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Interactive comment on "The diurnal stratocumulus-to-cumulus transition over land" *by* Xabier Pedruzo-Bagazgoitia et al.

Anonymous Referee #1

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This well written article describes a number of large eddy simulation (LES) experiments of the diurnal stratocumulus-to-cumulus transition over land. The study compliments the DACCIWA field campaign that observed the stratocumulus to cumulus transition over West Africa, by seeking to provide a mechanistic description of the transition and to compare and contrast the mechanisms with those observed in the substantially more well studied marine stratocumulus. I think the article will be of wide interest and provides important insight into little studied and poorly understood processes. The experiments seem well posed and the analysis of results is exemplary. It is my opinion that article should be accepted for publication following revisions to address my concerns below.

While the paper is quite detailed, the article glosses over relatively important details

about the numerical implementation of the LES. The article does mention that DALES version 4.1 was used for the study, however that version of the code offers numerous options for how the equations of motion are discretized. It is well known that details of how numerical errors from the discretized equations of motion interacts with the subgrid-scale closures is important in determining the fidelity of the simulations (e.g. Pressel et al, 2017). It is also possible that the conclusions drawn here, could be quite sensitive to which set of discretization were used in the simulations. While numerical sensitivity tests would be nice, it is probably not realistic to ask for more simulations to be done. However, without such sensitivity tests it is imperative to provide a detailed description of the LES to make the experiments reproducible by others.

Not unrelated, the authors also fail to mention if their LES uses a Galilean transformation of the of the equations of motion. Depending on the numerical schemes used in the LES, it could well be that the simulations with mean wind and shear are highly sensitive to the assumed domain translation velocity. In particular, I am concerned that in the shear case if the Galilean transformation is such that the transformed mean wind in the stably-stratified free troposphere is significantly non-zero, a large component of the increased entrainment may be driven by numerical error (in the form of oscillations) in either the momentum or scalar fields. This would be particularly likely if the momentum equations were discretized using conservative centered difference scheme, as stable stratification would likely prevent the SGS model from providing sufficient dissipation damp the numerical oscillations inherent with such schemes. If the simulations do not use a Galilean transformation, I strongly recommend that they do, with a transformation selected to keep the transformed mean wind close to zero in the free troposphere.

Small Correction: p3 L11: rol -> role

Pressel, K. G., Mishra, S., Schneider, T., Kaul, C. M. and Tan, Z. (2017), Numerics and subgridâĂŘscale modeling in large eddy simulations of stratocumulus clouds, J. Adv. Model. Earth Syst., 9, 1342– 1365, doi:10.1002/2016MS000778.

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