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Interactive comment on "Direct numerical simulations of particle-laden density currents with adaptive, discontinuous finite elements" *by* S. D. Parkinson et al.

P. A. Ullrich (Referee)

paullrich@ucdavis.edu

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To follow up on this line of discussion:

You are correct. The sixth order method used by Espath et al. (2013) gives additional degrees of freedom and hence will provide Espath et al. (2013) with the accuracy that we gain by having a higher local mesh resolution.

I am particularly confused about this statement: Espath et al. (2013) use a finite difference method, where each element is associated with exactly one degree of freedom per state variable. For finite difference methods, unlike finite element methods, the order of accuracy is independent of the number of degrees of freedom (only the size of

the stencil increases). Can you clarify?

I would argue that it isn't particularly surprising that Espath et al. (2013) can produce a more accurate simulation with a higher-order method. A similar result arises for rising thermal bubble experiments – anybody who has ever performed a Robert (1993) experiment can tell you that an extremely high grid resolution is needed for convergence with a second-order scheme, which is not required for a high-order scheme. This observation suggests that for the case of a turbidity current that p-refinement (a higher-order polynomial reconstruction) may be more computationally efficient than h-refinement (increasing the local mesh resolution).

References:

Robert, A. (1993). Bubble convection experiments with a semi-implicit formulation of the Euler equations. Journal of the Atmospheric Sciences, 50(13), 1865-1873.

Interactive comment on Geosci. Model Dev. Discuss., 7, 3219, 2014.