Reviewer #2

Transit and residence times in the surface Adriatic Sea as derived from drifter data and Lagrangian numerical simulations" by P.-M. Poulain and S. Hariri.

I think the goal of estimating the residence time for the Adriatic Sea using drifter data is an admirable one, but the scientific benefit of this paper might be improved. I did not find any major scientific conclusions in this paper and apart from the estimate of residence and transit times obtained using drifter trajectories integrated over a long time (~18 years of data) combined with a statistical advection-diffusion model.

To estimate transport timescale using drifters is not a "new" subject, but the data is original. Nevertheless, this is an interesting approach that has been used for different places, and I am indeed sure that this manuscript can become a reference for studies about the Adriatic Sea after a careful revision. This manuscript clearly seems to be a continuity of research by the authors (e.g. Poulain, 2001; Ursella et al., 2006; Falco et al., 2010). The provided results add value to the current knowledge in oceanography of the Adriatic Sea. Therefore, one would recommend this manuscript to be published after revised.

The general discussion seemed easy to read, and suitable to the purposes of a research paper. I indeed hope that authors could attend all or possibly most of my comments.

Comments about abstract

Comment 01: Could the authors please be consistent and sticky to the word “drifter”, instead of using eventually different words to replace such as “object”?
Comment 02: I am not sure if “diffusion” is the appropriate word, because most of the recent literature shows the word “dispersion” to proper describe the mixing processes due to the different physical mechanics such as time and spatial wind variability, tides and many others.

Comments about the definitions considered

Comment 03: I would like to ask the authors to re-check the definition of residence and compare with the definition of flushing time (e.g. Andutta et al., 2013; Valle-Levinson, 2010; Delhez and Deleersnijder, 2006; **Monsen** et al., 2002). Clearly the residence time depends upon the time of deployment and location. Therefore, the accurate definition should be provided.

In page 198:

25 A useful indicator for water mass mixing, and biogeochemical processes, is the residence time in a basin, that is, the mean time that a water particle stays in the basin.

Comment 04: Could the authors please provide a reason for estimating both residence time and transit time? The reader needs to know what residence time shows that transit time does not, and vice versa. What kind of information that residence time provides that transit time does not?

Comment 05: Could the authors please check the definition of transit time and the age? I believe the authors have calculated the age (e.g. Andutta et al., 2013; **Monsen** et al., 2002; Delhez and Deleersnijder, 2001; Deleersnijder et al., 2001). Unless the transit time

probability density function is a definition that differs from the common definition of transit time (e.g. Wolanski et al., 2012; Zimmerman, 1988; Takeoka, 1984).

In page 199:

Falco et al., 2000). The transit time probability density function (pdf) is a diagnostic commonly used to summarize the rate at which water particles are transported from one region to another via a multiplicity of pathways (Holzer and Hall, 2000). The first

Comments about implications about using data from different seasons

The authors inform that there is a seasonal and mesoscale variability of the mean surface circulation.

In page 199:

15 over the last decades with surface drifters. The mean surface circulation, its seasonal and mesocale variability, and the role of the wind-forcing have been investigated by Poulain (2001) and Ursella et al. (2006). Adriatic surface transport properties have

Comment 06: I would like to know what would be the consequences of estimating the mean residual circulation using drifters deployed in different seasons (e.g. during summer and winter).

Comment 07: Is the standard deviation of the transit time relatively large because data from different seasons are used in the exact same analysis? Or is it because of the minimum number of drifters in each box that are used for calculation (i.e. minimum of 5 observations).

Comment 08: Is the residence time or the transit time different if the estimates are obtained using data of drifters from different seasons? Let's say during normal conditions in summer, and during Bora events (Poulain, 2001).

Comments about data analysis

I thought the transect data were well collected, and reasonably analyzed. I would thus suggest the authors to observe the following,

In page 199, line 21: In this paper, the entire surface drifter dataset available in the Adriatic Sea (1990–2007) is used in concert with a Lagrangian circulation model to estimate the surface residence time in the basin, and surface transit times between different locations within the semi-enclosed sea.

Page 205, line 2: The transit time standard deviation (not shown) varies between 65 days (near the exit) and 135 days (in most of the basin).

Page 205, line 23: The standard deviation around these values (not shown) vary essentially between 20 and 165 days.

