Towards co-producing environmental scenario research: A case of climate engineering

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This paper calls for co-production of environmental scenario research in line with the Future Earth's ideal of knowledge co-production with stakeholders. Taking climate engineering as an example, we articulate how such co-production method might benefit discussions of the risks, benefits, and governance challenges of this technique. We believe that this approach can be extended to other areas of sustainability scenario research.

In sustainability research, scenarios occupy a unique position. It is the standard tool of scientific inquiry as well as a communication medium for policymakers, stakeholders, and citizens. Scenario research is also crucial for solar geoengineering, a controversial set of technologies that are gaining increasing traction. It refers to a variety of techniques that are intended to directly cool the climate system to counteract global warming, and is also called solar radiation management (SRM) or climate engineering (which is actually a superset of solar geoengineering). In recent years, the Geoengineering Model Intercomparison Project (GeoMIP) (Kravitz et al., 2011, 2015) have analyzed mostly idealized climate scenarios to identify robust features of solar geoengineering.

The GeoMIP exercise was aimed at improved scientific understanding. It can be contrasted with other scenario exercises such as the shared socioeconomic pathways (SSPs) (Riahi et al, 2017), which were created to help climate projections and analyses of mitigation and adaptation policies. GeoMIP's emphasis on science is understandable because science of solar geoengineering is at an early stage. Nevertheless, sometimes scholars and stakeholders treat the results of GeoMIP as a policy-relevant piece of research, leading to some confusion about the implications of solar geoengineering.

Scenario research on solar geoengineering would benefit from more active engagement of researchers in other fields. Following the SSP process, one might construct narratives for solar geoengineering with the ultimate goal of producing a wide range of quantitative scenarios. Moreover, geoengineering scenario research should actively involve stakeholders and the publics in order to fully reflect their concerns and interests. Since it is a prima facie case of post-normal science, extended peer review would be a crucial input. We should invite various actors to voice their opinions, desires, and worries (Sugiyama et al., 2016).

We think that such an exercise would create a more nuanced, pluralistic set of scenarios. Reflecting diverse concerns about solar geoengineering, the resultant scenarios would range from categorical rejection to limited deployment scenarios (e.g., Keith & MacMartin, 2015) to significant deployment. In limited deployment scenarios, solar geoengineering could be used to shave off the peak warming or slow

down the pace of climate change. We believe that such scenarios would enable better characterization of climate benefits and side effects of solar geoengineering.

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