Unless Drastic Counter Measure,Arctic Ice Lid Vanish would Become Catastrophic.

Unless drastic and emergent global counter measure,it is certain we would be extincted in few decades !!!. 2011/11/27,12/4,7

NOTIFICATION:

Following are correction on Arctic Ocean Heat Capacity in following site.
Author made terrible mistaking **1/10 smaller Heat Capacity of Arctic Ocean**,
however now, which became no substantial trouble in the scientifical essense,
however it could become **supreme trouble** for mankind and other spieces.
Author entirely wish global wisdoms of you all !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
http://www.777true.net/GLOBAL-DECLARATION-WAR-on-CARBON-with-Geo_Engineering_Part_C.ppt
*incomplete photos p12,15,16 are supplemented in this last pages.

(1)Arctic ocean area(above latitude 70°).
＊area=1.409x10^13m^2 (author's error is 1.409x10^12m^2 !!!) .
http://www.oceansatlas.com/unatlas/about/physicalandchemicalproperties/background/seemore1.html

＊area=9.5x10^12m^2(right)。Area above 70 latitude must be substractrd by area of Greenland and other ilands.
http://ja.wikipedia.org/wiki/%E6%B5%B7

(2)water specific heat＝4.178KJ/Kg.K is not right ,salty degree is 10 times larger in Arctic, then we could derive salty sea water 2.85KJ/Kg。
http://detail.chiebukuro.yahoo.co.jp/qa/question_detail/q1265159167

(3)Arctic ocean depth and methane clathrate reservoir distribution(200～1200m)。
http://www.marinebio.net/marinescience/04benthon/arcocean.htm
You could see that almost half of Arctic ocean flor is shallow as 300～600m depth, in which almost MC reservoir seems to lie. Then depth 1255m is too deep.

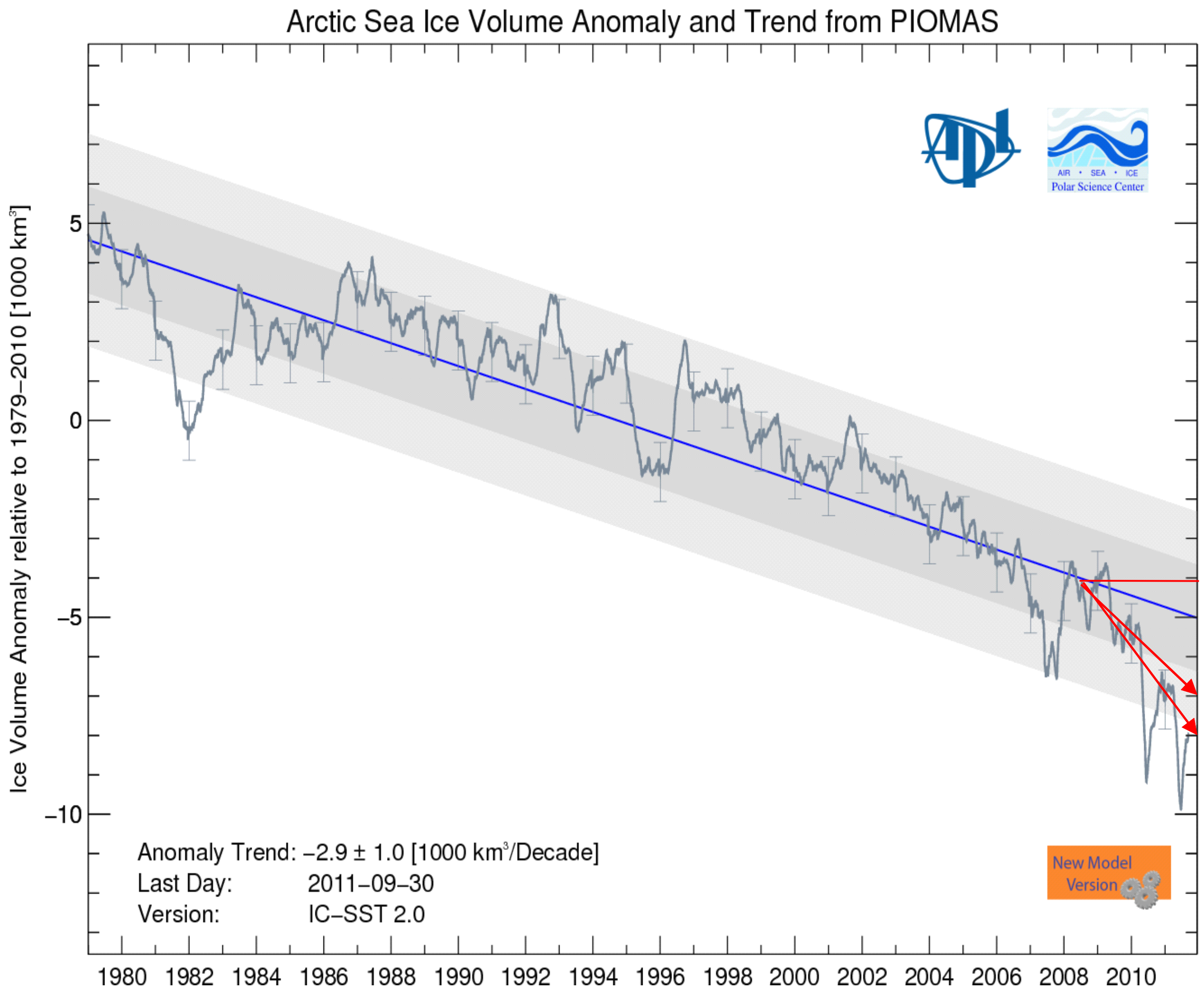
(4)**Arctic Ocean Heat Capacity C_A**＝$3.3X10^{22}$J/K(depth 1200m).

