR on each of the specified bio-optical characteristics in these areas was analyzed. The experimental data were obtained by measuring chlorophyll-a and CDOM concentrations using the SeaBird SBE 19-plus multiparameter probe with the Licor Li-193 spherical PAR sensor and calibrated WETStar fluorescent sensors. Three types of models were used in the study: *KPAR* was calculated only through *C* (mC), only through *D* (mD), and simultaneously through *C* and *D* (mCD). It was found that in Amur Bay and Ussuri Bay, *KPAR* variability is primarily influenced by variations in CDOM content, while in Posyet Bay, it is determined by variations in Chl-a concentration. Incorporating both Chl-a concentration and CDOM concentration (mCD model) in all analyzed cases increases the accuracy of *KPAR* estimation from measurements of optically active components by 30–40 %. For the general model, this approach improves accuracy by approximately twofold compared to using Chl-a concentration alone. The application of the general mCD model for different areas of Peter the Great Bay yielded *KPAR* estimates with the following relative root mean square errors: $RMSE\ \%^{\mathrm{mCD}}_{\mathrm{Amur}} = 23.6$, $RMSE\ \%^{\mathrm{mCD}}_{\mathrm{Ussur}} = 19.3$, $RMSE\ \%^{\mathrm{mCD}}_{\mathrm{Posyet}} = 15.5$. It is advisable to use the general mCD model, as it demonstrates greater adaptability to regional conditions in Peter the Great Bay.

Keywords:
underwater photosynthetically active radiation, colored dissolved organic matter, chlorophyll-a, bio-optical characteristics, optically active constituents, the Sea of Japan

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