

# Big Data and Supercomputing - for Sustainable and Resilient Society

by Yan

16 Jan, 2016

## Abstract

Global warming is having a remarkable effect on developing countries. These countries depend on agriculture which is fragile in extreme weather, and this damage becomes the cause of poverty. 17 new sustainable development goals from the United Nations are largely related to disasters, especially in developing countries.

Technology development shows new possibilities to reduce damage by early notification and to design social infrastructures/systems adaptable for global change by observation and simulation. The presenter is engaged in designing for the operational organization of Japan the climate change adaptation program "DIAS: Data Integration and Analysis System". DIAS integrates various observation/ simulation data and social data using 25 petabyte huge data storage, PC-clusters and a high speed network to develop solutions for various social issues

## Participants

アカーシャ (AkashaKokuu Resident), Areyn Laurasia, Arianne (ArianneJP Resident), CB Axel, Chantal (Nymf Hathaway), Cyrus Hush, Dae Miami, Dar (Darrwen Resident), DarDar (Darrwen Resident), DukeVan Acker, Fumon Crystal, Leif (Asleifsson Resident), Mike Shaw (Shawza Tunwarm), Nat Ure (Nat Spirt), thief Burner, Tooyaa (Thuja Hynes), Vic Michalak, Wisdomseeker (Lissena Resident), よおな (yoona Mayo)

## Organizer

Spammy (Jes Cobalt), Chantal (Nymf Hatherway)



(Check Voice chat and “YouTube on a Prim”)

[06:49] Jes: Welcome! Please do find a seat, make sure you have voice enabled, and media enabled as we will be using **YouTube on prims** today.

[06:51] Yan: I'll use Voice. Please mute **streaming Music** of SL

[06:51] Yan: Do you see this Earth animation?

[06:52] Vic: yes... behind you?

[06:52] Yan: yes

[06:52] Yan: this is YouTube on a Prim

[06:52] Vic: And the slide with the ENIAC computer from the 1940s

[06:53] Tooyaa: great your grant came through for a billion dollars to buy the supercomputer bank!

[06:55] Vic: A good audience today

[06:57] Yan: Please streaming Music mute, and **Voice and Media** enable

(Start presentation)

## Big Data and Supercomputing - for Sustainable and Resilient Society

Yan Lauria

Abyss Observatory, the Modern Museum and the Education Portal

Hajime Nishimura

Japan Agency for Marine-Earth Science and Technology  
(JAMSTEC)

Yan: Welcome to The Science Circle presentation! I'm a curator of Abyss Observatory, the Modern Museum and the Education Portal in SL, and in RL, I'm working at JAMSTEC.

I'm not a scientist but a project manager of many kind of Earth science research, so I could learn science from many scientists in personally. And Earth science is related with many field, and its purpose is for society and need to collaborate with society, and scientist are not specialist for outside their field, so I don't hesitate with scientists.

Yan: But be careful for what I talk today. Scientists teach me only good things for them and they don't teach me “inconvenient truth”. I learned how to find “inconvenient truth” but please confirm and judge by yourself.

Yan: And question is welcome in any time. Please type in Nearby-chat. If I don't realize your question, please copy & paste again.

(Is climate changing?)

Yan: 1st, I'll talk about climate change.

Many anti climate change books have been published before.

“Is climate changing?” or

“Is recent global warming caused not by CO2 but by solar activity or natural variation?” or  
“Doesn’t IPCC hide inconvenient truth?”

are frequently asked. Please type do you agree IPCC or doubt?

[07:05] Vic: Please repeat the question?

[07:05] Yan: Type agree or doubt IPCC?

[07:05] CB Axel: agree

[07:05] DukeVan Acker: agree

[07:05] Mike Shaw: agreed

[07:05] Arianne: agree

[07:05] Vic: IPCC = Intergovernmental Panel on Climate Change

[07:05] Chantal: agree

[07:05] Areyn: do we agree with the IPCC or not?

[07:06] Vic: Do you agree that there is climate change?

[07:06] Vic: YES!!

[07:06] Leif: agree

[07:06] Dae Miami: I would like to see more data. I am teaching climate change this week in my  
classes

[07:06] Wisdom: yes

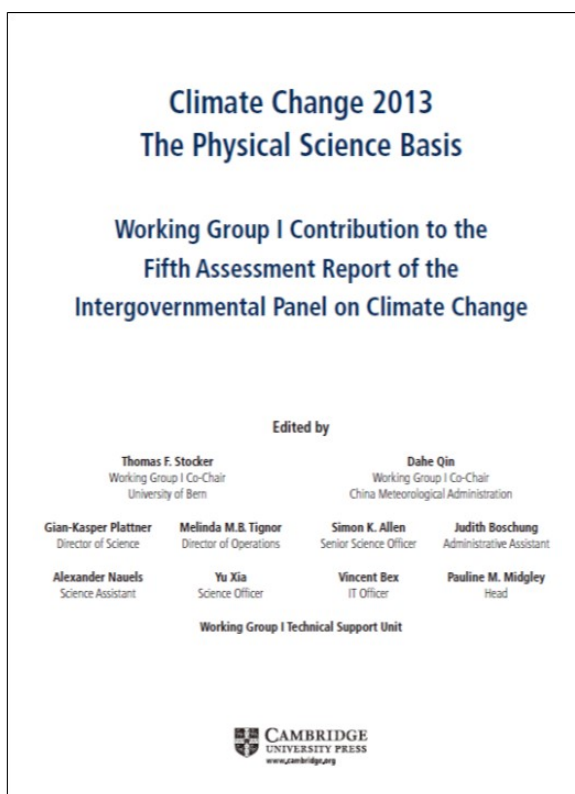
[07:06] Areyn: agrees with Dae

[07:06] Dae Miami: but yes I am concerned about climate change

Yan: I’ve given up to purchase all of those books because all of the counter-opinions are the same  
on these books. It is strange.

I simply recommend you two things.

