



UAA Institute of Social
and Economic Research
UNIVERSITY of ALASKA ANCHORAGE

Rural Alaskan Fresh Food Supply Chains and Constraints

Michael Jones, Ph.D.

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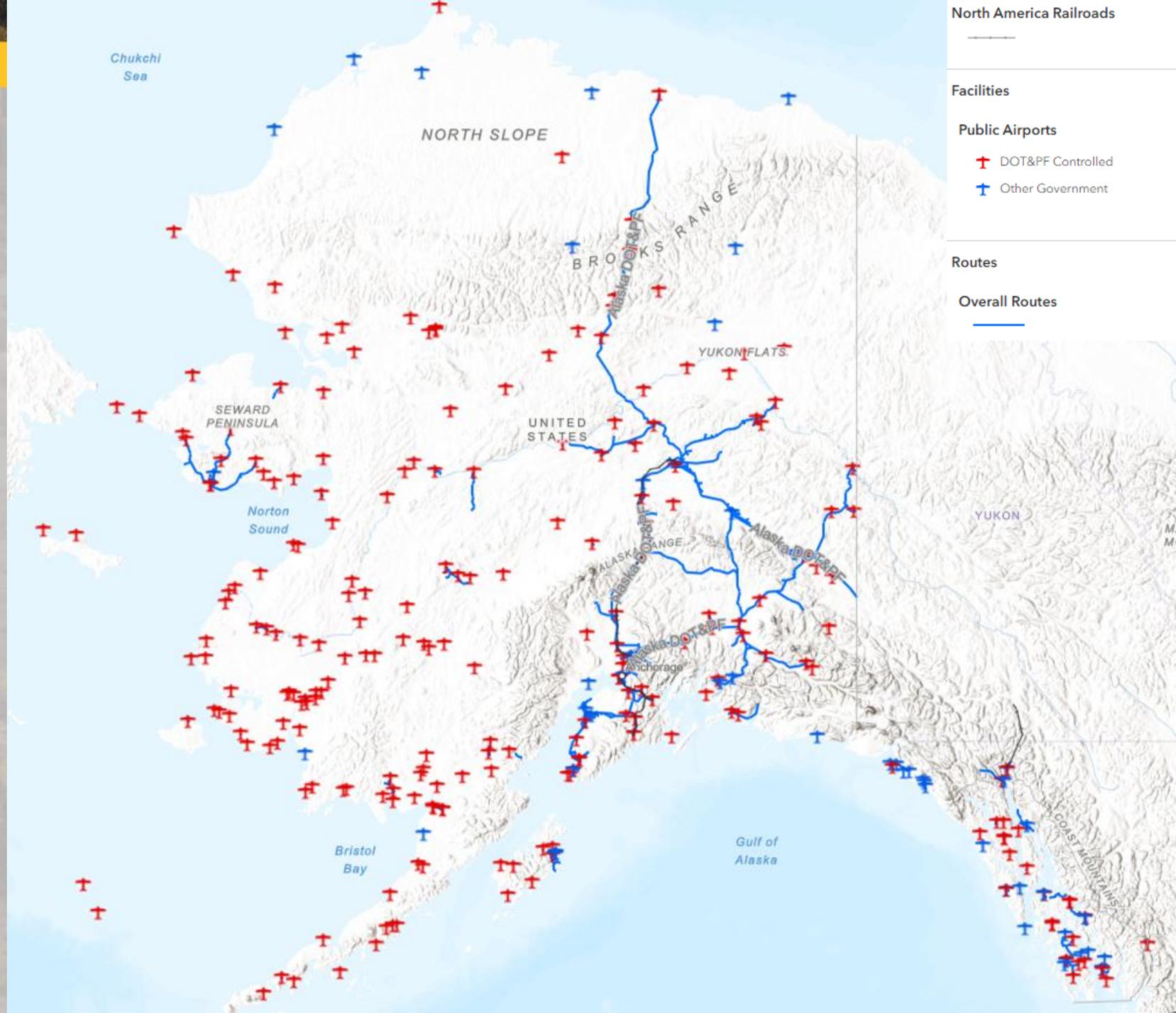
Virtual Alaska Weather Symposium (VAWS) Webinar (7MAY25)



