

Subject: WCRP's Lighthouse Activity on Climate Intervention Research

The World Climate Research Programme (WCRP) has launched a Lighthouse Activity (LHA) on Climate Intervention Research. Lighthouse activities are designed to be ambitious and transdisciplinary research efforts that integrate across other WCRP programs to rapidly advance the science and institutional frameworks needed to better manage climate risk and meet society's urgent need for robust and actionable climate information. Climate intervention (CI) refers to the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change. CI includes both large-scale carbon dioxide removal (CDR) and sequestration technologies as well as solar radiation modification (SRM).

CDR approaches are aimed at intervening in the Earth's carbon cycle to remove carbon dioxide from the atmosphere. Recent scientific assessments indicate that holding climate warming to below 1.5°C is implausible without significant deployment of CDR, and in ambitious mitigation scenarios, net-negative emissions are reached by mid-century. However, there are substantial environmental, technical, and cost challenges in using CDR at the scale needed to significantly halt or reduce global warming. These challenges, and the slow response of the climate system, make it unlikely that CDR could be implemented rapidly enough or at sufficient scale to avoid potentially dangerous levels of climate warming in the coming decades.

As a complement to long-term emissions reductions, adaptation, and CDR, SRM is being considered as an approach to rapidly counter near-term climate warming. SRM approaches are aimed at directly influencing the Earth's radiation budget – such as by reflecting a small percentage of incoming solar radiation back to space or reducing the amount of infrared radiation retained by Earth. While SRM may rapidly counter some greenhouse gas warming impacts, the extent to which SRM can reduce climate change hazards has not been robustly established, nor has the extent to which SRM may introduce new risks to people and ecosystems. Also, since SRM does not reduce GHG emissions, and it does not address the causes of anthropogenic climate change, some other environmental harms from increased concentrations of CO<sub>2</sub> and other GHGs would continue. Any potential SRM deployment would therefore be at best an approach that could operate in parallel with mitigation measures, with SRM deployment declining as CO<sub>2</sub> emissions and atmospheric concentrations decline globally.

With many scientific knowledge gaps and uncertainties around the potential benefits, risks and sustainable scale-up potential of CI, rigorous, transparent, and globally inclusive research is required to further understand and facilitate the comprehensive assessments that are needed to inform climate policies. The new WCRP LHA will form a basis for such assessments, which are critical for evaluating the rapidly evolving CI literature, identifying key scenarios, environmental consequences, uncertainties, and knowledge gaps, and guiding the research necessary to serve as a foundation for governance and decision making. Furthermore, the WCRP LHA will ensure that research to inform decisions about CDR and SRM will be conducted transparently, with open access to data, results, and the models used to assess interventions and their impacts. Importantly, the LHA will also ensure that scientists globally will be involved in the research and in defining metrics of relevance for assessing the climate risks and benefits of CI approaches.