

The Climate Change Portal, a science basis for ESD: Education for Sustainable Development in collaboration with RL science museum in Japan

Date and time: 7th Dec (Sat) at 7:00 am PST/ 15:00 GMT/ 24:00 JST

Tour guide: Hajime Nishimura, senior staff of Japan Agency for Marine and Earth Science and Technology (JAMSTEC). Yan Lauria in SL

Location:

- Starting point: <http://maps.secondlife.com/secondlife/Geoffroy/138/23/24>
- Chaos and climate prediction: <http://maps.secondlife.com/secondlife/Farwell/156/204/3501>
- Etopia: <http://maps.secondlife.com/secondlife/Etopia%20Island/191/54/23>

Participants:

Ari (Arisia Vita), Arianne (ArianneJP), Edgar Artaud, George Newberry (Mustang1943), Hades Nostram, Katja Luminos, Lovely Kass (StarKass), Mike Shaw (Shawza Tunwarm), Nat Ure (Nat Spirt), OptoMystic (Scottmerrick Oh), Stephen Xootfly

Organizers: Chantal Jager (Nymf Hathaway), Jawesome (Jes Cobalt)

Abstract:

Greta Thunberg, 16 years old, became famous since her solo school strike in 2018. Her movement is spreading in many schools in the world, and recently, she had a speech at the UN Climate Action Summit on 23 Sep, 2019.

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

Aside of her provocative words, "How dare you!", I was surprised how she understood IPCC latest special report on "Global Warming of 1.5 deg C" well.

But after her speech, she got not only lots of applauds but also lots of bashing from all over the world.

For example, above YouTube gets 44 thousand likes and 22 thousand dislikes. This is unusual number of dislikes for a girl's speech. I doubt haters' organizational operation.

Greta said in her speech, "... if you really understood the situation and still kept on failing to act, then you would be evil." It means she thought before that top-level leaders don't understand well so still kept on failing to act, but she came to doubt recently.

But I doubt not only President Trump but also any other top-level leaders really understood the IPCC reports because it is impossible for usual people to read and understand more than one thousand pages of full reports.

So I made a portal of science basis of Climate Change based on not only IPCC reports but also another latest resources.

There are many graphs and they are difficult for children. And Graphs are 2D, so it is not always necessary to use 3D space. But seamless 3D space can make possible to arrange them along their relations and help students to understand.

And I rezzed several teleporters where students can experience CO2 rich world in the past Earth, vulnerable nature and global situation of the present Earth, and also experience future sustainable society and learn how to predict the future Earth.

This portal could be developed through several times of remote classroom in collaboration with NPO co2sos and RL science museum in Japan, Sci-Pia.

1. Introduction

Yen: Hello everyone. Here is the home region of Japanese non-profit organization, co2sos.

Can you see a building with a dome on the roof? At sea side.

That is the virtual mock-up of real science museum in Japan, Sci-pia.



Yan: I had many remote classrooms for children at Sci-Pia, about whales and dolphins, space exploration and astronomy, Earth and life evolution, Joules Verne world and climate change.

We are standing at the “Climate Change portal” where people can learn about science basis of climate change for ESD: Education for Sustainable Development.



Yan: This is Gouguan’s famous painting, “Where do we come from?, What are we?, Where are we going?”



Yan: This is the same approach with climate change research.

So, I designed this portal as same way,
 1st floor is learning from past and present,
 2nd floor is future prediction and Impact,
 and 3rd floor is Action for the future sustainable development.

Yan: There are many graphs. Graph is difficult for children and 2D graph doesn't need 3D space,
 so it is better to teach them in real classroom.

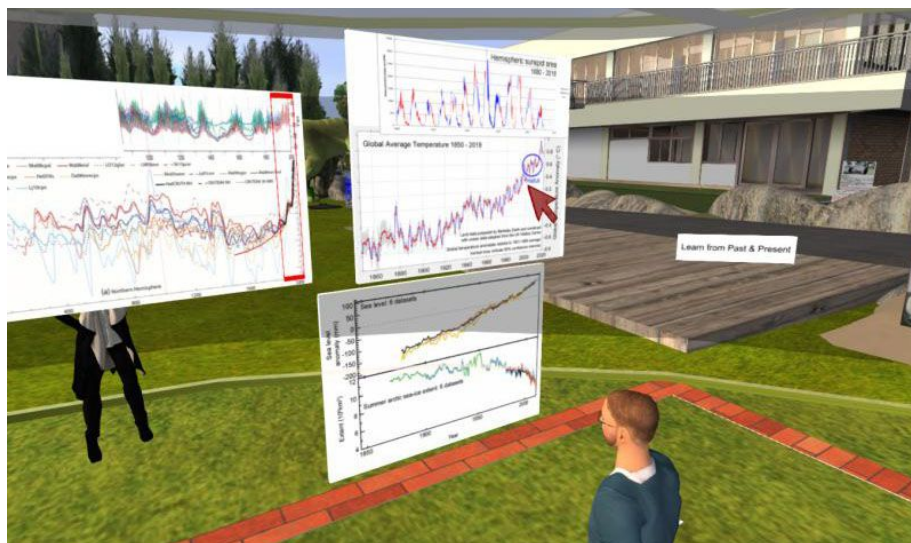
But there is an advantage that graphs can be arranged in unlimited 3D space to find each relations easily.

