Definition on Radiative Forcing. 2014/4/26,,5/6.6/4,6/19.

Radiative forcing (≡**RF**)is the most key concept in **heat debt budget** causing global **temperature rise**,while the definition is obscure in IPCC document at least for author.Once again he tried its verification and **correcting** on **effective RF(heat debt budget)** derived by instantaneous RF calculable in chemical physics.Some correction is necessary in his report However,the result would not change the global policy conclusions for climate change .

[1] : Effective RF is calculable by instantaneous RF in IPCC's definition.

(1)**Effective Radiative Forcing**≡ $\Delta F_e(t)$: **the heat imbalance in earth heat budget.**

$C_G(dT(t)/dt)=(1-a(t))I_0(t)-@(t)\sigma T(t)^4\equiv\Delta F_e(t)$.

earth heat capacity<C_G>×global temperature change/y<$dT(t)/dt$>

=insolation input<$(1-a(t))I_0(t)$>−Cooling Radiation output<$@(t)\sigma T(t)^4$>≡**Debt Heat**/y

＊a(t)≡averaged albedo of earth surface

＊@(t)≡averaged passing probability magnitude of Cooling Radiation of T(t).

(2)**IPCC the original definition**<**changes from IR time(1850 : t=0)**>.

$0\equiv\Delta F(0)\equiv(1-a(0)I_0(0)-@(0)\sigma T(0)^4$.........<in **heat balance at** IR time(1850 : t=0)>.

$\Delta F_e(t)\equiv(1-a(t))I_0(t)-@(t)\sigma T(t)^4-<(1-a(t0)I_0(0)-@(0)\sigma T(0)^4>$

$=(1-a(t))I_0(t)-<1-a(0)I_0(0)>-<@(t)\sigma T(t)^4-@(0)\sigma T(0)^4>$

$=-(a(t)-a(0))I_0(0)\quad -@(t)\sigma<T(t)^4-T(0)^4>$

$+(1-a(t))<I_0(t)-I_0(0)>-<@(t)-@(0)>\sigma T(0)^4$.

(2)**Exact effective RF($\Delta F_e(t)$) due to RF components in IPCC's definition**

$C_G(dT(t)/dt)\equiv\Delta F_e(t)=-(a(t)-a(0))I_0(0)\quad -@(t)\sigma<T(t)^4-T(0)^4>$

$+(1-a(t))<I_0(t)-I_0(0)>-<@(t)-@(0)>\sigma T(0)^4$.

The utility of this equation is that **T(t) could be calculable** by **instantaneous RF**≡ $\Delta F_G(t)\equiv-<@(t)-@(0)>\sigma T(0)^4\equiv-\Delta @(t)\sigma T(0)^4$.

,where @(0) is determined as value of IR time.

＊ $\Delta F_G(t)$: **instantaneous radiative** forcing from IR time temperature= T(0).

This is **calculable** by Chemical Physics on GHGs concentration change.

☞: **IPCC's original definition *the changes from IR time needs* approximations by neglecting small increment of 2nd orders of {$\Delta x \Delta y$}.**

(a)**Temperature Negative FeedBack:**

$-@(t)\sigma < T(t)^4 - T(0)^4 > \equiv -<@(0) + \Delta @(t)> \sigma < T(t)^4 - T(0)^4 > \fallingdotseq -@(0)\sigma\ \Delta T(t)^4$.

***for example,**$@(t)) - \Delta @ = @(0) = 0.60016 - (-0.012) = 0.612$.

$@(0)/@(t)) = 1.02$. It is **2% error** which is negligible in rough climate science.

(b)**Insolation term:**

$(1-a(t)) < I_0(t) - I_0(0) > \equiv (1-a(0) - \Delta a(t)) < I_0(t) - I_0(0) > \fallingdotseq + <1-a(0)> \Delta I_0(t)$.

*perhaps $< I_0(t) - I_0(0) > \fallingdotseq 0$ .Insolation change may be negligible(no data).

(c)RF kinds	Representation as IPCC definition by neglecting 2nd order term
albedo	$-(a(t)-a(0)) I_0(0) \quad = -\Delta a(t) I_0(0)$
insolation	$(1-a(t)) < I_0(t) - I_0(0) > \fallingdotseq <1-a(0)> \Delta I_0(t)$
ppm$\equiv \Delta F_G(t)$.	$-<@(t)-@(0)> \sigma T(0)^4 = -\Delta @(t) \sigma T(0)^4$
Temperature nega FB **TNFB**	$-@(t)\sigma < T(t)^4 - T(0)^4 > \fallingdotseq -@(0)\sigma\ \Delta T(t)^4$

However, in this report,author employ **no approximation representation** as follows.

(3) $\Delta F_e(t)$ = **albedo change + insolation one + ppm change + temperature change**

$\Delta F_e(t) = -\Delta a(t) I_0(0) + <1-a(t)> \Delta I_0(t) - \Delta @(t) \sigma T(0)^4 - @(t) \sigma\ \Delta T(0)^4$.

negligible in at this time. $\Delta F_G(t)$ **TNFB**

＊Maybe albedo change at now and future could not negligible !!!.(no data).

＊**ppm change ≡ passing probability magnitude change** caused by $\Delta F_G(t)$.

(a): **Instantaneous Radiative Forcing in Gas concentration change from C_0 to $C(t)$**

$\Delta F_G(t) = 5.35 \ln(C(t) / C_0)$ *) $\equiv \Delta @(t) \sigma T(0)^4$. RF by carbon concentration change.

*)IPCC(1990),and Myhre et al(1998).

http://ja.wikipedia.org/wiki/%E6%94%BE%E5%B0%84%E5%BC%B7%E5%88%B6%E5%8A%9B

This is an utilizable tool for estimating temperature by **GHG density change**.

(b): **TNFB ≡ Temperature Negative Feed-Back.**

$\sigma\ \Delta T(0)^4 \equiv \sigma < 288^4 - 287.15^4 > = 4.58 W/m^2$.

$@(t) \sigma\ \Delta T(0)^4 \fallingdotseq 0.6 \times 4.58 W/m^2 = 2.75 W/m^2$.

This important term ≡ TNFB has been not defined in IPCC's work ??!!

In this report,we take it into account.This is the main reason for **correction at this time.**

(c)**an example calculation values** :

	Model_1(at now)	Model_0(1850)	Change from 1850
albedo	a(t)＝**0.31**//235.98.	235.98.	≡0
insolation	$I_0(t)$＝**342**W/m^2	$I_0(t)$＝**342**W/m^2	≡0
ppm	@(t)＝0.60016	@(0)=0.6120 ＝@(t)－Δ@	-Δ@σT_0^4＝2.75＋1.87, Δ@=－0.012.
temperature cooling RF	$T(t)^4$≡**288K**^{4} @(t)σ $T(t)^4$＝234.11	$T(0)^4$≡**287.15K**^{4} 235.92W/m^2	@(t)σ Δ$T(t)^4$＝－**2.75**W/m^2 <@(0)＝0.6121>
CO2-RF	5.35xln<(400ppm)/280 ppm)>＝1.91W/m^2 **??**		
Radiative F	Δ$F_e(t)$＝**1.87**W/m^2	Δ$F_e(0)$＝0.06=0	Δ$F_e(t)$＝**1.87**W/m^2

(d)**Algorithm for determining** {Δ@、@(0)}.＊as for C_G＝64W/m^2K,see[３]：(1).

1＊Δ$F_e(t)$＝1.87W/m^2.　←　Δ$F_e(t)$＝C_G(dT/dt)＝64W/m^2K×0.029℃/y?＝1.87W/m^2

2＊@(t)＝{(1-a(t)) I_0－Δ$F_e(t)$}/σ $T(t)^4$＝**0.60016.**

3＊**Temperature change**≡－@(t)σ Δ$T(t)^4$≡－@(t)σ<$T(t)^4$－$T(0)^4$>＝**－2.75**W/m^2.

