Photo courtesy of the National Weather Service (NWS)

Arctic Observation Storylines: River Watch

WHY OBSERVING MATTERS AND HOW WE CAN MAKE IT BETTER TOGETHER

Ice jam flooding is one of the most significant hazards that Alaskan communities face each year. During the spring 'breakup' season, Alaskan rivers transition from thick ice used for winter travel to open water with ice jams and flooding possible. These ice jam floods can cause significant damage to communities and critical infrastructure. Early warning systems protect life and property and can reduce costly clean-up efforts after a flood. River Watch is a partnership between the State of Alaska and the National Oceanic and Atmospheric Administration's National Weather Service (NWS) Alaska Region that integrates snowpack, weather, and stream observations into a comprehensive, engaging, and timely understanding of springtime river conditions. The goal is to enhance community flood preparedness and provide advanced warning for flooding should an ice jam form. In addition to drawing upon a suite of sustained satellite and in situ observations, River Watch engages with Indigenous experts within communities to link their Indigenous Knowledge of conditions with other tools, including River Watch reconnaissance flights.

ABOUT THIS ASSESSMENT

The US Arctic Observing Network (US AON) is a strategic and collaborative initiative that advances partnerships, and systematic and equitable planning approaches to Arctic observing in support of societal benefits. US AON's Benefit Tool allows users to build diagrams that show the flow of information between Arctic observing and data systems, and products and applications that provide societal benefit. Individual assessments show how critical observations, datasets, and other inputs are to creating a specific product and how observing systems, products, and applications support societal benefits.

By facilitating these assessments, US AON aims to help those living and working in the Arctic better understand the interwoven connections between observing systems and the tools and decision-making they support. Combined with other methods, we can begin to see more systemic trends in the Arctic observing system and identify where networks could be improved to support shared benefits.

NWS River Watch team members, Crane Johnson and Celine van Breukelen, provided the expert ratings for this assessment. The societal benefit ratings were constrained by the 2017 International Arctic Observing Assessment Framework.

