This paper (#nhess-2019-6), submitted in EGU's journal *Natural Hazards and Earth System Sciences (NHESS)*, reports on an effort to investigate the effects of Mediterranean cyclones on large sea level anomalies (SLA), both positive and negative, with focus on the coastal zone. SLAs in the Mediterranean are correlated to the intensity and position of cyclonic motions in the atmosphere based on a pre-validated storm track algorithm. Several coastal stations scattered over the basin are used in the analysis, where hindcast SLA modeling results are considered. Main findings refer to the contribution of barometric lows and related strong wind fields especially in shallow water areas with sufficient fetch. The inverse barometer effect is proved to be the prime factor of large positive SLAs at the coast near cyclone centers, whereas negative SLAs at the opposite far away sides of the Mediterranean basin are also attributed to a cross-basin SLP gradient due to the presence of cyclones. Furthermore, negative SLAs are also thought by the authors to be partly caused by residual water mass redistribution within the Mediterranean. Positive SLAs are related to the cyclones' positions and intensities. Overall, cyclogenesis is westernmost in the Mediterranean basin producing positive SLAs enhanced also by Atlantic cyclones. Eastern stations are mostly influenced by the classic Eastern cyclogenesis centers, and North African cyclones mainly induce positive SLAs at the central African coast and negative SLAs at the eastern Mediterranean and North Aegean coasts.

The features of the manuscript could be summed up to the following:

ISSUES	***GRADING***
Originality / Impact of the Work	Good
Amount / Significance of the Work or Results	Good (needs corrections)
Acknowledgment of the Work of Others in References	Good (needs additions)
Completeness of the Reported Work	Good (needs extra clarifications and further removal or addition of some results)
Clarity in Writing	Very Good
Clarity in Tables and Graphs	Good

This is an interesting paper that is well structured and should deserve publication, but only after a major revision. Changes could be included regarding possible additions of new graphs about negative SLAs correlation to anticyclones and barometric highs over the Mediterranean or eventual removal of the try to link negative SLAs in specific locations of the basin to cyclonic motions over other remote parts of it. Moreover some extra clarifications of the approaches followed could enhance the paper's current scientific value. If the authors decide to defend their choice to link negative SLAs to storm tracks rather than to anticyclonic high SLPs in the area of study, then some extra clarifications are needed and/or more convincing explanations should be provided about the soundness of the approach. Moreover set-up/down results could be strengthened by further explanations behind the hydrodynamic response of SLAs to wind patterns in the area. The use of English language is good for a publishable article in *NHESS* (please see comments on a few expressions in Specific Comments).

In the following, I present my basic concerns and some specific comments/questions together with a few editorial changes needed in order to strengthen the manuscript's quality. Major revisions would be required.

General Comments:

1) Page 2 Line 20: In the Introduction the authors provide a brief review of storm surges in the Mediterranean and state that “there is little literature considering the synoptic conditions leading to storm surges at other locations and no study has considered negative SLAs”, yet there is crucial literature left out from their state-of-the-art. The following references should be added and their basic findings concisely discussed in connection to the present paper’s goals:

Bengtsson, L., Hodges, K.I., Roeckner, E. (2006). Storm tracks and climate change. *J. Clim.* 9(15): 3518–3543.

Calafat, F.M., Jordà, G., Marcos, M., Gomis, D. (2012). Comparison of Mediterranean sea level variability as given by three baroclinic models. *J. Geophys. Res.* 117, C02009.

Campins, J., Genovés, A., Picornell, M.A., Jansà, A. (2011). Climatology of Mediterranean cyclones using the ERA-40 dataset. *Int. J. Climatol.* 31(11): 1596–1614.

Makris, C., Galiatsatou, P., Tolika, K., Anagnostopoulou, C., Kombiadou, K., Prinos, P., Velikou, K., Kapelonis, Z., Tragou, E., Androulidakis, Y., Athanassoulis, G., Vagenas, C., Tegoulias, I., Baltikas, V., Krestenitis, Y., Gerostathis, T., Belibassakis, K. and Rusu, E. (2016). Climate Change Effects on the Marine Characteristics of the Aegean and the Ionian Seas. *Ocean Dynamics*, 66(12): 1603–1635.

Marcos, M., Jordà, G., Gomis, D., Pérez, B. (2011). Changes in storm surges in southern Europe from a regional model under climate change scenarios. *Glob. Planet. Change*, 77(3): 116–128.

Vousdoukas, M.I., Voukouvalas, E., Annunziato, A., Giardino, A., Feyen, L. (2016). Projections of extreme storm surge levels along Europe. *Clim. Dyn.*, 47: 3171–3190.

Vousdoukas, M.I., Mentaschi, L., Voukouvalas, E., Verlaan, M., Feyen, L. (2017). Extreme sea levels on the rise along Europe’s coasts. *Earths Future*, 5: 304–323.

Fernández-Montblanc, T., Vousdoukas, M.I., Ciavola, P., Voukouvalas, E., Mentaschi, L., Breyiannis, G., Feyen, L. and Salamon, P., 2019. Towards robust pan-European storm surge forecasting. *Ocean Modelling*, 133: 129-144.

