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DOI:

[10.3197/096327123X16702350862737](https://doi.org/10.3197/096327123X16702350862737)

## Document Version

Accepted author manuscript

[Link to publication record in Manchester Research Explorer](#)

## Citation for published version (APA):

Andow, J. (2023). Slippery slope arguments as precautionary arguments: a new way of understanding the concern about geoengineering research. *Environmental Values*, 32(6), 701-717.  
<https://doi.org/10.3197/096327123X16702350862737>

## Published in:

Environmental Values

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# Slippery slope arguments as precautionary arguments: a new way of understanding the concern about geoengineering research\*

James Andow

It has been argued that geoengineering research shouldn't be pursued because of a slippery slope from research to problematic deployment. The paper urges a new interpretation of these arguments as precautionary arguments. This interpretation helps us better appreciate the potential normative force of the worries and their potential policy relevance.

Keywords: geoengineering; slippery slope arguments; precautionary principle; ethics; climate change

## 1 Introduction

This paper offers a new way to understand so-called “slippery slope arguments” against geoengineering research. The key insight is that these arguments are best understood as having a precautionary spirit, i.e., relying

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\*This is a pre-print version of an article now published in *Environmental Values*. Please refer to the final published version for citations, etc. DOI: 10.3197/096327123X16702350862737

on some form of precautionary principle. §2 motivates the paper and introduces slippery slope concerns to geoengineering research. §3 considers some prominent treatments of slippery slope arguments in the literature and suggests that they point to a new understanding in precautionary terms. §4 outlines an interpretation of slippery slope arguments against geoengineering research which gives a central role to precautionary thinking—and outlines some key advantages to this approach. In particular, this approach helps us appreciate the potential normative force of slippery slope arguments against geoengineering research that extant treatments have missed, it helps us appreciate how the concerns expressed in slippery slope arguments against geoengineering research should feed into policy decision-making, and it directs our attention in productive ways making clear what evidence is needed to assess the force of slippery slope arguments against geoengineering research.

## **2 Slippery slope arguments against geoengineering research**

I make the case that slippery slope arguments (SSA) against geoengineering research are best understood as a form of precautionary argument.<sup>1</sup> This claim shouldn't be understood to entail that those who make SSA in this context are deliberately appealing to precautionary considerations. Although I suspect many would concede the point, I can't provide evidence for that claim here. Rather, I will make the case that a better way to articulate the underlying moral concern that this variety of SSA attempts to

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<sup>1</sup>Slippery slope arguments against geoengineering of various kinds can be found in Jamieson 1996, McKinnon 2019, Lin 2016. For an overview of precautionary arguments see Steele 2006, Rechnitzer 2022, and for prior discussion in this journal, see Sandin 2016, and O'Riordan & Jordan 1995.

express would be as a precautionary argument, i.e., one that appeals to some form of precautionary principle, and am open to this being a revisionary interpretation. Understanding SSA against geoengineering as underpinned by precautionary considerations represents an important step forward in our understanding of the relevant SSA, and in particular casts a new light on their use in policy contexts – those with an existing commitment to precautionary policymaking should take notice of the relevant SSA.

Many are suspicious of arguments framed in terms of “slippery slopes” and often for very good reasons.<sup>2</sup> Recent attempts to assess SSA against geoengineering research, without understanding the relevant arguments as having a precautionary spirit, conclude that they are far from compelling.<sup>3</sup> So, one might expect my proposed reframing or reinterpretation of SSA against geoengineering research to be part of an effort to defend the relevant arguments. However, precautionary principles are themselves controversial, and just as much in need of clarification and scrutiny as appeals to “slippery slopes”, and I make no attempt to defend precautionary arguments here. So, I don’t (indeed can’t) offer anything as direct as a defence of SSA here. Nonetheless, I do think that my proposed new way of looking at SSA casts them in a new light which helps us see their *potential* normative force in a way that the “slippery slope” framing does not. Whether or not that normative force is realised will depend on factors that will need to be evaluated elsewhere.

The “slippery slope” framing is an unfortunate way to present the relevant worries about geoengineering research. SSA really do have a bad name and deservedly. Calling your argument, a ‘slippery slope argument,’ means

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<sup>2</sup>See, e.g., for some discussion, see Walton 2017, Jefferson 2014.

