

Testimony of

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Before the

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Subcommittee on Research and Technology

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Introduction

Chairman Miller, Ranking Member Ross, and members of the Subcommittee, I am Dr. Scott Weaver, Founder of CLIMET Consulting, LLC, a new consultancy focused on science and policy issues in weather and climate. I have also served in several scientific leadership roles within the federal government, including as a Research Meteorologist for NASA and NOAA, Director of the interagency National Windstorm Impact Reduction Program led by NIST, and most recently as the inaugural Executive Director of the Interagency Council for Advancing Meteorological Services, or ICAMS, at the White House Office of Science and Technology Policy. Thank you for the opportunity to appear before you today.

The ICAMS aspirational goal as stated in its 2020 Charter¹ is:

“The United States will lead the world in meteorological services via an Earth system approach, providing societal benefits with information spanning local weather to global climate”

So, the question before us today is essentially, what are the requirements for the United States to lead the world in meteorological science and services and ensure that all sectors of American society are prepared for, and able to adequately respond to the pervasive weather threats that menace our country on an increasingly frequent basis?

This is a timely question. I come before you today at a critical time for the meteorological science and services enterprise. Since 1980, the United States has experienced over \$2.5 Trillion in economic losses and over 8,000 fatalities from extreme weather events, with \$1 Trillion of those losses occurring in the last seven years alone (see figure 1). No one is immune from the effects of extreme weather. Hurricanes, tornadoes, heatwaves, wildfires, floods, and droughts are causing severe impacts across all 50 states (see figure 2), and the impacts are worsening.

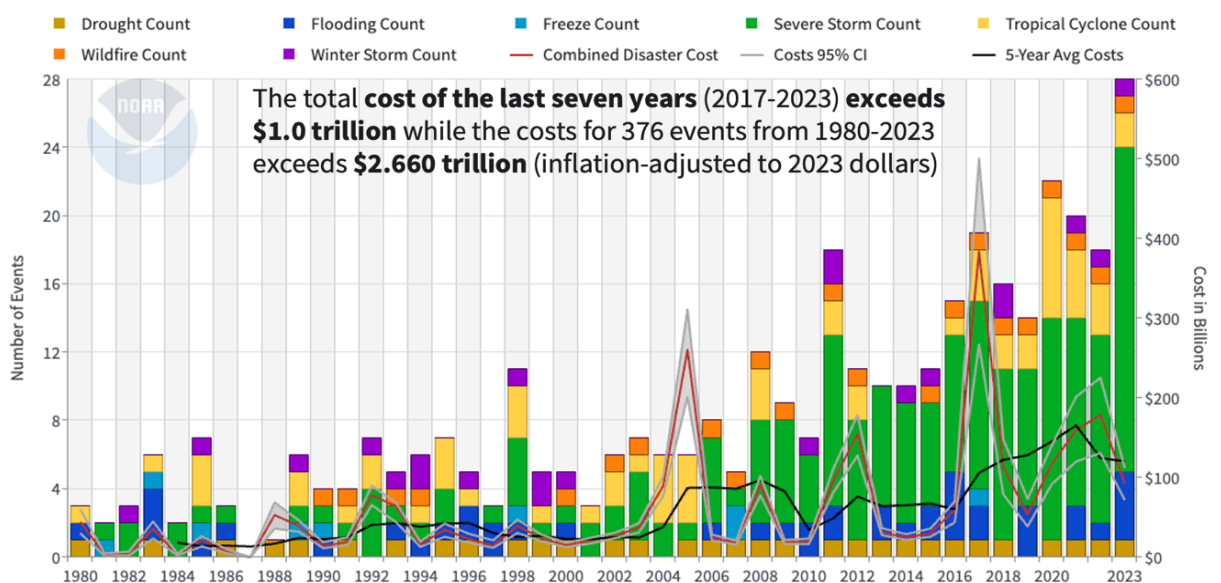


Figure 1: NOAA Billion Dollar Disasters – Bars are annual event count; lines are total annual cost.

