

Interactive comment on “Quasi-hydrostatic equations for climate models and the study on linear instability” by Robert Nigmatulin and Xiulin Xu

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Dear Ilias Sibgatullin,

Thank you again for the comments. And sorry to the readers for such tedious discussions. Some clarifications are made for a better understanding of mathematics in the manuscript. The numbering corresponds to that of the previous comment (SC10).

1. The reason why the quasi-hydrostatic equation can be used in the long-term climatic modeling is that under such scales, in the vertical momentum equation the vertical acceleration term is negligibly small in comparison with gravity. However, the quasi-

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hydrostatic equation is not valid for small scale processes and extreme weather, where the vertical motion is essential. The theorem is proved under the condition that the inertial forces are negligibly small in comparison with gravity.

2. According to the previous answer (SC8), the term A is estimated using the Mean Value Theorem for Integral. If we focus on one altitude, the terms of divergence can sometimes compensate, but our estimation is made for the integral over all levels of the vertical column.

3. For this question please refer to SC3 (eq 1) and SC8 (answer #1). Your example of geostrophic balance is not a counterexample; it is identical to eq(1) of SC3 if the acceleration term is not neglected in the momentum equation.

4. We stick to the answer in AC4.

5. "But the partial derivative of the pressure over x is not equal to zero, since the level of sand near the borders is much less than in the center." As far as I can understand, the partial derivative of pressure over x is calculated at the same level.

I am sorry that our answers do not satisfy you. We will of course try our best to improve the manuscripts to make the derivations more clear for the readers. We are very happy to hear from you again if you have any new doubts or questions associated with the content of this manuscript. But please do not repeat the same questions, or the readers can easily get confused. I hope other readers can make some comments about this discussion. Thank you again for your time.

Best regards,

Xiulin Xu

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