

## ***Interactive comment on “Interaction of Small-Scale Gravity Waves with the Terdiurnal Solar Tide in the Mesosphere and Lower Thermosphere” by Friederike Lilienthal et al.***

### **Anonymous Referee #2**

Received and published: 4 March 2020

Recommendation: major revision

#### **\*\* Summary**

The study is devoted to the implementation of a new gravity wave parameterization into a mechanistic circulations model which falls into the field covered by GMD. The particular impact of gravity wave launch spectra on circulation patterns and terdiurnal tides is elucidated, in particular the different role of intensity and width. The response of tides depends on many details of their generation and propagation, which all are influenced, among others, by gravity waves. In order to qualify the influence of gravity wave parameterizations, the old and new scheme should be compared with each other

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and be validated against available observations. Such information is pretty sparsely scattered in the text and should be presented with additional figures and text. It is also necessary because this is the first publication on the new gravity wave parameterization in MUAM. Acknowledging this additional work I recommend major revision.

#### **\*\* Major comments**

1) Comparison: In the text you mention some changes in dynamics which are due to the change from the former Lindzen-type to the new Medvedev&Klaasen-type gravity wave parameterization. I think, there are some important circulation patterns which can only be properly treated with the new scheme. However, for the setup you mention some simplifications, such as no eddy diffusivity, which should also be further documented. So I suggest to add a detailed comparison between the two schemes.

2) Validation: These different circulation and tidal patterns should be related to available observations and simulations. Some of those are mentioned in the text, but I think the paper requires substantially more information in terms of text and figures. A detailed discussion of relevant publications (for example Becker, 2017 or Liu et al., 2018) in this field is expected.

#### **\*\* Technical comments**

L48: Insert "The" before "next..."

L65: "extrem" -> "extreme"

L75: Without "around the world" it is more neutral style.

L79: "due molecular" -> "due to molecular"

L113: Abbreviation for "Southern Hemisphere" was defined already in L109.

L188: I think the narrower spectrum is the key - suggest to write "Modified GW Spectrum: Narrower flux at Source Level"

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L192-194: These sentences confuse me: If you make the spectrum narrower, you shift the phase speeds to lower values and increase the momentum flux they carry. All in all, the total momentum flux remains the same. What you write, is the opposite ("shift.. phase speed... to larger values... decreasing the momentum flux they carry")

L239: May be you wish to give a number like "a TDT of 22 m/s is changed by a GWD\_TDT of 7.5 m / s / d over 6 hrs by 2.5 m/s which makes up 20 %" or so.

L276: Didnt you want to write "In the additional experiment (EXP2)..."?

**\*\* References**

Becker, E., 2017: Mean-Flow Effects of Thermal Tides in the Mesosphere and Lower Thermosphere. *J. Atmos. Sci.* 74, 6: 2043-2063, doi:10.1175/jas-d-16-0194.1.

Liu, H.-L., C. G. Bardeen, B. T. Foster, P. Lauritzen, J. Liu, G. Lu, D. R. Marsh, A. Maute, J. M. McInerney, N. M. Pedatella, L. Qian, A. D. Richmond, R. G. Roble, S. C. Solomon, F. M. Vitt & W. Wang, 2018: Development and Validation of the Whole Atmosphere Community Climate Model With Thermosphere and Ionosphere Extension (WACCM-X 2.0). *J. Adv. Model. Earth Syst.* 10, 2: 381-402, doi:10.1002/2017ms001232.

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