

Wind Energ. Sci. Discuss., referee comment RC1  
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## **Comment on wes-2021-138**

Anonymous Referee #1

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Referee comment on "Including realistic upper atmospheres in a wind-farm gravity-wave model" by Koen Devesse et al., Wind Energ. Sci. Discuss.,  
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The article is very well written and discusses a problem with a well-established methodology by subdividing the perturbation equations into several layers where the analytical solution is found, reducing the differential problem to an algebraic linear system.

I have few comments to improve the analysis:

1) Section 2.1 and 2.2 do not have any graphical schematic to help the reader to understand the layers subdivision. I think that adding those (at least for one section) will facilitate the understanding

2) Equation 14. The total derivative operator is undefined. The authors are also focusing on stationary waves, right?

3) Equation 20. Are the derivatives evaluated at  $Z=H$ ?

4) The method described by equation 20 is very common in acoustics (see the book of Salomons, Computational Atmospheric Acoustics about the FFP method)

5) around line 245: since the authors give importance to the computational time, it is worth to state what solver was used to solve the banded matrix? Was that the native numpy routines or did they use a home-made algorithm?

6) Line 254. I would replace frequency with wavenumber since frequency is more related to temporal variations, while your method is for stationary waves. This applies to the entire manuscript

7) Line 289. The agreement is qualitatively well but not perfect. How can one improve the agreement? By adding more layers? or there is a limitation in the original data from Wells and Vosper?

There are some typos here and there. I have found two at page 5 at rows 2 and 6 where coefficients and inversions should be singular.