

Arctic Ice Vanishing within 15years=toward Methane Catastrophe !!

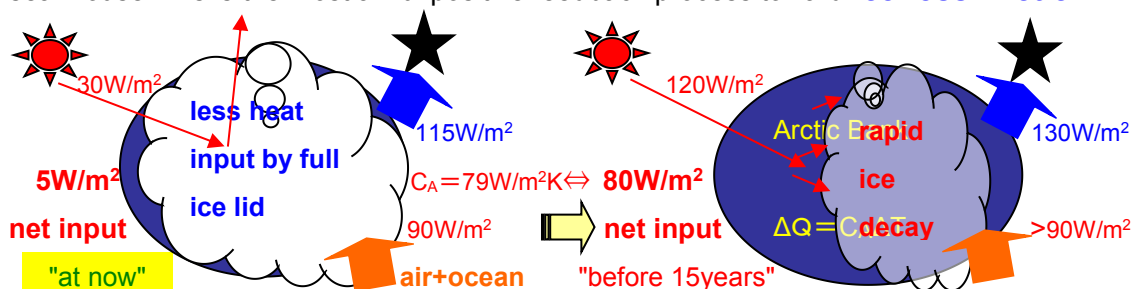
This is **policy decision**,but not physics. The prediction is , unless **emegent implementation of Arctic Cooling Engineering**,we would face hell gateway toward **Arctic Methane Catastrophe within 20±10 years** .If we lost chance of **global unite with a truth at now !!!!!!!**,every things would be hindsights.

<2018/08/09,10>

[O]: This report shows you a varidity of **ice vanishing within 15 years** by heat budget account.

I :Arctic Ocean would be a small pond heating up 10°C/20year by ice full vanishing.

Solar heat is reflected by white ice lid,while absorbed by black sea mouse.The latter is to warm sea water which is to melt more ice lid.Ice area decreasing is to cause more heat input sea mouse.This is the most awful positive feedback process toward **ice-less Arctic**.



"Heat budget in Arctic at now"

http://www.colorado.edu/geography/class_homepages/geog_4271_f12/lectures/notes_2.pdf

Account for annual Heat Budget (in unit area and time)Arctic Ocean with Heat Partition{=ε}			
at now		Ice less time(about 15±5 years later).	
	solar input into Arctic Ocean 30W/m²	solar input into Arctic Ocean 120W/m²	
I	{air+ocean} flow heat input 90W/m²	{air+ocean} flow heat input more than 90W/m²	
K	cooling radiation output into space 115W/m²	cooling radiation output into space 130W/m²	
D	I - K = D debt heat input into the Ocean 5W/m²	I - K = D debt heat input into the Ocean 80W/m² ! ! ! ! ! ! ! ! ! !	
ocean warming heat	Ice vanishing heat	ocean warming heat	Ice vanishing heat
= (1-ε)=4.8W/m²	=ε=0.2W/m²	= (1-ε)=77W/m²	=ε=3.2W/m²
C _A =79W/m²K=Heat Capacity(in 1m²)of Arctic Ocean of 600m depth(thermocline). C _A is heat for 1°Cup for Arctic Ocean of 600m depth(thermocline). Ice less Arctic Ocean's heat input is about 80 W/m², which could heat up the ocean 1°C by a year !!! → Arctic Ocean is a small pond !!!			

II:Arctic Ocean becomes mass destruction thermal bomb by heatup 10°C/20years !!

(a)Methane=CH4 is more **56**(20years→25) times strong as GHG effect than CO2.

http://unfccc.int/ghg_data/items/3825.php

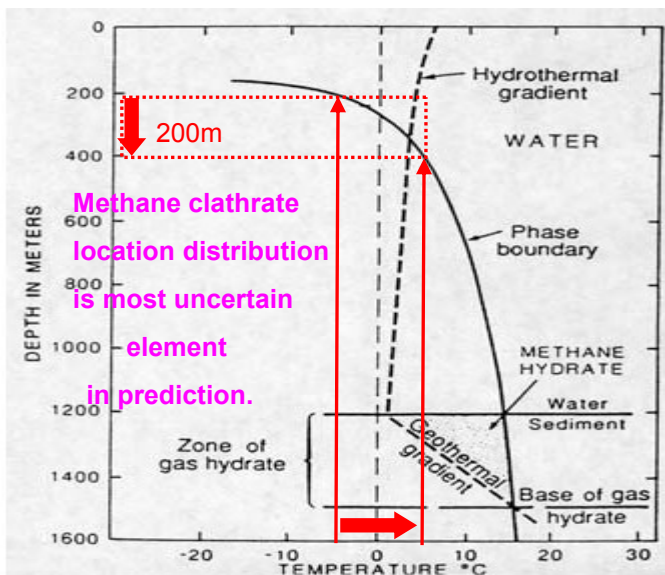
GHG could cause **heat accumulation(radiative forcing=RF)** by suppressing cooling radiation into space.The global **methane clathrate reserver** is told about 10000GtC(about 1000GtC in Arctic).Now global temperature rise by CO2(400ppm)is about **0.03°C/y**.Then **50GtC** melting by ocean warming is to cause global temperature rise **0.06°C/y**. **The total may be 1°C/10years. This is evidently catastrophic !!!**.Earth is full of outrageous Bombs.

(b)**ice CH4 melting mechanism=CH4 phase diagram by temperature &pressure**

(sea depth). <http://www.killerinourmidst.com/methane%20and%20MHs2.html>

☞ **absolute temperature** may be not exact,but note awful **10°C rise effect in a model !!**.

10°C sea water temperature rise can cause methane melting of **200m depth distribution**.



For being solid methane clathrate, temperature is lower and pressure is higher as is drawn in the fig. Upper half of the graph is gas, while lower one is solid.Note methane clathrate 400~1000GtC can be in only depth 200~1200m.

Then **assuming uniform distribution density** is $D=0.4\sim 1.0\text{GtC/m}$.

200m→ 80~200GtC melting !!!

(c)**CH4 Radiative forcing=how high temperature rise by how much methane release.**

melting amount	radiative forcing as surplus heat for heat up earth's 1m ² area/1sec				
50GtC	3.80W/m ²	0.06°C/y	500GtC	13.34W/m ²	0.20°C/y
250GtC	9.02W/m ²	0.14°C/y	1000GtC	19.75W/m ²	0.30°C/y

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

A few as 0.1°C global temperature rise could be dangerous !!!,

<http://www.777true.net/0.1C-Temperature-Rise-could-cause-Climate-Wild.pdf>

(d)**Massive methane release is “catastrophic” by becoming big fireball !!!**

It is told most of spieces would die by **oxygen deficit** due to massive CH4 burning.

[2]:the predicting solution graphs of temperature with ice area.

