

Ocean Sci. Discuss., referee comment RC1  
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## Comment on os-2021-48

Yavor Kostov (Referee)

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Referee comment on "Role of air–sea fluxes and ocean surface density in the production of deep waters in the eastern subpolar gyre of the North Atlantic" by Tillys Petit et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-48-RC1>, 2021

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Dear editor and authors,

This well-written manuscript presents interesting and significant results highlighting the important role of ocean surface density variability in the eastern subpolar North Atlantic for driving changes in water mass transformation. I recommend publishing the manuscript subject to minor revisions.

Detailed comments:

- Title: Consider changing the preposition in the title. For example, you could say "Role of air-sea fluxes and ocean surface density for the production..." or "Role of air-sea fluxes and ocean surface density in the production..." Alternatively, you can use "Impact of air-sea fluxes and ocean surface density on the production..."
- Line 69, "density": Do you mean potential density referenced to the surface? (Here and at several other instances throughout the text.)
- Line 116, "is the potential density": Do you mean the density referenced to each vertical level  $z$ ? You are computing vertical stratification, so I imagine that in this particular case you are not using potential density referenced to the surface.
- Line 120: also cite Desbruyeres et al. (2019) <https://doi.org/10.5194/os-15-809-2019>
- Lines 197-198, "Though a strengthening of the buoyancy forcing generally leads to an expansion of the surface area.": The correlation does not necessarily mean that this is the direction of causality. Is it possible that the direction of causality is the other way around: an expansion of the surface area can drive a buoyancy flux anomaly?
- Line 199: You could change "30%" to "less than 30%" if  $R^2$  is closer to 0.27 than 0.30 ( $R=0.52$  according to line 209).
- Figure 3: What does panel (f) represent, and what are the units in that panel?
- Lines 235-247: Consider adding some discussion on whether the surface density variability is dominated by salinity or temperature. This could make a difference, as salinity variability does not directly drive local surface buoyancy fluxes, while

temperature variability does.

- Line 271, "the buoyancy anomaly": Do you mean "the buoyancy flux anomaly"?
- Line 323: Consider changing "dependent" to "interdependent" (which sounds more physically intuitive) or "statistically dependent" (which is a more mathematical phrase).

Sincerely,

Yavor Kostov