4＊Δ$F_G(t)$≡－Δ@σ T_0^4＝Δ$F_e(t)$＋@(t)σ Δ$T(t)^4$＝4.65W/m^2 .→　Δ@＝**－0.012**

5＊@(t)－Δ@＝@(0)＝**0.6121**.

☞:instantaneous RF＝Δ$F_G(t)$ could not calculable without fixing surface temperature $T(0)$.

Δ$F_G(t)$≡－Δ@(t)σ $T(0)^4$.

(4)**Deriving effective radiative forcing**:

Ⅰ：**IPCC original definition of Instantaneous Radiative Forcing for ppm term.**

Δ$F_G(t)$≡－Δ@(t)σ $T(0)^4$. →　Δ@(t)＝Δ$F_G(t)$/σ $T(0)^4$.

example) ΔF_G≡5.35xln<(C(t)/C_0)>＝Δ@(C(t)/C_0)σ$T(0)^4$.

Ⅱ：@(t)≡@(０)＋Δ@(t)＝@(０)－Δ$F_G(t)$/σ $T(0)^4$。

@(０)≡is calculated value at_ t=０.

Ⅲ：**TNFB**≡－@(t)σ Δ$T(t)^4$≡－@(t)σ<$T(t)^4$－$T(0)^4$>.

Ⅳ：Δ$F_e(t)$≡－Δ@σ T_0^4－@(t)σ Δ$T(t)^4$.

Ⅴ　C_G(d$T(t)$/dt)＝Δ$F_e(t)$＝Δ$F_G(t)$－@(t)σ<$T(t)^4$－$T(0)^4$>.

Δ$F_e(t)$＝Δ$F_G(t)$<$T(t)$/$T(0)$>^{4}－@(０)σ<$T(t)^4$－$T(0)^4$>.

C_G(d$T(t)$/dt)＝Δ$F_G(t)$<$T(t)$/$T(0)$>^{4}－@(０)σ<$T(t)^4$－$T(0)^4$>.

*If nothing insolation change,RF(effective)is function of Δ$F_G(t)$ and $T(t)$

(a) $\Delta F_e(t) \equiv \Delta F_G(t) - @(t)\sigma < T(t)^4 - T(0)^4 >$.

$= \Delta F_G(t) - < @(0) - \Delta F_G(t) / \sigma T(0)^4 > \sigma < T(t)^4 - T(0)^4 >$.

$= \Delta F_G(t) + < \Delta F_G(t) / T(0)^4 > < T(t)^4 - T(0)^4 >. - @(0)\sigma < T(t)^4 - T(0)^4 >$.

$\Delta F_e(t) = \Delta F_G(t) < T(t)^4 / T(0)^4 > - @(0)\sigma < T(t)^4 - T(0)^4 >$.

$= \Delta F_G(t) < T(t) / T(0) >^4 - @(0)\sigma T(0)^4 < T(t) / T(0) >^4 - 1 >$.

$= < T(t) / T(0) >^4 \{ \Delta F_G(t) - @(0)\sigma T(0)^4 \} + @(0)\sigma T(0)^4$.

(b) $\Delta F_e(t) = \Delta F_G(t) - \underline{@(t)\sigma < T(t)^4 - T(0)^4 >}$. $@(t)\sigma < T(t)^4 - T(0)^4 > = 2.75 W/m^2$. .

$\Delta F_G(t) = \Delta F_e(t) + @(t)\sigma < T(t)^4 - T(0)^4 >$

$= 1.87 + 0.60016\sigma < T(t)^4 - T(0)^4 > =$ **4.62**W/m².

→ 5.35xln<(C=400/C_0=280)>=1.91W/m². ?........This is not agreement !!

(5)**modification on carbon radiative forcing:** $\Delta F_G(t) = F^* \ln(C(t)/C_0) = 12.95 \ln(C(t)/C_0)$.

(a)instantaneous RF is not $\Delta F_G(t) = 1.91 W/m^2$, but must be $\Delta F_G(t) =$ **4.62**W/m² at now.

$\Delta @(t=2014)\sigma T(0)^4 \equiv \Delta F_G(t) = \Delta F_e(t) + @(t)\sigma < T(t)^4 - T(0)^4 > = 1.87 + 2.75 =$ **4.62**W/m².

$\Delta @(t=2014)\sigma T(0)^4 \equiv \Delta F_G(t) = F^* \ln(400)/280)$.

$F^* = \Delta @(t=2014)\sigma T(0)^4 / \ln(400)/280) =$ **4.62**W/m²/ln(400)/280)=12.95W/m².

$\Delta @(t)\sigma T(0)^4 \equiv \Delta F_G(t)$

$\neq 5.35 \ln(C(t) / C_0)$、→ $= 12.95 \ln(C(t)/C_0)$.

Is this modification allowable **?????**

(b)Author once derived passing probability as follows by *a most primitive model analysis*.

http://www.777true.net/Radiative-Forcing-0dim-Model-p1.pdf

$@ = 1/(1 + \alpha H/2)$.

,where H(m) is effective atmosphere heigh for heat trapping gas

So, α (m^{-1}) is something proportional to **GHG(carbon) density**.

$\Delta @ \equiv 1/(1 + \alpha(400ppm) H/2) - 1/(1 + \alpha(280ppm) H/2) =$ **−0.012**.

$\Delta F \equiv \sigma T(0)^4 * \Delta @ = 5.67 \times 10^{-8} . \times 287.15^4 * \Delta @ = 385.5 * \Delta @ =$ **4.62**W/m²

$\Delta @ = =$ **4.62**W/m²/385.5= **−0.012**. → $1/(1+400\beta) - 1/(1+280\beta) = -0.012$

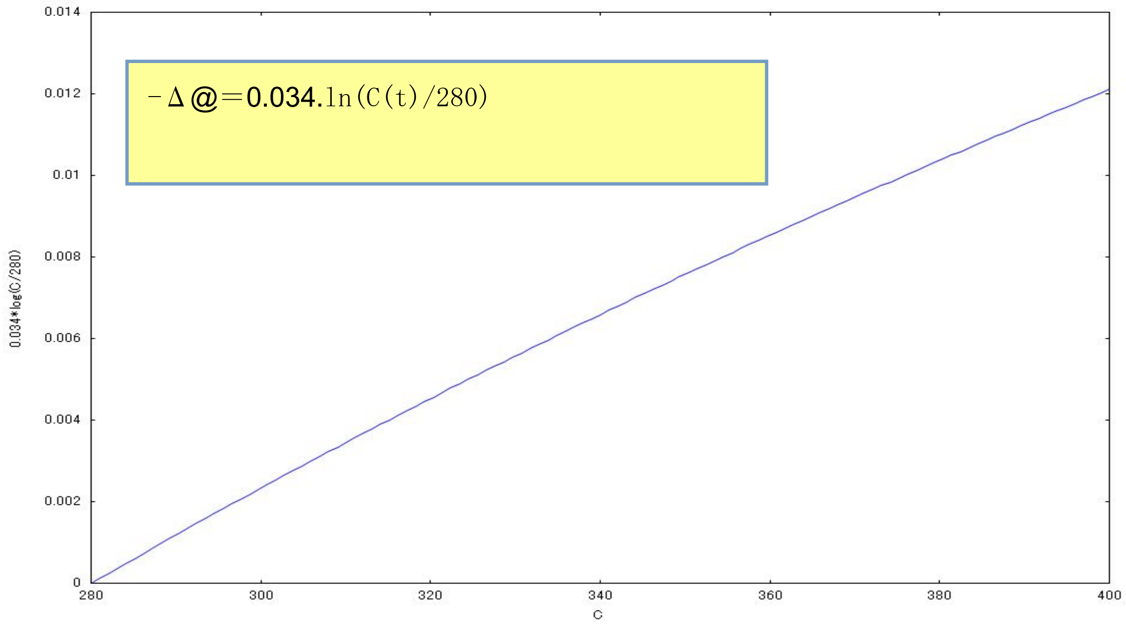
$120\beta / (1+400\beta)(1+280\beta) = -\Delta @$

$-120\beta / \Delta @ = (1+400\beta)(1+280\beta) = 1 + 680\beta + 400 \times 280\beta^2$

$0 = 1/400 \times 280 - 9320\beta + 400 \times 280\beta^2$ → $0 = -0.083\beta + \beta^2$. → $\beta = 0.083$.

