Winter Rain in Alaska

Transportation impacts and community preparedness

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A NOAA RISA team

UAF University of Alaska Fairbanks



Photo credits: Ed Plumb, ACCAP

Presentation overview

1. Understanding Winter Rain & Changing Patterns
2. Transportation Impacts Across Rural Alaska
3. Preparedness and Partnerships

Building on ACCAP winter rain work

Eleanor Greenbaum | Alaska Fellows Program, ACCAP

27 cross-sector interviews; preparedness brief helped inform the updated FNSB hazard mitigation plan.

Tricia Hutton | UAF Atmospheric Sciences

Master's thesis research on historical rain-on-snow patterns, seasonality and changing snowpack.

Both inform today's rural transportation focus.



ACCAP Winter Rain Preparedness Brief · 2026

Four related hazards, different consequences

Winter rain

Liquid precipitation during winter, even when temperatures briefly rise above freezing.

Rain-on-snow

Rain falling onto an existing snowpack can create wet snow, slush or ice.

Freezing rain

Supercooled raindrops freeze on contact with exposed surfaces.

Flash freeze

Water or slush freezes as temperatures fall, leaving hard, slippery surfaces.



“Winter rain, the gift that keeps on giving...”

— Rick Thoman, ACCAP Climate Specialist

Geography, snowpack and timing shape the hazard

Regional Climate Differences

• Winter thawing is more common in southern coastal Alaska, while colder Interior and Arctic conditions can allow ice to persist longer

Snow Cover Influences Winter Rain Impacts

• Rain can soak into existing snow or refreeze within it, while exposed frozen surfaces are more prone to smooth ice buildup.

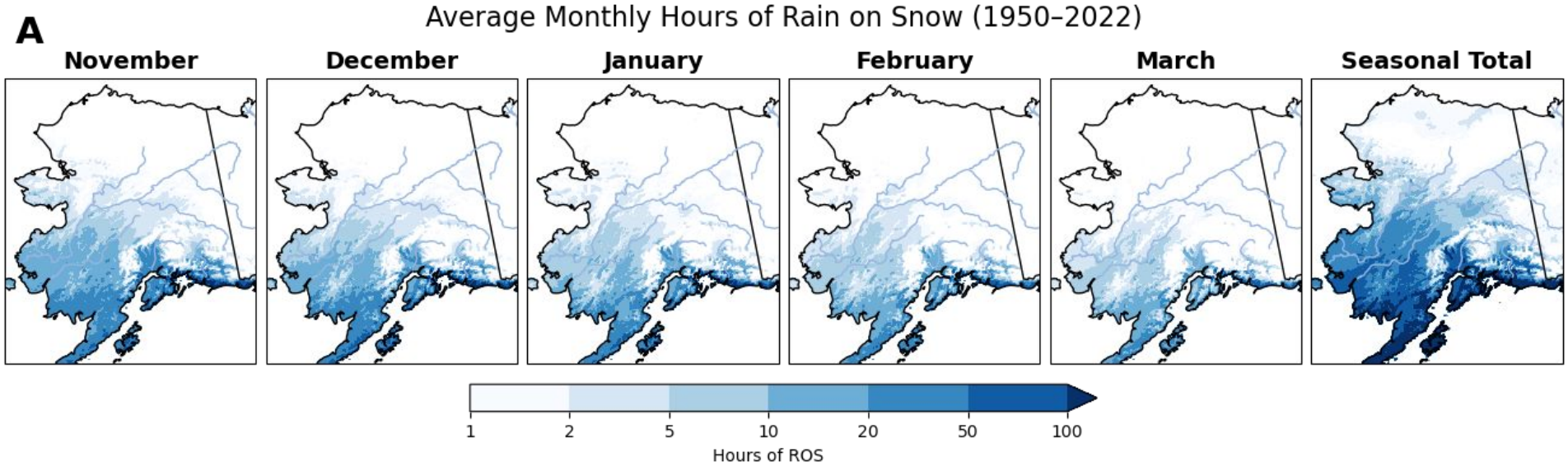
Near-freezing temperatures can change conditions rapidly

• Small shifts in temperature determine whether surfaces stay wet or freeze.

