Thanks for your efforts and useful comments. We make a summary of brief reply to the major comments by all reviewers. Since your comments are so many, we make a point to point reply to your major, specific and figure comments. The technical corrections (typos, grammars) are made simply by following the suggestions without any reply.

Major comments:

- The first step of the algorithm, the eddy identification has been published previously as the authors say (Li et al., 2014, Li and Sun, 2015). Please state very clearly what code/section/figure you have taken straight from there, where you summarize the previous papers and where you potentially add a new facet for the purpose of the merging/splitting assessment in the present paper.

Reply: We rewrite section 2.2 based on comments by you and others.

- Given that the paper presents a method and the associated code, my suggestion would be to (i) state in the text overly clearly what the input of the code is, what programming language it is written in, how efficient it is (based on the North Pacific example) and (ii) publish it along with the paper (or provide a link to a repository where you uploaded the code). Obviously, it is left to authors if they like to follow this suggestion but I believe it could greatly enhance the impact of the paper.

Reply: The programs are written in Fortran 90/95 standard with windows platform, including seven f90 program files. In a personal computer with CPU of i7-6700k and 4.00 GHz, program Mei.f90 uses 15 minutes to identify vortices, program Vortex.f90 uses about 25 minutes to establish similarity, and program Eddy.f90 uses about 10 minutes to track eddies. We state these in our program readme file, since lots of program details may not be concerned by users or readers. We simply copy the relative part below.

Data and file preparation

GEM uses SLA data as input. We store all the SLA data files ('msla_19930101.dat') in a given directory as "SLApath", and all the data filename (19930101, 19930102, etc) in a txt file ('intxt =E:\sunl\WORK\Eddytrack\ini.txt'). Besides, we also use a topography file ("topofile=E:\sunl\WORK\Eddytrack\topo_721_1440.txt") since the SLA data have useless values on lands or coastal regions.

Then we need to prepare initial parameter file of 'inipara.txt' (see inipara in "Typeconst3.f90"), which includes these parameters.

```
open(22,file=inipara,form='formatted',action='read')
read(22,*) iconmin,iconmax, ias,ide !
read(22,*) intxt,topofile       ! datefile, topofile
read(22,*) SLApath                    ! SLA data path
read(22,*) vorpath,eddypath     ! vortices path, eddy path
close(22)
```

where iconmin=1 (first file), iconmax=7305 (last file of 20 year SLA data), ias=ide=1 is used for similarity calculations in "vortex.f90".

The outputs of programs include identified vortices (vorpath) from SLA data and eddy tracks from vortices (eddypath).

In "vorpath", there are three series of files as "date-vor.dat", "date-voi.dat", "date-vet.dat", where "date" means "19930101, 19930102, etc."

In " eddypath", there are "Eddy-eddv.dat" and "Eddy-eddt.dat" (Eddy is identified as a integer number starting from 1000000), which contains long-term eddies (defined as life time>MP_Eddylif_CV_MIN). Besides there are two files as "TbEddy.txt" and "TpEddy.txt", which list parameters of all eddies (even life time< MP_Eddylif_CV_MIN).

- I was wondering if it was useful at all to apply your tracking algorithm to eddies identified not with the watershed? Would you recommend to use the two algorithms you present to identify and track eddies "in conjunction" or does it make sense to test your tracking algorithm separately e.g. with eddies identified with OW. In the text it appears not conclusive to me, on the one hand you say that segmentation is necessary in the identification process, on the other hand you mention in future research that one could test the algorithm with eddies identified based on other methods.

Reply: In our programs, user can use either OW, GV (Geostrophic Vorticity, normalized by Coriollis parameter *f*), SLA, or hybrid of them to identify eddy. But a watershed algorithm is always used in these programs. The identified eddies by using other identification algorithm without watershed can also be tracked with our programs given proper input. In this case, there should be no difference in eddy track itself (Eddy-Eddv.dat). But the records of merging /splitting relationship (Eddy-Eddr.dat) will change. The strong interaction of eddies "in conjunction", which leads to genesis and termination of eddies, is more likely missed. However, some weak interaction of eddies in some far distance (watershed free) could still be recorded. We are sure for this because we have analysized many cases of our output data. We noted (not mentioned in this paper) that lots of merging/splitting records occurred at the interaction of two eddies with a certain distance. This kind of interaction can't be recorded by previously interaction-free tracking algorithm (only isolated tracking eddy record), but it is still scientifically very interesting to investigate. Finally, the programs at least have "look-ahead" approach, which can effectively reduce the temporarily missing eddies at identification comparing with previous programs.