The size of the challenge

State Population (~714,000 total):

- Road System: ~78%
- Off-road: ~22%



Food sources and food systems



Wild Food Collection



Home & Community Cultivation



AK farms/fisheries to retail



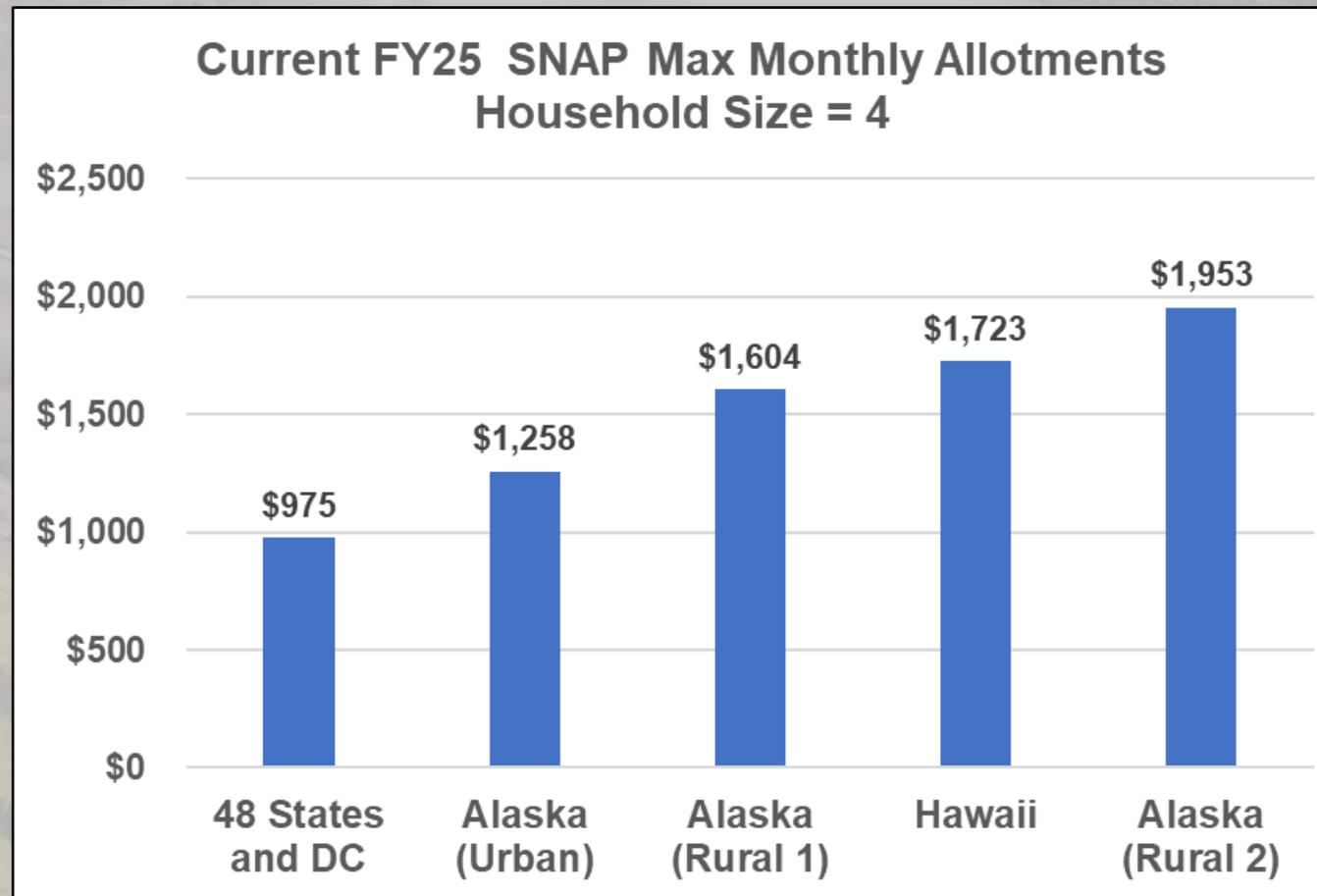
“Outside” sources to retail



USDA has policy thoughts...