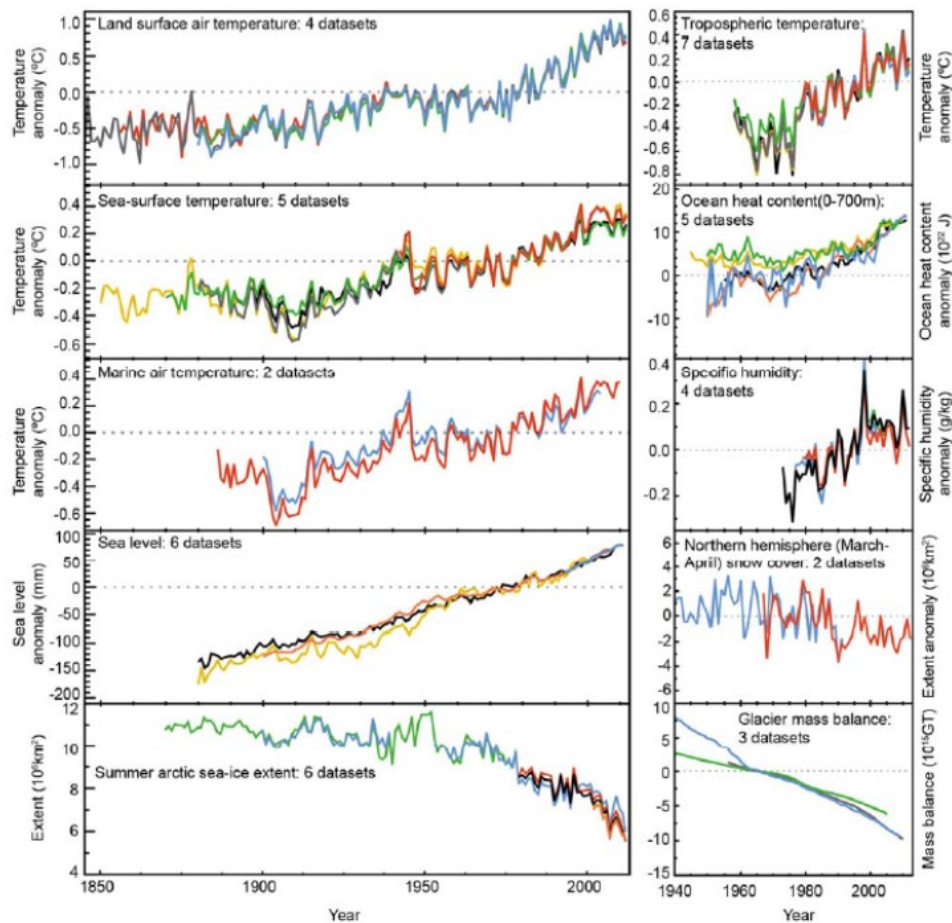
**First** is to read Technical Summary of 5th Assessment Report of IPCC Working Group 1.



[07:07] Tooyaa: on the conclusion that The major conclusion was that research since 1990 did "not affect our fundamental understanding of the science of the greenhouse effect and either confirm or do not justify alteration of the major conclusions of the first IPCC scientific assessment"?

(Yan's comment: It is long complicated sentence so I'm afraid reading mistake but I think basically Yes. 3rd, 4th, 5th Assessment improved evidences and reduced uncertainly. New understanding is that global warming is not linearly progress. Destabilization of climate is new founding from our experiences but still not evaluated. )

Yan: There are many kind of data, temperature on land and Sea, Sea level and extent of sea-ice.

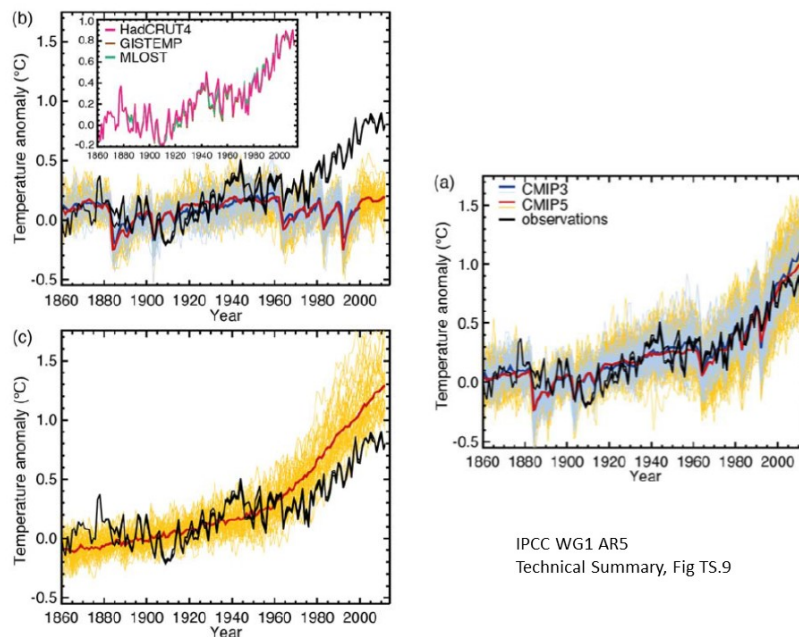


IPCC WG1 AR5  
Technical Summary,  
Fig TS.1

[07:07] Dae Miami: And Yan gives me what I need

[07:08] Dae Miami: wow temp change is up to 1.5 degrees

.Yan: And next is comparison of Observation and Simulation.



Yan: Black line is observation, red line is **Natural Variation** only by model (red line of upper graph) and **Anthropogenic Variation** only (red line of lower graph). Combine of them coincident with observation (Black line) well

[07:09] Vic: If you want to see more charts on this topic, please see the charts I have in the pyramid on STEM Island

[07:09] Leif: ok

[07:09] Chantal: slurl, Vic?

[07:09] Dae Miami: **are these annual averages Yan?** (Vic replied as follows)

[07:09] Chantal: STEM Island (189,193,95)

[07:11] Vic: **Some of the lines are annual averages and some are probably five year averages** to account for annual variations --- the important thing is the overall trend, which is pretty undeniable

[07:13] Dae Miami: ok so we have a 0.5 degree increase in temp in the past, but it looks like they are extrapolating a much faster increase for the future

[07:13] Dae Miami: in fact from 2000 to 2010 the curve appears to level off

[07:15] Dae Miami: Temperatures seem higher in Virginia. We set records for Christmas this past year in Roanoke

[07:16] Dae Miami: 25 degrees C

[07:16] Vic: A 0.5 degree C change may not seem like much, but this type of AVERAGE change over the entire WORLD can change a lot

[07:16] Dae Miami: Yes and it can be up to 7 degrees at the poles

[07:16] Vic: See this site -- <http://globalwarming.berrens.nl/globalwarming.htm>

