Evolution Equation of Global Surface Temperatre(correction 3) '09/10/28,30,

This is a corrected version of EGT(Equation of Global Temperature) solution.
The calculation was done by semi-automatic one with assumption of constant K_G.

By anyhow, it could grasp a whole looking of **the temperature trend** with a possible CO2 decreasing simulation(**1.5ppm/year CO2 pulling down**).

☞:This is an emergent supplement version for Global Temperature Fact.
http://www.geocities.jp/sqkh5981g/Global-temperature-fact.pdf
It takes more time to do the full verification.

❶Solution enviromental data:

(1) $C_G(dT_G/dt) = 4\pi R_E^2 \delta F_0 = 4\pi R_E^2 (\sigma @(t)) \{T_A(t)^4 - T_G(t)^4\}$. <EGT>

(2) $@(t) = \{(F_0/4)[1-m(t)] - \delta F_0\} / \sigma T_G(t)^4$. ← $\delta F_0 = (F_0/4)[1-m(t)] - @(t)[\sigma T_G(t)^4]$

$= (1366/4)[1-0.3]-1.6]/5.67\text{x}10^{-8}\text{x}287.5^4 = 0.614$.

(3) $dT_G/dt = [4\pi R_E^2(\sigma @(t))/C_G]\{T_A(t)^4 - T_G(t)^4\} \equiv K_G\{T_A(t)^4 - T_G(t)^4\}$.

(4) $K_G(t) \equiv @(t)[4\pi R_E^2 \sigma / C_G] = @(t)\ \sigma\ (dT_G/dt)/\delta F_0 = 4.35\text{x}10^{-10}/yK^3$.

Certainly $K_G(t)$ is time dependent due to @(y), however its change is less than 0.5%(see correction 1), so we are to neglect its time dependency by assuming constant for easy solving. But actually to tell, it is very slight change of @(y) itself that vary $\delta F_0 = (F_0/4)[1-m(t)] - @(t)[\sigma T_G(t)^4]$.

(5) $T_G(t=0) = 287.5K$. <observed value>

(6) $(dT_G(t)/dt) = 0.02K/y, 0.03K/y$. <observed value>

(7) policy simulation variable $T_A(t)$: <note that T_A never depend on $(dT_G(t)/dt)$>

$T_A(t) = [(dT_G(t)/dt)/K_G + T_G(t)^4]^{1/4}$

$= [(dT_G(t)/dt)/\langle @(t)\ \sigma\ (dT_G/dt)/\delta F_0\rangle + T_G(t)^4]^{1/4}$

$= [\delta F_0/\langle @(t)\ \sigma\rangle + T_G(t)^4]^{1/4} = [1.6/0.614\text{x}5.67\text{x}10^{-8} + 287.5^4]^{1/4} = 288.0$.

(a) $T_A(385ppm, 20xx) = 288.0K$.

(b) $T_A(280ppm, 1750) = 286.7K$.

(c) coarse linear estimation of $T_A(t)$ with 1.5ppm CO2 pulling down.

$T_A(t)$ (policy value) $= 288 - (288.0 - 286.7)\text{x}(1.5Y/105) = (288 - 0.0186Y)K$.

❷step by step approximation of EGT solution with constant K_G.

(1) $dT_G(t)/dt = K_G\{T_A(t)^4 - T_G(t)^4\}$.

$T_G(t+\Delta dt) = T_G(t) + \Delta t(dT_G(t)/dt) = \Delta t K_G\{T_A(t)^4 - T_G(t)^4\}$

$T_G(t+2\Delta dt) = \Delta t K_G\{T_A(t+\Delta dt)^4 - T_G(t+\Delta dt)^4\}$

. . . .

$T_G(t+(n+1)\Delta t) = \Delta t K_G\{T_A(t+n\Delta t)^4 - T_G(t+n\Delta t)^4\}$.

(2) step by Δt=1 years, t=[0 , 50 years]

(3) Following caluculation were done by Spreadsheet in (King Office 2007).

A1=288.0 ; B1=287.5,

K_G*=4.35x10^{-10}/yK^3、(dT_G/dt=0.02K/y).

=6.53x10^{-10}/yK^3、(dT_G/dt=0.03K/y).