¹ ICAMS Charter: https://www.icams-portal.gov/resources/signed_icams_charter.pdf

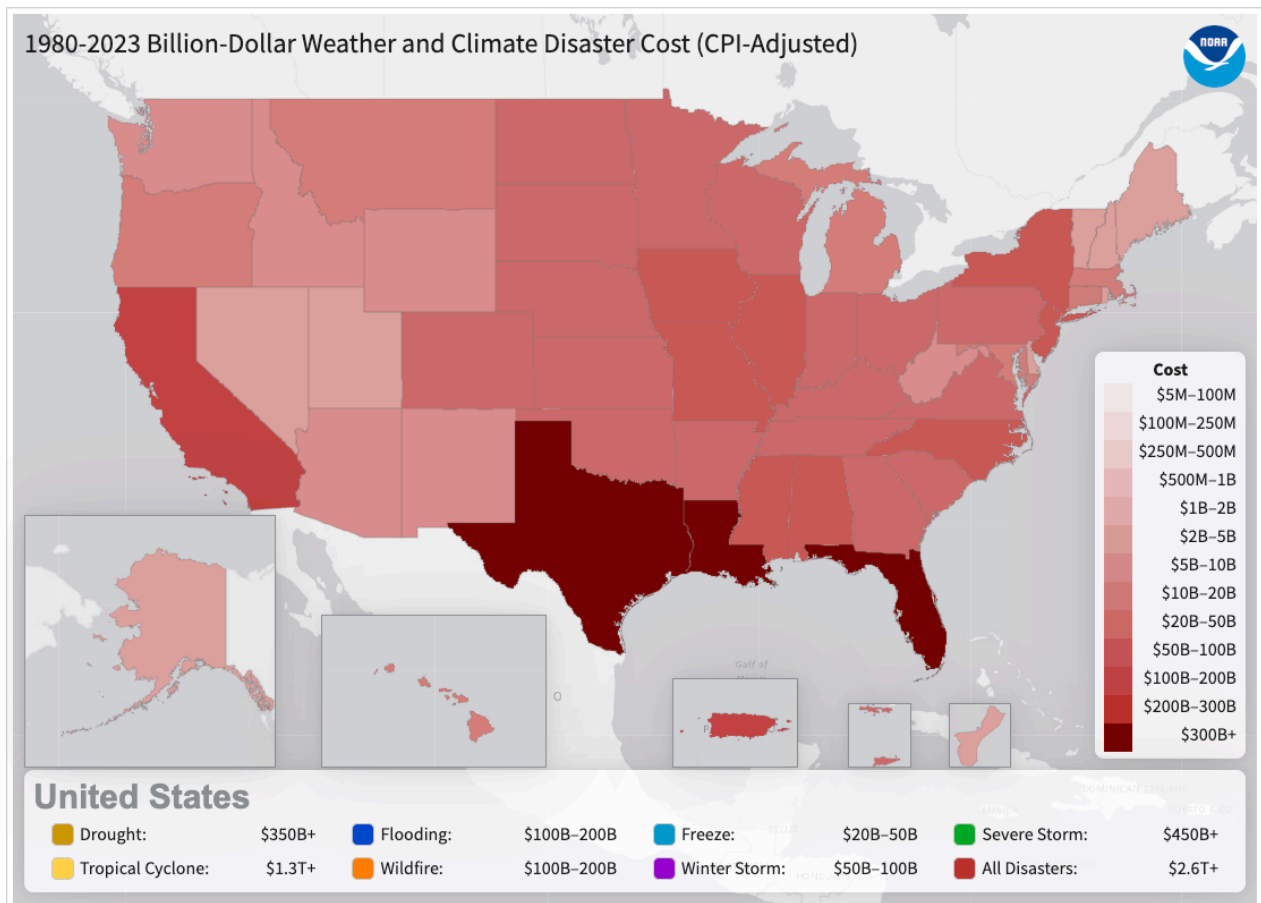


Figure 2: NOAA Billion Dollar Weather Disaster Cost by State 1980-2023 (darker shading indicates greater cost)

