

Interactive comment on “An analytical verification test for numerically simulated convective flow above a thermally heterogeneous surface” by A. Shapiro et al.

C. van Heerwaarden (Referee)

chiel.vanheerwaarden@mpimet.mpg.de

Received and published: 22 April 2015

General comments

I recommend **minor** revisions. The paper presents a validation test for solvers for buoyancy driven flows. To the reviewer’s knowledge it is the first validation test for wall-bounded Boussinesq flows including buoyancy and therefore deserves publishing. I have tested the MicroHH (<http://github.com/microhh/microhh>) code against the analytical solution provided in the paper and it gives the correct solutions (see attached figures).

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

Nonetheless, there are a couple of improvements that could be made. First of all, it would be great if the reference cases could be presented in a non-dimensional framework, to make them more general. Second, GMD suggests strongly to submit code for benchmarking papers. I would appreciate if the authors can provide their code, to enable the readers to use the test case with their own code.

Minor comments

- *Abstract* Maybe the authors can stress here that there are very few, or maybe even no analytical solutions for wall-bounded buoyancy driven flows around and their paper is therefore really a novelty.
- *Page 2850* Can the authors shortly explain how they got to their set of equations?
- *Page 2857* It would be good if the authors can write some guidelines on how to use their validation test with a model with staggered grids. For instance, if u is interpolated, how fine does the analytical solution need to be in order to have reference data for which the error in the analytical solution is negligible to the model error?
- *Formula 41* Why don't the authors define the first Reynolds number as the vorticity advection divided by the vorticity diffusion?
- *Page 2859* Why are 50.000 terms taken? Isn't this an enormous amount?
- *Page 2864* Do I understand correctly that the authors underline statements by previous papers that models on a staggered grid do not require a pressure boundary condition?

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

- *Page 2865* In the last statement the authors mention the numerical boundary layers. Are these a problem in explicit codes as they are using as well, or does this problem only play a role in case implicit diffusion has to be applied?
- *Figure 6* Why are the results asymmetric? You are solving a purely symmetric system. Which process introduces the asymmetry in the solution?

Interactive comment on Geosci. Model Dev. Discuss., 8, 2847, 2015.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

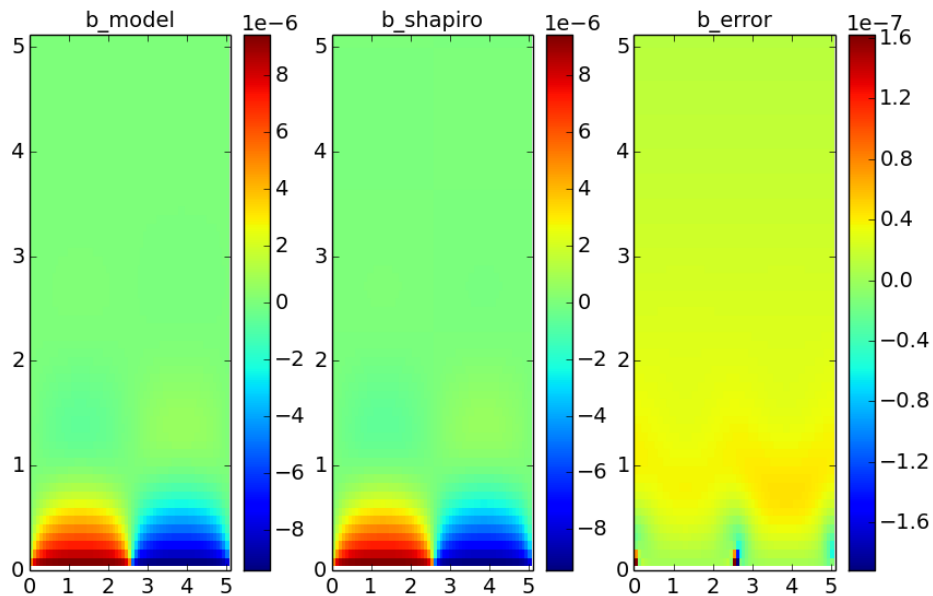
[Interactive
Comment](#)

