Comment

C1. I think but it should be mentioned more prominently the Izmir Bay is relatively unexplored region compared to other regional areas and that available reanalysis data sets and observational data sets to initialize the model are not appropriate for that region. This justifies the more conceptional approach of the current study.

Explanation

E1. Monitoring in İzmir Bay has been initiated seasonally since 1990. Approximately 100 cruises were done up to now. There are sufficient data sets to initialize the model. However, the approach of the study is to analyze the wind driven circulation under different stratification of the Bay. Two representative summer and winter stratifications were chosen in current study. The distribution of stations was important by this cruise selection.

C2. What is the motivation to apply this model to this research area? What is the advantage compared to previous approaches to model that region?

E2. Generally, the wind is very important for coastal regions. The deepest part of the İzmir Bay is about 70m. Therefore, lasting strong wind from certain direction generates wind-driven circulation patterns in the Bay. The motivation is to detect these patterns and to know if they change depending on the stratification on the background. The other former model approaches are; i) They study the circulation pattern (snap-shot) in Izmir Bay by using real time wind forces and cruise time stratification. ii) They try to find the circulation regime in the Bay with some restrictions.

C3. The methods section lacks fundamental information about the experimental setup and strategy: How long was the model integrated for each experiment. There are results shown for winter and summer. Are this different experiments or were the summer experiment initialization with circulation regime of the winter experiment?
What was the motivation to use the artificial wind fields that were used to force the model. Are there some related to a predominant wind direction over the area. Do they represent a spectrum to cover the main probable directions? When no meteorological information is available this should be explicitly mentioned.

E3. The steady current is achieved by controlling the kinetic energy of the system. The integration is stopped as soon as the kinetic energy level reaches to a plateau. This information is already in the material and method section. Every experiment has own initialization procedure.
The information about the wind regime of the İzmir Bay environment is given in the section of material and method.
The blowing strong wind in certain direction if it continues long time, approximately more than 12 hours, the current fields in the Bay will go under the influence of the wind and form expected circulation patterns. After run with artificial wind fields, we are able to give information about the circulation patterns to other discipline interested in them. It is not easy to get justification for recirculation patterns from all disciplines. But some remote sensed observations can help.
For example, Figure **a** shows the TSS (Total Suspended Sediment) distribution in the İzmir Bay in first September 2016 (personal communication, Eronat, 2016, not published). Figure **b** gives information about the wind intensity and directions before and after date of remote sensed TSS field. As it is noticed that the anti-cyclonic pattern of TSS field has well agreement with the circulation pattern obtained from the model results of northerly wind case.

Figure a) Total Suspended Sediment distribution in the İzmir Bay.

GFS 27 km	Wind speed (knots)								Wind direction							
	00h	03h	06h	09h	12h	15h	18h	21h	00h	03h	06h	09h	12h	15h	18h	21h
25.08.2016	8	8	9	10	12	16	12	10	↙	↙	↙	↙	↙	↙	↙	↙
26.08.2016	9	9	10	11	13	17	11	9	↙	↙	↙	↙	↙	↙	↙	↙
27.08.2016	9	9	10	10	11	16	10	7	↙	↙	↙	↙	↓	↓	↙	↙
28.08.2016	6	6	8	7	10	11	8	6	↙	↙	↙	↓	↘	↘	↓	↓
29.08.2016	6	5	6	6	11	11	6	4	↓	↙	↙	↘	↘	↘	↘	↘
30.08.2016	4	4	5	8	13	16	8	7	↙	↙	↓	↓	↘	↘	↘	↓
31.08.2016	7	7	11	14	15	16	10	9	↓	↓	↙	↙	↙	↙	↙	↙
01.09.2016	9	10	12	13	14	16	9	8	↙	↙	↙	↙	↙	↙	↙	↙
02.09.2016	8	8	10	11	14	16	9	8	↙	↙	↙	↙	↓	↓	↓	↓
03.09.2016	8	9	11	11	14	17	11	9	↙	↙	↙	↙	↓	↙	↙	↙
04.09.2016	8	8	9	9	7	9	8	5	↙	↙	↙	↙	↓	↓	↙	↙
05.09.2016	5	4	4	2	10	9	3	3	↙	↙	↙	↘	→	→	→	↑

Figure b) The wind intensity and directions (https://www.windguru.cz) before and after date of remote sensed TSS field.