<sup>3</sup>Notably, Callies, who doesn’t invoke the precautionary principle. But I should note that in passing, he does acknowledge that slippery slope arguments are associated with precaution and describes measures that mitigate against slippery slopes around geoengineering as precautionary (Callies, 2019a,b).

many others will assume it is fallacious.<sup>4</sup> They will assume this for good reason. Many, and in fact possibly the vast majority of arguments that appeal to “slippery slopes,” are clearly fallacious upon inspection.<sup>5</sup> And where SSA are not fallacious, they are deemed unhelpful and unnecessary.<sup>6</sup> SSA tend to be difficult to pin down on their exact claims and structure, and many appeals to a “slippery slope” seem to largely serve a reactionary and rhetorical role which is underpinned by only the vaguest and slipperiest substantive objection. Prominent recent treatments of SSA against geoengineering research only help a little: suggesting that insofar as SSA against geoengineering research are well-structured arguments, their foundation is impoverished.<sup>7</sup>

SSA against geoengineering research are of a particular kind.<sup>8</sup> It is worth emphasising that these do not share certain characteristics with other “slippery slope” arguments that might be more familiar.<sup>9</sup> First, they are *causal* slippery slope arguments rather than logical slippery slope arguments; the focus is not upon what inferences are licenced by particular normative foundations but rather on the causal effects of actions licenced by those foundations.<sup>10</sup> Second, they do not rely on incremental change; the focus is not upon a causal “momentum” within chain of similar incremental actions each leading on from the other but rather make a distinctive central appeal to what

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<sup>4</sup>Walton reports “slippery slope” arguments are frequently listed as fallacies in informal logic textbooks.

<sup>5</sup>See comments by Jefferson 2014, for instance.

<sup>6</sup>See, e.g., LaFollette 2015

<sup>7</sup>Callies 2019b

<sup>8</sup>I am open to the possibility that the central points I make in this paper would extend to other varieties of slippery slope argument too. But I haven’t thought carefully enough about that and certainly don’t make the case here.

<sup>9</sup>For a discussion of some more familiar SSA in this journal see Tanner 2009.

<sup>10</sup>Although perhaps in many cases this distinction is somewhat superficial. The main reason to be concerned about the logical version, is that one predicts that people will in fact make the relevant inferences.

has been called “institutional momentum.”<sup>11</sup>

The details of SSA against geoengineering research require some clarification, and I won’t have space to do all that here. But the basic structure of the relevant kind of SSA is that recommendations to halt or limit research into geoengineering of certain kinds and scales are made on the basis that such research programmes involve an “institutional momentum” towards the development to deployment readiness and then deployment of the relevant geoengineering technologies. I think the best understanding of this claim of momentum is that the whole process determining whether the programme results in deployment is insufficiently sensitive to whether moral concerns about the deployment have been sufficiently addressed or assuaged, i.e., to whether it is a good idea to deploy.<sup>12</sup>

Why might one think that the establishment of a programme of research into geoengineering might establish this kind of momentum towards deployment? Callies provides a useful synthesis of considerations (from Jamieson, Gardiner, and Lin):<sup>13</sup>

- our cultural imperative to develop technologies that are within our capabilities (summarising Jamieson)
- the fact that scientists generally want their projects to continue (summarising Jamieson)
- people like to justify their sunk costs (quoting Gardiner)

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<sup>11</sup>Callies 2019b

<sup>12</sup>This doesn’t seem to be widely recognised in the literature but is, I think, likely part of what Walton has in mind in his discussion of slippery slope arguments in general when he talks about “lack of control” over the process (Walton 2017).

<sup>13</sup>Callies 2019b.

- starting usually creates a set of institutions whose mission it is to promote such projects (quoting Gardiner)
- creating ... a scientific lobbying constituency for development and eventual deployment (quoting Lin)

I make the case that the best way to understand SSAs against geoengineering research based on these kinds of concerns about institutional momentum is as having a precautionary nature. The basic idea is that such SSAs express a lack of confidence in the ability of the existing or expected processes and institutions around geoengineering research to be such that they ensure that geoengineering technologies are only deployed (if at all) when it is appropriate to do so taking into account risk of moral catastrophe, and recommend a moratorium or heavy regulation of research in this area as a way to take appropriate precautions in light of these uncertainties. This way of putting things carefully hedges its bets about exactly which risks inspire the precautionary response. I make the case that the best interpretation of slippery slope arguments attributes a precautionary response in relation to (at least) two things. I'll unpack what I mean by that later.