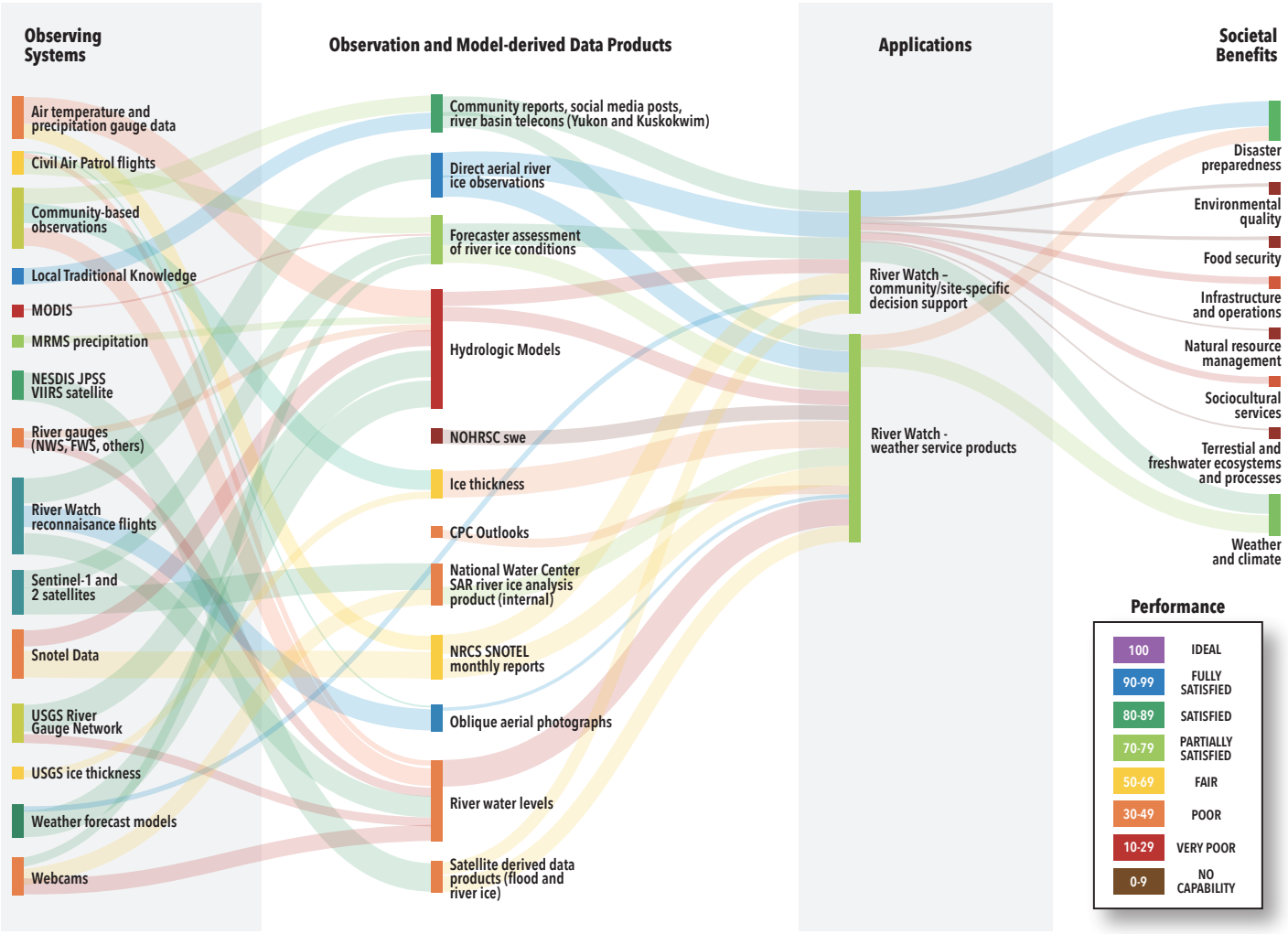
HOW TO READ THE DIAGRAMS

This diagram, generated using US AON's Benefit Tool, shows how observing system inputs feed through data products to River Watch products, to provide societal benefits. Color coding indicates a performance score within this context - answering the question "What is your satisfaction with this input?" Line thickness indicates the criticality of each input - answering the question "How much would the loss of this input impact the performance of your data product or application?"

Ratings are given for a particular context by an individual or small team. They are subjective but well-informed representations of reality. The ratings convey the input of these experts, not US AON's assessment of a given product or system.

The righthand side of the diagram shows the connection between the River Watch products and societal benefit areas. Ratings are context-dependent and attempt to reflect the many nuances of societal impact. Currently, the thin red lines indicate societal benefit areas (e.g. food security) where the River Watch products are not designed to provide a direct impact but have some marginal benefit. As US AON works to improve the Benefit Tool methodologies, we would be interested to hear from you how we can make this nuanced representation more intuitive.

FIGURE 1



KEY TAKEAWAYS

Recommend sustaining high-performing aspects of the River Watch program, while investing in filling critical gaps.

