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[00:00:00] we'd like to thank Tom, uh,

for doing a podcast on the impacts of, uh, geothermal. Energy on climate, we have, uh, for

folks here today, uh, myself,

uh, James came as

Dr.

and

Brian cat and, uh, uh, 1st, a little, uh, introductory work is in

order here. I, I'm I'm a physical geographer

from George Washington University and the college of Southern Maryland. I'm retired. I have interest in geothermal

energy and its impact on climate. And the title of my

presentation is going to be the mid

ocean.

Geothermal flux impacts on the thermal circulation

and global climate. Uh, James

is a geologist,

the author of the books, play climatology theory and geological impacts on

climate. The title of his presentation today is [00:01:00] going to be

the plate climatology theory, how geological

forces influence, alter, or in some cases control Earth's climate and climate related events.

Dr. Wiss Yim is a geologist from the University of Hong Kong with interest in submarine volcanism and its impact on sea surface temperatures. The title of his presentation today is Geothermal Impacts

of Volcanoes, atmospheric,

uh, plumes and Oceanic Blobs. And finally, Brian Katt is a physicist and engineer

with interests, uh, on volcanism, paleoclimate,

and the physical bases of the volcanic and astrophysical influences

on climate.

The title of Brian's presentation today is,

do Submarine Volcanoes Change

Climate.

Art Viterito: Mid-Ocean Geothermal Flux

So today I'll be speaking about the mid ocean geothermal flux and its impacts on the thermohaline circulation and global climate.

, so the first slide is up there with the UAH global temperature average. For the past [00:02:00] 25 years, global temps have experienced a relatively small yet significant warming.

For the past 25 years, global temperatures have experienced a relatively small yet significant warming. Here is the average yearly global temperatures from 1979 to 2022 as measured by satellites and compiled by the University of Alabama Huntsville.

The prevailing school of thought is that rising levels of anthropogenic carbon dioxide are driving this increase. Now, two important features stand out from the time series of global temperatures. First is that the warming has been punctuated by distinct inflection points. As we can see here on the graph, we can see these two episodic jumps, one in 1995,

the other commencing around 2015.

The second point is that the, uh, UAH data shows that there's an uneven geographic distribution and rates of warming. There's a clear north to south gradient with the greatest warming occurring at the north pole. In this case, [00:03:00] the north pole is designated 60 to 90 degrees north latitude. It's the north polar region.

This phenomenon is well documented in the literature and is referred to as the Arctic amplification.

Now, these curves are from Hawaii and the South Pole, and they cast serious doubt on the CO2 as a control knob hypothesis. First, if the CO2 is rising steadily, Then why is the temperature increasing in a punctuated fashion? Second, if we have virtually identical concentrations of CO2, uh, at two distant points, the equator and the South Pole, why do we have a highly irregular geographic pattern of temperature increase?

So, these two things don't comport with each other. Furthermore, the models which predict the warming based on CO2 as the driver are woefully inadequate. Suggesting that a different mechanism is probably responsible. So here we see [00:04:00] the projections for global temperatures based on CO2 concentrations, which is the black line here.

And here we see the actual temperatures as measured by three different, um, uh, three different suites or ensembles of data, the UAH satellites, the RSS satellite, and the four different reanalyses.

Until recently, there's been very little research on the impact of geothermal heat and its impact on global temperatures. It has not been a popular topic for discussion, and we know that the vast majority of geothermal heat is emitted by volcanoes and hydrothermal vents in the middle of the world's ocean basins.

This is a, this graph is from Davies and Davies from 2010. And we can see these long linear stretches throughout the ocean where the, uh, crustal plates are diverging or splitting apart. Magma is able to rise up through [00:05:00] those fissures and give us these long linear zones of geothermal heat venting up to the, towards the surface.

Here we see a schematic of a hydrothermal vent. It's now thought that the mid ocean ridge system may have as many as 30, 000 vent fields. Um, a recent study showed that, uh, there is possibly one vent field for every two kilometers, and there's 60, 000 kilometers of ridge system.

And although we have very little direct measurement of the geothermal flux in the mid ocean ridge regions, also called the mid ocean spreading zones, a good proxy indicator is provided by the number of seismic events in these areas. And here we rely on a study by Davis, um, et al., published in Nature. It says, uh, seafloor hydrothermal systems are known to respond to seismic and magmatic activity along mid ocean ridges, often resulting in locally positive changes [00:06:00] in hydrothermal discharge rate.

Temperature, microbial activity and shifts in composition occurring at the time of earthquake

swarms and axial crustal

die conjections. Corresponding regional effects have also been observed. So we know that there's a very, very high correlation. I believe the correlation coefficient that came up with this is 0.

97. Is that the more seismic events you have, the more magmatic activity you have, and also the more, uh, geothermal flux that we have.

Now, if we plot the mid ocean seismic activity, and this is reported by the GCNT, the Global Centroid Moment Tensor Catalog, which is a complete catalog, they have zero or virtually zero sampling error, the Earth's mid ocean seismic activity, and corresponding with geothermal flux. Has a very similar stair step pattern to the global temperatures.

Additionally, there appears to be a two year lag, and that the [00:07:00] change in global temperatures lag the change in mid ocean seismic activity by two years. And let's notice this 1995 inflection point. And we see, in 1995, we see the first leg up, and then up to this, uh, first plateau, and then later a jump up to the second plateau.

We have direct evidence that the bottom waters of the ocean have warmed since the mid 1990s. Keep in mind that 1995 was that first inflection point, and we see we have a it's not an exhaustive list but certainly highly illustrative list of well researched peer reviewed literature that has talked about the.

Heating of the oceans, uh, at the bottom. So here we have one, uh, two, two studies for the Arctic Basin. Here we have one for the, uh, Pacific Ocean. Here we have one for the North Pacific. Here we have one for, uh, Antarctica, the Weddle Sea. [00:08:00] Here we have, uh, bottom water freshing in the South Pacific.

And here we see the

Southern Indian Ocean.

So again, not exhaustive, but highly illustrative that we have detected warming at the ocean bottom since the nineties. Now, we're going to put these two curves together. The global temperature is the blue curve, the mid ocean seismic activity here is the red curve, and this is them matched up year by year.

So in this case, the 1979 temperature reading is paired with the

1979 seismic activity reading and so forth.

So 79 is matched with 79, 80 with 80, 81, 81, and down the line. And here's what these two curves look like. Now, if we lag it by one year, so that the 79 temperature reading is paired with 78 seismic reading, we

see this, the two curves

start to match up better, and finally, if we factor in [00:09:00] a two year lag, here we see a very tight fit.

Between the mid

ocean side of the activity and global temperatures. And here we can see the the crenellations of El Nino and La

Nina show up very, very nicely. And we see a pretty tight correspondence between the tail, especially here in the more recent years. We see these two peaks. Correspond nicely, we see a nice correspondence of the peaks down here.

We hear it gets, uh, we hear the system gets highly energetic. We see the peaks correspond, but not quite as tightly as they do in the more quiescent periods. And here's where the rubber hits the road. If we do a regression

analysis of this.

Uh, regression analysis yields a strong relationship between mid ocean seismicity and geothermal flux in the global temperature since 79.

For the two year lag experiment, there's a correlation [00:10:00] coefficient of 0. 74, and that demonstrates that mid ocean geothermal flux account for nearly 55 percent of the variability of global temperatures. The probability of this is a 9e-06%. Um, that is, this is what is referred to as highly statistically significant.

And there's, there's really very little, uh, uh, wiggle room on this. The chance of

this, uh, just occurring as happenstance is zero for all intents and purposes.

Um, now, Ballarat, et al. Have shown that geothermal heating at the bottom significantly strengthens the thermal hay line circulation, the greater the geothermal flux, the greater the strength of circulation.

And this is this is a really important quote, and it appeared in the [00:11:00] climate of the past discussions. It says that although the ocean is largely heated, thermally drill at the surface, recent studies suggest that or ocean geothermal heating can also affect the ocean dynamic of heat budget. By spatially applying constant or variable heat flux in ocean general circulation models forced with the present day climate, it has shown that oceanic geothermal heating is a significant forcing that can weaken the stability of the water column, warm the bottom water, and strengthen the thermal haline circulation.

Now this is critically important. And here we see a number of other studies that corroborate this, and we see that the, uh, the conclusion of these studies again, although this list is not exhaustive, but it's highly illustrative, shows that global heating does have a significant impact, geothermal heating has a significant impact on the global ocean circulation. [00:12:00]

And this thermohaline circulation is illustrated here in this rather simplistic graphic and geothermal heating of the ocean ridges effectively energizes this, uh, this circulation. This is a circulation whereby the oceans circulate from top to bottom over a 1, 000 year cycle, and we have Uh, a system that is driven by density differences due to differences in temperature and differences in salinity.

This is well documented in the literature. This is a, uh, shall we say a well known or well established science. Well known fact in the oceanic sciences. Now, this is effectively a heat pump. And if we energizes heat pump, we can have an acceleration [00:13:00] of movement At the surface and underneath the surface, and we can, we're going to focus here on two choke points and the choke points that I think are of most interest here are, of course, the Arctic Basin, the North Atlantic and the Arctic, which is, if you will, it is a cul de sac.

It's a dead end to the thermohaline circulation. This is the point where surface water then starts to sink down to the to the bottom. We have a second choke point here in the Pacific, where we have the, uh, Indo Australian landmass, which serves effectively as a barrier to this flow that slows the flow down tremendously.

And we'll, we'll talk about these, uh, in more detail. First, we'll look at the Atlantic sector. And this is taken right from the Encyclopedia Britannica. We say here, a significant characteristic of the large scale North Atlantic circulation is the polar transport of heat. Heat is transferred in a northward direction throughout the North Atlantic.

This heat [00:14:00] is absorbed by the tropical waters of the Pacific and Indian Oceans, as well as the Atlantic, and is then transferred to the high latitudes, where it is finally given up to the atmosphere. This is again. This is well established science. The mechanism for this heat transfer is principally by the thermal haline circulation.

