

Environmental Information Services Working Group (EISWG) Statement Concerning the Ongoing NWS Data Dissemination Challenges

Submitted to the NOAA Science Advisory Board (SAB) for
approval and action

(The EISWG is a Standing Working Group of the SAB)

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Today's Key Challenges ... faced by the National Weather Service (NWS):

- *Keeping Pace with accelerating scientific and technological advancement*
- *Meeting Expanding and Evolving User Needs in an increasingly information-centric society*
- *Partnering with an Increasingly Capable Enterprise that has grown considerably*

--from [Weather Services for the Nation, Becoming Second to None](#), The National Academies Press, 2012.

Background

The distribution of foundational weather data and severe weather warnings is one of the most important services of the National Weather Service (NWS) and is the basis for the NOAA [Environmental Data Partnership Agreement](#) with emergency management agencies, companies in the United States weather industry (including broadcast/cable media outlets), and the academic/research community. The positive result of this policy has been the growth of a robust Weather Enterprise that works together with NWS to meet the expanding and evolving needs of a [Weather Ready Nation](#). However, today's reality is that NOAA NWS information delivery infrastructure has not kept pace with the growing demands for these services and the NWS is now facing very serious challenges across its data dissemination, bandwidth resources, and internet service capabilities. In this statement the Environmental Information Services Working Group ([EISWG](#)) seeks to raise awareness to the situation, provide four initial recommendations, and offer its support in bringing together Weather Enterprise stakeholders with broad expertise to jointly explore alternative potentially innovative solutions.

Findings

The growing information delivery challenges the NWS is experiencing are likely the result of (a) tremendous growth in the demand for weather- and climate-related data, (b) the lack of sufficient infrastructure growth and modernization, and (c) the difficulty of working within the constraints of government processes and severely limited resources. The impacts are beginning to extend beyond inadequate bandwidth as data requests are now being distributed across multiple NOAA delivery points, which reduces and/or eliminates their primary objective of providing backup for maintenance and outages. This has resulted in significant production system downtime, which has already had serious, disruptive repercussions throughout the Weather Enterprise. Of particular concern are recent substantial multi-day outages affecting data dissemination platforms including the National Operational Model Archive and Distribution System (NOMADS), one critical access point for operational NWS datasets. The NWS and its dissemination partners rely heavily on many of these access points for assessing and predicting high-impact weather events, generating their own forecasts, analytics and alerts, as well as enabling communication of critical information to the public, businesses and emergency managers. In addition to these impacts, there is increasing public awareness of the issues and a potential decrease in the public's confidence in NOAA NWS's ability to deliver its highly valued services.

The NWS released a [Public Information Statement](#) (PNS) on November 18, 2020, announcing a proposal to uniformly apply rate controls of 60 connections per minute (cpm) for access to NWS public foundational data available at 53 or more web and data services. This step was taken to stabilize the heavily used system and speaks to the urgency and criticality of the situation. Unfortunately, an implementation of such a policy would also negatively, and possibly catastrophically, impact individuals and businesses that rely on these data to make critical, life-saving decisions when seconds count and lives are on the line.

In response to public comments on the PNS, and enabled by \$1.5M in emergency funds, the NWS released on March 17, 2021, a [Service Change Notice \(SCN\)](#) reducing the scope of the proposed changes and limiting their affect to 5 NOMADS/FTP Web Services. It was further communicated that to prevent system crashes during peak demand times, an aggregate rate control of 120 cpm would be instituted across the 5 associated websites beginning April 20, 2021. EISWG appreciates the work the NWS has completed to limit the rate controls to only 5 websites and to double the allowed rate from what was initially proposed. However, even this is considered too risky. Weather is a 24x7 industry, yet, in the event a data user exceeds the cap of 120 cpm, their access will be blocked and it will not be restored until it is done manually during regular business hours. This will undoubtedly result in extended outages for individual partners that could be catastrophic to their business and customers.

Rate limits have the potential to disproportionately affect users of NWS foundational data who have a mission-critical need to frequently access large volumes of data for their business and/or public safety purpose. These users, particularly those in the United States weather industry and other app developers, often provide significant assistance as partners to NWS in providing warnings and other content to a wide audience. Without knowing exactly when data are available on the NWS servers, an organization must probe the servers repeatedly to get the data as soon as possible, potentially causing them to exceed the aggregate 120 cpm limit, particularly when they are trying to download multiple models and datasets across the 5 rate-limited websites.

In addition to these emergency measures, the NWS has made significant progress toward improving the overall situation through a strategic framework as identified in the NWS report "[Future Needs of the Integrated Dissemination Program: An Implementation Plan, August 2020](#)"; hereafter referred to as the IDP. Overall, the EISWG strongly supports the IDP for a long-term solution; it targets the NWS's dissemination objectives and prioritizes partnering with the broader Weather Enterprise to support a Weather Ready Nation. However, it is not clear the short-term resources and diversity of technical approaches are sufficient to protect and restore services as quickly as necessary to reduce risk and address today's immediate challenges. As such, the EISWG offers its expertise and support to the NWS to bring more stability, resiliency, and redundancy, to what is an increasingly over-loaded and threatened vital infrastructure.