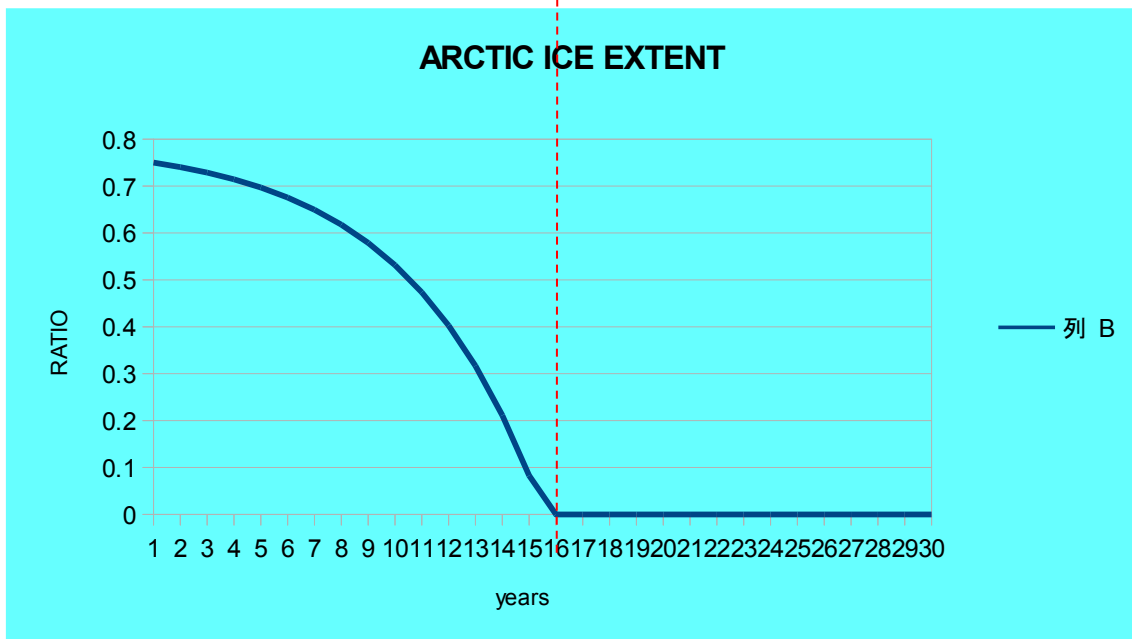
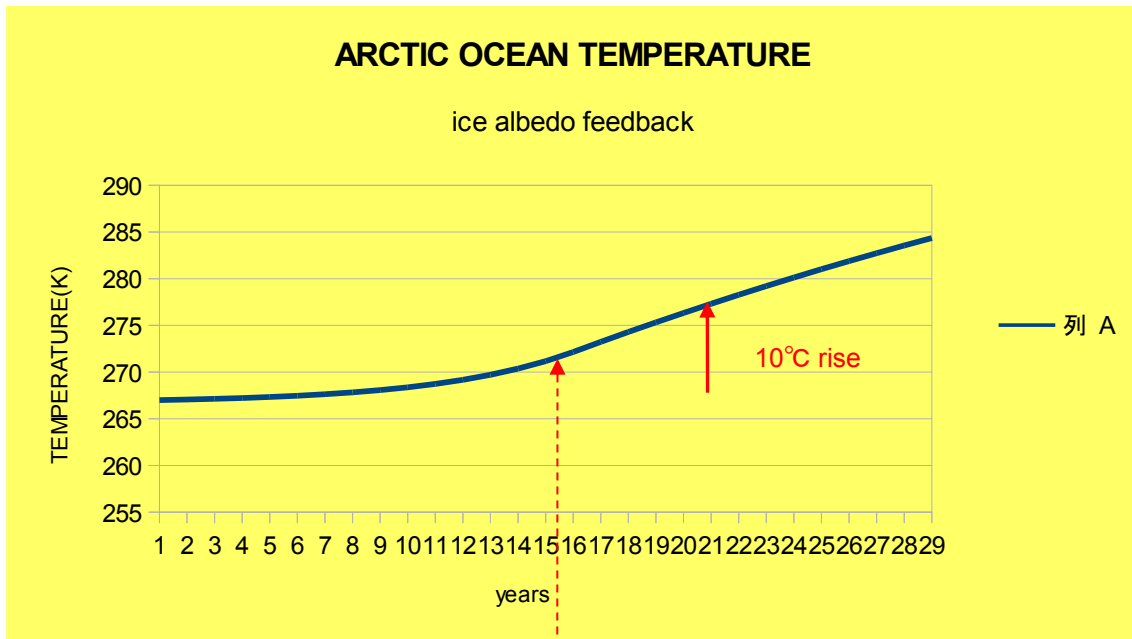
I :Arctic Ocean would be a small pond heating up 10°C/20year by ice full vanishing.

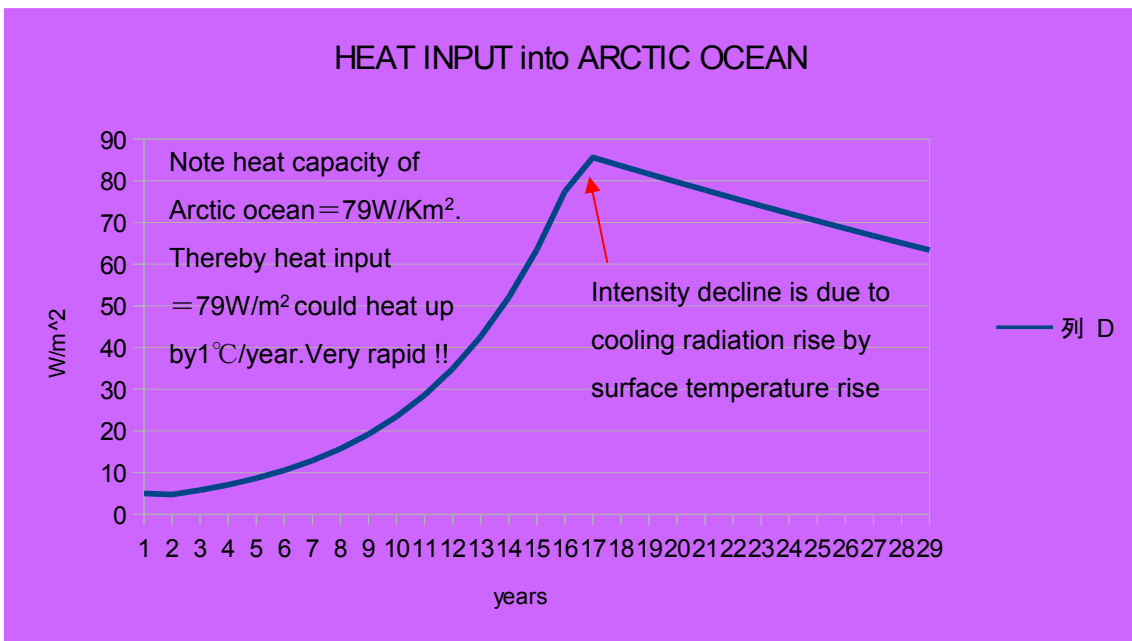
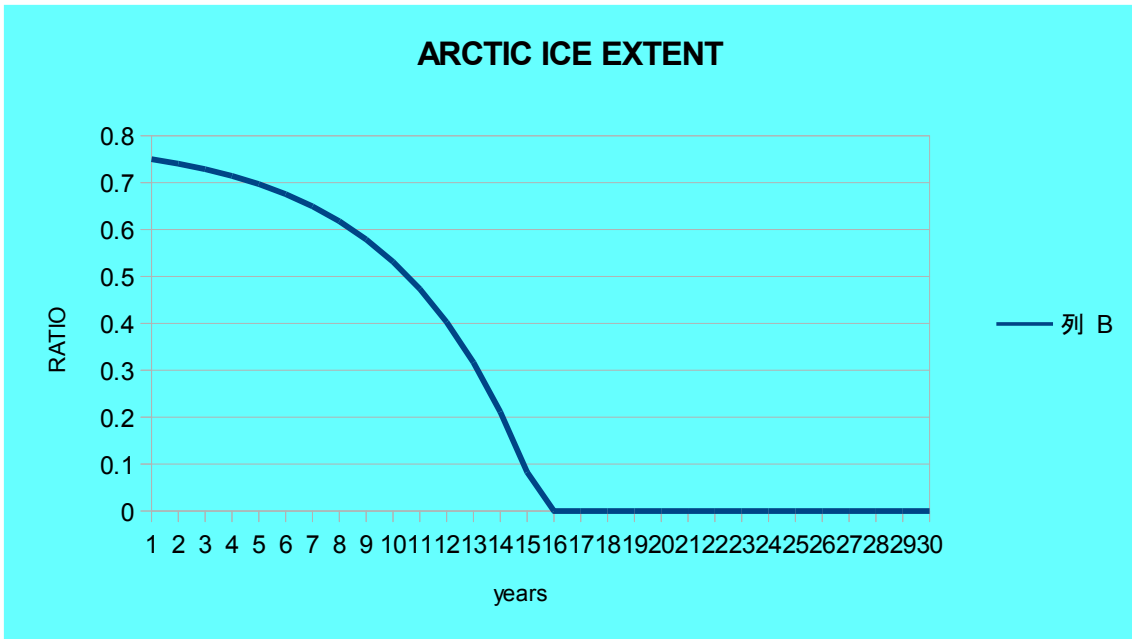
II :Arctic Ocean becomes mass destruction thermal bomb by heatup 10°C/20years !!