Winter Rain Impacts Vary by Location and Transportation Type

• Winter rain can affect runway conditions, road safety, trail access, and the reliability of ice roads and river crossings

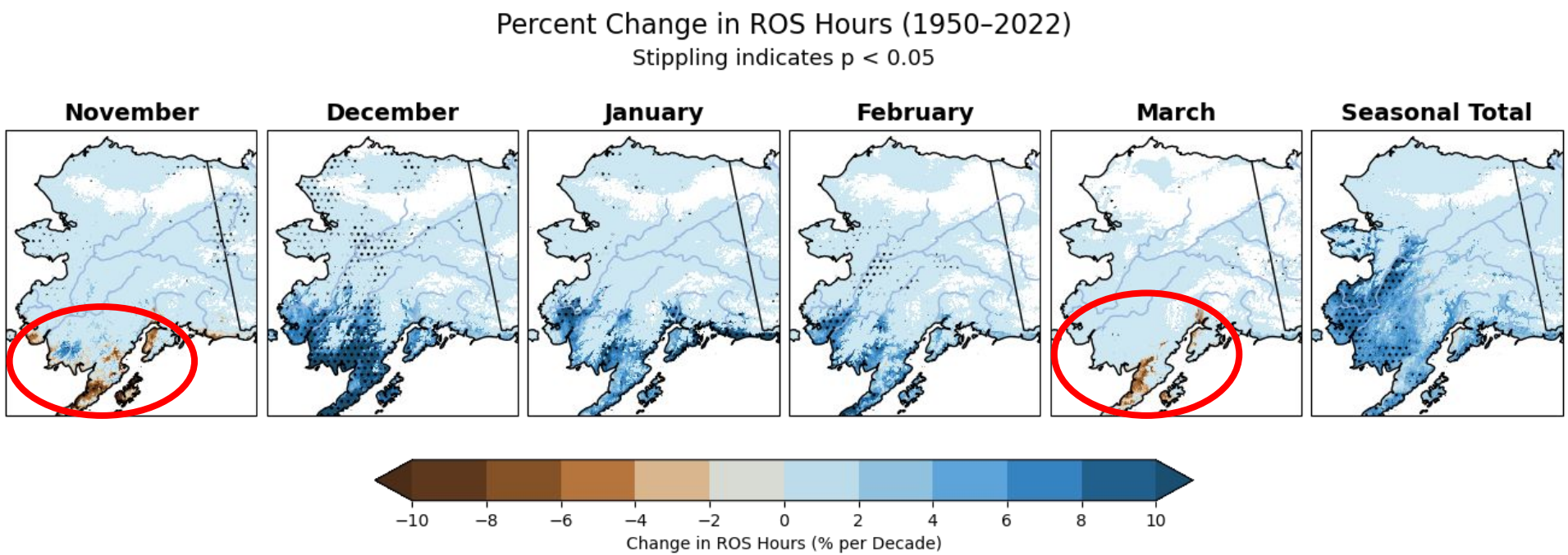
Statewide research: where rain-on-snow occurs



Historically, rain-on-snow hours are generally greater near Bering/Gulf of AK coasts and most common in November and December.

Source figure: Hutton (2026), presentation slide 21. Historical ERA5-based analysis, 1950–2022.

