

Interactive comment on “Improving subtropical boundary layer cloudiness in the 2011 NCEP GFS” by J. K. Fletcher et al.

Anonymous Referee #1

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General Comments

This study summarises the change in low cloud parameterisations in GFS and their sensitivity tests using single column model as well as global coupled model. The authors showed that lateral mixing and conversion rate to falling species are useful parameters to improve shallow cumulus profile as well as excessive precipitation bias. The authors also pointed out that well represented LWP in stratocumulus is achieved by the physics parameterisations controlling stratocumulus are too tuned toward precipitation as a mechanism for PBL drying. The authors hypothesize that increasing the entrainment rate while simultaneously decreasing the autoconversion rate in the stratiform microphysics scheme can maintain observed LWP while reducing excess precipitation. These results are informative and useful for cloud modelling community.

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Specific Comments

Abstract

The authors write in the abstract that model has bias in clouds, but it is not obvious whether the model overestimates or underestimates low clouds. As Figs 6 and 7 show, low clouds are underestimated just off the coasts but overestimated in the open ocean. 'Biased' does not sound an appropriate word to summarise these errors. The model rather fails to reproduce low cloud fraction contrast between off the coast and the open ocean.

Global model sensitivity tests Figs.6&7 Explanation is needed how clouds and cloud radiative effects for 1948/long term mean (1948-1998) can be evaluated using 2006-2010 data.

Definition of cloud fraction from satellite data is different from model's cloud fraction. Is the model cloud fraction from Cloudsat/CALIPSO fraction from COSP?

P2260

L3 There is no sensitivity test focused on the efficiency of conversion of updraught condensate in a grid layer to precipitation and detrains it to grid scale condensate. Why NewEntr has to be with efficiency of conversion to precipitation?

P2262

L5, What does '...cloud water and cloud fraction from both the stratiform microphysics scheme and the radiation scheme' mean? Does the model cloud fraction from two schemes?

L14, Why cloud fraction needs to be defined in two schemes? How cloud fraction in the microphysics scheme and that of the radiation scheme are defined and used?

L23 What does 'convection is oftentimes only one or two grid levels deep' mean?

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P2264

L20 If background diffusivity same as the operational GFS is used, does the single model results show the same biases that the global coupled model shows in the North-east Pacific?

P2265

L25 Please explain why the oscillations happens with shallow convection scheme is active.

P2266

L6 Please clarify which parameter changes are included in Shortrun1 and Shortrun2.

P2267

L28 What does 'This method enhances the cloud fraction.' mean?

P2270

L4 The sentence needs clearer explanation. The authors write that reduced cloud radiative forcing biases in the deep convective region help weaken the Walker circulation. -The authors do not show longwave cloud radiative effect. Errors in clouds in the deep convective region often are related to deep convective clouds and reduction of the error in deep convective clouds reduces error in cloud radiative effect not only in shortwave but also in longwave. How errors in longwave cloud radiative effect contribute to the deep convective region and the South East coast in these runs? -If the basin-wide Hadley-Walker circulation pattern is sensitive to changes in marine low clouds, isn't it more appropriate to say that improvement to the boundary layer clouds drive weakening of the Walker circulation and reducing errors in cloud radiative effects?

P2271

L5 Please describe how the horizontal wind changes in the new version.

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Technical Corrections

Table 2. As for Shortrun2, doesn't DYCOMS study suggest PBL Bckgrnd Diff 0.3, rather than 1.0?

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