C4. The results and discussion presents several a number of different characteristic circulation patterns. The authors should avoid here to remain on an exercise level. Which are the structures and currents that important with respect to the general scientific question of the study? Which structures are important for water mass transfer. Which might be important for sediment transport and coast forming processes (if there are some!). What might be important for biology and ventilation. In its present for its hard to read and one wonders what is the main point here.

E4. We added the importance of different characteristic circulation patterns for biology and related to sediment transport and distribution of some substances in the Bay. On the other hand, the other disciplines do not have enough data resolving the gyres and small features in the Bay. But some very few study (not published) mention about the biological and chemical activity depicting the role of the Middle Gyre. The phytoplankton tends to move up and down in water column depending on the sign of the circulation. Also TSS sinks or comes up to surface as a result of anti-cyclonic or cyclonic movements respectively in the Middle Part of the Bay (E3, Figure a).

C5. As I understand, no further mass and energy fluxes (except momentum) at the air sea boundary were applied. A discussion of how this influences the results would be helpful (especially for the thermohaline case study). Also is the freshwater discharge of the Gediz

river accounted for in the simulations? Would be good to know to get insight into the baroclinic behavior and eddy generation near the river mouth.

E5. The reason of the running model in short time is to avoid the meteorological influence which are causing slow change in baroclinic field. It is focused on the fast evolving circulation patterns under the influence of strong lasting wind from certain direction in current study. Sea level can change the circulation pattern. But sea level data is too coarse for İzmir Bay environment. Coarse data brings more difficulties and the obtained results with sea level are far from expected real cases.
In the last years the discharge from Gediz River is reduced drastically because of usage of fresh water for other purposes in the land. The local authorities have built a channel around the Bay to collect the fresh water coming from small streams around since 2000. The leaking fresh water from Gediz and coastal area are occasional and cannot influence whole Bay except in the limited area near coast and near river mouth in rainy days. Therefore, their influences on the baroclinic behavior and eddy generation can be neglected.

Specific Comment

C6. line 6: "thermohaline forces". Be more specific, what is the physical force?

Explanation

E6. Thermohaline force here is the force consist of temperature and salinity (density) field differences in space horizontally and vertically along the water column. They turn to geostrophic force together with effect of real topography.

C7. line 10: two layered"" and "horizontally shared " is very vague and hard to understand

E7. İzmir Bay which is a coastal shallow area, has vertically two layer in summer. The first layer has high temperature (26° C) and second layer has lower temperature (16° C) and higher salinity. It causes a density difference in the water column. Therefore, the surface currents generally are opposite directions to the lower layer in such a two-layered system. On the other hand, in winter the currents have tendency to flow in one directions. Although existing homogeneous water along the water column in winter, the temperature and salinities in the Outer part of Izmir Bay are always different compared to the temperature and salinities in the Inner part of the Bay. Therefore, we can consider İzmir Bay generally horizontally shared domain in winter.

C8. line 14: I suggest to reformulate this sentence.

E8. The sentence "Although the stratification in the bay changes the behaviour of the circulation, the recirculation pattern does not change seasonally, but changes under the influence of wind forcing" is changed. New sentence;
"The lasting <u>strong</u> wind from certain direction generates circulation patterns independent from the seasonal stratification in the Bay".

C9. line 24: I suggest the term silt sediment or silty deposits rather than silt

E9. This sentence is quoted from Maddy et al. (2012).

C10. 25 what is mean by physical characteristics? topography water masses?

E10. The sentence is corrected as: "It can be divided into three areas according to their physical characteristics (containing different water types and bathymetry, etc.): Outer, Middle and Inner Bays, as indicated in Fig. 1".