Before moving on, it will be helpful to have a little bit of background about geoengineering, the ethics of geoengineering, and SSA in this context. Geoengineering is typically understood to include any large-scale deployment of technology to mitigate the effects of climate change as the result of anthropogenic greenhouse gas emissions.<sup>14</sup> A top level division is drawn between solar-radiation management (SRM) (e.g., sulphate aerosol injection) and carbon dioxide removal (CRD) (e.g., bioenergy and carbon capture and storage, and afforestation). Ethical concerns about geoengineering vary substantially between proposed methods. Common themes, however, include

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<sup>14</sup>Here I use the IPCC labels and acronyms

a credible threat of serious negative consequences for certain current and future populations.<sup>15</sup> This is the case particularly with sulphate aerosol injection (SAI) a form of SRM (e.g., due to effects of changes in precipitation patterns, and due to the effects of sudden climate changes following sudden and sustained termination of SAI). Ethical scrutiny of geoengineering research typically target SRMs rather than CRD, and most commonly target specifically SAI technology rather than other forms of SRM.<sup>16</sup> This pattern is replicated in recent discussion of slippery slope arguments in this domain.<sup>17</sup> The reason for this focus is partly that SAI is seen to raise particularly strong moral concerns.<sup>18</sup>

A final piece of background: Why be concerned about the deployment of geoengineering technologies? The reasons vary considerably depending on the kind of technology we are talking about. And I'll abstract away from the details for the most part in the following. But the general fears are that due to being careless or to being unlucky, large-scale intervention in the composition of the atmosphere and/or reflectivity of the Earth could have dramatic and unpredictable effects which might result in considerable net harms to particular populations, regions, or generations in a way that raises justice-based concerns, or even humanity overall.<sup>19</sup> One might hope that further

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<sup>15</sup>For an excellent literature review of work on the ethics of geoengineering, see Pamplany 2020. And see this journal Gardiner 2011,

<sup>16</sup>See, for example, Svoboda 2016

<sup>17</sup>See, e.g., Callies 2019b.

<sup>18</sup>There are other reasons too, e.g., concerns about procedural justice. In this paper, I'll not dig into the merits of any particular concerns about any particular technologies. The points I make here are at a more general level. However, it is worth noting that the patterns of effects of widespread deployment of, and the risks posed by sudden termination of, other forms of geoengineering shouldn't be underestimated. The focus on SAI in the literature is not because SAI is *unique* in raising such concerns. See, e.g., González (2018).

See, e.g., IPCC AR6 WG1 Chp 4&5, WG3 Chp 3.

<sup>19</sup>For an extensive list of possible concerns, see Pamplany et al 2020/



research would mean we would one day be in a position to avoid careless deployment or deployment that relied on getting lucky. The concern about institutional momentum is in essence that this hope would be ill-founded.

### 3 Why appeal to a slippery slope?

Although not in fact what initially inspired this paper, and although not originally made in relation to this kind of SSA, a helpful starting point for my discussion is an observation made by Hugh LaFollette.<sup>20</sup> LaFollette observes that one would not cast one's argument in terms of a "slippery slope" if one had a strong straightforwardly causal, consequentialist argument available.<sup>21</sup> For example,

- (1) The effects of geoengineering research (of a particular kind, scale, etc.) will be catastrophic (in terms of value loss, injustice, etc.).
- (2) That which has catastrophic effects shouldn't be done
- (3) So, geoengineering research shouldn't be done.

Such an argument doesn't appeal to a "slippery slope" from research to problematic deployment because it doesn't need to. So, why would one make an argument in terms of slippery slopes? What would the appeal to a slippery slope be doing? In the kind of case that we are talking about, one main function of the "slippery slope" framing seems to be to draw attention to the grounds for accepting the first premise, i.e., the claim about institutional momentum.

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<sup>20</sup>Lafolette 2005

<sup>21</sup>A similar point is made by others, e.g., Walton (2017).