2) Page 4 Lines 7-17: The cyclone identification methodology for the Mediterranean is pre-validated, but it is not clear if the specific approach can avoid misrepresentation of storm tracks due to secondary lows, *i.e.* setting an acute angle <85° between two segments of the track defined by three successive points of predicted low pressure centers, in order to consider separate storms. Please see e.g. NASA's storm tracking algorithm (https://data.giss.nasa.gov/stormtracks/). This criterion is usually invoked as the enfeebled extratropical cyclones of the Mediterranean are not found to "double back" on themselves over the course of 6- to 12-hourly timespans. By setting such a limit the possibility of an algorithm to misidentify secondary lows (which can form in the wake of extratropical cyclones) as a reversal of the primary low pressure centers can be avoided. Please further discuss the use of storm identification techniques.

3) Throughout the entire paper, the authors claim that negative SLAs (extensive set-down of coastal sea levels) are attributed to cyclonic motions in the atmosphere in sites practically very far away in the opposite side of the basin, rather than the high pressure barometric systems (anticyclones) during "good weather" over the specific study areas. There is an idea presented that the big negative SLAs are associated with cross-basin SLP gradients, but this seems like a speculation as it is not fully proved and further methods and graphs are need to support the authors' assertions. In the specific comments some recommendations are provided.

4) Moreover no Aeolian regime and wind patterns/vector-maps are given in the study area to uphold the authors' conclusions about negative SLAs induced by wind set-down. Therefore wind roses or other related info should be provided to confirm interesting results of set-up and set-down.

5) Results about positive SLAs are finely reproduced and very interesting, but the correlation of negative SLAs to cyclonic atmospheric motions seems specious. Specifically, there may exist different cyclones (or barometric lows in general) outside of the Mediterranean window presented in the paper (thus not shown in maps), which may develop in regions even closer to the specific study locations compared to classic cyclogenesis centers of the basin, especially in the eastern and southern parts of it. Moreover certainly there exist essential periods of negative SLAs throughout the Mediterranean during good/mild weather with high pressure systems over the entire basin that cannot be linked to a cyclone. These cases refer to mild recession or still water levels of the sea surface in most parts of the

basin, but are overlooked by the authors in their quest to associate extreme barometric lows to negative SLAs.

Specific Comments:

Data and Methods

Page 3, Line 4: There are surely other important sites on the Mediterranean coastal zone with estimated larger values of SLAs. They should be at least mentioned. Please advise on References provide in General Comment #1.

Results

Page 4 Line 30 – Page 5 Line 7 and Figs. 2-3: High correlation coefficients between modelled and observed MSLP composites are well-expected, since ERA-Interim re-analysis data are corrected based on the same in situ observations that the authors use for comparisons. In any way, are the input (atmospheric) data further properly validated or are they evaluate in previous studies? Please elaborate. It would be preferable if the authors used comparisons of modelled SLP fields vs. measurements by meteorological stations unassimilated in the modelled ERA data.

Page 4 Lines 6–15 and Fig. 3: Logically the "large" values of negative SLAs are mostly associated to the huge SLP values (e.g. scoring up to 1025 hPa) over the area, rather than small SLP values in regions far away from the coastal study locations, in opposite sides of the Mediterranean basin.

Page 6 Lines 3–7 and Fig. 5: This comment seems to be based on a misconception of the inverse barometer effect. In what sense is that an exception? Large negative SLAs are consistent with the very large values of MSLP (huge barometric highs of 1025hPa) in all graphs and over vast areas around all study locations.

Page 6 Line 11: Yet again the passage of a deep MSLP minimum over central Europe is likely not the first and basic reason for negative SLAs in North-African coasts, but the anticyclone (high barometric) in atmospheric circulation over these areas.

Page 6 Lines 21-22: This seems like a circumstantial observation and should be backed by wind roses or maps in the area to support the existence of offshore winds over shallow continental shelf.

Page 6 Lines 18-19: With an average velocity of translation of the cyclone center close to 32km/hr (Lionello et al., 2016), for a timespan of 44hr (as top in Fig. 5), you have a movement of the low barometric center of about 1536km, which is still very small compared to the distance in Fig. 5 map.

Page 7 Lines 15-23: This analysis could only be corroborated by correlation to the wind characteristics by PCA method, SOMMS approach and/or other methods of weather pattern identification. It could be omitted if not supported by further analytical comments and results on correlation of SLAs to atmospheric forcing.

Page 7 Lines 29-31: This sentence needs rephrasing. From "showing that he main…" and on this expression is not an explanation or a conclusive remark but a repetition of the first half sentence.

Page 10 Line 31 and Fig. 9: This exactly proves that the inverse barometer effect is mainly responsible for negative SLAs as MSLPs are pretty high over the certain study locations.

Page 11 Line 36 and Fig. 10: 700km are not rendered as large distances in terms of synoptic scale phenomena. Moreover the fact that big distances of the cyclone center donot allow for any influence of the cyclonic low MSLPs to the point-modelled SLAs is proven by Fig. 10, see e.g. green cells in Iskenderun and Alexandria maps. If there was a similar Figure for negative SLAs this would be further strengthened. Or else if such a figure disproves the authors' claims then this kind of analysis should be discarded form the paper.

Page 12 Lines 23-25 and Fig. 12: This is probably the case, but further wind data in the surrounding area in the Libyan and Adriatic Seas are needed to be shown in order to prove that.

Technical/Editorial Comments:

Page 2, Line 20: correct to "Apart from…"

Page 6 Line 20: change "high pressure over most of the basin" to "high pressure over a large part of the basin"

Tables 2-3: Correct to “Dubrovnik”

Page 13 Lines 8, 9 and 33: Correct to “An SLA hindcast…”, “along the entire Mediterranean…” and “which is an..” respectively. Page 14 Line 6: Delete one “also”.