[07:16] Dae Miami: Great thanks for the urls

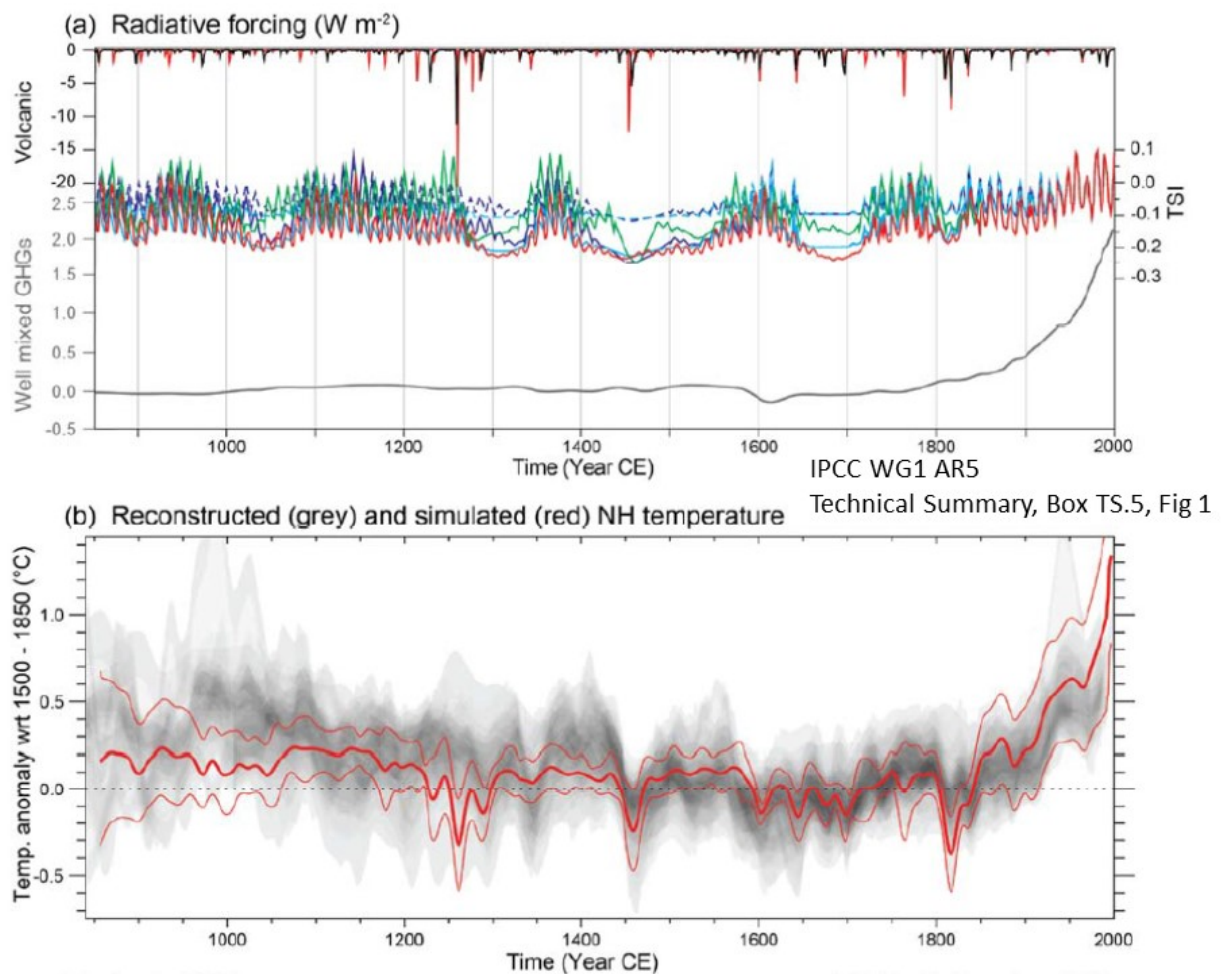
[07:16] Dae Miami: Please share more of them

[07:18] Dae Miami: <http://www.ipcc.ch/>

[07:18] Dae Miami: There seems the main link for IPCC



Yan: Every models consider Solar and Volcano activities. Grey is more than 1000 years observation data or **proxy data** like tree-rings, pollen, stalactite, historical documents, etc. Model Result coincident with past data well.



[07:18] Vic: Example: 6000 years ago it was 1 degree warmer than 1900s average and places that grow much food now were deserts then

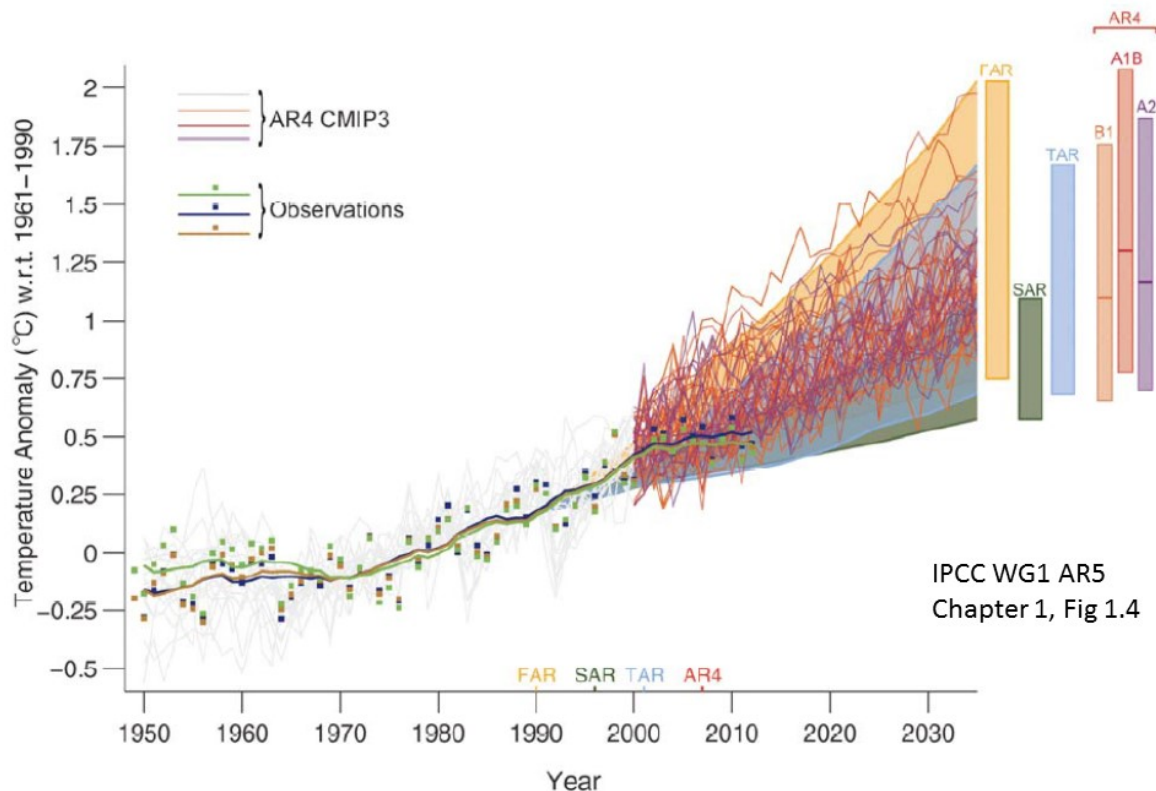
[07:20] Chantal: ☺ likes that

[07:22] Dae Miami: found some data on plots on the IPCC website:

