Evolution Equation of Global Surface Temperatre(correction 2) '09/10/28,

This is a corrected version of EGT(Equation of Global Temperature) solution.
The calculation on the solution has some unceratainty due to approximation error.
By anyhow, the non-linear equation must be solved correctly by something tools.
However it could grasp a whole looking of **the temperature trend** with a possible CO_2 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
So before long, this would be necessary of version up.

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

Certatinly $K_G(t)$ is time dependent due to @(y), however its change is less than 0.5%(see here), so we are to neglect its time dependency by assuming constant.

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

(6) $(dT_G(t)/dt)=0.02K/y$. <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 CO_2 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) $\Delta t=3$ years, $t=[0, 69\text{years}]$

❸calculation table(1):

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

$K_G(t) \equiv @(t)[4\pi R_E^2 \sigma / C_G] = @(t)\sigma(dT_G/dt)/\delta F_0 = 4.35x10^{-10}/yK^3$.

$T_A(t) = [(dT_G(t)/dt)/K_G + T_G(t)^4]^{1/4} = [(0.02)/4.35x10^{-10} + 287.5^4]^{1/4} = 288.0$.

	385ppm	380.5	376	371.5	367	362.5	358	353.5
Δy=3	0y	3	6	9	12	15	18	21
T_A	288.0	287.98	287.96	287.94	287.93	287.91	287.89	287.87
dT/dy	.021K/y	0.0174	0.0145	0.0120	0.010	0.0079	0.0062	0.0046
T'=dT+T	T_G=287.5	287.56	287.61	287.65	287.69	287.72	287.74	287.76

	349	344.5	340	335.5	331	326.5	322	317.5
Δy=3	24	27	30	33	36	39	42	45
T_A	287.85	287.83	287.81	287.80	287.78	287.76	287.74	287.72
dT/dy	0.0033	0.0021	0.0008	-.0004	-.0012	-.0021	-.0025	-.0029
T'=dT+T	287.77	287.78	287.79	287.81	287.81	287.81	287.80	287.79

	313	308.5	304	299.5	295	290.5	286	281.5
Δy=3	48	51	54	57	60	63	66	69
T_A	287.70	287.68	287.67	287.65	287.63	287.61	287.59	287.57
dT/dy	-.0033	-.0037	-.0037	-.0041	-.0046	-.0050	-.0054	-.0054
T'=dT+T	287.78	287.77	287.76	287.75	287.74	287.73	287.72	287.70

❸calculation table(2):

(2) $dT_G/dt = 0.03K/y$.

$K_G(t) \equiv @(t)[4\pi R_E^2 \sigma / C_G] = @(t)\,\sigma\,(dT_G/dt)/\delta F_0 = 6.53x10^{-10}/yK^3$.

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

	385ppm	380.5	376	371.5	367	362.5	358	353.5
Δy=3	0y	3	6	9	12	15	18	21
T_A	288.0	287.98	287.96	287.94	287.93	287.91	287.89	287.87
dT/dy	.031K/y	0.0243	0.0187	0.0137	0.0106	0.0075	0.0050	0.0025
T'=dT+T	T_G=287.5	287.59	287.66	287.72	287.76	287.79	287.81	287.83

	349	344.5	340	335.5	331	326.5	322	317.5
Δy=3	24	27	30	33	36	39	42	45
T_A	287.85	287.83	287.81	287.80	287.78	287.76	287.74	287.72
dT/dy	0.0006	-.0006	-.0019	-.0019	-.0025	-.0031	-.0037	-.0044
T'=dT+T	287.84	287.84	287.84	287.83	287.82	287.81	287.80	287.79

	313	308.5	304	299.5	295	290.5	286	281.5
Δy=3	48	51	54	57	60	63	66	69
T_A	287.70	287.68	287.67	287.65	287.63	287.61	287.59	287.57
dT/dy	-.0050	-.0056	-.0050	-.0056	-.0056	-.0056	-.0056	-.0056
T'=dT+T	287.78	287.77	287.75	287.74	287.72	287.70	287.68	287.66

(3) It is very hard, but not impossible that we could stop the 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 $= dT_G/dt$.

Note that $T_A(t)$ never depend on (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.

postscript: By anyhow, analytical method has certain limitation on solving non-linear equation, so it would take more time for the research.