Okay, so this is Encyclopedia Britannica. And I've had people argue with me. Well, no, it's it's really caused by the atmospheric circulation cycle. No, it's not. Here, uh, this is well illustrated, um, that the, uh, the AMO, the, what's called the Atlantic Multi Data, Multi Decadal Oscillator, is positive when we have intensified flow.

That is, we are currently in this phase of a positive AMO, that is, we have a warmer North Atlantic, and this is well illustrated, um, and this, this flip to what we call the positive phase, like I say, warmer North Atlantic. Has was [00:15:00] initiated in 1995. We'll show you the graph in just a second. Uh, and that's the year that we saw a major inflection point in the mid ocean seismic activity.

Here's the graph of this AMO index. So here we see it flips in 1995 from a negative phase to a positive phase. We've been in that positive phase since 1995 and continue to be in that phase to this day. Now, here's a key study by Oziel et al that shows that the, the marine biome is shrinking. With increasing temperature and receding sea ice cover and is tightly connected to the lower latitudes for the North Atlantic by flowing northward through the European Arctic quarter of the North Atlantic waters, transport most of the ocean heat, which is again cited in the Britannica article there, but also nutrients and planktonic organisms towards the Arctic Ocean using satellite derived altimetry observations.[00:16:00]

We reveal an increase up to twofold in North Atlantic current

surface velocities over the last 24 years, which then

corresponds with 1996, the year after the inflection point. Here we see these, uh, currents in greater detail, the North Atlantic current. And here we can see a recent study that details the warming from 2000 to, whoops, I should say 2000 to 2022.

This clearly parallels the spatial pattern of arctic currents we see in this slide. So this is where most of this arctic warming has occurred. We see here that the, uh, the cloud cover is now able to, uh, has declined steadily since 1995. Again, 1995 is the, um, is the inflection point. We see that, uh, in 1995, we see changes to the freeze and break updates and, uh, advice in the Hudson Bay region.[00:17:00]

We see a rapid warming of what's known as the subpolar gyre that commenced in 1995. It's clearly demarcated on all these graphs. Here's what the subpolar gyre looks like. It is an offshoot of the North Atlantic current. Here we see that, uh, commencing In the spring and the fall, we see that the Arctic temperatures that is north of 80 degrees latitude suddenly took a turn higher, and we see that the winter temperatures also took a turn higher, but that turn was taken a little bit later on, uh, commencing in 2000.

So there was a bit of a lag here, but the fall and spring temperatures, 1995 was the inflection point. We see that the northern hemisphere sea ice also started to decline in 1995. This is clearly demarcated. This is from the National Snow and Ice Data Center out in Boulder, Colorado. Now the enhanced, so in addition to enhancing the flow of [00:18:00] heat into the Arctic, which is, it's well documented, I think, as I said, I, I have presented what I think of the most illustrative studies on this, the enhanced thermal haline flow will also cause more warm water to accumulate in the Western Pacific.

The physiographic and bathymetric features that region restrict the flow of the equatorial current, creating a vast reservoir of warm water, which is the driving force behind El Nino events. So here we see this north and south equatorial currents, uh, originating here in the eastern Pacific and moving all the way across the Pacific Basin until it, um, gets to the western, uh, the eastern shores of Asia.

And what this does is it enables heat to accumulate. And a warm pool of water known as the Western Pacific warm pool. This represents a massive store of heat that can be redistributed across the entire Pacific Basin when pressure wind conditions switch from a neutral phase to an El Nino phase. Here [00:19:00] we see a comparison of the 1993, uh, Western Pacific warm pool, which is the top image.

The bottom image is the, um, um, we see it in 2014, and this is under the neutral stage of it. It's not an El Nino or La Nina. It's in the neutral phase. And we see that the heat contact in 2014 is much greater. The number of terajoules is much higher in 2014 than it is in 1993. The area is also larger. In addition to that, we see that the thermocline started to go lower in 1995, and we see that the difference pre 1995, post 1995, a 10 meter difference in the depth of the thermocline.

The thermocline, of course, demarcates. Colder water from warmer water. So this Western Pacific warm pool has gotten larger and it has gotten deeper here. We see this Western Pacific warm [00:20:00] pool spreading out and which has given us that

this is the super El Nino of

2015. We see the heat redistributed across most of the Eastern Pacific Basin, all the way out to the international date lines and up and down the coast of North and South America.

We also see a strengthening of the what's known as the Kuroshio current and the Kuroshio extension. The Kuroshio current As the current that moves, it's the equivalent to the Gulf Stream for Asia. It moves upward here, um, on the, uh, shores of Japan, the eastern shores of Japan, and moves out into the central, north central Pacific.

So this is, this is well marked. Here we see our Indo Pacific Warm Pool, also, uh, another name for the Western Pacific Warm Pool. And what has happened is that, in a recent study by, uh, Adrian Lamb, We see it warms stems from the surface waters into the Western Pacific Ocean along the [00:21:00] equator, creating the Western Pacific warm pool, the current then takes us past the Japanese coast and then eastward at 36 degrees north latitude where joins the open Pacific Ocean.

tHese currents, the ratio and the shield extension are warming at two to three times faster than other areas of the ocean.

Ocean model studies and observational data show that the ker ratio current. Extension is shifting northward and increasing its transport capacity notes as that Western Pacific warm pool has, uh, increased in area and in depth. It's it's a larger store of heat, and it is now spilling over into the current at higher higher levels.

So, if we, this is a sea surface temperature snapshot from August. We see all of these things that we've talked about here highlighted very nicely in this. First, we see the, uh, Arctic amplification here. We see much warmer temperatures [00:22:00] up in the Arctic region as designated by the black boxes. We see a warming of the subpolar gyre here in this white circular area.

We see a warming and a more intensified El Nino, which we're having right now, which is now in its waning phase. And finally, we see a warming of the Curacao current. This, this to me is the most fascinating because that Western Pacific warm pool, what it does is effectively once it breaks up, it goes both north and it sloshes back and then eastward direction.

So it's a, it's a really fascinating phenomenon. I think this is the last piece of a puzzle I've been able to find in the literature. So in summary, We have come up with this, um, schematic that says that greater mid ocean geothermal flux, driven by greater mid ocean ridge seismic activity, intensifies the thermal haline circulation, and then from that, we have increased heat transport into the western Pacific, amplified El Ninos, Kuroshio [00:23:00] warming, and then finally higher Pacific temperatures,

northern hemisphere tropics, and exotropics.

From the Atlantic side, we see that the increased heat transport in the North Atlantic, Directly, um, it's the, uh, North Atlantic and Arctic oceans. And at the same time, we now have an interesting feedback of reducing the ice and cloud cover and that feeds back into the system. Um, uh, Joe Bastardi, a preeminent, uh, weather forecaster has also commented that what this has done is it's raised, uh, global.

Humidities and that the water vapor content is increased. And that is another feedback that we will incorporate into this. So we say ample, I think, uh, verification of this, uh, through both theoretical studies and through observational studies. I think we've got a working model here. Thank you.

James Kamis: The Plate Climatology Theory

Today, I'm going to present the plate climatoLogy theory, which states that geological forces influence alter, or in some [00:24:00] cases controls Earth climate and climate related events.

I developed the theory in 19 to 77, been working on it since started posting it. On 2014 so let's take a look at the 1st slide. We're going to look at some examples of how geological forces influence climate and climate events. We'll start with Antarctica. This is a picture. I'm sure you're a photo.

You're not, uh, have not seen about Antarctica. It shows Mount Erebus, which is 12, 448 feet high. It's erupting. It has been continuously erupting for the last 10 years. And it's, uh, one of the volcanoes that persists through the ice. A lot of people, when they think of the Antarctic, they see pictures that show, uh, flat ice, scientists leading into strong winds, snow and chenum, and everyone presumes that [00:25:00] that's the entire continent.

It's not. There's some geological, uh, strong geological things going on beneath the ice.

So on the left screen is an outline of the Antarctic continent. It's important to know that this continent is larger than the lower 48 of the United States, so it's pretty darn extensive. What we're looking at on the last slide is temperature, surface temperature, and you can see that West Antarctica, which is 25 percent of the continent, has very high surface temperature, and then East Antarctica, a lot less.

The boundary between West Antarctica, warm, and East Antarctica, cool, is very sharp. There's no, uh, fuzz across there. It's just bang. So why is that true? Because if there's atmospheric global warming, you would think that there would be an even temperature [00:26:00] across Antarctica. Another thing that's pretty important is the atmospheric temperature of Antarctica is minus 58.

7 degrees Fahrenheit. So really it's not global warming. It has to be something else. The slide on the right is the answer. to why the heat flow is so different. There's a large fault zone that has formed western arctica which is kind of a long peninsula and there's many many faults in there, volcanoes that are flowing heat, small geysers, and actually some of the secondary faults within this.

are emitting heat. So not global warming geology. So if we cut, uh, across West Antarctica, kind of slice it and turn it so we can see that slice, this is what it looks like. The reason we can get such a good image is because we have shot sound waves to [00:27:00] the subglacial Geology, and it shows a really exact image here.

Lots of faults, uh, secondary faults, which you just talked about. And the overlying glacialized at the top, you can see there is very flat. And that's what people think about it. Really. One of the most important ones is a 14, 400 foot deep Canyon. They discovered it, uh, about four or five years ago. It's deeper than the Grand Canyon and more extensive.

This is what the geology looks like. Under West Antarctica. So we're going to start, start in the northern part of West Antarctica and look at several specific examples. This one is the South Shetland Islands. You can see they're marked kind of on the left central part of the right screen. The Shetland Islands has an active caldera, kind of collapsed volcano [00:28:00] in it.

This is what it looks like here. There's still geothermal hot springs on the bottom of the bay and on the edges of the bay there's hot springs that tourists visit on their first cruise to Antarctica. On the right slide you can see Red circles that was represent earthquakes back in October of 2022.

This part of the Shetland islands experienced 85, 000 earthquakes. So that's quite a bit, and it was formed by movement of a volcano at that junction, two long junctions.