[07:22] Dae Miami: [http://www.grida.no/publications/other/ipcc\\_tar/](http://www.grida.no/publications/other/ipcc_tar/)

(Yan's comment: This is too old (3rd Assessment. 2001). Please download 5th Assessment 2013 from <http://www.ipcc.ch/report/ar5/wg1/>)

[07:22] Chantal: 14 should be up



### (Global warming Hiatus)

[07:24] Dae Miami: It looks like temp is leveling off from 2000 to 2010 (Vic replied as follows)

[07:24] Dae Miami: so why are models predicting an accelerating increase

[07:24] Dae Miami: but overall there is an increase

[07:25] Vic: The basic explanation has to do with the ocean absorbing the warming..

[07:25] Vic: I will find the link

[07:26] Vic: Yes... that is the explanation --- the world is complex...

[07:26] Dae Miami: please keep going this is interesting

[07:26] Vic: BUT the temperature is still going up... the Earth is trying to cope but the fact is it is still going up, as is CO2

[07:26] CB Axel: So the warming hiatus is because the oceans were absorbing the warming?

[07:28] Vic: See

<http://news.stanford.edu/news/2015/september/global-warming-hiatus-091715.html>

[07:28] CB Axel: Thank you.

[07:28] CB Axel: And thank you, Vic.

[07:29] Vic: Explanation for the 'global warming hiatus' that is not true --- it is just an anomaly

[07:21] よおな: Scientists says many things, temp is increasing, CO2 concentrations is increasing etc.. What can you do for the earth? Most on the earth dose not know the crisis of the earth.

[07:21] よおな: ♡I love you PEOPLE ♡hoooOoOoOoo lalala lala ! ♡

[07:25] Thief: I wish I could

[07:25] Vic: But now it cannot...

[07:25] Chantal: sorry :(

(Fake or Truth?)

Yan: I said "I recommend you two things" at first. **Second** is to check references of anti-climate change books. Please search each reference by internet, and think these references are really evidence for counter-opinions by your knowledge.

Scientists have already answered their counter-opinions but these authors don't make mention the answers or reply to the answers. It is also very strange.

[07:28] Arianne: China was abscent . too

[07:24] Arianne: I know fake datas inducted the story , "worming " is wrong, years ago but now is worming common to us? If it is true ,scientists has responsibility to share alerts for people.数年前に温暖化のデータがねつ造というニュースが流れました。これはちゃんと訂正されたのでしょうか、もしそーだとすれば科学者は温暖化が確実なことを周知する責任があるのでは?

(Yan's comment: I think this is "Hockey stick controversy". please see

[https://en.wikipedia.org/wiki/Hockey\\_stick\\_controversy](https://en.wikipedia.org/wiki/Hockey_stick_controversy). Latest curve )

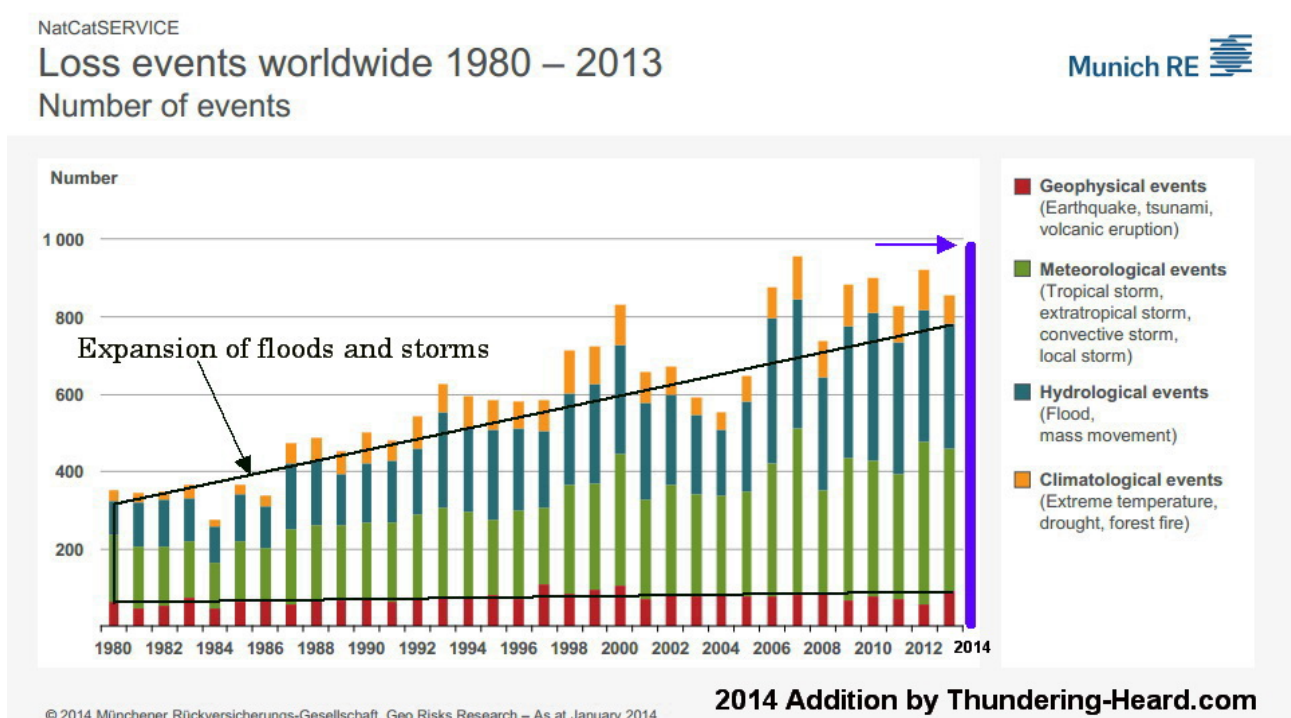
(Impact of climate change?)