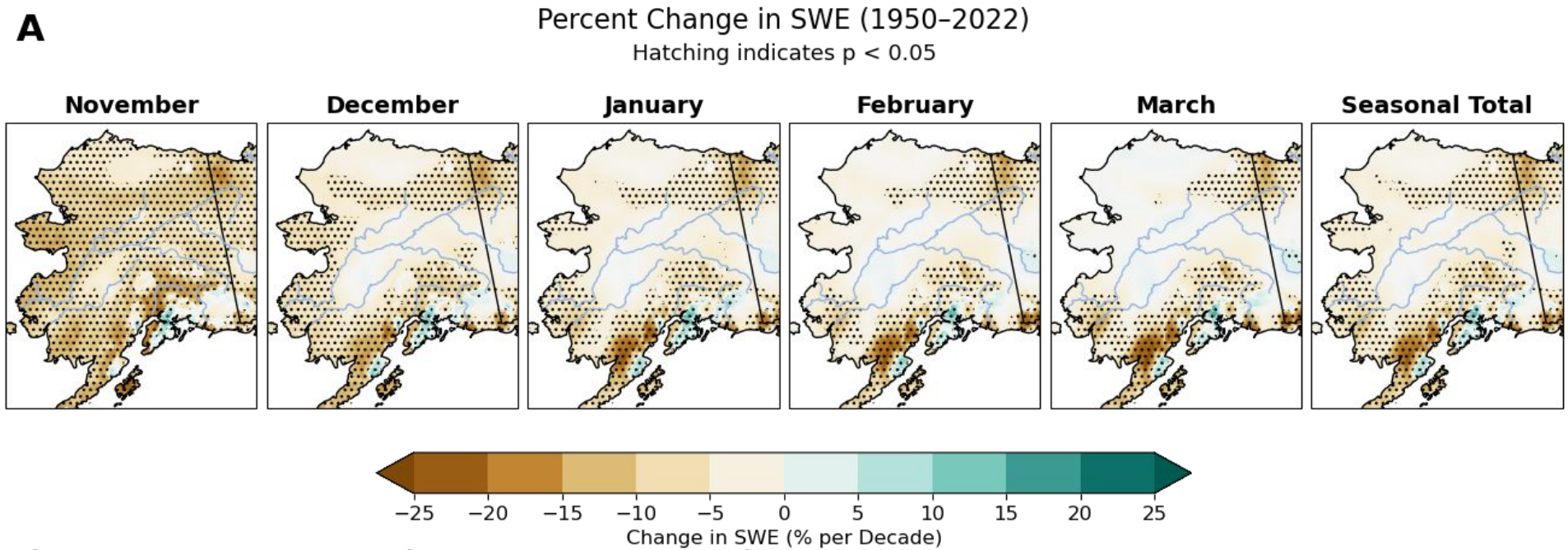
Changing patterns: December stands out



- Historical rain-on-snow (ROS) hours increased in many areas, especially in December.
- ROS decreased in some areas during November and March, including parts of Southwest, the AK Pen and Southcentral Alaska.

Source Figure, Hutton (2026), presentation slide 23. Trends vary by region and month.

Less snowpack can change what counts as rain-on-snow



Snow water equivalent (SWE) is the amount of water stored in the snowpack. As snow cover declines, winter rain may reach exposed surfaces and create ice when the surface is already frozen or temperatures subsequently drop.

Hutton (2026), slide 25. Historical analysis; changing snow cover affects ROS classification.

Looking Ahead: Winter Rain in a Warming Alaska

RAIN VS. SNOW Warming winters can mean more rain instead of snow, especially when temperatures are near freezing

SNOW COVER Changes in snow cover and how long it lasts can affect where and when rain-on-snow events occur

TRANSPORTATION Changes in winter rain, snow, and ice conditions can affect both aviation and travel on local roads and trails

Qualitative planning implications, not a map or quantified projection from Hutton (2026).

