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When Global Catastrophes Collide: The Climate Engineering Double Catastrophe

By Seth Baum

It could be difficult for human civilization to survive a global catastrophe like rapid climate change, nuclear war, or a pandemic disease outbreak. But imagine if two catastrophes strike at the same time. The damages could be even worse. Unfortunately, most research only looks at one catastrophe at a time, so we have little understanding of how they interact. My colleagues and I at the Global Catastrophic Risk Institute are beginning to fill this void, starting with a new paper [1] involving climate engineering and a separate catastrophe combining for a "double catastrophe". It's a grim prospect that could even result in human extinction, but we can also work to avoid it.

Let's start at the beginning of the scenario. Yes, the climate is changing, and we're already seeing damages from it. But our planet is, as they say, just starting to warm up. Unless we do something to keep temperatures down, things could get much worse. One grim possibility is that large portions of Earth become uninhabitable to mammals [2]. (That includes us.) Temperature and humidity get too high for mammals to cool our bodies through perspiration – even if the wind's blowing – and so we overheat and die. By continuing to put greenhouse gases into the atmosphere, we are tempting an extremely dangerous fate.

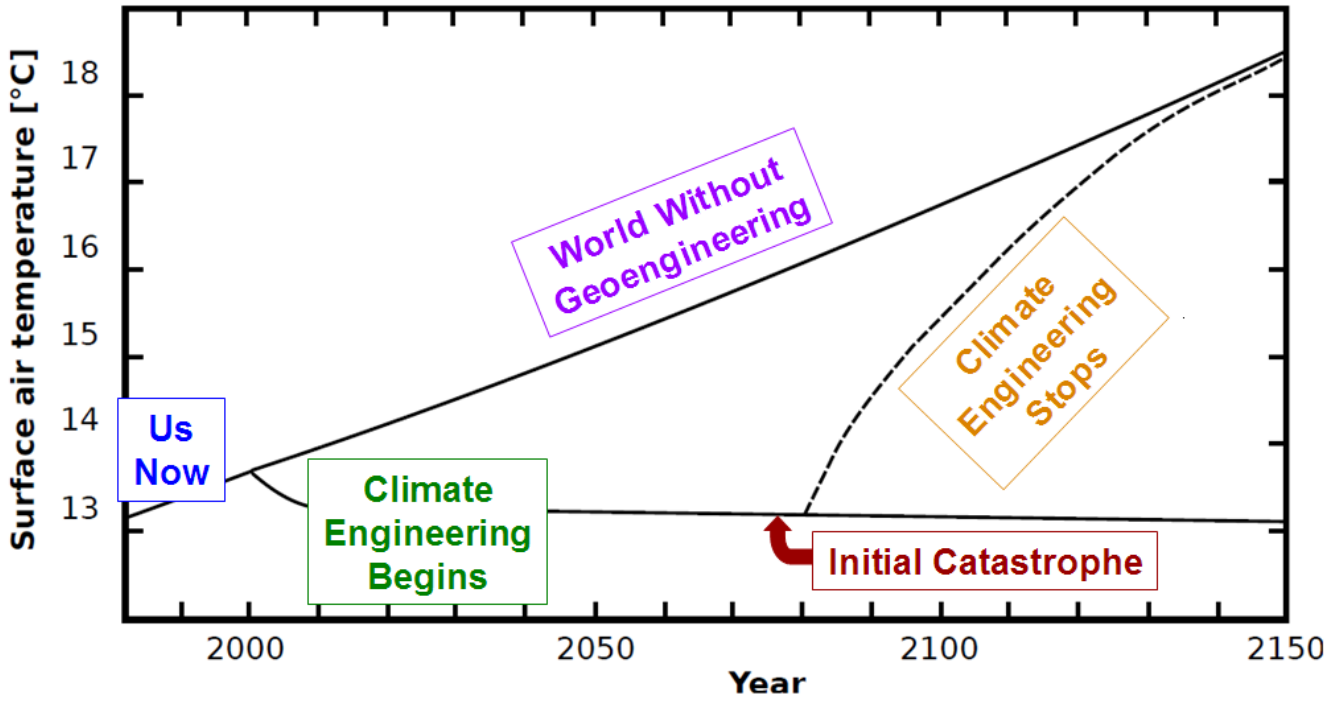
Alarmingly, we have been slow to reduce greenhouse gas emissions, and the climate is changing faster than ever. Because of this, some people – myself included – have been interested in alternative ways to cool things down, mainly by engineering the planet. There are several approaches to climate engineering (also known as geoengineering). The most popular approach involves putting little particles into the atmosphere to reflect incoming sunlight back out to space. The more particles we put up there, the less sunlight reaches the surface, and the cooler temperatures will be. If it works, it could help us avoid the worst harms of climate change.

