**If you’ve been a reasonably regular viewer of this channel over the last few years you will no doubt have listened to me banging on about Arctic Sea ice on several occasions. It’s a subject that the mainstream media wasn’t at all interested in when I first started making videos about the climate emergency back in twenty seventeen.**

**But then, when those media outlets realised it made for nice dramatic headlines and lots of clicks, it suddenly became a hot topic, to the extent that by now most folks probably feel like they’ve heard it all a million times before and, you know, let’s move on to the next exciting news headline as if Arctic Sea ice loss was a single event that happened once and doesn’t require any further attention.**

**That’s not a view shared by climate scientists though. They do think it requires further attention. And the more attention they give it the more concerned, or to put it another way, terrified, they appear to become.**

**In its Sixth Climate Assessment report, published in twenty-twenty-one, the Intergovernmental Panel on Climate Change projected that as long as we kept greenhouse gas emissions in reasonable check there would be a low risk of regular ice-free Summer Arctic Seas until the last couple of decades of this century.**

**But the trouble with those pesky scientists is they keep doing more research and coming up with more accurate data and demonstrable, empirical evidence. A research paper full of just such research was published in twenty-twenty-three and it found that whatever we do now, we are almost certainly heading for regular ice-free Summer Arctic Seas well within the next couple of decades.**

**So, I thought we’d better have a bit of a think about that.**

**Hello and welcome to Just Have a Think**

**Every September, at the end of the Northern hemisphere summer, the surface area of the ice pack covering the Arctic Sea reaches its lowest point. It’s a pretty decent swing from maximum to minimum as well, as this animation shows.**

**That’s all a perfectly normal part of the seasonal ebbs and flows that keep our planets ecosystems regulated and allow life to flourish. The thing is though, as we all know only too well, greenhouse gas emissions have been accelerating since the industrial revolution and that warming has been reducing the amount of ice cover all over the place, including in the Arctic Sea.**

**In nineteen fifty the world emitted six billion tonnes of carbon dioxide. By nineteen-ninety it was more than twenty billion tonnes, and today it’s around forty billion.**

**Ice is white so it reflects sunlight as a result of what the scientists call ‘high albedo’. The sea is dark, so it has very low albedo and it’s very good at absorbing sunlight. That means as sea ice surface area reduces, more sunlight gets absorbed into the water, heating it up and melting even more ice, which means less reflection of sunlight and more absorption of heat and so on and so on in a self-reinforcing feedback loop. That’s one of the main reasons why the Arctic is warming three to four times faster than the rest of the planet, and in some regions more like seven times faster.**

**Which brings us neatly to the recent research paper, written by a team of authors from a variety of institutions including Pohang University in South Korea, the Canadian Centre for Climate Modelling and Analysis, and the Institute of Oceanography at Hamburg University.**

**What they wanted to know is whether the methodology set out in the IPCC Sixth Assessment Report was robust enough to accurately predict the rate of sea ice decline up in the Arctic.**

**The IPCC uses what they call Shared Socioeconomic Pathways or SSPs to provide projections based on how our global society might behave in the coming decades. There are five SSPs ranging from “Kumbaya” to “Kiss your ass goodbye”. Based on real-world satellite observations of changes in the Arctic since nineteen-seventy-nine, fed into an enormous climate modelling program called the Coupled Model Intercomparison Project Phase 6 or CMIP6 for short, the IPPC concluded that, as long as we restrict ourselves to the less severe scenarios, then we can expect a good level of Arctic Sea ice cover for more or less the rest of this century, in theory buying us plenty of time to sort ourselves out, radically reduce our emissions, slow down the warming and avert the worst consequences altogether.**

**The main challenge posed by this latest paper is to the measuring methodology itself.**

**The total surface area of the Arctic Ocean is about fourteen million square kilometres. A so-called ‘ICE-FREE’ Arctic is defined as occurring when ice surface area drops below one million square kilometres. The conventionally accepted measure of ice in the Arctic Sea is known as ‘Sea Ice Extent’. The ocean is divided up into a grid and then each square in that grid is considered in isolation. If a square contains at least a fifteen percent sea ice concentration, then it counts as being covered in ice.**

**The wonderful scientific understatement used by this paper’s authors to describe that methodology was that it was ‘strongly grid dependent’.**

**You and I might use slightly more direct language, like ‘totally bonkers’, but for the purposes of this video I’ll stick to the science and try my best to avoid over-dramatic hyperbole.**

**These researchers followed a different path. They used a measure of sea ice area defined as the ACTUAL area covered with sea ice, which they claim to be ‘more appropriate for comparison with satellite observations than sea ice extent, having a smaller observed uncertainty than sea ice extent’.**

**They applied that method to three satellite observation data sets taken from nineteen-seventy-nine to twenty-nineteen and then overlaid their measurements onto the same shared socioeconomic pathways that the IPCC uses.**

**The results indicated that we won’t have to wait until twenty-eighty to see the first ice free Summer Arctic. In fact, it’s highly likely to occur as early as the twenty-thirties and almost certainly before mid-century, EVEN if we stay on the very lowest shared socio-economic pathway, which of course we’re nowhere near achieving at the moment.**

**So, why does that matter then?**

**Well, Arctic Sea ice plays a crucial role in the Earth's climate system. It influences global weather patterns, supports diverse ecosystems, regulates temperatures, and serves as a vital component of indigenous cultures.**

**We’ve already touched on the most obvious benefit of ice cover, which is to reflect sunlight back up into space to help keep our planet at a safe temperature.**

