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**Geoscientific
Model Development
Discussions**

Interactive comment on "Formulation of and numerical studies with the Dutch Atmospheric Large-Eddy Simulation (DALES)" *by* T. Heus et al.

Anonymous Referee #1

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General comments

This paper presents an excellent summary of the physical and numerical formulation of a large-eddy model together with brief but interesting introductions to the sorts of applications for which it has been, and is being, used. I think it would be fair to say that very little of the material is new - I would probably class it more as a review article - hence I have marked the "Significance" only as "Fair". It is, however, extremely clearly written and so will I'm sure serve as a valuable reference for anyone interested in large-eddy modelling.

One question I find the authors have largely left unanswered, is what sort of sensitivity to resolution does this new version of the model have? Clearly this will be situation dependent and it would be particularly welcome to see additional results exploring this

for the examples where the authors point to some improvement due to the revised numerical methods (such as the sheared convective boundary layer or stratocumulus simulations).

Specific comments

- Section 2.3.1, p.108, line 5: the switch between wet and dry buoyancy coefficients is made abruptly as χ_* crosses 0.5, a value that seems largely arbitrary. Have you investigated sensitivity to this value and have you explored a smoother transition (perhaps weighting by χ_* itself)?
- section 2.3.1: I can't see a definition for c_h, or Pr, in unstable conditions? Presumably Pr is continuous across neutral? As $N \to 0$ from the stable side, (26) implies $\lambda \to \Delta$ and so (27) gives $c_h \to 3c_m$, or $Pr \to 1/3$. I would have expected a value closer to 1 at neutral.
- Section 2.4: the drag coefficients appear to be calculated using domain mean near-surface wind speed. Why isn't the local grid point wind speed used, as eddies will give significant local variation that will undoubtedly be important for the local flux generated?
- section 3.1.2, "smaller entrainment fluxes due to improved numerical schemes": both simulations use the same advection scheme so could you be more specific as to what aspect it is that has given this improvement?
- p142, line 2: interaction with radition is not so important for shallow cumulus clouds more because the clouds themselves are shortlived rather than just because of their small cloud fraction (although the two are linked)
- Section 3.3.1: can you comment on why RF01 is much more strongly sensitive to the choice of advection scheme than Eurocs? Is it connected to the typical χ_* generated?

Technical corrections

- p 116, line 20: should read (see Wesseling, 1996)
- typos: "extend" should be "extent" on p140 line 27 and p141 line 14
- typo: p 141 line 9, missing "to" in "due to the longwave cooling"
- Fig 12 has no caption!

Interactive comment on Geosci. Model Dev. Discuss., 3, 99, 2010.