OCEAN VISIONS
Advancing Solutions for Ocean-Climate Restoration

Advancing Understanding of Approaches to Protect and Restore Arctic Sea Ice

Request for Proposals

Motivation and overview

Ocean Visions is a science-based nonprofit conservation organization with a comprehensive agenda that includes ocean-based pathways to reduce emissions, remove legacy carbon pollution, and responsibly research approaches that may protect and restore marine ecosystems – including Arctic sea ice.

In this call for proposals, Ocean Visions intends to support cutting-edge research efforts that address a subset of approaches described in Ocean Visions' Arctic sea ice road map. We intend to fund work that addresses and fills some of the critical knowledge gaps for key approaches and informs various dimensions of future potential (e.g. efficiency, scalability, and safety) with an objective of improving our overall assessment of the potential of these approaches to slow the loss of Arctic sea ice. Ocean Visions' work to support responsible research on approaches to protect and restore Arctic sea ice is guided by these facts and principles.

The Arctic is integral to global climate, and changes in the Arctic have and will continue to have far-reaching impacts globally. Arctic sea ice is a critical component of the global climate system because of its contributions to Earth's reflectivity – reflecting heat energy away from Earth. As sea ice is lost, the Arctic Ocean is absorbing more heat energy, contributing to the rise in Arctic temperatures four times the global average, making it the fastest-changing region on the planet due to anthropogenic climate change. The significant loss of summer sea ice to date has already had profound impacts on the Arctic region, its ecosystems and people, the global climate system, and the broader ocean. The loss of summer sea ice is a precursor to and accelerator of Greenland Ice Sheet melting and Arctic

permafrost thaw – leading respectively to global sea level rise and release of methane that will cause further warming. In addition, the absence of sea ice will fundamentally transform Arctic ecosystems and impact the people and other living creatures that rely on them as well as introduce new security challenges amongst Arctic nations. Prolonging the health of Arctic sea ice is a potentially powerful tool for lessening the devastating impacts society faces from climate change.

We know that the only permanent way to stop the loss of Arctic sea ice, and ultimately enable it to rebuild, is to reduce global temperatures. That requires drastically cutting emissions of greenhouse gases as well as cleaning up and removing the legacy greenhouse gases built up in our atmosphere and oceans. Unfortunately, society is not on track to reduce global temperatures in time to prevent the complete loss of summer sea ice. Therefore, a range of additional approaches are under consideration to try to slow the loss of Arctic sea ice alongside efforts to reduce and remove emissions of greenhouse gases.

Society does not have enough information on most of the approaches currently under consideration to know if they could be effective in slowing the loss of Arctic sea ice and what their impacts may be. In addition, very few avenues for funding are available to support research into these ideas, impairing rigorous evaluation and consideration of approaches.

In 2024 Ocean Visions published its Arctic sea ice road map, a synthesis and evaluation of 21 approaches to slowing the loss of Arctic sea ice. The road map was developed in partnership with an international, multidisciplinary team of experts spanning climate and earth science, governance, and Arctic issues. The road map identifies existing knowledge gaps and "first-order priorities" – the most important next set of actions needed to further advance our understanding of each approach.

This RFP targets a subset of research questions identified within the first-order priorities and invites formulation of additional questions that may help to determine whether the focal approaches could work to help slow the loss of and restore Arctic sea ice.

We intend to fund between three and five projects in total across the range of topic areas, with the exact number dependent on the range and size of funded projects. Applicants can apply for grants anywhere between $100k and $500k with a project duration of one year.

Letters of Intent are due **September 14, 2025 at 11:59 pm Eastern Time**.

Scope

Due to the need for urgency in finding new tools to slow the loss of Arctic sea ice, our intent is to support research that will quickly help determine whether further work on the focal approaches is worthwhile. Proposals must be relevant to one of the approaches and consider the associated research topics below. Proposals can propose research addressing alternative research questions for one of the included approaches, with a justification for how that question(s) will help determine if the approach has sufficient potential to slow the loss of or restore Arctic sea ice to warrant further research. For further information about each of the following approaches, see the Arctic sea ice road map and references therein. While we recognize that additional research is also needed across other dimensions, such as governance and impacts, this RFP focuses on determining the potential of the approaches to slow the loss of Arctic sea ice.

Blocking sea ice export

Description of approach

Arctic sea ice in significant volume is naturally exported every year out of the Arctic through a few specific areas, including the Fram Strait along the eastern edge of Greenland and Nares Strait between Canada and Greenland. An amount of sea ice equal to about 10% of the total Arctic summer sea ice area is exported every year via natural circulation (Smedsrud et al. 2017). *In theory*, some of this ice might be prevented from being exported out of the Arctic. This could have a positive impact on Arctic sea ice as past periods with lower levels of sea ice export are associated with more and thicker sea ice remaining in the Arctic (Smedsrud et al. 2008). In this potential approach, strategically placed human-made barriers, or reinforcement of natural barriers, such as ice arches or bridges, may be able to block ice export. In Nares Strait, sea ice export has been naturally blocked in the past by ice arches. These arches have weakened over time due to climate change (Vincent 2019, Moore et al. 2023). Strengthening ice arches may reinforce blocking of sea ice export, increasing sea ice concentration, thickness, and albedo in the Arctic (Moore et al. 2023).

