"Inferring flow energy, space and time scales: freely-drifting vs fixed point observations"

response to reviews #1

General response

Dear editor and reviewers,

This novel submission is composed of a revised version of the manuscript in response to reviewer #3 comments as well as a pdf of the differences from the original manuscript and a detailed response to reviewers. Much of the modifications requested concern relatively minor clarifications. Overall, we believe the manuscript has substantially matured and we look forward to hearing about your decision regarding its publication.

Sincerely,

Aurelien Ponte & coauthors

Reviewers comments are in regular font and our responses in **bold**

'Comment on npg-2024-10', Anonymous Referee #3, 07 Sept. 2024

General:

The study addresses the interesting topic of the inference of spatiotemporal decomposition of oceanic surface flow variability. The authors presented a novel method to deal with the problem and evaluated the its performances in a synthetic idealized configuration. From the perspective of computation cost and environment impact, the novel method highlights the superiority of the drifter deployments.

The paper is interesting and well structured, which may have important inspirations to the scientific community. I recommend it to be accepted before some minor revisions.

More detailed comments are below.

1. The authors claimed that the observed data **y** was obtained by adding the white noise to the flow time series. The properties of white noise have important impact on the accuracy of the experiment result. Generally, different amplitudes of white noise

may lead to different results. More detailed descriptions of the white noise and its possible impacts of different amplitudes are preferable in this paper.

We have added a paragraph (L181-L187) in section 2.3 that puts into context the observation noise level chosen here and lists the investigation of the robustness of inferences to noise level as a future study.

2. The nonlinear characteristic is obvious in the oceanic surface flow variability, which means the dynamical trajectories of surface flow are sensitive to the initial conditions. Besides, the synthetic idealized configuration used in this study has no parameter errors, which are different to real oceanic systems. If the nonlinearity is taken account, whether it change the conclusion, please give some discussions.

The flow considered in the present study is indeed extremely idealized and does not follow for instance the evolution predicted by a particular dynamical system. Moving toward more realistic configurations will require considering dynamical systems that are representative of oceanographic flows and, often as you point out, is nonlinear. The choice we have made here is justified in the first paragraph of section 2.2 and a discussion about the difficulties that will arise in more realistic configurations is found in the conclusion (second and third paragraph). Following your comment, we have added to the discussion and now mention the advection of drifters could include a stochastic component (L363-L365).

3. The study is carried out in an ideal model, which has much differences from the real scenario. What is the most challenge, if the novel method is applied to the real oceanic systems? And how do the authors apply it to the real oceanic systems. Please clarify.

We agree the flow considered here is extremely simplified (see reply to previous comment). The most substantial challenges regarding applications to realistic configurations are listed in the conclusion and are the following: space-time non-separable kernels and computational burden. We now explicitly mention that these are the most important challenges associated with the space-time separability L344 and L369.