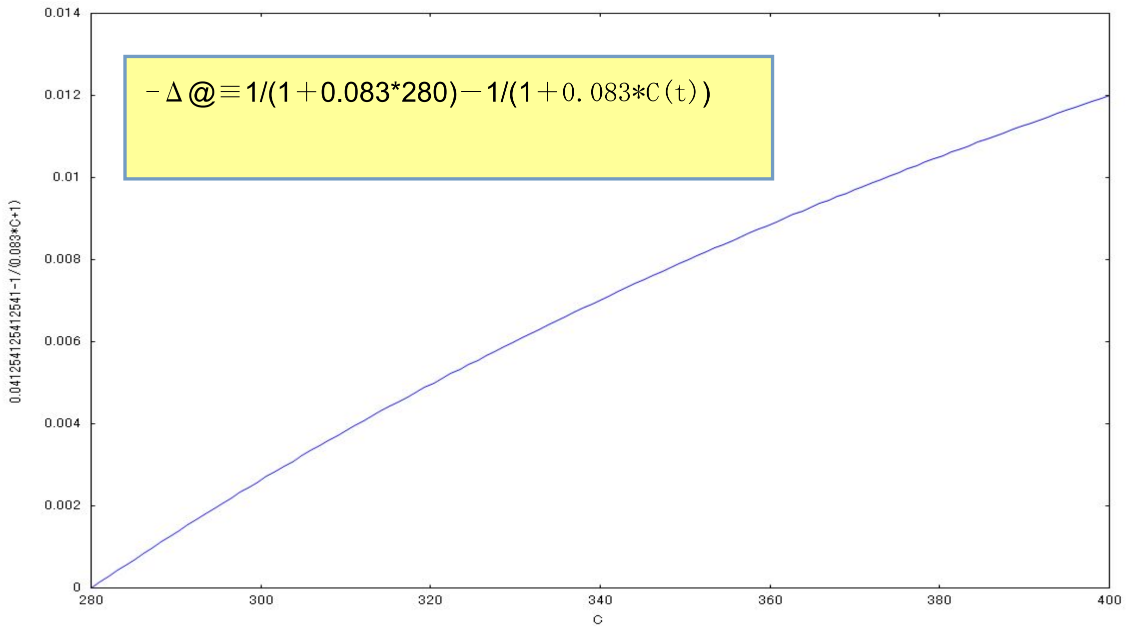
(c)**modified Experts model:**

Δ@=−0.034.ln(C(t)/280).　　　　　　← 0.012/ln(400/280)=0.034



(d)**Authors model:**

Δ@≡1/(1+0.083*C(t))−1/(1+0.083*280)　→ 0.012=Δ@(280,400)



As is seen both have *rather* similar trend.Those have similar kernel mechanism of RF.

［2］: **Carbon parameter policy** :

⑴**CO2 observed data**:

http://www.globalcarbonproject.org/carbonbudget/12/files/CarbonBudget2012.pdf

emission	absorbtion(sink)	accumulation in atmosphere
man-made＝ 8.3±0.4 PgC/yr 90%	land＝ **2.6±0.8** PgC/yr 28%	atmosphere＝ 4.3±0.1 PgC/yr 46%
natural＝ 1.0±0.5 PgC/yr 10%	marine＝ **2.5±0.5** PgC/yr 26%	**2.1** ppm per year during the last 10 years

Total accumulation amount＝(8.3±0.4)＋(1.0±0.5)＝9.3GtC/yr

Emission amount＝4.3±0.1GtC/yr

Absorbtion amount＝(2.6±0.8)＋(2.5±0.5)＝5.1GtC/yr.

⑵**Carbon parameter policy:**

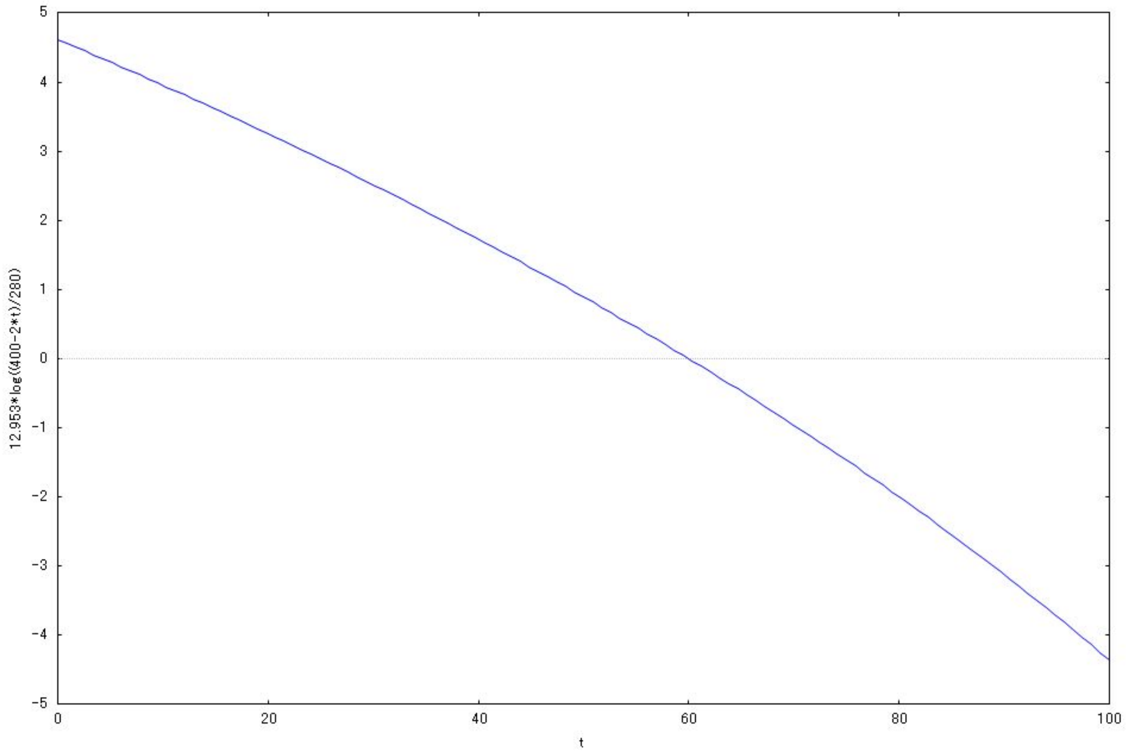
Max Sink＝(5.1－1.0)GtC＝2.1ppmx(4.1/4.3)＝**2.0**ppm/y.

90% reduction＝(5.1－1.0－0.1x**8.3**))GtC＝3.27GtC＝**1.6**ppm/y.

80% reduction＝(5.1－1.0－0.2x**8.3**))GtC＝2.44GtC＝**1.2**ppm/y.

