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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Statistical analysis of Lagrangian transport of subtropical waters in the Japan Sea based on AVISO altimetry data" *by* Sergey V. Prants et al.

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The author's respond to the Reviewer #2

Reviewer #2. Recommendation: The paper merits for publication in NPG, however some minor changes should be done that in my opinion may enrich the text.

1. Cited from the referee's report Colors or gray shades in Fig.2 should be different as it is impossible to see anything. I do not understand why to compare with real drifters in Fig.3. Drifters and tracers do not match as it is already stated by the authors. The corresponding blue line should be deleted from Fig.3. Vertical black lines in Fig.3 confuse the reader. Our response As to Fig.2, it does not pretend to give an exact quantitative

information. It designed to show a meridional inhomogeneity of northward transport of subtropical water across the Subpolar Front with an increased (decreased) density of points corresponding to transport gates and barriers, respectively. It is clear that areas with increased density of points in Fig. 2a correlate well with areas with increased average values of the northward component of the AVISO velocity field in Fig. 2b. The chosen color gradation has been found empirically to be optimal to represent forbidden zones as bright spots. We would like to stress that the density difference in some meridional ranges in Fig. 2a may be very large because of the logarithmic-scale representation. As to Fig.3, the meridional dependence of the number of crossings of zonal lines by available drifters confirms partly the existence of simulated forbidden zones. The vertical black lines in Fig.3 are plotted to compare different curves and their maxima and minima. We rewritten the first two paragraphs in Sec.3.2 to be: "Now let's look more carefully at the meridional distribution of subtropical tracers crossed the Subpolar Front for the whole period of simulation. We choose for reference four zonal lines along the AVISO grid at \N{42.125}, \N{41.875}, \N{40.125} and \N{39.875}. They are shown in Fig.$\sim$\ref{fig3} by solid curves with superimposed meridional distributions of the averaged northward AVISO velocity (arrows). The number of crossings of those latitudes by available 333 drifters is shown by dashed curves. The correspondence between the peaks in the meridional distributions of the tracers, drifters and the averaged northward AVISO velocity is rather good for all the chosen zonal lines confirming their direct connection. However, the comparison with drifters should be taken with care because of a comparatively small number of available drifters. Drifters, are not ideal passive tracers, and their motion is subjected to submesoscale features which were not caught by altimetry-derived data. Moreover, the drifters have not been launched at the zonal line \N{37} like artificial tracers in simulation. Their launch sites for more than 20 years have been distributed rather randomly over the basin." The correspondence between the curves for drifters and the averaged northward component of the AVISO velocity is rather good at 40 N. It is worse at 42 N, however, it is clear that the drifters are transported mainly by the Tsushima Current. The vertical black lines in

Fig.3 facilitate a comparison between different curves.

2. Cited from the referee's report Why do you choose so strange latitudes as 39.875, 40.125, etc in Fig.3 when in the rest of the paper, latitudes are integer numbers as 40N or 42N? Could you re-draw that Figure to be consistent? Our response In Fig.3 they are chosen to fit the AVISO grid where we estimate the AVISO velocities. We need not that in other figures. 3. Cited from the referee's report Besides, Fig.4 is quite obscure, and the results shown there are already shown in Fig.3. Why do not define the regions (I to VIII) in Fig.3? Clearly, due to the coast line and currents most of the particles should move towards the east as they move northward as it is already shown in Fig.3 and repeated in Fig.4. In my opinion Fig.4 could be deleted. Our response Figure 4 contains new information as compared to Fig.3. It shows how many and at which final longitudes λ_f the tracers with initial longitudes λ_0, launched weekly at t 37N from January 2, 1993 to June 15, 2013, were able to cross 40N and 42N latitudes. The three paragraphs in Sec.3.2 are devoted to describe this new information.

4. Cited from the referee's report An interesting result shown in Fig.5 is that gates may be closed during some period of time (white patches at certain longitudes). However the reason for that it is not clear for me. May be the authors should make an effort to explain that more clearly. These patches repeat regularly on time? may be with a seasonal period? Our response It is defined by the properties of the local advective velocity field. The gates open due to suitable dispositions of mesoscale frontal eddies facilitating propagation of subtropical waters to the north. It is documented in the paper with the help of different kinds of Lagrangian maps in Figs.6 and 7 and validated by tracks of available drifters. For example, a vortex street with four anticyclones has been formed in the fall of 2005 to the north of the Subpolar Front in the western part of the sea. Their centers are marked in Fig. 6a by the elliptic points (triangles) with the coordinates 39.1N, 131.5 E; 39.3N, 130.1E; 40.8N, 131.4E and 41.7N,130.8E. It is explained on p.11 (L.10-15), on p.12 (L.80-15) and on p.11 (L.10-15) in the text. The gates open at those places where suitable dispositions of eddies and vortex streets

appear time to time to facilitate the northward transport. They may appear due to different reasons, e.g., due to a seasonal variability of the current field, migration of frontal eddies, etc.

5. Cited from the referee's report Finally, the English style should be checked, but I suppose the journal will take care of that later on. Our response We did our best to edit all the text.

Please also note the supplement to this comment:
http://www.nonlin-processes-geophys-discuss.net/npg-2016-67/npg-2016-67-AC2-supplement.pdf

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