$$C_A = 9.5x10^{12}m^2 x1200m x1020kg/m^3 x2.85KJ/Kg = \mathbf{3.3X10^{22}J/K.}$$

Part Ⅰ:The fate of Arctic Ice lid.

［1］: How much heat input for melting ice lid.

[1]:Data Reveals Ice Albedo Feedback Causing Abrupt Heat Input Rise in Arctic.



Ice decreasing amount/year is equivalent to melting heat input＝Pm in to the ice.

(1)ice melting heat＝334.7kJ/kg

(2)ice density＝0.917g/cm^3＝0.917kg/m^3

(3)ice decrease/y＝2.9x100km^3/y＝2.9x100x$1000^3$$m^3$/y＝2.9x$10^{11}$$m^3$/y＝2.66x$10^{11}$kg/y.

(4)melt heat/y(1978～2006)≒＝2.66x10^{11}kg/y×334.7kJ/kg＝8.9x10^{19}J/y≡Po.

This may be mainly due to Pacifc and Atlantic ocean heat input.

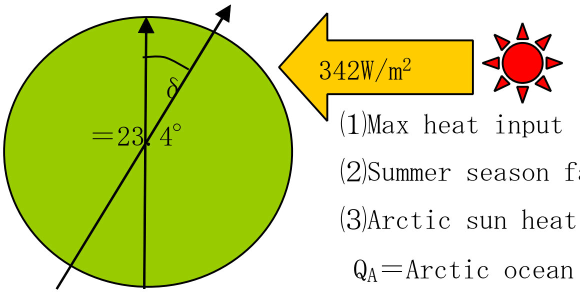
(5)melt heat/y(2006～2011)≒4.5×8.9x10^{19}J/y＝4x10^{20}J/y≡Pm.

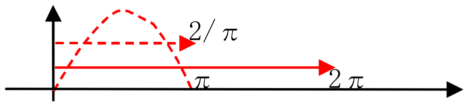
Note ice temperature rise heat is no concerned.So the actual heat input is larger than Pm.

(6)Sudden decline at 2006～2008 may be beggining of **ice albedo feedback**.
Summer **opened black sea mouth** absorb more sun heat, which is to accelate more ice vanishing. This become omnious positive feedback. See P4 in the below.

[2]:How much Heat Input Rise ? at Albedo Feedback. Saturation of Ice Lid Vanishing Time.

Following are rather wild estimation, so you should read carefully.





(1)Max heat input into Arctic≒342W/m^2×sinδ=136W/m^2.

(2)Summer season factor U=1/π.

(3)Arctic sun heat input/y of albedo(=m) function=

Q_A=Arctic ocean area×(years second×U)×136W/m^2×(1-m)

=9.5x$10^{12}$$m^2$x(3600x24x365)U×136W/$m^2$(1-m)=**(1-m)**1.3x$10^{22}$J/y.

(4)ΔQ_A=1.3x10^{22}J/y(-Δm)=heat input rise by albedo down=Δm.

(5)Estimation on albedo down=Δm at current(2011)trend of Pm.

ΔQ_A=1.3x10^{22}J/y(-Δm)= Pm−Po(ocean heat input)≒4x10^{20}J/y−1x10^{20}J/y.