So now we're going to move down to the central part of, um, the Western Arctic Rift. And what this shows is, uh, [00:29:00] black lines, uh, with hatch across it. That represents the outline of the rift, uh, anetic fault, sometimes called the rift zone. And you can see some red outlined blobs. These are the hot, extreme hot spots within the, uh, rift or fault zone.

Now I did show you that a lot of it has high heat flow. These red circles area are extremely hot. So, you may have heard. A lot of media talk about glaciers that are melting in Antarctica. One of them, you can see on the left slide, is marked Pine Island Glacier. The red represents tremendous thinning in the overlying glacial ice.

Uh, and actually, uh, the, the thinning from the bottom up. So this glacier has been tote a touted as, uh, the poster child of climate [00:30:00] change for many years. I don't know if everybody remembers that, but the media and scientific studies have emphasized this over the last year or so, well, um, it's geological.

It's not true on the right slide. You can see what is a mantle plume. We'll talk about that in just a minute.

Um, another Glacier on the left side is marked as the 40s Glacier and again in red has extreme heat flow again proxied by ice changes. This one has recently on the media been termed the doomsday Glacier. I'm not sure why it's characterized. It's that because there are Really strong features, uh, information that shows there is very, uh, large heat flow beneath it.

The University of Texas. Which looked at this Marie Bird mantle [00:31:00] plume, showed that the heat flow underneath the ice is three times normal heat flow for continents around the world. University of Texas, um, other research studies have shown that this area, one of them is the BBC, uh, have shown that this area is extremely hot.

So let's, again, move over to the right screen. Um, this shows a slice, slice through the entire Earth. It shows a plume of molten, uh, molten lava coming up from the core. The core is that, um, red, uh, circle down there. And molten lava starts coming up from the core. And the ring of the core is about 1, 800 miles down from the surface.

So this molten lava pushes up. Hits the crust or the surface rocks, and then the molten lava [00:32:00] pushes out and makes its way down to the, um, to the core. This, um, mushroom shaped feature is called a mantle plume. The mantle plume has a lot of effects on the surface geology of, uh, the Earth. So, another thing on that right hand slide, if you look at the marks, The letters that are called the ocean layer, that's the thickness of all the oceans across earth.

So you, it's in the perspective, the image there is actually to scale. So you can hardly see the thickness of the ocean. Then there's another layer there that shows land. Uh, so again, it's so minute that it really just is almost nothing compared to these mantle plumes. To me, uh, [00:33:00] that's another strong indication that geology really has a great influence on, uh, our atmosphere and our oceans, our climate and our climate related events.

Also on that right slide, you can see in red what's called a pull apart fault. So on occasion in certain areas on Earth, these mantle plumes Uh, puts tremendous stress and push through the crust there and through the ocean. What results is the, the earth surface, uh, separating. So this separation, uh, has a movement component to it.

So I'm sure all of you have heard about, uh, continental drift. Uh, sometimes called, uh, plate tectonics, this is what drives, uh, movement of the entire continents. It also, uh, [00:34:00] as we've talked about, pushes up through other areas. Um, its pressure is enough that it pushes up geological features from the ocean and from the land.

Uh, all sorts of them, like we've talked about, active faults, um, lava flows. And all sorts of things that push through the United States. Oh, excuse me, the Earth. So we're going to switch to El Niño and La Niña here. As has already been talked about by Art, the El Niño on the left is a warm phase in the Pacific Ocean.

So, the boundary of an El Nino is very strong, you can again see that the change from warmed phase in red to the cooler phases on the outer sides of that is pretty dramatic, and there is one source point for that. All the El [00:35:00] Ninos in history, since they've been recording them, have originated at this exact same point, and have this exact same shape.

So, uh, I know that in the media and some research studies, which are done by very intelligent, hardworking people who believe in their research, that these, uh, that the El Ninos are increasing in strength and duration, turns out that's not correct. When you look as much data as you can, certainly there are some little blips in it, but overall, uh, El Niño and La Niña have remained the same.

Looking at the La Niña in the center here, the cool water phase, it mimics the warm phase. Uh, the cone shape and their strong changes from cold phase to warm phase on both sides. So the cone shape there is [00:36:00] similar. That really, again, doesn't fit. With this glowing, uh, going on in the ocean, temperature increases and atmospheric, uh, changes the atmospheric change, uh, since 1880 has changed about 0.

2 degrees Fahrenheit per year. Point two degrees. So not a lot in the atmospheric change. I mean to say same thing with La Nina. You really wouldn't seen these rapid changes. So another thing to consider is that, um, the changes happen very rapidly. And if we have global warming with no change, it seems unlikely that these would happen.

One other thing here about La Niña and El Niño is that they change pretty rapidly in many cases, so that change being rapid cannot be accounted [00:37:00] for again by this uniform atmospheric warming. So on the right slide is an analogy to the fixed point of La Niñas and El Niños. This, in red triangle, is an erupting volcano.

The image, or the photo, is taken from space by NASA, and you can see that as the ash expulses from the volcano, it forms this cone shaped. Absolutely identical an indication of geology. This may amaze you. It amazed me. The scientists who've made these statements about El Nino and La Nina, uh, have said that they don't know what the origin of these is.

That's amazing, right? I'm sure that you have, uh, read a few media and media videos [00:38:00] that say when they In El Niño or La Niña form, the trade winds change, and of course, the water temperature change. So, they always use the word when. They don't ever mention the origin or the cause of these El Niños and La Niñas.

They certainly say that there's all sorts of dramatic changes, um, in all sorts of things. death of some of the, um, reefs, the Great Barrier Reef. Uh, all sorts of changes in, uh, migration patterns, uh, marine, and in some cases atmospheric, uh, changes. Uh, when you look back on this, they don't really mention.

But there are many civilizations in the, uh, Central America and, uh, uh, Northern South America got hit with droughts, and that's why those [00:39:00] civilizations had to move, uh, farther south and get to, uh, The middle part of South America. So I just think that, uh, if some of this that I'm talking about was be shared with the media, it would give people the possibility to understand a plausible alternative explanation for these two phenomenon. We'll spend some time talking about ice ages, so they're really not ice ages, they really are time periods where the glacials melt. On the right, uh, every hundred thousand years, there is pulses of heat that melts away the, and those heats are from, uh, volcanic activity. Let's wrap up by talking about the validation.

Of the plate [00:40:00] climatology theory. Again, I originated in the 1970s. Seven. The University of Cambridge on June 2023 came out, their conclusions of their study was all climate models need to be updated, all climate models, and they have failed to include volcanic activity in the models. Of course, they have stated that the large volcanoes erupt and they change the climate.

But what they found out was even some of the supposedly extinct and smaller land volcanoes. Um, really contribute to it won't get into detail here cause I'm running out of time, but the university of Vermont, uh, released a study in 2023 that Greenland was ice free at 2000, uh, 289 parts per million today, it's 414 parts per million.

So it looks like really that [00:41:00] CO2 in many cases did not, it's not the reason of melting a lot of this ice. University of Oxford Fever. Uh, the study in 2023 says that they found a lot of rock layers across Earth. Then instead of absorbing, uh, CO2, they were omitting CO2. Last thing is the high resolution, um, effort started in 2019 to, uh, find.

Thousands and in some cases millions of geological features on the ocean, which represents 71 percent of Earth, have not been recognized. So this study has recognized them. If you want to look at a lot more in detail of everything I've said, I would refer you to my latest book, Geological Impacts on Climate.

If you type that in and hit, uh, [00:42:00] Amazon, you'll be able to get to it. Or you might want to go to my plate climatology theory. My over 100 articles talk about many other ways that geological features, uh, affect climate

and climate related events. Well,

thank you. Hopefully that was a little interesting. I'm also appreciative that Arthur has put this together and allowed us all to use it.

Um, greatly appreciate that. Okay.

That's it.

Wyss Yim: Geothermal impacts of volcanoes

So my topic. Geothermal impacts of volcanoes, and I'm going to use observation records to look at geothermal heat released from volcanoes through atmospheric plumes and oceanic blobs.

Basically, we have three types of [00:43:00] volcanic eruptions. The first type are the subaerial or terrestrial type, and this is geothermal warming initially at least. In the subarea eruption, followed by cooling, but we must not forget lava flows into the sea can also heat up the oceans. The changes taking place are summarized in note form.

So, all these have been found with some examples. The second type, which is much more important, are the submarine volcanic eruptions. And basically, these are geothermal warming of seawater to form hot surface seawater in the oceans. Often be mistaken for global warming. So this generates sea surface temperature anomalies and all these associated changes, [00:44:00] including polar sea ice retreat, green and ice sheet melting.

I have examples of some of these having reported in different places. The final type are the mixed volcanic eruptions. So most submarine eruptions eventually may lead to the creation of a new island. So the submarine eruption generates an oceanic block, but once the island is formed, an atmospheric plume may develop.

So it's a mixture of combination of one and two can be found.

Most climate change are regional, and these are some of the changes taking place in different parts of the world, together with the monsoons. When volcanoes erupt, either on land or under the sea, [00:45:00] it changes the conditions of these regional forces, and this is the basis of it. I won't have time to go through any of these, I think Art has covered many of these already.

In my subaerial volcano model, basically, it's a reduction of solar radiation leading to the end product cooling, while initially the plume can warm up the atmosphere. Volcanic eruptions of this type is great for forming clouds. It releases various gases. Very important is Sulfur dioxide, which has solar radiation impact, but the scale of the eruption is also quite important.

It's measured by what is called the [00:46:00] Voxplosivity Index. And this is the scale we have from 0 to 8. The Yellowstone eruption 600, 000 years ago has a scale of 8. And the biggest eruption in the last 100 years or so is Pinatubo in 1991. It has a scale of 6. If we have a VEI 2 event, already we can usually see some regional impacts on weather.

Some impact factors that we need to look at that may be important is the location of the volcano, the cloud formation, the plume height, the VEI, the timing duration, history of the eruption, the weather conditions at the time, input of solid materials. Very important is the input of [00:47:00] water vapor, which is a much more important greenhouse gas than carbon dioxide, input of gases, including sulfur dioxide, hydrogen chloride, as well as some carbon dioxide, as in the case of some Iceland eruptions.

