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Interactive comment on “Variability in the Subtropical-Tropical Cells and its Effect on Near-Surface Temperature of the Equatorial Pacific: a Model Study” by J. F. Lübbecke et al.

Anonymous Referee #1

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Review of "Variability in the Subtropical-Tropical Cells and its Effect on Near-Surface Temperature of the Equatorial Pacific: a Model Study" by Lübbecke et al

This paper is a study of interannual to decadal time scale variability in the Pacific Ocean in a set of forced ocean general circulation model runs. The model is ORCA-LIM with a range of coarse to fine resolution; the atmospheric forcing is from NCEP-based fields developed by Large and Yeager over the 40+ year period 1958-2000. The main themes of the paper are how near equatorial vs off equatorial wind stress forcing affects the Pacific Subtropical Cells (STCs) on interannual to decadal time scales; and the nature of compensation between interior flows and western boundary current flows.

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The paper is well written and the numerical experiments are clearly described. The results are valuable as confirmation of previous modeling studies that have examined similar issues. This study also illuminates some of the important model sensitivities that affect numerical studies of the STCs in the Pacific, e.g. grid resolution and atmospheric forcing. For these reasons the paper is worthy of publication in Ocean Science.

The most original contribution of the paper is an interpretation of the compensation between interior and western boundary current flow in terms of a "wobbling" in the poleward extent of the tropical gyres. Unfortunately, this is also the weakest part of the paper. The authors use two figures to illustrate this idea, but one (Fig. 13) is very complicated and difficult to read. The other (Fig. 14) is suggestive but by itself does not clearly distinguish the idea of wobbling from previously proposed ideas cited by the authors. Moreover, the authors do not address the issue of what dynamically (vis-a-vis kinematically) this wobbling represents. It must be related to wind stress curl forcing and involve Rossby wave adjustment, so what is the fundamental distinction between "wobbling" and mechanisms proposed by Lee and Fukumori and Capotondi et al? It would be helpful if the authors could illustrate more clearly and interpret dynamically the concept of "wobbling".

The authors also choose to use near surface temperature (specifically temperature below the surface mixed layer at a depth of 80 m) rather than SST to describe the model's response to atmospheric forcing. They argue that the prescribed surface flux forcing constrains SST so that it is not a prognostic variable whereas temperature in the thermocline evolves more freely. However, since a goal of the paper (p. 532, line 26) is to understand how SST responds to atmospherically forced STC variability, one could argue that SST is still the appropriate temperature to focus on despite its limitations. SST and T80 are in any case are highly correlated, so there is effectively little distinction between the two. The question then becomes what are the forced ocean circulation patterns that are consistent with the observed SST?

Minor points:

1) Early in the manuscript, the resolution of the model is described as 2° , 0.5° , and 0.25° . Then on lines 16-17 of p. 533, the qualifier “longitudinal” is applied. This is confusing. What is the meridional resolution of the model?

2) p. 544, line 25. Should 5b be 13b?

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