Rain, Slush, Refreezing: Timing is Everything

RAIN

Rain wets snow, ice or frozen ground

COOLING / FREEZING

Rain may freeze on cold surfaces or after temperatures fall

TRANSPORTATION IMPACTS

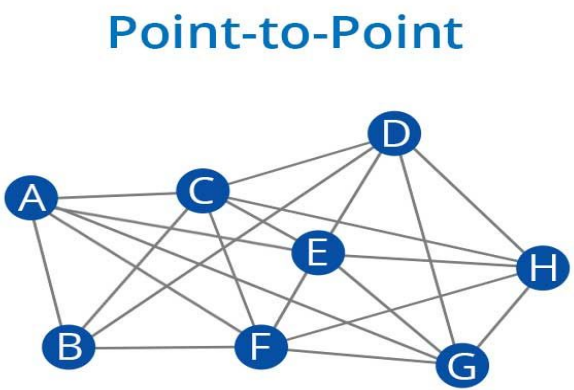
Slippery surfaces, frozen ruts and difficult maintenance

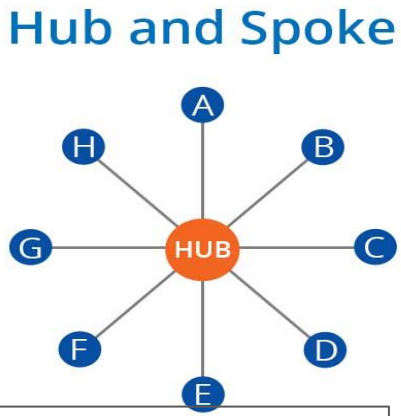
PERSISTENCE

Ice may persist for weeks or months—sometimes all winter until spring breakup.

The most difficult maintenance conditions may emerge after precipitation ends.

Winter Rain Impacts Can Extend Across Alaska's Aviation Network





Passenger Travel

Air travel connects rural residents to jobs, schools, family, and essential services.

Medical Access

Flights provide access to medical appointments, specialized care, and emergency transfers.

Food, Mail, Freight, & Fuel

Aircraft deliver groceries, medications, mail, and other essential supplies, including fuel in some communities.

Hub-and-Spoke Connections

Disruptions at regional hubs can delay flights and deliveries to villages even when local weather is favorable.

Network concept adapted from Hutton (2026), slide 6.

When rain and ice affect airport operations

AIRCRAFT / FLIGHT

- Freezing rain can cause hazardous ice accumulation on aircraft.
- Changes between snow, rain, and freezing rain complicate flight and ground operations.
- Icing and changing weather conditions can lead to delays or cancellations.

RUNWAYS / FACILITIES

- Ice accumulation on runways, taxiways, and aprons.
- Rain, slush, and refreezing can rapidly change surface conditions.
- Limited equipment and maintenance resources can complicate operations.



The 'Yeti,' developed by Fairbanks airport maintenance staff, breaks up ice on taxiways following freezing rain (Photo: Mark Nicholls / Alaska DOT&PF)

A hub disruption can ripple across the network



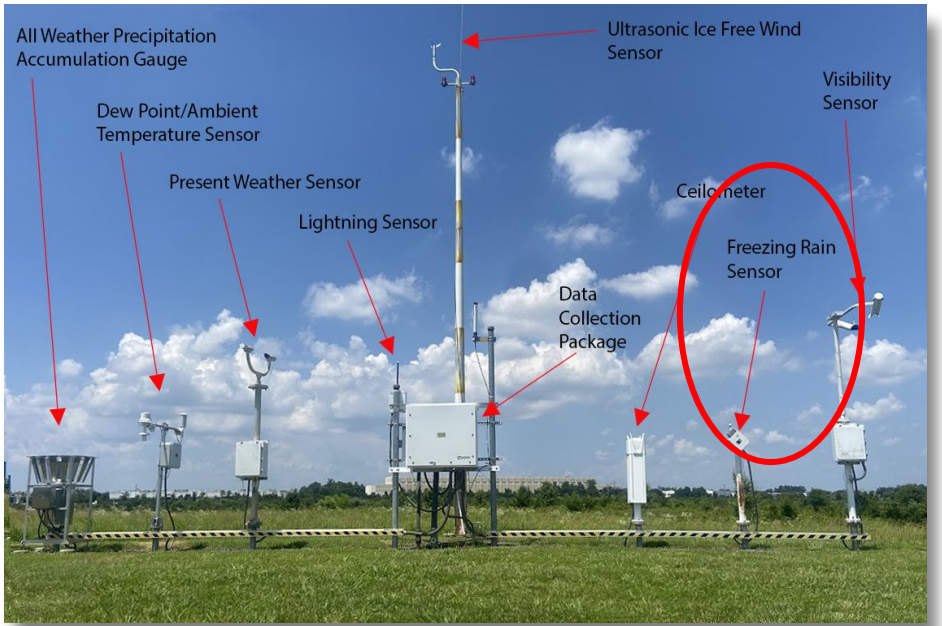
- Icing at one hub can disrupt connecting flights through other hubs and onward to smaller communities.
- Aircraft delays can affect scheduled flights elsewhere, even where local weather is favorable
- Flight and freight backlogs can extend disruptions beyond the storm itself.