We are fortunate to have satellite tracking to observe the volcanic clouds from sub aerial eruptions as they disperse all over the globe. El Chichon was one of the first eruptions that we are able to track the volcanic clouds circling the globe in 21 days.

I have listed here some of the climatic impacts of selected atmospheric plumes. The first eruption at Gong, we do not have satellites in those days, but [00:48:00] from the excellent reports we have, I became interested in explaining Hong Kong rainfall. This is how I got started my interest. 1963 was the driest year on record since the year started monitoring rainfall in 1884 in Hong Kong.

And basically there are reports of global temperature decline in Hong Kong where I'm in. It was the driest year on record since 1884. And the cause of this, I've looked at the wind shift, was predominantly offshore wind, causing very dry conditions. Water questioning, four hours water supply in four days.

That's how bad it was. 1982 was the first eruption we had satellite observations to track the volcanic cloud. [00:49:00] These 1982 eruptions circled the globe in 21 days. There was a global temperature decline, and it turned out to be the second wettest year on record since 1884 in Hong Kong, again because of my local interests.

I became very much interested in this. While Pinatubo in 1991 erupted as a VEI of 6, but the same year there was also another Chilean volcano, Cerro Hudson, later that year, which is also VEI 6. But basically, that year, we have large volume of water vapor entering the stratosphere, assisted by a passing typhoon at the time, called Typhoon Yanya, and the global temperature dropped by almost half a degree Celsius.

And that year also turned out to be the 11th driest year on [00:50:00] record in Hong Kong. So it helps to explain Hong Kong rainfall.

The Chilean volcano Chi 10, which has a EI of five, you can see the plume height in the next column. It led to the aerosols from the volcanic cloud going around the world. It passes Argentina coast, Indian Ocean. The

South African continent and parts of Australia, causing some of the airports like Adelaide and Melbourne to be shut.

But the second time around the globe, it came to Hong Kong after 35 days. And this fitted in with the sulfur dioxide e folding time discovered in Pinatubo. So this is [00:51:00] really interesting for me. The rainstorm we had on the 7th of June 2008. was the worst in Hong Kong's history, resulting in 2, 400 landslides on one island, and was the wettest on record since the year 1884.

So it's able to explain all these unusual rainfall in Hong Kong. In 2010, in the Caribbean, the Soufriere Hills volcano erupted in Montserrat, and we had been lucky enough to look at the satellite tracking of the eruption cloud. The eruption time was 11th of February, 2010. Day by day tracking shows that it led to frontal activity storm in [00:52:00] Madeira, which is a colony of Portugal.

The exact timing of it matches perfectly. And when it hits Western Europe, we have cyclone Cynthia causing storm surge flooding and wind damage in Western Europe over a three day period. So that was really exciting. We are able to track day by day. And basically the eruption occurred in winter time in Northern Hemisphere.

And the warm sector was excavated by the volcanic cloud, making it even hotter. So the North Atlantic was very cold, so this frontal activity storm led to all these damages that we've seen in Europe and Madeira. The same year, Iceland had a volcano that erupted [00:53:00] on the 14th of April. I call it Yi 15 because I can't pronounce it.

This has a VI of 4. It only went up 9 kilometers. But the transfer of moisture into the continental interiors was amazing. Without the volcanic cloud bringing frontal activity systems. Occluded fronts into Central Europe, we would not have all these major flooding in Central Europe, including Slovakia, which had the wettest year since 1881.

So Central Europe was severely flooded as well as Pakistan and China. So penetration deep into continental area is brought about by these volcanic clouds. Severely cold winter also in Eastern North America and Northern Europe also occurred. [00:54:00] More recently, the Tonga eruption, Paya Paya, so in 2022, This actually started off as a small submarine volcanic eruption.

The temperature anomalies is not particularly large, so it generates the blob initially. But then on the 15th of January 2022, we had this huge sub aerial eruption that went up 58 kilometers above sea level. And the large volume of water vapour entering the stratosphere led to, within the same month, record rainfall and severe flooding in eastern Australia and New Zealand.

So I just have time to show you an example of a plume, and this is the one for Pinatubo in 1991. [00:55:00] Now the eruption, the major eruption occurred on 14th of June, so five and a half month has already passed that year, and yet the annual rainfall in Hong Kong was still the 11th driest, and based on study by other workers, They discovered the e folding time of sulfur dioxide was 35 days.

So usually after 35 days, something interesting happens if you are able to track the eruption cloud, where it got to. And this usually brings about heavy rainfall.

You can see in this image, the white cloud system surrounding this blue cloud system over here. So this is the eruption taking off at the beginning stage. The typhoon [00:56:00] cloud reached a height of about 12 kilometers maximum, but eventually the volcanic eruption cloud shot up to 55 kilometers, basically overwhelming it.

But with the typhoon cloud is able to provide lots of water vapor transferred into the stratosphere. So perhaps making it a global drought year and some quite unusual event, including heavy snowfall in the eastern Mediterranean during wintertime and so on.

Now the submarine volcanic model to form oceanic blobs is shown here. Some examples. In the North Atlantic, El Hierro, which is a volcano in the Canary Islands, erupted for six months from October 2011 to March [00:57:00] 2012, and that led to some major climatic events in the North Atlantic basin. And earlier, Tonga eruptions, Tonga has been particularly active.

We've studied Tonga eruptions from submarine eruptions initially three times. And each time it forms a hot water blob, which I've named South Pacific blob. This is an earlier one, in December 2014 to January 2015. So it's over the southern hemisphere, summer. And then the one that's particularly interesting is Nishinoshima in the North Pacific Ocean, 940 kilometers south of Tokyo.

And this is a long lasting submarine eruption, eventually changing to a mixed eruption after a new island was created. [00:58:00] And this erupted for two and a half years. creating what is called the North Pacific Block. So the impacts I've listed here, hot ocean water on the sea surface, pressure changes, surface wind changes, sea level changes, ocean current changes, As well as impact on polar sea ice because the Pacific and the Atlantic is connected to the North Pole and the South Pole.

We found instances where the retreat was greatest when there's a block close to it.

We're lucky enough to have this Argo network of data buoys since the early 2000s. So this provides temperature and salinity profiling down to a depth of

2, 000 meters. So it's a very good way of confirming SST provided [00:59:00] by satellites, which is available from NOA in the present day, I think for Coral Watch.

So we can at least look at the sea surface anomalies, how big the temperature differences from the normal. So we have about 4,000 of these data boys. So if we have assembly, eruption, forming, hot surface sea water, this is one of the ways of. Confirming it. Impact factors of oceanic blocks are summarized here.

It depends on the location of the submarine volcano, seabed depth, the timing, duration, and history of eruption, oceanic conditions, the number and distribution of vents, magma composition, basaltic magmas, much hotter. Well, acidic magma [01:00:00] is usually more explosive, and then the composition of gases and so on.

But every volcanic eruption, whether it's on land or under the sea, is different. Until we study it, we just don't know. Some examples of oceanic blobs that have been studied are shown on this table. So the 2012 El Hijo, which I mentioned already in the North Atlantic Ocean, it led to record low sea ice.

That year in September, and it's the wettest summer in England and Wales in 100 years. Severe summer melting of the entire Greenland ice sheet, which is reported in Nature magazine. Extremely active hurricane season, including Hurricane Sandy. Estimated damage 65 billion US dollars. [01:01:00] 147 fatalities. Most severe drought in Central North America since 1895.

We can explain all these. The North Pacific blob is a long lasting one. So it lasted almost two years from 2014 to 2015, still to this submarine volcano initially in Nishinoshima, 940 kilometers south of Tokyo. It was also responsible for retreat of Arctic sea ice. A much more gradual decrease, not as greatly as in 2012 with

El Hierro, but the retreat has taken place in Bering Strait, which is next to the North Pacific, the hot water block that was created.

We are two years without winter in the Northeast Pacific area. Ethnological changes, including [01:02:00] mass mortality and algal blooms, to some people, the sign of global warming to come. It's also the major contributor, if I, based on my thinking, of the 2014 2016 ENSO. But quite a number of volcanic eruptions were involved.

I think I have reported it elsewhere. Over the North American interiors, we had polar vortex during the winter, and this is because of the blockage due to the North Pacific block. 2014 to 2015, hunger erupted as a submarine volcanic eruption at the beginning. This was responsible for super cyclone clam, which devastated Vanuatu.

It's also a contributor. One of the contributors that we identified for this 2014 2016 strong and long ENSO. [01:03:00] Southwest Indian Ocean, due to this volcano near Madagascar, to the north of it, Mayotte, reported by the French oceanographers, record breaking typhoon season, intense tropical cyclones, disastrous wind damage, heavy rainfall, and severe flooding.

Then another South Pacific blob occurred in 2019 to 2020. This is actually a much stronger blob compared to the latest one. Two volcanoes, one is just called Volcano F and the other is Laetitia. It led to record temperatures in Antarctica over the Aspira base. We've reported in a blob. Antarctic cis melting was also really rapid in February, 2020, so it's a case of [01:04:00] oceanic blob causing this.

If you ask me based on the evidence that we have found. Then in 2021 to 2022, the summary and eruption for hunger higher pie. Which is rather short. It started in mid-December, and the temperature anomalies was rather small compared to 2019 to 2020 2019, 2020. The anomalies as much as six degrees Celsius.

While compared to 2021 2022, only two degrees Celsius different, based on the SST, we still have record rainfall, severe flooding, and landslide in New Zealand by the end of January, after the sub area eruption on 15th January. Of January 2022, and it's a contributor [01:05:00] to the linear conditions due to the warm pool, shifting to the West Pacific.

So, this is just one example of the North Pacific blob on January 2nd, 2014, when it was well developed off the coast in the Northwest, Northeast Pacific, Nishinoshima is located at the red triangle. So this has been active for 30 months. The earliest sea surface temperature warming that we were able to locate was March, 2013, and the submarine eruption subsided in August, 2015.

Well, to finish off, I have this model of the 2021, 2022 Tonga eruption. This is a simplified model. [01:06:00] So basically the submarine eruption is not so hot, but once it changed into sub aerial eruption, we have very heavy rain in the area because of the enormous height of the plume went going up to 58 kilometers, and this led to rapid cooling of the oceanic block.