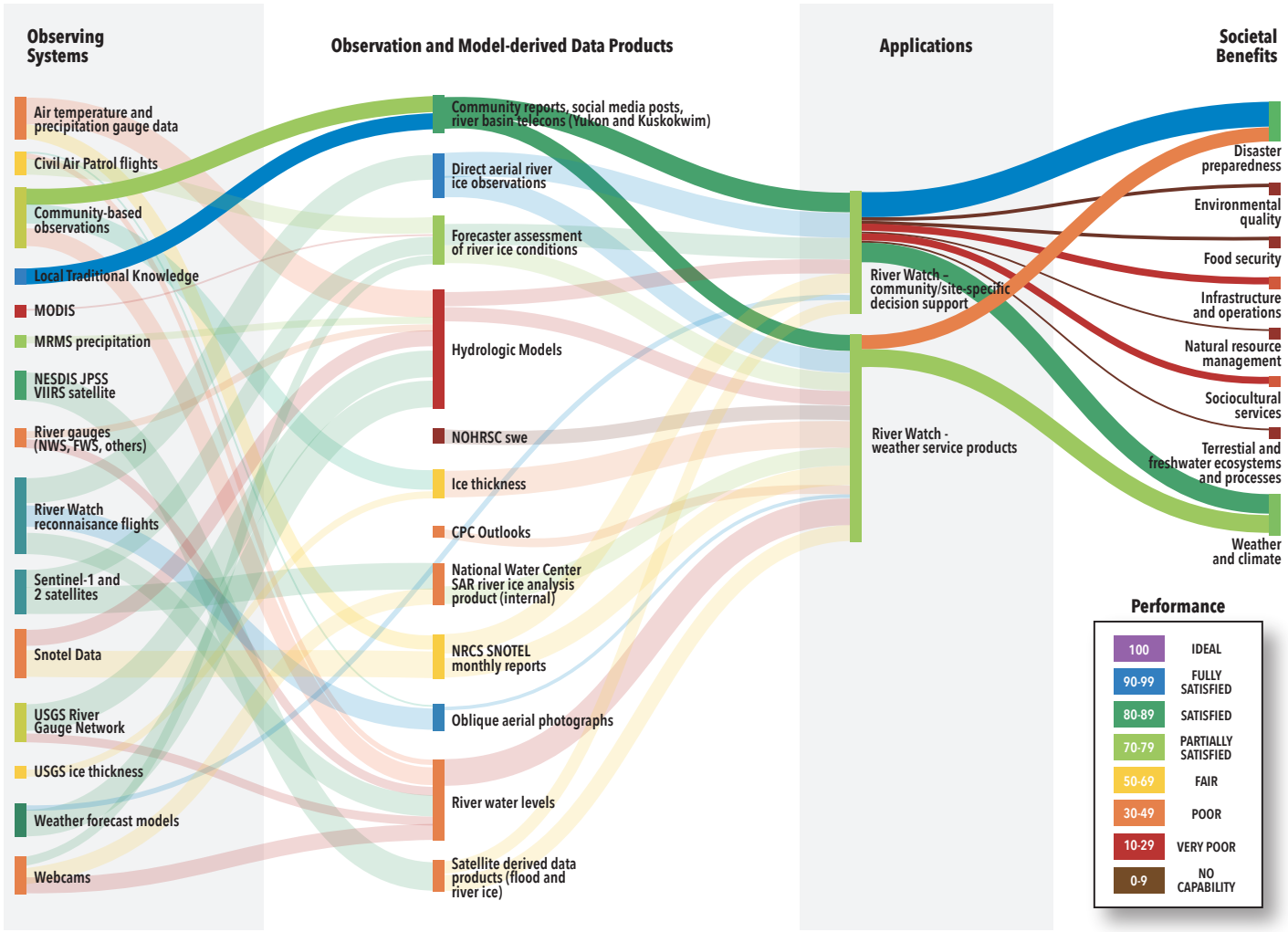
- Long-term observing systems, like stream gages, SNOTEL snowpack sensors, and air temperature sensors, provide important benefits as they can provide a baseline point for comparing trends and calibrating models. It is critical that these are maintained.
- Performance would be improved by increasing the spatial density of stream gages with a focus on rivers with ice jam concerns.
- Newer technology is needed to allow for accurate readings during ice movement and breakup.
- There is a need for more widely dispersed observations, including precipitation data, snowpack sensors, planes, and webcams.
- Improvements are needed in temporal and spatial coverage of remotely sensed river ice information. More frequent passes of satellite data would be helpful; however, persistent cloud cover in the Arctic limits the usefulness of satellites for predicting flood conditions. The River Watch team noted that satellite data is "helpful for 'filling in the gaps' between locations we are able to fly, but [the River Watch team is] still learning to interpret the data." Satellite-derived datasets do not currently provide enough information to replace crewed aerial flights, and will never be able to replicate the quality and shared knowledge of local data and interpretation from on-the-ground observers.
- Real-time or near-real-time observations are needed for decision support. For example, the River Watch team noted that it would be ideal to have observations of "real time water levels at every community."

Photo courtesy of the National Weather Service (NWS)

CRITICAL VALUE OF COMMUNITY PARTNERSHIPS

River Watch illustrates the value of engaging Indigenous expertise through culturally relevant mechanisms, like conference calls. The River Watch community/site-specific decision support relies heavily upon community-based monitoring and direct communication with local communities. As highlighted in Fig. 2, this community/site-specific decision support yields stronger societal benefits than traditional weather service products in the two main benefit areas (Disaster Preparedness and Weather & Climate), while also delivering marginal value to six additional societal benefit areas. Engagement with communities yields multiple benefits and strong, local observations, especially in remote areas. Community-based monitoring requires time, effort, and regular communication to obtain consistent measurements.

