

# Protecting American Weather Sovereignty Strategies for a Safe and Secure Atmosphere for America

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# The Atmosphere: America's Next Strategic Domain

The atmosphere is rapidly emerging as a critical domain for American security and economic competitiveness, with overarching influence on national defense, agricultural productivity, and public safety. As China races to become a “weather superpower” and private companies mobilize billions for atmospheric interventions, the United States confronts a dual challenge: first, the rapidly expanding efforts that outpace our knowledge of reasonable and safe practices; second, the threat of rising foreign capabilities that could reshape global environmental conditions, all of which could have an effect on America’s security, economy, and communities.

**Protecting America’s weather sovereignty—the nation’s ability to understand, monitor, and safeguard our own skies—has become a fundamental and urgent matter of national security, public health, and economic prosperity.**



America's atmosphere and weather policies should be rooted in ensuring American weather sovereignty and in eliminating threats from foreign interventions in the weather system.

The atmosphere shapes the conditions for economic activity—from agriculture, to energy production, to resilient infrastructure. American competitiveness and economic security require leadership on understanding, forecasting, and securing the atmosphere. We face a critical knowledge gap at precisely the moment when both foreign governments and private entities are moving beyond localized cloud seeding and racing to develop capabilities for regional and global atmospheric modification. U.S. federal science capabilities, as well as the ingenuity of American businesses innovating to provide better information, forecasting, and tools, can drive American competitiveness and pathways to prosperity.

**The critical issue is whether the United States will protect its weather sovereignty through leadership in atmospheric research and monitoring, or allow competitors to dominate this strategic domain and put American communities and interests at risk. Without the ability to observe, attribute, and understand changes in our own atmosphere, the United States cannot reliably assess potential foreign interference, respond to emerging threats, or protect critical civilian and defense systems that depend on accurate weather and climate intelligence. Weather sovereignty is therefore not only a matter of economic resilience and public safety, but also a prerequisite for national security and strategic deterrence.**



## What's Currently Happening: Cloud Seeding Programs

State-authorized weather modification through cloud seeding with the goal of increasing rain or snowfall has been undertaken in the U.S. for decades, primarily in Western states (and does not create visible effects). Undertaken safely, these programs often prove valuable for American communities and lands.

Cloud seeding programs currently support water supplies in states facing scarcity. Agricultural operations rely on these interventions during drought conditions. Energy systems benefit from enhanced water availability for hydroelectric generation.

These existing programs require better monitoring and analysis of weather effects to provide the authorities and the public with transparent information on their safety and effectiveness. States leading in information for analysis include Idaho, Utah, and California.



# What's Being Developed: Regional and Global Atmospheric Modification

Today's weather modification via cloud seeding produces highly localized effects. Other atmospheric modification approaches—sometimes called [solar radiation modification](#) (SRM), climate intervention, or geoengineering—are designed for regional or global impact: reducing storm intensity, preserving polar ice, protecting coral reefs, or cooling the entire planet. The development of capabilities for this is escalating, but none of these have been implemented in the U.S. or anywhere in the world—**yet**.

These large-scale interventions require the ability to monitor and forecast conditions across the planet and years into the future to assess effects on any country or community. Risks and threats include:

- + Threats to the ozone layer
- + Changes in weather patterns
- + Alterations in sunlight
- + Impacts on communications, energy, and military systems
- + Impacts on natural systems and human health

Private companies, NGOs, and foreign governments are racing toward deployment of these technologies by decade's end—but this timeline outpaces our ability to understand the risks. Neither the U.S. nor the international community has conducted the rigorous evaluation needed to assess these approaches and their dangers. **Without monitoring capabilities to detect interventions or guardrails to prevent harm, we are unprepared for what is coming.**



# A New Domain of Competition

Both commercial and nonprofit organizations are now raising and mobilizing funds to explore atmospheric technology.

Private companies (and some NGOs) developing atmospheric modifications will need to work with policymakers to balance key questions, such as:

- + Speed of advancing and deploying new technologies
- + Balancing intellectual property protections and public disclosure
- + The need for economically efficient deployment while ensuring safety

Current private efforts should develop the scientific, technical, and organizational transparency essential for scientists, policymakers, and the public to understand and assess their approaches.



# Intensifying Global Activity

China, the UAE, Singapore, Indonesia, the U.S., and a number of other countries have operational cloud seeding programs to increase rainfall. Several nations, including the UK, Australia, China, and Japan, have established major R&D programs focused on developing large-scale atmospheric modifications. The lack of transparency in some foreign governments' research, operations, and decision-making processes raises significant risks that these technologies could be deployed without accountability or in ways that undermine U.S. interests.