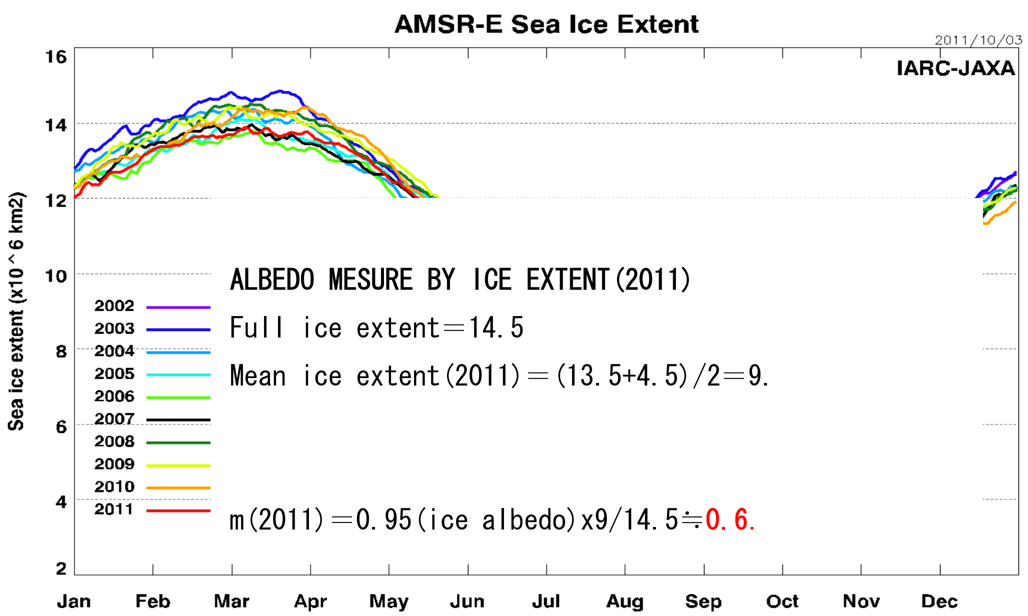
→ Δm≒0.023.

(6)**albedo change with the input- heat- rise.** **saturation point**

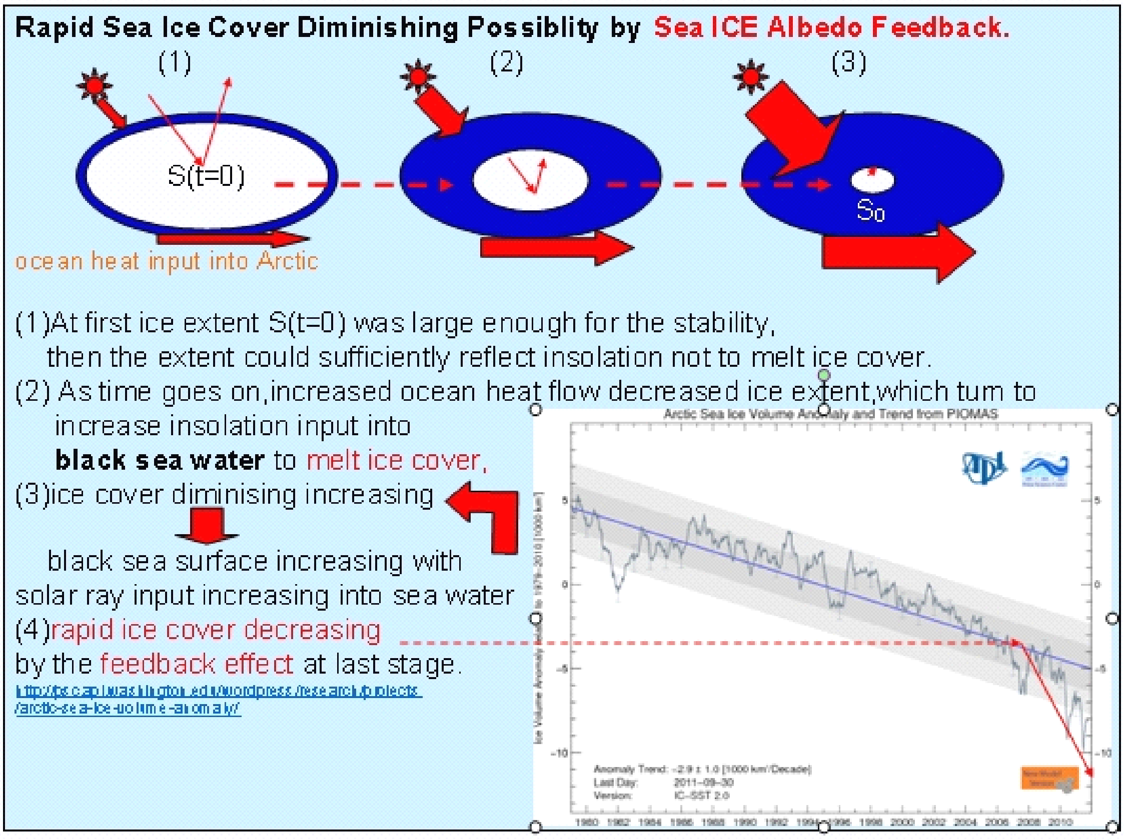
Δm≒-0.023		Δm≒-0.23		Δm≒-0.6
ΔQ_A=3x10^{20}J/y	→	~~3x10^{21}J/y~~	→	7.8x10^{21}/y ?!

