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Discussions

Interactive comment on "A new Lagrandian based short term prediction methodology for HF radar currents" *by* Lohitzune Solabarrieta et al.

Anonymous Referee #1

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The manuscript describes the application of the method of analogues to the prediction of Lagrangian trajectories computed from HFR.

Lagrangian trajectories are computed from an historical data set providing surface currents from HFR systems. The catalogue of these Lagrangian trajectories is the basis to be compared to any new data set, from a present HFR surface currents. Then the future time evolution of the analogue provides the forecast for the present case.

The best analogue is selected in 2 steps. First the difference between the centroid of the 25 trajectories (the 48-h or the end position, is not clear) of each hour of the catalogue is compared with the centroid of the target field. Only the analogues resulting in a difference lower than 10km are selected. Then a Lagrangian error (\epsilon_ANL) is defined as the sum of the mean separation distance between trajectories computed

from the catalogue fields and those computed from the target field, at 4 different times (6, 12, 24, 36 hours of advection). This error is in km^2. The field having the lowest error is selected and will provide the analogue forecast.

Why do we need the first step? I suppose that if \delta_cg is bigger than 10km, then the error is high? Is it for computational issues?

To assess the performance of the method, an equivalent Lagrangian error is computed. I'm not sure that the definitions of the errors (\epsilon_STP and \epsilon_PRS) (line 303-304 308-309) are correct. I think that the authors compute the forecast so next 48 hours instead of last 48 hours. Otherwise, I really misunderstood completely the method, which is possible, according to my numerous questions. For example, on Figure 3, I do not understand why the blue dots are the same in a) and c) (or (b) and (d)). The end points of a) shouldn't be the start points of c)? Either (a) is a backward trajectory plot, and (c) a forward plot, or again I'm missing some fundamental explanation.

So let's assume that the authors were mistaken, and that the performance is evaluate by computing the error on the next 48 hours (forecast), by comparing the original field with the analogue forecast. Another forecast is used for comparison, based on a persistent field (constant velocity field for the future). The time series and spatial distribution of the errors have then been analyzed for 2 regions (Bay of Biscay & Black sea)

Figure 4 shows the time series of the errors ANL,STP and PRS . The black dots over the timeline shows the times the STP error is higher than PRS according to the caption, the other way around in the text (line 328)! At this point I was thinking to give up the reading, too many errors, to complicate to decrypt the manuscript. But let's go on. . .. PRS method seems better during winter period, since high persistent structures are present. The correlation between ANL-STP is 0.46 and ANL-PRS is 0.05. How significant are both values? Are the authors happy with the 0.46 value? Does it mean something for the methodology?

Then the analysis is done by plotting errors (STP, PRS) or separation distances versus error_ANL comparisons are shown and discussed. Here my question is how reliable are the results in terms of the dynamics. The error values are enormous, hundreds of km^2, considering the domain size ($\sim 1.5^\circ * 1.5^\circ$ according to Fig1), and the correlation coefficients quite low (maximum of 0.56 according to Table 2). Maybe a visual and qualitative comparison between the eulerian fields (the winner analogue , its forecast vs the target fields) could give an idea of the performance of the method. The values alone are not enough in my sense to validate the methodology.

Maybe this method is worthwhile to be further investigated, but I would recommend to go through a major review, making the method clearer, making a methodological analysis in parallel to a physical explanation. The methodology should also be more detailed. Results should be better presented to be convincing. The analogue method was developed mainly for meteorological dynamics, which have very different time and spatial scales. Moreover, the application of this method to Lagrangian motion which very often exhibits chaotic behavior, even in regular and simple Eulerian flows, is questionable. A sub region may have analogues in one period, and a distant region another period. The authors may consider to work on sub region, and with a higher number of trajectories.

Specific comments:

- Once the Error is defined (eq.1) no need to repeat it (eq.2 & 3), since the difference between the errors is not the equation, but the field used to compute the trajectories and the separation distance.

- Not sure either that the definition of the time interval in line 293 is correct. Maybe the authors wanted to write v(ti)=v(tf), ti=[tf tf+48] ?

- Please find better definitions, and schematize the method. Instead of realized you

may use truth, as for the twin experiments in data assimilation?

- The authors say that the method has been applied to the eulerian field with unsatisfying results (no improvement compared to other methods). Can the authors suggest some explanations for this?

- How the trajectories are computed is not explained, since the readers may not know the CODAR package. Are they purely advected? Is there any diffusion term?

- What is the physical significance of the error (thousand of kilometers)?

- What is the distance between initial points?

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