Provisional Research Questions

The provisional questions here focus on exploring the potential of this approach to slow the loss of Arctic sea ice, how it might be operationalized, as well as potential impacts on atmosphere and ocean circulation.

- What is the potential for this approach to increase sea ice extent and facilitate cooling, taking into consideration more details than the theoretical upper bound (e.g., provide a case study for this approach for a specific location, use a sea ice

model to explore this approach, or an earth systems model to look at implications on sea ice extent and temperature)?
- How might such an approach best be operationalized, and what would be the most critical hurdles to feasibility of such a deployment? How might they be addressed?
- How would blocking sea ice export influence atmospheric temperature and circulation?
- How would blocking sea ice export influence ocean circulation?

Marine cloud brightening applied to the Arctic

Description of approach

Marine Cloud Brightening (MCB) is a strategy to increase the abundance or reflectivity of low-lying clouds over particular regions of the ocean (NASEM 2021) by adding particles to the lower atmosphere via spraying very small droplets of seawater into the air. Impetus to explore MCB stems from observations of cloud brightening formed from pollution of ships moving in the ocean ("ship tracks"; Diamond et al. 2020). An application of MCB for brightening Arctic clouds has been proposed, although there is less known about the potential for regional application in the Arctic versus global application or application focused on lower latitudes.

Provisional Research Questions

The provisional research questions here focus on better understanding clouds in the Arctic and the energy budget of the Arctic to estimate the potential of Arctic MCB.

- Do clouds in the Arctic include those that are susceptible to MCB, and are they at large enough scale to impact Arctic regional temperatures as a result of Arctic MCB?
- Do observations of ship tracks in the Arctic support the idea that MCB could be effective in the Arctic region?
- What would the potential impact of Arctic MCB be on sea ice, considering interactions between the atmosphere and sea ice and taking into account MCB's impact on top of the atmosphere as well as surface radiation? What is the minimum scale that would need to be achieved to have a measurable impact?
- If MCB works over the open ocean, the increase in cloud lifetime may lead to more low clouds overlying sea ice, where they would have almost no albedo effect but would emit downwelling longwave (LW) radiation. Under what circumstances would Arctic MCB lead to warming and potentially sea ice loss?

Mixed-phase cloud thinning

Description of approach

Low- to mid-altitude clouds called mixed-phase clouds (MPCs), can exhibit both heat-trapping and reflection properties. MPCs occur most frequently at high latitudes (Zhang et al. 2018 cited in Villanueva et al. 2022). During winter in the Arctic, these MPCs trap heat. In mixed-phase cloud thinning (MPCT), ice-nucleating particles are proposed to be used to seed clouds to turn water vapor into ice and thereby 'thin' the clouds and reduce the heat trapping effect. Since these clouds do have reflective properties, to be effective, this technique can only be done at the poles during winter when there is no, or very little, solar radiation and the heat-trapping properties of these clouds dominate. The seeding done with MPCT enhances the seeding that already occurs naturally with natural dust (Villanueva et al. 2022) and in some high latitude ship tracks (Christensen et al. 2014). This technique is similar to precipitation enhancement which is already done around the world (e.g., Vonnegut 1947, Flossmann et al. 2019).

Provisional Research Questions

The provisional research questions here focus on better understanding the presence, extent, and duration of mixed-phase clouds and their interaction with sea ice as well as ice nucleation.

- What is the potential for MPCT to impact heat energy release and sea ice extent? What is needed to improve model estimates of the impact on sea ice?
- Are enough mixed-phase clouds susceptible to seeding present in the Arctic region to lead to significant cooling?
- What are the highest potential options for ice-nucleating particles (dry ice, commercial options, biogenic options, dust, etc.)? What are the tradeoffs of using different options?

Funding Opportunity Details

Eligibility

All organizations capable of receiving grant funds from a US-based non-profit are eligible to apply. Proposals may include more than one organization but must designate a lead organization. The principal investigator (PI) must be affiliated with the lead organization. Individuals may serve as PI on only one submission but may serve as a partner on others. We encourage projects that engage with Arctic local and Indigenous communities and/or are led by Arctic individuals and organizations. There are no limits to the number of

proposals submitted by an organization. Ocean Visions expects to grant funds only to the lead organization, which would then be responsible for administering subawards to other collaborating organizations. Funded research teams must commit to ethical research principles including transparency and open-access research, minimizing risk, and engaging with key communities.