(7)Ice Extent Data:Max=1.4x10^{13}m2. Min=0.5x10^{13}m2≒30% at 2011.

http://www.ijis.iarc.uaf.edu/en/home/seaice_extent.htm



[3]:Arctic Ice albedo feedback causing rapid ice vanishing and heat input rise.



(1)**:The Cause of Rapid Melt by Albedo Feedback.**

Ice lid melt amount(area)/year(dS(t)/dt) is proportional to heat input into ice/year, which is also proportional to solar input to opened mouse sea area $=(S(t)-S_0)$. Hence we derive,

$*(dS(t)/dt)=k(S(t)-S_0)\equiv(S(t)-S_0)/\tau$.

$\rightarrow dS/dt-kS=-kS_0. \rightarrow d(S\exp(-kt)]/dt=-kS_0\exp(-kt)$.

$S(t)=-S_0\exp(kt)k\int_0^t du<d\exp(-ku)/du>+C\exp(kt)$.

$=-S_0\exp(kt)[\exp(-ku)]_0^t+C\exp(kt)=S_0+(C-S_0)\exp(kt)$.

$\rightarrow S(t=0)=S_0+(C-S_0). \rightarrow C\equiv S_0-\delta. \rightarrow$ δ is something small constant.

$*S(t)=S_0-\delta\exp(kt)\equiv S_0-S(tm)\exp(<t-tm>/\tau)$。 $<S(tm)\equiv\delta\exp(ktm)>$

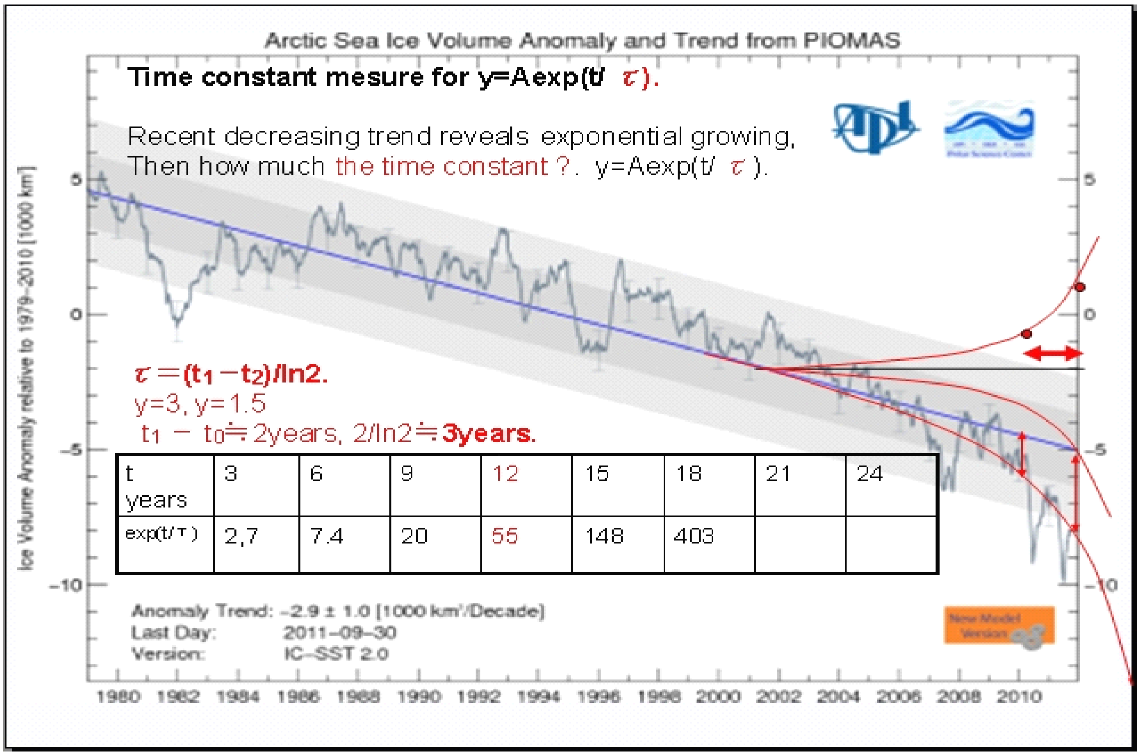
verification: $dS/dt=-\delta'\exp(kt)-k\delta\exp(kt)=-k\delta\exp(kt)=k(S(t)-S_0)$.

(2): $\{S(tm),\tau\}$ are observable value by recent data.