And associated changes, we have upper atmospheric circulation changes, including jet stream meandering, the creation of atmospheric rivers due to the huge volumes of water vapor transferred into the stratosphere. So the input led to cloud formation, trade winds increases, cyclone formation, record rainfall, and then the change into the linear conditions because of the low pressure over the area.

Okay, just to conclude, geothermal heat [01:07:00] released naturally through submarine eruptions, through volcanic eruptions, in combination with the sun. The sun is always there to play its part because of the timing of the eruption. It's an underestimated cause of both regional warming and cooling. Atmospheric plumes predominated by cooling are generated by sub aerial eruptions.

They are responsible for extreme weather, including severe winters, cyclonic activity, droughts, heavy rainfall, floods, and landslides. Oceanic blobs are formed by submarine and mixed eruption. The main volcano contributing heat to the North Pacific blob, Nishinoshima, was active for up to 30 months. The climatic impacts include mild winters, Heat waves, cyclonic [01:08:00] activity, droughts, heavy rainfall, floods, polar vortex, ENSO conditions, polar sea ice retreat, as well as Greenland ice sheet melting, based on the observation records that we have studied.

I think the missing heat attributed to carbon dioxide stored in the oceans. is better explained by the release of geothermal heat from submarine volcanoes. The role of geothermal heat in atmospheric and oceanic circulation changes needs to be taken into account in climatic modeling. Thank you very much.

I have one more slide just to take home. Volcanic eruptions, a natural diversity experiment to learn from. The present assisted by the superior observation record. It's a key to the past and the future. [01:09:00] If you ask me. Thank you.

Brian Catt: Do Submarine Volcanoes Change Climate?

I am this person, which you can check later. Um, so I'm not reading this. This is done for somebody else, but unlike, uh, I think most of the other presentations, I'm an engineer and a physicist, so I'm more interested in being able to show a cause for an effect, not say, oh, it's dramatic and it's caused by CO2, probably, um, uh, you know, with correlation, but no actual means of proof.

So I'm very interested in quantifying The scale of effects from submarine volcanoes in particular, because that's obviously where most of them are and where all the heat goes into where all the heat is stored, which is the world's oceans, which have 96 percent of it. Um, okay, so that's basically where I'm coming from.

So I'm quite focused on real things I can measure rather than things I can only guess about. Um, ever so quickly, looking at this [01:10:00] multi scale diagram, I'm just covering the cooling earth from the period from when South America bumped into North America and we got ice ages starting two and a half, 2. 8 million years ago there, and then we had what, one and a half million years of 41, 000 year Transcribed Ice age cycles and now we're on to the last million years of 100, 000 year ice age cycles, which is important as concerns one of the mechanisms that I will discuss, which is solid gravitational tides moving on

an arrow. Right, so just quickly, you'll see the relevance of this much later. Here's the last four, um, interglacials, generally featuring a 7, 000 year absolutely relentless rise to the interglacial phase, which is basically defined by a tropical climate at the equator when you get saturation and the heat starts [01:11:00] spreading towards the poles.

And 10, 000 years or so, it calls down and it's basically an exponential cooling curve, um, and what you're seeing, it's superimposed on that, are the effects of the 41, 000 year cycles, and of course they all work together, all three of them, Milankovitch, and the pink bit there on the end is where we are now, which is a rather runtish interglacial of the last 10, 000 years, which we're now in the neoglacial of.

So, current interglacial is cooler than the last four and nearly ended, so I would stop worrying about global warming, everybody. Um, right, let's have a look. How do we know the frequencies of these cycles? People say, oh, it can't possibly be the 100, 000 year cycle because it's not exactly 100. No, that's because it only occurs, I might have time to talk about this, it only occurs when you have a 100, cycle combining with a 20, 3, 000 year or whatever it is, a processionary [01:12:00] cycle when perihelion occurs when the northern hemisphere is closest to the sun.

Yeah, that's the only time you get an interglacial. And Ralph Ellis pointed this out on Tom Nelson's podcast a while back, which is a brilliant observation. Basically, it means the only time we get rid of the ice is when the northern hemisphere is closest to the sun as it ever gets. Boom. So let's have a look at this.

There's your Vostok Ice Core time series, Pettis SL 1999. And we want to find out what frequencies are on this. We use a thing called, well there are multiple frequency analysis tools, but Fourier is the one many people know. We've basically got a chord there, which I used the guitar for when I talked to Tom about it the first time, but it's a number of notes all ringing at once making a chord.

We want to know what those notes are. So we separate the notes from the chords by applying our mathematical tool, and down there on the [01:13:00] right, we get the deconvolve chord. We've separated the frequencies now and guess what spikes we get 100, 41, 23 and 19, which are the Milankovitch frequencies. So clearly there are Milankovitch frequencies driving all this.

What I will discuss is it's not just electromagnetic radiation, insulation effect. There's also a solid gravitational tidal effect on the Earth, which affects the volcanism. Um. So, uh, am I going to do anything?

All I've done here is that I've included the eccentricity, precession and tilt. This is a tool you can get from down the bottom there.

Milankovitch, uh, it's sixth, I don't know what you call it, high school grade sort of tool, and you can add in the different frequencies and see how they overlap the Vostok high score. Um, and you can see very clearly if you add all the three frequencies together, you get a pretty good match [01:14:00] between what happens, um, in the Vostok Ice Core and, uh, the, the overlapping powers.

I don't quite know how they've allowed, defined the power. It matches. And the one that's an absolute doozy, guess what, is the Eemian, and the reason the Eemian is such a doozy is because all three frequencies are in phase. So, during the Aemian, we had eccentricity, precession, and, uh, obliquity, or tilt, as they call it in America, because it's too long to say obliquity.

Um, then all of those three are in phase, which is why it was so So warm for so long and why we had hippos in Honiton because the heat's got nowhere to go. Hippos on the Thames. The heat's got nowhere to go from the equator because it's reached that saturation point where you don't have a normal climate anymore, so it spreads towards the poles.

Nice and simple. According to Brian, [01:15:00] where else does it go? Right, we've covered this reasonably well. This is a picture which shows you that there are tectonic fault lines. I think I'll go straight to the text. So the highest rate of divergence is about 24 centimeters per annum. That's roughly what it is when it's disappearing under Hungatonga heading northwest.

And the, let's keep going. The ocean crust is incredibly thin. Or 7 kilometers, only 7 kilometers thick where it forms. It gets a millilithosphere attached to it as it drifts towards its eventual subduction. Um, continents can be 70 kilometers, 10 times as thick. It just depends who you ask, which geologist.

Um, so the continents will always effectively float over the denser basalts of the ocean floor. Um, which is why when the ocean floor reaches the continents it is subducted. Um, mostly [01:16:00] always I think so and interestingly as we'll see in a minute older submarine volcanoes of course are continually subsumed by the continental plates as they form and then they get ground down and recycled.

So, as a result of this, the oceanic basaltic crust is no more than 200 million years anyway. That's how long it takes to get from that divergent fault of South America to Kamchatka Peninsula. That's the oldest bit of ocean crust anywhere that I'm aware of. Um, Click click click. Come on. Always remembering of course, I don't even bother talking about the land surface of earth anymore because it hasn't got any heat capacity and has almost nothing to do with the climate apart from making it more extreme one way or the other.

So the ocean is 70 percent of the earth's surface. On the continents we see 1500 active volcanoes. So Brian's finger [01:17:00] in the air. The reasons I will expand on is that you should have probably at least 5, 000 active volcanoes under the ocean. That's more than twice, and the reason for that I will get to, uh, and there's one.

The thickness of the crust, the oceanic crust, is so thin, just from the Bernoulli principle, it's a lot easier for magma to flow and also for holes to form. So I've allowed myself a little bit of, um, optimism, so it's more than three and a half thousand, I think, five thousand. That's my reason for using five thousand.

So I've got a number, which is five thousand volcanoes.

Now let's have a look at these nice blue oceans. Obviously there's a 70 percent cloud cover over this as well, which, of course, Mr. Al Gore removes from all his pictures. But it's an awfully blue planet. Nice blue and shiny and but what's underneath?

[01:18:00] Well, that's off This is quite topical. I think from Wizzy's stuff. This is the Kermadec trench where the Pacific plate is being It's being subsumed by the Australian plate or the Indo Australian plate You've got the Kermadec arc here with these are trenches which are what 30, 000 feet whatever that is 10 kilometers deep Um, uh, the Tonga Trench here and then of course you go up to the Marianas.

Uh, is it Marianas Trench? There's other trenches all the way along where the Pacific plate that this um, ridge here is a very old ridge rather like the Emperor Ridge that Hawaii is formed on but all of it I am told by a geologist from Hawaii is dead. So it's just making its way under down the trench to be recycled just over here.

There are about 30. Volcanoes all waiting to pop off along here. There's Tonga and Hunga Tonga, of course is pretty close by. So it's a busy old place to be [01:19:00] volcanically and that's because of the subduction of the pacific plate under the Australian plate. Um, don't go and visit the islands when it's going bang.

That's a very bad idea. So my art Interesting, but I did quite a lot of looking at this for WIS. Um And here's a reconstruction. These are the Comoros Islands. It's interesting to think what that was like when it formed. There's the Comoros Islands in the middle. They did very well at the footy this year.

In the white ring, under the surface, is our Mayotte volcano. And this was a unique event, very fortunate, because, um, it howled globally, everybody could see it on the seismic indicators, um, and it erupted violently in September 2018, but underwater, uh, everybody knew something was going on because the islands were moving around, and they were sailing up and down with a research ship because they [01:20:00] knew it was there and they knew something was going to happen, and what they found was a volcano that wasn't there before.

And it had grown five cubic kilometers in six months, uh, which is about 15 billion tons. And they got a nice little ultrasound snapshot of it. There it is. Um, and there's your plume. You can't see the blob, but I'll come to that in a second. So there is actually your Myot volcano as scanned, and it wasn't there.