Amount of Funding

We intend to fund between three and five projects in total across the range of topic areas, with the exact number dependent on the range and size of funded projects. Applicants can apply for grants anywhere between $100,000 (USD) and $500,000 (USD) and will be expected to justify their budget.

Project Duration

We intend to fund projects that can provide useful and conclusive results in the near term. Project timelines must be no longer than one year.

Allowable Expenses

Proposals can include the following allowable expenses:

- Salary and related benefits for PI, co-investigator(s), and/or other individuals listed on the proposal (including those yet to be identified, such as new hires).
- In the case of graduate students who act as major contributors to the scope of work listed in the proposal, graduate student tuition is an allowable expense.
- Research equipment and supplies, including computing expenses.
- Domestic or international travel for project personnel to field sites, for collaborative visits, and/or for conferences and meetings.
- Publications fees for open-access scientific journals.

Note: Indirect costs are permissible and are limited to 10% of total direct costs. Total award size includes both direct and indirect costs and shall not exceed award size limits.

Project Deliverables and Expectations

Deliverables

1. Final Report, including summary of findings and an assessment of the approach's potential (across a number of dimensions) to slow the loss of Arctic sea ice and

whether or not it warrants further investment into research, development, and/or demonstration.
2. Data products and data sharing plan.
3. Projects are expected to result in research findings suitable for peer-reviewed open-access publication. Funded projects will need to submit peer-reviewed publications or provide plans and timelines for manuscripts not yet submitted.

Participation

Funded project teams will be expected to participate in:

1. Virtual meetings with Ocean Visions staff and other grantees (approximately once every quarter)
2. Presentation of project at an Ocean Visions webinar and at the Ocean Visions Summit (estimated March 2027)

Project titles, institutions, lead investigators, and total project funding provided by this RFP will be listed on the Ocean Visions website.

How to Apply

This RFP will be implemented in a two-stage process, first with a Letter of Intent (LOI). After review of LOIs, a subset of applicants will be invited to submit a full proposal.

Letters of Intent (LOI)

Project leads will use the online platform Submittable to submit a LOI outlining their proposed scope of work. The LOI will include the following sections (each will appear as a fillable text box on Submittable): 1) Focal area and research question(s); 2) Short description of methods; 3) Expected contribution to determining if the approach warrants further exploration; will the results help inform different dimensions of potential including efficiency, scalability, and safety?; 4) Short budget table with categories and subtotals of expenses (not binding; a more complete budget will be required for those invited to submit full proposals); 5) Description of why the project personnel and institutions are equipped to undertake this research (e.g., access to resources and equipment, experience running similar models, etc.). 6) Description of how this award would allow you to leverage existing funding or better position you for future funding opportunities.

How to submit

LOIs will be submitted using Submittable at this link. Project leads will need to create an account.

Due date

Letters of Intent are due by September 14, 2025 at 11:59 PM Eastern Time.

Review process and timeline

Letters of Intent will be reviewed by Ocean Visions personnel and a team of advisors. Decisions and invitations to submit a full proposal will be made by the end of September 2025. Applicants invited to submit a full proposal will be provided with further instructions.

Full proposals, including expansion of sections in the LOI, a detailed budget, and an engagement plan, will be due by November 9, 2025 and will be reviewed by Ocean Visions personnel and external reviewers. Applicants will be notified of award decisions by the end of December 2025. Selected projects can be expected to begin by February 1, 2026, or whenever an agreement is available to execute.

Assessment Criteria

The overall merit review criteria will be based on the following factors:

- **Impactful**: The proposed research answers key questions and addresses challenges, with the end result that the potential impact of the pathway is better understood and next steps for further work, if warranted, are clear and defined.
- **Efficacy of work plan**: Success is measured with clear metrics, activities are logically organized, and timelines are realistic. The budget is appropriate for the scope of work.
- **Qualifications & Resources**: The team is well-qualified and equipped with the resources needed to do the proposed research.
- **Funding Leverage & Additionality:** The proposed research is cost-efficient and leverages existing funds (if applicable) or other in-kind resources.

FAQs and further information

See below for frequently asked questions. Additional questions about the RFP and process not addressed here can be directed to info@oceanvisions.org.

Can I submit a proposal for a technology not mentioned in this request for proposals?

For this opportunity, we are focusing on blocking sea ice export, marine cloud brightening specific to the Arctic, and mixed-phase cloud thinning and will not evaluate letters of intent for other approaches.

Can non-academic organizations apply for this funding opportunity?

Yes, we welcome letters of intent from non-academic organizations. All funded projects are expected to result in research findings suitable for peer-reviewed open access publication and will need to make their results public and transparent.

Can I submit my letter of intent via email?

No. All applicants must use the online platform Submittable to apply to this funding opportunity.

Who is making this RFP possible?

This program is designed and managed by Ocean Visions. This RFP is made possible with support from the Kissick Family Foundation and the Navigation Fund, with other support pending.

Contact us if you are interested in supporting this work.