Yan: Then, Climate is changing. but how about the Affection or impact of Climate change?

I am 60 years old, so I know first-hand temperature rises and extreme weather increases, but I'm not certain how such a change have affected Japan. East-Asia and India scientists have also said "Climate is changing" and they feel their environment becomes worse.

Yan: Local impacts are complicated. Sea level rise is the same everywhere in the world. The Arctic is the most sensitive area to temperature rise, but in terms of overall human societal impact, rainfall pattern change and extreme weather or natural disaster is more important and needs more accurate climate prediction. Also natural variations like El Nino events make the impact more complicated.

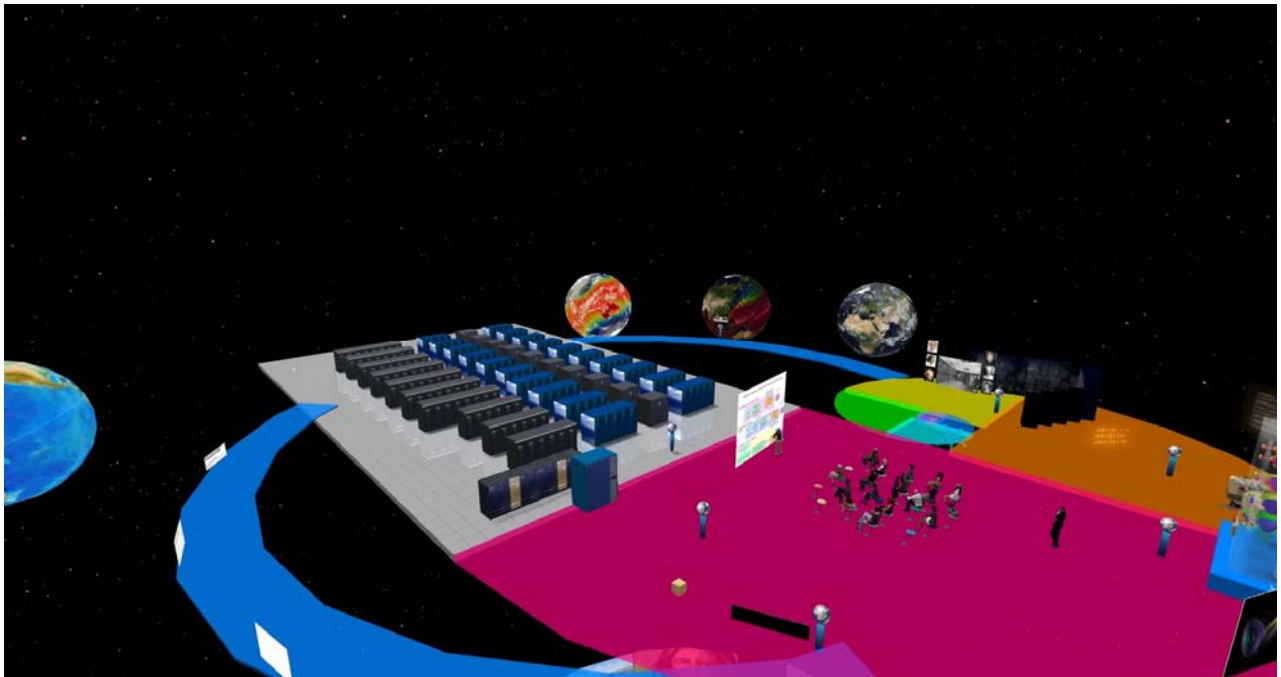
Please see following chart;





Yan: This is the number of natural disasters in the world over 35 years by Munich Re-insurance. Please note Red (Earthquake, tsunami and volcano) increases a little, but Green (Storm) + Blue (Flood, mass movement) + Yellow parts (Extreme temperature, drought, forest fire) increased 2.6 times.

Yan: Of course, these are caused not only by climate change but also by the expansion of human activity into fragile areas or other reasons. Anyway, a casualty insurance company also said to me that casualty insurance payouts for unknown factors have increased in these years. We can say that in the past, our society could be managed by knowledge learned from past, but in these days, we need to manage not only by experience but also by observation and simulation..



### (Observation Data and Simulation)

Yan: Please stand up and come on.

[07:29] Akasha: Follow Yan

Yan: You can see various global observation data, mainly satellite data on left side of this floor. Center of this floor, there is Earth Simulator, 3rd renewal of my research institute, JAMSTEC.

Top500 supercomputer ranking is no means for climate prediction because LINPAC benchmark test mainly depend on number of computing cores. So No.1 machine of latest Top500 has 3 million cores.

Yan: But climate prediction including ocean circulation depends on performance as ONE MACHINE.

New Earth Simulator has only 20,480 cores but practically No.1 in the world for Earth system simulation.

And this is simulation data. simulation data show more information than observation data.

[07:34] Vic: Have you heard the story about how to boil a frog? (just a story; I would not do this)

[07:35] Vic: If you put the frogs in boiling water they jump out....

[07:35] Vic: If you put the frogs in water and very slowly turn up the temperature, they do not realize the water is getting warmer...

[07:36] Vic: They sit and debate about it for a long time until the water is too hot and they boil...

[07:36] Wisdom: point taken, Vic :) also :(

[07:37] Arianne: cool story . ironic

[07:37] Tooyaa: is "jumping out" a solution or option for Earth's inhabitants?

[07:37] CB Axel: Part of the problem, though, Vic, is that too many of the frogs think that the warming is natural and there is nothing they can do about it.

[07:37] Wisdom: paying attention is, Tooyaa

[07:37] Vic: For 7 billion people, no.... For the millions who will be flooded or affected by intense storms, probably not...