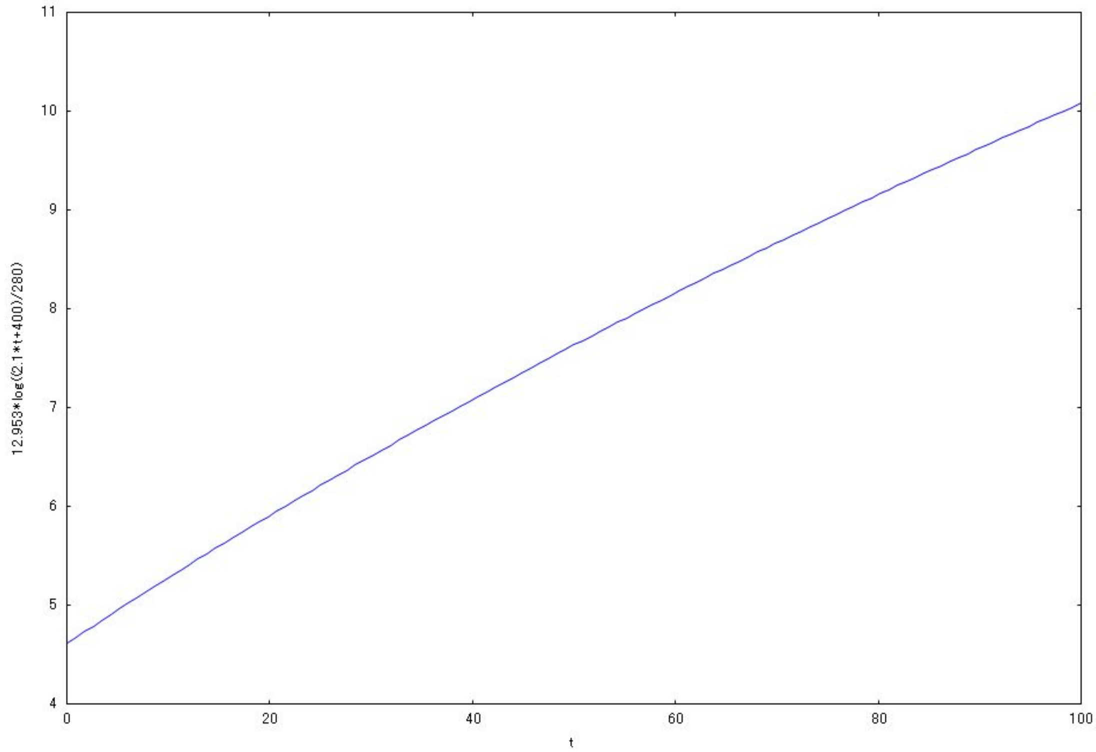
50% reduction＝(5.1－1.0－0.5x**8.3**))GtC＝－0.05GtC＝－**0.02**ppm/y.

0% reduction＝(5.1－1.0－1.0x**8.3**))GtC＝－4.2GtC ＝－**2.05**ppm/y.




```
plot2d(12.953*log((400-2*t)/280),[t,0,100]);
```

```
plot2d(12.953*log((400+2.1*t)/280),[t,0,100]);
```



[３]：**Solving the Temperature Equation:**

(1)Now we will derive temperature trend by each carbon parameter policy.The non-linear equation is solved **by approximation** by step by step integration in time interval.

＊C_G＝**Global ocean active heat capacity;** $C_{G\#}$＝C_G/YS＝55W/m^2K,＝64W/m^2K.

＝3.61x$10^{14}$$m^2$×(600m)700m×1020kg/$m^3$×4.02x$10^3$J/kg＝(8.89x$10^{23}$J/K)、1.04x$10^{24}$J/K. .

＊Normalization factor YS≡years time in seconds×earth surface area

＝3600x24x365×π(6.38x10^6m$)^2$＝1.61x$10^{22}$$m^2$s.

$C_G(dT(t)/dt) = \Delta F_G(t) < T(t)/T(0) >^4 - @(0)\sigma < T(t)^4 - T(0)^4 >$.

$dT(t)/dt = C_G^{-1}\Delta F_G(t)[T(t)/T(0)]^4 - C_G^{-1}@(0)\sigma < T(t)^4 - T(0)^4 >$.

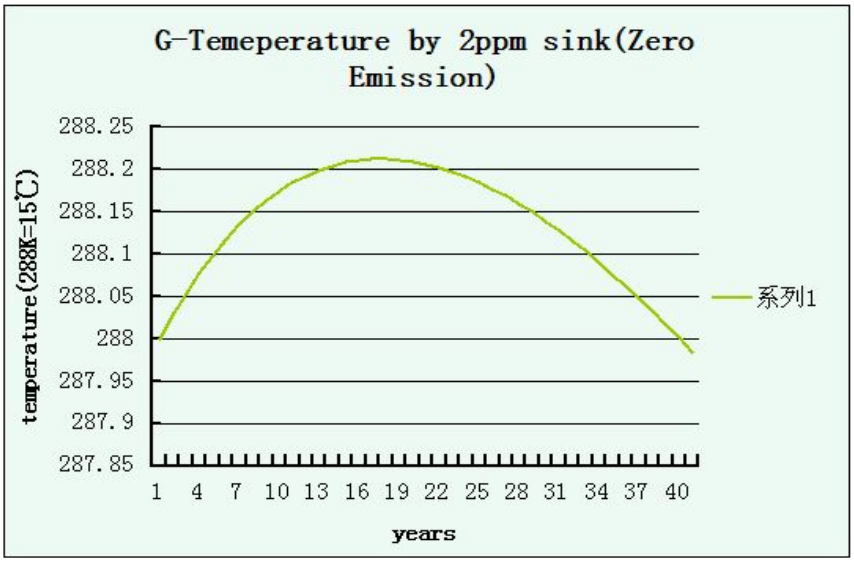
$\Delta F_G(t) = 12.95*\ln(C(t)/C_0)$. C_0＝280ppm,C(t=2014)＝400ppm,

$T(t+dt) = T(t) + dt < dT(t)/dt >$。

$T(N+1) = T(N) + C_G^{-1}\Delta F_G(N)(T(N)/T_0)^4 - C_G^{-1}@(0)\sigma < T(t)^4 - T_0^4 >$. (dt＝1,N=1,2,3...)

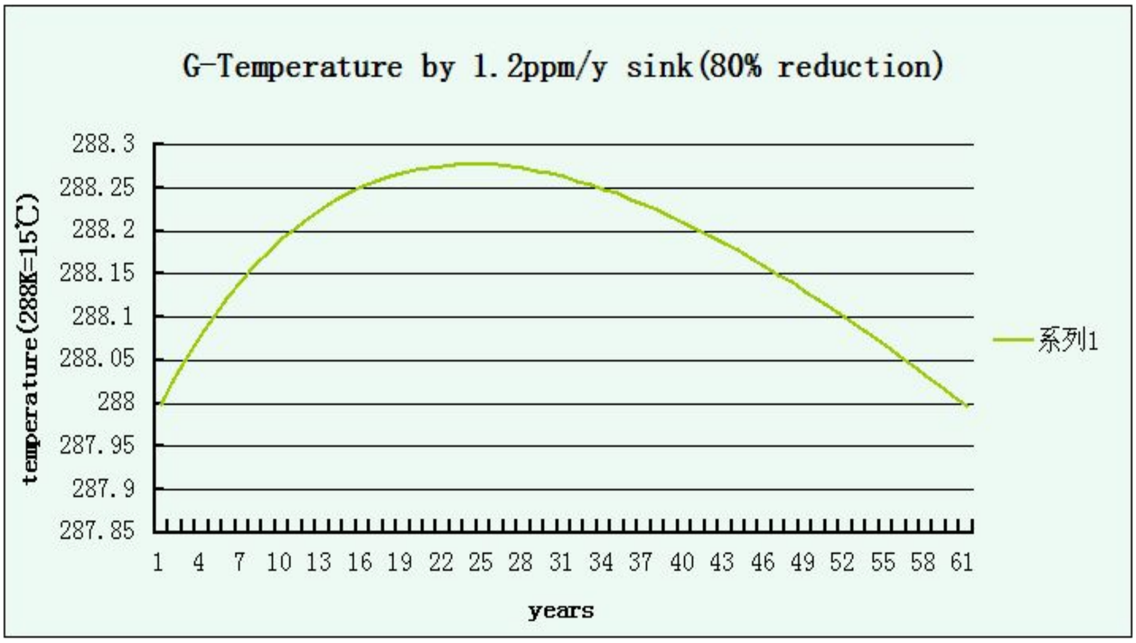
⑵**Spread sheet function<Excel for function table calculation >:**

