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Interactive comment on "The Mediterranean Outflow in the Strait of Gibraltar and its connection with upstream conditions in the Alborán Sea" *by* Jesús García-Lafuente et al.

Anonymous Referee #2

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The manuscript tackle an important and relevant scientific issue regarding the analysis of observations downstream and upstream the Gibraltar Strait; in particular in four different sites (Espartel Sill (ESP), Camarinal Sill North (CSN), Camarinal Sill South (CSS) and in the Western Alboran Gyre (WAG) through the proxy (deduced by altimetry data), in order to evaluate a connection between the strength of the WAG and the hydrological composition of the Mediterranean Outflow (MO).

This study is very interesting because increase understanding on the dependence expected between the variability of the two different ocean regions that the Gibraltar Strait connects (Gulf of Cadiz-Tangeri Basin (TB) and Alboran Basin respectively).

The analysis of the connection between the two side of the Strait is based on the study

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of the physical mechanisms that drive the variability of the MO; focusing on the main ocean phenomena observed in Gibraltar Strait, like mixing between different types of water of Mediterranean and Atlantic origin. The present paper is also relevant for ocean climate variability studies and in particular for research and simulation of the interaction between Mediterranean Sea and North Atlantic ocean.

For all these reasons that the results of this paper are very interesting for the oceanographic communities and in particular for those scientists more implicated on the Mediterranean-Atlantic interaction or on its parameterization in numerical climate models. Therefore I recommend this paper to be published, almost in the present version, however I would like to give some general comments and minor revisions in order to increase the impact of this manuscript around the oceanographic (and not only) community.

General comments:

The scientific matter of the manuscript isn't a really new augment, actually in the literature there are many example on this, either in the modelling field or like in this case in the analysis of the in situ observations. But the novelty of this manuscript (at least in my knowledge) is on the very detailed analysis of the hydrological characteristic in the key points, like CSN and CSS and ESP, crucial on determine the interaction, at different scale, between Mediterranean Sea and the Atlantic ocean.

However I have some doubts on the efficacy of the proxy (the altimetry height) used for analyse the WAG strength and its variability. I think that the matter of this manuscript is a little bit more complex. Is matter of fact that the inflow/outflow is regulated not by a "single gyre" (WAG) but from the "double gyre". Actually, from satellite observations and from numerical simulations (see references 2 to 6 below), the Alboran Sea is dominated by the 'double gyre' system and the Almeria-Oran front could be a good "proxy" of the variability of this system and consequently of the variability of the Atlantic water enters the Alboran via the straits of Gibraltar. Long-term monitoring of these

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currents is possible using data from satellite altimetry and finally will represent better the complexity of the processes of which the authors of this manuscript want to connect at the variability of MO. Moreover, correctly in the manuscript the authors investigate in details on the mixing that take place inside and outside the Gibraltar Strait and the Almeria-Oran front again is also a proxy of these events, because is link also to the hydraulic condition along the Strait. The authors know very well (they wrote many papers on that) that the hydraulic control produces a hydraulic jump (forced by the tide) and consequently more vertical mixing is enhanced. These events in my opinion can modulate also the variability of the MO at larger frequency respect to the tide.

The second suggestion that I would like to put on the table for further discussion regard the Gulf of Cadiz, everybody know that when the MO pass over ESP has lost its original characteristic, taking now the properties of the source water of the MW that will be later observed in the North Atlantic, but still maintaining the memory of the originated Mediterranean water, in fact, following Fig. 4 of Fusco et al, 2008, is very evident the impact on the MO hydrological value of the quasi-periodical extraction and evacuation of WMDW from the Mediterranean into the Atlantic, that is the matter of this manuscript. Therefore, should be very interesting to verify the hydrological characteristic of MO in the Gulf of Cadiz and its interannual variability in relation of those observed in CSN, CSS and ESP.

Minor revision:

Fig.2 the range of the value of density is wrong;

Line 30-31 page 10 and line 1-3 page 11 I suggest to cut this sentence, the difference of the flow is so small that don't permit further considerations;

Fig.6 using this data set could be very interesting to do a SSA (Singular Spectral Analysis) of the time series, in order to capture the main low-frequency variability of this time series and verify the occurrence of a ghost limit cycle related to a physical oscillation of the dynamical system that has generated the time series (Ghil et al. 2002).

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Please also note the supplement to this comment:
http://www.ocean-sci-discuss.net/os-2016-90/os-2016-90-RC2-supplement.pdf

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