Comment 09: Clearly the authors used about 18 years of data. I was wondering why the magnitude of the standard deviations was relatively large.

Interpretation of results

Page 200, Line 1: The trajectories of surface drifter can be directly affected by the winds and waves, and as a result, deviate from those of real water particles. The first problem can be assessed and somehow alleviated by using a statistical model.
Comment 10: Could the authors please provide details and equations used to alleviate the mentioned problem?

The inflow open boundary is located in the northern part of the Otranto channel (see Figures below). Therefore, I would expect the transit time to be small near the inflow open boundary and larger near the outflow open boundary (e.g. references).
Comment 11: Results calculated using the numerical model seemed to have the timescale inverted. Could you please compare scale between figures 3b and 3c?

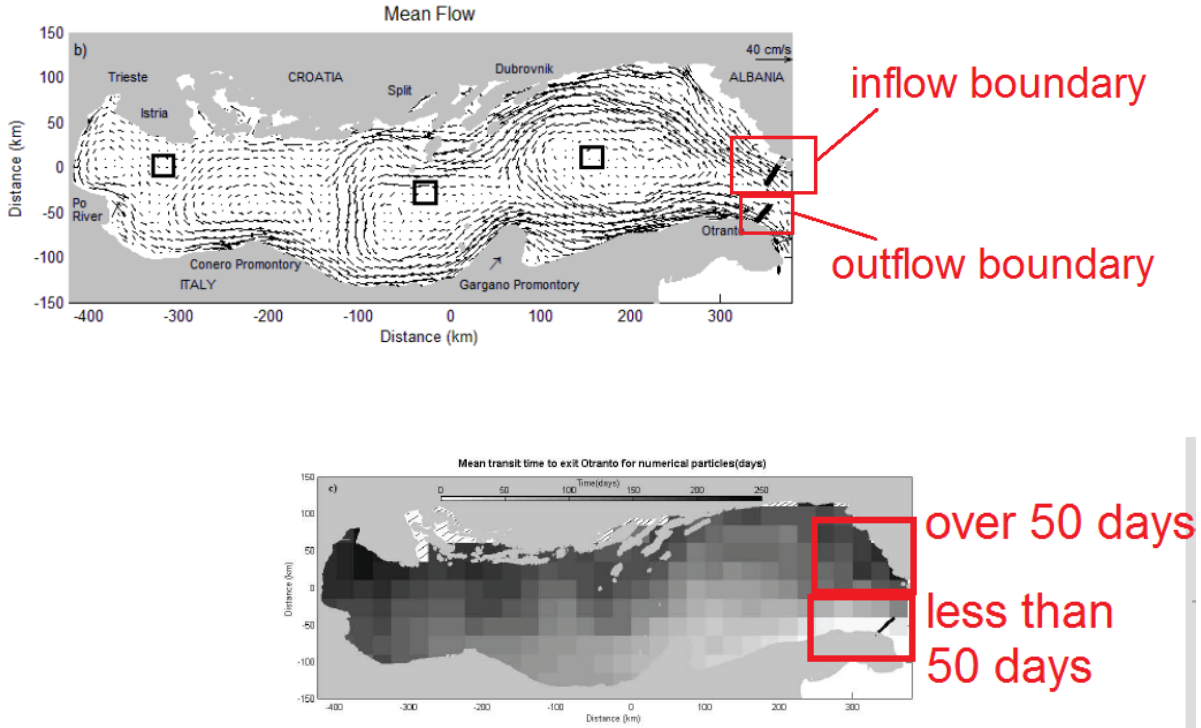

Fig. 3. Trajectories of the real drifters exiting the Adriatic Sea **(a)**. Geographical distribution of the mean transit times to exit via the western Otranto Channel (through section shown with black line) estimated from real drifters **(b)** and numerical particles **(c)**.

Comment 12: Could you please compare figure titles (Fig. 3c) and (Fig 5c)? It appears that the authors created two different definitions for transit time. One result is calculated by considering the inflow open boundary, and the other considers the outflow open boundary.
If the transit time pdf is calculated according to the inflow or outflow open boundary, please make this definition really clear in the introduction.

From figure 3c:

Mean transit time to exit Otranto for numerical particles(days)

From figure 5c:

Mean transit time after entering via Otranto for numerical particles(days)

OBS: Could the authors please check the definitions of age and residence time?