☞ : you could veify these solutions by yourselves<see Appendix>.

(a)Arctic Ocean Temperature with Ice Area,and Heat Input.

Note 10°C change by about 20years.then absolute temperature value might not exact.





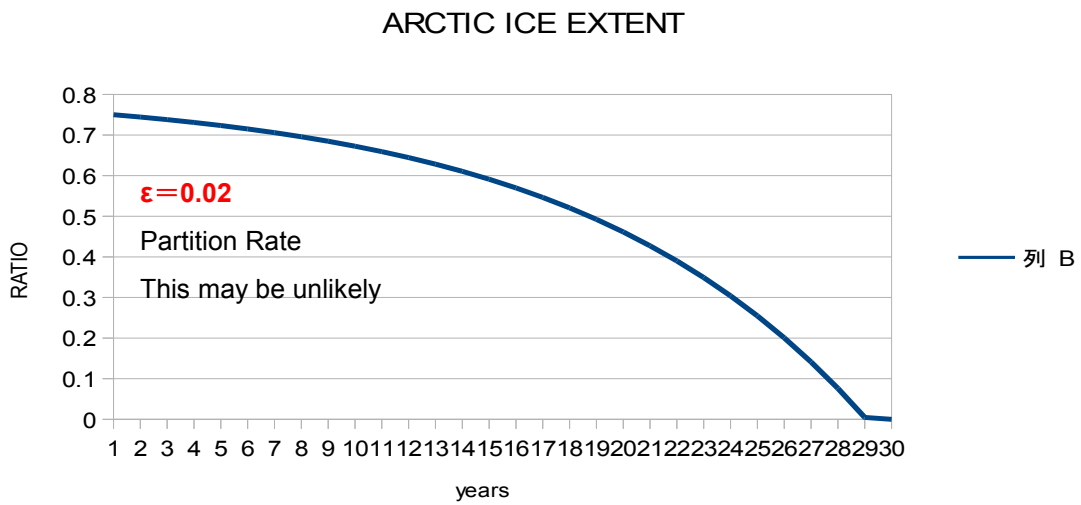
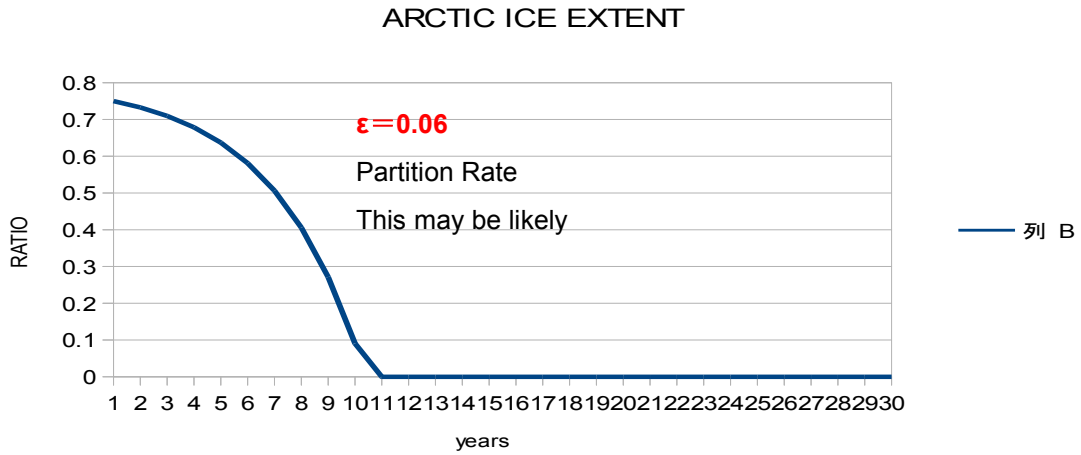
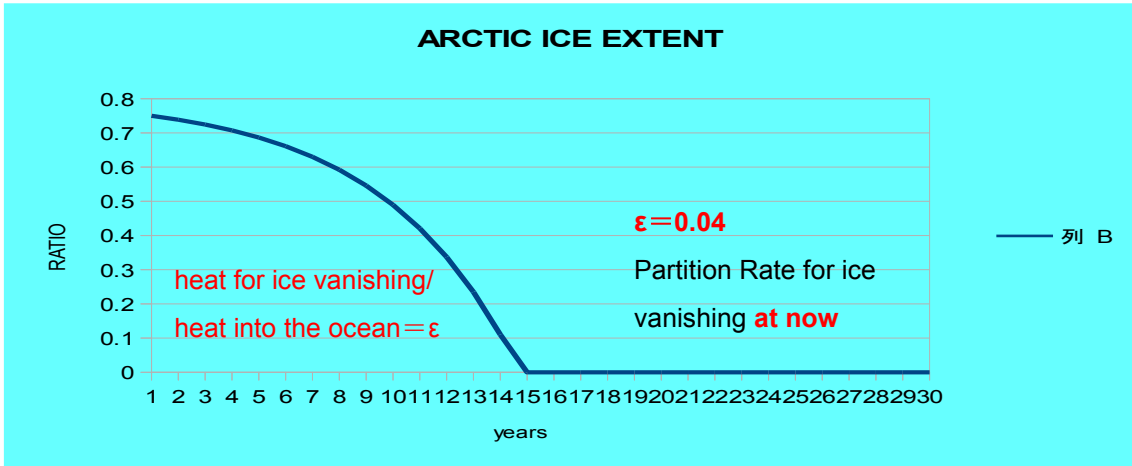
* **Excell Calculating Sheets**: you could see to verify the calculations at here.

http://www.777true.net/ARCTIC-ICE-DEACAY20150807_C.xls

http://www.777true.net/ARCTIC-ICE-DEACAY20150807-E-0.16-0.08_C.xls

http://www.777true.net/ARCTIC-ICE-DEACAY20150807-E-0.16-0.24_C.xls

(b) **Ice full vanishing time** by heat partition rate for ice vanishing (error range estimation).