But there's a big catch. The particles don't just stay in the atmosphere where we put them. They gradually drift towards the North and South Poles and fall to the surface. That takes about 5 years. And so if we stop putting particles into the atmosphere, we get a very rapid temperature increase, until temperatures finally stabilize at where they would have been without the particles. This rapid temperature increase is many times faster than that of climate change alone and would be very damaging.

All this is well established within climate change research. Here's where our paper starts introducing new ideas. First, it's unlikely that society would just stop putting particles into the atmosphere, because of how harmful that would be. We'd be fools to impose that rapid temperature increase upon ourselves. However, if a big enough catastrophe occurred, then we could lose the capacity to continue the climate engineering. The catastrophe could be something like a major war or disease outbreak. If this causes

society to stop climate engineering, then the rapid temperature increase would hit a population already very vulnerable from the initial catastrophe. The result is a double catastrophe that could be very devastating for humanity.

The graphic below shows one possible version of the double catastrophe. The temperatures shown are adapted from prior research using climate models to study climate engineering [3]. The details of the curves depend on when the initial catastrophe occurs and how much greenhouse gas has been put into the atmosphere prior to the initial catastrophe. The more greenhouse gas is in the atmosphere, the larger and more rapid the temperature increase will be when the climate engineering stops.



One possible version of the double catastrophe scenario.

Just how devastating would it be? This is a difficult question to answer. Catastrophes like this have never happened before, and so we have no prior experience to draw from. We can use climate modeling (as in [3]) to assess how climates would change after we stop putting particles into the atmosphere. But the key question is how humans would respond. This remains an open research question. Right now, I'm especially worried about agriculture. In general, crops are sensitive to climatic conditions [4]. If temperatures increase too rapidly, then we may not know which crops are best to plant in any given year. Food security would be a concern anyway after a big catastrophe. Rapid temperature increase would make it that much more of a problem. And of course, without food, humans cannot survive. So I believe that, in the worst case, the double catastrophe could result in human extinction.

There are several lessons to be learned from the double catastrophe scenario. The simplest lesson is that we really, really need to reduce greenhouse emissions. The less we emit, the less the climate will change and the less we need to resort to climate engineering. And if we do try climate engineering,

lower emissions means less rapid temperature increase in the event that we stop putting the particles up. Reducing emissions will take a lot of effort, but in the end I believe it will be just fine for our lives and our economy, despite what the fossil fuel lobby would sometimes have us believe. A good start is to put climate policy at the top of the new Congress's agenda, and to that effect recent debates about political strategy (e.g. this and this) strike me as productive.

The second lesson is that if we do implement climate engineering, we should design it to avoid the double catastrophe. This could mean decentralizing the capacity to put particles into the atmosphere, so if catastrophe strikes one group, then others can continue. Given how important it is to avoid rapid temperature increase, this could be an important step. Or, it could mean pursuing a completely different approach to climate engineering. One alternative is to put reflecting objects into orbit between Earth and the Sun. This would be much more difficult than using particles, but the objects could be designed to stay in place even during a catastrophe.

Perhaps the most important lesson is that we need to look at multiple catastrophes together. Climate change and, say, pandemics are not separate issues. But all too often, we have separate conversations about them. This is a major mistake, as the double catastrophe scenario demonstrates. Climate engineering may be able to keep temperatures low, unless some other catastrophe occurs. Thus whether climate engineering is a good idea depends on how likely it is that some other catastrophe occurs, how that other catastrophe would affect our ability to continue climate engineering, and how it would affect our ability to endure rapid temperature increase. We can only answer these questions by studying it all together.

To be sure, understanding what happens when global catastrophes collide is a difficult challenge. Each catastrophe is complicated enough on its own. For the sake of our species' survival, we should rise to this challenge.

References:

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