2. First floor: Learn from Past and Present

2.1 Learn from Past

Yan: Then, let's start "Learning from past".

This is global average temperature in the last 170 years.



<http://berkeleyearth.org/2018-temperatures/>

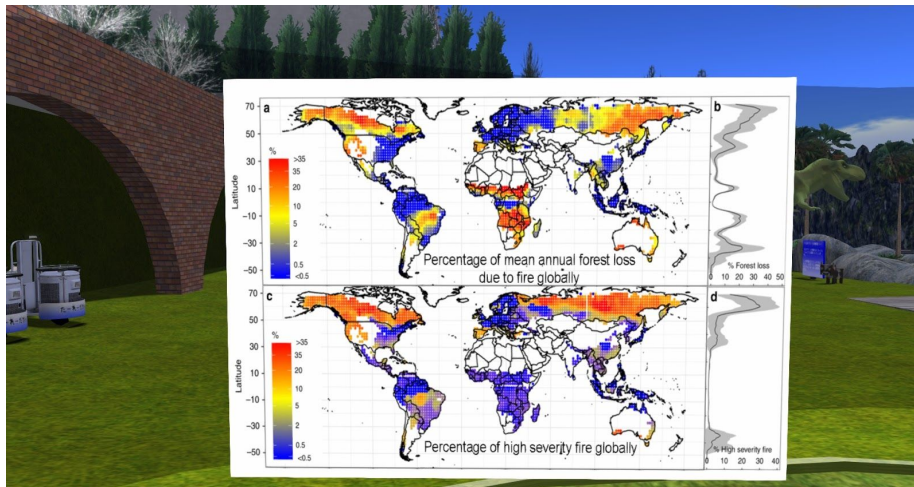
<http://users.telenet.be/j.janssens/SC24web/SC24.html>

IPCC/AR5/WG1

<https://www.ncdc.noaa.gov/global-warming/last-2000-years>

Yan: Here is the Hiatus. Few years ago, someone said global warming is a fake. Climate will go into glacial period in corresponding with decreasing of solar activity.

But now we can see temperature rising is continue and the Hiatus is only one of temporal stagnations.



Yan: Upper is the forest fire loss and lower is the severe forest fire loss. You know California forest fire.

In Australia, increasing is a little at the east coast.

I think recent long dry season is inter-seasonal change due to natural variation.

[07:14] Arianne: Poor Koalas.

[07:15] Jes: indeed :(

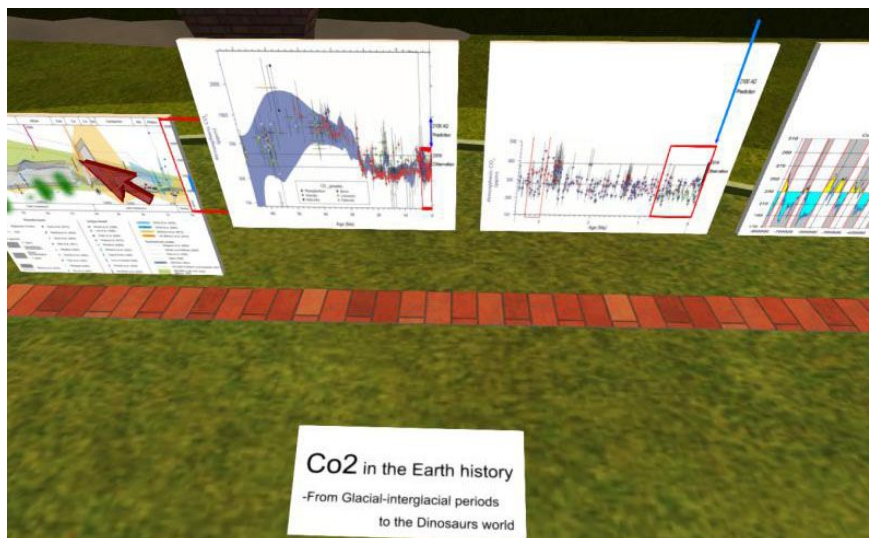
[07:16] Kass: yes

[07:16] Mike: yes

[07:18] George: What was this about corporations and bankruptcy?