B2=B1+(12.953/64)*((B1/287.15)^4)*ln((400-2*A1)/280)-(0.612/64)*5.67*10^-8*(B1^4-287.15^4). <B1=**288**,........, A1=**1**,2,3,.......>



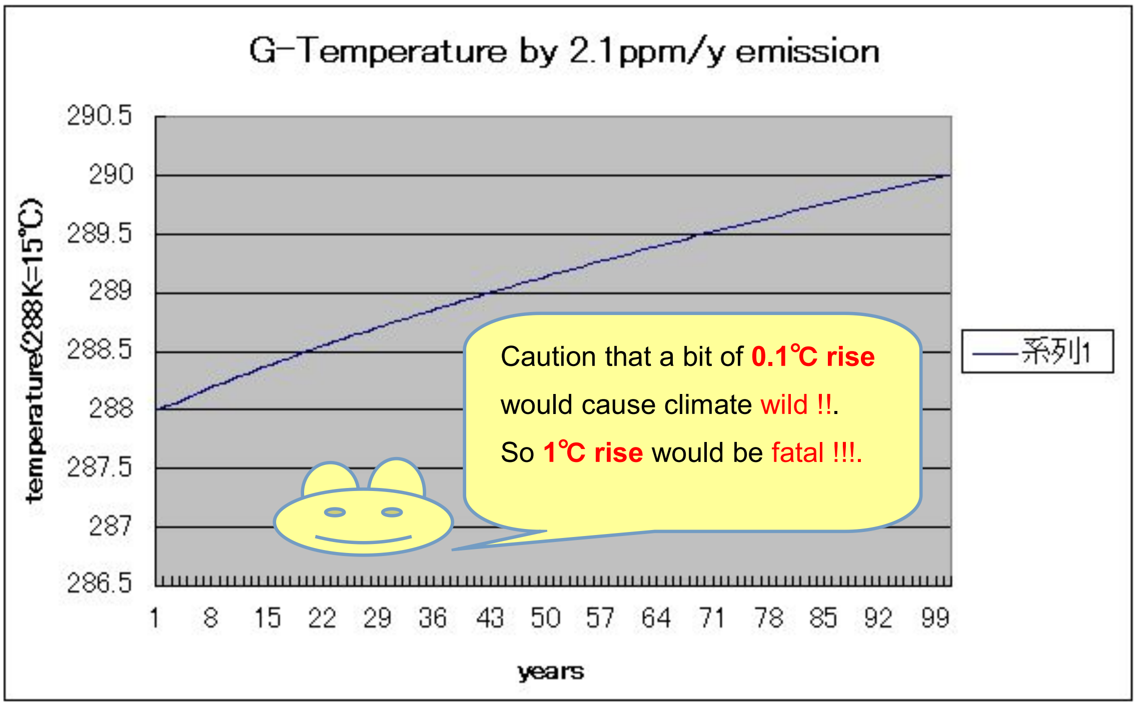
⑶**Spread sheet function:**

=B1+(12.953/64)*((B1/287.15)^4)*ln((400-1.2*A1)/280)-(0.612/64)*5.67*10^-8*(B1^4-287.15^4)



(4)**Spread sheet function:**

=B1+(12.953/64)*((B1/287.15)^4)*ln((400+2.1*A1)/280)-(0.612/64)*5.67*10^-8*(B1^4-287.15^4)



(5)**Caution** above naive model does assume **constant reduction or emission rate** which could not be assured in coming uncertain future.The possible reason may be as follows.

(a)a(t): clouds **albedo change** by temperature rise,

＊massive humidity would increase clouds which prevent both insolation and Cooling R.

(b)@(t): :**natural emission increasing** from **organics** by by temperature rise,

***Arctic Methane eruption risk** is highly possible, if ice shield would have vanished.

(c)@(t): **natural CO2 sink ability decreasing** in **ocean** ＆ **lands** by temperature rise.

The possible emergent defence method at now is only two.

Ⅰ:emergent implementation on Arctic Cooling Engineering.

Ⅱ:emergent implementation on more than 80% CO2 reduction.

Ⅲ:**some rightists group might take final strategy operation EndGame.**

It should be told highly possible to **breakout global nuclear war** with nuclear winter.

However,such world would be no use by massive radiation contamination.

Then how to survive ??.Or final mass suicide ??.

Appendix_1-1:Final equilibrium temperature by fixing $\Delta F_G(t^*)$.

This is very useful formula estimating coming temperature rise by without details,but **constant value** of present effective radiative forcing $\Delta F_G(t^*)$ only. If we could fix instantaneous RF of $\Delta F_G(t^*)$at time=t* by **fixing GHG concentrations**, then final temperature rise is so as to cancel effective $\Delta F_e(t^*)$,which could be determined coming temperature rise.This could be a good coming Temperature estimation$=T(t\%)$ by instantaneous RF .The time would be more than 50 years.

[1]:(4)<6/4-addendum>: $\Delta F_e(t)=\Delta F_G(t)[T(t)/T(0)]^4-@(0)\sigma<T(t)^4-T(0)^4>$.

Note,temperature rise by GHG fixing is to decrease $\Delta F_e(t)$ toward zero.

$\Delta F_G(t^*)=-\Delta @(t^*)\sigma\ T(0))^4$. Fixing at time=t*.

$0=\Delta F_e(t\%)=\Delta F_G(t^*)(T(t\%)/T(0))^4]-@(0)\sigma<T(t\%)^4-T(0)^4>$.

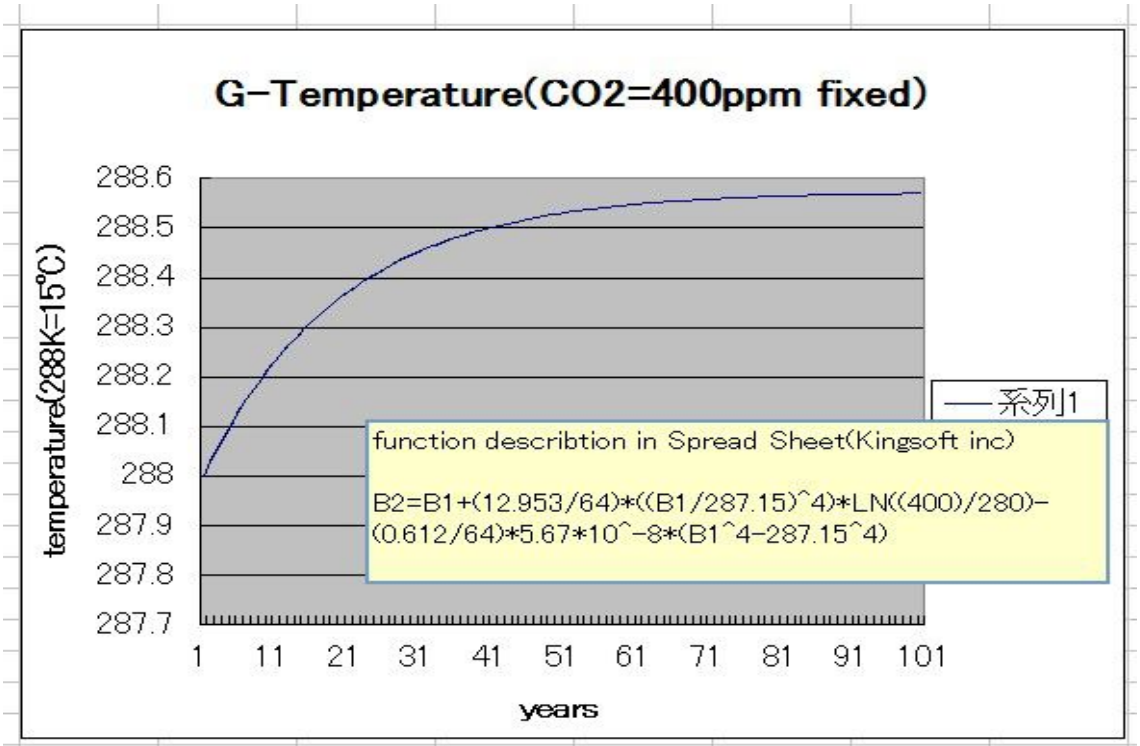
$=<T(t\%)/T(0)>^4\{\Delta F_G(t^*)-@(0)\sigma\ T(0)^4\}+@(0)\sigma\ T(0)^4$.