## **Possession of large-scale weather control and atmospheric modification capabilities grants a state the potential to:**

- + Gain geopolitical leverage
- + Manipulate precipitation patterns, impacting global water supplies and agriculture
- + Influence the international climate agenda to their strategic benefit
- + Conduct modifications harmful to U.S. interests, potentially without clear attribution



# China's Rise as an Atmospheric Superpower

China is rapidly advancing its capabilities in atmospheric science, emerging as a major global competitor in weather and atmospheric modification, at both regional and global scales. This is a development China's Meteorological Administration views as integral to the nation's goal of becoming a "weather superpower."



# Key Facts on China's Atmospheric Programs

## World's Largest Operation

China maintains the world's most extensive weather modification program, employing an estimated 35,000–40,000 personnel.

## Scale of Operations

Between 2002 and 2012 alone, the country conducted over 500,000 localized weather modification operations.

## Accelerated Growth

Operations are projected to have increased by 20% in 2025 compared to 2024.

## SRM Funding

China is a leading state funder of SRM research globally.

## Talent Recruitment

The Chinese government is actively recruiting **American academics** to participate in its clandestine, government-backed research programs on global and regional atmospheric modification and SRM.

## Militarization Focus

China also operates programs specifically focused on the militarization of its atmospheric research.

The combination of massive operational capacity, military focus, and lack of transparency means that within a few years, China could conduct atmospheric interventions affecting U.S. weather, agriculture, or security, **without the United States having sufficient capabilities to detect, monitor, or respond.**





# National Security is Imperiled by Critical Knowledge Gaps

The expansion of foreign atmospheric capabilities introduces a new class of national security risk defined less by overt attack than by uncertainty, ambiguity, and strategic blindness. Large-scale atmospheric interventions may be difficult to detect, attribute, or assess in real time, complicating deterrence and crisis response while operating below traditional thresholds of conflict. Adversarial use of these capabilities could disrupt weather-dependent systems essential to U.S. stability, including energy generation and transmission, agriculture and water supply, aviation, communications, and military readiness.

The United States' ability to responsibly assess or respond to atmospheric modifications is severely constrained by insufficient information and limited analytical capacity. As other nations advance their atmospheric science capabilities and private entities move toward regional and global deployment, gaps in monitoring, attribution, and governance weaken America's ability to observe, analyze, and assign responsibility for activities within its own skies.

Possible scenarios include foreign-induced drought wrecking agricultural production or targeting power-generation capability. These weather-induced attacks would be hard to detect with current technologies.

Without robust federal leadership in atmospheric monitoring and analysis, the United States risks missing deliberate interference in this emerging domain, undermining strategic awareness, national resilience, and confidence in critical civilian and defense infrastructure.



## NGO Pressure for Rapid Deployment

While U.N. bodies have recommended research and rigorous scientific assessment, none have recommended the development of regional or global atmospheric modification capabilities. However, a number of U.S. and international NGOs are working to advance rapid development of these capabilities in response to a prospective climate emergency.

This approach faces critical challenges. Model projections of weather and climate beyond the near-term remain highly uncertain, while the monitoring and regulatory systems needed to protect public and environmental safety do not exist. With that in mind, scaling capabilities based on today's limited data and models puts deployment ahead of the development of the tools and oversight needed to protect Americans and our environment.



# Deficient Monitoring and Analysis Capabilities

The United States currently lacks the essential infrastructure to adequately observe baseline atmospheric conditions and natural variability. This absence of comprehensive, multi-year observations makes it impossible to reliably detect, measure, or attribute the existence or effects of weather or other atmospheric modifications, whether from domestic private entities or foreign adversaries.

## Key Deficiencies

### **Lack of Airborne Sampling**

No systematic measurements of stratospheric chemistry are being collected via airborne platforms.

### **Satellite Gaps**

Dedicated satellite instruments for observing the atmosphere are aging or scheduled to be decommissioned soon. Some important planned programs have been suspended or cancelled.

### **No Comprehensive Monitoring System**

There is no system capable of detecting, identifying, and attributing unauthorized or harmful atmospheric modifications.



## As a result of this insufficient monitoring, the U.S. lacks critical visibility into:

- + Atmospheric modification and geoengineering activities conducted by foreign governments
- + Weather modification and experimentation activities by domestic private entities
- + The long-range effects of aerosols and pollution
- + Changes in the atmosphere that impact aviation safety, public health, and military operations
- + Forecasting data relied upon by vital economic sectors, including insurance, reinsurance, agriculture, finance, and disaster planning

Furthermore, current Earth system models are inadequate, failing to project specific regional and local effects with the precision required for informed decision-making. The nation cannot yet accurately evaluate how atmospheric modifications would impact:

- + Weather patterns and precipitation
- + Agricultural productivity and water supply
- + Energy infrastructure and economic activity
- + Ecosystem stability and human health

The government needs to work with the private sector to leverage data, AI, and high-performance computing to improve models and develop infrastructure for enhanced atmospheric monitoring, forecasting, threat detection, and regulation of weather and atmospheric modification.