[07:19] Kass: Great graphs!

Yan: Next corner is CO2 level in the long history of the Earth



Yan: First is 800 thousand Glacial-interglacial cycle.

Black line is recent observation data. So prominent.

And blue line above graph is extent of future CO2 level in corresponding with CO2 emission scenarios.

Yan: Gracial cycle is due to change of Earth orbit parameters mainly 40 thousand years and 100 thousand years, so it is said that 400 years ago is resemble with current days.

Warm period is long enough so don't worry about coming glacial period for at least 10 thousand years.

Yan: Next is 3.5 million years, human ancestors history. They experienced current temperature, but future prediction is extraordinary high.

Unmanaged future CO2 level can be same order of Cretaceous age, 100 million years ago, dinosaurs were walking, “Greenhouse Earth” without polar ice sheet.
 250 m sea level rise and 1/3 of land area was sunken.
 We can experience such a world, but we’ll pass today.



2.2 Present Earth- Vulnerable ecosystem

Yan: Next is “Learning from present Earth”. We can visit various vulnerable natures for climate change.



Yan: This is the teleporter to the “Field study centre at Bowness”, made by “National Institute of Education, Singapore”. There are Coral Breaching Simulator.
 This sim is designed based on Six Learnings curriculum framework, Learning by Exploring, Collaborating, Being, Building, Championing and Expressing. These are same idea of the Teacher Training Tower. So please visit later.
 And this is the teleporter to coastal habitats in Abyss Observatory made by Delia Lake.
 But we’ll also pass these two regions today.

[07:23] Arianne: These panels were made by Yan using a new scripting way.

2.3 Present Earth- Observation and modeling

Yan: Today, I’ll show you new exhibits of present Earth from space. Let’s teleport.

[07:24] Yan: <http://maps.secondlife.com/secondlife/Farwell/156/204/3501>

[07:24] Chantal: all to Farwell, please

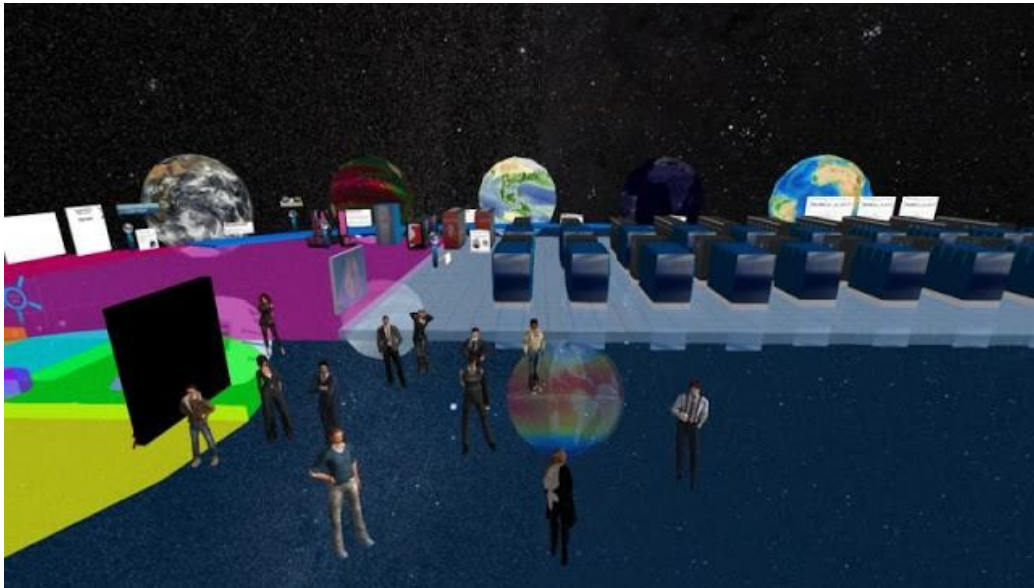
[07:24] Yan: please teleport

[07:25] George: We’re done here?

[07:26] Chantal: George, field trips take patience
[07:27] Mike: ☺
[07:27] Arianne: Thank you for your introducing Chantal.
[07:27] Chantal: ♥
[07:27] Chantal: Arianne
[07:28] Chantal: Jamstec
[07:28] Chantal: Marine biology institute in Japan
[07:28] Kass: Cool

Yan: Here is 3500 sky of Abyss Observatory.