But as LaFollette makes clear, this is odd. In other contexts, we wouldn't talk about cause and effect in this way

Someone would use a slippery slope argument only if she lacked the empirical evidence to support a straightforward causal argument. To explain why, consider the following example. Frank intentionally drops a Ming vase from six feet above a bare concrete floor. The vase breaks. It would have been silly to have mounted a slippery slope argument against his dropping the vase since dropping the vase, barring something or someone to cushion the fall, just is to break the vase. Increasing the temporal gap between  $x$  and  $y$  does not alter the facts: my detonating strategically placed explosives atop a Swiss mountain is not the first step down a slippery slope to killing people at the bottom. Rather, barring some freakish intervention, I kill villagers below by means of an avalanche. Adding a month-long timer does not relevantly change matters.

LaFollette notes that adding a month-long timer does increase the possibility that  $Y$  might not occur if  $X$  does. But that this doesn't affect our understanding of the causal structure of the case. It would likewise (and here I depart from LaFollette perhaps) be silly to cast an argument based on expected value (weighting possible outcomes according to our assessment of how likely they would be to transpire) in terms of a slippery slope. If what is wrong with performing a certain action is that it results in considerable expected harm, the time elapsed between the action and the harm seems immaterial. The relevant nature of the relation between normative status of the action and the relevant harm doesn't change when more time elapses. Hence, any "slippery slope" appealed to, in the context of an argument aiming to settle the normative status of an action which results in considerable expected harm after some considerable time, is normatively irrelevant (or at

least unnecessary).

What LaFollette sees as characteristic of worries described in terms of “slippery slopes” and marking them apart from causal arguments (again, although he doesn’t actually consider the “institutional momentum” kind of worry that concerns us here) is that (a) the causal structure of the relevant cases is disrupted as they involve a chain of agents (or at least actions) such that it would be odd to say that (to take the case of geoengineering research) the agents (or actions) that caused the catastrophic consequences of deployment are the same as those involved in the decision to pursue research, (b) (more or less relatedly) our assessment of the probability of catastrophic deployment given research should be far less than 1, and (c) the recommended normative attitude to research doesn’t seem to have been straightforwardly reduced—in any way that might have seemed appropriate in a causal argument—to accommodate confidence levels in the claim that the catastrophic consequences of deployment will occur given research.

This analysis doesn’t cast SSAs in a good light. Building on what is in essence LaFollette’s point, these features are naturally taken to suggest that causal slippery slope arguments (that focus on institutional momentum) are often used largely for rhetorical effect. The idea might be that, (a) a presentation of the concerns as a straightforward causal argument would make clear that it rests on questionable premises, e.g., that research causes the relevant catastrophe or makes it (almost) certain to occur, (b) a presentation of the concerns that adopted more acceptable premises would have to rely on questionable normative premises, e.g., that our attitude to that which *probably* causes X should be the same as to that which causes X, or present weakened conclusions (e.g., that research has some probability of being wrong). The proponents’ choice to present the concern in terms of “a slippery slope” rather

than to make any of these other moves might be suspected to be rhetorically minded (in the sense of being made in response to an understanding making any of those other moves would “diminish their arguments’ ability to sway public opinion” – and we might add the opinions of policy makers and other key actors to that too).

Although LaFollette doesn’t consider slippery slope arguments based on concerns about institutional momentum in any detail, his response to slippery slope worries that concern the possible catastrophic consequences of policy decisions (e.g., to construct nuclear power stations) gives some hints about what his response would be to the case of geoengineering research and other cases centrally involving institutional momentum. Where there is some plausible causal link between X and Y (which would be catastrophic), LaFollette simply urges *a conscientious cost-benefit analysis of X*. He does caveat this, however, saying the following:<sup>22</sup>

In saying this, I do not wish to suggest that cost-benefit analysis is a cure-all. It, too, is beset with problems. We typically lack the knowledge to make precise predictions about the outcomes of complex social policies. However, skepticism about cost-benefit analysis does not require us to embrace slippery slope arguments. Rather *we might think about how to behave in cases where we cannot accurately predict the outcomes of available actions*.

I think LaFollette’s caveat points the way to another understanding of what “institutional momentum” versions of slippery slope arguments are up to in the first place. At the beginning, I said that many slippery slope arguments seem to play a rhetorical role which is underpinned by only the vaguest substantive content. This paper’s aim is to suggest that there may be

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<sup>22</sup>LaFollette 2005, my emphasis.

something more substantive underpinning slippery slope arguments against geoengineering. Rather than seeing them as mere rhetoric, obfuscation, or as “poor substitutes for a careful assessment of risk”, we can see them as an expression of a moral concern that includes an already developed position on responding to risk: the precautionary principle. We can see them as having already thought *about how to behave in cases where we cannot accurately predict the outcomes of available actions*.

