Dear colleague,

You have made two important critical remarks about our work (reproduced below), and we thank you for having pointed out these weaknesses; consequently we have modified the initial version to account for your criticism.

Actually, the methodological part has been completely recast and the missing information is now fully (yet concisely) provided- see below the modified section-.

The debate about the use and the exact significance of the term  $(a_y)$  –your second question-, is introduced as a logical complement of the methodology, so that this new section is the continuation of the recast paragraph. The difference between the present  $a_y$  quantity, and the  $a_{CDM}$  quantity as produced by GSM is explained, and a reference is given (histograms in Fig.7 from Morel-Gentili, 2009) which showed at the scale of the global ocean, the systematic (small) difference existing between these two quantities. Your comments:

i our comments.

1- Methodology:

The explanation of the derivation of  $a_{y}$  for the present paper is insufficient. This needs to be clarified. I do not know what the origin of the total absorption is. Is this in situ measurements? Inversion of reflectance spectra? I understand it's completely described in Morel and Gentili 2009 but it will be simple enough to restate it here.

## 2- I'm not sure the "a\_{y}" abbreviation

should be used in the context it is here. It has been used in the past, unfortunately, to refer to absorption by CDOM, whereas in this case it is clear that the absorption described is the sum of CDOM and particulate detritus absorption at this wavelength. I would suggest a\_{cdm} as an alternative, but on the other hand this is used to denote the CDM product of the GSM algorithm – while these parameters are supposed to be the same, because of their divergent derivation they should be distinct. I don't have a solution here,

Recast section, as follows (addition in red)

## "METHODOLOGY

The technique developed to separately assess the yellow substance absorption coefficient at a given wavelength  $\lambda$ , hereafter denoted  $a_y(\lambda)$ , and the chlorophyll concentration, [Chl], was described in detail elsewhere (Morel and Gentili, 2009). For completeness, the main features are summarized below. In Case-1 waters, the above quantities were related through a non-linear mean relationship (Morel, 2009; Morel and Gentili, 2009) of the form

$$a_{y}(\lambda, [Chl]) = Y(\lambda) [Chl]^{0.63}$$
(1)

where the term a<sub>y</sub>, empirically related to [Chl]

## $a_{y}(\lambda, [Chl]) = a_{tot}(\lambda, [Chl]) - a_{w}(\lambda) - a_{p}(\lambda, [Chl])$ (1')

was obtained by subtracting the pure water absorption,  $a_w(\lambda)$ , and the particle absorption,  $a_p(\lambda)$ , from the total absorption,  $a_{tot}(\lambda)$ . The spectral coefficients  $a_w(\lambda)$  were adopted from Pope and Fry (1997), and for  $\lambda$ =400 nm, from Morel et al. (2007c); the particle (i.e., algal and non-algal particles) absorption coefficients,  $a_p(\lambda, [Chl])$ , which depend on [Chl] according to power laws, were adopted from Bricaud et al., (1998); the total absorption coefficients,  $a_{tot}(\lambda, \lambda)$ [Chl]), also depending on [Chl], were obtained by inversion of the spectral attenuation coefficient and spectral reflectance,  $K_d(\lambda, [Chl])$  and  $R(\lambda, [Chl])$ , respectively (see Eq. 3 in Morel, 2009). According to the way it is derived, the a<sub>v</sub> term actually refers to, and is essentially determined by, the absorption by the dissolved yellow substances (also called chromophoric dissolved organic matter, CDOM). However, those small sized non-algal particles (colored detrital material), able to pass through GF/F filters (effective pore size  $\sim 0.5$  $\mu$ m), and thus not included in  $a_p$ , may also contribute to the formation of the present  $a_v$  term (discussion in Morel, 2009). Therefore a<sub>v</sub> may slightly exceed the absorption by truly dissolved materials (operationally defined as those able to pass through a membrane filter with 0.2 µm pore size). Note that the absorption coefficient (at 443 nm), as retrieved via the "GSM" method (Siegel et al., 2002), and denoted a<sub>CDM</sub> by these authors (where "CDM" stands for colored detrital material), describes the absorption by the dissolved organic matter (i.e.,  $a_v$ ), plus the absorption by non-algal (supposedly "detrital") particles. At least in principle, a<sub>CDM</sub> must exceed the absorption by truly dissolved materials, yet by a small amount (discussion in Siegel et al., 2002); it also must exceed the present a<sub>v</sub> term by an even smaller amount, since the tiny non-algal particles (within the 0.5- 0.2 µm range) contribute to the formation of  $a_v$  (Eq. 1'). Actually, the histograms of the  $a_{CDM}$  and  $a_v$  distribution within the global ocean (Fig. 7c-d, in Morel and Gentili, 2009) clearly show that a<sub>CDM</sub> is systematically, (albeit slightly, by 10-15%) larger than  $a_v$ .

The above Eq. 1 represents an "average" relationship in the sense that it statistically derives from a considerable number of optical data, namely the  $a_p(\lambda,[Chl])$ ,  $K_d(\lambda,[Chl])$ , and  $R(\lambda,[Chl])$  coefficients, obtained in several zones of the world ocean, at differing seasons, and in various trophic situations characterized by differing [Chl]. When assembling these various data, however, the restriction was to exclusively consider oceanic environments with well identified Case-1 waters."

Another point and question you raised is as follows, and deserves an explanation

3- One thing that really grabbed me was the distribution of  $\Phi$  in the eastern North Atlantic (Fig. 2). While clearly below that of the Mediterranean in both seasons, the mean was clearly larger than 1. This suggests a bias in the "mean state" bio-optical algorithm. A global  $\Phi$  product would probably be of considerable interest.

Actually, there is no bias; the median value for the global ocean is well unity; the eastern north Atlantic, however, is permanently above 1. A sentence (see below, in red) has been introduced in the revised text which hopefully clarifies this issue; the reference to an already published histogram is provided by which it was shown that the "mean state" is well centered on  $\Phi = 1$ .

"Globally, the Mediterranean  $\Phi$  values are systematically above (up to twice) those in the neighboring Atlantic, or those of the whole ocean within the zonal (30-45°N) belt (Fig. 3, upper row). Nevertheless, zonally averaged  $\Phi$  values are clearly larger than 1 in the eastern Atlantic, or everywhere within the zonal belt, which means that there would exist at these latitudes a permanent excess of CDOM in comparison with the mean oceanic "state" (i.e., the state corresponding to  $\Phi = 1$ ). Actually, when the whole ocean is considered the central  $\Phi$ value is well unity (see histograms in Morel and Gentili, 2009), but in the Northern hemisphere and at the latitudes considered,  $\Phi$  is always above 1 (ibid., Fig 5, and Fig 4 in Siegel et al., 2002). This observation is here confirmed."

We hope that we have complied with your questions and criticism, and thank you again for your helpful comments.