$y=A\exp(t/\tau). \rightarrow \{y_1=A\exp(t_1/\tau), y_2=A\exp(t_2/\tau)\equiv 2y_1\}$

$\tau=(t(y_2)-t(y_1))/\ln 2.$

(3)**Time constant τ mesure and the ice lid fate with exponential growing heat.**



(4)**time for ice lid zero≡t_z with the max albedo radiative forcing in Arctic.**

The ice melt amount years function Y(t) may be Y(t)=Aexp(t/τ)+Bt+C. Then dY(t)/dt=ice volume decrease/year=melting heat input/y(albedo feed back).

*P(t)=(A/τ)exp(t/τ)+B≒(A/τ)exp(t/τ). <B(ocean heat) is smaller>>

That is, heat input is also exponential growing with the same time constant=τ.

Pm(2007～2011)≒$3\mathrm{x}10^{20}$J/y. (minus ocean heat=$1\mathrm{x}10^{20}$J/y)

Pm(Δm≒-0.6)≒$7.8\mathrm{x}10^{21}$/y≡Pz . (max albedo radiative forcing at m=0:zero ice lid)

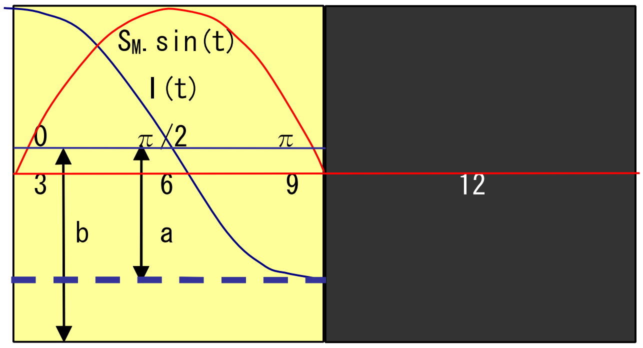
Time for ($7.8\mathrm{x}10^{21}$/y/$3\mathrm{x}10^{20}$J/y)≒26 times(time for ice lid zero≡t_z) is about t_z=**10 years** ± "**climate fluctuation width**" ? **in exponential growth.**

(5)**Time for whole Arctic ocean 1℃ up**=C_A/**Pm.**<C_A=$3.3\mathrm{X}10^{22}$J/K. see p1>

Pm(Δm≒-.023)2011	**Pm**(Δm≒-0.23)2018	**Pm**(Δm≒-0.40)2019	**Pm**(Δm≒-0.6)2021
radiative forcing			26W/m².
$3\mathrm{x}10^{20}$J/y.	$3\mathrm{x}10^{21}$J/y	$5.2\mathrm{x}10^{21}$J/y	$7.8\mathrm{x}10^{21}$/J/y
110y	11y	6.3y	4.2y

This is valid only when exponential growth of constant τ is right.

Appendix1:Arctic annual heat input＝Q_A by sea ice albedo＝m.



＊S_M. sin(t)≡seasonal solar heat.
＊ I (t)≡acos(t)＋b.
≡ice extent。A_0≡ocean area.
＊S_M≡max solar input into Arctic
＝342W/m^2. sin(23.4℃)＝136W/m^2.
＊b≡center value of ice
extent/max, λ≡ice albedo～0.95.

(a)Q_A≡year averaged heat input in Arctic＝mean solar heat(1-albedo)＝(S_M/π)(1—m)
＝(1/2π) $\int_0^{\pi}$dtS_M. sin(t)[A_0-λ<acos(t)＋b>]/A_0.
＝(S_M(1-b')/2π) $\int_0^{\pi}$dt. sin(t)＝S_M(1-b')/π≡(S_M/π)(1—m).
1—m=1-b'.→ m=0.95(ice surface albedo＝λ)b.

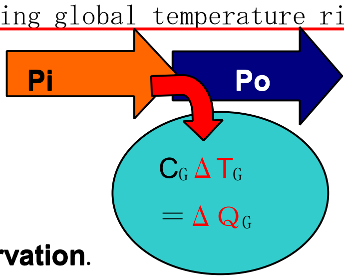
(b)remain albedo(2011)≒0.95x(13.5＋4.5)/2x13.5＝60%.

PartⅡ: A coarse estimation on the Arctic Methane Catastrophe.

Once ice lid had vanished, and sea water temperature would rise, irreversible and catastrophic methane catastrophe would begin in decades year range.
Foillowing are a simple model analysis, but it may grasp the perspective mechanism. You should carefully examine **the causality chain**. 2011/11/30,12/5

[0]: Physical Basis with the "perspective and averaged" view point.

(1)Radiative Forcing(**DEBT HEAT** in year budget)driving global temperature rise.

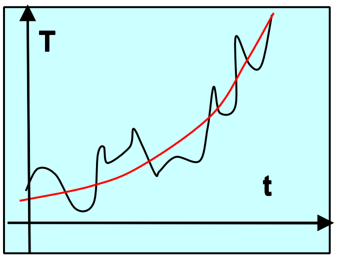


(a)**debt heat(~radiative forcing)/year**
=**incoming heat/y**−**outgoing heat/y**($\Delta Q \equiv dQ/dt$).
(b)**heat capacity(≡C)×temperature rise(**$\Delta T \equiv dT/dt$**)**
=**input heat increase(**ΔQ**)**; $C\Delta T = \Delta Q$.
This is the 1st low of thermodynamics **energy conservation**.

