

Interactive comment on “Relating Agulhas leakage to the Agulhas Current retroflection location” by E. van Sebille et al.

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General comments =====

The authors calculated timeseries of the western extent of the Agulhas retroflection and timeseries of the agulhas leakage from an ocean model. The correlation between both timeseries is used to estimate Agulhas leakage from satellite observations of sea surface height. It is stimulating to see that simulations and observations are combined to create a powerful tool to better understand the ocean circulation. However, a correlation between two independent timeseries can't be proof for the hypothesis that the western extent of the Agulhas retroflection regulates Agulhas leakage. A clearer picture of the overlap of lagrangian particles and the sea surface height signal of the Agulhas rings and retroflection is needed to convincingly show the physical basis of

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the correlation. Lagrangian trajectories can then be separated into 4 groups: inside or outside the ring, and into the Atlantic or into the Indian ocean. Together with the fact that both the model and the observations already show a very similar behaviour of agulhas ring size as a function of retroflection retreat, this will lend more confidence to the predicted agulhas leakage. The authors already have the necessary data and it should therefore not be too difficult to do. Furthermore, the overlap calculation also gives an estimate of the fraction of agulhas leakage in rings vs. the fraction in e.g. filaments and jets. And can this 'background Agulhas leakage' be pinpointed to a particular depth? Donners et al. have used the same technique to show that agulhas rings stay fairly homogeneous (ie. don't mix into the environment) in the upper 800m. Would the correlation be stronger if lagrangian particles below 800m are ignored?

Specific comments =====

-write something about the general properties of Agulhas leakage in the model: how many, how large/warm/salty? how long lived? ie. how realistic is the leakage?

-pg 1199: "Agulhas rings are the most notable transport agent". Can you give an estimate of agulhas leakage which is not in rings with the extra diagnostics?

-pg. 1999: "if several rings are found, the closest one is chosen". How many rings are ignored? Are there sometimes no rings?

-pg 1201: The trend in the wind stress curl in the Indian Ocean affects Agulhas Current strength, which affects leakage. Is the change in Agulhas Current strength reflected in the amount of seeded lagrangian trajectories? ie. less trajectories, but more that reach the GoodHope section?

-pg 1201: at what depths are lagrangian particles seeded? How often are particles seeded? Every 5 days or? How is the vertical distribution of $F_{AL}(t)$?

-pg 1202: the trajectory calculation does not interpolate velocity fields between 5-day means. However, the same Lagrangian technique can be extended to time-interpolated

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velocity fields (de Vries & Döös 2001). This would partially resolve/quantify the second type of error.

Technical comments =====

-the point p_s is mentioned sometimes at 32E or at 32S. Which one is correct?

-pg 1202: the authors mention model snapshots, while before they were 5-day means. Which one is correct?

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