Hutton (2026), slide 7, citing a December 2025 news report; verify exact cancellation scope.

Winter Trails, Ice Roads and Subsistence Access

- Rain-soaked snow can refreeze into hard, uneven snowmachine surfaces
- Frozen ruts, overflow and fallen trees can obstruct established trails
- Hazardous conditions can restrict hunting, trapping, fishing and other access
- Ice-road surface conditions do not establish safe ice thickness or load capacity
- Fresh snowfall can help restore travel surfaces but may conceal underlying ice hazards

What we don’t see: observing winter rain



Automated Surface Observing System (ASOS) instrument suite

- Many rural airports rely solely on automated weather observations, while others have no on-site reporting at all.
- Automated sensors can miss or misidentify rain and freezing rain near 32°F.
- Weather reports don't necessarily tell us whether ice has formed on runways, roads, or trails.
- Local reports help fill these gaps and identify hazardous surface conditions

Source: Hutton rain-on-snow research; ASOS/AWOS observing systems.

Detecting freezing rain doesn’t tell us what’s on the ground

AUTOMATED REPORTS

- ASOS freezing-rain sensors detect ice accumulating on a small vibrating probe.
- A freezing-rain report doesn't tell us how much ice has formed on nearby runways, roads, or trails.
- Rain can freeze on cold-soaked surfaces even when air temperatures are above 32°F.

WHY LOCAL REPORTS MATTER

- Airport personnel, road crews, and community members can report icing conditions that automated stations don't capture.
- These observations help NWS forecasters assess conditions and provide more useful weather information.



Ice covered branches during the Dec 2021 Fairbanks “Icemageddon event” (photo: Ed Plumb)

December 2021: Fairbanks “Icemageddon”

An Unusual Winter Storm

A major winter storm brought a combination of heavy snow and rain to the Fairbanks area.

Heavy Snow, Then Rain, Then More Snow

About 9 inches of snow, followed by 1–1.5 inches of rain and another 8 inches of snow.

Persistent Ice

Rain froze on cold surfaces, leaving extensive ice that persisted long after the storm ended.



“Science writer Ned Rozell holds a slab of ice following the December 2021 winter storm in Fairbanks.”

“Ice persisted on some roads until spring, requiring repeated scraping and ice removal by Alaska DOT crews”



Ned Rozell and Tom Douglas photos

Icemageddon: Transportation and Infrastructure Impacts

- Roads and sidewalks became dangerously icy, creating prolonged travel hazards
- Emergency response and essential services were disrupted by hazardous travel conditions.
- Ice accumulation and tree damage contributed to widespread power outages.
- Ice persisted on some roads until spring, requiring repeated scraping and ice removal by Alaska DOT crews.



Photo: Fairbanks Daily News-Miner



Alaska Center for Climate Assessment and Preparedness

Source: Greenbaum (2026) event spotlight; documented Fairbanks-area impacts

Eleanor’s work: Impacts Beyond Icy Roads

Transportation & Access

Persistent ice complicated road maintenance, travel, and access to essential services.