Specific Comments:

Text:

Comment L14/15: isn't it mainly the look-ahead approach which solves the missing eddy problem, and the similarity approach helps to reduce the number of missing eddies?

Reply: Yes, both approaches solve different problems in missing eddies, e.g., the similarity approach reduce the mistakes of one eddy track to another.

Comment L15 "parents and children": unclear at this point; if you want to mention this in the abstract I suggest to explain the terms.

Reply: suggestion followed. "parents (a new eddy) and children (e.g., splitting eddies from parent eddy)"

Comment L54 "related to sampling errors and measurement noise": I suggest to make this more general (as you do in L79) and add sth like "but also due to limitations of the eddy detection step"; a missing eddy problem can occur also in model data (e.g. if an eddy is not well defined in a time step or too weak/small etc).

Reply: suggestion followed.

Comment L66 "larger computational complexity": I suggest to define computational

complexity.

Reply: suggestion followed.

Comment L93 “If the algorithm works well”: don’t you show that it works well?

Reply: We are sorry for the unclear. We mean, if the algorithms was implemented with the computer codes properly. Since the GEM model itself (Fig 8) doesn't take efficient algorithms/codes for granted, it can be implemented with different algorithms/codes by users. Thus, the accurate and efficient may be much different. We have modified to "if the GEM was implemented with the computer codes properly".

Comment L96 “to limit the size of the study area”: why do you do this? Because of computational costs?

Reply: Since we are more familiar with NPO, we only output NPO data to limit the analysize region. However the codes are for global oceans.

Comment L99 “computation complex”: unclear, please rephrase.

Reply: Suggestion followed: "computational complexity".

Comment L105 “mainly include”: unclear; “consists of”?

Reply: Suggestion followed " consists of"

Comment L126-129: I suggest to order the constraints the same way as you apply them in section 2.4.

Reply: Suggestion followed. We rearrange it in section 2.2

Comment L127 “the SLA value”: the average SLA value?

Reply: No. All the SLA values.

Comment L128: do you need the 1 cm constraint? It would be nicer without as you may discard long-lived weak eddies.

Reply: Yes, we used this 1 cm constraint so that weak extremes are not taken as eddies.

Comment L129 “large enough”: large enough for what, any reason for the 16 pixels? The “potential usefulness” noted in L136 is not obvious to me.

Reply: large enough for estimating eddy parameters.

Comment L138 “The above criteria...”: isn’t it mainly criterion (1) which helps to get rid of the huge features?

Reply: Yes, criterion (1) which helps to get rid of some features. Then criteria (3) and (4) also do this job.

Comment L141 “territory”: any reason not to call this “area” as you have done before? In general, I suggest to stay either with “territory” or “area” unless you have a reason to use the two (e.g. also L147 “area”). The nomenclature is not always clear to me. Similarly, I would stay either with “eddy detection” or “eddy identification” if you talk about “finding” individual eddies in an SLA map (e.g. you call the section 2 “Eddy detection” and subsection 2.2 “Eddy identification”, and if you do so say early on in the paper that you will refer with “Eddy identification” always to XXX). To keep the nomenclature consistent and as simple as possible will help the reader to keep track of what you are doing. Maybe you can come up with an expression for the “final” eddies also, which includes identified eddies and their tracks (e.g. “tracked eddies”)? Along these lines, what is the difference between “link” and “connection” (e.g. Fig. 4)? And, I suggest to either use “intersection” or “overlap” for the territories.

Reply: We use area in this paper. The “map link” is relation between two time steps and then

connecting all time steps to the “track tree.”

Comment L143 ff “Necessity of segmentation”: if this is taken straight from the previous Li papers I am not sure if you really need 2 Figures explaining it- I like Fig 2 to get the point across, but is Fig 3 really necessary? Also, it is somewhat unclear what is taken straight from Li (previous papers) and what is new here in terms of the eddy identification, I suggest to be very clear about it and start section 2.2 with sth like “we have taken/adopted the eddy detection step from Li et al XXX which provides us with the necessary input for the tracking routines, namely eddy territories and boundaries”, followed by a summary of the method.

