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Discussions

Interactive comment on "Warmer winters causes an increase of chlorophyll-a concentration in deeper layers: the opposite role of convection and self-shading on the example of the Black Sea" *by* Elena A. Kubryakova and Arseny A. Kubryakov

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Vladimir Silkin (Referee) vsilkin@mail.ru Understanding the critical role of winter convective mixing in the annual dynamics of phytoplankton is well known. However, this factor's effect on the vertical distribution of chlorophyll remained unclear, which was due to the lack of reliable methods. The development and improvement of methods for remote sensing of the sea surface have made it possible to obtain information about the environmental situation over large areas. However, this information is only concerned with the sea surface. The emergence of floating buoy technology allows solving the

vertical distribution of the environmental indicators. The authors of this paper used Biogeochemical-Argo floats' technology to find out the regularities of the vertical distribution of chlorophyll and estimate the depth maximum of chlorophyll (DCM) in the Black sea. Comparing the warm year 2016 with relatively weak convective mixing and the cold year 2017 with intense mixing, they found significant differences in the DCM position. To explain this phenomenon, the authors propose the hypothesis of regulating the DCM position using light. It is based on the idea that chlorophyll concentration in UML depends on the amount of nitrogen received in winter. Since the amount of incoming nitrogen is determined by the intensity of convective mixing in winter, after cold winters, should be expected higher chlorophyll concentrations in UML and, therefore, higher light absorption. By studying the light attenuation coefficient's distribution with depth, the authors revealed the critical role of the DCM position's self-shadowing effect. My familiarity with the previous version (dated June 16, 2020) and the current version (dated October 15), as well as with the comments of reviewers, allowed me to conclude that the new version meets all the requirements and can be published. However, it seems to me that the paper will be improved if the authors take into account my comments and recommendations: 1. In the Introduction, it is necessary to formulate the research objectives more clearly. In particular, the sentence on line 68 should be moved to the end of the Introduction. 2. On lines 78 - please provide a reference. 3. In the Results, provide only the authors' results and move the comments and reference to the Discussion (Lines, 144-145, 157-158, 160-163, 173-183, 201-205, 2016, 234, 244, 265). Individual comments and recommendations: 1. Line 19 and 201-chlorophyll concentration and productivity are not the same things. 2. Line 35 - "the biomodelling study" rewrite as "the modeling study.Âż 3. Line 85 - Cold intermediate layer mark as CIL and use it later in the article. 4. Lines 50-55. Rewrite these sentences "At the same time, high values of irradiance may cause photoinhibition and decrease of Chl near the surface (Platt et al., 1982) caused by several effects including non-photochemical quenching, photoinhibition, and photoadaptation (Falkowski & Raven, 2013). The latter is partly associated with the increase of Chl content per cell

(MacIntyre et al., 2002), documented for the Black Sea in (Finenko et al., 2002, 2005; Churilova et al., 2019)Âż. Here it would be best if you replaced photoadaptation with photoacclimation, since changes in the chlorophyll content in the cell are acclimation. Further, the chlorophyll content in the cell increases when the light intensity decreases. Therefore, it decreases at the surface. 5. Line 110-111. Rewrite this sentence. 6. Line 121. More correct to write Kd(z) rather than Kd(λ) since this parameter changes with depth. 7. Line 129-decode DAC. 8. Line 187-there is no dot at the end of the sentence. 9. Line 315-chlorophyll and biomass are not the same things. 10. Figure 4 is missing the dimension for PAR. 11. In the caption to Figure 7, there is no designation of the curves (red and blue).

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