Power & Utilities

Ice accumulation and damaged trees caused outages and complicated power restoration.

Public Safety & Healthcare

Icy conditions contributed to crashes and falls, while hazardous travel affected emergency response and home healthcare visits.

Community Services

Winter rain disrupted schools, businesses, and other community operations.

Source: Greenbaum et al., ACCAP Winter Rain Preparedness Brief (2026).

From Fairbanks Lessons to Rural Transportation

FAIRBANKS-AREA EXPERIENCE	POTENTIAL RURAL ALASKA IMPLICATIONS
Roads and airport surfaces become icy	Icing can affect runways, roads, trails, and ice roads, sometimes with limited alternative routes.
Travel and essential services are disrupted	Flight disruptions can delay freight, mail, medical travel, and other essential services.
Power outages affect critical services	Outages can affect airport operations, communications, & other essential infrastructure.
Ice removal and recovery take time	Limited equipment and access to supplies can make recovery more challenging.

Fairbanks-area findings: Greenbaum et al. (2026). Rural implications are planning considerations.

Tanana: Firsthand Account from December 2021

Conditions Reported in Tanana

- Water, slush, and overflow affected the ice road.
- Icy slopes made vehicle travel difficult or impossible.
- Hazardous conditions led to some travelers needing assistance or rescue.

Impacts on Travel and Deliveries

- Aircraft were unable to reach Tanana for approximately two days.
- Limited local equipment and staffing complicated road maintenance.
- Interrupted transportation delayed groceries, freight, and other supplies.

Source: Eleanor Greenbaum's interview notes with Tanana's mayor. One community account.

Wildlife, Subsistence and Access to the Land



- Rain-on-snow events can create hard ice crusts that affect wildlife movement and access to food.
- Icy or deteriorating trail conditions can disrupt travel to hunting, trapping, and other subsistence areas.
- Impacts vary by location, species, and event, with consequences for both wildlife and peoples access to the land.

Source: Hutton (2026). Photos: NWS Fairbanks (moose); National Park Service (caribou).

What Can Transportation Partners Plan For?

- Which airports, roads, ice roads, and trails are most vulnerable to winter rain and refreezing?

What are the consequences if air service or critical overland routes are disrupted for several days?

What equipment, staffing, and other resources are available to maintain or restore access?

Who is responsible for reporting changing conditions and communicating transportation disruptions?

How can winter rain impacts be incorporated into Small Community Emergency Response Plans (SCERPs) and hazard mitigation plans?

Forecasts, Local Observations and Coordination

Forecasts & Briefings

- Connect with your local NWS office to learn about available decision-support emails, briefings, and notification lists.
- Monitor forecasts and warnings for winter rain, freezing rain, and refreezing.
- Use advance weather information to anticipate potential transportation impacts.

Local Observations & Reporting

- Share firsthand reports of icing, changing surface conditions, and transportation disruptions.
- Consider joining an NWS storm spotter program to help report significant weather and local impacts.
- NWS forecast offices are staffed 24/7 and can receive timely reports of hazardous conditions.

Connect with your local NWS office before the next event: both to receive weather information and to share observations from your community

Alaska National Weather Service Contacts

Connect before the next high-impact weather event

NWS Fairbanks

Jason Laney, Warning Coordination Meteorologist
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Alaska Aviation Weather Unit

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weather.gov/aawu

Research and Source References

Research and Background

• Tricia Hutton: Alaska rain-on-snow climatology and historical trends

Eleanor Greenbaum and colleagues: Winter Rain Preparedness Brief, Interior Alaska

ACCAP: Winter Rain two-page summary

ACCAP: Winter Rain Webinar Recording

Additional Resources

ACCAP Interior Winter Rain project page

NWS Alaska weather and aviation resources (covered on the preceding slide)

THANK YOU!

- ➔ Eleanor Greenbaum (ACCAP) and Tricia Hutton (UAF)
- ➔ AKTTAP Organizers and Attendees

QUESTIONS?

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