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Interactive comment on "A modelling study of eddy-splitting by an Island/Seamount" *by* Shengmu Yang et al.

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In general, the topic is interesting and the study is relevant for Ocean Science. There will be numbers of extension works following this study, given that it clearly figures out the frame of such works. However the broad but imprecise introduction, the deficient design of study cases, and the ambiguous choice of parameters may reduce its potential value. So I suggest the authors should better clarify their frame work of studies in generally, and focus on their problem more precisely.

Major comments

The title is vague. Some critical information may be appended to the title, such as "with f-plane" or "β-plane", "Island size", "seamount submergence depth", etc.

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Discussion paper

As an ideal simulation, the authors should not be constrained by the background or previously study on the South China Sea (e.g., Wang et al., 2003, 2005). Otherwise, the authors can directly simulate the observed eddy-island interaction events near Dongsha Island.

The study is in f-plane or β-plane? Since the present study zone is relatively small, it is better to use f-plane rather than β-plane approximation for simplification. For example, supposing 100 km with β=2$\times$10$^{-11}m^{-1}s^{-1}$, the Coriolis parameter only varies about 2 $\times$ 10$^{-6}s^{-1}$, which is only 2% of the local Coriolis parameter f=9$\times$10$^{-5}s^{-1}$. And the eddy motion in this study has notable different from that in β-plane (e.g. Early et al., 2011). The study on eddy splitting in f-plane itself is a valuable work. This can also be a baseline for further study with β-plane approximation.

The eddy is mesoscale or sub-mesoscale? As mentioned in first sentence, the mesoscale eddies (scale of 100 km) and sub-mesoscale eddies (scale of 10 km) have different scales. Although the choice of ideal Gaussian-type profile (e.g., Zhang et al. 2013, Wang et al., 2015) is valid for this study, the choice of L=15 km is subtle. It might be better to choose a typical value either for mesoscale eddies (e.g., L=50 km) or for sub-mesoscale eddies (e.g., L=5 km) in this study.

There are lots of physical effects and control parameters in eddy-splitting due to eddy-island interaction. The authors introduce two dimensionless parameters R and S. They are important, but they may not enough. According to our previous study (unpublished work), the eddy amplitude/strength, the speed of eddy motion, and the distance between eddy and island will play the comparable role as R and S. In present study, the authors may want to give a comprehensive review of these effects, then focus their study only on one or two of them by fixed other parameters.

Minor comments

Page 2, line 1 Guihua et al. 2005 ->Wang et al., 2005. And the reference is corrected as below. And another pioneer paper (Wang et al 2003) should be better cited here.

Page 2, line 3, The paper in Science (Zhang et al., 2014) should be better cited here.

Page 3, line 10 "there are few cases of eddy-splitting found by satellite images so far." our recent published paper in this journal (GEM: a dynamic tracking model for mesoscale eddies in the ocean) just illustrates such kind of case.

Page 4, line 10, "Fig.1 shows the temperature and azimuthal velocity distribution on the cross section through the eddy center." Page 6, line 10 At the beginning of the model integration, the eddy will adjust itself to a dynamic balance. It is better to show the balanced eddy structure rather than the initial eddy structure in Fig.1.

Page 5, line 9, "parameter β = 2 $\times 10^{-11} m^{-1} s^{-1}$ and the Coriolis parameter f = 9$\times 10^{-5} s^{-1}$, which are the typical values in the SCS, are used in model." This is not correct. Such values suit for 38$^o N$ are taken from Wei and Wang (2009). While at Dongsha Island (20$^o N$) in SCS, the parameter β = 2.15 $\times 10^{-11} m^{-1} s^{-1}$ and the Coriolis parameter f =5$\times 10^{-5} s^{-1}$.

References:

Early J J, Samelson R M, Chelton D B (2011). The evolution and propagation of quasi-geostrophic ocean eddies. J Phys Oceanogr, 41 (8): 1535–1555.

Wang Z, Li Q, Sun, L, Li S., Yang Y.-J., and Liu S.S. (2015). The most typical shape of oceanic mesoscale eddies from global satellite sea level observations, Front. Earth Sci. 2015, 9 (2): 202-208. DOI 10.1007/s11707-014-0478-z.

WANG, G.H., CHEN, D. and CHU, P., 2003, Mesoscale eddies in the South China Sea observed with altimeter data. Geophysical Research Letters, 30, 2121, doi:10.1029/2003GL018532.

Wang, G.H., Su. J.L., and Li, R.F.: Mesoscale eddies in the South China Sea and their impact on temperature profiles, Acta oceanologica sinica, 24, 9-45, 2005.

Zhang Z G, Zhang Y, Wang W, Huang R X (2013). Universal structure of mesoscale eddies in the ocean. Geophys Res Lett, 40(14): 3677–3681.

Zhang Z, Wang W, Qiu B. Oceanic mass transport by mesoscale eddies. Science, 2014, 345(6194): 322-324.

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