These are Earth Simulator of JAMSTEC, Yokohama Institute where I am working



Yan: 1st Earth is satellite data which is most similar with true color from space.
Resolution becomes fourfold than before.



[07:29] Kass: The Earth is such a beauty

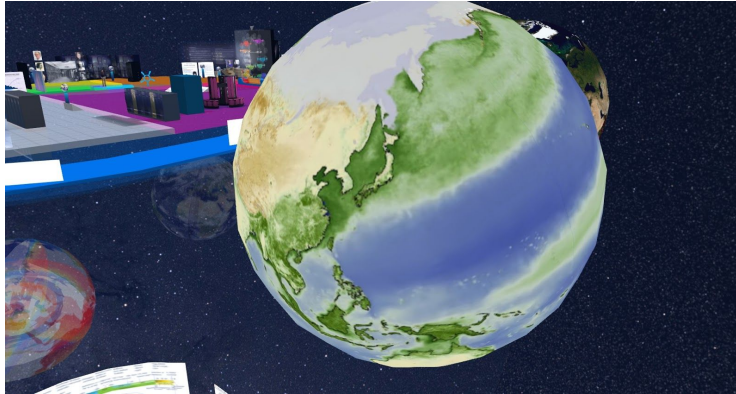
Yan: Please look opposite side. There are night side.

It is winter now so north pole region is under "polar night".

Please look opposite side, Antarctic region is under "Midnight sun",

To teach seasonal variation of vegetation and phytoplankton, it is need to teach "polar night" and "midnight sun"

Yan: 2nd Earth displays ocean current and sea surface temperature. Ocean current can't be observed by satellite sensors so this is simulation data calculated by the Earth Simulator.
Yan: 3rd Earth shows Vegetation and Phytoplankton, 10 years seasonal change.
Green color means chlorophyll observed by satellite sensors.



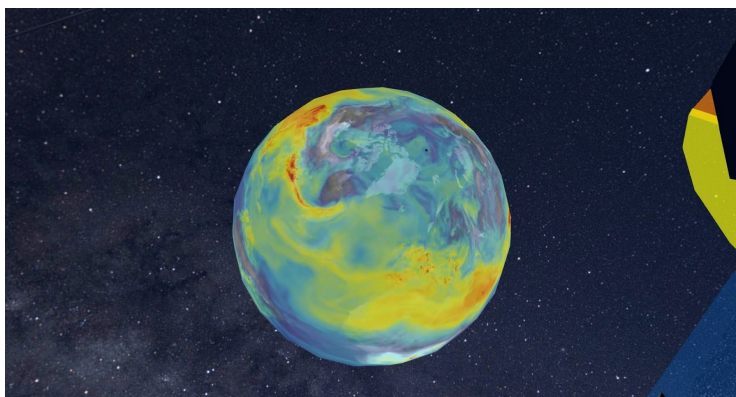
Yan: Please look down from the North Pole. In summer, very large area of Northern hemisphere becomes green due to midnight sun and long daylight, and in winter, becomes white due to polar night and short daylight. Change of green and white is so dramatically. Please remember.

[07:30] George: clever work
[07:32] Chantal: Great work!
[07:33] Arianne: Green work , too.:)
[07:33] Chantal: yes 😊
[07:33] Kass: you have to click
[07:34] Nat: don't look down
[07:35] Chantal: 😊 Nat
[07:35] Chantal: oh my 😊
[07:35] Chantal: did look down 😊
[07:35] George: The annual freezing and melting
[07:35] Kass: Fantastic

Yan : Next, let's go to opposite side of this floor.

This shows various Earth using numerical model GEOS-5 of NASA Goddard Spaceflight Center.

Touch this console, and select CO2. Wait a moment. This is CO2 concentration in one year.



[07:36] Arianne: ok
[07:36] George: Yes
[07:36] Stephen: That is sweet
[07:36] Chantal: Yes
[07:36] Kass: wow

Yan: January, February, March, April.....

CO2 is accumulating in the northern hemisphere.

China is emitting lots of CO2.

Although emission per population is a half of USA, population is sixfold of USA and China depends on coal very much, CO2 emission is 30% higher than oil.

June, CO2 is decreasing.

Large area of northern hemisphere, CO2 was disappeared.

[07:37] Kass: **how long does you have to calculate this scene with your computers?**

Yan: **Display is very easy by copy and paste from YouTube of NASA. I don't know how long did NASA/Goddard take time to calculate on their supercomputer,**

[07:39] George: Aside from the area around Brazil

[07:39] Chantal: incredible

Yan: Why does CO2 in northern hemisphere disappeared in summer?