(c) **Arctic Ocean Temperatures Keep Rising**<by AMEG>

<http://arctic-news.blogspot.jp/2015/07/arctic-ocean-temperatures-keep-rising.html>

NASA GHCN-v3 1880-02/2015+SST:1880-02/2015 ERSST.base period 1951-1980

The image below(3 kind of warming)shows a non-linear trend that is contained in the temperature data that NASA has gathered over the years, as described in an earlier post. A **polynomial trendline** points at global temperature anomalies of over 4 ° C by 2060. Even worse, a polynomial trend for the Arctic shows temperature anomalies of over **4 ° C by 2020**, 6 ° C by 2030 and **15 ° C by 2050**, threatening to cause major feedbacks to kick in, including albedo changes and methane releases that will trigger runaway global warming that looks set to eventually catch up with accelerated warming in the Arctic and result in global temperature anomalies of 16 ° C by 2052.

* * **As for “prediction by polynomial trendline”:**

<https://support.office.com/en-gb/article/Choosing-the-best-trendline-for-your-data-1bb3c9e7-0280-45b5-9ab0-d0c93161daa8>

A past data has caught something mechanism that could predict future trend !!

This is very simple method **without concern on explicit physical mechanism**,but reliable by certain degree. “**prediction by polynomial trendline** may be smoothing,but not amplify radical. Therefore coming reality might reveal more radical of such discontinuous transition.

(d)**Rapid Temperature Rise in Arctic_a simple verification**(author2014/4/15,2015/7/26).

<http://www.777true.net/Rapid-Temperature-Rise-in-Arctic-a-simple-verification.pdf>

Also this report by author predict about **15 years for ice full vanishing** in another math calculation method.

[3]:About on the solution of temperature with ice area<also see APPENDIX_1>:

Aim of this report is **enhancing rapid policy decision**,but not science advancing. Thereby author employed popular economy concept(budget account and partition rate},but not details of physics of ice melting.The merit is easy,but enough reliable,but large uncertainty.Note ice vanishing time 15years±1 years or 15years±10 years could not be so much cared in policy decision<*The Rio Declaration: Principle 15 - the Precautionary Approach*>.

(a)**The Overview:Arctic had been coldest,but would be hottest in near future.**

I :Arctic Ocean would be a small pond heating up 10°C/20year by ice full vanishing.

II :Arctic Ocean becomes mass destruction thermal bomb by heatup 10°C/20years !!



Some scientists had known Arctic Methane Catastrophe.However at that time,they might have no idea of Arctic Cooling. The left fig is the dire prediction.Work of the risk report is originally not that of author.

<http://www.realclimate.org/>

(b)**An exponential rise by positive feedback** is terrible rapid enough,because the 1st ten yeas temperature rise is about 1.5°C,whle 2nd rise is alomst 10°C。 It's certainly catastrophic. 30 years could rise about 20°C ocean warming. **10°C sea water rise** could be catastrophic to melt methan clathrate in sea floor by heat invasion depth = **200m** → **80~200GtC melting !!! in assumption of uniform distribution 400~1000GtC from 200m depth to 1200m.**

(c)**How much and where methane clathrate are reserved ??**

Non could tell exact the distribution,but coarse value are estimated.Even by such data, we could make policy decision.Methane are too enough to cause our extinction.

D=Methane density per unit length = {**400~1000GtC**}/{1200 - 200m} = 0.4~1GtC/m.

<http://arctic-news.blogspot.jp/2014/08/horrific-methane-eruptions-in-east-siberian-sea.html>

Then the radiative forcing by methane eruption is about

(d)**CH4 Radiative forcing=how high temperature rise by how much methane release.**

melting amount	radiative forcing as surplus heat for heat up earth's 1m ² area/1sec				
50GtC	3.80W/m ²	0.06°C/y	500GtC	13.34W/m ²	0.20°C/y
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<https://ja.wikipedia.org/wiki/%E6%94%BE%E5%B0%84%E5%BC%B7%E5%88%B6%E5%8A%9B>

A few as 0.1°C global temperature rise could be dangerous !!!,

<http://www.777true.net/0.1C-Temperature-Rise-could-cause-Climate-Wild.pdf>

Thereby, 0.03°C/y + 0.06°C/y by CH₃-50GtC is told catastrophic by experts.

More 1 °C rise agreement COP16 would cause catastrophic ?!!.

<http://www.777true.net/suffer-for-perishing-or-for-surviving.pdf>

(e) **Fireball Earth** = extremely too much of easily flammable CH₄{1MtC ~ 1000GtC}

annual global insolation input = **5.5 × 10²⁴ J/year**

CH₄ of 1000GtC = 1 × 10¹⁸g → P = **6.6 × 10²² J: burned energy output**

CH₄ of 3.2MtC = 3.2 × 10¹²g → P = **2.1 × 10¹⁷ J: burned energy output**

CH₄ of 1MtC = 1 × 10¹⁸g → P = **6.6 × 10¹⁶ J: burned energy output**

Tsar Bomba (1961_USSR) < TNT 50Mt > **explosion energy = P = 2.1 × 10¹⁷ J**

3300 times of little boy of Hiroshima Bomb.

(f) **How Methane Gas Releases Due To Global Warming Could Cause Human**

Extinction Updated on March 24, 2014

<http://rocknj.hubpages.com/hub/How-Methane-Gas-Releases-Due-To-Global-Warming-Could-Cause-Human-Extinction>

methane reacts with dissolved oxygen which can severely limit the amount of oxygen available for sea creatures, such as fish, causing them to die in large quantities. This would cut off a major source of sea-based food that humans rely upon for survival.

.....

lightning from thunderstorms will cause the methane releases to catch fire, causing huge fireballs that will scorch areas of the Earth that are close to the oceans.

.....

average global temperatures rising by **8 degrees Celsius**. This event is known as the Paleocene-Eocene Thermal Maximum (PETM).

[4]: Emergent Arctic Cooling Geo Engineering = Our Final Hope !!!.

I : Possible Countermeasure as Mending Deadly Planet.

(1) emergent 80%CO2 cut = popularizing NEW ENERGY

http://www.777true.net/Part_6_non-carbon-Energy-Engineering.pdf

(2) emergent Arctic Cooling Fixing

<http://www.ameg.me/>

<http://arctic-news.blogspot.jp/p/the-need-for-geo-engineering.html>

<http://www.777true.net/How-to-Make-Clouds-for-Intercept-solar-heat-in-Arctic.pdf>

(3) Global Climate War-Time Regime = How to make our life in Climate War.

<http://www.777true.net/Life-Assurance-by-National-Strategy-in-coming-climate-WAR-TIME.pdf>

II : The oil money should be paid for mending deadly planet.

The military budget should be paid for mending deadly planet.

To tell hiding reality, it is the oil and military industry that are most desperate ones.

<http://www.777true.net/Oil-and-Military-the-Deathperate-Industry-has-been-causing-the-world-desperate.pdf>

(a) Everyone know oil nations are rich enough. However it is oil that has been causing climate crisis toward global extinction. While it is also them who has been hiding the decisive facts. It is so called upside down world, which must be emergently tuned to righteous way. Then it is also they who could devote climate fixing by their rich wealth.

<http://www.mapsofworld.com/world-top-ten/world-top-ten-oil-reserves-countries-map.html>

<http://www.indexmundi.com/energy.aspx>

<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RCLC1&f=D>

World Oil Spending in 2012 $\doteq 80\$/\text{bri} \times 900000 \times 1000\text{bri}/\text{day} \times 365\text{day} = 26\text{trillion}\$!!!$

(b) Also note military industry are enough big business to destruct the world by their products.

It is also those who should be called upside down world. In fact, if the world is peace, their budget are entirely waste, while not in peace, their results are destructing the world.