In short, slippery slope arguments against geoengineering research can be seen as expressing a lack of confidence in the ability of existing processes and institutions around geoengineering research to ensure that geoengineering research projects only (if ever) progress to deployment in ways that are appropriately sensitive to the risk of moral catastrophe. Above, I made the slightly cryptic remark that this way of putting things hedges its bets about exactly which risks inspire the precautionary response. It is time I expand on that remark.

## 4 A precautionary spirit

One of the writers who has spent the most ink on slippery slope arguments is Walton whose analysis of slippery slope arguments maintains that they are a subspecies of the kind of causal argument outline above (making his treatment a little different from LaFollette’s for example).<sup>23</sup> The features that mark the subspecies apart, for Walton, are not precautionary ones. However, the themes that come up in Walton’s analysis, to my mind, point the way towards a precautionary analysis. Walton’s suggestion is that what marks “slippery slope” arguments apart from simple causal arguments is their use

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<sup>23</sup>E.g., Walton 1992, 2015, 2017. The details of his treatment vary over time, I mainly rely on the two later papers.

of a claim about the initial action being “the first step in a sequence leading through a *gray zone* to an ultimate outcome” where what he means by a “gray zone” concerns a loss of control.<sup>24</sup> The thought is that what slippery slope arguments are worried about is that—at some point along the causal path from the initial action through to possible catastrophe—control over the process is lost.<sup>25</sup> The reason Walton refers to a “gray zone” is that in slippery slope arguments no determinate claim is made about where exactly in the causal chain control would be lost.<sup>26</sup> Walton also that “the ultimate outcome has to be describable as catastrophic, i.e., it has to have high negative value.”<sup>27</sup> The claimed centrality of uncertainty within SSAs along with the general tendency to note that it is characteristic of SSAs that they tend to invoke the possibility of catastrophe, to my mind, point towards treating SSAs as having a precautionary spirit at their core.

I don't want to follow Walton's precise thinking about the way that indeterminacy or uncertainty enters the picture with respect to SSA. But uncertainty must be on our minds when thinking about SSAs against geoengineering research. In the geoengineering case, we are currently in a position of uncertainty about two things. First, what the results of any particular way of deploying any particular geoengineering technology would be and im-

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<sup>24</sup>Walton, e.g., 2017.

<sup>25</sup>Walton (e.g., 2015), for some reason, just focuses on the initial agent's losing control and eventually doing something catastrophic. I set that aspect aside as it seems a mistake to include that restriction. There surely is no worry real about a slippery slope if some other perfectly responsible agent will at some point gain perfect control over the process, and it seems immaterial who directly brings about the catastrophe. I think the worry only gets going with a loss of control (of responsible agents) more generally. Walton's focus on a single agent also fits uncomfortably with the impression of other, e.g., LaFollette, that it is characteristic of slippery slope arguments that the agents at the beginning and end of the envisaged causal chain are distinct.

<sup>26</sup>Walton 2015

<sup>27</sup>Walton 2017

portantly the chances of catastrophe. Second, whether (or perhaps rather the extent to which) the kind of research project required to resolve the first kind of uncertainty would, once set up, take on a kind of institutional momentum towards deployment such that their chances of deployment wouldn't be appropriate responsive to good information about the chances of catastrophe (either because the good information ends up not being gathered or isn't given due weight).

I think this uncertainty is key to why the relevant arguments against SSA are expressed in terms of “slippery slopes” rather than as straightforward causal arguments. Unless we were facing uncertainty of the first kind, we wouldn't be talking about slippery slope arguments or conducting the relevant kind of research. And the same goes for the second too. If potentially catastrophic deployment was *guaranteed* by research, then we wouldn't be talking about slippery slopes. All that would be needed to reject geoengineering research would be that it caused something that was potentially catastrophic—a straightforward precautionary argument. Moreover, while there is some talk, in the literature on slippery slopes and geoengineering, about an “inevitability” of deployment (which then might be catastrophic) once a serious research project is up and running, it is difficult to take that seriously if intended literally (this point is rightly focused upon by those critically engaging with such arguments).<sup>28</sup>

One underlying point of slippery slope arguments, at least against geoengineering research, then, in my view, is to recommend a precautionary approach in the face of a credible threat of catastrophe.<sup>29</sup> The reason to fo-

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<sup>28</sup>Jamieson 1996 explicitly talks of development and deployment being “inexorable”. See Callies 2019b for critical engagement with claims such as these.