Reply: we add the sentence to section 2.2

Comment L143 subsection title: as you submitted to an oceanographic journal I suggest a less technical and more purpose based section title, sth like "Determination of merging and splitting events" (..."based on segmentation" if you wish).

Reply: Suggestion followed.

Comment L149 “above-identified”: unclear, what do you refer to here?

Reply: The amplitude and area of eddies.

Comment L154 ff: A side note: the watershed segmentation appears elegant but the so defined territories cut across SLA contours- which appears somewhat non-physical. You mention this briefly but I would make it clearer in a sentence. If I think about trapping of mass and material properties by eddies, “stuff” in the outer area (closed SLA contours which enclose both extrema) intuitively may end up in either of the two enclosed eddies if the split in a subsequent time step, i.e. this outer area technically does not belong to either of the two but is a separate area.

Reply: We rewrite this part with the order of identification by following the suggestion before and hope it is more clear now.

Comment L154: it is irritating presently that 2.3 and 2.4 are named very similarly. I suggest to insert the text of 2.4 right in the beginning of 2.2 (as it provides kind of an overview), and then have subsections for the segmentation step if necessary.

Reply: We insert first paragraph of 2.4 right after 2.2, and combine 2.3 and 2.4 as one section.

Comment L156: when do you apply constraint (4)?

Reply: In the last step, we used this 1 cm and 16 pixels constraint so that weak/small extremes are not taken as eddies. We add this to section 2.4. And we rewrite the paragraph.

Comment L168 “which is less dependent on physical parameters”: can you say why this should be a good thing? Not necessarily intuitive to me as an oceanographer.

Reply: GEM itself should be less dependent on physical parameters. However, MEI does not. It is MEI that defines the eddy with physical parameters. And we found that GEM parameters are sensitive to the eddy identification method. We add a paragraph in discussion section 5.2.

Comment L173 ff: this section didn’t help me all that much when reading it the first time as I wasn’t familiar with the technical terms used in there. I suggest to either try to make it more general/easier to understand or to get rid of it.

Reply: We use subsubsections to do so.

Comment L177 “first”: you have a "first" and "second" part here but 4 subsections which follow thereafter. I suggest to either refer first, second, third and forth here or to reduce to two subsections, if needed with subsubsections.

Reply: We use subsubsections to do so.

Comment L178 “link between eddies in different snapshots are saved”: could you define “link” here in “plain English”, e.g. “link of an eddy from one temporal snapshot to the next, namely living, missing, death, birth, and the associated dynamical processes of merging and splitting?”. I suggest this as after your elaboration of “map link” I still didn’t get what it exactly represented.

Reply: The relationships are determined by two relatively independent steps i.e. the GEM algorithm consists of two parts (see Fig.4 for details): first, measuring the “map link” between two time steps and then connecting all time steps to the “track tree.”

Comment L183 ff: I don’t find it straightforward to get here the differences of “links”, “branch” and “tree”.

Reply: an eddy branch involves 2 time steps, and track tree is then the result of concatenating all time steps

Comment L193 “Similarity vector”: once more I suggest to phrase the sections less technical and more objective driven, e.g. "Eddy similarity" or "Recognizing eddies in subsequent time steps" or so. Similarly, section 3.3 – 3.5 are titled very technically, too.

Reply: We modify to Eddy similarity

Comment L193 ff: the section is rather long and sounds rather complicated. In my understanding, you simply define similarity based on the overlapping area of eddies in consecutive time steps. Subsequently, the overlapping area which is closest to the one of the original eddy is defined to be the successor of the original eddy (if the threshold is met).

Can you summarize the section in plain English in the beginning of the section?

Reply: we summarize this at the beginning of the section.

Comment L195 “evaluates the similarity of these eddies”: “evaluates the similarity of these eddies which is defined here based on the overlap of the territory of an eddy in two consecutive time steps.” or so.

Reply: suggestion followed.

Comment L203 “rectangular comparison region”: I cannot find this in the figure.

Reply: We do not show this in figure, because the rectangular may .

Comment L219 “The last type...”: unclear sentence, please rephrase (e.g. “can also be identified”to “is prescribed”?).

Reply: suggestion followed.