**Beyond that though, the formation of sea ice contributes to the process of thermohaline circulation, which drives the movement of ocean currents around the globe. As sea ice forms, it expels salt into the surrounding water, increasing the salinity and density of the water. That dense water sinks, helping to drive the global conveyor belt of ocean currents that regulate temperatures and distribute nutrients around the world.**

**A rapidly warming Arctic has also altered wind patterns, which among other things has led to the EXPORT of sea ice FROM the central Arctic TO the North Atlantic, where it melts. More melted ice in THAT region means less salty, or fresher, water, which means less sinking, and a slowing down of systems like the Atlantic Meridional Overturning Circulation or AMOC, which is a key DRIVER of the global thermohaline circulation. And just to really exacerbate the situation, as all our global oceans warm, scientists are seeing a greater influx of those warm waters FROM lower latitudes up into the arctic region, further accelerating sea ice loss. And by the way, it's not just declining surface area that has the scientists worried. Arctic Sea ice is also becoming thinner and younger too, which means it’s much more vulnerable to extreme weather events breaking up the pack and acerating the melt in any given season.**

**Global ocean temperatures in twenty-twenty-three and twenty-twenty-four have been so far above any previously recorded levels that even when a strong El Nino effect is taken into account, oceanographers and climate scientists are unable to explain the additional heat being measured all the way from the surface right down to depths of two thousand metres. Their real concern is that those vast volumes of water, which have until now absorbed more than fifty percent of all human induced CO2 emissions and more than ninety percent of the consequent extra heat, may have finally reached their limit and could now be starting to release that energy back into our atmosphere. Which would be bad. It’s a phenomenon that was very bluntly and graphically explained by climate expert Johan Rockström during a recent Ted talk, which you can watch by clicking the link at the top of the screen. And I’ll leave a link to that video in the description section as well.**

**It’s not just the ocean circulatory system either, by the way. The Arctic acts as a cold cap on the planet, and as it warms, it’s disrupting the northern hemisphere jet stream, causing more frequent and severe weather events like heatwaves, extreme cold snaps, and more violent storms in North America, Europe, and Asia. Losing such a large expanse of sea ice also warms the air over Greenland, causing an acceleration in the melting of the Greenland ice sheet which in turn contributes to the rising sea levels that are already threatening coastal communities worldwide with increased flooding and erosion.**

**Then there’s the release of methane from thawing permafrost. Methane is a greenhouse gas about eighty times more potent than carbon dioxide over the roughly twelve years or so that it exists in the atmosphere before being broken down into carbon dioxide and water. There’s thought to be about fifteen-hundred-billion tonnes of methane locked up in permafrost across the entire arctic circle, so even if only a tiny fraction of that was to escape in a short timescale, the additional, currently unaccounted for, warming effect would be very significant indeed.**

**All of this stuff is catastrophic in itself, but if you’re a modern market-driven capitalist and you just want the cold hard numbers, then how about this. According to the latest estimates highlighted by Rockström in his TED talk, our current path will result in an eighteen percent loss in global GDP by twenty-fifty. That’s a cost to you and me and everyone else on the planet of thirty-eight trillion dollars every single year. And that WILL hurt! Even here in our cosy rich western economies.**

**So, what does the Arctic Sea Ice minimum look like in September twenty-twenty-four?**

**Well, it’s not quite as low as twenty-twelve when a freak weather system called the Great Arctic Cyclone smashed up the already thin and fragile ice pack, leading to unusually accelerated levels of melting. But it’s not far off, and neither was twenty-twenty-three. And all of the last few years are clearly well below the nineteen-eighty-one to twenty-ten median, shown here in grey.**

**According to Johan Rockstrom, there is at least a faint glimmer of light at the end of the tunnel, although I have to say it’s far from likely that we’ll reach it. During his TED talk he tells us that if we wanted to stay within the safe zone of only one-point five degrees of warming then we will only be able to emit another two-hundred billion tonnes of carbon dioxide in total. That might sound like a lot but given the fact that we currently churn out forty billion tonnes of the stuff every year, that means we’ve only got five years to reduce those emission to zero. On our current trajectory and based on much more up to date and accurate modelling done by ever more powerful computers, Rockstrom says we will sail past two degrees Celsius above pre-industrial levels within twenty years, and three degrees by the end of the century – temperatures that this planet has not experienced for more than three million years, and that the human species has never experienced in its entire existence.**

**Now you might accuse me of presenting exactly the same sensationalist click bait material here that I accused the mainstream media of at the start of this video. But I can assure you that salacious headlines and maximising clicks has never been the motivating factor for the Just Have a Think channel. I present unsettling information like this from time to time not to send everyone into a doom loop of defeatism but to galvanise all of us into much more positive and affirmative action in order to bring about the changes we so desperately need as quickly as humanly possible. I’ll leave it to you to consider what those changes might look like in your own life, and I’ll be very interested to hear your views in the comments section below.** **I would strongly recommend watching Rockström’s TED talk video though. It’s a real eye opener.**

**Anyway, that’s it for this week. Thanks, as always to the amazing folks who support my work via Patreon. Don’t forget to jump over to Patreon dot com forward slash just have a think to have a look at all the exclusive perks you can enjoy there. And if you found this video useful and informative then you can hugely support me absolutely for free by hitting the like and subscribe buttons on YouTube and clicking on all notifications Doesn’t cost a penny to do that and it’s just a simple click away, either down there or on that icon there.**

**As always, thanks very much for watching! Have a great week if you can, and remember to just have a think.**

**See you next week.**