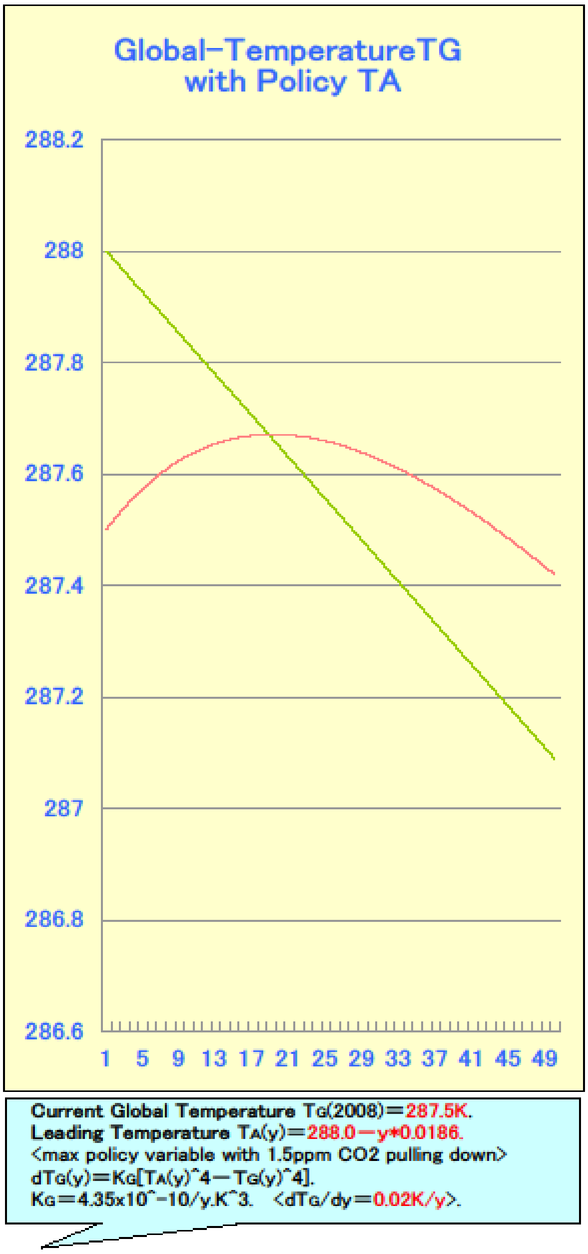
BN+1 = K_G*{(AN)^4−(BN)^4}+BN <N=1, 49>.

❸calculation table(1):

(1)$dT_G/dt=0.02K/y$.

$K_G(t)\equiv@(t)[4\pi R_E^2\sigma/C_G]=@(t)\sigma(dT_G/dt)/\delta F_0=4.35\text{x}10^{-10}/yK^3$.

288	287.5
287.981	287.5207284
287.963	287.5398266
287.944	287.5573619
287.926	287.5733991
287.907	287.5880001
287.888	287.6012245
287.87	287.6131292
287.851	287.623769
287.833	287.6331963
287.814	287.6414615
287.795	287.6486127
287.777	287.6546963
287.758	287.6597565
287.74	287.6638359
287.721	287.6669752
287.702	287.6692136
287.684	287.6705885
287.665	287.671136
287.647	287.6708899
287.628	287.6698839
287.609	287.6681494
287.591	287.6657166
287.572	287.6626148
287.554	287.6588716
287.535	287.654514
287.516	287.6495673
287.498	287.6440562
287.479	287.6380042
287.461	287.6314339
287.442	287.6243667
287.423	287.6168234
287.405	287.6088239
287.386	287.6003872
287.368	287.5915314
287.349	287.5822741
287.33	287.572632
287.312	287.562621
287.293	287.5522567
287.275	287.5415536
287.256	287.530526
287.237	287.5191873
287.219	287.507551
287.2	287.4956281
287.182	287.4834319
287.163	287.4709733
287.144	287.4582633
287.126	287.4453123
287.107	287.4321304
287.089	287.4187272



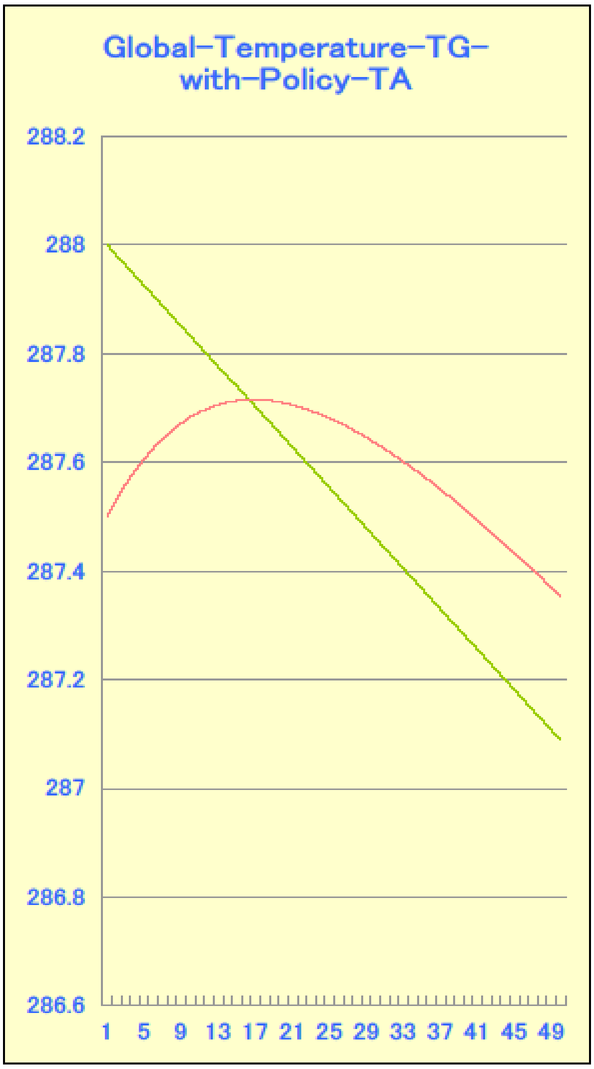
❸calculation table(2)：

(2)dT_G/dt＝0.03K/y.

$K_G(t) \equiv @(t)[4\pi R_E^2 \sigma / C_G] = @(t)\,\sigma\,(dT_G/dt)/\delta F_0 = 6.53\text{x}10^{-10}/yK^3$.

$T_A(t) = [\delta F_0/\langle @(t)\,\sigma\rangle + T_G(t)^4]^{1/4} = 288.0$.

288	287.5
287.981	287.5311164
287.963	287.5591407
287.944	287.5842644
287.926	287.6066675
287.907	287.6265189
287.888	287.6439771
287.87	287.6591908
287.851	287.6722995
287.833	287.6834344
287.814	287.6927181
287.795	287.7002661
287.777	287.7061864
287.758	287.7105805
287.74	287.7135435
287.721	287.7151647
287.702	287.715528
287.684	287.7147111
287.665	287.7127884
287.647	287.7098288
287.628	287.7058968
287.609	287.7010533
287.591	287.6953551
287.572	287.6888556
287.554	287.6816048
287.535	287.6736497
287.516	287.6650342
287.498	287.6557997
287.479	287.6459847
287.461	287.6356254
287.442	287.624756
287.423	287.6134083
287.405	287.6016121
287.386	287.5893954
287.368	287.5767845
287.349	287.5638041
287.33	287.5504771
287.312	287.5368252
287.293	287.5228688
287.275	287.508627
287.256	287.494117
287.237	287.4793561
287.219	287.4643599
287.2	287.449143
287.182	287.4337192
287.163	287.4181014
287.144	287.4023016
287.126	287.3863313
287.107	287.3702011
287.089	287.3539209



Current Global Temperature T_G(2008)＝287.5K.
Leading Temperature T_A(y)＝288.0－y*0.0186.
<max policy variable with 1.5ppm CO2 pulling down>
$dT_G(y) = K_G[T_A(y)^4 - T_G(y)^4]$.
$K_G = 6.53\text{x}10^{-10}$/y.K^3.　<dTG/dy＝0.03K/y>.

(3)It's very hard, but not impossible that we could stop temperature rise in decades, but it is not likely to become down in a short years !.

Then maximum temperature T_G depends on current temperature trend$=dT_G/dt$. Never mis-understand that quick temperature trend could stop temperature rise earlier. This may be due to time scaling dependency caused by K_G variation.

The assuption of conatant $K_G(t)$ is mere a convinience for the EGT solving. $K_G(t)$ is time dependent due to @(y), and it is very slight change of @(y)-itself that varies $\delta F_0=(F_0/4)[1-m(t)]-@(t)[\sigma T_G(t)^4]$ by hudge scale amplifier of T_G^4.

postscript(09/10/30): It would take more time for verification on {@(t) as a function of GHG concentration CO2(t), etc and EGT equation}.