Based on the Thrifty Food Plan for the mainland US

- Allotments imply Alaska Urban (ANC) vs. Lower 48 = +29%
- AK "Rural 1" vs. ANC = +28%
- AK "Rural 2" vs. ANC = +55%

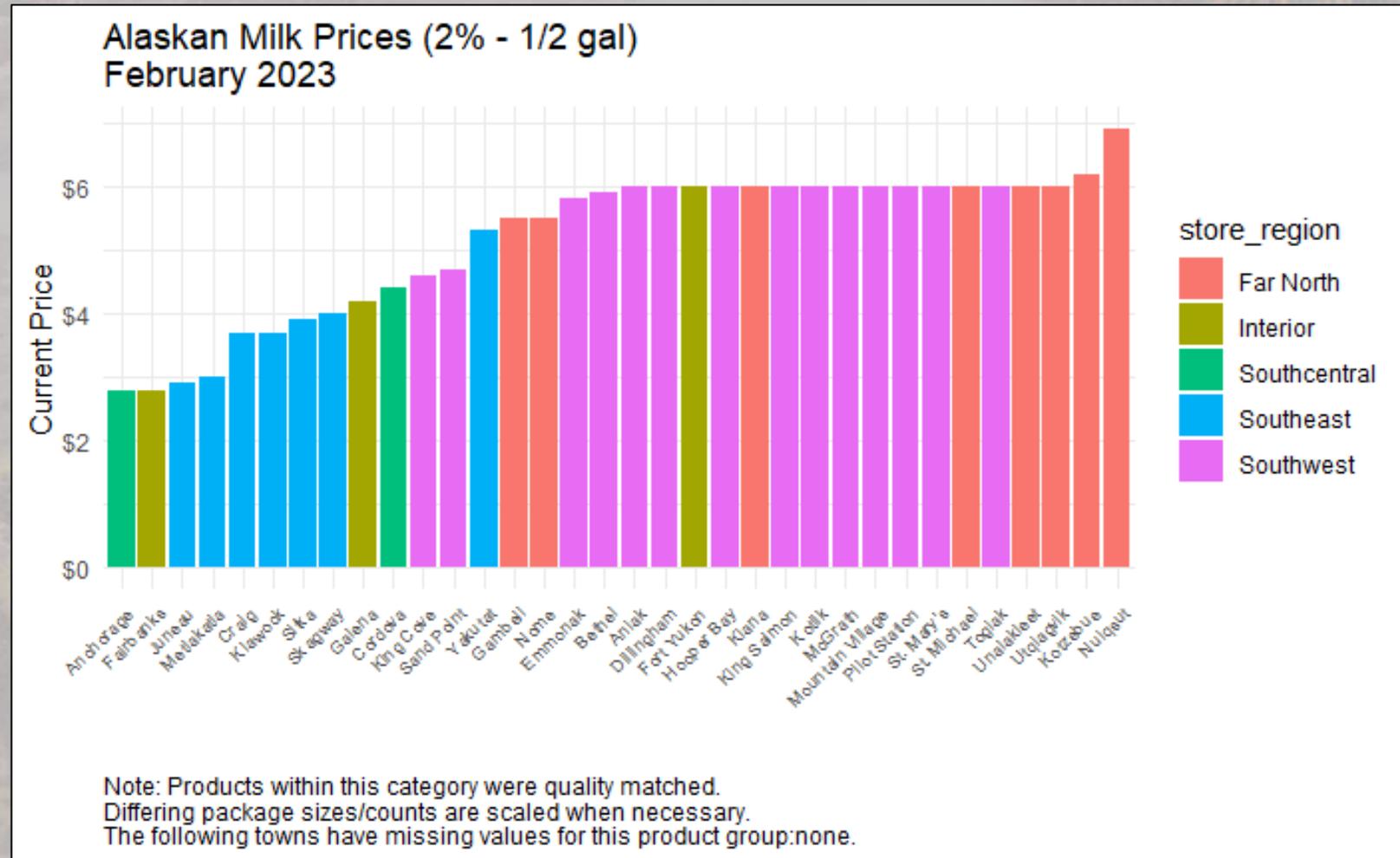


