General comments to all three referees

We are thankful to the three reviewers for their thoughtful comments on the manuscript. After a careful reading of the reviews, it is clear that we will need to modify the text, some figures, as well as substantial parts of the manuscript itself to achieve more clarity. This will require some time, but in the meantime we wish to outline how we would like to respond, and to clarify some of the concerns raised by the referees. We already took care of small (i.e., typo) changes based on specific comments of the reviewers, and in the figure of the conceptual model.

Our modeling study was part of a multidisciplinary project (PROMESS project; see *Oceanography* **31**(4)) for which we gathered data in the San Jorge Gulf, located on the Patagonian Shelf, in Argentina. Many data are still unpublished as journal papers but available in two PhD and MSc theses. These data include echograms showing zooplankton vertical migration in the water column (see Figure 1). Moreover, a large number of observations on diel migratory patterns are also found in the published literature, such as for the continental shelf of Eastern United States (Ashjian et al. 1998), the inner Scotian shelf (Cochrane et al. 1991), the Gulf of Maine (Baumgartner and Fratantoni 2008), and the Black Sea (Mutlu 2002), just to name a few.

Our goal in this work is to dive into the representation of DVM in plankton models. We want to understand how introducing DVM as a behavioral trait of the zooplankton compartment of a widely-used NPZD model affects the response of this model, focusing especially on the carbon export in coastal waters. It is to this end that we establish a new, yet simple, parameterization for DVM in this less studied environments through models, keeping in mind that complexity often emerges from simple sets of rules. As Aumont et al. (2018) explicitly assert in their publication, there are so far two studies that represent DVM in biogeochemical models: Bianchi et al. (2013b) who present a 1D water column modeling study, and their own work, a 3D modeling study, both focusing on the open global ocean, characterised by deep environments. This last model was also implemented in Gorgues et al. (2019), where the migrating depth is such that it excludes the continental shelves and where they state that the bathymetry determines the diel movement of mesozooplankton. In contrast, our work is meant to be a tool for improving processes modelling within the pelagic ecosystems, which will hopefully serve the larger community interests of interpreting measurements and compile better observations on zooplankton group. In our humble contribution to the efforts of the larger community, our purpose is to look closer and better understand processes and their interactions.

As the majority of the scientific community agrees, zooplankton DVM plays a key role on carbon export, especially in coastal waters, such as shelves, estuaries and fjords, where large amounts of organic carbon are being buried every year. In addition, even if these environments (coastal shelves and seas) represent a small portion of the global ocean area, they account for 30 % of the total carbon globally buried. Given zooplankton's importance, and the widespread and ubiquitous nature of DVM, it is worth considering how to incorporate this process in models that are used to understand marine ecosystem dynamics.

Most plankton models are phytoplankton-centered. Arhonditsis and Brett (2004) found in published biogeochemical models that 95% of them validated their results against phytoplankton data, but less than 20% compared model output with zooplankton data. Also, in the relatively rare instances where zooplankton were considered in biogeochemical models, they were more poorly simulated than almost any other state variable (Arhonditsis and Brett 2004).

In this sense, our aim in revising the manuscript will be both to rewrite and restructure the text to clarify the general and specific objectives. We understand now that it is particularly important to expose this background context and to cover the above mentioned aspects when we describe our parameterization, our experimental set up, our results and the discussion. In summary, this study is intended to elucidate the impacts of introducing zooplankton DVM on plankton-based ecosystem dynamics and its carbon production and export in relation with physical driving forces such as turbulence and light. Additionally, significant efforts will be dedicated to improve the individual sections.

In addition to the general comments, perhaps most importantly, we will explain much more clearly the underlying background (regarding general comments of Referee #1 and #3), which is in relation with hunger-satiation hypothesis largely discussed by Pearre (2003) for zooplankton migrating groups in aquatic and marine ecosystems. This is a strong basis on which our DVM parameterization as a function of a critical phytoplankton concentration is laid out, which is strongly criticized by Referee #1.

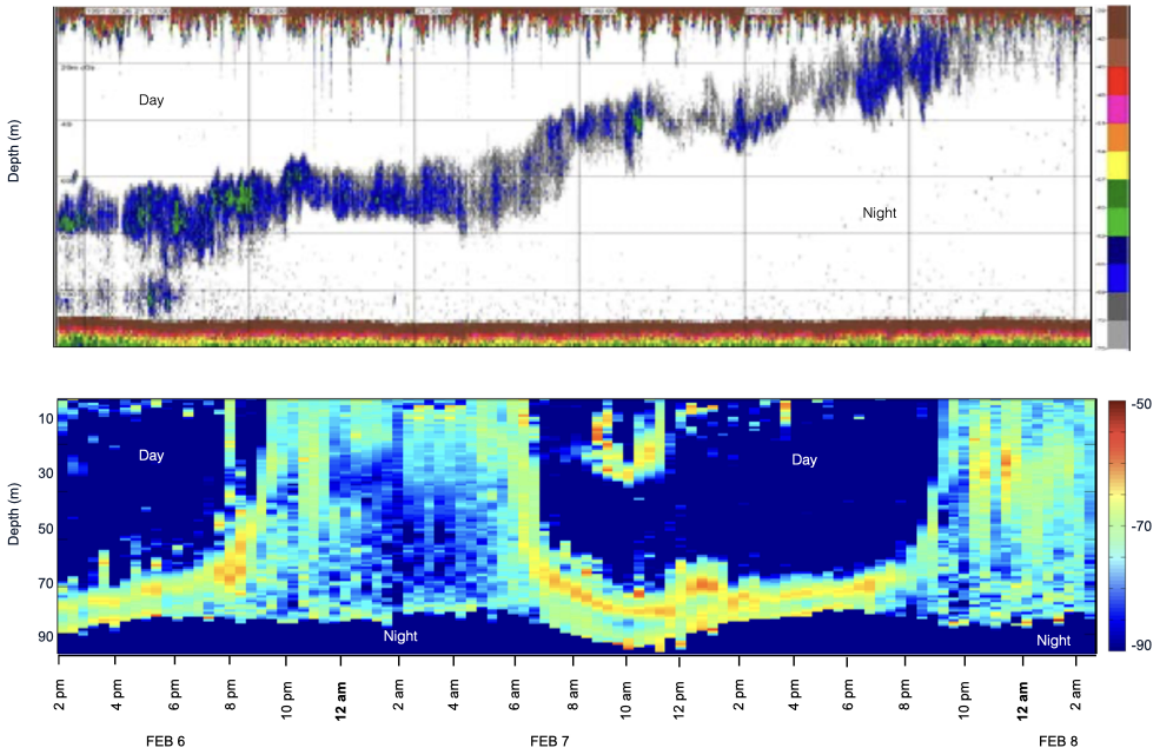

Figure 1. Example of echograms obtained for the San Jorge Gulf (Patagonia, Argentina). Upper panel: during the day-night transition for 11st August 2011 (EK500 and EY500, 200 kHz), taken from Alvarez Colombo (2013). Lower panel: 48 hs echogram (EK60, 120 kHz), adapted from Nocera (2018) and courtesy of Valeria Retana (PROMESS project).

Finally, we will also add an Appendix to address comments regarding parameters and parameter space, that are well explained in Burchard et al. (2006) and that are reused in the present work.

We thus ask the Editor to agree on our manuscript to be reviewed after the modifications we proposed and explained above are done, hoping it will then be acceptable for publication in BG.