$T(t\%)^4=T(0)^4<@(0)\sigma\ T(0)^4./\{@(0)\sigma\ T(0)^4-\Delta F_G(t^*)\}>$

$T(t\%)=T(0)<@(0)\sigma\ T(0)^4./\{@(0)\sigma\ T(0)^4-\Delta F_G(t^*)\}>^{1/4}$.

$T(0)=287.15K$	$\Delta F_G(t^*)$ $=4.65Wm^{-2}$	$\Delta @(t^*)=9.30$	$\Delta @(t^*)=13.95$	$\Delta @(t^*)=18.6$
@(t*)=0.6121	288.58	289.05	291.56	293.11

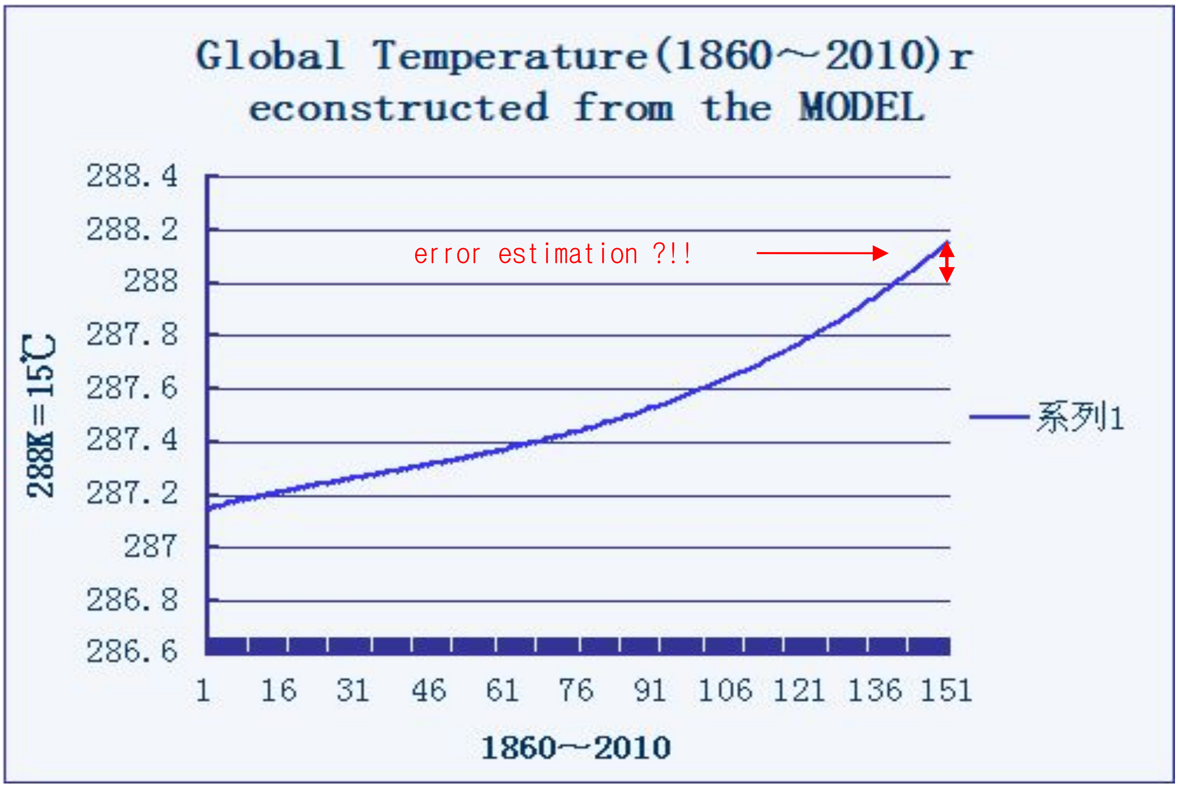
Note 289k is no salvation !!!.



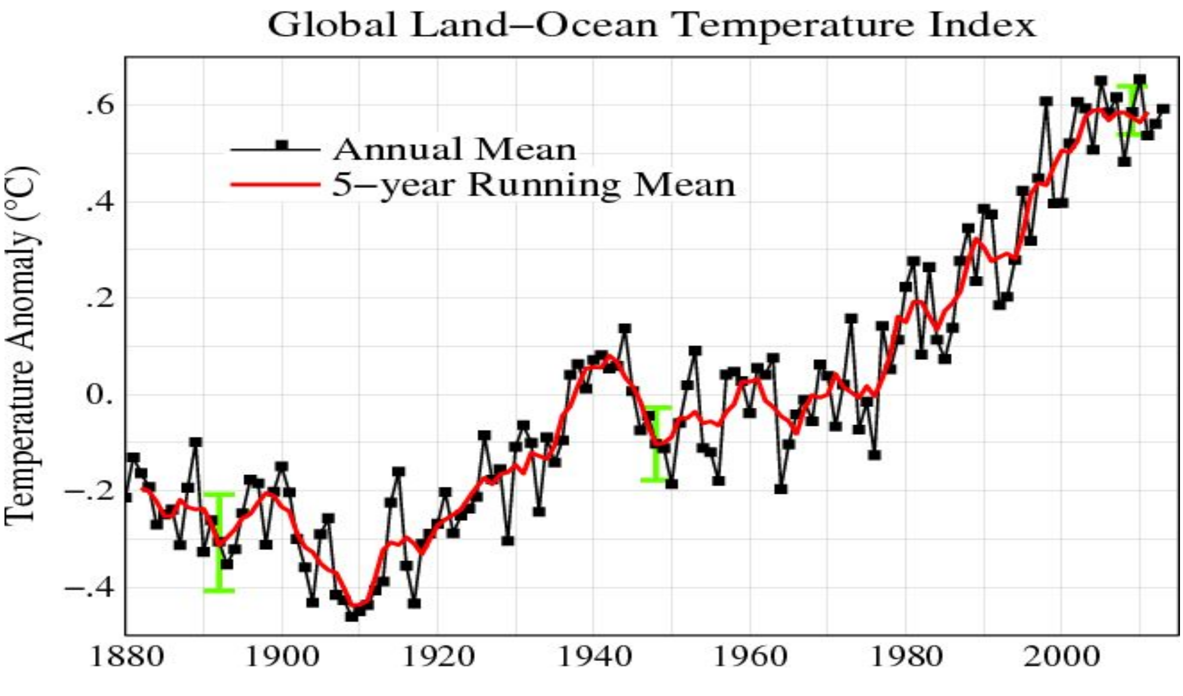
Appendix_1-2:recovering the Past Temperature Records(1860~2010).