These weather disasters highlight a somewhat uniquely American experience. No other country in the world faces such a diversity, frequency, and intensity of extreme weather events. As such, our national weather prediction challenges are exceedingly difficult by comparison, and in some instances, require targeted phenomenologically-based modeling approaches that may not be as necessary for other countries. Indeed, the U.S. experiences approximately 1400 tornadoes per year on average², dwarfing the annual tornado count of any other Nation in the world. There is a similar situation with tropical cyclones. In 2020, there were 31 Atlantic tropical storms and hurricanes, 11 of which made landfall in the U.S., causing tens of billions of dollars in damage to the American economy, while in 2017 our nation experienced nearly \$300 billion in tropical storm and hurricane losses from three landfalling storms, and the list goes on.

Despite these sobering statistics, over the last seven decades our Nation has made significant progress in Numerical Weather Prediction (NWP) – the foundational element and first line of defense for a multi-sector enterprise focused on the provision of meteorological forecast products

² <https://www.spc.noaa.gov/wcm/ptornrgraph-big.png>

and services on timescales ranging from minutes to years. One shining example of our collective progress in NWP is the role it has played in the enormous reduction in tropical storm and hurricane forecast track errors over the last 50 years. For instance, the average three-day track forecast error has been reduced from 450 miles in 1970 to just 50 miles today (see figure 2 yellow dashed line). This incredible scientific and technological achievement is the result of an international multi-decade long investment in a coordinated research to applications effort.