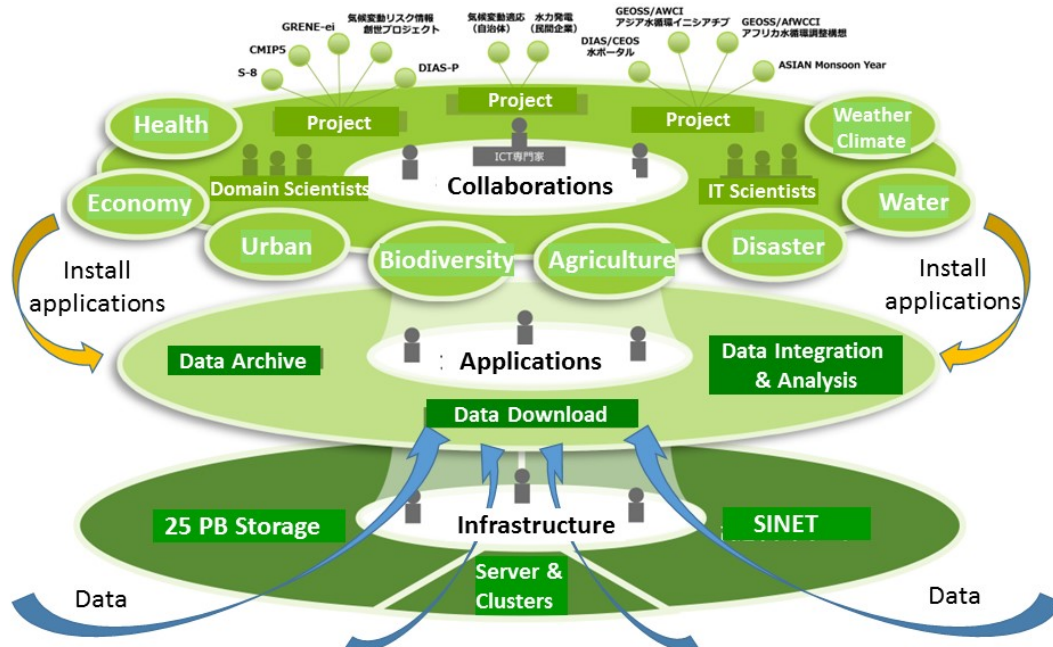
[07:38] Areyn: One good thing about global warming.. if it keeps up, we'll get tropical weather in the future..

[07:38] Vic: Or those who will starve because of changes in food production..... or increase in the area of tropical diseases, etc...

[07:39] CB Axel: CB Axel is not a fan of tropical weather

(What is DIAS?)

## DIAS: Data Integration and Analysis System



Cross-disciplinary collaboration platform for solution of various social problems

Yan: I'm working in designing of the operational organization of Japan climate change adaptation program "DIAS: Data Integration and Analysis System."

This is concept of DIAS mechanism. DIAS consists by three layers. Lower layer is 25 petabyte huge data storage, PC-clusters and high speed network

Yan: Upper layer is various collaboration projects in which decision maker is involved from initial stage and integrates various observation/ simulation data and social data to develop solutions for various social issues..

Yan: Middle layer is a team of IT researchers and programmers. They help install output of projects into DIAS system so that outputs can be shared and improved.

In this way, DIAS is expand its data and functions gradually for various social fields.

[07:40] Vic: PB = petabyte = 1000 TB (terabyte) = 1,000,000 gigabytes

[07:40] Vic: Not your personal computer! ☺

[07:41] Vic: Tahiti



***Where Do We Come From?***

***What Are We?***

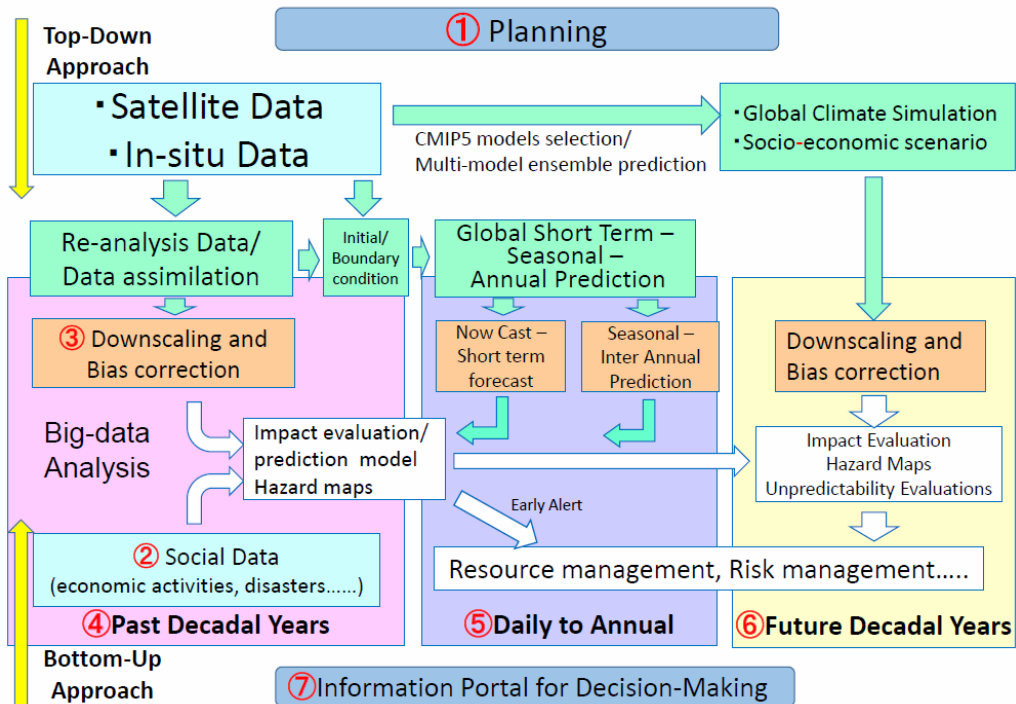
***Where Are We Going?***

**Paul Gauguin 1897-98**

Yan: This painting by Guguin is very famous for its long title, “Where Do We Come From? What Are We? Where Are We Going?”. By leaning past to know present and future prediction. This strategy is same as climate change adaptation.

[07:42] Vic: (Saw these paintings in the Musee d'Orsay a year ago in Paris.... lucky)

## Top-down/ Bottom-up approach for Solutions related to environment



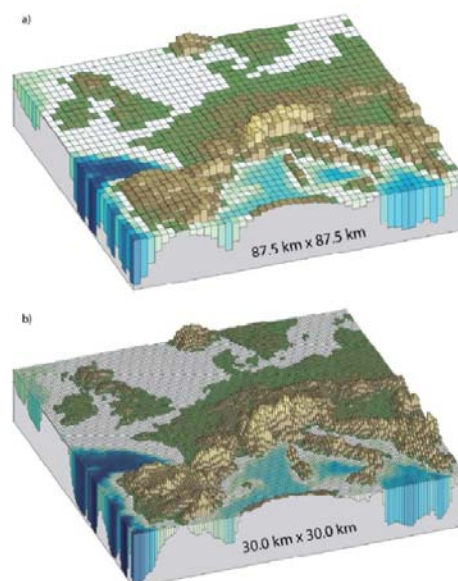
Yan: Pink is past, purple is present or near term and yellow is long-term future.