Comment L239 ff: I find 3.3, the look-ahead method, difficult to follow, especially paragraph 2 and 3. Partly this is due to the phrasing using T0 to T3 (rather than “unrelated” etc). Can you try to rephrase and make it clearer? Also, doesn’t belong the first section more to the previous section?

Reply: We modify the figure and add notations on each type, e.g. T3(living). For example,

Comment L255 “closed day”: I don’t understand the concept of closest day, please try to elaborate.

Reply: Maybe “earliest day”.

Comment L264: do I understand correctly that an eddy branch involves 2 time steps, and track tree is then the result of concatenating all time steps? If so, please say so, if not, please clarify. It is not entirely clear to me what makes an eddy branch.

Reply: Yes, as you mentioned: an eddy branch involves 2 time steps, and track tree is then the result of concatenating all time steps.

Comment L277 “we could not decide”: why not in a technical sense? Because the similarity was not sufficiently high for either eddy?

Reply: Yes, modified.

Comment L279 “increases”: why increase, doesn’t it reduce the number of detected eddies (as one has one eddy birth less as a result)?

Reply: This choice (keeping parent eddies P_1 and P_2 alive) artificially increases lifetimes of eddy P1 and P2.

Comment L279 “other tracking problems”: such as?

Reply: This can't be addressed in a few words, but readers can image what would happen. At first, in each time step, we need write the same track to two different eddies. To this end, in each time step, we need to check each eddy whether it has a company eddy, and find out which eddy number is, where it is stored, etc. This will make the codes very complex and would easily have bugs in codes. Besides, the storage can't support this, if this new eddy has merging/splitting events eventually.

Comment L293 “two generations”: “three generations”? Parent, child and grandchild?

Reply: We only records two generations "Parent and child", due to the storage and complexity. The grandchild is recorded as the child of a child eddy.

Comment L294 “due to the complexity of the output”: is it only that or does also the computational complexity and cost increase with more generations?

Reply: The computational complexity and cost have limited increase. But the logical complexity, store structure and the codes increase very much.

Comment L296 “Computation complexity”: “computational cost” or so? This is what I, as user of the code applying it to my data, would be interested in.

Reply: In computer science, it is "computation complexity". So we simply follow this.

Comment L302 This might be the fastest method possible”: possible to do what? Why “might”? Change to sth like “The look-ahead method can hardly be made any faster/more efficient”.

Reply: modified as suggetion.

Comment L321 “NECC”: the NECC is rather close to the equator and at the boundary of your detection domain, hence I would be careful with interpretations here.

Reply: Thanks for suggestion. It is NEC but NECC.

Comment L330 “The long-lifetime eddy trajectories imply that the quality of the tracking results is reasonable”: I am not sure if this is true. You can easily connect many tracks which do not belong to each other and get a very long, but “bad” track.

Reply: If the eddy satisfy the overlap criteria, the track will be ok. Otherwise, there is a risk of connecting many tracks which do not belong to each other, especially by those simple tracking algorithms.

Comment L331: you look at only one example here. Can you elaborate on a few more examples and/or if you have done a visual evaluation of your tracks (e.g. animations)? One example appears not sufficient to justify the conclusion that the tracking algorithm “works”.

Reply: Yes, we have many such of examples and made animations of them. We can send one or two of them to editor. But we do not want to include them into the present paper except for the example in Fig.11, because the paper is too long to be hold by us. From 2014, we spend too much time in reversing this paper but few time in the analysis of results and other studies.

Comment L335 “puzzle”: has this happened only once? Why did you come across it? Have you checked this somewhat systematically in your eddy data set?

Reply: For this example, it is only once. We noted such kind of jump before and found that is hard to choose distance criteria in tracking. This is the reason why we want to develop a new tracking method and solve the problem from beginning. But for this example, it is only a chance. We only drew the long-term eddy track, and found that there is a jump. We also noted that this kind of jump can easily be found in long-term eddies, but we do not check it systematically (our time are spent to the paper itself).

Comment L343 “A similarity vector”: is it obvious if the number of missing eddies is reduced due to the fact that it is a vector or your approach of using the overlapping of territories?

Reply: Yes, when we use overlapping of territories, the missing eddies is reduced.

Comment L345 “as scale”: “a scalar”? Btw, oftentimes, people previously have used not only distance but in addition a similarity parameter as well, but a scalar defined based on eddy properties such as amplitude/size/vorticity etc.

