**Geoscientific
Model Development
Discussions**

Interactive comment on "A semi-implicit, second order accurate numerical model for multiphase underexpanded volcanic jets" by S. Carcano et al.

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Given the complex nature of the jet, the quantitative comparisons for example with Ogden et al. 2008b which are within a few percent for the location of the Mach disc, or velocities are a good start. But the first thing I would do, when presenting a new scheme for validation, would be far simpler - and thus tougher to get right, like solutions to the Riemann problem for the multi species case, where one can obtain exact solutions.

Another test case, albeit containing the viscous parts would the linear growth of disturbances on a periodic shear layer. These are quite important to get right in order to finally get the right entrainment rate at the edge of the jet. And this is where dissipative schemes generally have a hard time.

Another questions concerns the model equations itself. Since the code is run massively under-resolved, the model has to be a model less LES or MILES model. They usually depend very much on the resolution and are also depending on the grid orientation. Could you please comment on those two points?

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