C11. 28: "silting process" do you mean the continuous filling of the Bay by riverhine sediment loads? I think its not so important for the study whether it is sand, silt clay or muddy material

E11. It is a priory knowledge that the topography has been changing slowly in years. The topography is important which has influence the currents flowing above it. The model is running with the real bathymetry of the İzmir Bay. It is true that it is not important for the study whether it is sand, silt clay or muddy material.

C12. 29 "used to join" - formerly?

E12. The sentence has been changed accordingly.

C13. 35-36 sedimentation accumulates? sedimentation may lead to accumulation when the sedimentation rate is larger than sediment loss at the bottom due to dissolution, erosion or whatever. Be more precise with what you want to express.

E13. It is quoted by Karahan (2002). I think he ment "accumulation" as the sedimentation rate is larger than sediment loss at the bottom.

C14. 41: when you distinguish different types of water then a few words to characterize the types would be helpful.

E14. Outer Bay water type ASW has a greater volume than the other water types in the bay. Relatively small temporal changes are observed in its temperature and salinity values due to its large volume. Inner Bay water type IBIW is the coldest in winter and its temperature varies from 9.1 °C to 13.9 °C. It has maximum temperature in summer and changes from 24.5 °C to 27.5 °C. IBW is formed in the middle Gyre area, influenced by the Gediz River inflow and by the upwelling and downwelling processes that are mainly driven by southerly and northerly winds, respectively. IBW seems that it is a mixture of IBIW and ASW in winter. But it is very distinguished water type in summer with its higher salinity values varying between 39.6 psu and 39.9 psu.
This information is added to the manuscript.

C15. 43 transport processes through vertical sections. Is there already something known about the renewal time? May be in Sayin 2003? then report this here. Later in the MS you present no volume transport calculations to give support for this.

E15. The information about renewal time is added as:
The renewal time considering the water exchange through the vertical section between İzmir Bay and Aegean Sea is found by 46 and 29 days for the winter and summer case, respectively (Sayın, 2003).

C16. 53-66: Several previous studies are mentioned here. The outcome and results for the circulation should be referred a bit more verbose. Which question are still open and which of them do you want to address here with your model. Example: ".Eronat & Sayin (2014) studied on the temporal evolution of water characteristic..". But the reader get not any further

information about. If this study is of interest for reader without knowledge on Izmir Bay oceanography you have to give more information.

E16. Some information is added.

C17. 79 -87: So what is the advantage of this model compared to previous model approaches? why do you think currents are better represented with this model?

E17. All model mentioned in the manuscript use the Navier-Stokes equations and are able to model İzmir Bay. But they have different approaches. These approaches are explained before in the explanation E2.

C18. Figure 2 shows results for summer and winter for a westerly wind regime. Why westerlies are chosen, how is this wind generated to force the model.

E18. Figure 2 shows the winter and summer temperature and salinity fields in the Bay. It is not related to wind-driven circulation.

C19. What was the reason to chose 5m/s winds at constant rates? Related to observation or theoretical considerations?

E19. First we integrated the model until the steady current is achieved by controlling the kinetic energy of the system. Afterwards it is seen that 5 m/s wind intensity was sufficient for resolving eddy circulation.

C20. What is about the model topography, did you use at established data set for this, do you a flat bottom? Please be more verbose with what you have done to obtain the results.

E20. The model experiments are conducted using real topography. This information is added to method section.

C21. How long were the individual simulation integrated? This is important information.

E21. This integration procedure has been already explained by E2.

C22. So is there no heat or water exchange with the atmosphere in all the experiments? Is that right? if so how would this influence the results for the thermohaline circulation. Is the Gediz river water discharge represented in the model? I think this would be important for the discussion of the thermohaline experiments (baroclinic eddy generation etc.)

E22. The necessary explanations to the arising point has been done already in E5.

C23. Figure 2: is this the depth averaged salinity and temperature or the first level? what is exactly shown? Please also tell the reader how the CTD measurements are brought onto the model grid?

