

Ocean Sci. Discuss., referee comment RC2
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Comment on os-2021-94

Anonymous Referee #2

Referee comment on "Passive tracer advection in the equatorial Pacific region: statistics, correlations and a model of fractional Brownian motion" by Imre M. Jánosi et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-94-RC2>, 2021

Analysis of tracer advection, particularly analysis of the Lagrangian trajectories, is of much importance. This paper investigate tracers' trajectories in terms of spatial pattern, relation to ENSO, statistical properties and the role of fractional Brownian motion. The topic is somewhat interesting, but some fundamental flaws, in terms of methodology and interpretation, are seen in this manuscript and important additional calculations or evaluations are needed.

Major comments:

- The key points of this study are: interannual variability of advection is related to ENSO, and well reproduce the statistical properties of the tracers' trajectories with a fractional Brownian motion model. It is well known that the oceanic advection is associated with ENSO cycle and there are actually numerous previous studies have examined the relationship between oceanic advection and ENSO in very details and on multi time scales. So, to me, the most important point of this paper the latter, i.e., the interpretation of the observed statistical properties of the tracers' trajectories using the fractional Brownian motion model. The authors examined the tracers' trajectories which are 10, 20, 40, and 80 west of the starting position, claim that "the westward moving tracers can be mapped into a simple 1D stochastic process" and "numerical simulations of the fractional Brownian motion model that it is able to well reproduce the observed statistical properties of the tracers' trajectories". However, this may not correct. The advection of sea water particles is influenced by not only molecular-scale processes, but also small scale, mesoscale to large scale processes that related to geophysical fluid dynamics. Although the molecular-scale processes and even small scale processes may be stochastic, the geophysical fluid dynamical processes are not stochastic, whose major component is linear. One of the difference between the two kinds of processes is

in the spatiotemporal scales. Because the spatial scale of mesoscale to large scale processes is much greater than 8 degrees and the time scale of large scale processes is longer than order of 100 days, the conclusions of the present paper is very misleading to the oceanography community. So, the authors may extend the range of tracers' trajectories in investigating the role of fractional Brownian motion in the observed trajectories.

- The writing of this manuscript needs further improvement, including the logic structure and grammar.

Minor comments:

Abstract:

- What does "advection strength" mean? The definition should be specified here
- What kind of data or "numerical experiments" used?
- It's needed to replace equatorial with "tropical" since the domain in this paper beyond the equatorial region obviously
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Lines 14-15: Non sense. The authors may delete this sentence.

Lines 50-51: Explain how did AVISO calculate geostrophic currents in the equatorial region

Figure 1: How did you choose these representative trajectories?

Figures 3-6: (1) It seems that the 99% confidence interval is shown in plenty of grey lines? Why? (2) It should be specified in the captions what a positive time lag means

Section 3.2: I am confused what your purpose of section 3.2 is.

Figure 6: The relationship between ONI and SOI is well known. Figure 6 is not necessary and should be removed.

Line 174: what does "distance" mean?

Lines 176-177: The definition does not show an average. The authors may modulate the formula

Line 179: any reference for the "super diffusion"

Line 192: need to show the four positions in Fig.1

Lines 200-202: please cite these references properly

Figure 7: why did you choose 1-8 degrees? How about longer distances?

Line 212: suggests -> suggested or suggest

Figure 10: add unit of t

Line 232: pacific -> Pacific

Lines 235-236: what are the "two phenomena"?