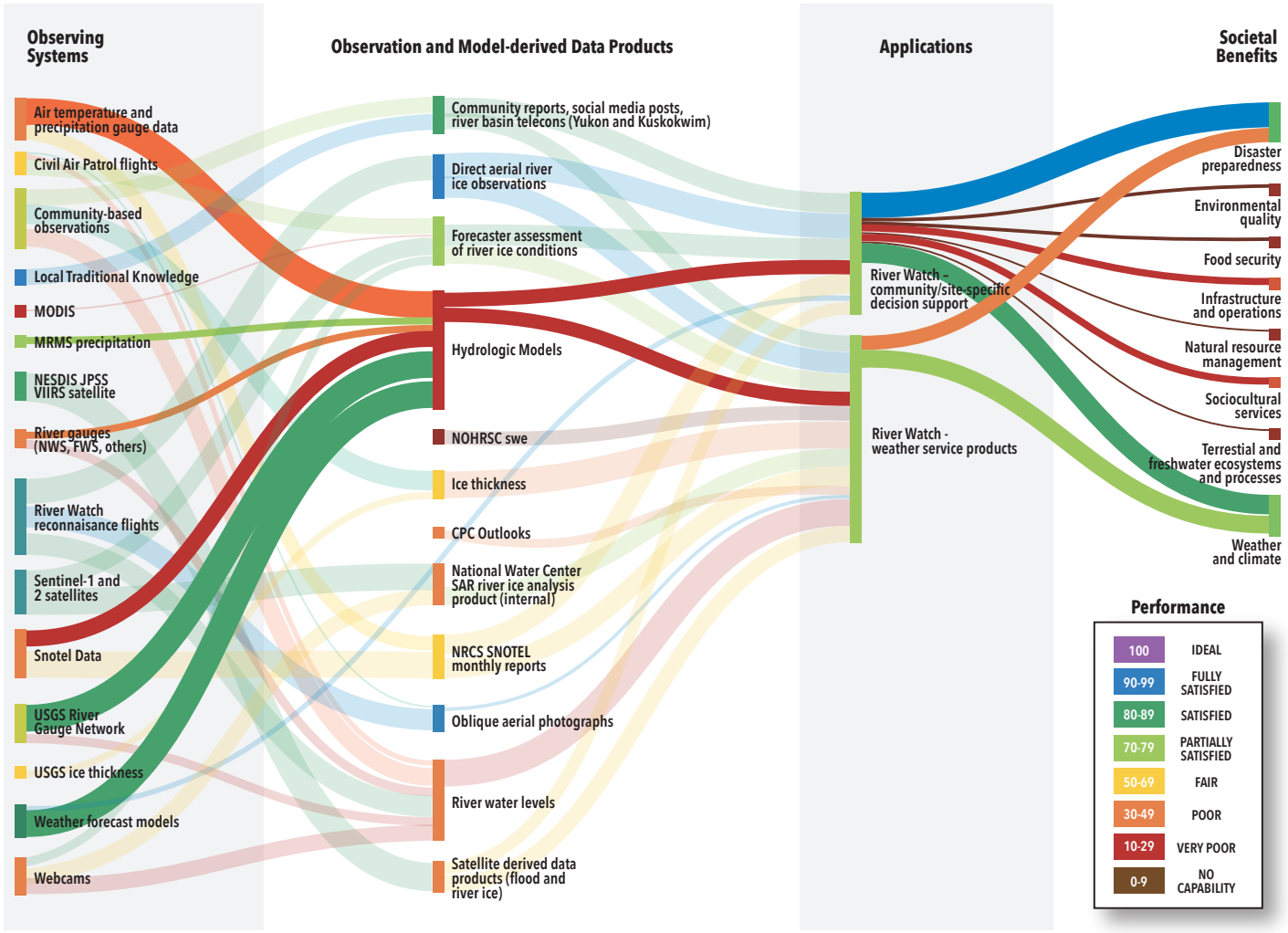
FIGURE 2



MODEL IMPROVEMENTS NEEDED

Currently, hydrologic models are performing poorly for this particular application, see Figure 3. Collaboration between operational decision makers at River Watch and modelers would allow for feedback, potentially leading to improvements in the models and forecasts, as well as to underlying observation networks.