There are two approach, Bottom-Up Approach from concerned people side, and Top-down approach from climate researchers.

**Bottom-Up Approach** is gathering existing data both observation data and social data or disaster events, so prediction is weak point.

**Top-down approach** is possible to predict short-term and long-term, but resolution isn't enough for social and disaster events. It means there is a gap like orange parts.

### b) Downscaling?



IPCC WG1 AR5  
Chapter 1, Fig 1.14

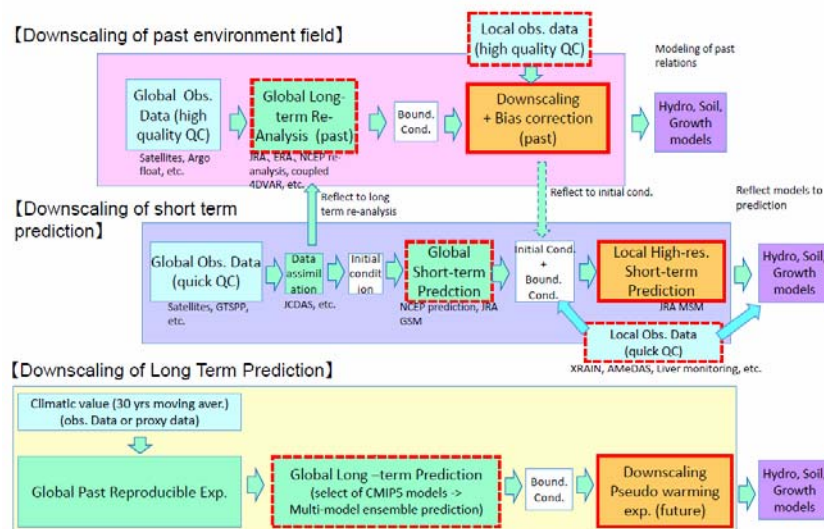
Yan: Above is resolution of global climate model, **GCM**, by high level supercomputer. So we need at least 30 km resolution to predict local weather. 10 km or 1 km for other social issues. This is “**downscaling**”

[07:46] Vic: Here is what Yan is explaining: What is a GCM?

[07:46] Vic: Supercomputers can take a lot of data from the past and project it into the future

Yan: This is last sheet.

### Relations between Observation Data and Downscaling



Yan: **Pink** is Downscaling for past. We can find relation between social issues and environment field variation.

This is most important process with concerned community or decision maker. Due to limitation of supercomputer, there isn't all-purpose downscaling. It needs optimize for concerned issue, flooding, land sliding, sustainable farming. So Inter-disciplinary/ Trans-disciplinary collaboration or involvement of decision makers are essential.

And when we developed **Affection or Impact model** for evaluation or prediction of concerning issues, then,

Yan: **Purple** is Downscaling for near-term prediction. We can take decision making to save lives by early alert.

This is very important. Long term prediction still has lot of unknown factor and can differ according to economical development scenario or RCP (Representative Concentration Pathways). On the other hand, we feel weather becomes unstable than before. It is difficult to construct perfect wall for flooding, but if we can alert people to evacuation enough early, we can save human life and reconstruct infrastructures again.

This is **Resilient Society**. We develop high resolution short term forecasting, and connect above Affection or Impact model, then people can make decision adequately.

and last,

Yan: **Yellow** is Downscaling for long-term prediction.



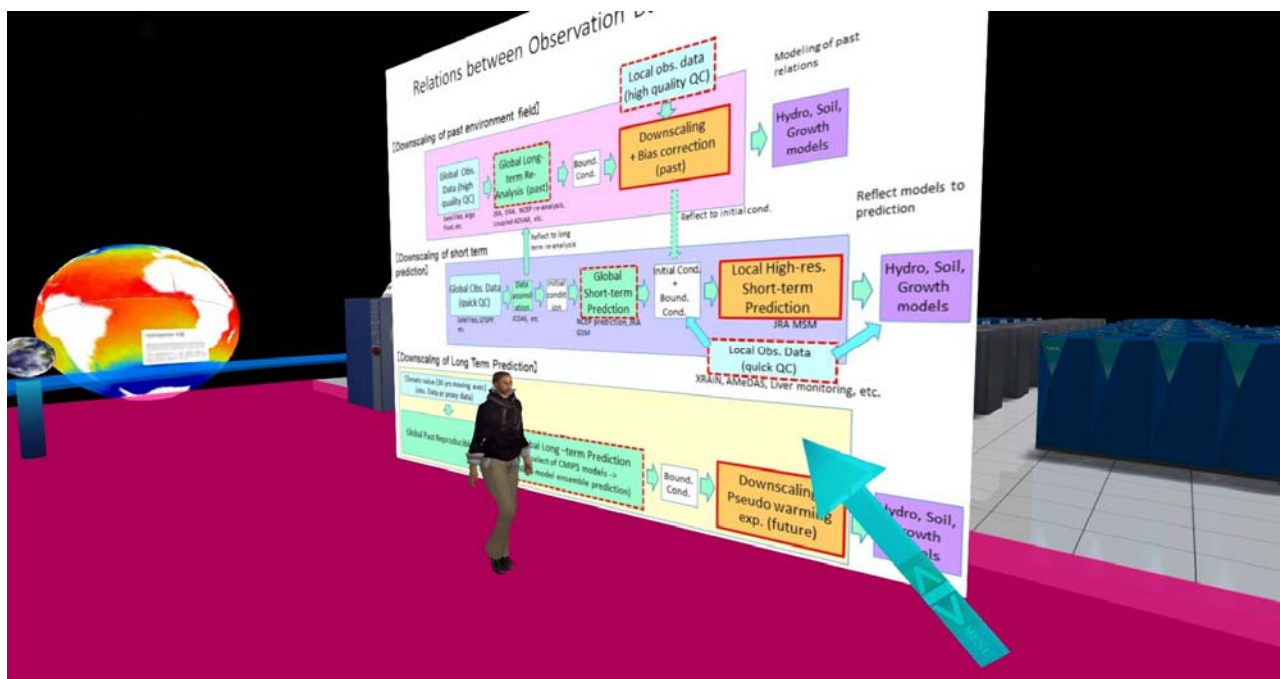
For decadal years, rainfall patterns will change, high immersion risk area will expand by sea level rise, and therefore we need to relocate farming land and cities and re-design infrastructures. This is **Sustainable society**.

Yan: At first, GCM (General Climate Model) modelers execute “Global Past Reproducible Experiment” and optimize parameters of each model by past data.

