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.

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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 λ displayed in my comment SC3

$$
\begin{aligned}
R = {} & F + \lambda T_S + a_2 a_1 (\lambda_2 - \lambda_1)(T_{S,2} - T_{S,1}) + \\
& + a_3 a_1 (\lambda_3 - \lambda_1)(T_{S,3} - T_{S,1}) + a_3 a_2 (\lambda_3 - \lambda_2)(T_{S,3} - T_{S,2})
\end{aligned}
\tag{1}
$$

where it is implied that $R = a_1 R_1 + a_2 R_2 + a_3 R_3$, $F = a_1 F_1 + a_2 F_2 + a_3 F_3$, $\lambda = a_1 \lambda_1 + a_2 \lambda_2 + a_3 \lambda_3$ and $T_S = a_1 T_{S,1} + a_2 T_{S,2} + a_3 T_{S,3}$. 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.

C1

However, T_S is a global average. In the case with the climate feedback parameter Θ 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 Θ. 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:

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