☞: Global ocean's annual dynamic heat capacity(C_G) depth is almost 600m.
$C_G(dT_G/dt) = U\pi R_G^2 F_0(1-m) - U4\pi R_G^2 @\sigma T_G^4 = (U\times 4\pi R_G^2)F$.

Global Debt Heat Rise/y=Insolation input/y−Radiation output/y=Radiative Force.
*@≡Space passing probability of cooling radiation(σT_G^4)due to GHG density.
* $(U\times 4\pi R_G^2)$=3600x24x365sec×global area(m^2).
*$F_0(1-m)$=solar inputx(1−ray reflection rate(albedo)).

(c)global and years averaged view point:
(**ensemble averaging reducing random noise**).
In local view point, there are **random variations** at anywhere anytime, however, global and years perspective view is to reveal simple and accurate causal tendency.



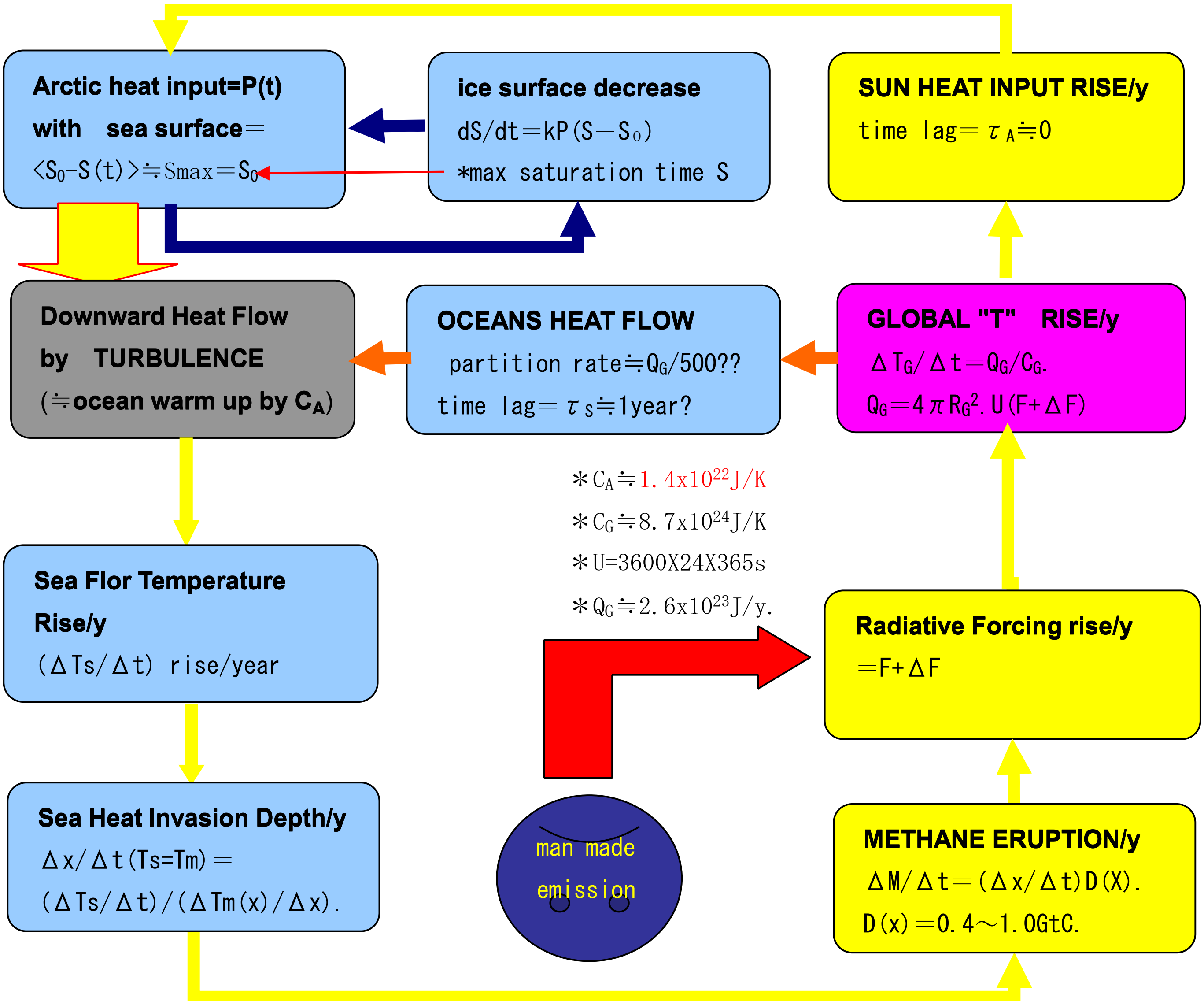
(d)Professional Global Circulation Model has a defect.
Youd could see **smoke flow trajectory** clearly at first, however as time goes on, those would disapeare due to microscopic molecular random collissions(**diffusion**).
$m d\mathbf{V}/dt = \mathbf{f}$. → $\rho(D\mathbf{V}/Dt) = \mathbf{f} = k\nabla^2\mathbf{V} - \text{grad}\,P + \rho\mathbf{g}$.<<Fluid Dynamic Equation≡FDE>>