Price patterns by region

ANC, FAI, JNU almost always equivalent

Marginal cost (ish) pricing up the SE barge line

Block pricing in SW

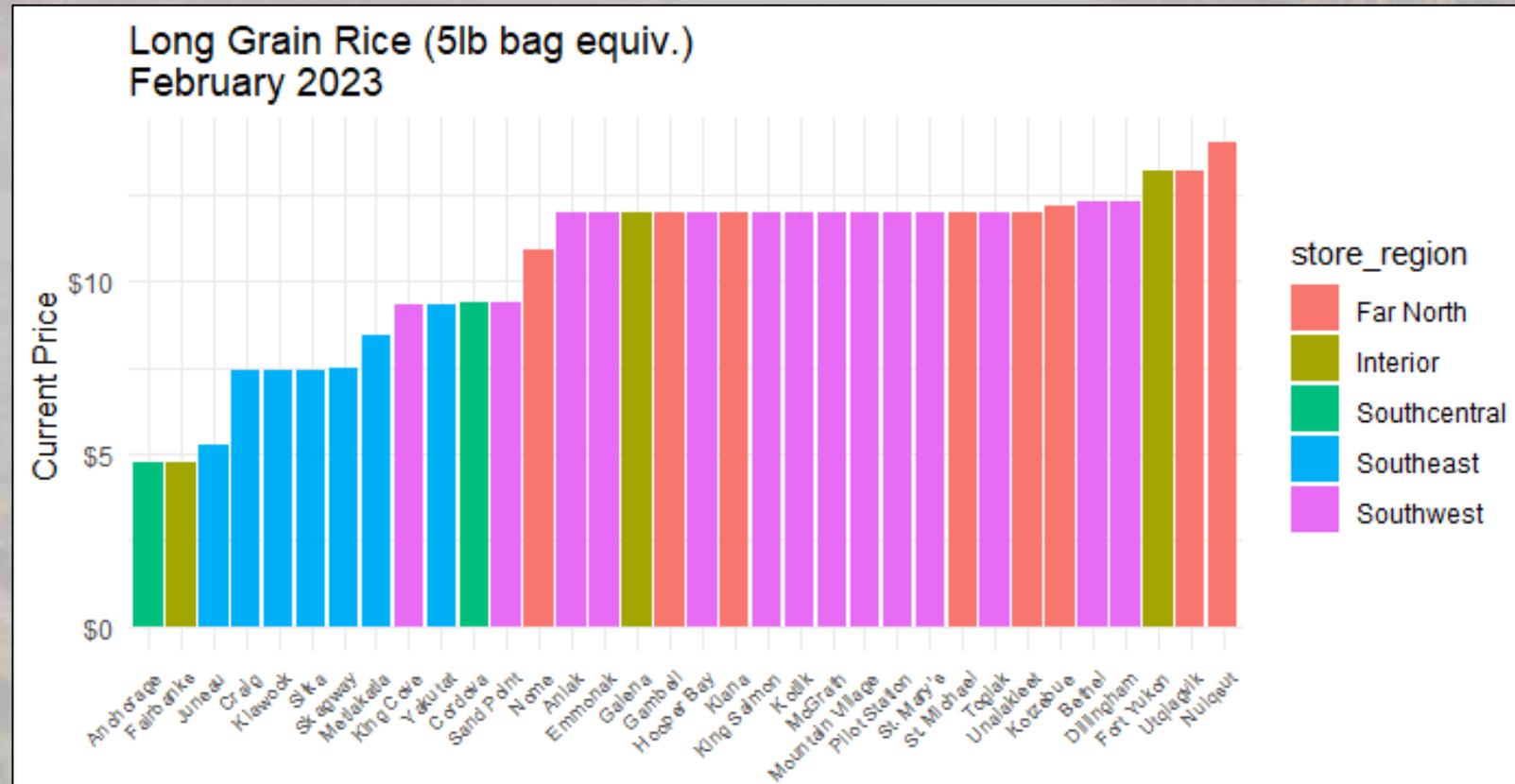


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