A multiproxy approach to understanding the "enhanced" flux of organic matter through the oxygen deficient waters of the Arabian Sea review (referee #2)

General comments:

The present manuscript aims to study mechanisms controlling the organic matter flux through the Oxygen Deficient Zone (ODZ) in the Arabian Sea. The approach is complex but the explanations are relevant and on average well described. Some of them have been tested and measured for this purpose but some of them are just assumed. This should be clarified in the introduction.

In the discussion, it seems that mechanisms M1 and M2 (carbon remineralization and growth efficiency and chemoautotrophy) are the most relevant based on the present dataset. Based on XPS measurements, mineral protection appears to have a low effect on organic matter flux. Hypothesis on zooplankton interference and additional refractory material can not be proved and seems to be not very conclusive. Finally sinking speed changes should be a robust idea but again no data set are present here to sustain (or not) this hypothesis.

The methodology of sediment trap collection is not clear. How the sample traps are preserved from the organic matter degradation during the deployment ? Did authors deploy traps by using formaldehyde poison or not ? If traps are deployed from 12h to 48h, we were wondering if the organic matter is still intact after 2 days of particle matter collection in water depth where biological activity is intense. Secondly, authors should know that swimmers (zooplankton which swim into the trap and die there from contact with the poison) may be a significant problem in the use of sediment traps to estimate the particulate flux of certain elements and compounds even at depths greater than 1000m and swimmers certainly are a critical problem for the use of traps in the very important surface waters (Michaels et al. 1990, Lee et al. 1992). Any precision of how sediment traps samples have been collected. Did authors remove the swimmers from the trap samples ? A clarification is necessary here to justify the robustness of the mass flux and the carbon and nitrogen concentrations measured in the samples.

An important point should be also notified here. The ballast effect might play an important role in the sinking flux (and the organic matter export) if a phytoplankton biomass bloom occurs in the euphotic layer acting as a glue for lithogenic particles (dust particles alone do not export so much). Moreover, additional TEP (transparent exopolymer particles), which are formed abiotically from dissolved precursors and released by phytoplankton, should be also consider in the present manuscript. Because of their high abundances, large size and high stickiness, TEP can alter the sinking particles flux by aggregating solid particles (Passow, 2002). Finally, others studies revealed that the positively buoyancy of TEP can largely affect the sinking particle export and then complicate the export mechanism and the ballast theory (Azetsu-Scott and Passow, 2004). A point should be mentioned in the manuscript regarding the possible TEP impact in ODZ: what is the fate of TEP in the ODZ ? Did authors analyze TEP in the trap samples ?

Specific comments:

- Page 7 line 9-14: What is the definition of "pellets" ? Detail more the protocol used to collect the particulate matter in traps

- Page 9 line 13 : why sinking particles are collected at 80m for the incubation studies ? Is it related to the DCM depth in order to get a maximum of fresh organic matter ? Explain more.

- Page 12 first paragraph: any idea of the oxygen remineralization rates on sinking particles ?

- Table 1: add a column with the trap deployment duration. What are the standard deviation error on parameters ? Change "sed rate" by "flux"

- Figure 1: Stations location should be represented on all graphs. Add units on Sigma-t plot. Add a diagram theta-S-O2 with water mass definition

- Figure 2: in the graph A, the maximum of mass flux (station 2, 80m) is not represented here. This should be adjusted (63.2 g/m2/yr). Add error bars on all plots

- Figure 7: why plots with 40 μM oxygen are different between panel A and B ?