☞: $k\nabla^2\mathbf{V}$ is **inter- fluid friction force** temr causing trajectory disappearing in long time.

Weather forcasting is accurate in short days, but becomes uncertain as day longer.
This is essentially due to **the nature-itself(chaos)**, but not due to defect of science. A climate dynamics has an uncertainty due to those reason. Therefore, in

possible some cases, we had better to take another method without FDE.

[1] : OCEAN,ICE ALBEDO,METHANE- FEEDBACK PROCESS AROUND ARCTIC.



[２]：Instant Sea Flor Heat Transfer Model in the long time range:

(1)**Melting Heat Invasion Depth**≡x(t)**/year:**

$dx(t)/dt=(dTs(x,t)/dt)/(dTm(x)/dx)$. <<Ts=Tm>>

(2)**Methane Melting Amount/year in the one dimensional distribution**＝D(x)**.**

$dM(t)/dt=D(x)(dTs/dt)/(dTm/dx)$. <<$dM(t)/dt=D(x)\langle dx/dt\rangle$>>

＊D(x)≡Methane Clathrate Distribution Density at depth x＝0.4～1.0GtC/m.

(3)**Sea Temperature Rise/year by Radiative Forcing by Ice Albedo**(m) **and Methane**(@).

$C_A(dTs(t)/dt)=US(F_m(t)+\Theta F_@(t))$.

Note right term is heat input on sea surface at time=t, and left is temperature rise of sea flor to where heat transfer takes finite time delay τ(x,t) in actual, however, we take τ(x,t)≒0 approximation in global scale time constant(10 years).

＊$F_@$≡Radiative Forcing by CH4 and that by CO2. <<This is global>>

As for Arctic, RF local factor$\equiv\Theta=(\langle T_A^4\rangle/\langle T_G^4\rangle)$ must be multiplied.

＊F_m≡Radiative Forcing by Arctic Ice Albedo(≡m) Change$=-F_0\Delta m$. <This is local>

＊S≡Area of Arctic Ocean with Methane Clathrate Reservoir in the sea flor.

＊U≡3600x24x365s＝years time by second.

＊Ts(x,t)≡sea flor temperature of melting point x≒Ts(t).

☞：Actual Ts is depth=x and time=t dependent complicated function with time delay of heat input at sea surface, however, we take **a wild approximation** of depth uniform model without the time delay in long time constant view(10 years).

＊C_A≡Dynamic Heat Capacity of Arctic Ocean with Methane Clathrate Reservoir.

☞：Global ocean's annual dynamic heat capacity(C_G) depth is almost 600m.

$C_G(dT_G/dt)=U\pi R_G^2F_0(1-m)-U4\pi R_G^2@\sigma T_G^4=(U\times4\pi R_G^2)F$.

Global Debt Heat Rise/y＝Insolation input/y－Radiation output/y＝Radiative Force.

＊@≡Space passing probability of cooling radiation(σT_G^4) due to GHG density.

(4)**Methane Radiative Forcing<≡**$F_@(t)$ **>Evolution Equation.<<** $\Gamma(M)\equiv dF_@/dM$**>>**

$dF_@/dt\equiv\Gamma(M)dM/dt=[\Gamma(M)D(x)/(dTm/dx)](dTs/dt)=[\Gamma D/(dTm/dx)]\langle US/Cs\rangle(F_m+\Theta F_@)$

$=[\Gamma D/(dTm/dx)]\langle S/Cs\rangle F_m+[\Gamma D/(dTm/dx)]\langle S/Cs\rangle F_@$.

(5) $dF_@/dt-[\Gamma D(x)/(dTm/dx)]\langle US/Cs\rangle\Theta F_@=[\Gamma D(x)/(dTm/dx)]\langle US/Cs\rangle F_m$.

(6) $dF_@/dt+fF_@=g$.

(7) $F_@(t)=\int_0^t du\,g(u)\exp(-\int_u^t dv\,f(v))+C\exp(-\int_0^t du\,f)$.

