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Interactive comment on "Waveguidability of idealized midlatitude jets and the limitations of ray tracing theory" *by* Volkmar Wirth

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This is a very nice paper which provides useful analysis and insight into the concept of waveguiding. I suggest acceptance subject to minor revisions.

One general query I had is whether any comment can be made on how much the results might apply to non-stationary situations. The analysis focuses on stationary waves but it seems the mechanisms should be similar? The O'Reilly et al case is an interesting one in this regard, with an initial transient development with non-zero phase speed acting to set up the 'circumglobal' stationary pattern.

I wonder whether the discussion on ray tracing should be broadened a little. Of course there are many issues with a literal interpretation of this, as the author shows very con-

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Discussion paper

vincingly, but the results here are quite specific to a zonal waveguiding situation. More broadly, ray tracing theory has some predictive power to suggest wave paths resulting from vorticity sources, for example, which just a quantification of the PV gradient doesn't. (Though this application also has limitations, and should in general not be relied upon in isolation.) Essentially, the theory also suggests a refraction towards higher values of K_sˆ2, not just the simplistic turning latitude approach taken here.

My only real concern with the paper (and a minor one) is the use of just one measure of waves, named epsilon here (eq 33). In some applications, the approach is to define a conservative wave activity, by dividing the enstrophy by the mean PV gradient. This is probably not important, but I just wonder if this would alter some of the interpretation of K_s - ie could K_s have a better relationship to the waveguidability W if a different measure of wave activity was used?

Minor queries

- line 35: Does quasi-resonance concern the resonance of the wave with itself, as suggested here, or the resonance of forced and free waves?

- line 50: not sure this is right. In ray tracing you have to specify the zonal wavenumber, which is a property of the wave.

- line 55: clarify the length scales in this paragraph

- I didn't find fig 1 very convincing. It seems there is a lot of transient activity which has to be averaged out, though I suppose this is not unlike reality. Are the magnitudes in fig 1 weaker than those in fig 3b?

- lines 246-251: These sentences seem a bit out of place in a paragraph on solid body rotation.

- The focus is exclusively on zonal PV gradients - can the concept be extended to relate to meridional gradients and wave propagation.

- l267-9: I'm not sure this means much - surely this is the only thing that can happen in that model?

- l306: I would have thought it depends strongly, not slightly, on the choice of downstream longitudes.

- I found the argument around line 420 a bit hard to follow. Presumably a key step is that the linearisation can be excluded as a reason, given fig 10?

- the discussion at the end of section 5 is interesting. So would the author expect K_s to be more useful in the limit of no damping? Are the experiments sensitive to the damping?

typos - l45: straddled - search for this - l59: midlatitude - l74: The key ? - l245: poles - l266: exponentially - l292: midlatitudes

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