<http://www.globalissues.org/article/75/world-military-spending#WorldMilitarySpending>

World Military Spending in 2012 = 1.7trillion\$!!!

(c) *Save the Arctic sea ice while we still can!*

2015/03/06

<http://arctic-news.blogspot.jp/2015/03/save-the-arctic-sea-ice-while-we-still-can.html>

Fortunately researchers are increasingly confident that a stratospheric aerosol haze, produced from sulphur dioxide, SO2, could provide significant cooling of the Arctic for modest expenditure of the order of a few billion dollars per year.

This type of cooling could be replaced by cloud brightening using ultra-fine seawater droplets when the technology is ready for large-scale deployment within a year or two.

APPENDIX_0:Why you can't help,but concern for some degree of the details.

The Rio Declaration: Principle 15 - the Precautionary Approach.

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, **lack of full scientific certainty** shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

= Decision Making by 51% approval.

* Climate science is not micro scale, but global scale, even as though, climate science in general can not evade some uncertainty due to macroscopic turbulence in fluid motion as that of atmosphere and ocean dynamics. Certainly this is a weakpoint, however this is the best way as we can.

The most emergent problem of now world is not economy, nor global nuclear war, but **Arctic Methane Catastrophe Possibility due to abrupt ice lid diminishing in recent years**. Climate change debate have become active recently due to increasing evident observing on climate disasters in the world. However degree of global recognition on the Arctic ice risk has been substantially nothing. The problem is rather complicated to understand in general people. Above all, Arctic is very far from our homes..

It is entirely upside down due to **the scientist society=IPCC's fatal sabotage**.

IPCC has been neglecting the most emergent & fatal Arctic methane with **ice decay risk**.

If they had confessed the serious fact, the world now would be **revolutionalized**.

Just do NOT tell them the monster exists:The Arctic Methane Monster

<http://arctic-news.blogspot.jp/2013/10/just-do-not-tell-them-the-monster-exists.html>

As the awful consequence, **any nation leaders** in the world debate ordinal climate change policy, **but never refer to Arctic risk !!!**. CO2 reduction could be accomplished by each nation governments in their each ways, while Arctic Cooling Engineering never be done by non, but by **global emergent cooperation**. Because the scale of engineering is outrageous extent, but the time for implementation is not so much left at now.

The aim of this report is make a shocking in global people toward their awakening.

Author is not the experts, but a physics engineer, so who faced many difficulties to collect reasonable data for Arctic. **Therefore the report could not be told exact in each "data", but even as though, the policy conclusion could be exact.**

That is, left time for implementing Arctic Cooling is not so much, therefore, the nation leaders must take emergent actions. Note such leaders means not only governmental, but also NGO. **Any Climate Orgs never can succeed without recognition on emergent Arctic risk.**

Author himself had actually faced **many and deadly collapse of science societies {elementary particle,,,,,, climate,... who are given NOBEL prize}**, so he never take **authorized position** to order or force people something to follow, but entirely position to **assist** their own voluntary comprehension by their endeavoring. It is nothing, but **truth** derived by massive independent, or cooperative studies that can accomplish emergent global unite with the common truth. Above all, author recommend this work for **global students and engineers** who are rather accustomed with math calculations. ***A correct answer is to be uniquely determined as a truth in science <Goedel's assurance>***

you should learn Arctic climatology ,basic heat physics and convention in heat account .You may consider Arctic is coldest,but **sun heat in summer** is hotter than equator.That is why solar ray reflective ice area in Arctic can be massively melted in half year.

(a) **Insolation Input into Arctic.**

Insolation function in Arctic($\Theta=90$)is calculable in following page:

http://www.777true.net/Insolation_Function.pdf

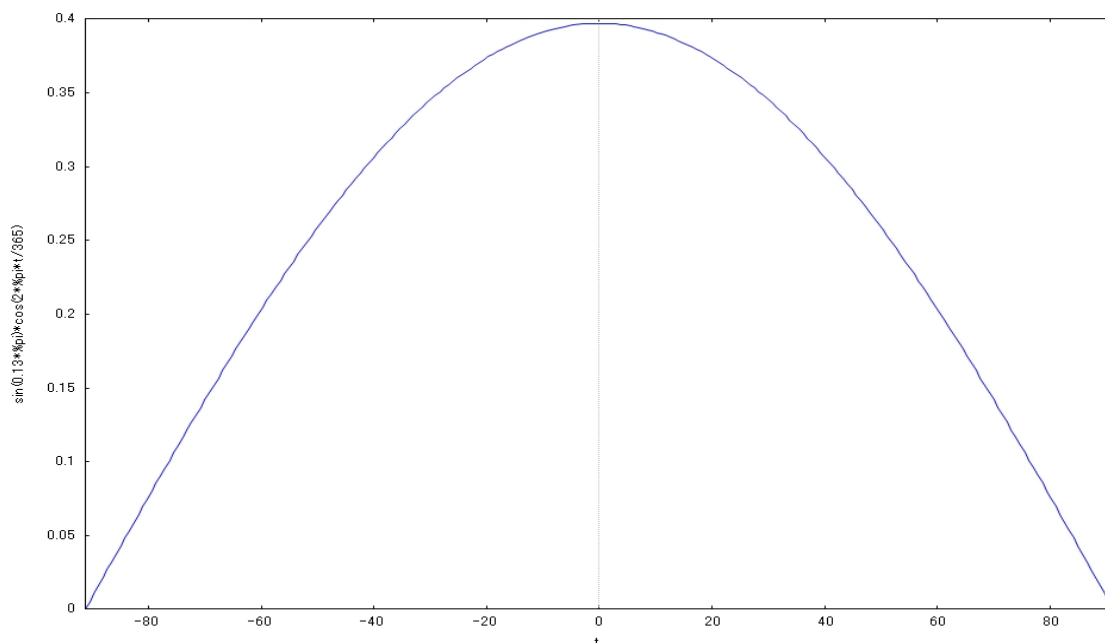
North Pole: $\Theta=90$.

$$R(t) = (\mathbf{r} \cdot \mathbf{s}) = \cos[90 - \chi(t)] \quad ; \quad \chi = -\text{Sin}^{-1}[\sin(23.4) \cos(360t/365)] > 0.$$

$$\text{night sun days}(t=0 \sim 182.5 \text{days}) \rightarrow 0.397_{(\text{max})} \geq R(t) \geq 0.$$

$$R(t) = (\mathbf{r} \cdot \mathbf{s}) = \cos[90 - \text{Sin}^{-1}[\sin(23.4) \cos(360t/365)] - \chi(t)]$$

`plot2d(cos(%pi/2-a sin(sin(2*%pi*23.4/360)*cos(2*%pi*t/365))), [t, -91.25, 91.25]) ;`



$F_0 = 1366 \text{W/m}^2$ solar constant.

$$\langle \text{mean value} \rangle = (2/\pi) \int_0^{\pi/2} \sin(t) dt = (2/\pi)$$

$$0.397 \times (2/\pi) \times 1366 \text{W/m}^2 = 345 \text{W/m}^2 \rightarrow \text{year average} = 345 \text{W/m}^2 / 2 = 172 \text{W/m}^2.$$

$$\text{Global average Desolation} = 1366/4 = 342 \text{W/m}^2.$$

(b) **Annual Heat Budget Account(201X)** :

Heat budget values in this report were cited from this site.

http://www.colorado.edu/geography/class_homepages/geog_4271_f12/lectures/notes_2.pdf

input heat – **output heat** = heat for **warming ocean, decaying ice area /1 year**