Recommendations

From the EISWG's perspective, it is recommended that any approach be both rapid and comprehensive, and focus on several fundamental objectives:

1. *Design and implement an emergency response:* It is imperative the NWS legacy data dissemination systems and associated infrastructure be stabilized, with the immediate goal of providing robust, reliable capacity with backup capabilities that function without the need for data access limits. This will likely require additional critical infrastructure investments that serve primarily as a stopgap (and possibly independent of the IDP) until longer-term solutions can be finalized and implemented. EISWG encourages NOAA leadership to explore and implement strategies that will lead to increased bandwidth and infrastructure modifications necessary to bring immediate short-term relief to this critical situation.
2. *Strengthen engagement with the broader Weather Enterprise:* The value of NWS public engagement after the PNS was first announced was demonstrated by the reduced limits implemented in the SCN. NWS should expand the successful engagement with external partners in a public forum to identify immediate, short-term actions all parties can take to provide emergency improvements while the upgrading effort in (1) is underway. The EISWG membership includes representatives from across the Weather Enterprise that are informed of the issues and are engaged in finding solutions, and could co-sponsor or facilitate such a forum.
3. *Prioritize designing and moving to an appropriate scalable architecture:* Given the dramatic overall growth in demand, and the intermittent, event-driven surges, it is critical that elements of the architecture be collaboratively designed to address these dynamic data delivery needs. The need for an adaptable, scalable architecture is critical because while future demand is expected to increase, the rate of increase is difficult to predict. The EISWG encourages exploring different options, including:
 - a. *Leverage Content Delivery Networks:* A major rapid enhancement for the current data dissemination system may be found in the increased use of Content Delivery Networks (CDN) that can quickly enable greater scalability of the existing NWS data delivery system. Using CDN technology, data files that do not change once produced (bulk model data grids, as one of many examples) can be cached on the edge of the CDN. This removes the need for every user data request to hit the NWS origin servers, providing the potential to greatly reduce the throughput of requests going directly to NWS. Demand will only increase as new models and products are developed, including the just released new version of GFSv16.
 - b. *Accelerate the migration to commercial cloud networks:* EISWG is fully supportive of the IDP, with particular focus on Phase 4, which will require new resources and considerable time. As such, NWS should strongly consider how it could accelerate the migration of their last mile of data dissemination services to secure commercial cloud networks; such networks have demonstrated the ability to facilitate effective and efficient data management, including large-scale distribution. The NOAA Big Data Project implemented in collaboration with Amazon, Google, and Microsoft web services, provides useful experiences. The last mile delivery of NWS foundational data through commercial cloud environments must also comply with long standing NOAA principles around equal access to all data at no cost and mechanisms to ensure that no entities

receive preferential treatment in terms of data available, or speed of availability. In summary, the EISWG endorses the use of commercial cloud networks (identified in the NWS IDP as part of Phase 4) and encourages the NWS to strongly consider reprioritizing such efforts to more rapidly move foundational data to the cloud. This will facilitate increased data distribution and have the greatest impact on reducing data requests from end users to current NWS data systems.

4. *Enhance user management, product availability announcements, and training programs:* Efforts are needed to reduce unnecessarily excessive demands placed on NWS infrastructure by outside entities. The NWS Office of Dissemination should strongly consider the development and distribution of a best practices document for data access. Inclusive to this would be a real-time notification system such as product availability announcements using widely available messaging. Users could then subscribe to receive announcements indicating availability of certain data products as opposed to continually requesting file lists from NWS servers in rapid succession to see if new files are available. To promote compliance with best practices, rather than continuing to allow data users to remain anonymous, it would be beneficial for the NWS to institute enhanced methods that would facilitate fast and definitive identification of individuals, organizations and institutions, to eliminate the challenges caused by their data acquisition methodologies. This capability would allow the NWS, with appropriate public notice to those entities, an opportunity to address and remediate concerns with individuals and organizations that put undue pressure on NWS infrastructure and provide users with ample notice to improve their code in accordance with NWS best practices.

Conclusions

In closing, the NWS data dissemination is a critical part of NOAA's mission and the NWS has taken actions under various constraints (e.g., financial, government contracting) to move toward mitigation of these increasingly critical data dissemination challenges. With the above four recommendations, EISWG encourages the NWS to further engage the entire Weather Enterprise to continue the prompt actions that are needed to minimize short-term risks while jointly assessing and implementing longer-term solutions. The EISWG is eager to hear back from NOAA regarding these recommendations and stands ready to work with the NWS through the SAB and NOAA liaisons to help identify problems and devise the innovative solutions necessary to ensure all users can access NWS foundational data in a rapid and reliable method.