That bump in the ocean floor wasn't there six, when they first scanned six months before this. Now, energy. If you take your, if you do your sums and work out, it's 1. 4 times 10 to the 9 magma. You'll find that's 20 exajoules. 20 times 10 to the 18 joules. Which is about, I think, I can't remember, it's 200, I think, Hiroshima's.

Um, roughly. And that heat is not stopping. It's on the way to the surface. [01:21:00] You know, this is the difference between geothermal heat, which is sort of warming the bottom, or you know, by conduction or leaky gas valves or whatever. They've got hydrothermal vents as they're called. Um, and that heat can spread.

I suggest that can be conducted and moved around the ocean and generally dispersed. This isn't dispersed. It's 1200 degrees and it breaks for no one. Um, it's on its way to the surface. And what happened, as we said, was there were, I know the numbers for this as well, there were two more major hurricanes that year than the eight there normally are, or ten, it was twelve rather than ten, can't remember which number is, but two more.

And if you look at the result, you'll see that Madagascar and East Africa, Mozambique were severely flooded. And I would suggest to you, you've got the candidate right there on your screen, in the bottom left hand picture. Um, bloom and blob. So that's basically what happens. Um, if you have a very intense energy source, in this case I've used a hydrogen bomb because I didn't [01:22:00] want to mess about, um, and it hits a discontinuity, some kind of discontinuity, uh, then it will spread violently.

So the heat is, the whole point about this is if you have a volcanic event, the heat is going to go straight to the surface and spread out across the surface because there's a complete discontinuity between water and air, um, and the water conducts heat rather well and the air doesn't. It's more of an insulator as you know if you're double glazing.

So let's move on with that. That took a long, a lot of thinking to get to that mechanism. They say, oh well the heat just coming out of volcanoes just spreads around and no it doesn't. It only gets spread around when it hits a discontinuity and so it can heat the surface of the ocean by a degree, two degrees.

This is really for the general audience. It's mostly rock, which you know, um, that's how much water there is on the rock. The big ball is quite a well known picture but, uh, [01:23:00] by weight, um, the rock is 4, 000 times more than the water. And a million times the air. Don't worry about the next ones.

Next slide. The point here, of course, and this is my cause for my effect, is it's not really solid. Because I'm clicking, but nothing's happening.

There we go. The earth is not solid, okay, and there's a multi frequency effect on this non solid body. This is just a picture to basically make the point that if you, you cannot represent, the crust of the earth is so thin, the solid crust, that you cannot represent it on a sheet of A4 paper using a half millimeter pen, okay.

So basically [01:24:00] you're living on, on a jelly ball, um, and it's covered with this ultimately thin crust.

So that's why it's smooth and roundish, because it's not solid and internal gravity determines the oblate spheroid shape and orbital gravitational fields cause it to move around continually, which I've termed planetary twerking, which most of my more elderly colleagues don't understand, but I do. Um, the it's a twerk is a multi frequency oscillation in a semi viscous object.

Um, for those who are familiar with the. Next thing, um, um, the pressure here, you get geologists banging on about how the oceans, the oceans stop volcanoes or modulate them, um, when [01:25:00] there are high tides. This is absolute tosh, um, the pressure under the, uh, under the mantle is 10 to 30, 000 bar. The pressure at the bottom of the deepest trench is a thousand bar.

The, the, the stuff that's trying to get out from inside really doesn't care about what the oceans are doing above. It doesn't know where it's going, but it sure as hell coming out the other end, and it's a really thin hole. It's a tenth the thickness of the continental crust. The other line I rather like is that the earth can be modeled as a liquid for collision purposes, which I picked up in my research, which means if it bumps into something, it'll splatter all over the place as if it were a ball of wet stuff.

Um,

everything's held on by gravity, the crust is held on by gravity, the oceans are held on to the [01:26:00] crust by gravity, and the atmosphere is held on to the whole thing by gravity. Um, that's the magma pressure. Now, again, the shape is constantly modulated by the orbital gravitational forcing of the sun and the moon, primarily Jupiter a bit.

Thing to remember here is, it's constantly being massaged. And that massaging is going to depend on the Impact of the solid gravitational, sorry, on the gravitational forces on the, on the viscoelastic body of the planet. At the moment, people say, well, 55 centimeters per day solid tide at the equator. So it's going up and down 55 centimeters.

What's that about that every day? Diurnal as well as up to 100, 000 years under the eccentric orbit of the sun. So there's a few frequencies in there. Right, so there's a summary [01:27:00] for you. Might as well read it and I'll shut up for a second.

What does this mean for our submarine volcanoes? The ocean floor is thin and it's being constantly massaged by the planetary twerking. The driving pressure is huge and unaffected by the ocean. The path to the surface is 10 percent of the path of continental volcanoes. Crustal forts are being continually massaged by Uh, at varying rates by the gravitational solid tides in the planet, uh, the modulation amplitude changes with orbital forcing, where the moon is, where the, where we are in the Milankovitch cycles.

Um, I covered that. Right, this is interesting. Not only does the, does the obvious Bernoulli length of the orifice being a tenth [01:28:00] suggest you get ten times more magma, a gentleman called Scott White, et al., famously has done the sums, and William Atten measured them. I tried doing this myself, and I didn't really have enough data.

He had lots. He did 170 volcanoes, and what he found was, what the output of volcanoes were, on average over their lives, and that's quite, within quite small limits. I don't quite understand how this is, because they do vary a lot, as being pointed out by Wissetel.

Um, 6. 4 times the output under the ocean than on the ocean, and you can find this study.

Scott, uh, Scott White is his name. Yes, sorry, White SL. And unsurprisingly, the largest hole in the ocean floor is the Hawaiian hotspot, and I've spoken to the people at the University of Hawaii about this a few times. It's a hundred million cubic meters per annum. That is. And of course that's going into the [01:29:00] sea, basically.

No, it's building a bit of an island, but a lot of it's going into the sea. And the average output of a submarine volcano is 28 million cubic metres per annum. So here we go. We're into numbers now. And the question is, of course, if you're going to have change, you need variation, which is why geothermal is, is less of an interest to me, because obviously if it's conductive, that's fairly constant.

Um, whereas these can vary. Yes, they can. Um, first of all, we get the average. So 28. I've done 5, 000 volcanoes, 28 tons of 6 meter cube, that's 140 kilometers cube per animal, 400 billion tons, okay, um, and that's much larger than other geologists, geologists sort of bang on about 4 cubic kilometers, 40 cubic kilometers, and mostly talking about it coming out, filling the gaps between the [01:30:00] diverging plates, they don't even look at the volcanoes, okay, and volcanoes dominate that particular leakage, Um, Unit heat content, you just take the temperature, I said a thousand degrees differential, a thousand, a ton, a thousand kilograms, a thousand joules per kilogram, uh, degree, and you get one times ten to the nine joules per ton, you get, then, I forgot this to start with, you've got the heat of crystallization of magma, which is four hundred million joules per ton, so you've got a 1.

4 gigajoules per ton, um, So you take your 400 billion tons and you end up with 5. 5 times 10 to the 20 joules

per annum of heat entering the oceans. Is this a lot? Um, well it can because it's a plume a plume and blue plume bloom bloom and blob. Um It can vary the temperature of the ocean by a degree or so, [01:31:00] but it's only in fact 0.

034 watts per square meter on average, which is 0. 1 percent of the average solar insulation reaching the planet from the sun. An interesting contrast and as I said before, how does it vary? Because volcanoes are famously not average in the way they emit. So beware of cyclists. Let's have a look. Man called Kustaf and Kutterolf went on a boat in 2012 and drilled, they drilled some holes in the ring of fire.

And came up with graph A here, which is the rate of, uh, rate of eruptions on the Ring of Fire. They then subjected that to the Fourier analysis I described earlier. And guess what? Ping! He got, um, you can see here there are various peaks, but a very strong, intense, but short peak at 41, 000 year, which is interesting because that was the first, [01:32:00] um, ice age cycle frequency.

But in fact, the one that sustained, although not as Powerful in terms of the frequency spectrum is the hundred thousand year and it's lasting there from what 70 to 100 or so Thousand years so volcanicity is increasing Uh, quite a lot on the maximum eccentricity, which is unsurprising because that's when the planet's being pulled and pushed and pulled most at maximum eccentricity, I suggest.

So volcanic maximums occur at Milankovitch orbital forcing maximum. They don't, again, the climate, the climate lunatics all say, oh, well, it's obvious, it's clear that climate change volcanicity. Duh, um, perhaps it's the other way around, guys. So they went back, um, shingle Beck, Julie. In fact, etal and etal included Stefan cutoff.

They went back in [01:33:00] 2018 and had another look at this. And the, the, by the way, the thing at the bottom is the, the rate of, um. It's the rate of eruptions, emissions, eruptions, and if you look at this, um, perhaps later, better, but you'll find every time you get to an interglacial event, which is the, the grey shady bits, there's a peak, okay, quite often, not every time, but usually there's a rise there, there's a rise there, it looks very much like there's a volcanic eruption.

Okay. a large and sustained volcanic increase before an interglacial, during the period before an interglacial. And that in fact, if you look at Ellison Palmer, which some of you may be familiar with, it's also born out there. And what they found on this occasion was that this 100, 000 year effect was far bigger.

The 41,000 and the 23,000. The other thing you may care [01:34:00] to notice, for instance, between the last, uh, between the eemian and now on the left hand side, there's nothing going on on the ocean floor. Um, for a big ch for the half, what? Halfway through the interglacial, but the 80,000 years between the end of the last interglacial.

In the beginning of this one, there aren't any volcanoes pretty much, and all of a sudden bunch off, they all go again. So this is very interesting. Yes, they do vary and they vary a lot. The problem is how much. How variable then? So I have to start guessing. So I guessed. Um, I said let's take 20, 000 years and 80, 000 years and distribute them between those two.

So the highest maximum on that crude two level basis would be five times the average over 20 percent of the time with 0 percent over 80 percent of the time. Okay. So on that sort of crude and assessment, it might be five times more than the average. [01:35:00] Uh, in the end, I decided to settle on 4. 6 times as the biggest amplification I could.