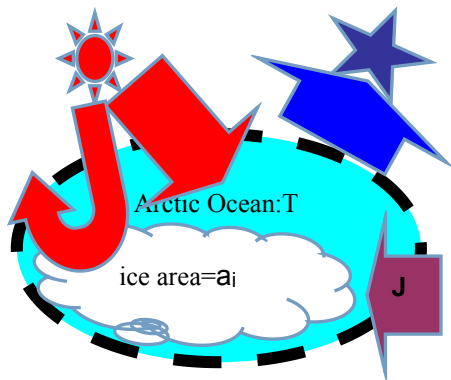
= ocean heat for 1°C rise × <temperature rise/1 year>;

ice melting heat for unit area × <decayed area/1 year>

total input	total output	debt heat : $C(dT/dt); M(da/dt)$
solar = $I_0(1 - a_i)$	Ice reflecting solar	ocean warming = $C_{A\#}(dT/dt) \sim 5W/m^2$,
	cooling radiation	$C_{A\#} = 79W/Km^2, (dT/dt) \sim 0.06^\circ C/y$
air + ocean flow = J		Ice decaying = $D(da/dt) \sim 0.2W/m^2$.
Ice flow out	Ice flow in	$da/dt \sim 0.01, M = 335KJ/Kg \times 917Kg/m^3 \times 2m^3/Y = 20W/m^2$

Ice extent trend date $da/dt \sim 0.01$ is here.

http://www.data.kishou.go.jp/kaiyou/shindan/a_1/series_arctic/series_arctic.html



Read here after (b)

input heat – **output heat** =

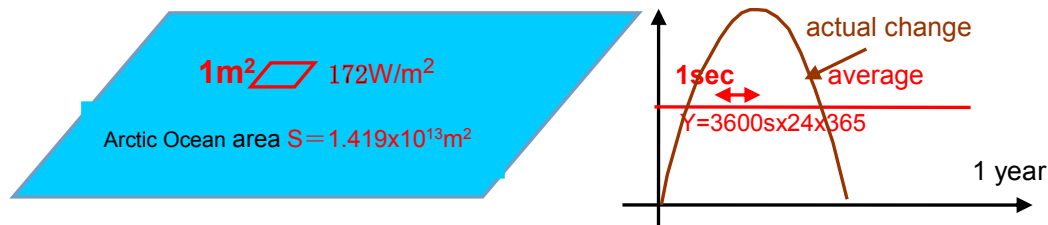
= **ocean heat capacity** × <temperature rise/year>

The yellow portion could be local space and time as W/m^2 , while years change is years change.

The yellow portion could be normalized by YS , while gray is not. It is simple calculation result.

(c) **real comprehension is making big problem small simple as possible.**

For an example, an assumption of space and time **uniformity** on **solar heat input change** in 1 year Arctic big ocean becomes event in area = $1m^2$ in time = **1sec** (YS scale transform).



In fact, solar input intensity = I_0 in Arctic varies by place and time, however if we take **averaging** by total Arctic region and by 1 year time interval, **the value becomes unique** at any place in all Arctic region and any time at all the year round. The actual total value = $172W/m^2$ $YS = 7.7 \times 10^{21}$ Joule.

APPENDIX_1: <some discussion at here is rather wild < $\delta T = 15^\circ\text{C}$ >>

Heat account yields temperature equation predicting rapid catastrophe !!.

Only budget account with partitioning rate determine the evolution equations.

$I - K \equiv \{\text{solar+ocean+air heat input} \equiv I - \text{cooling radiation output} \equiv K\}/\text{year}$
 $= \text{debt(damage,death)heat accumulation in "Arctic Ocean" in a year} \equiv D \equiv I - K.$
 $= \{\text{ocean warming} + \text{ice vanishing}\}/\text{year} \equiv D(1 - \varepsilon) + D\varepsilon.$

$D(1 - \varepsilon) \equiv C_E(\text{heat energy for } 1^\circ\text{C up}) \times \text{temperature rise/year} \equiv C_E(dT_E/dt).$

$D\varepsilon \equiv M(da/dt) \equiv \text{melting heat for unit ice area} \times \text{area decay/year} \equiv da(t)/dt.$

"Ocean sea water Temperature equation as heat account principle"

$(1) C(dT/dt) = (1 - \varepsilon)\{I_A(1 - a(t)) + J(t) - @\sigma <T - \delta T >^4\} \div I_A(1 - a(t)) + J(t) - @\sigma <T - \delta T >^4. \ll \varepsilon \ll 1 \gg$

ocean temperature rise/year = {heat input ocean - heat output from ocean}/year.

(a) $1 - \varepsilon \equiv$ heat partitioned rate for Ocean sea water warming ~ 0.96 at now.

(b) $\varepsilon \equiv$ heat partitioned rate for annual ice vanishing by heating ~ 0.04 at now.

(c) $I - K = I(1 - a(0)) + J(0) - @\sigma <T(0) - \delta T >^4 = C(dT(0)/dt) = 5\text{W/m}^2. <\text{time } t=0 \text{ at now}>$

(d) $C = 79\text{W/m}^2\text{K}$, heat capacity in 1m^2 area in **600m depth Arctic** <total area $S = 1.4 \times 10^{13}\text{m}^2$ >

(e) $dT/dt = (I - K)/C = 5/79 = 0.063^\circ\text{C/y}$ ocean temperature trend at now

(f) $I_A = 170 \times 0.7$ (cloud albedo) = 120W/m^2 . max solar input ocean surface of 1m^2 area.

* 170W/m^2 . = annual average insolation input into Arctic

(g) annual average ice albedo $\equiv a(t)$.

* $I_A(1 - a(t=0)) = 120(1 - 0.75) = 30\text{W/m}^2$. heat input into Arctic ocean warming now.

(h) $J = <\text{air} + \text{ocean}>\text{heat flow input} = 90\text{W/m}^2$. this will rise from hereafter by global warming.

(i) $@\sigma <T(0) - \delta T >^4 = 115\text{W/m}^2 =$ cooling radiation output from Arctic ocean in 1m^2 area at now.

(j) $@(t) =$ emissivity of Arctic about 0.5 for $@\sigma <T(0) - \delta T >^4 = 115\text{W/m}^2$. $\delta T = 15\text{K}$.

= infrared ray passing probability through GHG layer into space.

(k) $<T(0) = 267\text{K}$: Arctic ocean temperature at now. $@ = 0.5$; $\sigma = 5.67 \times 10^{-8}\text{W/m}^2\text{K}^4$.

☞ : {Ocean sea water temperature - cooling radiation surface temperature} $\equiv \delta T = 15^\circ\text{C}$.

This model employs output heat only **surface cooling radiation** = $@\sigma <T(t) - \delta T >^4$. On the other hand, debt heat **$D = (I - K)$** is stored only in **ocean heat capacity** = $C(dT/dt)$. The latter temperature is that of average ocean sea water of 600m depth, thereby this model very coarsely assume that radiation surface temperature $\equiv T_R$ and ocean average one $\equiv T_A$ are different by **$\delta T = 15\text{K}$** . These situation might be reflected in **emissivity = @ ~ 0.5** which is lower than that of global one <the effective emissivity of earth = about 0.612>. Note ocean cooling is not only radiation, but also evaporation. The latter could be counted in $J(t) \sim <\text{air} + \text{ocean}>\text{heat flow input into ocean} = 90\text{W/m}^2$. Then the component is negative sign due to heat output. **These are adjustments to establish heat budget account at now.**

“ice melting equation as ice albedo feedback mechanism”

$$(2) M(da/dt) = -\epsilon \{I_A(1-a(t)) + J(t) - \sigma T(t)^4\} = -\epsilon C(dT/dt).$$

$$\rightarrow da/dt = -(\epsilon C/M)(dT/dt).$$

At now, more than 90% heat input is paid for ocean warming, while $\epsilon=4\%$ is for ice vanishing.

