

## ***Interactive comment on “Phenomenology of convection-parameterization closure” by J.-I. Yano et al.***

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Reply to the Referee #1:

i) Overall: thank you for your very positive and emphatic evaluation for our review. We are glad to know that the main goal of the present review has been well appreciated by the present referee.

We believe that the review must inevitably dense in order to present various existing perspectives in succinct manner. Nevertheless, we will further paraphrase various statements as requested in section ii) by the present referee in revision.

ii) Questions/Comments to the authors:

1) on page 25755, last paragraph, the authors state that "(...) CAPE didn't affect the linear dry or moist modes, but they were decayed by the CAPE closure":

The sentence in concern will be modified in revision as follows: "In this manner, it is found that the introduction of CAPE into closure didn't affect the overall structure of both linear dry and moist modes, but they were simply decayed by the CAPE closure."

2) on page 25756, 2nd paragraph, where WISHE mechanism is introduced:

The sentences in concern will be modified in revision as follows: "A CAPE-based adjustment description only gives a damping mode, as emphasized by Emanuel et al. (1994) as moist convective damping. They further emphasized that an extra effect such as wind-induced surface heat exchange (WISHE: Yano and Emanuel 1991) is required in order to induce a growing mode. However, in the present series of studies, no instability is found for realistic wavelengths even when WISHE is added."

Recall that a combination of CAPE closure and WISHE is an important thesis of a review by Emanuel et al. (1994). Thus it is worthwhile to refer to those new results in its own right.

3) on page 25758, 4th paragraph, line 17:

This is just an example that observationally identified correlation does not necessarily leads to a useful closure, as emphasized in the last section. In revision, a short sentence will be added to the end of this paragraph as a reminder: "Thus, observationally identified correlation does not necessarily lead to a useful closure."

4) on page 25760, 2nd paragraph, line 10:

The sentence in concern will be expanded into a following discussion in revision: "Zhang (2002) notes that the change in CAPE is due to the two components: those coming from the free tropospheric environment and those from the boundary layer. He suggests that change in CAPE due to the free tropospheric environment is related to the convection, but not a part coming from the latter, leading to a concept of parcel-

environment CAPE closure."

5) on page 25766, last paragraph, line 21:

The sentence in concern will be modified in revision as follows: "In turn, the cloud work function,  $A_\lambda$ , is modified by a rate

$$\sum_{\lambda'} \gamma_{\lambda, \lambda'} M_{\lambda'} \quad (3)$$

defined in terms of a matrix  $\gamma_{\lambda, \lambda'}$  that characterizes the efficiency of a particular convection type,  $\lambda'$ , in modifying the other convection type,  $\lambda$ , given a specific cloud-base mass flux,  $M_{\lambda'}$ ."

6) on the page 25769, last paragraph, line 25:

The sentence in concern is expanded as follows with a reference added: "The scheme includes a triggering similar to the Kain Fritsch scheme (Kain 2004): an entraining lifting air parcel is raised to its LCL where it receives a buoyancy kick. The kick, conditioned by a threshold of the resolved vertical velocity,  $\bar{w}_{LCL}$ , at LCL, allows the parcel to pass its LFC. Note that this is only a particular choice for trigger, and sensitivities of the model on trigger must also still be investigated in the same manner as for the closure." The trigger scheme sensitivity is clearly left for the future study.

iii) All proposed technical corrections and suggestions will be incorporated into the revised text as proposed, except for:

10) This sentence must be sufficiently assertive, thus "To repeat the point" is retained.

17) "against CIN" is modified to "against use of CIN"

24) Kain (2004) is referred in revision

30) corrected as suggested except for "convection" instead of "convections"

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