[07:39] Mike: plant use of CO2?

Yan: Yes, reason is due to vegetation. Photosynthesis absorbed CO2.

So children can realize how human are emitting CO2 so much and also children can realize how vegetation can be affecting for Earth environment.

[07:42] Edgar: beautiful and sad at the same time

3. Second floor: Future prediction and Impact

Yan: Let's return to the climate change portal.

[07:42] Yan: <http://maps.secondlife.com/secondlife/Geoffroy/123/18/23>

[07:42] Chantal: Teleport again, please

Yan: And let's go to 2nd floor. Here is the Future prediction and Impacts.

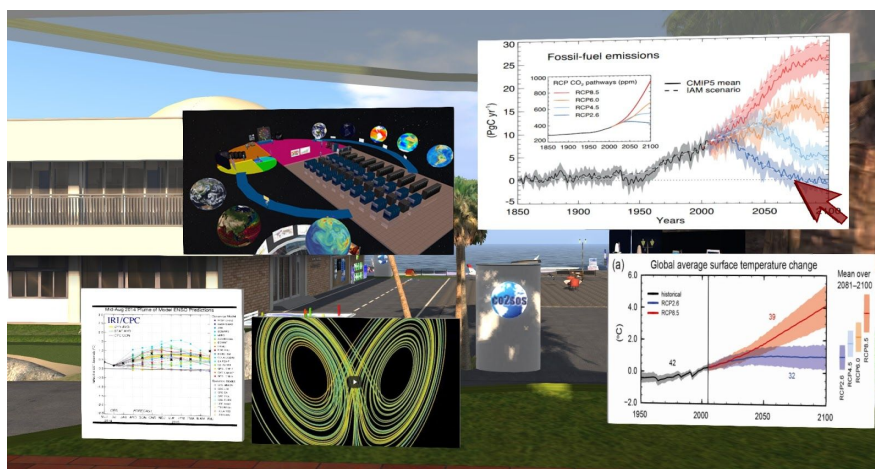
3.1 Future Prediction

Yan: This graph shows temperature prediction for next 80 years. Of course, prediction depends on CO2 emission scenarios in the future.

Blue is desirable prediction, Representative Concentration Pathways, RCP 2.6.

But this scenario needs considerable effort to realize zero CO2 emission until 2050.

And red is uncontrolled future, RCP 8.5.



IPCC/AR5/WG1

3.2 How to predict climate change?

Yan: President Trump says Global warming theory is a fake.

I don't know we can teach children why the theory is true, because it is impossible for children to read and understand more than a thousand pages of IPCC assessment full report. But these are minimum panels to teach how to predict global warming.

(Chaos and Ensemble)

Yan: Do you know Lorenz chaos theory or "Butterfly Effect"?

[07:50] Chantal: Butterfly effect?

[07:50] Kass: Strange attractors?

[07:51] Arianne:

https://19january2017snapshot.epa.gov/climate-change-science/future-climate-change_.html

[07:52] Chantal: yes

[07:52] Arianne: yes

Yan: Maybe you know, single weather forecasting result changes largely by slight difference of initial condition. So long range forecast is difficult.

But we can indicate the range of possible future by many forecasts. It is said as ensemble forecasting.

[07:53] George: Kinda reminds me of a string. Even lightly tapping the top of a hanging string, the bottom is greatly affected.

[07:54] Chantal: 😊

Yan: Can you see this panel? This is 9 months forecast of El Nino event.

X is observation and yellow thick line is ensemble mean of 17 models.

Yan: In almost cases, observation and ensemble is well coincided except in super El Nino event in 2015, one of decadal natural variations.

But scientists think Multi-model ensemble is useful for 20 years or 50 years long prediction.