## What the United States Must Do

Ensuring atmospheric security requires the United States to responsibly leverage public-private partnerships to rapidly expand its knowledge base and establish governance and enforcement mechanisms.



# The Federal Government's Role in Monitoring and Analysis

Unlike state-level programs, no U.S. federal agency is currently engaged in modifying the weather or atmosphere for water or energy purposes. Still, essential oversight work is underway in multiple federal programs:

- + **NOAA leads efforts to develop approaches for monitoring and analyzing the weather and climate effects of atmospheric modification activities**
- + **EPA regulates emissions into the atmosphere, and established a permitting program for marine geoengineering, but does not currently have specific rules on weather and other atmospheric modification**

Federal agencies are also working to establish capabilities to analyze both domestic weather modification programs and potential future atmospheric interventions. This work is essential to protect public safety and ensure accountability as atmospheric technologies advance. Without robust federal oversight and monitoring capabilities, we will not be able to adequately protect American interests or distinguish safe and beneficial activities from harmful interventions.

We need our government to do more, fast, to understand and monitor what is happening in our atmosphere.



# Immediate Research Priorities

**American imperatives call for rapid public investment in securing the atmosphere.**

## **Support Essential Programs**

Ensure robust support for globally unique and essential observing capabilities and related programs, such as [NOAA's Earth's Radiation Budget](#), [SABRE](#), and [AIRMAPs](#) programs; NASA platforms, including WB-57 and satellite instruments; and platforms and programs for observing the stratosphere, ozone layer, aerosols, Earth's radiation budget, and the long-term environmental effects of substances in the atmosphere.



### **Scale Atmospheric Observations**

Expand monitoring and observing capabilities to understand baseline conditions, natural variability, and atmospheric responses to different influences—the foundation for detecting anomalies and attributing activities—with public-private partnerships to promote efficiency, scale, and innovation.

### **Accelerate Scientific Advance**

Researching atmospheric composition, chemistry, and processes to improve understanding of how the atmosphere responds to various proposed materials for, and approaches to, modification, and to reduce major drivers of uncertainty in forecasting how the atmosphere and Earth system will evolve over time.

### **Improve Models, AI, and Analytical Tools**

Expanding observations for use in AI analyses designed to reduce uncertainties in some important processes, improving the ability to simulate weather effects beyond a few weeks and better quantify the effects of larger-scale atmospheric modifications.

### **Study and Evaluate Substances and Approaches for Modification**

Assessing potential materials and methods for atmospheric modifications in order to develop detection systems and security measures and to evaluate effectiveness and safety before any significant use.

### **Rapidly Develop Advanced Detection Capabilities**

Combining improved observations with AI and modeling tools to develop capabilities for identifying atmospheric interventions by foreign state or private actors as a foundational and essential step for maintaining weather sovereignty.





# International Enforcement Framework

U.S. security against foreign activity includes mechanisms for monitoring and enforcement globally. The world's most successful environmental protection framework, the [Montreal Protocol](#), established by and supported under Republican administrations, demonstrates the power of three common-sense building blocks:

## **Research and Observations**

Building scientific knowledge and data sets

## **Scientific Assessment**

Independent evaluation free from advocacy

## **Transparent, Science-Based Frameworks**

Providing public information about activity via federal leadership

Independent scientific assessment and enforcement must be conducted by institutions free from the organizational pressures affecting commercial ventures and advocacy nonprofits. This will ensure evaluations prioritize public safety over market positioning or other organizational goals.



# Building American Weather Sovereignty

U.S. science agencies have world-leading capabilities for research, observation, and modeling of the atmosphere.

**Maintaining this leadership will require commitments and coordination across the federal landscape.** Financial investment must be expanded and redirected toward atmospheric monitoring infrastructure, enhanced U.S. capabilities, public-private partnerships, academic research, technology innovation, and retention of critical scientific talent.

For this mission to succeed, there must be U.S. federal leadership on public data, monitoring infrastructure, and enforcement.

The U.S. can and should lead development of transparent, science-based enforcement mechanisms internationally, building coalitions with allied nations for cooperative research and monitoring, and establishing monitoring and open data mechanisms for atmospheric interventions. In this way, we ensure American leadership in the technical, political, and security dimensions of this critical strategic domain.



## Monitoring, Not Bans: The Conservative Alternative

Some states are advancing government proposals to restrict or prohibit "weather modification activities." This approach is counterproductive and fails to address legitimate American concerns.