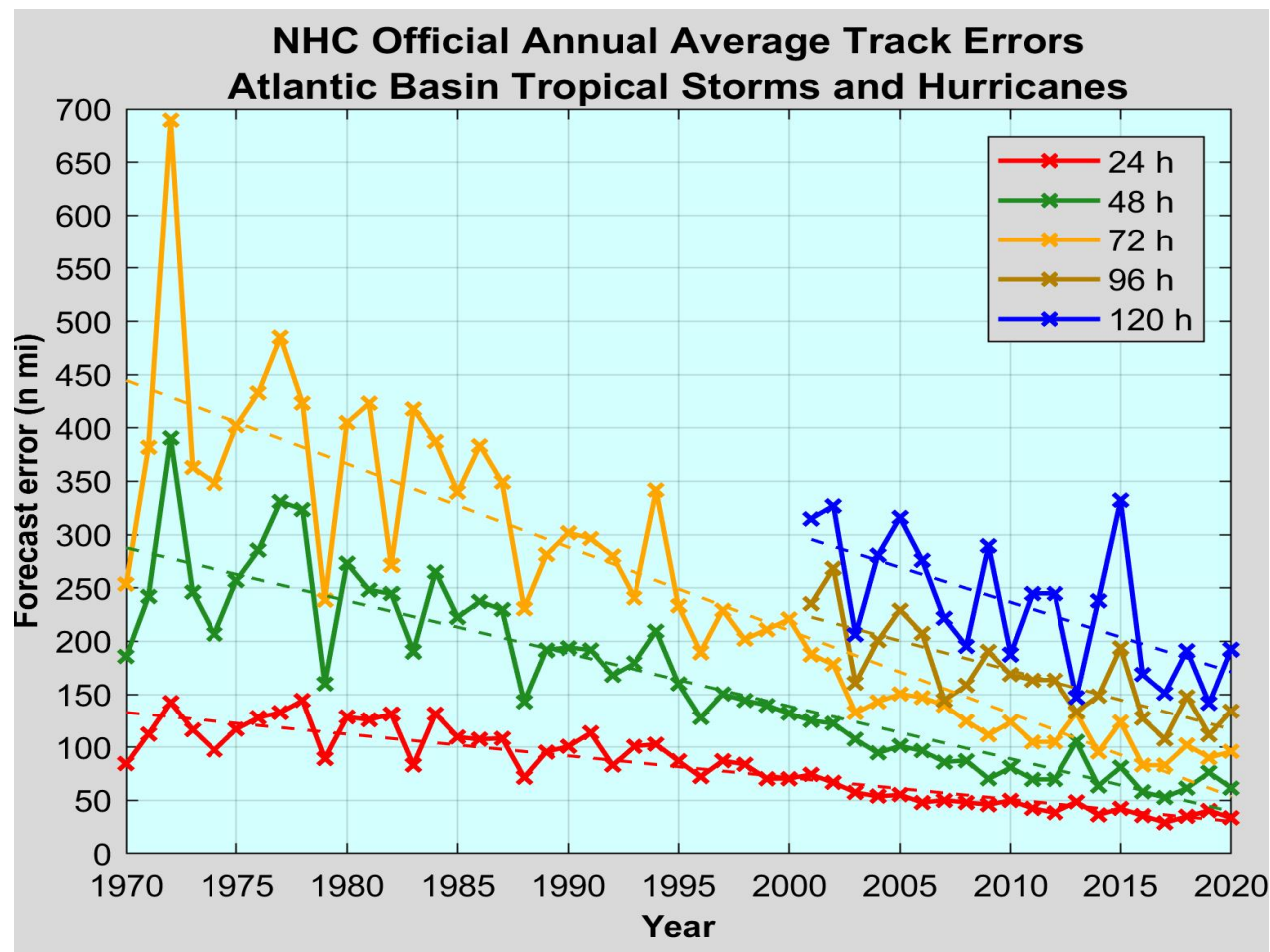


Figure 2: NOAA/NHC forecast TC track error validation for various lead times (colors).

Despite this, and other similar successes, there still exists a critical need, and an incredible opportunity, for the United States to lead the world in meteorological science and services. To achieve this requires developing, supporting, and coordinating a robust and thriving research and applications enterprise to tackle our most pressing national challenges in weather and climate prediction, and finally begin to bend the curve in the Nation’s accelerating annual weather disaster losses. However, for America to lead the world in meteorological science and services requires focus on more than just the foundational scientific and technical aspects that are required to improve the skill of our Nation’s Earth system prediction models. It is also essential to improve coordination of the Nation’s vast meteorological assets, to ensure that we are efficiently and effectively managing our investments across the entire weather enterprise.

While the federal government is only one sector that makes up the meteorological enterprise, it serves as the de facto strategic leader, especially given that the federal meteorological science and service agencies report annual investments approaching \$6 billion in the congressionally mandated federal meteorological enterprise budget crosscut, some of which supports the academic, commercial, and non-governmental organization (NGO) sectors.

Given the significant federal investment of resources, it is critical that the federal government engage in strong coordination of its own assets, in addition to providing a leadership role in the broader meteorological enterprise. However, significant obstacles exist. Varying missions, budget development approaches, and legislative requirements make it challenging to effectively develop shared priorities and practices across the range of meteorologically sensitive federal agencies. While coalitions of the willing exist in small pockets of interagency activity (e.g., wildfire), and are commendable, these voluntary coalitions are not the most effective way to develop, coordinate, and implement a far-reaching national strategy for advancing the entire meteorological enterprise.

Towards Improved Coordination of Meteorological Science and Services

In recognition of the need to better coordinate meteorological science and services across the federal government, in the 2017 Weather Research and Forecast Innovation Act, or “Weather Act”, Congress created the Interagency Council for Advancing Meteorological Services (ICAMS) to elevate federal coordination of meteorology to the White House level, to ostensibly provide the requisite leadership to advance this critical national priority. The impetus for this 20+ federal agency³ coordination effort is further summed up quite well in a quote from a recent peer reviewed publication in the Bulletin of the American Meteorological Society⁴:

“Although the Weather Act covers a broad range of meteorological topics, the motivation for administrative restructuring was driven largely by the need for better coordination of relevant weather research and forecast innovation activities through elevated visibility and engagement among principal-level policymakers.”

