Response to the comments of referee #1 on “Determining the depth and pumping speed of the equatorial Ekman layer from surface drifter trajectories” (egusphere-2025-089) by Paldor and De-Leon

We were happy to read that referee’s general comment that: “The approach demonstrates a certain level of innovation.”. The remaining general comments are repeated in the particular comments and our detailed response to these comments are detailed follow with the comment in black and our response in blue. The comments are listed as written by the referee i.e. each comment is denoted by the line number of the original draft to which it relates.

Lines 18-22: Please provide more details in your abstract. For example, the specific latitude defining the equatorial ocean should be clarified. Specifically, what are the deflection angles between current velocity and wind speed, as well as between current velocity and water mass transport? It should be explained why the angle is 90◦. How are the equatorial current and the equatorial Ekman flow distinguished? Why it is defined as equatorial Ekman flow?

Abstract is expanded as requested. The deflection angle is not addressed since the zonal motion of the center of oscillation results solely from the westward motion of Inertial Oscillation when the Coriolis frequency varies with y. This point requires an analysis that is beyond the scope suitable for the manuscript that only applies theoretical expressions to archived drifter observations.

Line 43: There is an extra comma in "Ekman layer."

Done. Thank you

Lines 50-52: The text in these lines is difficult to comprehend and should be revised for clarity.

A more detailed explanation of the essential theoretical background of the theory developed in Paldor (2004) now appears both in the Introduction and in Sec. 2a (see L60-67, L.117-132 and new Fig. 1)

Line 75: Is the formula derived from Paldor (2024)?

Yes, this is now clarified new L119-121

Line 91: It is mentioned that 30,000 buoys were deployed from 1979 to 2025, but the wind stress data is from 1999 to 2009 (Line 120). This discrepancy should be clarified.

The 10 yearlong wind stress is representative of the climatological winds used in Eq. (3). This length of averaged (over all relevant longitudes and latitudes) wind stress should accurately represent the climatological stress

Line 127: Are the regional variations in the Pacific and Atlantic Oceans significant? This should be discussed in more detail.

The regional variations are now briefly described in L220-230 (but not studied in depth as this beyond the scope of the present simple model).

Line 147: The estimation of vertical velocity w appears to be overly simplistic. A more rigorous approach, such as calculating differentials between two consecutive time points of each drifter trajectory, should be considered.

The method we applied is highly robust in terms of the resulting value of *H* while the proposed method is subject to large errors at short distances due to the sensitivity of Eqs. (2) and (3) at small values of $y_i(t + \Delta t) - y_i(t)$. In addition, the suggested, short time, application does not filter out the oscillatory motion from the observed drifter trajectories. See L160-162 and L231-240 of the revised version.