Um, and that brings you up to 2. 2 times 10 to the 21 joules per annum over the 20, 000 years of the interglacial, which is 0. 16 watts per meter squared by this measure. So that's the most you can get, which isn't much. That's a tenth of the supposed anthropogenic global warming. Anything else, as I race to the end, probably talking too quickly.

The unquantifiable, I'm actually going to talk about what I don't know about now. Um, so far I've stuck with a reasonable estimate, like an empirical engineer would. What does this look like? This is the interesting part, ladies and gentlemen. This is done by a weather lunatic who lives near Tornado Alley called James J.

Covington. And he very cleverly decided to plot [01:36:00] four interglacials on top of each other on the time, same time base, okay, so each one of these squares is a thousand years and one degree basically, one degree centigrade. Generally speaking, the last three, although two of two of these are from Greenland and two of them are from Antarctica because you can't go back more than two interglacials in Greenland.

You know, it's rock. These all climb up nice and happily to the peak before sort of settling back to what the Interglacial optimum and then into the neoglacial, which you are probably all aware of. Uh, our interglacial didn't work like that. Got off to a a bum start. Suddenly caught up with itself, and then for reasons unclear, the Younger Dryas event occurred, which is a massive anomaly, and it knocked the temperatures in Greenland, and we can talk about this in the question time, questioning later, um, for [01:37:00] 3, 000 years, the temperatures were back down to glacial levels, before they suddenly shot back up again.

Okay, well, whatever it was, let's say, um, It wasn't actually, but, um, I was going to say Jellystone, Yellowstone, Yellowstone Caldera erupted or something. It would take something really huge to do that. But, bye bye the younger Dryas. This is the sea level graph, which also everybody knows, but nobody ever puts two and two together.

Except for me, of course, because I'm like that. If, here, from 14, 000 11, 000, whatever, There was a return to glacial temperatures on land. How come the ice sheet kept melting?

Because it did. And there's absolutely no negative [01:38:00] turn here in the rise of the oceans by 130 meters from the end of the glacial period to the Colosseum optimum. It just kept rising, even though the temperatures on the land were going back down to glacial temperatures. Where's the heat coming from to melt the ice sheets?

Just one more, just to put this all into context. Geothermal is a small proportion of total surface energy, I think, as James said quite clearly at some point. So there's your relative planets at relative size with the little old sun here on the left. That is the relate. This is a physical relationship in size.

Um, and I just did the numbers quickly. Geothermal conduction through the surface of the [01:39:00] planet is 47 terawatts. You've probably read to the bottom already. The average submarine volcanic effect is 18 terawatts and peaks at about 83 under a hundred anyway, and the average human energy used just for comparison is 20 terawatts.

The solar EMR is 173, 000 terawatts. So, as somebody famously said, it's the sun, stupid! I put some summaries there. I think you probably do better off. These are the sorts of things that I was trying to address. I don't know whether to scan them or not. I'll just tell you what the conclusions are.

Volcanic submarine effects are regionally significant in the weather. There is almost no doubt about that. And, and. Talking about it being caused by climate change is an absolute nonsense when you know, you can see there's a blob there and if they sent a [01:40:00] ship out I guarantee you'd almost find a volcano underneath it.

So volcanic activity is significant and variable on the three vol, three Milankovitch cycles and I say that is basically by solid gravitation or tide effect. Just has to be. Um, what else is there?

Does the driest cooling event suggest that? The warming of the oceans has to be in some way geo thermal. It doesn't seem to be enough heat. Um, what I would suggest is we discuss asymmetry of the planet. Because basically, as you go from top to bottom, you get more oceans. Which would explain some of the things that were suggested by the first speaker, Mr.

Vittorito. Um, submarine volcanism, can it drive an interglacial? I don't think so. I think it helps. has something to do [01:41:00] with it, but I think it's the insulation change in planetary asymmetry in some way that do that. I may be ignoring spillage from divergent ridges. I don't know how much that is and that may be a mistake.

And, uh, certainly above all else, we know now, and we can easily estimate from the data there is, not by listening to the consensual nonsense that people make up, that The volcanic effects are larger than that believed, but they're still not significant compared to the total insulation reaching the planet, and I think that's a good time to shut up.

So, please send questions regarding the facts of the physics to brian. cat at deconfused. com. Thank you for your attention.

Q and A
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many, many interesting points, uh, brought up by, by all of us. And, uh, I guess, um, [01:42:00] actually, Brian, I, I, I would like to ask you a question or actually comment on the point that you made that geothermal is probably a minor or nonfactorial list.

When I show the graph with a very, very high correlation between global temperatures and number of seismic events in mid ocean. Keep in mind that's in the 5. 3 to 6. 3 approximately range and that relationship is exponential because in a 4. 3 to 5. 2 it's for the high level, it's 1000 seismic events versus 200 so.

It ranges from about 100 to 20. So if we go down the next step of the ladder from, uh, from, yeah, 4. 3 to 5. 2, it's 1000 versus 200. Next up in the ladder from 3. 3 to 4. 2, it's 10, [01:43:00] 000 versus 2000. And the next step in the ladder from 2. 3 to 3. 000 versus 20, 000. And next step in the ladder is 1. 3 to 3. 2. 2 is 1 million versus 200, 000.

And the final step, final run in that ladder is from 0. 3 to 1. 2. That's 10 million versus 2 million. I'll see you 11, 000, 000 seismic events at the bottom versus the 2, 000, 000 versus the few events we get that break through to the surface. In other words, we're comparing apples and oranges. That is high intensity, low frequency events, which are the large volcanic eruptions clearly are important.

They clearly have regional effects. They clearly do impact, um, uh, on a, uh, Uh, a restricted but important scale versus what are called low intensity high [01:44:00] frequency events, which is what I'm looking at. In addition to that, where is the honga tonga influence or the other large volcanic events? In the Arctic, you don't have that.

We don't have these, these large volcanic events occurring in the Arctic. Up there, you have the Gackle Ridge, which is the slowest moving ridge in the system, puts out the least amount of geothermal heat, has the least amount of volcanic activity. And as a result, the Arctic amplification is the sort of the hallmark of the current ridge.

Warming period. So I would say that we're actually arguing both sides of the same coin again. You're arguing high intensity, low frequency, and I'm arguing low intensity, high frequency and you add the two together. And I think this is we have a combined effect and we have to look at both. We can't ignore the yes.

We can't ignore the catastrophic flood, but you can't also ignore the day to day erosion that goes on in a riverbed because they both act in [01:45:00] concert to give us our end result. So, uh, having said all that, um, my question is a very general question. I don't want to throw out to the whole group is where do we go from here?

I think a lot of excellent points were made. By by all of us, and I think at some point we have to come up with sort of a uniform message on this. And who do we get this message out to? I mean, Tom's done a fabulous job getting this out to a wider audience. How do we broaden that audience? And how do we deepen the audience?

How do we get this message deeper into the scientific literature?

By starting a new university, um, where they're not, where, where they don't have to recite the consensus, they can actually do some science for a change. Can I just reply to your point? I am very aware, I think I said in the summary, probably a bit vaguely, I have only looked at the Submarine seamounts for the [01:46:00] simple reason that they are something you can measure and quantify it doesn't exclude There being Geotherm, well, I don't think geothermal vents are going to have a significant effect because The effect that that heat can have on the whole volume of the ocean if it spreads through it slowly isothermally if you like Kind of contradiction in terms is bugger all it's sort of 10 to the 25 joules per degree or something Just you need so much heat.

However, if your cracks and leaks are In any way volcanic ie there's magma coming out of them Um, you know real magma not superheated gas or something like that then probably yeah Uh, it's being entirely missed in my calculation because I have no way of assessing it All right, finally The mechanism I would suggest for all of these [01:47:00] things, or changes of these things, is the cyclicity of it, is the solid gravitational tides.

Okay, I Yeah, I think, again, we may be at cross purposes here, but the

11 million That's what drives, that's what drives the movement in the crust. The planet is moving continuously, and it's going to move at its maximum extent when the Milankovitch cycles decide, and less And of course, there's a daily thing as well.

The planet is being dragged around on a diurnal basis by its own moon. Correct.

But since, uh, since 1995, we've seen a jump up of approximately 9 million mid ocean seismic events. And the orbital variations don't act on that time scale, obviously. So, so there are other factors involved, such as the depletion of the radioactive materials at certain levels in the mantle.[01:48:00]

There's one theory out there that says that, uh, we have a concentration of radionucleotides down in the mantle. They then episodically come up with, uh, They inject more magma, raise the temperature, and then deplete, and then they restore and deplete again, so that there is that cyclical aspect that has to be factored into it.

But the, uh, the point, the point being that the geothermal energy at the bottom, there's well established literature in the oceanographic literature that says that Using the, uh, the very small millawatts, the 1 10th of a millawatt at the bottom. If you vary that, it does modify the thermal hayline intensity.

And that modified that the thermal hayline flow really affects. It's a, it's a heat pump effectively, just like the cooling system in your car. Um. You shut that thermostat off and all of a sudden an entire [01:49:00] temperature distribution goes completely out of whack. So, so it's a question of how heat is being moved around, not in terms of an actual, um, store of heat being added to the system.

It's in how heat is also being moved around through that giant heat engine, the, the ocean. Yeah,

and of course, I couldn't agree more with James on what causes El Nino. It just has to be a cyclic. The question is what cycle? A cyclic volcanic event. It just, it just is, isn't it? Everything, everything about the characteristics of the event make it appear as a volcanic event.

The problem is nobody's going and towing a boat around and sons and drones or whatever, whatever the hell they're called. Um, to look at this, it needs so much more study. The

oceanographic folks tell us it's, it's a sash [01:50:00] what happens to sea level in the western

Pacific gradually rises to about one foot higher than it is in the eastern Pacific and eventually under its own weight, the water has to slosh back and the equatorial countercurrent is the vehicle by which it does that.

So the equatorial carrot countercurrent is able to pull the water back. Um, under, under its own weight. It's, it's a Kelvin wave. It's a gravity wave. And, uh, as to what triggers it, yes, a volcanic event may be the trigger. Okay, but I think even if you took the trigger away from there, you can't keep building that mountain of water up indefinitely.

