Earth Syst. Dynam. Discuss.,
https://doi.org/10.5194/esd-2018-52-RC1, 2018

Earth System Dynamics
Discussions
Open Access
EGU

Interactive comment on "North Pacific subtropical sea surface temperature frontogenesis and its connection with the atmosphere above" *by* Leying Zhang et al.

Anonymous Referee #1

Received and published: 13 August 2018

This paper considers the mechanisms maintaining and enhancing the meridional temperature gradient in the North Pacific Subtropical Front using a combination gridded state estimates from SODA, Argo, and GODAS, as well as output from the NCAR climate model. Forcing is taken from OAFlux and ECMWF. It is concluded that both net heat flux and meridional advection by the Ekman transport contribute to the enhanced meridional SST gradient from October to February. These results are generally consistent with prior work. The relative contributions from various heat flux terms are described and the seasonal evolution of the Ekman transport is related to the position of the Aleutian Low.

Printer-friendly version

Discussion paper

While I see nothing incorrect in their analysis, the results are underwhelming. As best I can tell, their primary results (role of surface heat flux and Ekman transport) have been previously found, as cited in the manuscript. The breakdown of the heat flux into individual terms and the tracking of the Aleutian Low might be new but I do not think they are sufficiently interesting or novel to warrant publication. My recommendation is for the paper to be rejected for publication. It is possible that I am missing something more impactful here, but if that is the case the authors have to do a much better job of elucidating their results. More specific comments follow.

lines 98-101: does "These data" refer to GODAS? Is atmospheric data just winds and geopotenial? Please clarify.

line 104: This is not an energy equation, it is the heat equation. This needs to be corrected throughout.

line 117/118: dissipation is a subgridscale process. In general this term is not large, but the authors make no attempt to understand what process is important. It seems most likely to be entrainment in Fig. 4f, but some scaling estimate would be useful here. It could also be lateral eddy fluxes.

line 141: Show the region of interest on Fig. 1.

line 146: define the winter and spring time period.

line 147: I do not understand "maximum center expanding".

Figure 2: The zonal velocity is surprisingly weak in the region of strongest SST gradient. Is this because salinity is density compensating?

line 151: Expect –> Except

line 163: I do not see a significant southward shift from Sept to Feb. Similar for the "slightly migrates southward until March" comment.

Figure 3 and line 205: Why does the residual act to halt frontogenesis? Some ideas

and order of magnitude estimates would be useful here. The NCAR model could provide the residual terms explicitly.

lines 221, 224, 233: It seems that the findings up until this point are not new. Please clarify if I misunderstand.

Figure 10 and discussion: I did not find this very surprising, but also not very useful.

Line 329: I think of a slab ocean model as one that has no advection. However, this slab model has a horizontal advection (line 356/357) so I think the authors need to be more explicit about what the slab model is.

line 355: Seems like the authors have the means to provide a further explanation, why not figure this out an include it in the paper?

Interactive comment on Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2018-52, 2018.