<sup>29</sup>The relation between precautionary thinking, as enshrined by ‘precautionary principles’, and geoengineering is far from straightforward. See Elliott (2010) for a survey of numerous aspects of that relation

cus on the “slippery slope” is that the credibility of the ultimate threat of catastrophe rests not only on there being a plausible causal path from some deployment methods to catastrophic results, but also on there being an additional plausible causal path—from setting up a research project to properly assess and scope for minimizing the risk of catastrophe posed by certain deployment methods to a situation in which deployment is possible and the decision to deploy being made—in which the relevant causal mechanisms are insufficiently sensitive to strong moral reasons not to deploy.<sup>30</sup> We ultimately have the same reason not to pursue geoengineering research as we have not to currently deploy geoengineering methods: there is a credible threat they will result in catastrophic deployment.

My view is that we talk of the “slippery slope” when talking about worries about geoengineering research in part to capture both aspects of uncertainty and our response to uncertainty. Taking a “precautionary approach to geoengineering” captures only one subset of the safeguards potentially called for by the risk of catastrophic consequences, i.e., not going ahead with deployment where there is a credible threat of catastrophe. Talking about the “slippery slope” helps to capture the fact that a richer portfolio of safeguards is called for in light of a credible threat of the slippery slope of institutional momentum.

Why is this a better interpretation of the slippery slope argument against geoengineering research? The standard interpretation (as it could be called at

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(although not, I think, the aspect considered here.).

<sup>30</sup>Interestingly, Walton’s 1992 schema for a causal slippery slope argument actually puts things in terms of “plausibility” too which makes it look to me like the real nature of slippery slope arguments might often be to urge appropriate precautions in the face of credible threats of catastrophe.



this point) and its shortcomings are apparent in this conclusion from Callies:<sup>31</sup>

[T]he Slippery Slope Argument against stratospheric aerosol injection is insufficient to ground a moratorium on research. We have reasons to question both the conditional, empirical claim (that research will lead to deployment) and the normative claim (that we have decisive moral reasons not to deploy the technology.) In order to determine whether or not stratospheric aerosol injection is something we have decisive moral reasons to pursue or abandon, we need an all-things-considered judgement that takes into account (a) the potential benefits of the technology, (b) the potential negative effects of the technology, and, importantly, (c) the circumstances in which the decision is taking place. And before we can make that all-things-considered judgment, we need to know the morally relevant facts about the technology – something that can only come from appropriate research.

The first reason for thinking that a precautionary reading of the concerns expressed by slippery slope arguments against geoengineering is thus that standard interpretations make the argument look weak. To my mind, Callies's analysis ultimately misses the true force of the objection. To argue that geoengineering research literally makes wrongful deployment "inevitable" or quickly leads to genuine lock-in would be absurd, and indeed any claim that research makes wrongful deployment probable is also likely absurd.<sup>32</sup> Likewise, it would be normatively absurd to argue that any activity which merely raises the probability of wrongdoing is itself wrong. Both Callies's and LaFolette's criticisms of SSAs are on point, so far as they go; whatever normative grounds for a moratorium or similar that slippery slope arguments

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<sup>31</sup>Callies 2019b

<sup>32</sup>Callies 2019b

are gesturing at, it had better not be anything in that ballpark. Walton's focus on "loss of control" and the uncertainty about where this might happen doesn't really help either simply because Walton's analysis never ultimately explains why these features make it the case that what is morally called for is refraining from the initial action or any other precautionary measures (what is missing from the analysis is, in my judgement, some precautionary premise or other).

