

Climate Intervention Requires Enhanced Research, Consideration of Societal and Environmental Impacts, and Policy Development

Humans are responsible, through the release of carbon dioxide (CO₂) and other greenhouse pollutants, for most of the increase in global average temperatures over the past half century. Deep reductions in these emissions must be central to any policy response to the dangers of climate change. In tandem with those reductions, there may be a need for climate interventions to help reduce or offset some of the effects of climate change. AGU urges national funding agencies to create substantial research programs on climate intervention so that the risks and opportunities are much better understood. A proper and full evaluation of potential uses and impacts of climate intervention will require a broader dialogue that engages more societies and the public.

In conjunction with this statement, AGU has issued a short white paper that examines the case for climate intervention and related research in more detail.ⁱ

Climate intervention is a “deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change.”ⁱⁱ The most plausible approaches to climate intervention fall into two distinct categories.

The first category, known as carbon dioxide removal (CDR), utilizes approaches and techniques that remove CO₂ directly from the atmosphere. CDR approaches include large-scale afforestation, which is already being done on the planet to some degree, along with enhanced mineralization or weathering, combining energy crops with storage of CO₂ in the soils or reservoirs deep underground, and machines that chemically capture carbon dioxide from the atmosphere.

AGU endorses calls for substantial CDR research programs such as those outlined by the National Academies.ⁱⁱⁱ Understanding the economic, environmental, and practical challenges in scaling these options is essential given the urgency of the climate problem and the potential roles for CDR in overall strategies for lowering the concentrations of warming pollutants in the atmosphere.

The second general category of climate intervention proposals is albedo modification (AM). It involves cooling Earth by reflecting sunlight away from the planet. Most AM research has focused on putting reflective particles into the upper atmosphere or seeding clouds in the lower atmosphere to brighten them. AM cannot substitute for reductions in greenhouse gas emissions, because its effects on the climate are not simply to reverse warming and because it would have no direct effect on ocean acidification caused by increasing carbon dioxide levels.

However, in theory, it could reduce some harm done by climate change during the time it takes for societies to implement deep cuts in greenhouse gas emissions while also potentially developing and deploying CDR systems. It could also, in theory, cool the climate quickly and thus prove highly valuable should society at some point face rapid changes in climate that cause unacceptable damage.

AGU urges national funding agencies to create substantial research programs on AM and to embed them, where appropriate, in existing larger programs on climate science because much of the knowledge needed to understand AM systems overlaps heavily with the knowledge needed to understand the changing climate system. Since 2009, several groups have advocated AM research programs. These include the U.S. National Academies,^{iv} whose findings on this topic AGU endorses. Such research, if conducted openly with introspection and self-scrutiny as befits the global scientific community, could help diffuse information widely and also help facilitate the development of appropriate international norms about testing and evaluation of AM systems. AGU is concerned that scientific discussions around AM are taking place mainly in a small number of western countries. A proper and full evaluation of potential uses and impacts of AM will require a broader dialogue that engages more societies and the broader public.

While much can be learned from laboratory and modeling research, AGU finds that robust AM research programs must recognize that important advances in knowledge may also require field experiments. Decisions about where and how to conduct field experiments are best left to competent authorities that already oversee such questions; where adequate national oversight does not exist, active efforts will be needed to build that capacity.

AGU is concerned that the debate over research funding for CDR and AM has been prone to paralysis. While legitimate concerns have been raised about scalability and the side effects of climate intervention schemes, those same concerns have been used to block funding of the research that could help understand and address them. The reality is that climate change is happening, and it too creates risks; balancing those risks is essential to effective policy strategies. There are currently no large public research programs on climate intervention and only a few private sector efforts aimed at advancing particular technologies. Public sector research programs are essential to ensuring transparency and an adequate coverage and level of research support.

CDR and AM cannot substitute for deep cuts in emissions or the need for adaptation, but it is possible that they could contribute to a comprehensive risk-management strategy aimed at reducing the harms of climate change.

Adopted by AGU on 12 January 2018. Based on an earlier statement adopted by AGU on 13 December 2009 in collaboration with the American Meteorological Society (as adopted by the AMS Council on 20 July 2009) which was revised and reaffirmed February 2012.

ⁱ AGU White Paper 2017: *Climate Intervention Requires Enhanced Research, Consideration of Societal Impacts, and Policy Development*. <https://sciencepolicy.agu.org/files/2017/11/AGU-White-Paper-on-Geoengineering.pdf>

ⁱⁱ Shepherd, J. G. S., et al., 2009: *Geoengineering the climate: Science, governance and uncertainty*, RS Policy Document 10/09 (London: The Royal Society).

ⁱⁱⁱ National Research Council, 2015: *Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration* (Washington, DC: The National Academies Press) <https://doi.org/10.17226/18805>

^{iv} National Research Council, 2015: *Climate Intervention: Reflecting Sunlight to Cool Earth* (Washington, DC: The National Academies Press) <https://doi.org/10.17226/18988>