

Webinar Scenarios May 6, 2020

IAMs, Mitigation, and Scenario development for combined intervention strategies

The second of a series of nine webinars included four presentations by Dale S. Rothman, Massimo Tavoni, Ted Parson, and Christopher Trisos. **Douglas MacMartin**, Senior Research Associate and Senior Lecturer in Mechanical and Aerospace Engineering at Cornell University, moderated the session.

The first presentation was given by **Dale S. Rothman**, Associate Professor in the Josef Korbel School of International Studies at the University of Denver: “**General History of Futures Thinking and Scenarios**”. Dale began by discussing the general idea of thinking about the future in a structured fashion. He argued that thinking about the future is necessary because, although the future is inherently uncertain, the choices we make today will play a role in determining what it will be. Our uncertainty about the future stems from ignorance (limited understanding), surprise (the world is filled with the unexpected and the novel), and volition (human choice matters). Thinking in a structured fashion implies that our work be salient, legitimate, and credible. Scenarios provide one approach to doing this. There are a variety of scenario types and methods, but all share the characteristic that they are not meant to be predictions, but rather, at most, conditional forecasts of the future under particular assumptions about how the world works and policy choices. Given our limited understanding and the fact that policies may have very different effects, he argued for the use of multiple baselines in scenario studies. He also highlighted the role that both narratives and numbers can play in scenario developed. Finally, he traced some of the history of global scenario work back to around the period of WWII.

The second presentation was given by **Massimo Tavoni**, Professor of Climate Change Economics at Politecnico di Milano and director of the RFF-CMCC European Institute on Economics and the Environment (EIEE): “**Integrated modeling of SRM**”. Massimo began by briefly reviewing the role of Integrated Assessment Models (IAMs), distinguishing between benefit-cost IAMs and detailed process IAMs. He noted that, to date, there have been very few efforts to include the full range of climate interventions, including solar radiation management, in IAMs, especially the detailed process ones. He then proceeded to review some published work exploring the role of SRM to complement mitigation when accounting for its uncertain effects as well as its governance implication on international cooperation. Massimo then discussed the need to move beyond single objective optimization, e.g. reach a 2°C target, to consider multiple objectives when evaluating the complex trade-offs which climate interventions raise. Finally, he concluded with open issues that need to be resolved, including better estimates of the economic impacts of climate change and SRM and improved frameworks allowing for exploration of multiple objects and deep uncertainty.

The third presentation was given by **Edward (Ted) Parson**, Dan and Rae Emmett Professor of Environmental Law and Faculty, and Co-Director of the Emmett Institute on Climate Change and the Environment at UCLA: “**Geoengineering scenarios in climate assessment and policy debates – experience, insights, and prospects**”. Ted began by reviewing scenario basics. He emphasized that scenarios are intended to inform near-term decisions, are not scientific or

objective using tradition definitions of these terms, and that they do not generally represent endorsements of any specific future. He noted some historical landmarks in climate change scenarios and discussed the specific challenges of these, including the vast audience, lack of a single decision-maker, and high stakes. Turning to climate intervention scenarios including SRMs, he also noted that these have been limited. He emphasized that the original GeoMIP scenarios, which were primarily meant to test the responses of climate models, have often been misinterpreted as realistic proposals for actual implementation. He then presented work on developing scenarios specifically related to governance for climate intervention, presenting some highlights from the activities at the Banff Summer School in 2019, which will be published in a forthcoming special issue of *Futures*. Ted concluded with a set of questions and proposed next steps for climate intervention scenarios, including both narrative and quantitative scenarios, and the desirability of integrating these.

The fourth presentation was given by **Christopher Trisos**, director of the Climate Risk Lab at the African Climate and Development Initiative, University of Cape Town: “**Choose your own scenarios**”. Chris presented the prototype for an interactive, choose-your-own scenario game for climate change and geoengineering in the 21st century (available at <https://bit.ly/2A8W0ch>). The motivation of the project was to design scenarios for geoengineering that achieve 3 objectives. First, an integration of natural and social sciences in both narratives and models, because whether proposed geoengineering technologies can even promote the achievement of climate targets likely depends as much on the social, political and environmental contexts in which they are used as it does on what they do to the climate. Second, increased dynamics by including feedbacks between the climate system and socio-economic systems. He said what is misleading is the notion of scenarios “on train tracks” to the future when in reality, greenhouse gas emissions will be driven by dynamic interactions between biophysical and human systems. Human emissions drive climate change, altering the occurrence of extreme events, which in turn influences human perceptions of and responses to risk, including emissions and climate change. These feedback processes are dynamic components of the Earth System that generate multiple alternative climate change futures, but they have often been absent from climate change scenarios. The third objective was to create more engaging and creative scenarios to tell stories that can engage the public and policymakers in imagining possible and positive climate change futures. He said climate change scenarios have tended to be developed by scientists with a focus on what is plausible. Science fiction stories about climate change can provide important additional insights not for what they predict about the future of the world but for how they unpack who we are in it, in ways that can often surprise us.

Questions, Comments, and Responses:

Dale's presentation:

Scenarios are (conditional) forecasts that do not dare speak their name.

Responses:

Ted: Yes, exactly. Claims of is/is not predictive must be understood in political/rhetorical as well as substantive terms. In fact, they are weakly, conditionally predictive, reflecting shared judgments of plausibility of makers and users -- but that subtlety is easy to attack, hard to defend, on contested political settings.

Dale: I would not put condition in parentheses. It is a significant clarification that should not be lost.

Massimo's presentation:

I think these graphics (in the section on Beyond single objective optimization) could be easier to interpret if shown as a snowflake with different frontiers along the various evaluation axes.