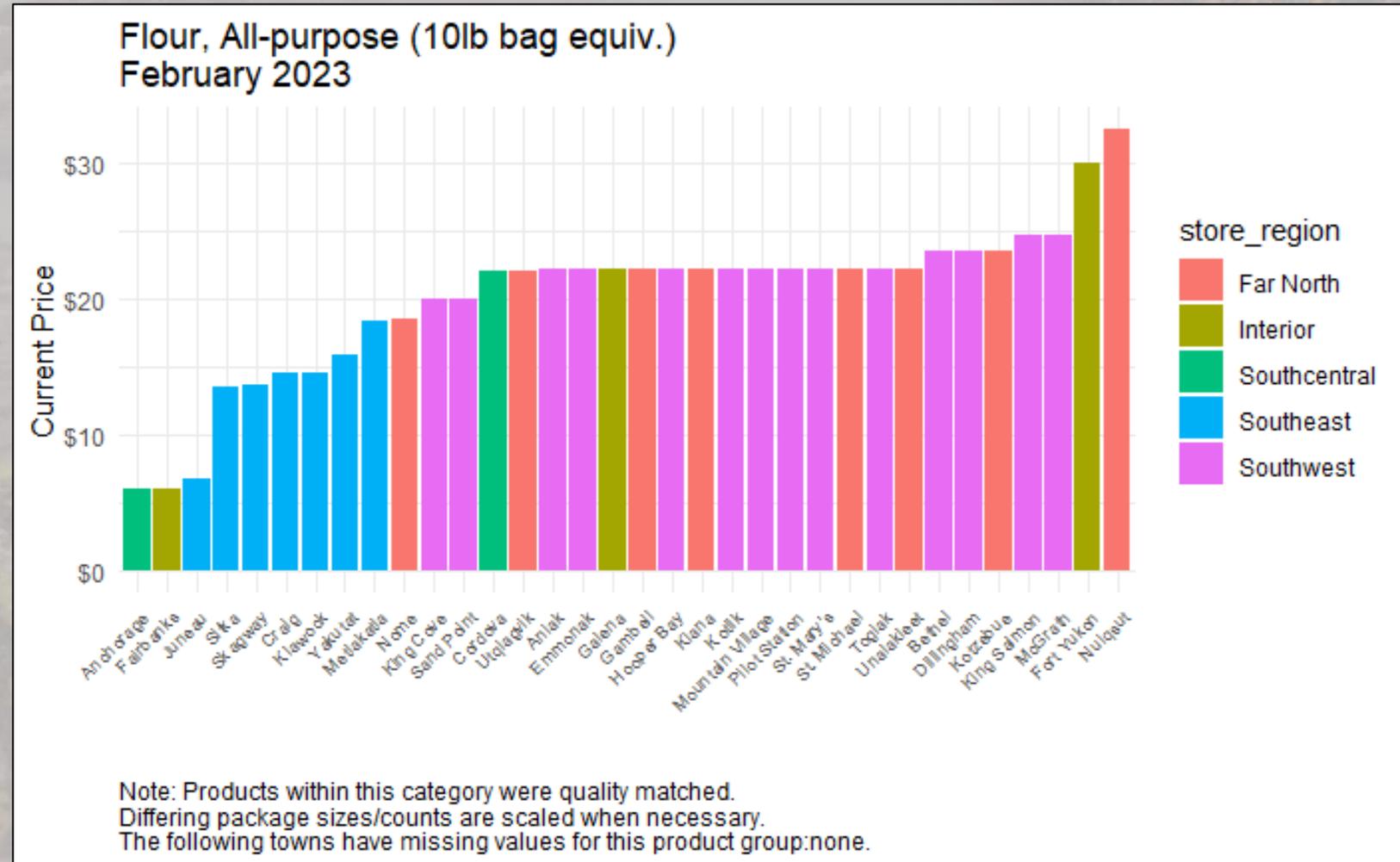
Note: Products within this category were quality matched.
Differing package sizes/counts are scaled when necessary.
The following towns have missing values for this product group:none.