E23. Figure 2 shows the winter and summer, temperature and salinity fields of 5 m that are prepared to give to the model as temperature and salinity distribution of the first level. Surfer Program has been used to distribute the temperature and salinity values to the model grids. The grids are prepared for the Model using a Fortran program creating a file to be read by the Model.

C24. Which is the number of observations that go into the model? Is 30, 300, or 3000. A profound oceanographic analysis of the observations you used would be also a result to

present here (if not elsewhere. Is it in agreement with the distinction of the water types you did above?

E24. Temperature and salinity values of approximately 40 CTD casts are used for each model experiment. The reason to choose these cruise data is that the data is representable for the physical oceanography of İzmir Bay indicating the water types already explained by Sayin et al., 2006.

C25. 120: Please indicate this bifurcation during summer in Figure 3. Its hard to see from the description alone

E25. This Figure is corrected.

C26. 125: " it is almost horizontally homogeneous; but vertically stratified water column changes the behaviour of the current during summer. " Hard understand what is meant here.

E26. The point is cleared in the Explanation E7.

C27. 145: "The current.." what is this certain speed that sets up the this current?

E27. The numerical experiment was conducted to show the development of circulation in the Inner Bay by increasing the wind intensity from zero to 5 m/s. The current, not only in the Inner Bay, but also in the other regions of the Bay starts to set up after a certain wind speed is exceeded. The current is very weak in the Inner Bay without the existence of wind force. The currents get stronger with increasing wind speed. Recirculation patterns which exist in the Middle Bay become well-developed after the increase of wind intensity above approximately 2.5 m/s and are observable both in the barotropic field and in the certain layers.

C28. 147: Didn't you say previously that you used a constant wind speed of 5m/s. Please give information about how you forced your model. Which was the max. speed?

E28. Explanation E27 is also applicable for the current Comment C28.

C29. 150ff: Ok you used several kinds of wind directions. Is there something known about what is the main predominating wind direction during the seasons. If so then give this info and the source.

E29. The predominant wind condition of Izmir environment is added to the Method section and shown in the Figure **c** below.

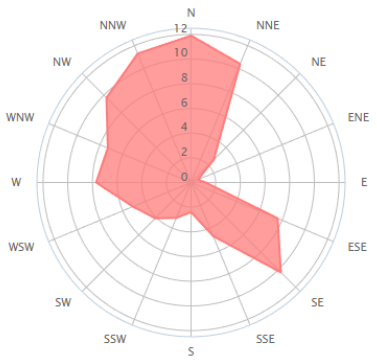

Figure c. Wind direction distribution from 1985 up to now (https://www.windfinder.com).

C30. You describe many different circulation patterns here, but it is not really clear what we can learn from that for the Izmir Bay oceanography. Is there any observational support for this. Or is the existence of the modelled currents any further implications for biology and possible implications sediment transport or so. Otherwise, the article turns of as a more theoretical exercise.

E30. The required explanation has been given already in E3.

C31. 175: "Sometimes...". Is there any explanation for that these features combine sometimes, and sometimes not? Or do we interpret here simply stochastic behaviour? Which is the message the reader could keep in mind here?

E31. If the sign of **M** and **O** are same and **M** is very near to Outer Bay, these features combine each other depending on the direction of wind. This information is added to the manuscript.

C32. The conclusions read very similar to what was mentioned already in the results discussion. Here would be the place for broader implications of the results. What would be the effect of the found recirculation patterns and eddies. How would they act to mix water across the different water types? What would be the implication for biology? Do the results support features from biologists or geologists? Can we draw conclusion for hazardous instances? The work was apparently supported by the Izmir Marine Research Project. Can we find here some motivation for the study?

E32. E3 and E4 explain why the study do not cover biology and other discipline implications. Without any information (published document) from the biologists and geologists it is hard to combine all disciplines to make analysis together. The chemical oceanographer, biologist and physical oceanographer make research together in Izmir Marine Research Project. But a synthesis could not be done because of disciplines having different monitoring purposes. I hope one (group) can get initiative to realize this very valuable issue. Thank the reviewer that remember us this important point.