Chaos theory: https://en.wikipedia.org/wiki/Chaos_theory

Lorenz system: https://en.wikipedia.org/wiki/Lorenz_system

Strange Attractor: https://en.wikipedia.org/wiki/Attractor#Strange_attractor

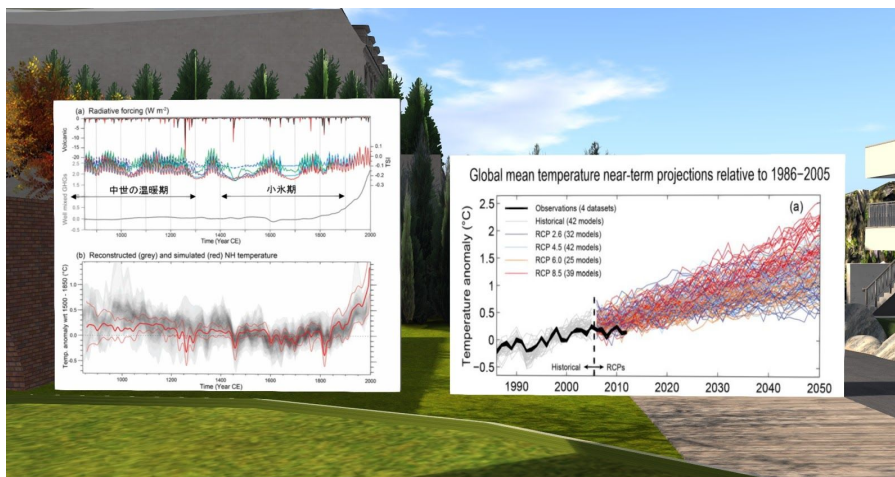
(YouTube: <https://www.youtube.com/watch?v=dP3qAq9RNLg>)

Butterfly effect: https://en.wikipedia.org/wiki/Butterfly_effect

Ensemble forecasting: https://en.wikipedia.org/wiki/Ensemble_forecasting

(Forcing and past variation)

Yan: Then, this upper graph is radiating forcing, volcanic, solar activity and greenhouse gas in the past 1250 years,



Yan: And lower graph, red lines are simulated by multi model and gray zone reconstructed temperature changes.

Red lines and grey zone is almost fitting. It means volcano, sun activity and greenhouse gas effects are adequately considered in models.

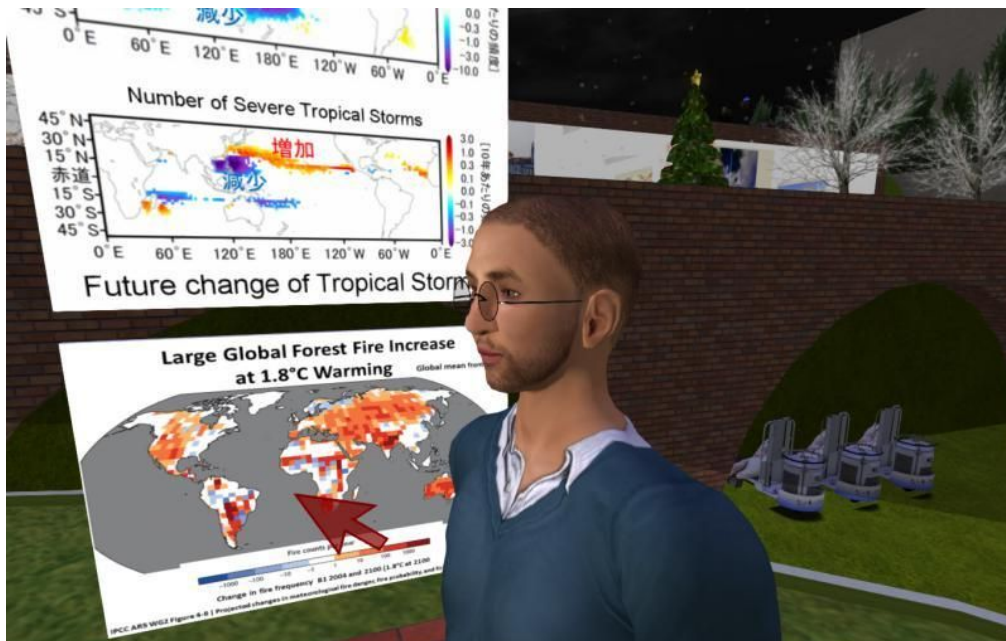
Next graph, in same condition of left panel, predictions are estimated by about 40 models in the world.

[07:58] Stephen: Probably not...

3.3 Impacts

Yan: Then next, I said warming is not always bad things. So, impacts for human society and ecosystem by global warming are next question.

This is future tropical storms.