Reply: suggestion followed.

Comment L364 “that cyclonic”: “a pair of cyclonic”?

Reply: suggestion followed.

Comment L365 “for cyclones”: “for atmospheric cyclones”?

Reply: suggestion followed.

Comment L369: I would be interested in the number of merging/splitting events per lifetime, could you mention it? And/or if you showed Fig 9 in terms of eddy tracks passing a grid box per year (instead of eddy extrema), one could easily compare Fig 12 to Fig 9 to roughly estimate such a number.

Reply: We add Figure 13 to show this. We have redraw the figure.

Comment L388: I suggest to highlight the regions you mention in the Figure, with a box or so.

Reply: We add a blue box for NEC and black box for eddy desert.

Comment L407 “false”: I don’t like “false” as it is not obvious what extrema are true and what are false. The original data may have errors and hence false extrema, the smoothed data likewise.

Reply: we modify it to "additional"

Comment L411 “This is one of the reasons why we need look-ahead”: “The ambiguity of the eddy detection procedure and the potential errors in the input data strongly suggest the application of a look-ahead approach. The resulting eddy tracks are largely insensitive
for instance to a filtering method applied to the input SLA data.” Or so.

Reply: We modified the text as suggestion.

Comment L413: in this section, it would be nice to quantify a bit more the uncertainty due to variations of N and variations of rc. For N you have partly done it (L424 where you provide the L418 “The numbers of eddies seldom change”: “The number of eddies does not change substantially”. Can you quantify this a bit more? E.g. provide the L421 “The numbers of merging and splitting events seem to converge for rc >0.5 as N increases.”: “The sensitivity of the number of merging and splitting events seem to converge to 0 for rc >0.5”. Can you briefly comment on why this is the case?

Reply: If rc<0.5, there might be two eddies which are taken as successors of an given eddy at

seem time. So the tracks might be randomly jump from one eddy to another. The results are not believable. We add this comment.

Comment L425 “missing eddies, which may also reduce both total eddy numbers and dynamic events.”: I would have expected the opposite (unless you consider only eddies with a certain minimum lifespan, e.g. 30 days. I guess this is the case here?)

Reply: Yes, it depends on which one would be counted as eddy. For eddies with lifetime>30 days, the missing eddies may reduce the total numbers. But if one consider all eddies (even lifetime>one day), the missing eddies increase the total numbers.

Comment L427 “0.6-0.7”: why is this optimal?

Reply: In our programs, it is reasonable. In one hand, we first require that rc>0.5. On the other hand, we know there is area error in calculation (~10%) since only eddy grids are taken into consider. This is also the reason why we need rc<0.9 or even smaller. So the optimal value should be within 0.5-0.9, and ~0.7 is just in this middle.

Comment L445 “Thus, it is difficult to directly compare the influences of eddy territory using different tracking algorithms”: I don’t see how this follows from what you said in the previous sentences. Also, you originally point out that you need specifically identified eddies which allow you to find the merging and splitting events. Which is why you use the watershed algorithm. Hence, overall I don’t really see the point of this paragraph.

Reply: The point is that it is difficult to directly compare the influences of eddy territory using different tracking algorithms. We rewrite this paragraph and move it behind.

Comment L447: The paragraph is difficult to follow except for the last two sentences. I like the sensitivity test with respect to the minimum amplitude, only an issue is that you don’t strictly test the sensitivity of the eddy boundary as the modification of the amplitude threshold also changes the number of identified eddies (as you state yourself). The whole point of section 5.3 appears to be that the sensitivity of the eddy boundary is not straightforward to determine but is estimated to be small.

Reply: Yes, the main point is that the sensitivity of the eddy boundary is not straightforward to determine but is estimated to be small for present eddy identification.

Comment L457: does it make sense at all to test the tracking algorithms with the input from other detection algorithms which do not include what you refer to with “segmentation”?

Reply: We hope the newly additional paragraph in section 5.4 answers the question.

Comment L465 “A better way to obtain these parameters might be to use a nonlinear fitting of the flow field”: unclear, please rephrase. The point of the whole paragraph is unclear to me.

Reply: Since they may not be sufficiently accurate for some applications. Besides, some physical quantity (circulation, angular momentum, energy) are required to be accurately calculated in the investigation of eddy dynamics process. A better way to obtain these characteristics might be to use a nonlinear fitting of the flow field with appropriate models other than simply estimated from identification.