Then, run each GCM 50 years to the future. 27 instituts submitted such a data to ICPP, and user select several GCM which represent concerned region well, and make average from them, it is said “multi-model ensemble prediction”. and downscaling for development of adaptation tactics.

[07:48] Arianne: Here you can see what is DIAS

[07:48] Arianne: [http://www.editoria.u-tokyo.ac.jp/projects/dias.old2/projects\\_1a.php?locale=en\\_US](http://www.editoria.u-tokyo.ac.jp/projects/dias.old2/projects_1a.php?locale=en_US)



Yan: Summarization

- How to judge science results as one of citizen
- Climate is changing, but Affection/ impact of climate change is complicate
- Developing Country and UN's Sustainable Development Goals
- What we are doing to realize Resilient and Sustainable Society
- Collaborate with society

(Discussion)

[07:54] Arianne: Can we help Banuatu for alerting them evacuating by your woks?

[07:55] Chantal: You did wonderful, Yan!

[07:55] Wisdom: very good discussion and graphics

[07:55] Chantal: Yan's pdf will be on the website this weekend

[07:56] Vic: Thank you very much for the explanation of how supercomputers can predict climate change!

[07:56] Vic: The principal problem is not the data.... it is people.

[07:56] よおな: Why don't folks on an earth know that an earth is only one?

[07:56] Jes: Thank you Yan ☺ impressive as usual

[07:56] Vic: 1. People are afraid of change, particularly negative things.

[07:57] Vic: 2. People do not want to believe in negative changes they cannot control.

[07:57] Vic: 3. This is a complex subject. You either have to examine the data yourself or trust that most of the world's scientists are correct.

[07:57] Vic: 4. It does not matter what you think or want to think. It is happening anyway.

[07:57] Arianne: Nice presentation. I proud you as one of Japanese

[07:57] Wisdom: yes, a problem with our bias toward optimism

[07:57] Leif: very good presentation

[07:58] Cyrus: Denial

[07:58] Vic: Yan, you are a treasure!

[07:58] Jes: I agree with Vic ☺ you are a treasure to SL education, Yan

[07:58] Cyrus: Yes you are :)

[07:58] Vic: We greatly appreciate you work and global thinking..

[07:58] Leif: Where can we get the pdf and other materials from the presentation?

[07:58] Chantal: Scroll up open chat Leif...or visit the SC website later this weekend

[07:58] Chantal: Yan just pasted it

[07:58] Yan:

[https://docs.google.com/document/d/1-nyVJ1ZpcuumvYC\\_dy5rMEeZuQmHAYI10IFaL-D2Klg/edit?usp=sharing](https://docs.google.com/document/d/1-nyVJ1ZpcuumvYC_dy5rMEeZuQmHAYI10IFaL-D2Klg/edit?usp=sharing)

[07:58] Tooyaa: Ironically, technocrats may dictate a sustainable platform, "from the top down" but it is local communities who have to make it happen, "from the bottom up"

[07:59] Chantal: Great presentation, Yan ☺

[07:59] Jes: Oh I have already got the PDF, sent it off to our webmaster earlier

[07:59] Areyn: changes from below make more real difference

[07:59] Jes: will be up later

[07:59] Arianne: good works

[07:59] Vic: No one wants to believe in something that will affect their economy or population...

[08:00] Vic: Most of us will be able to see this happen in their lifetimes...

[08:00] CB Axel: Politicians don't want to believe in something that will affect their chance of election/reelection. :(

[08:00] Tooyaa: Stop using vehicles that produce CO2 emissions

[08:00] Arianne: We must think around our grandsons and grand daughters

[08:00] Areyn: Is there any concern that global warming may lead to a melting of the permafrost in the Arctic and release buried viruses and bacteria that we aren't prepared for?

(Yan: We already thought about risk of buried microbe on deep drilling project. Basically harmful microbe survives in animals or their surrounding environment.)

[08:00] Tooyaa: Eat more spinach!

[08:00] Wisdom: Do other countries have anything like our US climate reality project?

[08:01] Thief: not in my Country

[08:01] Arianne: In Japan, flu patients are less than usual year, by a bit warmer days

[08:02] Vic: **As Yan mentioned, release of methane in the permafrost will greatly increase global warming...**

[08:02] Areyn: It's okay, Yan :)

[08:02] Areyn: It's not easy to consider all risks

[08:02] Cyrus: Smaller icecap will provide less reflectivity also.

[08:03] Areyn: Thank you

[08:04] Akasha: 生存している人間に悪影響を及ぼす生き物

[08:04] Tooyaa: **Is there evidence of increased cloud cover accompanying global warming?**

[08:04] Vic: IPCC is international.... a good beginning for governments worldwide to agree on action

[08:04] Chantal: Wish I could understand your language, Yan...it sounds beautiful ☺

[08:04] Akasha: バクテリアなどに対するものである

[08:04] Arianne: Hazardous bacteria also involved into global warming, he explained it in Japanese

[08:04] Akasha: 日本語で 簡潔にチャットすると 英訳はグーグル先生がしてくれるかな ^ ^

[08:05] Vic: Time to get some sleep! Sleep well!

[08:06] Yan: **Vic, I sent you by FB message**

[08:06] Chantal: Thanks everyone for joining ☺ and Yan for the good presentation :)

[08:06] Yan: **pls read**

[08:06] Tooyaa: Thank you again for this informative presentation

[08:06] CB Axel: I'm amazed at how our computers can predict the changes that happened and those that are likely to occur in the future.

[08:07] Jes: PDF will be available asap, will share it via SC facebook group and page when it is

[08:07] Leif: Ok thanks

[08:07] CB Axel: Imagine what future computers will be able to do.

[08:07] Yan: **I need to consider lagging next time**

[08:07] Jes: No problem Yan ☺ we learn

[08:07] Vic: Nice to have so many people attending! ☺

[08:08] CB Axel: We need big data to figure out what to do about lag. LOL

[08:08] Jes: Indeed, very good audience!

[08:08] Areyn: a quick sim restart helps :)

[08:08] Arianne: We need more budget lol

[08:10] Arianne: I thought . instead of spend much in making new drugs lol

[08:11] Arianne: Got it

[08:11] Arianne: You need one more 京

[08:12] Arianne: Ok, thanks

[08:12] Areyn: Thanks again

[08:12] Chantal: Put some photo's on the SC FBb group page ☺

[08:14] Jes: Ok, sleep well when you go Yan. Thank you so much!!! That presentation was WOW!