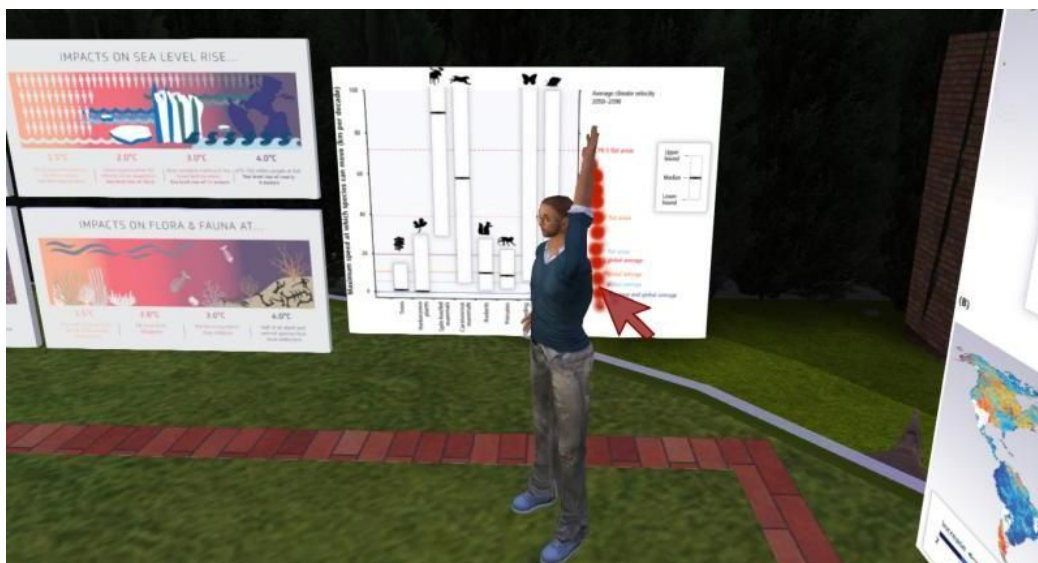
<https://www.dpac.dpri.kyoto-u.ac.jp/workshop/2017/proceedings/05-yoshida.pdf>

Yan: Number of tropical storms are decrease in almost land area. But number of severe storms are increasing near Japan and west coast of North America.

This result was obtained from 6000 years simulation by the Earth Simulator, Already, such a tendency is appeared in recent Japan.

Happy to say, for another regions, tropical storms are decreasing.

Yan: Last chart is about Ecosystem adaptation.



Yan: Each column is maximum speed across land of each species, and horizontal lines is speed of temperature across land of each CO2 emission scenario, and only RCP 2.6 scenario can avoid severe extinction.

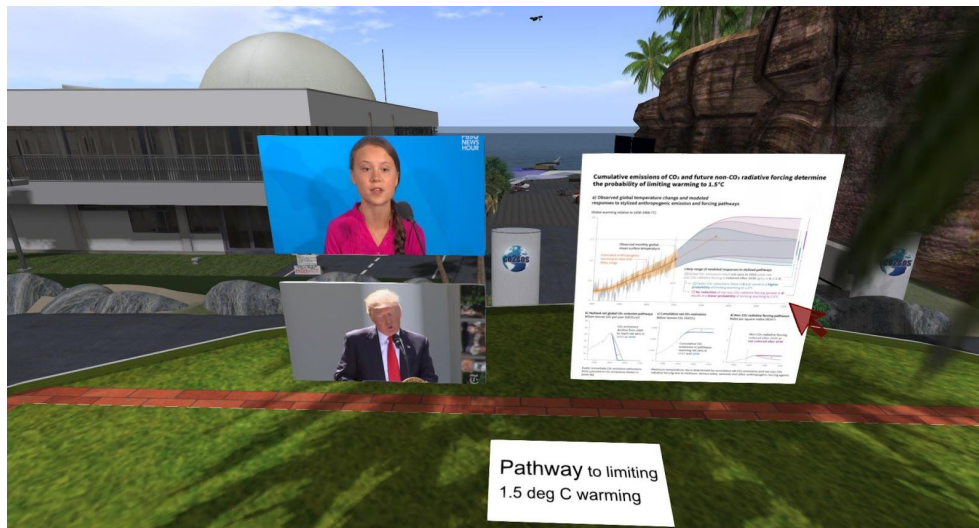
This is the major reason why scientists think “global warming of 1.5 deg C” is essential target.

4. Third floor: Action for the future

Yan: Then, let's go to upper floor. Here is “Action for the future”.

(Mitigation)

Yan: This panel shows the pathway to limiting 1.5 deg C warming.



Greta Thunberg talked about this at the UN Climate Action Summit in New York on Sep 2019.

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

On the other hand, lower youtube is President Trump statement in 2017 about exit from Paris accord for climate change.

[08:05] George: When I was taking my Earth Science class in college, a tree frog went extinct due to its idea climate being about 100 feet above its habitat.

[08:07] Kass: This is only CO2

(Adaptation)

Yan: At last, we'll talk about relation between Climate Change and 17 SDGs.

Pink frames is relating with vulnerable countries for natural disasters.

And Blue frames is relating with low carbon society.

