Review of the manuscript ***"Budget of the total nitrogen in the Yucatan Shelf: driving mechanisms through a physical-biogeochemical coupled model"*** *by Sheila N. Estrada-Allis et al.*

General comments

This revised manuscript presents an estimation of the Total Nitrogen (TN) budget in the Yucatan Shelf (YS). The estimate is obtained using a coupled physical-biochemical model (ROMS), validated by in-situ and satellite observations. The model solution is available for 9 year (2002-2010) while the in-situ observations used to validate the solution within the YS are available for Nov 2015. Physical processes that are relevant in explaining the estimated TN budget are identified and described. The main input of N is at the eastern boundary through the interaction of the western boundary current with the shelfbreak, presumably mainly due to Ekman transport at the bottom boundary layer. The imported N is then advected westward by the wind driven-circulation along the shelf. Most the N that enters the inner shelf (depths shallower than 50 m) is consumed by phytoplankton, and part of the N that enters the outer shelf (depths 50-250 m) is exported to the deep ocean in the west and northwest parts of the YS. This export of N is modulated by intraseasonal wind and Coastally Trapped Waves.

In the revision of the earlier version of this manuscript I expressed my concerns about the validation of the physical component of the model and the need to justify or acknowledge the limitations of the model configuration used. Both concerns have been addressed in this second revision.

The model validation of the revised manuscript includes comparison with EKE and variance maps from aviso, satellite SST, mixed layer depth from ARGO, satellite-derived surface Chl, Chl from profiling floats, surface currents form the GlobCurrent product, and comparison with some hydrographic profiles and sections of mean velocity from moorings along the eastern side of the YS. In addition, it is now acknowledged that the model vertical resolution at the shelf break (~20 m) cannot resolve the details of the bottom boundary layer. However I do not believe this to be a limiting factor for this exploratory study which aims to provide a first order approximation to the TN budget. The bulk properties of the bottom Ekman transport can be inferred just as surface wind stress is used to provide a bulk estimate of the Ekman transport near the surface.

As mentioned before, the manuscript addresses a relevant scientific question within the scope of BG and the modeling results suggest a very interesting case for the relevance of likely physical processes controlling or modulating the import and export of N in and out of the YS. While the new validation provides more confidence on the model results, I still think the manuscript needs to be highly revised for grammatical and redaction errors. I noticed that the quality of the

manuscript in terms of typos, clarity of the statements, grammar, etc. degrades towards the end. Please revise it carefully.

P1, L11: Maybe change to “due to enhanced bottom Ekman transport”?
Figure 1. The caption says “The seas of the Deep Gulf of Mexico, Campeche and Caribbean are also shown in (a). The inner and outer Yucatan Shelf is denoted in (c).” However the names are not shown in the figure panels.

Is Fig 12 of any use?. Not much information can be extracted from the time-series plots. The wavelet power spectrum is somehow useful but maybe a better colormap could help to emphasize the energy peaks. Revise “lanksos”.

Fig 13. Maybe plot just the amplitude, not the phase?

P12- L14: Revise. Maybe “We present results from a 9-year simulation of a physical-biochemical coupled model for the GoM, focusing on the YS.”?

P16, L16: Erase or revise this sentence.