Authors' response (AR) to Reviewers' comments (RC) on manuscript OS-2017-58 "Quantifying thermohaline circulations: seawater isotopic compositions and salinity as proxies of the ratio between advection time and evaporation time" by Berman, H., N. paldor and B. Lazar

General

Both reviewers raised a number of issues that are totally acceptable to us and which we intend to address in the revised version of the manuscript. These comments entail re-focusing the manuscript on semi-enclosed basins and eliminating the use of the term thermo-haline circulation (which will be changed in the revised manuscript to evaporation-driven circulation) since this term is presently used in the context of the global circulation in the Atlantic. As part of the change in focus, we intend to include in the revised version an analysis of surface salinity snapshots in the Mediterranean that bolster our use of the proposed new non-dimensional parameter. We thank the reviewers for their insightful review that helped us better clarify the points we are trying to make.

Our response to each of the particular points raised by the reviewers is listed below.

<u>Reviewer 1</u>

1. The term "strength" will not be used in the revised version. Instead γ will be called the index of evaporation driven circulation (EDC index). The magnitude of γ (<1) determines the fraction of the mixed layer (mean depth h) that evaporated during the time when the water moved a distance x at a speed u. Thus, the larger the γ, the larger the contribution of the evaporation-driven circulation to the actual circulation. The highest EDC index (measured in the extremely arid semi-enclosed Red Sea) is ~0.1. This will be explained in the revised version.
2. Indeed the assumptions employed in the derivation of γ are satisfied in semi-enclosed basins (the Red Sea and the Mediterranean, RS&M) and not in the open ocean. However, in the central part of the Western branch of the Indian Ocean Gyre the numbers work very well (which is not at all the case in other Western Boundary currents). We plan to focus the manuscript's sermon on RS&M and then to mention (separate from the "Results" section) that the idea works well in the Indian Ocean even though not all assumptions are met.
3. Additional references on the rates of evaporation in the Red Sea will be added
4. The title will be changed to: "Circulation in semi-enclosed basins: Quantifying the fraction of the mixed layer that evaporates during the horizontal flow" so as to emphasize that the manuscript deals mainly with semi-enclosed basins.
5. Data on East-West changes in SSS in the Mediterranean will be incorporated in the revised version. We will show that in the Mediterranean Sea the available data shows seasonal changes in the value of γ that reflect seasonal changes in excess evaporation (see Fig. 1 below).

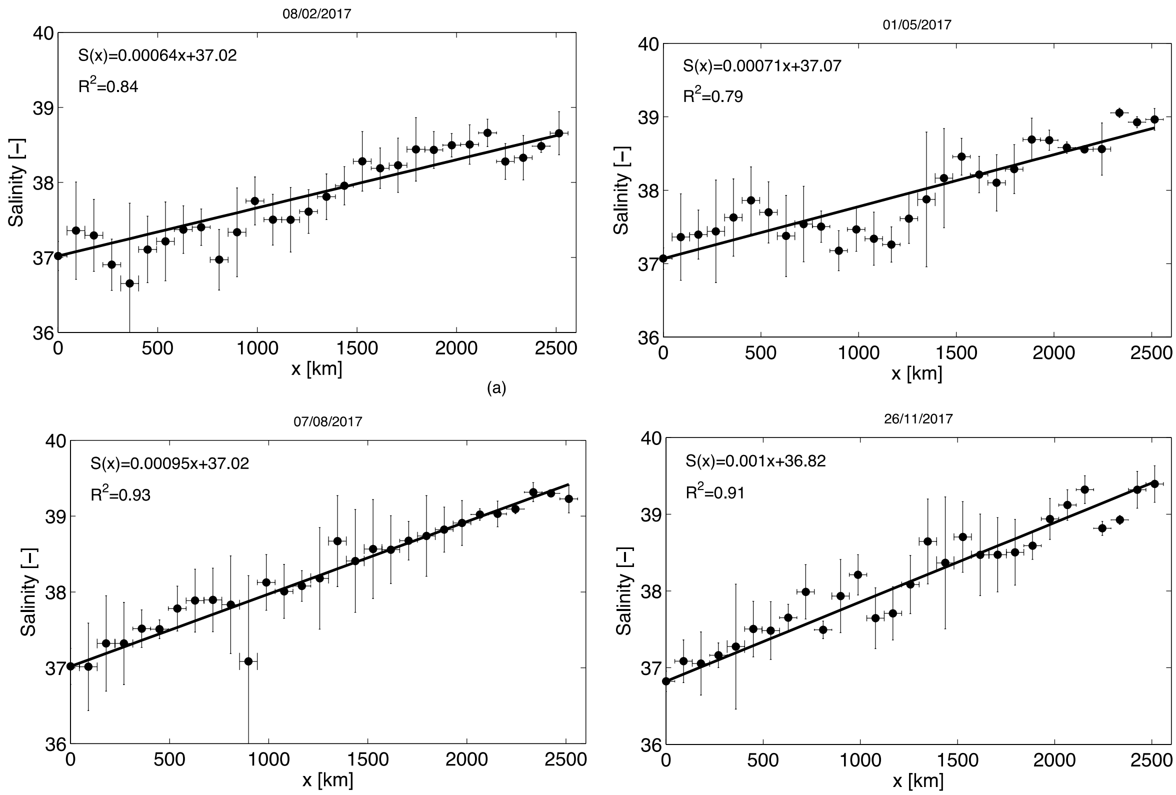

Figure 1: Meridionally averaged sea surface salinity in Mediterranean Sea as a function of distance from the Straits of Gibraltar (*x*) every 3 months during the year 2017. Data is taken from the SMAP (Soil Moisture Active Passive) Sea Surface Salinity (SSS) level 3 8-day running average[1]. The slopes of the trend lines are the highest during August and November (when precipitation is minimal, i.e. excess evaporation is maximal) and lowest in February and May when precipitation is largest (i.e. excess evaporation is lowest). The resulting values of γ vary between 0.06-0.07 in August and November, and are ~0.04 in February and May (only ~60 % of summer γ). These values are consistent with our claim that high γ values reflect higher contribution of evaporation driven circulation. It is also consistent with the highest value of γ= of 0.09-0.12 we estimated for the Red Sea, which is located in an extremely arid desert region with virtually no freshwater input and hence evaporation driven circulation is high there.

1 Meissner, T. and F. J. Wentz, 2016: Remote Sensing Systems SMAP Ocean Surface Salinities [Level 2C, Level 3 Running 8-day, Level 3 Monthly], Version 2.0 validated release. Remote Sensing Systems, Santa Rosa, CA, USA. Available online at www.remss.com/missions/smap, doi: 10.5067/SMP20-3SPCS.