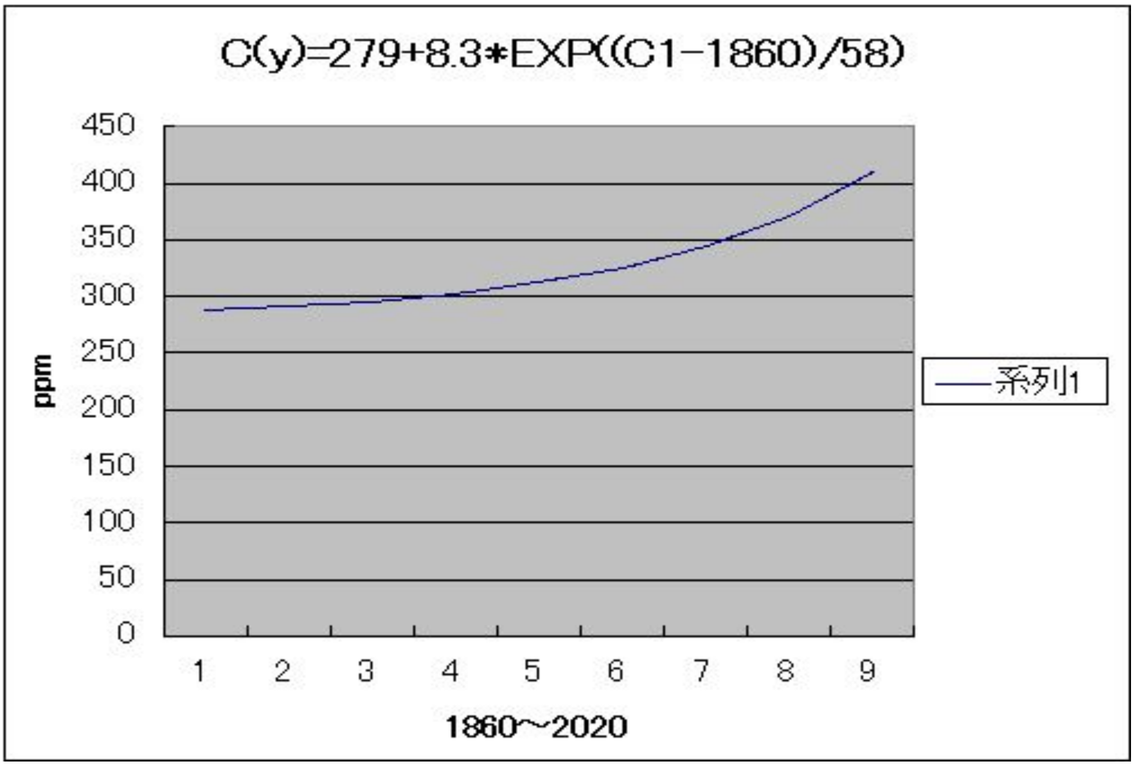
B2=B1+(12.953/64)*((B1/287.15)^4)*LN((283+3.63*EXP(A1/45))/280)-(0.612/64)*5.67*10^-8*(B1^4-287.15^4)..........sample coding for the calculation.

B1=287.15K,...........A1=1,2,3,4,.......,150.

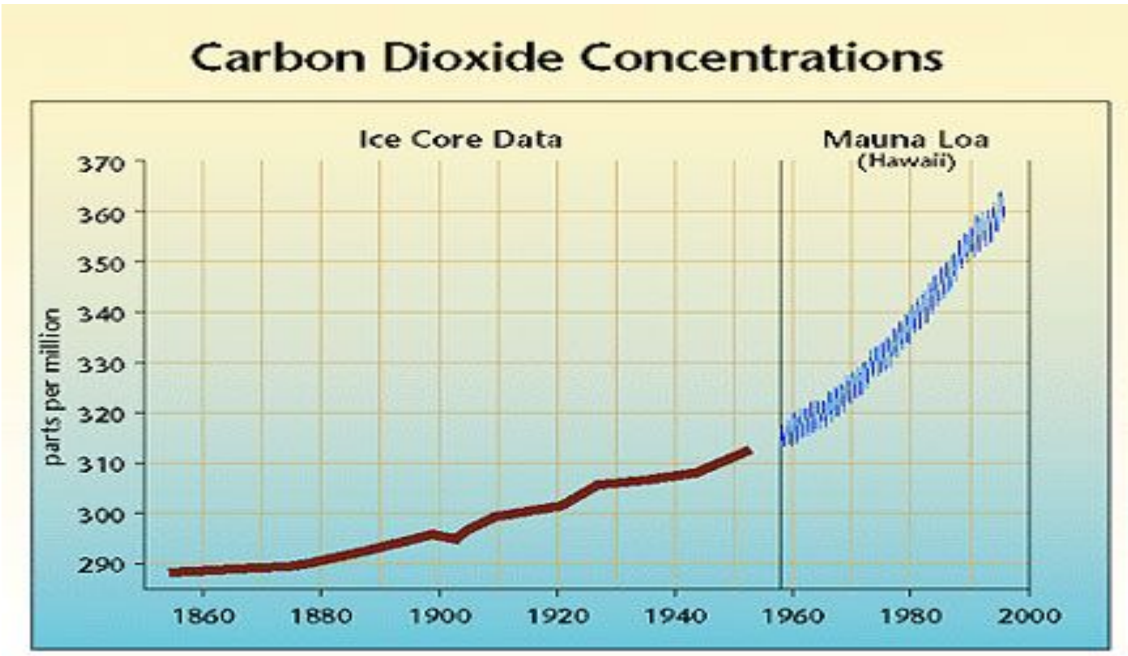


http://data.giss.nasa.gov/gistemp/graphs_v3/





https://www.esr.org/outreach/climate_change/mans_impact/man1.html



Discussion:

Our method of very primitive and simple,but exact **accounting principle** could be verified to be almost reliable.The temperature rise of 0.85℃ in 1850～2010 is almost reconstructed in above model.Consequently global temperature could be described by **zero dimensional model** with **principal ruling of carbon concentration change** so long as nothing fatal massive **methane emission**...

＊**A possible defect of zero dimensional model** may be **earth heat capacity,**which is represented by ocean heat capacity by depth about 700m. This should be a **seasonal parameter(heat pushing in summer and pulling in winter)**,while **long years capacity** should be **deeper** due to slow heat invasion toward sea flor by **perpetual tide stirring**. Which should be considered as lowering temperature.Therefore this model tend to derive rather higher temperature trend.

A decisive conclusion is once again,**CO2 is certainly dominant ruler of climate**. Coming wild climate world,**climate stirring**(increasing violent flow in atmosphere and ocean)would act to weaken temperature rise speed by heat dissipation to wide and deep.However **the process itself** is nothing but climate violence.**Climate-Dynamics** itself has been endeavoring to weaken temperature rise speed.

Appendix_１:Carbon concentration data and the quasi function values

A	B	C	D
1860	**288**		287.3
1880	**291**		290.7174959
1900	**295**		295.5421338
1920	**301**		302.3532993
1940	**308**		311.9689385
1960	**315**		325.5437833
1980	**337**		344.7080229
2000	**370**		371.763071
2020	**410**		409.9579402

-CO2 concentration change-

B is data mapped from original

D is quasi value of function

C=279+8.3*EXP(A1/58)

＊A1＝1,2,3,....,150,...,160.

Note the function＝” C” was derived by math experiments by few trials.

Which estimates rather higher concentrations.

Appendix_2:The cause of big fluctuations in climate dynamics.

Even a global climate data in general are very random,but not simple deterministic.

＊For example,recent years averaging of temperature rise is about 0.02±0.1℃/y.

Then ±0.1℃/y is year temporal and random fluctuation which is **not small.**

Thereby, In climate science,about 500% or more error may be told not so wrong ?? .

http://www.universetoday.com/51824/scientist-discusses-latest-report-of-rising-global-temperatures/

Though, it is one of worst cause that people would be confused in **climate evaluation**.

In the other hand,astronomical prediction are very exact which is derived from complete causal classical dynamics.Certainly microscopic quantum phenomena is told random due to essential property of quantum particle's probabilitical dynamics.Why such **big system** could be so random ??. Then one of certain conclusion is **years interval averaging** Is effective to eliminate noisy information.**Therefore ,look not by local,but by global !!!.**

⑴**Random Dissipative Process in Climate Environments.**

To tell fact,**fluid dynamics** is not complete causalitical,but **rather random** due to **frictional term**,which could be proved to **generate heat** by friction force. It's **entropy increasing process** with information loss due to **massive randomization process**.