(8) $f\equiv[\Gamma D(x)/(dTm/dx)]\langle US/Cs\rangle\equiv\Theta/\tau$.

(9) $g\equiv[\Gamma D(x)/(dTm/dx)]\langle US/Cs\rangle F_m\equiv F_m/\tau$.

[３]：Wild Estimation on the Time Constant of Exponential Growth.

[Γ(M)D(x)/(dTm(x)/dx)]<US/Cs>≡1/τ.

U≡years time by second.	3600x24x365s＝31536000s.
S≡Arctic ocean area for RF input http://ja.wikipedia.org/wiki/%E6%B5%B7	0.95X10^{13}m^{2}. US＝3x10^{20}m^{2}s.★
Cs≡Arctic ocean dynamic heat capacity S=0.95X10^{13}m^{2}. ρp＝density×specific heat＝1020kg/m^{3}×2.85KJ/Kg	Cs(300m)＝0.83x10^{22}J/K Cs(400m)＝1.1x10^{22}J/K Cs(500m)＝1.4x10^{22}J/K Cs(1200m)＝3.3x10^{22}J/K
D(x)≡MC distribution density	0.4～1.0GtC/m(x＝200？～1200m)
1/(dTm/dx)≡melt heat gradient★	≒1600m/70℃(x＝300m)→23 ≒1600m/45℃(x＝400m)→36 ≒1600m/30℃(x＝500m)→53
★dF(M)/dM≒0.39/√M. F＝0.036(√(472M)－√700ppb)－δ. Γ(M)≡dF/dM≡RF gradient by M. 1900ppb(2011)/472＝4GtC(2011) <<1GtC＝472ppb>> dM/dt≒0.02GtC/y(2011).	M＝4 →0.2 →x0.3～0.8→ 6～17y M＝14→0.10→x0.3～0.8→13～33y M＝24→0.08→x0.3～0.8→16～42y M＝34→0.07→x0.3～0.8→18～48y M＝100→0.04→x0.3～0.8 →31～83y M＝200→0.03→x0.45～1.13→30～74y
τ≡Radiative Forcing Rise Time. [Γ(M(t))D(x(t))/(dTm/dx)]<US/Cs>≡1/τ.	**5y＜ τ ＜50y**

★ ≡almost reliable.

*Fm≒26W/m^{2};initial domoinant factor due to max ice albedo radiative forcing[3](5).

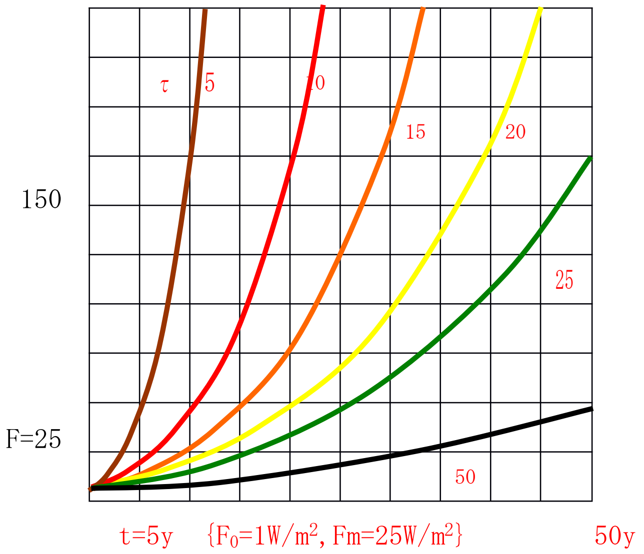
dF$_{@}$/dt＝(Fm＋ΘF$_{@}$)/τ.<this is only valid in Arctic,but not in global>

＊Note radiative forcing **F$_{@}$=1.6W/m^{2}** is equivalent to heat up earth ΔT/Δt≒ **0.03℃/y** and also global ocean temperature rise is the same.

＊time(ice lid vanish)→ ice albedo max radiative forcing Fm(Arctic)＝26W/m^{2}.

dF$_{@}$/dt＝(Fm＋ΘF$_{@}$)/τ≒26W/m^{2}/(5y～50y).

http://www.realclimate.org/



$F_@ = \int_0^t du\, g(u) \exp(-\int_u^t dv\, f(v)) + C \exp(-\int_0^t du\, f)$

$= Fm \cdot \exp(t/\tau)[1-\exp(-t/\tau)] + F_0 \exp(t/\tau)$.

Note that there could be no possibility to eliminate essential dangerous fact even by time and intensity scaling change with multiplying 2, 1/2 or 3, 1/3.

This is the essential danger of exponential growing by positive feedback.

Disucussion:

People must be awaken by this omnious climate fact right now.

The last betting may be geo-engineering with 80% CO2 cutting right now !

Author entirely wish global wisdoms of you all !!!!!!!!!!!!!!!!!!!!!!!!.