To provide this improved coordination, the ICAMS agencies established four standing committees under ICAMS: The Committee on Observational Systems (COBS), the Committee on Cyber, Facilities, and Infrastructure (CyFI), the Committee on Services (CoS), and the Committee on Research and Innovation (CoRI). Each of these committees contains subordinate bodies that reflect all relevant aspects of the meteorological enterprise (see figure 3). If properly resourced and supported, this structure has massive potential to be the gold standard in scientific interagency coordination and accelerate progress on an array of important issues in meteorological science and services, including NWP.

³ A list of the 28 ICAMS federal agencies is contained within the ICAMS charter: https://www.icams-portal.gov/resources/signed_icams_charter.pdf

⁴ Droegemeier, K. K., and N. A. Jacobs, 2022: Restructuring of federal coordination to advance meteorological services. Bulletin of the American Meteorological Society.

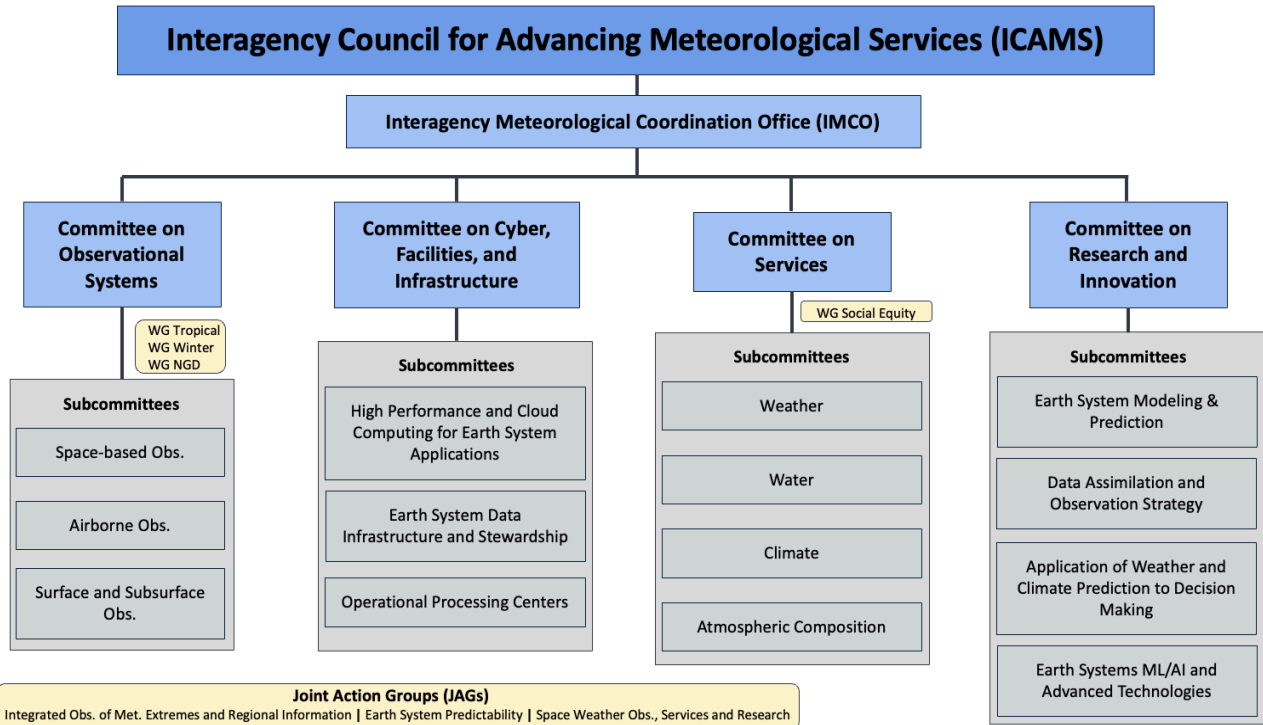


Figure 3: Organizational chart for the Interagency Council for Advancing Meteorological Services (as of July 2023)

To be sure, ICAMS has achieved some level of success already. In addition to the multi-year effort to establish the ICAMS structure and develop an initial set of near-term priorities⁵, in 2022-2023 the ICAMS agencies engaged in two efforts to advance interagency coordination of meteorological science priorities for wildfire. This included research-focused interagency workshops, and co-developing priorities for interagency research, development, and implementation of observational systems to inform various annual agency budget development processes for wildfire. Having a shared inventory of needs and requirements to address gaps in observations and modeling for one of the Nation’s most pressing meteorological disaster needs can be of high value, provided it is used to inform agency budget planning, as intended.