This is the reason why this portal can be also science basis for SDGs.



Yan: Next, upper graph, CO2 emission per country, China becomes twice than USA
 This is why president Trump said Paris accord is unfair for USA.
 But lower graph, CO2 emission per population, China is half than USA.

Yan: Last teleport is to Etopia. This region was made for demonstration of low carbon society.

[08:09] Chantal: Etopia, I was looking forward to visiting

[08:10] Yan: <http://maps.secondlife.com/secondlife/Etopia%20Island/191/54/23>



[08:11] Chantal: oh neat!

[08:14] Chantal: Blue balls provide a walking tour

Yan: There are not only renewable energy but also water recycling system, bamboo bicycle and ecology of foods production. But not enough.

We need to visualize more ideas for sustainable society.

Then, I finished today's trip. You can walk around by this ride. And you can get detail information by touching bot avatars.

Thank you very much!

Is there any question?

[08:14] Arianne: Thank you Yan , nice presentation today.

[08:15] Kass: Fantastic presentation Yan

[08:15] Mike: Yes for a lovely presentation!

[08:15] Chantal: oh my

[08:15] Mike: ☺

[08:15] Mike: Thanks much!

[08:15] Yan: Thank you all for long time

[08:16] Edgar: Thank you very much, wonderful and sad at the same time, but lovely

[08:16] Mike: This region is really detailed and fantastic!

[08:16] Kass: **One question Yan: are you more optimistic or pessimistic that we can handle this problem? We have some other problems too...**

[08:16] Yan: I agree Edgar

[08:17] Yan: Lovely, I am special optimistic person

[08:17] Edgar: :)

[08:17] Chantal: Thank you Hajime, for this urgent subject at a very late hour for you!

[08:17] Kass: Aww, I wish I am ;-)

[08:17] Yan: **But I think we need to get angry like Greta,**

[08:17] Edgar: yes of course

[08:17] Kass: Even more I think

[08:18] Arianne: Even anyone optimistic or pessimistic, climate change will involve all mankind and other animals.

[08:18] Yan: **Don't think adaptation first.**

[08:18] Yan: **Think mitigation of CO2 1st, and adaptation 2nd**

[08:18] Kass: it will Arianne

[08:18] Chantal: Easy to use the walk and bicycle tours for your students as well, Edgar

[08:19] Edgar: Oh yes, :)

[08:19] Yan: **And we need to abandon Donald Trump.**

[08:19] Kass: lol, and anothers too

[08:20] Chantal: I think individuals have to start making better decisions

[08:20] Yan: **There are wonderful future without coal mining industries.**

[08:20] Yan: **like this region.**

[08:20] George: Solar, wind, and the like

[08:21] George: The trick is doing so without clearing wooded areas to make room for solar or wind turbines

[08:21] Yan: **we also need to abandon cow beef**

[08:21] Yan: **cows are emitting methane gas**

[08:22] George: **There's a solution to some of the methane**

[08:22] Yan: **Is there?**

[08:22] George: **Running the manure through methane digesters**

[08:22] Kass: **Methane from the Taiga/Tundra will be a mayor problem soon**

[08:22] Arianne: We need constant efforts to make promotions to the people, not only the head leaders. MrTrump is just one of people ignoring the scientific facts

[08:23] Yan: **Methan is short life time so easier than CO2**

[08:23] Mike: I should wander.... thanks again for a great tour!

[08:23] George: **There's the direct emissions from the cows, which cannot be fixed**

[08:24] George: **There's a farm I visited once that used a methane digester to fuel generators to power the farm, and enough to put energy onto the grid**

[08:24] Yan: Aha

[08:25] George: **The manure is moved by conveyor belt to the digester**

[08:26] George: **There are two sets of generators. The second set is for when the mothers are carrying their young, as they are generating manure for two... per se**

[08:26] Kass: **methane from the farm animals are one problem, slaughter them is another...**

[08:26] George: It's not a perfect solution unfortunately

[08:27] Edgar: :) really interesting I will be back here with friends
[08:27] George: **There are also trees that are better at absorbing methane as well. Norther softwoods being one of them**
[08:27] George: **More specifically, spruce**
[08:28] Yan: **I hope to visualize such an idea for sharing in SL**
[08:28] Katja: Trees are a nice approach
[08:28] George: English Ivy also absorb it
[08:28] Katja: Really?
[08:29] Yan: humhum
[08:29] George: Yes, I researched it when I was writing my term paper
[08:29] Yan: Good
[08:29] Katja: Did you write about where to target planting and species?
[08:30] George: No
[08:30] George: Part of it was on sustainable environments
