

Review of os-2009-1:

On the multiple time scales of variability in the Northeast Pacific Ocean

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General Comments

The paper presents an analysis of altimeter-derived measurements of sea surface height (SSH) in the Northeast Pacific Ocean for the 15-year period, 1993-2007. Spatial and temporal distribution of SSH variance within three period bands are studied: (a) 3-9 months; (b) 2-3 years; (c) 4-6 years. Wavelet analysis is utilised to perform spectral decomposition. Significant signals are related to forcing such as changes in large scale atmospheric pressure patterns and advection/propagation related to El Niño-Southern Oscillation. An attempt is made to relate upstream and downstream circulation/variability structures. The author proposes three SSH-based, i.e. ocean-only, indices to characterise three regions: (a) the northeast coastal area; (b) the southeast area and; (c) the interior of the subpolar gyre. An example of a possible application to fish catches is given.

The paper represents a significant contribution to scientific progress in the field, uses valid and appropriate methodology, generally presents and discusses results well and in context with reference to relevant past literature. It is structured properly, and written in clear language with good use of figures. I recommend publication subject to the satisfactory address of all points below.

Specific Comments

- In §2.2 a clear description of the wavelet method is given, including a discussion of significance levels, following the method of Torrence and Compo (1998). In particular, the background “redness” coefficient (α) is introduced. Then, in §3.1, the author says “At high frequencies, α was set to 0.3, for the 2–3 year band, a value of $\alpha = 0.7$ was used, and for the lowest frequencies, α was set to 0.9.” Were these values of α simply fixed (“set”) at these values? Or were they directly *calculated* from the lag-1 and lag-2 autocorrelation coefficients of the relevant timeseries data? It is not made unambiguously clear. If the values of α *were* fixed, what governed the choice of values? And then the obvious question arises: how sensitive are the results to the choice of α values?
- In §3.1, page 398, lines 14-17: state that the “near zero lag” is a 7-day lag in order to match directly with the annotation in Figure 4(a). Also explain that the correlation value, r , of 0.53 means $r^2 = 0.28$; thus the observation about 28% of variance being similar.
- In §3.1, page 399, line 6 and line 22: make explicit why 6 and 3, respectively, degrees of freedom are the appropriate choices.

- In §3.2, line 8 (and elsewhere in the paper): wherever “significant” is used, is the author consistently referring to 95% levels? This needs to be made explicit.
- Page 400, lines 19-21: “A positive ALPI value indicates a strong low pressure pattern and and is consistent with a shift in the energy of the 3–9 band towards higher frequencies at less than season periods (0.25 years).” The reasoning here is not clear.
- §3.2.2 - §3.2.4, and Figures 6-8. The figure captions state that whitening has been applied, although there is no explanation or description of this in the main text. Why has this been performed? And how, given that whitening implies $\alpha=0$, does it square with the description given in §3.1 where nonzero redness values were set?
- §5. Conclusions. This section seems rather incomplete. Resummarise the aims and methods, and state explicitly once again which three period bands were analysed.

Technical Corrections

- “Indices”, rather than “indexes”, should be used consistently throughout.
- Page 391, line 24: incorrect spelling of “gauge”.
- Page 394, line 18: “in and area” should presumably be “in an area”.
- Page 395, line 22: “verse” should presumably be “versus”.
- Page 396, line 18: “spectra” should be “spectrum” (both times).
- Page 398, line 5: “the than” should be “that”.
- Page 399, line 9: “maybe” should be “may be”.
- Page 399, line 21: Presumably “maximum” should be inserted before “correlation value of 0.74”.
- Page 400, line 20, end of the line: “month” should appear after “3-9”.
- Page 400, line 20: duplication of “and”.
- Page 402, line 27: “bands” should be “band”.
- Page 405, line 18: “spectra” should be “spectrum”.
- Page 407, line 1: “maybe” should be “may be”.
- Page 407, line 6: “later” should be “latter”.
- Figure 1: label the axes (“longitude” and “latitude”).
- Figure 2: as above.
- Figure 4b: Surely the black line should be labelled “tropics < 20^o” rather than “Extra-tropics < 20^o”?
- Figure 4 caption: “vale” should be “value”. Also, presumably “maximum” should be inserted before “correlation” at the start of line 5.
- Figure 10, caption, line 3: delete “to” in “values to”.
- Figure 12, caption, line 6: delete “a” in “a relative”.