Erroneous MSLB Assertion

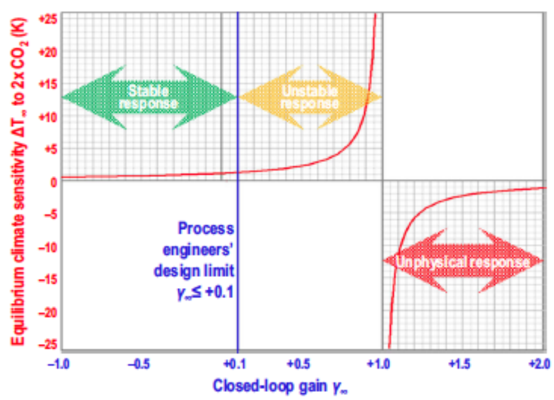
MSLB used a complicated method involving additional math not directly related to the irreducibly simple equation to calculate the equivalent of Bode f. Confusing, although apparently rigorous. The resulting Bode f equivalent is the closed loop gain $g_t = \lambda_0 * f_t$ where λ_0 is the zero feedback radiative forcing (see below) and f_t is the sum of all feedback radiative forcings like water vapor, lapse rate, clouds... MSLB estimates the IPCC f_t from Figure 3 (which reproduces AR5 WG1 9.43):

"*The feedback sum f_t (right-hand column) falls on 1.5 [1.0, 2.2] W m–2 K–1 for AR5, compared with 1.9 [1.5, 2.4] W m–2 K–1 for AR4.*"

MSLB Table 1 provides calculated g_t (IPCC Bode f) ranging from 0.31 to 0.75 for AR4 and AR5.

The IPCC Bode f could have been derived more simply. An ECS of 3.2C over Plank 1.2C yields a simple Bode multiplier of 2.67 ≈ 2.7 for (1/1-f). The IPCC feedback f is therefore ~0.63 since 1/(1-0.63) = 1/0.37 = 2.7. That is all MSLB had to do to be irreducibly simple in this part of the paper.

MSLB Figure 5 asserts that the more complexly derived values would result in unstable climates (the figure's x axis should have been labeled g_∞ per the accompanying text, a confusing chart/text discrepancy). MSLB therefore argues the GCM models are not trustworthy, because they result in unstable response regimes. It is evident by inspection that any Bode f under or around the inflection (below ~0.75) is stable. IPCC f ≈ 0.65 does not lead to an unstable climate. This conclusion is merely an unsupported "Process engineer's design limit ≤+0.1" assertion.



As is clear from either Lindzen's f plot or MSLB's expanded equivalent g_t plot, all of MSLB's calculated IPCC feedback f values are well behaved.

None of the paper's long 'step 3' 'closed loop gain' / Bode f discussion relates directly to the 'irreducibly simple equation' itself, or to its evaluation. It muddles the rest of the paper and obscures the equation's utility in my opinion.

What's Right with MSLB

The mathematical derivation of the 'irreducibly simple' equation appears impeccable. The 'simple' result (rearranged here for expository convenience and to accommodate some unexpected Climate Etc math formatting issues) is:

$$ECS = \lambda_0\ 1/q_t\ \kappa\ \ln(C_t/C_0)\ r_t\ 1/(1-\lambda_0 f_t)$$

For those with math allergies, here is a translation into sort of English:
ECS (equilibrium or 'effective' climate sensitivity) =
λ_0 (the traditional radiative forcing greenhouse effect with zero feedback. A radiative forcing equivalent to f_0=1.2C in the Bode model, with the same result.
* $1/q_t$ (times) where q_t is the proportion of total GHG that is CO_2. This scales from the CO_2 portion to the whole of anthropogenic GHGs.
* κ where κ is the CO_2 GHG forcing constant.
* ln (CO_2 at t something/CO_2 at t=0). This is the expected rise in CO_2. For sensitivity, the traditional test is doubled CO_2, so this term is just ln(2) = 0.69.
* r_t ('transience fraction'), the proportion of the eventual total climate response at time t. This lag arises mainly from ocean thermal inertia.
* $1/(1-\lambda_0 * f_t)$ is *where all the bodies are buried*. Since $\lambda_0 * f_t$ is g_t , which is none other than the (now familiar) Bode feedback f over some time t. This term is the simple Bode multiplier (1/(1-f) in disguise. Everything else in the equation is a different way to calculate a no feedback 'grey' earth Plank value equivalent to ~1.2C without using the Stefan-Boltzmann equation.

Lets rephrase this 'irreducibly simple' equation yet again, in even simpler more common sensical English with no mathy stuff at all:
Climate sensitivity equals the radiative forcing from all anthropogenic greenhouse gases including CO_2, times the (known since Guy Callender in 1938) logarithmically declining impact of increasing CO_2, times the transient lag to climate thermal equilibrium, times some net feedback on the direct GHG effect.

We are left with the Bode feedback f, wrapped in some interesting additional parameters to calculate an equivalent of ~1.2C. Such an uncontroversial thing cannot have motivated the viscous consensus attack on MSLB; it must have been conclusions derived from using it. Lets look more closely at what the equation produces.

MSLB derives values for the equation's five 'tunable' parameters using mostly IPCC AR4 and AR5, with fancy mathematical cross checking of λ_0.

- λ_0 ~0.31, the IPCC AR4/AR5 value.
- q_t ~0.83, the IPCC AR5 value (slightly dependent on RCP scenario).
- κ ~5.35, the IPCC TAR/AR4/AR5 value.
- r_t is potentially more complicated. MSLB Table 2 and discussion develop a plausible range of values for various assumed f_t. A reasonable range is perhaps 0.55 to 0.85. There is a simpler way to derive this 'transience fraction' (climate response lag) since r_t is tantamount to the ratio of TCR to ECS. The AR4 models (WG1 8.6.2.3) have r_t from 0.56-0.76. The newish Lewis and Curry estimate www.judithcurry.com/2014/09/24/lewis-and-curry-climate-sensitivity-uncertainty/ gives (TCR 1.3/ ECS 1.7) ~0.76, used here. Professor Lindzen points out that the higher a climate model's sensitivity, the slower its total response. Higher sensitivity IPCC models should have a smaller r_t … and they do. www.judithcurry.com/2012/04/04/Lindzen-et-al-response-and-parry/

That leaves f_t forcings. But, it is easier to substitute f. Anyone can plug any f they think suitable into either the MSLB equation (for $\lambda_0 * f_t$) or into the simpler Bode equation 1.2C*[1/(1-f)]. Or, just use Lindzen's graph. We found earlier that IPCC AR5 implicitly has an f about 0.65. This can be decomposed along MSLB lines. Water vapor feedback (including lapse rate) is about 65-80% of the total f_t (AR5 WG1 figure 9.43 or MSLB Figure 3), so Bode f_w ~0.45 to 0.5. The rest is about Bode f_c ~0.15 to 0.20, which is mainly clouds since the other stuff is smallish and mostly offsetting. Rules of thumb thinking. Simple models do not need precision to provide instructive lessons.