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Interactive comment on "Dynamics of turbulent western boundary currents at low latitude in a shallow water model" *by* C. Q. C. Akuetevi and A. Wirth

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This is an interesting paper that reports on the small scale turbulence that develops in an idealised western boundary current when the viscosity is low. I have a number of comments, given below, but after these have been addressed the paper should be suitable for publication.

Overall the paper is well written and easy to understand. However some copy-editing would be helpful, especially of the Introduction.

Comments on the Text:

1. Equation 8.

The paper needs to explain why this form of the wind stress forcing was used. For example why have a decay with distance from the coast? Why use the factor '4' instead of halving the value of 'L_x'. Why use the factor '-0.2'. What was the value of t_c and why was that value chosen.

Later the discussion needs a paragraph on whether this particular form of the forcing may have affected any of the conclusions of the paper.

2. Page 2467, line 25.

"... asks for a short time step.". Was the short time step just a guess (as the odd phrase implies)? If not how was it chosen? For example were tests made with shorter timesteps to check to solution had converged?

3. Page 2468, line 7.

"The highest viscosity experiments ... converged towards a laminar dynamics."

a) This implies more than one experiment was carried out. Explain. b) Do you mean "converged with time towards"? c) How did you convince yourself that the solution had converged? d) What do you mean by "maximal average"? e) Average over space, latitude or time? f) How did you estimate the Munk-layer thickness.

4. Page 2468, line 18.

"Lower viscosity experiments converge to a statistically stationary state".

Also in 3000 days?

5. Page 2469, line 22.

" It decreases rapidly with distance from the boundary."

a) Give the distance over which vortex stretching was important.

6. Page 2469, line 25

"The meridional velocity is close to the Munk-layer solution"

Give some numbers, i.e. at least one comparison.

7. Page 2470, line 26.

"..., with an almost motionless core."

Make it clearer that this refers to what you describe as rings and not eddies.

8. Page 2472, line 7.

"... the dynamics in the viscous sub-layer is not laminar".

You need to explain what property indicates that it is not laminar.

9. Page 2474, line 20.

Presumably the size of the Extended Boundary Layer increases during the first part of each run. Does it reach a fixed limit or is it still increasing with time at the end of the experiments?

10. Page 2476, lines 1-25

Figure 5 implies that the advection term (TRVA) is transporting vorticity into the boundary layer where it is lost to friction. If this transport down gradient - from a region of strong fluctuations to a quieter region? If so is there also a transport off-shore?

11. page 2480, line 17 to 20.

An important point made here is that viscosity values like 1000 (as used in EXP1000) give unrealistic boundary currents. However it reads as if the paper is reporting a conclusion reached earlier when in fact this is the first time the problem has been discussed.

One possible way of dealing with this is to include some lines near the end of section

4.6 which points out that EXPT1000 is actually unrealistic.

Comments on Tables and Figures:

Figure 1.

Nice figure, and on a screen I can zoom in to see the details, but on a printed page it will not show much of the vectors. I suggest that you add an insert with an expanded view of part of the boundary current.

Figure 5

On the printed page, the colours (especially black, grey and dark blue) are difficult to distinguish.

Figure 7

Caption indicates that the symbols refer to three different latitudes, whereas the figure shows 5, 5, 4 and 4 different values for the four experiments.

Interactive comment on Ocean Sci. Discuss., 11, 2461, 2014.