The second is that this interpretation of SSA makes clear some appropriate resources for responding to the normative concerns raised by the slippery slope argument. Discussions about the precautionary principle are fraught and characterised by many battles including over the basic rationality of precautionary thinking as well as the details of what a defensible precautionary principle might look like. That is to say: appeal to any particular precautionary principle stands in need of defence. One effective way to take the force out of the relevant SSAs would therefore be to present objections to the form of precautionary principle they require to get going. However, insofar as there is agreement in some particular context about how to use a precautionary principle to guide policy, and what shape that precautionary principle can take, this agreed approach can be rolled out in order to assess and respond to fears about a slippery slope in relation to geoengineering research and a case for a moratorium on their basis. That is to say that my proposed interpretation makes clear that institutions with an existing commitment to precautionary policy should take notice of the relevant slippery slope arguments and also makes clear that they should critically assess the relevant arguments in the context of that policy. Properly understood, I think, the force of the slippery slope argument feeds into policy making via a precautionary principle, rather than via a simple weighing of costs and ben-

efits. So understood, the relevant SSAs are not “poor substitutes for a careful assessment of risk”—to use LaFollette’s expression—but an articulation of a considered assessment of risk.

The third is that this interpretation makes clear that slippery slope concerns pick out potentially forceful moral concerns – rather than just vague rhetoric or fallacious reasoning. It is a shame that “slippery slope” arguments against geoengineering research have been given that name. It encourages comparisons with fearmongering rhetoric and sloppy reasoning. Nothing I say here intends to defend the name. Explicit appeal to a precautionary principle would involve a rhetorical loss of sorts as it would now be necessary to emphasise and acknowledge uncertainty about the slipperiness of the slope. However, that may be no great loss, as I think the appeal to “slippery slopes” only invites suspicion.<sup>33</sup>

The fourth is that, insofar as we buy some version of the precautionary principle, this interpretation directs our attention in productive ways. While the case for and against a moratorium is understood to rest simply on some calculation of expected value, the case should rightly be understood to rest on the kind of all-things-considered judgement that Callies mentions -- a kind of judgment we are not and will likely never be in a position to make. Fortunately, the main motivation for precautionary thinking is that it gives a steer in conditions of uncertainty. The details vary depending on the principle we endorse. But the simple line is—don’t do that which poses a credible threat of moral catastrophe! A precautionary principle guides our information gath-

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<sup>33</sup>So, why do philosophers thinking about these arguments and taking them seriously continue to use that terminology? I take it to be a symptom of a sense that (a) there is some underlying worry that deserves to be taken seriously about institutional momentum and research, and (b) taking the worry seriously in this high stakes and policy relevant domain involves not prematurely making moves to diminish its persuasive value. The availability of a precautionary reading might diminish that rationale.

ering and research in arguably more efficient ways with lower evidential demands— establishing the credibility of the threat of the slippery slope to catastrophic deployment.

To just elaborate on that last point, the slippery slope from research to problematic deployment was recognised as a possible concern in the WGII component of AR6 of the IPCC (the first acknowledgement I have found in an IPCC report, IPCC 2022). The IPCC assessment is that ‘‘There is low agreement whether research and outdoors experimentation will create a ‘slippery slope’ toward eventual deployment, leading to a lock-in to long-term SRM, or can be effectively regulated at a later stage to avoid undesirable outcomes’’ (citing many of the figures I’ve cited here). But note that the epistemic attention has been directed in the wrong place if the relevant moral concerns are correctly captured by my proposed interpretation here; the relevant assessment was as to whether there was a credible threat of a slippery slope.

Whether or not those who endorse SSA against geoengineering research would recognise their argument in the following form or recognise it as better expressing their underlying moral concerns, I think something like this version of SSA is the one that deserves our attention. It is these premises that deserve our scrutiny.

- (1) There is a credible threat that establishing a serious programme of geoengineering research (of a particular kind or scale, and without any regulation) will generate a kind of institutional momentum such that the process from research to development to the decision to deploy will not be sufficiently sensitive to serious moral reasons not to deploy and thus have catastrophic results.
- (2) The appropriate response to credible threats of catastrophic results

is to take precautions, including to not do that which poses the threat.

- (3) Precautions should be taken against the credible threats of catastrophic results posed by serious programme of geoengineering research, including not establishing such a programme unless effective regulation or governance can be instituted to effectively mitigate against the problematic kind of institutional momentum.

This captures many of the insights of previous work on slippery slope arguments but also represents an improved understanding for the reasons outlined above. One further consequence of understanding this argument in this way concerns recommendations we might make as to regulation or governance. Slippery slope arguments are frequently understood not as arguments that a particular activity should never be pursued but rather as arguments for careful regulation or governance.<sup>34</sup> The precautionary framing makes particularly clear why the relevant SSAs would have this character.

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<sup>34</sup>See, e.g., Callies 2019.

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