Eventually, it has to collapse under its own weight. So that's what, that's what the ocean folks tell us.

Yes, that's what they say.

I'll go with, I'll go with something volcanic, you know, the scale of the Schatzky rise type. There's something I I, I would suggest there's something down there which is kicking off, by the way, sadly, it doesn't appear [01:51:00] all the way through, but if you look at the two, the 2016 and the 1998 El Ninos, which were both doozies, guess how far they are apart timewise?

18.6 years. Mm-Hmm. , what is 18.6 years? It's the elliptic periodicity of the moon, and it's when the major tides 2016 and 1998 were both sort of peak, peak liquid tides. And of course, when you get a peak liquid tide, you get a peak solid tide as well in the structure of the planet. No

argument, maybe the gravitational forces are are serving again as the triggers for these El Ninos, as I said, we don't, the oceanographic literature is not clear as to what the threshold is to kick this off.

It's because it's a three to seven year period, and which there's a lot of variation within the three to seven year period, [01:52:00] but gravitational attraction, yes, may in fact

be the trigger. And we had an 18 year period between the 1998 and the 2016 one. Mm hmm. There wasn't anything going on in between. Okay, but I'm not disagreeing with your point that, you know, I'm missing stuff out.

I didn't try to count that because I don't know how to. What we need is a lot more information and a lot more oceanographers not making it up. Oh, I agree. We need boys measuring things going up and down, you know, sort of super Argo boys, although Munson assures me the Argo boys are useless because they don't go very deep.

That's correct.

They only go down to 2, 000 meters and most of the, uh, most of the, uh, submarine stuff is between 1, 500 meters, but they're not, they now have a new generation that will go down to 6, 000 meters. So [01:53:00] they're, they are getting that, uh, the deeper, the deeper readings now, um, uh, the, uh, But these, these oceanic transects, and they've run a number of them through both the, uh, the Pacific, Indian, and the Arctic, the southern ocean areas, they've all shown bottom warming by, by very small amounts, but nonetheless, the oceanic, uh, geothermal models show that that will impact the thermohaline, uh,

intensity.

Well, it would, I don't know this. I'm just checking with you, but it's unsurprising because you don't need to be a rocket scientist, but you can get a big grant for doing it as somebody did to go around the world and say, Oh, look, it's four degrees at the deep oceans everywhere. Well, surprise, you know, because that's where the water density is the highest.

So I assume that anything that occurs down at the bottom there where it has to be four degrees is going to be transferred out. Because, you know, thermodynamically, it's, [01:54:00] it can't stay there, can it, you can't have heat lurking around. It's gonna go up to where it is a few fraction of a degrees above four degrees.

Right. But you also have

to factor in the, the, the density differences, which is what

drives things. That's what I'm saying. Yeah. That is the density differences. Yeah. But salt factors

in there too. Ah, that's why it's called the thermal hay line. The hay line part is the salt part. Yes. For example, as you cool seawater and you start to freeze it, you pull the salt out, leaving a layer of fresh water on the top, and then the salt goes down to the bottom and then increases the density at the bottom.

So where do we go from here?

Ask the UN to actually do something in its decade of the oceans, perhaps, which isn't taking plastic bags from Hong Kong out of it.[01:55:00]

They've got this decade of the oceans. I don't know where all the money's being spent unless it's to relieve these massive, what are they called? Um, Thingies of plastic waste. I think that's all they were really interested in and overfishing probably. Yeah. They're worried about micro plastics. Yeah. Yeah.

We did utter bullshit, but, uh, all coming, all coming from the 10 rivers in countries where they don't have adequate waste collection, you know, what's the solution to the problem from the waste collection.

They need to collect money for all those private jets to go to these conferences. I mean, that's, that's a part of the equation,

right?

Well, I don't think they throw plastic bottles out the door. It's a bit difficult at 50, 000 feet in a GS. Excuse me, gentlemen, I have a personal business, so I'm going to leave. Thank you for the opportunity to participate. All

right. Maybe talk some more next time. All right, did you have any [01:56:00] final points you wanted to make, James, before you leave?

Or are you all set?

I think we covered it. Okay. All right. The best of that. All right. Thanks again, Tom and Art. Appreciate

it. you have any points you'd like to

make? Um, one of the thing is we do not have a scale for submarine volcanic eruptions. I've been thinking about it, whether the dimensions of the oceanic blobs, but there's a lot of problems.

We are not studying them well enough oceanographically. To monitor. How do we measure the heat input? One of the things that seems to be obvious from the Tonga submarine eruptions is that based on the three South Pacific blobs, we know which one is the highest in terms of temperature difference. From the normal, whether that's a good [01:57:00] indicator or not,

so the amount of heat causing this temperature anomalies, whether that's one way to go about this, I don't know what else, whether Artism

or Brian. I, you know. Yeah, me neither. I mean, what I did was, was basically say, what can I quantify, which is all I set out to do in the first place. Um, the stuff I can't quantify, and neither can anybody else, because it's a bit hard to crawl around, you know, four kilometers down on the ocean floor.

I was gonna say, there was one study early on that got me interested in this, was by Davies and Davies, they're a husband and wife team out at, uh, I think it's, uh, University of Illinois, [01:58:00] and they made the point that they were doing some survey work off the coast of Panama and Costa Rica, and they were very surprised at the bottom temperatures, and they said the bottom temperatures were much higher than they had suspected for an area about the size of the state of Connecticut.

That was their survey error. And I think what happens is that when you start to factor in everybody talks about the hotspot, you know, the black smokers and the white smokers. What we don't understand is there is this infinite network of cracks and fissures at the bottom that serve as giant radiators to effectively release the heat into the overlying ocean.

And, but you're right, we can't muck around at 4000 feet, you know, below the surface. That's the data. That's the piece that's missing

is to capture the actual heat flow out of these

systems. I, [01:59:00] the one thing that I did. Get very, very, uh, reset on was how much heat there is. I was sort of thinking that volcanoes cause the interglacials originally, because it's so obvious that there's a massive increase in vulcanicity and you get that very quick 7, 000 year rise.

The oceans just, it all kicks off, but there's just not enough. The thing that would drive that. Isn't enough. So, um, the point that I'm now thinking about is what the role of asymmetry is in the Earth's continental structure, because you've got, and this is the point about, perhaps relates to Art's point, as I said earlier, about the change you get for, in this case, a [02:00:00] given change in insulation reaching the planet, The effect of that, short term, because it will presumably even out over time, is to make the Northern Hemisphere, as you go further north, the effect will be much more extreme, because in the Southern Hemisphere, it's virtually all ocean, and as you go up from the South Pole to the North Pole, you just get more and more and more and more and more land, and people say, oh, the Arctic, the Arctic Ocean's a pond, it's mostly continental shelf, it's got a tiny little deep bit in the middle, And it freezes over without too much trouble.

So, basically, the North Pole just looks like something solid that reflects the sun, doesn't absorb much heat. So, any perturbation to that, i. e. in the amount of energy reaching it, is going to have a much greater effect there than it does in the South. Which is why, surprise, surprise, the Antarctic is so stable.

Hasn't changed, [02:01:00] the Amazon record hasn't changed in 50 years, pretty much. That's

a, that's a land pole versus a, versus an ocean pole. They're very, very different in that respect.

And, you know, that may be something to do. And, and this, this point that Ralph Ellis made so well, I think it's also been in a paper that NASA quote, but didn't understand because they're NASA and they're not that bright, is, um, that you have to have, to have an interglacial now, you have to take The north northern hemisphere with the ice sheets on it and shove it up against the sun as close as you can and then the ice sheets melt and that's the only time they melt I wanted to do that, that it's well worth playing with that Madison Wisconsin tool that I had earlier.

It's a great piece of stuff. I'm going to put it up in a second. Somebody else talk for Christ's sake.

I guess the one final point I would like to make is, first of all, to thank and to [02:02:00] congratulate you, Tom, for the great work that you're doing.

Your website, your podcast website, is a treasure trove of great stuff. I've been going through a lot of these videos, and you have done a tremendous service, I think, to the geoscience community, and I want to Yes, you got to keep this up. You're doing it. You're doing a great service out there. And if we could think of ways to expand the footprint, I think that would be a great thing.

All right. Yeah. Thanks

a lot. Thank you for the kind words. Thank

you.

Can I, if you've got time. Sure, sure. Just show this. And Tom's done so much other good stuff, by the way, as well, because he goes to the politics and the, you know, the actual psychology of the whole thing, how it's all being driven. Right.

Can you see that? Yes. Yep. Right. This is the thing. And you go, all you've got to do is type in Madison Milankovitch and you will find your own and you can play with it. Um, sorry, I'm just moving [02:03:00] things around a bit here. Um, right, so if I, what I'm going to do here, just quick, just make it go, orbit. And this, on the right hand side, you've got a Vostok, the Vostok ice core readings.

Okay, so click, that's the green one. and you can move this, see the earth, see the. Sure, sure. So, and this is actually, if I just let it go quickly, I'm not going to waste your time. Um, yeah, try not to waste it anyway. Right. So there it goes. Chugga, chugga, chugga, chugga. And this is the wrong way around actually.

So this is the opposite of the condition for you get a hundred thousand year old maximum eccentricity, but. The earth tilted the wrong way. Okay, that that will not give you an interglacial event at a hundred [02:04:00] thousand years So but now if I take the slider and go up to what is actually the emian here you see the earth There you go.

And now you look at that, you'll bang on the Green Peak is the Ian Interglacial and the, you've got it, it's wandering off now, but you've basically got the North Hemisphere tilted towards the sun at Perry Heian. You can play with this for ages. So that is my, that is my contribution. It's a great, great tool to play.

So

that's what allowed hippos to be in the Thames, right? Yes,

hippos in Hudson. And indeed, even the Germans had some on the Rhine.

Okay, on that note, maybe let's go ahead and wrap up if you're okay. Sound

good?

Sounds great, Tom. Alright, thank you everybody for your time. This is really good stuff. Thank you [02:05:00] all. Talk to you

next time.

Goodbye. Goodbye. Bye bye.