(da/dt) is ice extent decreasing rate/year, M is heat for unit area ice melting. So $M(da/dt)$

is heat for ice melt, which is partitioned by ϵ from **total heat input $D = \{I - K\}$,**

decreasing ice lid $a(t)$ is to increase heat input $I(1-a(t))$. **This is awful albedo feedback.**

(a) $\{M(da(t=0)/dt) = 0.2W/m^2, C(dT(0)/dt) = 5W/m^2 \rightarrow \epsilon = 0.2/5 = 0.04\}$ at now

(b) $a(t) = \text{ice albedo } a(t=0) = 0.75, \leftarrow I_A(1-a(t)) = 120(1-0.75) = 30W/m^2$

(c) **Annual ice volume diminishing rate I** $\langle S_A = 1.4 \times 10^{13} m^2 = \text{Arctic area}; Y = 3600 \text{sec} \times 24 \times 365 \rangle$

<http://psc.apl.washington.edu/wordpress/research/projects/arctic-sea-ice-volume-anomaly/#>

$dV/dt = 3 \pm 1 (1000 \text{Km}^3)/10 \text{years}$: total ice diminishing volume/10 years in Arctic

$\rho \xi = 917 \text{Kg}/1 \text{m}^3 \times 334.7 \text{KJ}/\text{Kg}$: ice melting heat for 1m^3 ;

$$\rightarrow \rho \xi (dV/dt) = 917 \text{Kg}/1 \text{m}^3 \times 334.7 \text{KJ}/\text{Kg} \times (3 \times 10^{11} \text{m}^3/\text{y}) = 9.2 \times 10^{19} \text{J}/\text{y} = \text{Ice melting heat/year.}$$

$9.2 \times 10^{19} \text{J}/\text{y} / \langle SY \rangle = 0.21 \text{W}/\text{m}^2$. **Ice vanishing heat for unit area in unit time.**

$P_i = 0.2 \text{W}/\text{m}^2 < 1980 \sim 2005 \rangle \sim 0.6 \text{W}/\text{m}^2? < 2006 \sim 2012 \rangle$: **Ice vanishing heat change**

$$M = \rho \xi (dV/dt) = 917 \text{Kg}/1 \text{m}^3 \times 334.7 \text{KJ}/\text{Kg} \times 2 \text{m} (\text{mean ice depth}) \times 1 \text{m}^2 = 19.5 \text{W} \rightarrow M = 19.5 \text{W}$$

$$P_i = M(da/dt) = 0.2 \text{W}/\text{m}^2 \rightarrow da/dt = 0.2/19.5 = -0.01. \text{ well agreement with observation.}$$

(d) **Annual ice volume diminishing rate II.**

Many might think of this equation is too simple to describe dire destiny of Arctic.

$$da/dt = -(\epsilon C/M)(dT/dt) = -(\epsilon/M) \{I_A(1-a(t)) + J(t) - \sigma T(t)^4\}.$$

Oth approximation is $-(\epsilon C/M) = -0.016$ constant as the postponing now state.

Higher order approximation may be taking following causes into account.

As $t \rightarrow 20 \text{years}$, following would arise

① $M = \rho \xi (dV/dt) = 917 \text{Kg}/1 \text{m}^3 \times 334.7 \text{KJ}/\text{Kg} \times 2 \text{m} (\text{mean ice depth}) \times 1 \text{m}^2 = 19.5 \text{W}.$

$M \rightarrow$ down due to ice depth decline, this may be certain.

② $\epsilon = -M(da/dt) / \{I_A(1-a(t)) + J(t) - \sigma T(t)^4\}$: As for ϵ , there would be 3 possibility.

“heat partition rate for ice vanishing $= \epsilon$ ” $= 0.04 = 0.2 \text{W}/5 \text{W}$ at now.

$\epsilon \rightarrow$ down due to ice boundary area (heat exchanging surface) decline, if nothing ice fraction.

$\epsilon \rightarrow$ up due to ice boundary area increasing, if ice fraction is too stronger.

$\epsilon \rightarrow$ constant as neutrality due to cancellation between area decline, but fraction increasing.

Now author coarsely assume $0.06 > \epsilon > 0.02$ (this lower value may be unlikely)

(e): **uncertainty estimations** : <discussion at here is not neat and exact>

☞ : In authors research environment, his available data are limited in **websites**, where **censoring** on climate science has been going up day by day. It is very hard to collect data which are full matching. However conclusion could be certain by **employing some essential mechanism** with uncertain data. For example, following data are rather uncertain in its absolute value, however **derived solution trend** could be certain with certain errors.

Frankly to tell, don't care on about **±30,40,50% errors** in climate time estimation.

Arctic ice would have been full vanished within 15 years ± 10years.

Arctic temperature would rise 10°C within 20 years ± 5years.

+5 years would be non-realizable, the event would be **rapid** than our expectation.

This is authors' coarse guessing by **few numerical experiments** by changing parameters.

* **environmental parameters** :: {C; I_A; J(t); @ (t)}

* **initial value error**;; {dT(0)/dt; T(0);; da(0)/dt; a(0)}

* **error** due to discrete calculation in software = neglect in 1years step calculation.

Arctic Temperature=T(t) equation with albedo variable=a(t).
(1) $C(dT/dt) = I_A(1-a(t)) + J(t) - @\sigma <T(t) - \delta T>^4$.
(2) $da/dt = -(\epsilon C/M)(dT/dt) = -(\epsilon/M)\{I_A(1-a(t)) + J(t) - @\sigma <T(t) - \delta T>^4\}$.

☞ : One could claim that above equation are not complete. Yes that right, However **about solution** could be rather right with large error, which enable policy decision.

variables and parameters	value at now	uncertainty	citation and comment
T(0):ocean temp	267K	±6?	115W/m²=@σ(252K)⁴:
T(t)-δT: radiation	252K	?	cooling radiation at now in Arctic
dT(0)/dt	0.06°C/y	+0.04	(5W/m ²)/79W/m ² K
a(0):ice albedo	0.75	±0.1	30W=I _A (1-a(0)):ocean heat input
da(0)/dt	-0.01	-0.02	Ice extent record
C:heat capacity	79W/m ² K	+25W/m ² K ?	
I _A :sun heat into ice	120W/m ²	±17W/m ²	170x(1-0.3(cloud albedo))=119
J(t):air+ocean heat	90W/m ²	± ?	
@ (t):	0,5	± ?	115W/m²=@σ(252K)⁴: cooling radiation at now in Arctic

☞ : absolute value(value at now) might be not correct.