Responses:

One of the challenges of current models is representation of non-linear change/ tipping points, an area where uncertainty is pronounced. Do you think it is possible to look at SRM in terms of minimizing tipping point risks?

Responses:

I've heard no mention of discounting (how are future impacts valued and counted now and how are commitments to future changes like long-term loss accounted for in doing the IAM analyses? So, what about intergenerational issues and responsibilities?

Responses:

Can modeling offer sufficient learning opportunities to provide a foundation for overarching decision-making frameworks (e.g. robust or 'risk-superior' governance strategies in a multi-risk world) to tackle the problem posed by SRM-uncertainty, climate-uncertainty and policy-uncertainty?

Responses:

Ted's presentation:

I do not believe that the pushback against high emission scenarios is all politically motivated. RCP8.5 and similar scenarios assume a return to coal. At the moment, coal can barely compete against wind and solar. A return to coal requires the exploitation of expensive resources. With coal costs rising and renewables costs falling, a return to coal is implausible.

Responses:

Ted: Agreed, not entirely -- but it's a salient theme. The plausibility of scenarios like 8.5 with that much coal liquids certainly merits critical examination, but in my view the claims that these

are mere fantasy, beyond the range of possibilities that even merits consideration (or attempts to avoid) are far from authoritatively established. Stakes * Plausibility.

Massimo: On the RCP8.5 debate. Not only it requires a return to coal, it also needs huge economic growth. Only SSP5 made it, with future growth as fast as past despite declining population. Pretty hard but not impossible. An expert elicitation put it at 5% , see <https://link.springer.com/article/10.1007/s10584-019-02500-y/tables/2>

Ted: And 5% is a reasonable threshold for something that needs to be considered in decision planning (assuming it's bad enough)

Are scenarios really neutral? Can they be a trojan horse for unpleasant policy?

Responses:

Thanks for providing a logical framework for some things I've thought about. For some time I've wondered about scenarios such as an example where CI is implemented, the monsoon fails in some country and people are starving, and a nationalist political party blames CI (without evidence). What happens next? War? Negotiation? Will science have input? That falls nicely into your narrative governance framework. I hadn't previously had that framework to classify this sort of narrative.

Responses:

Could you please expand on the way that scenarios might be used to access the Napkin diagram (from Ted's last slide).

Responses:

Chris' presentation:

How do you avoid nudging user perceptions with the scenarios? How is it decided what the consequences of empowered cities would be?

Responses:

It looks like you were running the 'choose your own scenario' generator locally? Is a public link yet available?

Responses:

Chris: We don't have a public link yet. We're still looking for some funding to make the full version look really nice and work well with the En-ROADS model. If you have any ideas I'd love to hear them

Does the system provide quantitative analysis in real time or are there some pre-canned results that are pulled in

Responses:

Chris: At the moment the results are pre-set, but a version where the model responds in real time is possible

Other comments, and posts:

While it is a very hard analytical problem, the underrepresentation of tipping points in GCMs, and therefore scenarios, has significant implications for consideration of SRM. One of the most significant characteristics of SRM is the speed with which it acts on the climate system relative to other methods. This becomes very relevant in the context of rapidly escalating changes and/or feedbacks. From a policy perspective, this is one likely framework for decisions in this area. So, even if it is very hard to analyze, it is likely to be useful, or even important, to include scenarios for preventing/arresting abrupt changes in critical ecosystems in scenarios for SRM. It's relevant to note that this framework reflects contemporary political responses to other systemic problems (wait until its critical) and also scenarios that are less polarized and more likely to induce agreement.

Responses:

Chris: We're thinking of using the approach in this paper (rdcu.be/b3sT) to see how SRM might avoid or delay abrupt ecological disruption from climate change. It would be great to talk more about this.

What information is needed from other groups, ESMs, impact assessments, ethical groups, to make progress on integrating SRM and CDR to a scenario development of "desired future outcome"? What other scenarios should we focus on, as ESMs that may be politically relevant?

Responses:

Is there a set of metrics that assess the damage or adverse impact of any geo engineering methods?

Responses:

Perhaps the speakers can comment on what they see as the utility of scenarios for interdisciplinary climate intervention strategies research?

Responses:

Chris: Our scenario exercise has both SRM and CDR. One of the major challenges in integrating them is that a lot of CDR is more local in deployment and in impacts/side-effects whereas SRM is typically considered as more global. What could a portfolio of CDR with an SRM deployment look like a good question

Does SRM replace mitigation if it is not adequately risk adjusted?

Responses:

Dale: Yes. Risk is a key issue.

Ted: It reduces optimal mitigation in an optimization framework. Its effect on actual mitigation (presently far below optimal) is a different question, and is contested.

Did I really hear Peter Irvine say that we should not study solar radiation management because it would replace greenhouse gas emission reduction?

Responses:

Pete Irvine: No, I think there will be opposition because of that, which may make such a substitution unlikely even if the cost-benefit approaches suggest it's the rational way forward.

It seems to me that the key question is to get the relative uncertainties about the future on whether one augments mitigation with climate intervention or not. There is much discussion of uncertainties of SRM, but there are also very large uncertainties about going ahead without SRM. What are the relative uncertainties of each—modeling intervention so a climate is about as today, versus not doing and going ahead to a climate for which we have no good precedent?

Responses:

From the point of view of uncertain risks, it may be interesting to introduce SRM in the context of uncertain abrupt change risks against uncertain solar climate. Intervention risks..? Rather than starting with primary pathways.

Responses:

There are lower risk options for SRM using surface albedo modification. I think considering interventions with considering only one option for intervention is unnecessarily limiting.

Responses: