



ASOS installation at Haines, Alaska.
Photo by Tom Burgdorf



Arctic Observation Storylines: Airport Weather Stations

WHY OBSERVING MATTERS AND HOW WE CAN MAKE IT BETTER TOGETHER

The [148](#) automated weather observations at airports are the predominant source of surface weather and climate information in Alaska. These measurements support operations for both civilian and military aviation, but also constitute the backbone of NOAA's weather and climate data products, as manual measurements have declined in recent decades.

The Automated Surface Observing System (ASOS) is a joint effort between NOAA's National Weather Service (NWS) and the Federal Aviation Administration (FAA), while the Automated Weather Observing System (AWOS) is operated and maintained by the FAA. The US Department of Defense also operates its own AWOS sites. These stations nominally report observations on cloud ceilings, visibility, atmospheric pressure, air temperature, dew point, wind, and precipitation accumulation.

While the information from these sites plays a crucial role in Alaska's aviation and public safety, it requires reliable data transmission, as well as sensor maintenance, and many stations have outages for months at a time. Agreements between agencies and telecommunication companies make it difficult to perform repairs, extending the data gap. Automated precipitation measurements in cold regions may also have systematic biases when wind-driven undercatch, ice buildup, and other phenomena are not accounted for.

In a state with few roads and a heavy dependence on aviation, these outages and biases pose a threat to public safety and commerce.

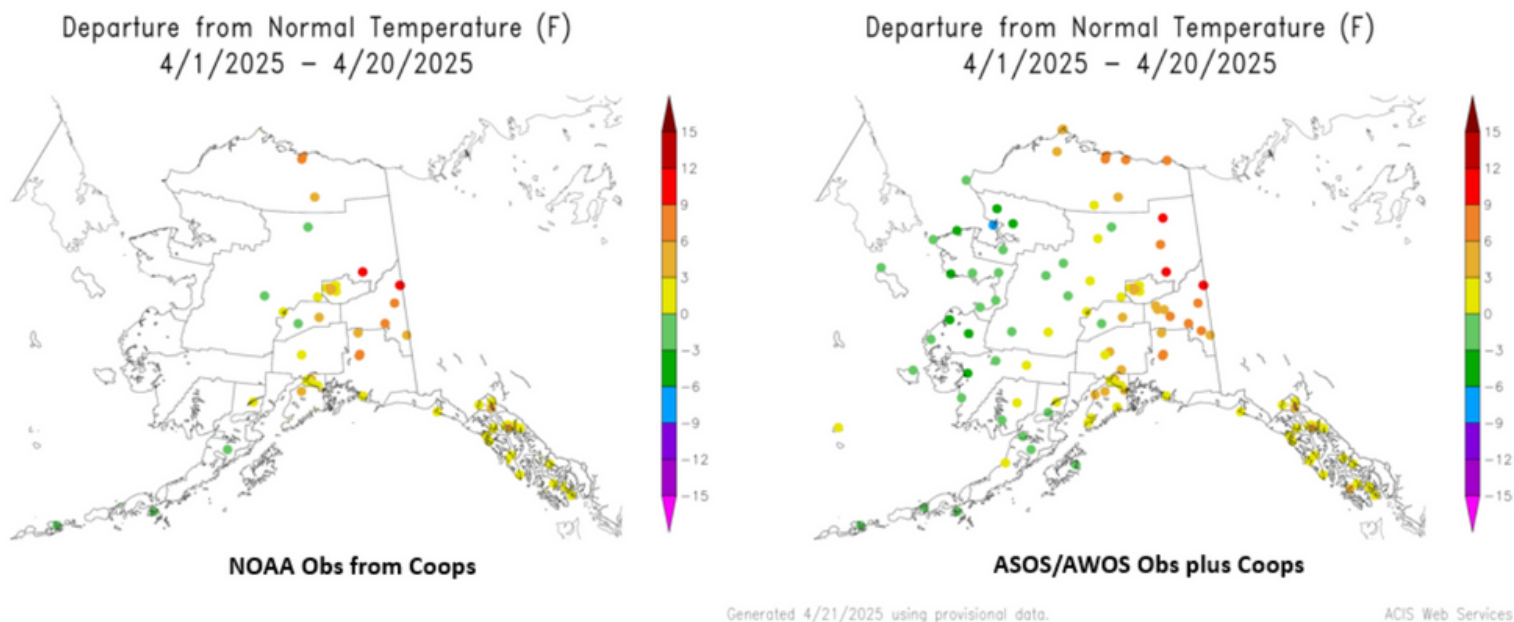




ARCTIC OBSERVATION STORYLINES: AIRPORT WEATHER STATIONS

Importance of the ASOS/AWOS data for long-term planning

The plots below show how a calculated climate anomaly is impacted by using only NOAA's Cooperative (manual) observers (figure on left) versus making use of the full ASOS/AWOS observational network (figure on right). While NOAA also maintains a Climate Reference Network, these have a much shorter period of record and aren't shown here. **The ASOS/AWOS, while designed for operational decision-making in aviation, are also a critical source of NOAA's climate data in Alaska, informing regional and global understanding of long-term temperature trends.**



Generated 4/21/2025 using provisional data.

AOS Web Services

Arctic Observation Storylines Series on Risk Management and Hazard Mitigation

The US Arctic Observing Network (US AON) is a sub-body of the Interagency Arctic Research Policy Committee (IARPC) focused on improving observations and data-sharing systems to support broadly shared societal benefits. It has developed the BENEFIT assessment method in alignment with other interagency efforts (e.g., US Group on Earth Observations Civil Earth Observation Assessment). BENEFIT is an acronym that describes the main goals of the assessment process: **B**enefit **E**valuation | **N**etwork **E**xploration | **F**ind gaps | **I**mprove **T**ogether.

BENEFIT assessment illustrates performance levels in current observing capabilities and provides actionable recommendations to build on strengths and address gaps. The IARPC has recommended that US AON apply BENEFIT assessment with a focus on observing systems that support risk management and hazard mitigation in Alaska. By facilitating these assessments, US AON aims to help those living and working in the Arctic better understand the connections between observing systems and the tools and decision-making processes they support. *Arctic Observation Storylines* are brief write-ups that share insights from BENEFIT assessment work.

BENEFIT assessment helps reveal systemic issues in the Arctic observing system and identifies where networks could be improved to support shared benefits. **Jessica Cherry**, NOAA Regional Climate Services Director for Alaska, is the point of contact for this case study, with additional contributions from **Sydney Luce** (Cadmus), **Rick Thoman** (Univ. AK-Fairbanks), **Mike Jones** (Univ. AK-Anchorage), and **Greg Dyer** (Woolpert). The societal benefit ratings were informed by the 2017 International Arctic Observing Assessment Framework.

ARCTIC OBSERVATION STORYLINES: AIRPORT WEATHER STATIONS



Key takeaways

ASOS/AWOS stations in Alaska require more comprehensive maintenance agreements with partners and upgrades to both data transmission systems and precipitation sensors to adequately meet societal needs.

- Downstream effects of transmission outages largely impact Alaska's remote communities, including villages, work camps, and defense infrastructure and operations. These communities are not connected to a road network and rely on aviation for food, medicine, commerce, and national security.
- ASOS and AWOS observations feed into higher-level products that are used to make decisions on flight routes, flight authorization, military operations, and more. These applications help ensure remote access to goods and services, inform disaster preparedness efforts, and contribute to an understanding of Arctic Systems.
- Aviation operators depend on certified surface observations (captured by ASOS/AWOS stations) to land a plane under a scheduled flight. To repair ASOS/AWOS units, technicians must charter a flight to access communities off the road system, at a great expense and personal risk.
- If and when communications outages are restored to stations, the climate data record is typically not backfilled with the missing data, which brings bias into essential climate products for Alaska.
- Accountability for ASOS/AWOS data distribution and maintenance is fragmented due to multiagency responsibilities, differing priorities of telecom contractors and subcontractors, and lack of accurate, timely, and transparent outage tracking. Better outage tracking could make repair prioritization more objective and easier to address.

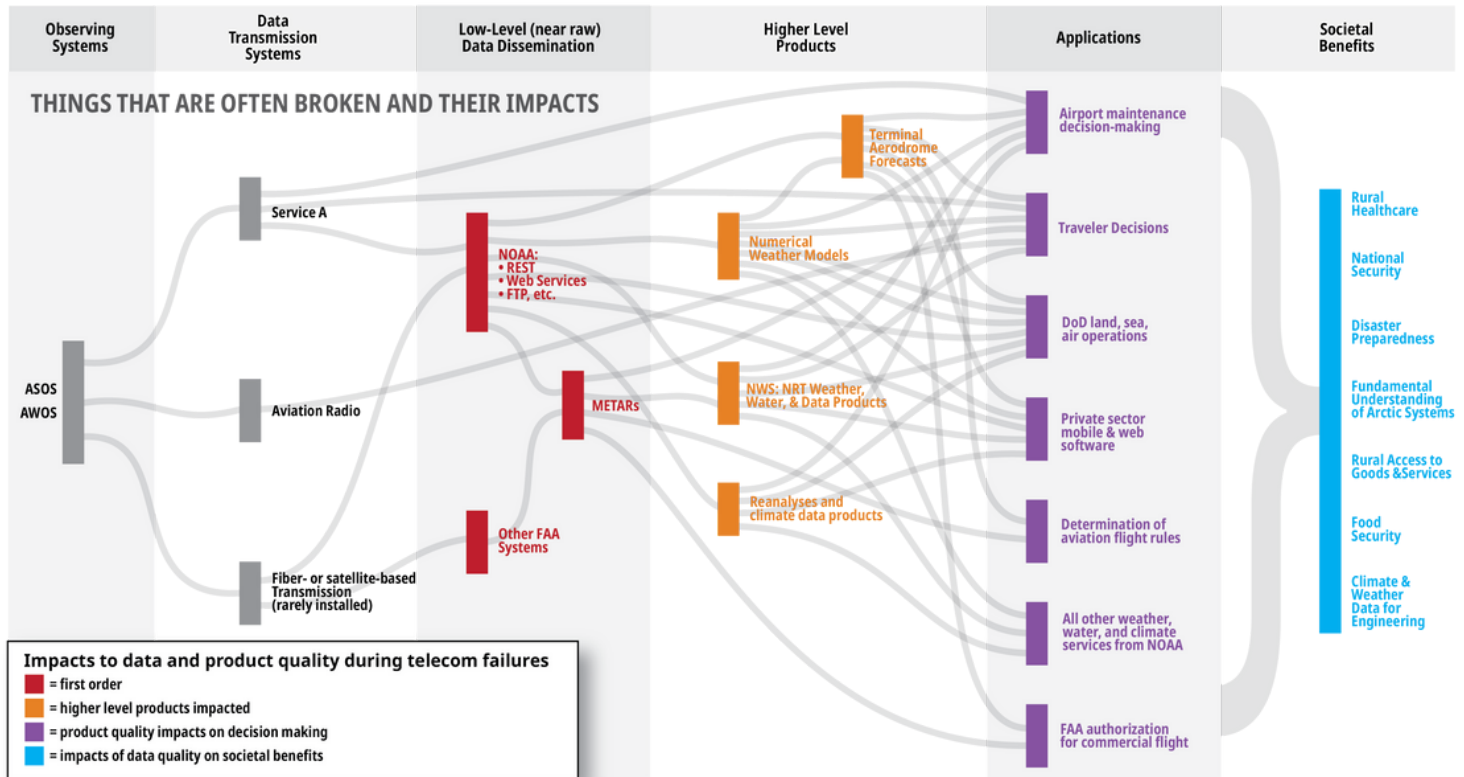


A plane making the final approach to Dutch Harbor airport. Photo by: Michael Theberge



ARCTIC OBSERVATION STORYLINES: AIRPORT WEATHER STATIONS

Visualizing ASOS/AWOS Applications and Outage Impacts



The BENEFIT assessment diagram above, modified for the specific needs of this case study, shows how ASOS and AWOS observations feed through various data products that are used to provide societal benefits. The grey lines represent the flow of data that informs a product, application, or societal benefit. Color coding indicates the downstream effects of ASOS/AWOS transmission outages and malfunctions. Data dissemination applications, indicated in red, are the first to feel the impacts when a sensor goes offline.

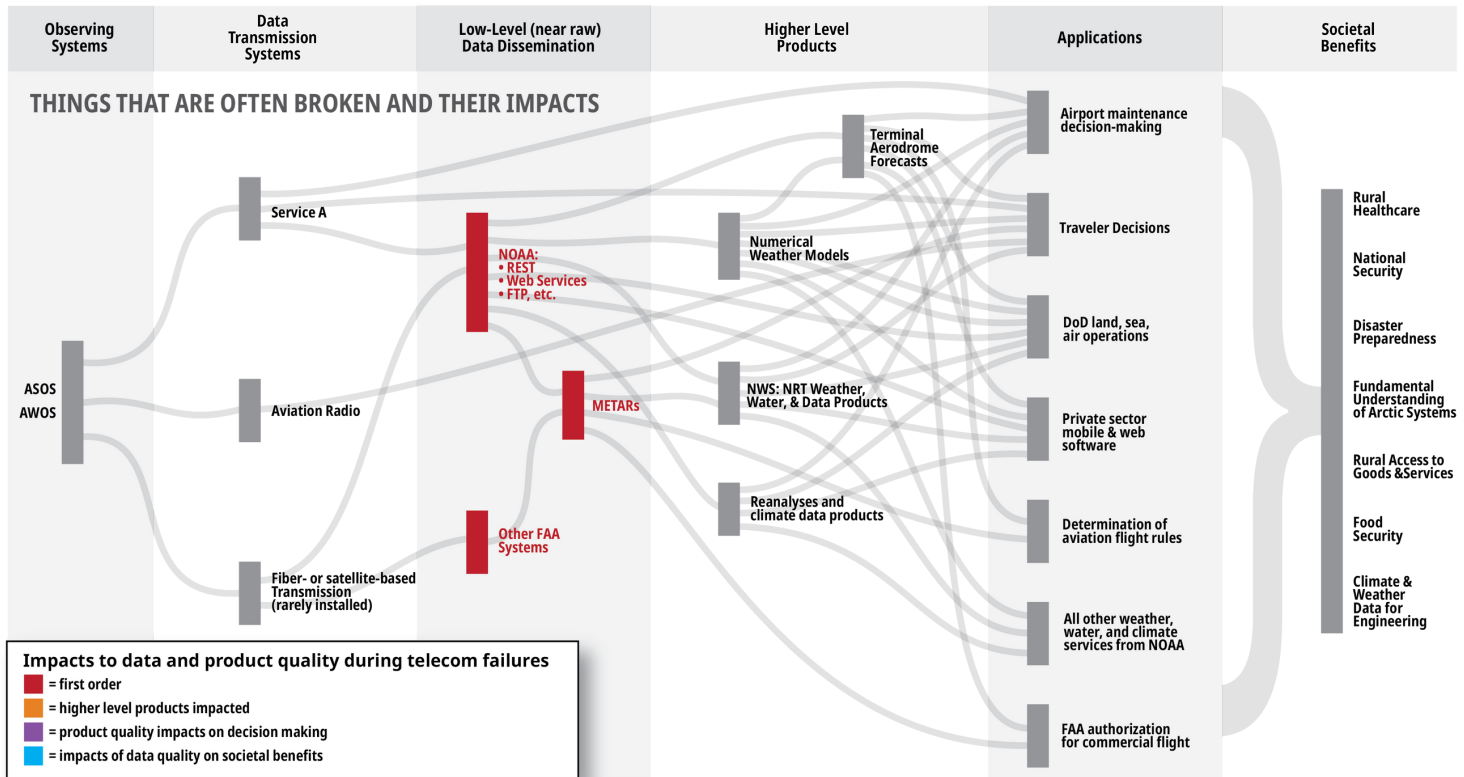
Alaska legislature sounds the alarm on critical and dangerous outages

The frequency of outages and their impact on Alaska's communities has received enough attention that the State Legislature passed Senate Joint Resolution 20 (SJR20) in 2024. SJR20 urges the U.S. Congress to address frequent outages of ASOS and AWOS stations in Alaska. One clause reads, "**According to Federal Aviation Administration outage logs, on an average day in 2023, about one out of every three AWOS and ASOS stations was experiencing some level of outage.**" It further notes, "From 2019 through 2023, reduced-service outages of AWOS and ASOS stations required a median of approximately 4.4 days to resolve; 10 percent of reduced-service outages were unresolved for more than 54 days, and five stations had reduced-service outages that remained unresolved for more than 637 days." The resolution cites statistics showing that aviation accidents have increased significantly in recent decades as the AWOS system ages.



ARCTIC OBSERVATION STORYLINES: AIRPORT WEATHER STATIONS

Essential services for remote communities and work sites



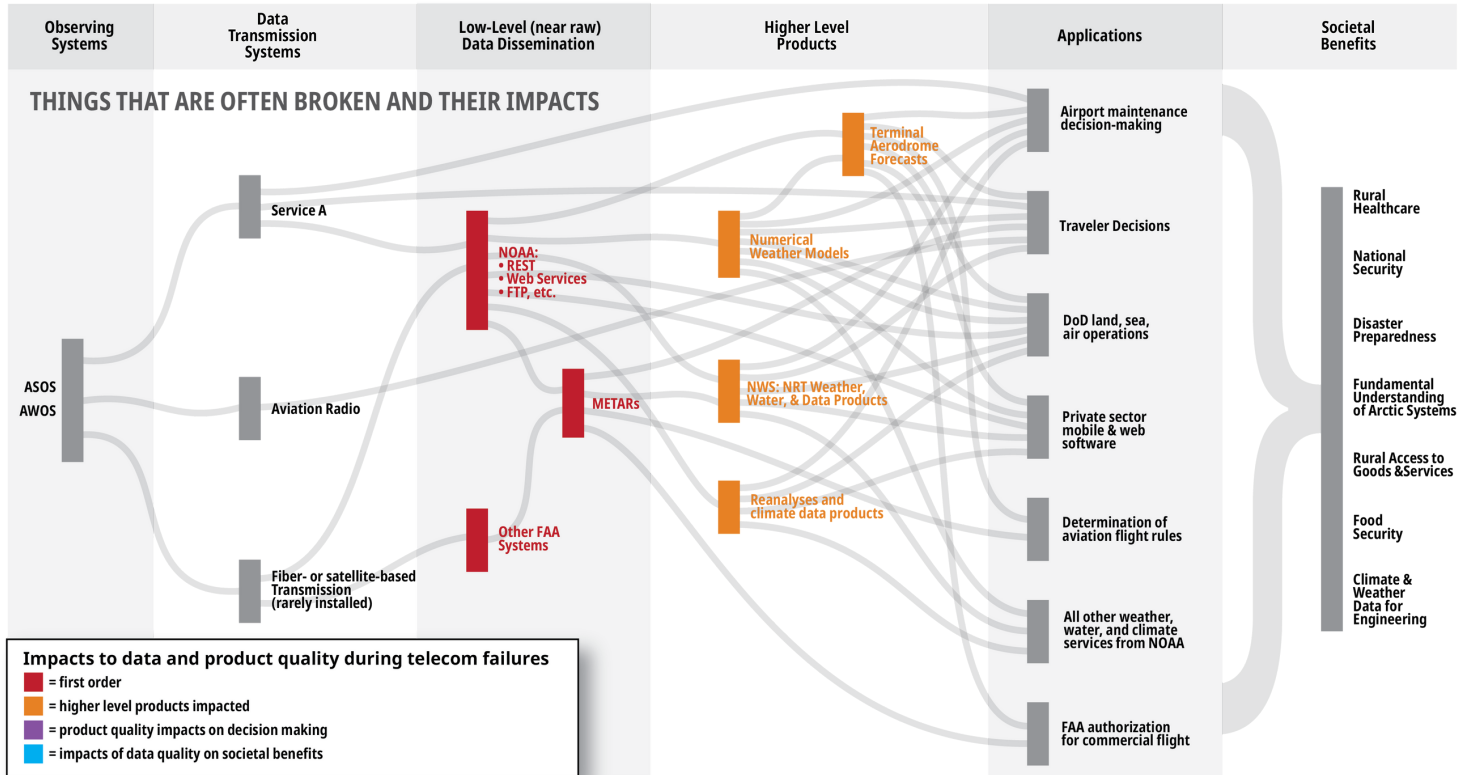
Data transmitted from ASOS/AWOS stations are disseminated along several pathways. Observations are designed to be available to people in the community via what is known as a Service A or “copper” line between the station and a public dissemination system. Historically, this is how NOAA has accessed these data for downstream services, and is what frequently malfunctions (red highlight in the diagram). **For meteorological data to make it into NOAA’s METAR system, which is used to make flight decisions, it typically needs the Service A line to be functioning.** If the data are only transmitted via aviation radio as they approach the airport, the pilot may not be certified to launch the flight in the first place. The FAA and NOAA are beginning to test satellite transmission at a few sites in Alaska, but neither agency has the current budget to convert all ASOS/AWOS to satellite systems. Fiber-based or other methods of transmission are in place at only a few sites.

Not only do offline weather stations potentially impact a pilot’s ability to land an aircraft delivering passengers, food, and other cargo, but locals use the weather data directly, and through downstream data products and services to make decisions for boating and overland travel. When an aircraft can’t take off again because of missing weather data, it cannot deliver passengers for medical care, or educational and business opportunities in Alaska’s bigger communities. When these data are missing for long periods of time, or collected with biases for elements like precipitation, they also cannot be used for engineering studies for infrastructure in that region or basic science.



ARCTIC OBSERVATION STORYLINES: AIRPORT WEATHER STATIONS

Impacts to higher level products

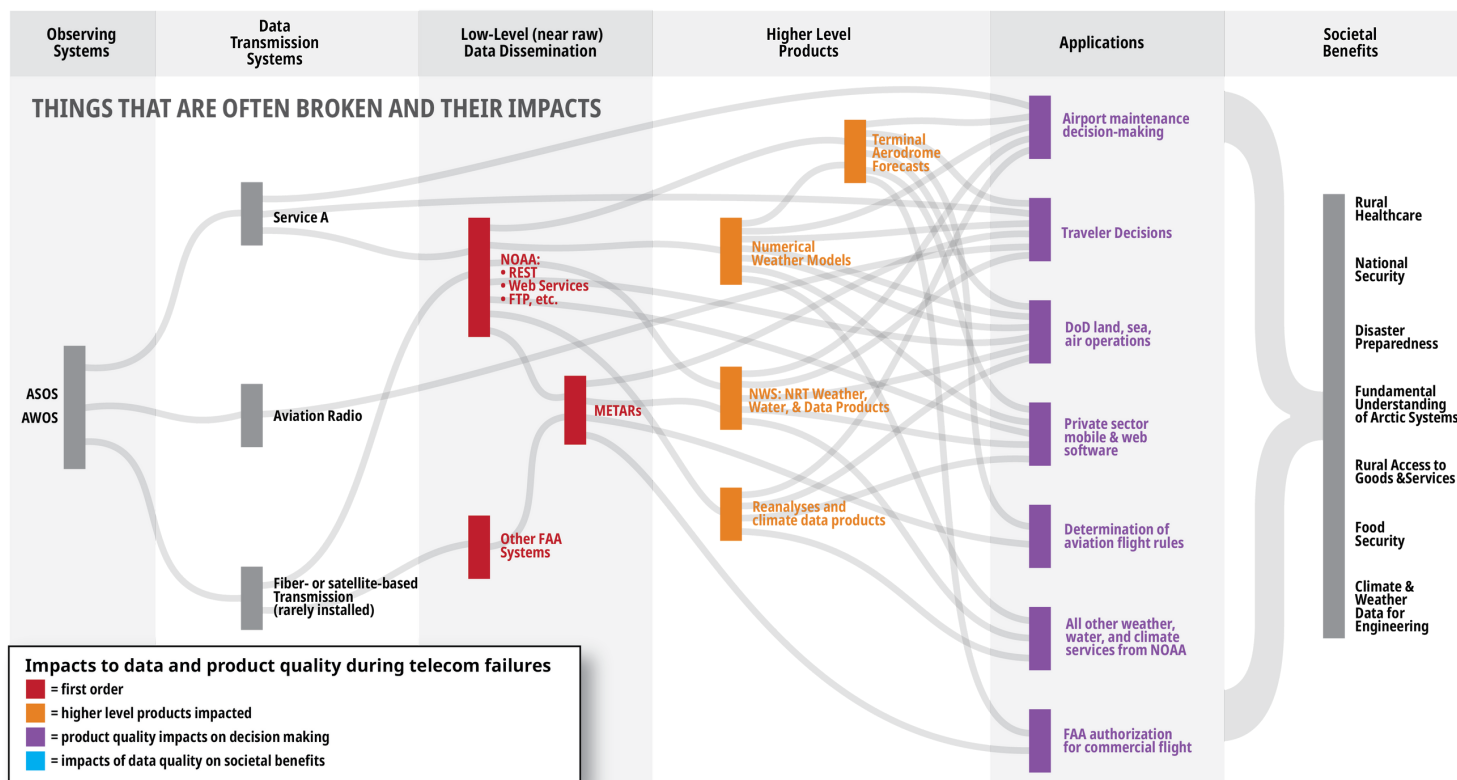


As data make their way from the data collection point at airports in Alaska, they make their way into a number of higher-level products and services at NOAA and weather agencies abroad (orange highlights in the diagram). These include global numerical weather models that generate public forecasts, aviation-specific Terminal Aerodrome Forecasts, near real-time weather watches, warnings, and advisories, and reanalyses and other longer-term climate products. When data are systematically missing from ASOS/AWOS sites, particularly in areas that are already sparsely instrumented, there may be biases in the forecast models and climate reanalyses. **When observations are missing, even just temporarily, the NWS may be unable to issue an aviation forecast needed by operators, or a watch, warning, or advisory needed for local decision making.** Operations by the US Department of Defense, whether conducted by air, land, or sea, are affected by missing products and services, as well as biases in forecasts and climate data for engineering projects.



ARCTIC OBSERVATION STORYLINES: AIRPORT WEATHER STATIONS

Agency coordination needed



While the ASOS/AWOS networks were designed primarily to support aviation, they have become the backbone of the weather and climate observational system for NOAA, as the number of manual observations collected by Cooperative observers has declined significantly in Alaska and other parts of the US. NOAA, the FAA, the Department of Defense (DoD) and many other entities have a direct stake in the quality and reliability of these observations (purple highlight in the diagram). This analysis demonstrates the many societal benefits brought by data collection, dissemination, integration into models, and applications. These include rural healthcare, national security, disaster preparedness, food security, data for engineering, and fundamental understanding of the Arctic System. **As funding becomes available for station upgrades, particularly for more reliable data transmission, it is important that NOAA, the FAA, and the DoD work together to prioritize sites.**

NOAA must also continue to support and expand observational infrastructure specific to its mission such as the Climate Reference Network (CRN) that focuses exclusively on reliable data for weather and climate applications (not aviation) and may have better accuracy than ASOS/AWOS instrumentation for precipitation in cold regions. In June 2025, NOAA operated 25 CRN stations in Alaska and two of those stations were offline. These CRN data are not currently assimilated into NOAA's numerical weather models but instead represent independent climate records, albeit with shorter periods of record than many ASOS/AWOS and Coop observations.