(f) **Initial Condition** **Solution is derived by integral step by step approximation**

$$T(t)=A1=267K \quad T(n+1)=T(n)+dt(dT/dt)=T+dt\{f(t_0+ndt)\}, dt=1(\text{years})$$

$$a(t)=B1=0.75$$

(g) **SPREADSHEET (CALC) function:**

ARCTIC OCEAN TEMPERATURE(K)

$$T(t)=A1+(120*(1-B1)+90-0.5*5.67*10^{(-8)}*(A1-15)^4)/79$$

ARCTIC OCEAN EXTENT in ratio

$$a(t)=B1-0.16*(120*(1-B1)+90-0.5*5.67*10^{(-8)}*(A1-15)^4)/79, a(t > 16) = 0.$$

ARCTIC OCEAN HEAT INPUT(W/m²)

$$P(t)=120*(1-B1)+90-0.5*5.67*10^{(-8)}*(A1-15)^4$$

(h) **DATA CITATIONS:** <data at here is neat and exact, but the citations are rather not>

Arctic Heat Budget

http://www.colorado.edu/geography/class_homepages/geog_4271_f12/lectures/notes_2.pdf

The large-scale energy budget of the Arctic(2007)

https://courses.eas.ualberta.ca/eas570/arctic_energy_budget.pdf

ice volume trend,

http://psc.apl.uw.edu/wordpress/wp-content/uploads/schweiger/ice_volume/BPIOMASIceVolumeAnomalyCurrentV2.1.png

ice extent monitor

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

ice albedo decline rate

http://www.data.kishou.go.jp/kaiyou/shindan/a_1/series_arctic/series_arctic.html

Temperature at North Pole.

<http://occco.nies.go.jp/100129ws/pdf/Enomoto100129.pdf>

Arctic Ocean Sea Surface Temperature

http://www.arctic.noaa.gov/reportcard/sea_surface_temperature.html

Steven Chu on Permafrost feedback

<https://www.youtube.com/watch?v=oHqKxWvcBdg>

This is going to occur but as we go to warmer warmer 456

APPENDIX_2: Methane Catastrophe Looping <discussion at here is not complete>

If Arctic ocean temperature would have exceeded 10 °C, then methane release would be 80 ~ 200 GtC !!!, which is **evidently** catastrophic. By such reason and for simplicity for explanation, this report describes **only ice albedo feedback**, but not methane melting feedback the major catastrophe cause. So author collected elements for establishing the feedback looping. Following equation set could be simultaneous equation describing the looping process.

I : GHG radiative forcing and @ <≡ passing probability magnitude ≡ ppm>

CH4 has 50 times stronger intensity than CO2 to heat up this earth by green house effect. Heat trapping gas (=GHG) in atmosphere reduces cooling radiation from global heat surface temperature (σT^4) into cosmos. Those trap the radiation (infrared ray) by molecular vibration resonance and re-emit by a lifetime. So those act like as **half mirror** in each trapping layer. As the consequence, they determine probability for J = passed Cooling Radiation from σT^4 .

$$@ \equiv J / \sigma T^4.$$

<http://www.777true.net/Definition-on-Radiative-Forcing.pdf>

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

*After all, author could not refer thesis on radiative forcing, so above are authors re-synthesis on radiative forcing theory.

COOLING RADIATION:

$$J(t) \equiv @ \sigma T^4.$$

instantaneous radiative forcing of GHG.

$$\Delta F(M(t)-M_0) \equiv \langle @ (t) - @ (0) \rangle \sigma T^4.$$

actual radiative forcing heating up globe.

$$\Delta F \equiv \{ I_s \langle 1 - a(t) \rangle - @ (t) \sigma T(t)^4 \} - \{ I_s \langle 1 - a(0) \rangle - @ (0) \sigma T(0)^4 \} \leftarrow T(0) = 287K.$$

$$= - I_s \langle a(t) - a(0) \rangle - \langle @ (M(t)) - @ (0) \rangle \sigma T(0)^4 - @ (t) \sigma \langle T(t)^4 - T(0)^4 \rangle.$$

the definition:

$$\Delta F(M) \equiv \langle @ (M(t)) - @ (0) \rangle \sigma T(0)^4. \rightarrow @ (M(t)) = \Delta F(M) / \sigma T(0)^4 + @ (0).$$

$$\rightarrow @ (M(t)) - @ (0) = \Delta F(M) / \sigma T(0)^4. \text{ : ppm change } \delta @ \propto \Delta F(M)$$

negative radiative forcing by temperature rise-itself

$$- @ (t) \sigma \langle T(t)^4 - T(0)^4 \rangle = - \langle \Delta F(M) / \sigma T(0)^4 + @ (0) \rangle \sigma \langle T(t)^4 - T(0)^4 \rangle$$

$$= - \langle \Delta F(M) \rangle \langle [T(t)/T(0)]^4 - 1 \rangle - @ (0) \sigma \langle T(t)^4 - T(0)^4 \rangle.$$

*This work could not be done by author at now, so this is a preparation for hereafter.

II : Global Temperature trend by Methan Burp in Arctic.

Following are easy, but exact heat budget account equation with $\{a(t), @_E(t)\}$

{solar heat input – cooling radiation output}/year

=heat input accumulation in earth in a year = heat capacity \times temperature rise/year

<http://www.777true.net/non-ipcc-Climatology-toward-Coming-Climate-Crisis.pdf>

(1) $C_E(dT_E(t)/dt) = I_0(1-a(t)) - @_E(t)\sigma <T_E(t) - \delta T >^4$ This is fairly certain.

(2) $@_E(t) = \Delta F(M(t))/\sigma T(0)^4 + @_E(0)$ This is definition.

Relation with Arctic Variables $\{@_A(t); J_A(t)\}$ in III : ARCTIC REGION.

(3) $@_A(t) = \gamma @_E(t) \equiv @_A(t)$. Unknown at now

(4) $J_A(t) = J_A(0) + \beta(dT_E(t)/dt)$. partitioned heat from Global one. β is unknown at now

III : ARCTIC REGION:

(1) $C(dT/dt) = I_A(1-a(t)) + J(t) - @\sigma <T(t) - \delta T >^4$ This is fairly certain.

(2) $M(da/dt) = -\epsilon C(dT/dt)$ This is fairly certain.

(3) $X(t) = X(T(t))$: **Methan phase diagram**.... This is certain.

(4) $dX/dt = (\partial X / \partial T) (dT/dt)$. melting depth rate equation.

(5) $dM/dX = R(X)$: **Methane Distribution** in 1 dimensional **MODEL**.

.... This is uncertain. **However conclusion for risk evading could be certain !!!!**

(6) $dM/dt = (\partial M / \partial X) (dX/dt)$. methane melting rate equation.

(7) $\Delta F = \Delta F(M)$. : **Methane radiative forcing function**.... This is certain.

(8) $d\Delta F(t)/dt = (\partial \Delta F / \partial M) (dM/dt)$. radiative forcing increasing rate equation.

$\rightarrow \Delta F(M(t))$ is fed to II : Global Temperature trend by Methan Burp in Arctic.

APPENDIX_3:the meaning of 0 dimensional climate model.

“space resolution vs possible predicting time interval in fluid dynamics”

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

(a) Fluid equation form is invariant by $\{x' = x/L; t' = t/L\}$ time space **scale** transform.

Small smoke would be dissapear in small time and space scale,then you should imagine 100kmx100km cloud,of which shape will be disappear withing few days ?!.

space resolution	predictable time length	user
100kmx100km	5days ?	Weather forecast
1000kmx1000km	50days ?	Long term prediction
$\pi(6380\text{km})^2$: global scale	1year ?	0 dimensional model

Then if you wish **10 years long climate prediction**,space resolution is larger than earth.

Or in other world.using fluid equation in climate dynamics could not be effective by anymore in this long time prediction.So **0 dimensional climate model** become genuine tools.

(b) **Statistical Climatic Mechanics:**

Long term regional prediction synthesis by Reverse Averaging:

Regional long term prediction is everyones demand,however direct fluid dynamics method would be in vain.The we can present another problem.**Can you synthesis regional temperature distribution from global average one ?!!.**