Fig. 1. buoyancy

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

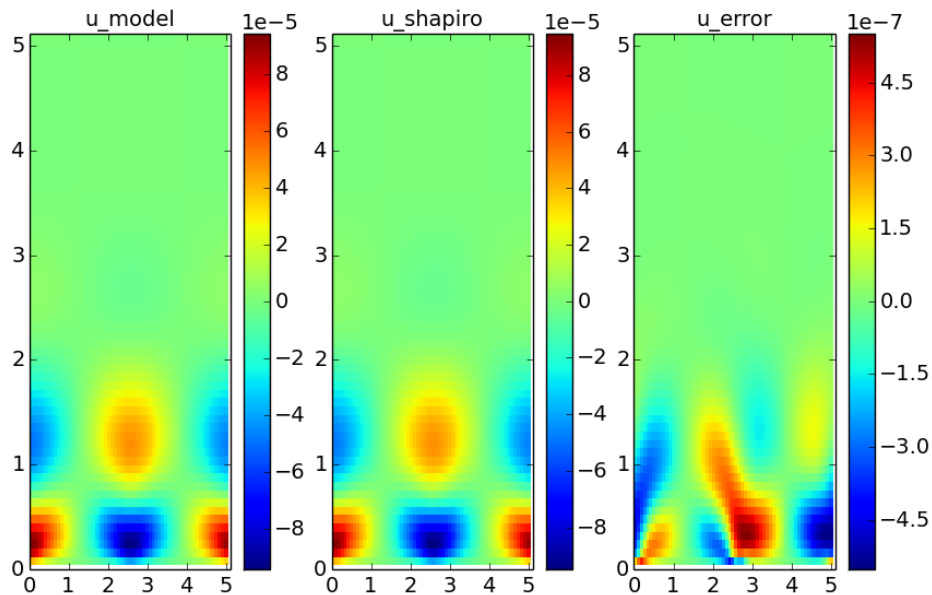
[Interactive
Comment](#)

Fig. 2. horizontal velocity

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

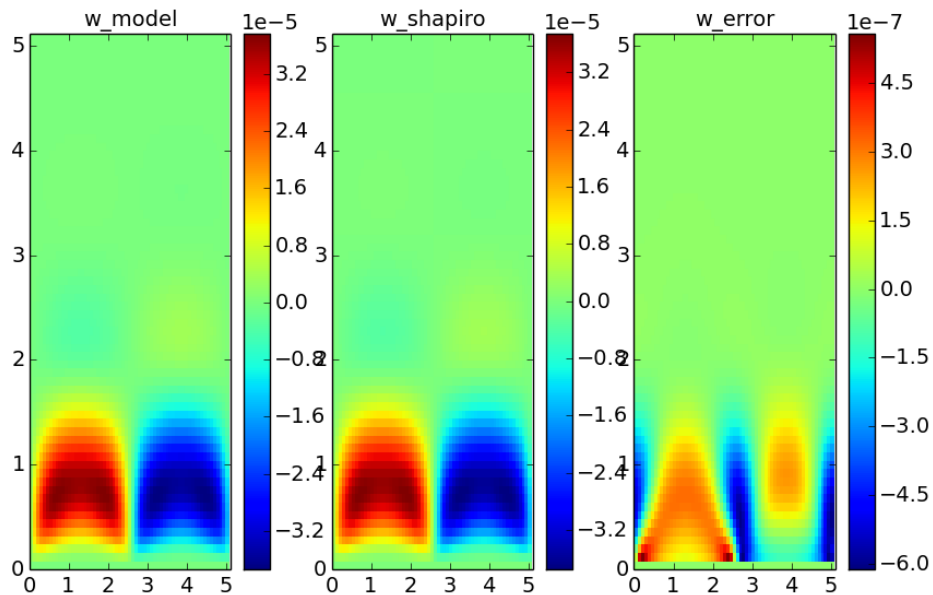
[Interactive
Comment](#)

Fig. 3. vertical velocity

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)