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Interactive comment on "Vertical distribution of chlorophyll a concentration and phytoplankton community composition from in situ fluorescence profiles: a first database for the global ocean" *by* R. Sauzède et al.

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Answers to Referee #1:

We are grateful to the reviewer for his constructive suggestions to clarify our manuscript. We have modified it accordingly and think that the new version is now improved. Our responses as well as the description of actions taken in regards to the comments are detailed below. We hope that we have sufficiently addressed the issues that were raised by the reviewer.

Comments from Referee:

1- Some crucial information, namely regarding the characterization of FLAVOR is missing in the present article. I would suggest adding this information. As well as a brief explanation how values of size-based community composition were obtained.

2- Authors discuss thoroughly the fact that Chla fluorescence is not Chla, but just a proxy for Chla. However, a key issue is the strong dependence of Chla fluorescence on light environment. Authors do not specify if any correction/modeling was made to correct this effect. Or at least, they should mention this issue in Discussion.

Author's response:

1- We agree that FLAVOR method described in Sauzède et al. (JGR, 2015) is at the heart of this study and was likely not enough detailed in this paper. This was our initial deliberate choice as the main focus of paper was to present the "calibrated data base". However given this issue is raised by both reviewers, we have subsequently tried to explain the algorithm more thoroughly in the Section 2.3 "Conversion of chlorophyll fluorescence into chlorophyll a concentration and phytoplankton community composition".

2- Some details were added to better understand the limitations of the method including the dependence of Chla fluorescence on light environment that is not corrected by the FLAVOR method. In the manuscript, it was already mentioned that "It is important to note that one of the main failures of FLAVOR is that the impact of the daytime Non-Photochemical Quenching (NPQ; see, e.g., Cullen and Lewis, 1995), which is responsible for a decrease of chlorophyll fluorescence values at high irradiance, is not accounted for by the method. If density profiles are available with fluorescence profiles, the NPQ could be corrected using the method of Xing et al. (2012) which involves substituting the fluorescence values acquired within the mixed layer by the maximum value within this layer." (p. 374 lines 3-9). However, we agree that this point is not sufficiently stressed out so we have added a paragraph on the limitations of the

method in the Section 2.3.

Author's changes in manuscript:

The main modifications to the manuscript made were:

1- Page 374 line 1, we added details about FLAVOR algorithm:

"FLAVOR is composed of two different neural networks: the first one was trained to retrieve the vertical distribution of [TChl] and the second one to retrieve simultaneously the vertical distributions of [microChl], [nanoChl] and [picoChl]. Both neural networks were trained and validated using a large database including 896 concomitant in situ vertical profiles of HPLC pigments and chlorophyll fluorescence. These profiles were collected as part of 22 oceanographic cruises representative of the global ocean in terms of trophic and oceanographic conditions, making the method applicable to most oceanic waters. The diagnostic pigment-based approach of (Uitz et al., 2006), based on (Claustre, 1994) and (Vidussi et al., 2001) was utilized to estimate the biomass associated with the three pigment-derived size classes for each profile. Finally, the dataset of concurrent fluorescence profiles and HPLC-determined [TChl], [microChl], [nanoChl] and [picoChl] at discrete depths was used to establish the neural network-based relationships between the fluorescence profile shape and the vertical distributions of [TChl] and phytoplankton community. The schematic overview of the FLAVOR method is shown on Figure 4 in Sauzède et al. (2015a). The global absolute errors of FLAVOR retrievals are 40%, 46%, 35% and 40% for the [TChl], [microChl], [nanoChl] and [picoChl] respectively (Sauzède et al., 2015a). The global absolute errors of FLAVOR retrievals are 40%, 46%, 35% and 40% for the [TChl], [microChl], [nanoChl] and [picoChl] respectively (Sauzède et al., 2015a)."

2- Page 374 line 3, we have added a specific paragraph that reports the potential limitations of our method:

"Admittedly, the FLAVOR method has some limitations. The dependence of chlorophyll

fluorescence on light environment is probably intrinsically accounted for in the algorithm thanks to the geolocation and date of acquisition used as inputs for the training. However, one of the potential concern with FLAVOR is that the impact of the daytime Non-Photochemical Quenching (NPQ; see, e.g., Cullen and Lewis, 1995), responsible for a decrease in chlorophyll fluorescence values at high irradiance, is not accounted for by the method. The NPQ uncorrected fluorescence profile shape is indeed used to retrieve the vertical distribution of phytoplankton biomass (see details in Sauzède et al., 2015a). Note that, if density profiles are available together with fluorescence profiles, NPQ can be corrected using the method of Xing et al. (2012). This method involves substituting the fluorescence values acquired within the mixed layer by the maximum value within this layer.

It has been previously mentioned that FLAVOR is not adapted for the retrieval of chlorophyll a concentration on a fluorescence profile-by-profile basis (Sauzède et al., 2015a). Rather, FLAVOR and, hence, the resulting database are relevant for large scale investigations, e.g. development of climatologies of the vertical distribution of chlorophyll a from which regional anomalies or temporal trends might be evidenced. In fact, the method was validated using a global database and it is not excluded that the retrievals from FLAVOR might be regionally biased. For instance, Sauzède et al. (2015a) have shown that FLAVOR retrievals for the Southern, Arctic and Indian Ocean are slightly less accurate than for the other basins. This is likely because the method is not enough constrained in these specific areas, which are known for data scarcity. Additional details about the performance of the method for various oceanic basins are given in Sauzède et al. (2015a), in Figures S3, S5-S7. Finally, it is worth recalling here that the relationships between the phytoplankton biomass or community composition profiles and the fluorescence profiles is assumed to be identical for profiles acquired before 1991 (not involved in the training data set because of lack of HPLC data) and after 1991 (only used for the training process). In the context of possible use of this database for supporting analysis looking for trends or shift in chlorophyll a time series, this assumption will have to be taken into consideration."

Interactive comment on Earth Syst. Sci. Data Discuss., 8, 365, 2015.