You could see those in smoking,where at first,smoke trajectory are very clear,while those are gradually to be invisible ,and at the final stage is complete vanishing due to massive stirring of air gas.Each smoke particles are widely diffused as time goes on.

http://www.777true.net/Information-Loss-Process-in-NS-Equation＝Cause-of-The-Chaos.pdf

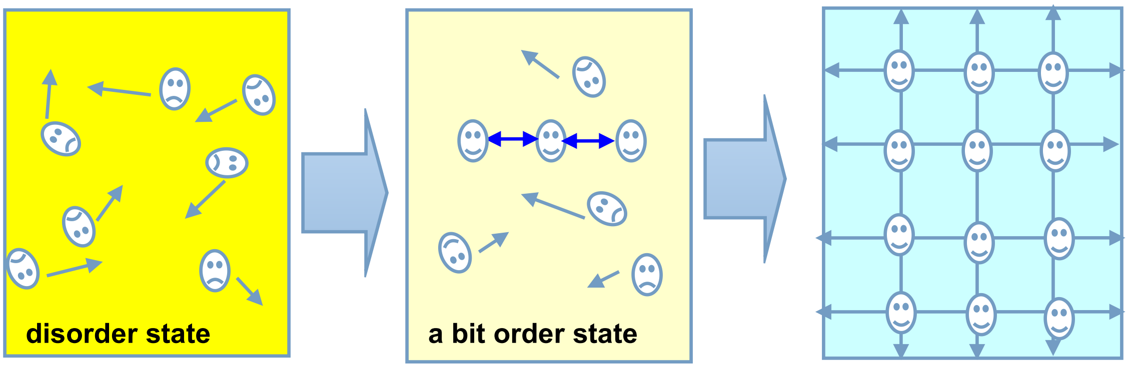
⑵**From Disorder to Order(Phase Transition in cloud forming ,rain and snow fall).**

Massive condensation phenomena in phase transition generated from randomness.

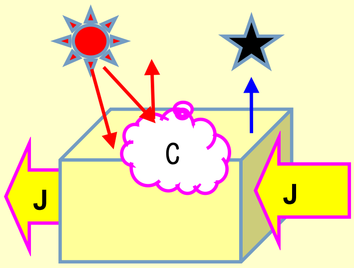
Usually atmosphere contains massive **humidity** which could form **cloud,rain,**and **snow.**

Those are **phase transition** of water by temperature and pressure change and with catalyzer **aerosols**(small contaminated particles such as carbon dust,pm25,..).

Then a ruling factor is **humidity density** for condensations in temperature and pressure environment ,where two or more water molecular is to be combined toward **clusters.**
It is forming an **order** from **disorder** in random flows.The result is macroscopically visible to cause **macroscopic weather change.** This is called also ***"percolation"*** dynamics in mathematics and physics.



⑶**Causes of Randomness in local Climate Dynamics.**
Local temperature may be determined by **heat budget＝incoming heat－outgoing one.**

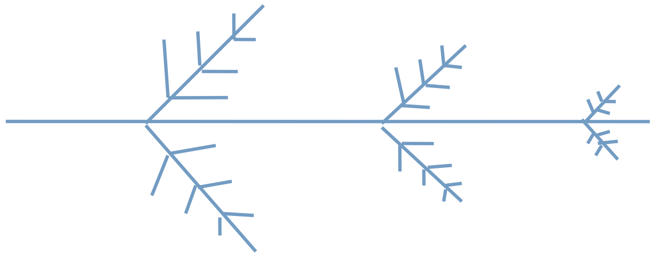


$C(dT/dt) = -\mathrm{div}((CT.\mathbf{V}) + I_0(1-a(t)) - @(t)\sigma T^4.$
$Q \equiv CT \equiv$ heat capacity × temperature at local spot.
$\mathbf{J} \equiv CT.\mathbf{V} \equiv$ heat flow density by air flow **V.**
$-\mathrm{div}((CT.\mathbf{V}) \equiv$ (incoming heat－outgoing one) by air flow **V.**
$I_0(1-a(t)) \equiv$ insolation input ruled by albedo＝a(t)),which is determined by **clouds**.
$@(t)\sigma T^4 \equiv$ cooling radiation output.　@(t) may be not extremely changed in a year.

Note pink zone factors{air flows＝**J**,clouds＝C}are **random factors**,which is to cause randomness in local climate variables.For example,a(t) may be extremely varied from 0(sky) to about0.7(full cloudy) by seasonal..Heat and cold wave flow of **J** causes extreme temperature.

In the other hand,randomness in global climate variables could not be explained directly from this **local property**. Because additive random variable is to tend to decrease its randomness(**statistical averaging effect** to reduce **fluctuational noise**).
＊In generally ,randomness is considered **random noise** which has **higher frequency** component(rapid change in time).This is against with **large scale system** in space and time ,which is ,in general,hard to have higher frequency components.

⑷**Causes of Macro-Randomness in global Climate Dynamics due to "*fractals*"?!.**
This is authors ad-lib **hypothesis** due to difficulty to find another comprehensible cause,but not strictly proved one.Fractals is a **mathematical concept** introduced by mathematician B.B.Mandelbrot. ***Some figure repeat "self similarity" both in local and global***. Typical example are told **tree** and **curve-line of sea coast line**.



Those seems always connected with some randomness(chaos,percolation). Therefore randomness in local weather variables in the graph is to repeat in global climate variables.
＊That ***self similarity Fractals is due to Chaos*** is told in general.
＊Note **fluid dynamics** has **Reynolds similarity low** in scale transformation.
Therefore,it might be possible to reveal similarity between local and global.
$DV/Dt=(1/Re)\nabla^2 V - \mathrm{grad}\,P$. 〈Dimensionless equation with Reynolds number=Re〉
☞:Could you simply explain the cause of **fractals** and chaos ?.A chaos is something **indeterministic**,so is it really possible to exactly explain from **something uncertain** ??!! However a self similarity both in local and global could be told true in experiences !!!.

Summary of Appendix_2.
Due to K.Goedel's **completeness theorem**(A true is provable to be unique) and **incompleteness one**(There is indeterministic phenomena*) **,**in this world,so there is nothing,but **causality**(former) and **probability phenomena**(latter).
http://www.777true.net/Goedel-Chaos.pdf

Ⅰ:A local trend almost always **with same bias** may be **deterministic**.
Ⅱ:A local trend almost always **with alternative bias** may be **indeterministic**.
This is called **random(information loss)**,or chaos with **fractals** ?!
Ⅲ: Actual process are mixed one of Ⅰ and Ⅱ.

*)A decisive example phenomenon is **infinity**.you never can tell largest number in natural number set.Or you can tell **both** (1/largest natural number)＝0,and not zero !!!.

Postscript:

☞: Author is not a professional expert in **climate science**,however he is obliged to pursue the facts.Thereby,he could not help to make rather obscure **junk models** by collecting free materials(data,etc) from websites,**some of which**(..ln(c(t)/C_0) **are not known well for him**. Thereby also reader should try to confirm those realities.The realty of @(t) due to **many GHGs** with proper chemical spectroscopy features is not so simple,but may be very complicated one.The analysis work could not be accomplished without computing devices with appropriate data by manpower in sufficient working times.

Then author has been wishing on disclosing **the comprehensible fundamental algorithm** to calculate **Global Circulation Models** employed in IPCC scientists,which never be disclosed ? to us non professionals.**Because all is determine by setting initial and fundamental postulates in any calculations.** A correct calculation is entirely same by anyone's doing.**That is,what IPCC scientists has been doing should be full disclosed to the general for enabling to be verified also by non-IPPCC experts(mathematician, physician and engineers on mathematical technologies).**