

Interactive comment on “The coherence of small island sea-level with the wider ocean: a model study” by Joanne Williams and Christopher W. Hughes

Anonymous Referee #1

Received and published: 17 November 2012

The study takes advantage of a relatively high-resolution (1/12 degree) OCCAM run to explore the relation between island and neighboring (deep ocean) sea level variability as function of position and time scale. The paper is a somewhat modified version of an earlier paper I had reviewed for a different journal, in which I suggested that the authors carry out a "control" analysis (not involving islands, but done over deep ocean regions) to check if coherence behavior between island and offshore variability is indeed dependent on bathymetry or not.

In fact, the inclusion of such "control" analysis in this version shows clearly that the lower coherence between island and offshore variability seen at mid latitudes is a gen-

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eral feature of the variability, independent of whether islands or other places are considered. These analyses provide interesting dynamical questions regarding the causes of such decoherence, and as discussed at the end, the results seem fairly consistent with the recent tide gauge/altimeter analysis of Vinogradov and Ponte (2011).

Although the analyses and some of the discussions in the current paper are not the easiest to follow, with some perseverance on the part of the reader the results emerge more or less clearly and mostly confirm previous well-known features of sea level variability (steric height dominating in the tropics, bottom pressure and large spatial scales at high latitudes, barotropic tendency increasing with frequency, etc.). However, the physical explanation for the minimum in spatial coherence of variability somewhere between the tropics and high latitudes remains unclear.

The authors provide some discussion in terms of baroclinic Rossby waves, but there is no clear understanding, at least in my mind, of why spatial decorrelation scales seem to be shorter for frequencies lying in the transition zone between barotropic and baroclinic regimes. The shorter decorrelation scales should imply larger wavenumber bandwidths at these frequencies, and a more detailed exploration of the wavenumber-frequency spectra of variability might be a useful future exercise. In the end, a number of different dynamical processes, including effects of nonlinear eddies, might be involved in accounting for the complex longitude and latitude dependence of the spatial coherence of sea level variability. The paper is likely to stimulate further research in the important topic of trying to understand and interpret available sea level records.

EDITORIAL AND OTHER MINOR ISSUES (by page and line number)

p3050, l19/ "...records. The question has..."

p3051, l26-29/ "better" in what sense?

p3052, l1-2/ examples near the Kuroshio are discussed in Vinogradov and Ponte (2011)

p3052, l3/ not entirely clear which mechanisms are meant here, please clarify

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p3053, l11/ are the areas really squares or rings? perhaps a schematic figure would help visualize what areas are used in the averaging

p3053, l26/ "steepen so much and is..."

p3057, l10/ "..between dominance of..."

p3057, l16-19/ can you clarify the meaning of this paragraph?

p3057, l25/ text starting here and to the end of section 3.4 jumps to considerations of dependence on depth or proximity and could be made into a new subsection 3.5

p3059, l5/ "steric power contained at frequencies lower than..."

p3059, l10-17/ this discussion is hard to follow: what is the relevance of considering "half the Rossby frequency"? the differences between nearby and distant rings and relation to eddies is obscure...much clarification needed here

p3060, l3-4/ seems like an ad hoc statement... a more general interpretation is that you have a very wide-band process that implies short decorrelation scales (white noise would have a zero decorrelation scale)

p3060, l5/ "...that the bathymetry is not..."

p3061, l6-12/ do we need this digression here? the last sentence is poorly connected to the rest of the discussion in the paper

Interactive comment on Ocean Sci. Discuss., 9, 3049, 2012.

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