Additionally, in late 2022, ICAMS embarked on the development of its first decadal strategic plan and provided multiple opportunities for the public and federal agencies to provide their perspective, including developing and gathering external stakeholder input via publication of a public request for information, holding multiple public listening sessions, a Town Hall event at the annual meeting of the American Meteorological Society, engagement during a federal roundtable, and an agency survey instrument. Given that ICAMS is still operating under short term priorities, it is critical that the development of the decadal strategic plan continue if ICAMS is to achieve its aspirational goal.

⁵ Mariotti, A., S. J. Weaver, N. Kanankutty, M. Paese, M. Yapur, 2023: Progress in federal coordination to advance meteorological services. Bulletin of the American Meteorological Society.

While these achievements are notable, ICAMS may never reach its full potential. The original Weather Act did not include much in the way of specifics for ICAMS, and accordingly, charged the OSTP Director with developing the details of ICAMS implementation, a mandate that was fulfilled in 2019 and 2020 with the development and release of the ICAMS Charter. However, interagency policy mechanisms like charters are subject to the whims of each administration, as opposed to more enduring legislative requirements. Therefore, strengthened provisions are needed in any Weather Act reauthorization to ensure that ICAMS remains elevated as a top national priority so that it can effectively respond to urgent national needs, such as those for NWP, and the many other important aspects of the meteorological science and services enterprise. Additionally, the Interagency Meteorological Coordination Office (IMCO) is vastly under resourced and under staffed to effectively coordinate a \$6 billion federal meteorological enterprise, and its location within a federal agency can oftentimes become a barrier to promoting robust interagency engagement.

Finally, over the last two decades, the meteorological enterprise has undergone significant changes. None of these is more impactful than the evolution of the private sector from primarily developing end user products and services, to that of a multi-billion dollar commercial enterprise that is in direct competition with the federal government to provide the very foundational data, modeling, and information that was once only the purview of federal meteorological agencies. This rapidly evolving landscape requires a nimble and effective strategy to make what amounts to an order of magnitude change in how the federal government engages with the commercial sector.

Recommendations

As the former inaugural Executive Director of ICAMS, I provide the following recommendations for consideration by Congress and the President:

- Mandate the completion and implementation of the ICAMS decadal strategic plan, which is already a required deliverable under the ICAMS charter, and necessary to guide short-, medium-, and long-term activities across the entire meteorological enterprise
- Reimagine the Interagency Meteorological Coordination Office (IMCO) by implementing an interagency resource support model similar to the U.S. Global Change Research Program
- Unleash the private sector by leading explicit coordination amongst the federal and private sectors to align Earth system research and development goals for mutual benefit, especially to enable the rapid development and implementation of emerging commercial technological advances for in situ and space-based observational systems
- Foster engagement at the agency head level to inspire interagency leadership conversations around shared priorities and opportunities in meteorological science and services to inform coordinated federal agency budget development activities

- Ensure that the ICAMS definition of meteorological science and services includes an Earth System approach to its scientific activities, similar to the World Meteorological Organization
- Implement mechanisms to encourage and enable the participation of nonfederal stakeholders in ICAMS to better reflect the diversity of perspectives across the broader meteorological enterprise, to ensure that the full slate of American meteorological scientific expertise is being thoughtfully leveraged

I thank this Committee for its recognition of the necessary role for the Federal Government and in supporting the meteorological science and services, and the resulting creation of ICAMS to provide the environment for advancing U.S. leadership in the meteorological science and services enterprise.

I look forward to our discussion today, and I am happy to answer any questions you may have.