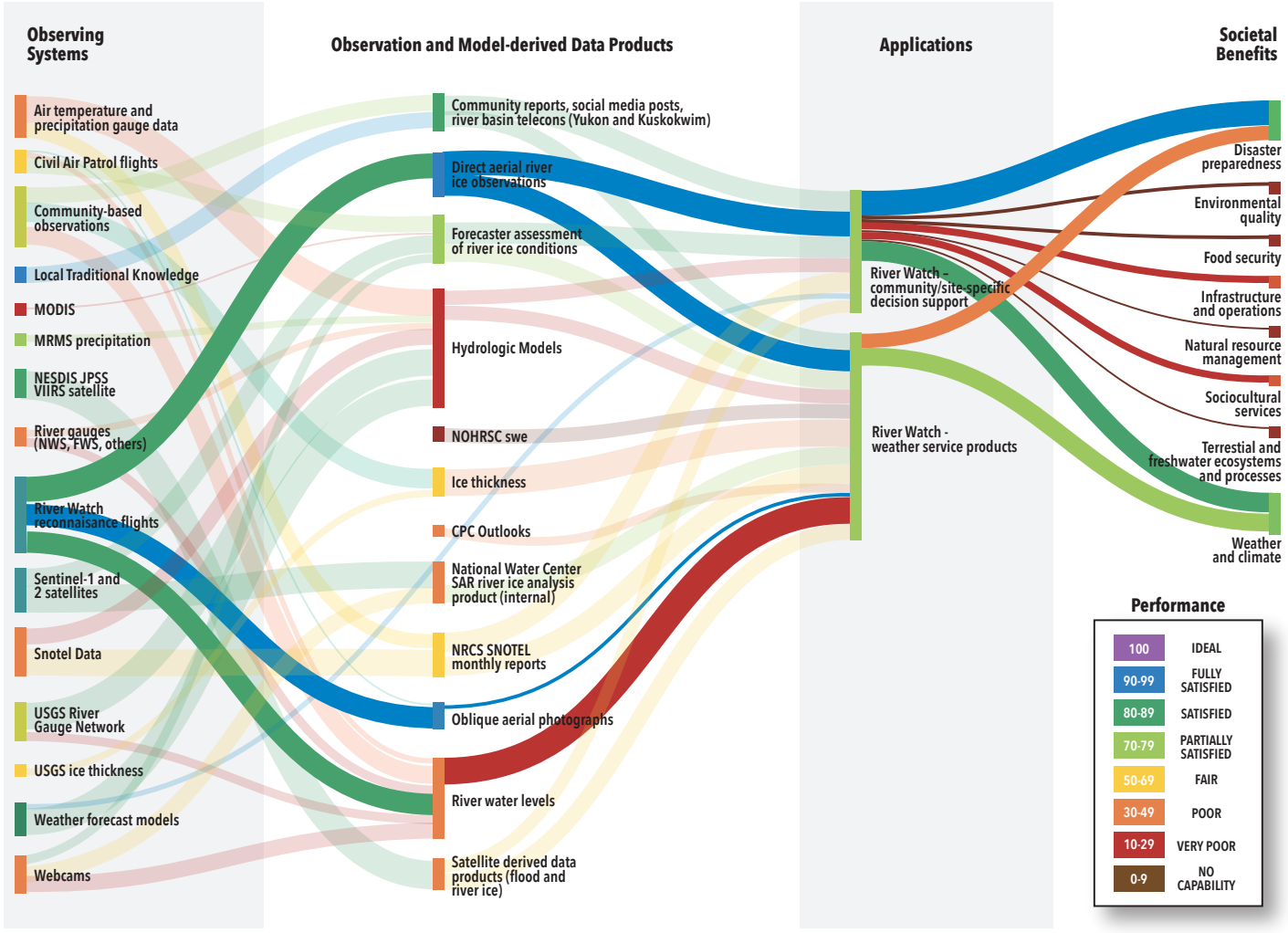
FIGURE 3



OBSERVING FOR A SPECIFIC APPLICATION

Figure 4 shows how River Watch flights, which specifically support hydrologist observations of river conditions, provide critical support for societal benefit areas, like disaster preparedness. River Watch reconnaissance flights are funded each year to observe water levels along key waterways. During spring breakup, this is the most reliable method of observing water level – the green and blue colors indicate the flights' high performance while the thick lines denote that they are a critical input. The Civil Air Patrol flies similar missions before the water starts rising, and while the River Watch team uses photos and pilot reports of ice and river conditions from these flights to inform predictions, the performance scores are slightly lower.

FIGURE 4



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