Interactive comment on “The influence of internal variability on Earth’s energy balance framework and implications for estimating climate sensitivity” by Andrew E. Dessler et al.

Pehr Björnbom

pehrbjor@kth.se

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Equation (1) in my comment SC4 has the same shape as Eq. (8) with respect to the traditional climate feedback parameter $\lambda$ displayed in my comment SC3

$$R = F + \lambda T_S + a_2a_1(\lambda_2 - \lambda_1)(T_{S,2} - T_{S,1}) + a_3a_1(\lambda_3 - \lambda_1)(T_{S,3} - T_{S,1}) + a_3a_2(\lambda_3 - \lambda_2)(T_{S,3} - T_{S,2})$$

(1)

where it is implied that $R = a_1R_1 + a_2R_2 + a_3R_3$, $F = a_1F_1 + a_2F_2 + a_3F_3$, $\lambda = a_1\lambda_1 + a_2\lambda_2 + a_3\lambda_3$ and $T_S = a_1T_{S,1} + a_2T_{S,2} + a_3T_{S,3}$. Here $a_1$, $a_2$ and $a_3$ are the area fractions of the three regions 90°N to 19.4°N, 19.4°N to 19.4°S and 19.4°S to 90°S.
However, $T_S$ is a global average. In the case with the climate feedback parameter $\Theta$ introduced in the discussion paper, the 500 hPa mean tropical temperature $T_A$ is used instead of $T_S$. Because $T_A$ is averaged over the tropical regions 30°N to 19.4°N, 19.4°N to 19.4°S and 19.4°S to 30°S there are different area fractions for $T_A$ than for $R$, $F$ and $\Theta$. This was overlooked in SC4. The correct equation with $T_A = b_1 T_{A,1} + b_2 T_{A,2} + b_3 T_{A,3}$ should be:

$$R = F + \Theta T_A + (a_2 b_1 \Theta_2 - a_1 b_2 \Theta_1) (T_{A,2} - T_{A,1}) + (a_3 b_1 \Theta_3 - a_1 b_3 \Theta_1) (T_{A,3} - T_{A,1}) + (a_3 b_2 \Theta_3 - a_2 b_3 \Theta_2) (T_{A,3} - T_{A,2})$$  \hspace{1cm} (2)