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Geoscientific Model Development Discussions

Interactive comment on "Implementation of an Immersed Boundary Method in the Meso-NH model: Applications to an idealized urban-like environment" *by* Franck Auguste et al.

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General comments

The authors have implemented an immersed boundary method for modeling complex obstacles in the atmospheric code Meso-NH. The proposed method consists of a modified ghost-cell technique in the velocity prediction step and a cut-cell technique in the projection step. Finally a wall model is presented along with the large eddy simulation. The proposed method is then validated through a wide range of benchmark tests.

In sum, the work is quite extensive and involves a lot of numerical techniques. But the implementation details are not clearly expressed. The illustrative figures are not well presented. Some of the notations used in the paper are also confused. This article can

be improved by taking the following suggestions into consideration.

Specific comments

Section 3

In Figure 1 (a), what does the triangle mean?

The authors should give the mathematical expression of the level set function and show how it is used to identify the interface by one example, as did in the cited paper of Tseng and Ferziger (2013).

Section 3.1

The authors have suggested to use more image point to avoid numerical issues when the ghost node is close to the boundary. The idea is new but not clearly demonstrated. Why this becomes necessary and how the new idea can solve the numerical problem ?

In the expression GI = 2 phi_G n, the variable "phi_G" is not defined.

The Figure 2 is not well illustrated, as the reader could not easily identify the difference of different approaches.

The use of "original" for the proposed method to differ from the classical method would be misleading and inappropriate. The author could use another word like "new", "novel" or "proposed" instead.

Section 4

The Taylor vortex or decaying vortex is considered as a potential flow as an accuracy test. However it usually refers to an unsteady rotational flow and hence not a potential flow.

Section 6

"A molecular diffusion is explicitly added as a source term in Eq. (3) to achieve a

converged in time and in space solution of a non-linear problem." This expression is confused as the molecular diffusion is just added for numerical purpose instead of from the physical viewpoint.

In the flow over a stationary cylinder test, the authors have studied different meshes but not indicated the domain size, while which has much greater impact to the final solution. Comparison could be made to the reference paper "Moving immersed boundary method, International Journal for Numerical Methods in Fluids, 2017".

A convergence study could be performed for the convergence rate of velocity, as it never shows in the other parts.

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