The authors have developed a neural network approach to predict Lagrangian trajectories. As the authors state, this is equivalent to solving an ordinary differential equation for a given integration time. The prediction of Lagrangian trajectories from known velocity fields is well-established with known inaccuracies from both the numerical integration, wind effects, and poorly resolved sub-mesoscale features when using geostrophic approximations. Their neural network approach requires specifying beforehand the length time of interest for both the training and the prediction. Presumably a new model would need to be trained for longer integration times, or their model would be iterated. The model requires the same velocity fields that conventional Lagrangian integration requires, in addition to temperature fields.

Given the reduced universality of their approach when compared to a simple numerical integration, the requirement of additional data sources, and the black-box nature of such machine learning, I see no reason why this method should be published. They have proposed a method with reduced utility, limited transparency, and no clear explanation why this is necessary or beneficial when compared with standard approaches.

We appreciate the reviewer's feedback and recognize that their concerns stem primarily from insufficient clarity in the current manuscript regarding our objectives and methodology. We will address this through comprehensive revisions.
Crucially, our work does not aim to emulate conventional Lagrangian integration using full velocity fields. Instead, we focus on the real-world challenge of estimating trajectories from partial observations available via remote sensing: specifically, surface geostrophic velocities and sea surface temperature (SST) evolution. Full velocity fields, required by conventional methods, are not directly observable.
Our neural network leverages the synergistic information within these observable surface fields (geostrophic velocity and advection-driven SST patterns) to improve trajectory predictions beyond what's possible by simply integrating geostrophic velocities alone. This addresses a key limitation in observation-based Lagrangian diagnostics where sub-mesoscale processes and wind effects are poorly resolved.
Therefore:

- *The requirement for SST data is a core advantage, not a limitation, as it provides physically relevant information unavailable to conventional integration using only geostrophic velocities.*
- *The method offers increased utility for observational applications, enabling improved trajectory estimates where full velocities are unknown.*

We acknowledge the challenge of model interpretability inherent in ML approaches. In the revision, we will enhance discussion on this aspect and the physical insights learned by the network. We are confident that clearly presenting these objectives and results will resolve the reviewer's concerns regarding the necessity, benefit, and novelty of our approach compared to standard methods applied under observational constraints.
General Comments:

The introduction is inadequate when reviewing earlier Lagrangian machine learning approaches.

We will revise the Introduction by carrying out a deeper search of the most recent and relevant literature and we are obviously open to receive any suggestion from the reviewer on specific papers to be cited.

All specific comments reported below would be easily addressed during the revision,

Specific Comments:

L16: Qualify this statement as there is a nonzero slip velocity between a drifter and the surrounding fluid.

L25-27: This under sampling needs quantification or citation

L38: Examples of such models?

L38-40: what metrics? You need a citation here too.

L40-41: Due to the chaotic nature of ocean surface currents, no model is capable of simulating Lagrangian trajectories without error. Please clarify what you mean by this.

L41-42: Remove this sentence

L47-57: This is far from a sufficient review of recent attempts to improve models of lagrangian trajectories with deep learning or neural networks. Please perform a meaningful literature review so as to put your results in context

L115-116: You require more data to perform a task which is already mathematically well-defined (equation 1) and has well-defined numerical accuracy.

Technical Comments:

Fix your citation style

L23-25 Rephrase this sentence for clarity