Comment L472 “computation”: is this referring to the computation time of the tracking procedure only or including the identification? This is great. Could you repeat the detail here on the model domain and other constraints (eddy size, amplitude, N etc) that the reader can get an impression what it would mean for his/her own application?

Reply: In a personal computer with CPU of i7-6700k and 4.00 GHz, program

Mei.f90 uses 15 minutes to identify ***vortices*** (snapshot of eddy), program Vortex.f90 uses about 20 minutes to establish similarity, and program Eddy.f90 uses about 10 minutes to track eddies in the North Pacific Ocean (NPO).

Comment L475 ff: I would stress this, this is the really exiting part for me as an oceanographer.

Reply: (i) the strong eddy interaction which leads to genesis and termination of eddies (ii) the weak eddy interaction which associates with merging/splitting events (iii) the weak eddy interaction which modulates the eddy track and motion.

Figures:

General:

-If you show snapshots of eddies, e.g. Fig 11 or 13, I suggest to roughly maintain an aspect ratio which doesn't distort the eddies that much (the extreme case is Fig 13!).

-please describe everything you show in your Figures, e.g. "white dots mark eddy centers" etc.; I mention some of the missing references below.

-the resolution could be increased in some of the figure and the labels increased (e.g. longitudes/latitudes are sometimes difficult to read).

Fig. 1: -mention that the background field shows SLA, and white dots mark eddy centers.

Reply: we add the notation.

Fig. 2: -say what the letters h, A, t etc in the figure refer to.

Reply: The h represents background SLA value, A represents amplitude of eddy, and t represents the map at different time.

Fig. 3: -cryptic caption, please expand (explain letters, what quantity do you illustrate in panel a etc).

Reply: Watershed as the natural division of eddies C1 and C2. from top view, where contours represent SLA. (b) The particles P1 and P2 on the watershed flow downward to the eddy centres C1 and C2 from cross-section view.

Fig. 5: -missing colorbar, say what A1 etc refer to.

Reply: Redraw the figures, and add the reference.

Fig. 6a: I suggest to shade only the overlap/intersection of eddy territories.

Fig. 6b:

-change "their are four types" to "there are four similarity types".

-in the text it says you used rc=2/3; you may want to illustrate this threshold here.

-it would help if you noted the "types of similarity" you write about in the text in the Figure in plain English, i.e. "unrelated" etc. You could also insert E2 to E4 in the respective types/quadrants to continue the illustration of 6a.

Reply: We redrew the figure, and modified the text.

Fig. 7:

-why are the eddies labelled now Ec1 etc instead of E1 etc? If possible, make it consistent.

-cryptic caption, please expand.

Reply: We expand them. (a) Three typical cases of successors (T1, T2 and T3) from one day (day 0) to another (day 1). (b) The eddy at day 0 may have different successors corresponding to different numbers of "look-ahead" days, e.g., Ed1 at day 0 may have a T3 eddy on day 2, and have two T2 eddies on day 3.

Fig. 8b:

-”of the eddies” or of an example eddy?

Reply: modified

Fig. 9:

-are all extrema counted here or only the ones belonging to eddies which existed at least 30 days?

-is the scale logarithmic or just nonlinear?

-mention the red box.

-instead of number of eddy extrema you could show number of eddy tracks per year (i.e. count an eddy which passes through only once – or have you done this? This is unclear) to make the numbers interpretable together with Fig 12.

-9c: I am a bit surprised that the eddy numbers are distributed that evenly.

Reply: Yes, they are 30 days at least. And the scale is logarithmic. We add the notation of red boxes. At least the example in Fig.11 implies that this region is anticyclonic eddies dominated.

Fig. 12:

-adjust colorbar so that the figure does not appear only in blueish colors.

-I cannot see the spatial pattern you describe in the text very clearly.

-12d: you could show the ratio of merging and splitting to highlight the difference (as you have done in Fig 9 for cyclones/anticyclones).

Reply: We redraw the figures.

Fig. 13:

-note in the caption what are the box, letters, white dots.

Reply: We add them.

Fig. 14a: I like figure 14 a lot, it is great that you tested the sensitivity of the results to the parameters.

-why do you have the spike at rc=0.6?

Reply: It is a typo in data, the new figure does not have this spike.