## The consequences are compounding:

- + Misinformation gains credibility when codified into statute
- + Legislators grow wary of atmospheric research broadly, including basic monitoring
- + Companies, universities, and federal agencies encounter heightened scrutiny
- + Federal appropriators interpret state resistance as a signal that atmospheric work is politically radioactive
- + Communities remain uninformed about actual atmospheric activities and risks

## The conservative alternative is partnership, oversight, and readiness:

- + **Incentivizing new models for public-private partnership** to leverage the best of American business ingenuity
- + **Monitoring and transparency** as tools of good governance
- + **Weather sovereignty** as America's right and responsibility to understand and monitor its own skies
- + **Threat detection** to identify and respond to foreign activities
- + **Science-based guardrails** that protect safety without impeding necessary research

Unilaterally laying down arms by establishing a voluntary ban can prompt adversaries to move faster for advantage, removing the possibility of deterrence and leaving the United States vulnerable and behind. This framework treats atmospheric monitoring, research, and innovation not as a threat, but as an essential function of national defense and responsible stewardship.



# The Essential Role of State and Local Engagement

States and local communities have legitimate concerns that require thoughtful engagement, not dismissal. An effective approach to atmospheric security must include robust state and local participation.



## State-level leadership plays a critical role in:

- + Protecting public health and safety within their borders
- + Voicing community concerns about atmospheric activities
- + Ensuring transparency and accountability in research
- + Partnering with federal agencies on monitoring infrastructure
- + Incentivizing responsible economic development in this emerging critical domain
- + Establishing appropriate oversight mechanisms

## Local communities across America—from agricultural regions to urban centers—need:

- + Clear, accessible information about atmospheric monitoring and research activities
- + Opportunities to voice concerns and have them addressed seriously
- + Local input on monitoring priorities that affect their regions
- + Transparent communication about what is being studied and why
- + Mechanisms for accountability when activities affect their air quality and health

**The goal is not to impose federal mandates, but to build cooperative frameworks that respect state authority, address local concerns, and ensure comprehensive atmospheric security for all Americans.**



## Our Leadership on the Atmosphere Cannot Wait

The emergence of well-funded private organizations and foreign government programs pursuing rapid atmospheric intervention makes U.S. public investment in monitoring and atmospheric science more urgent than ever. We cannot prevent development of interventions everywhere in the world, but we can ensure the United States leads in building the knowledge base for safety and security.

**The path forward requires rapidly expanding our knowledge base and governance capabilities, not building scaled deployment capabilities.** New tools for ensuring atmospheric safety and security will be critical to U.S. leadership and prosperity.



## Critical Next Steps

**Expand federal funding** for public-private partnerships for responsible atmospheric observations and research while ensuring state and local participation.

**Establish independent scientific assessment mechanisms** separate from advocacy organizations, with state-level advisory input.

**Establish oversight based on evidence.**

**Maintain U.S. technological leadership** to protect American weather sovereignty.

**Develop attribution capabilities** to detect and respond to unauthorized interventions.

**Engage states and communities** through transparent communication, local monitoring partnerships, and responsive oversight.



# America Must Have Weather Sovereignty

Atmospheric conditions form the foundation for economic activity, public safety, and national security. **The United States must lead in protecting American weather sovereignty and ensuring a safe and secure atmosphere—or risk ceding this critical domain to competitors.**

## **Current U.S. underinvestment in atmospheric research and observation is:**

- + Inducing transfer of critical talent to competitor nations
- + Accelerating threats to U.S. atmospheric security and weather sovereignty
- + Reducing the potential for American leadership and economic success
- + Creating strategic blindness at a moment of rising competition
- + Undermining national security by weakening the United States' ability to detect, attribute, and respond to foreign atmospheric activities that could affect critical infrastructure, energy systems, and military readiness
- + Leaving American communities without the information needed for public health and safety

**The greatest risk is not the small-scale activities happening today, instead, it is not having the information and tools to protect our weather sovereignty now and in the decades to come.**



# About This Brief

This brief is co-authored by the Rainey Center Freedom Project and SilverLining.

## SilverLining

SilverLining is a nonprofit organization dedicated to ensuring that society has the information and capabilities needed to ensure a safe and secure atmosphere. They support open research, science-based policy, and broad stakeholder engagement to advance understanding and protection of the atmosphere.

## Rainey Center Freedom Project

The Rainey Center Freedom Project works with conservative policymakers to advance policies that promote American security, freedom, and prosperity through evidence-based governance.

## Learn More

- + SilverLining's Roadmap for Research  
[silverlining.ngo/roadmap](https://silverlining.ngo/roadmap)
- + Rainey Center Freedom Project  
[raineyfreedom.org](https://raineyfreedom.org)

This brief frames atmospheric security around weather sovereignty, national security, public health, and responsible stewardship—not bans or ideological conflict. It emphasizes the essential partnership between federal capabilities, state authority, and local community engagement to protect the atmosphere Americans depend on for their safety and prosperity.





# Rainey Center

[info@raineycenter.org](mailto:info@raineycenter.org)  
[raineycenter.org](http://raineycenter.org)

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