Price patterns by region

ANC, FAI, JNU almost always equivalent

Marginal cost (ish) pricing up the SE barge line

Block pricing in SW



Getting to Alaska

Most goods by weight arrive by barge from Tacoma, WA

By value, *about half* arrives by air

USDOT Bureau of Transport Statistics' Freight Analysis Framework (FAF5) is imperfect starting source for overall flow data (by volume or value)



Moving to and through the hubs

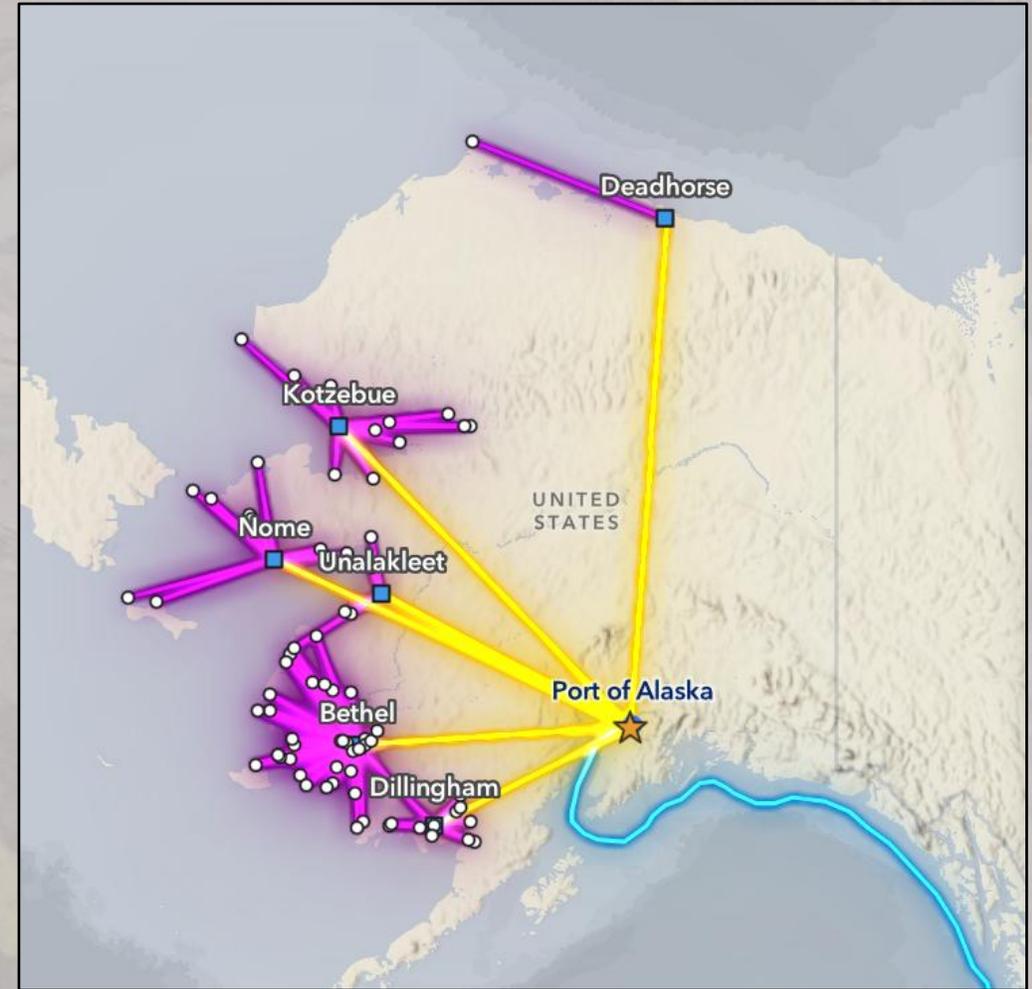
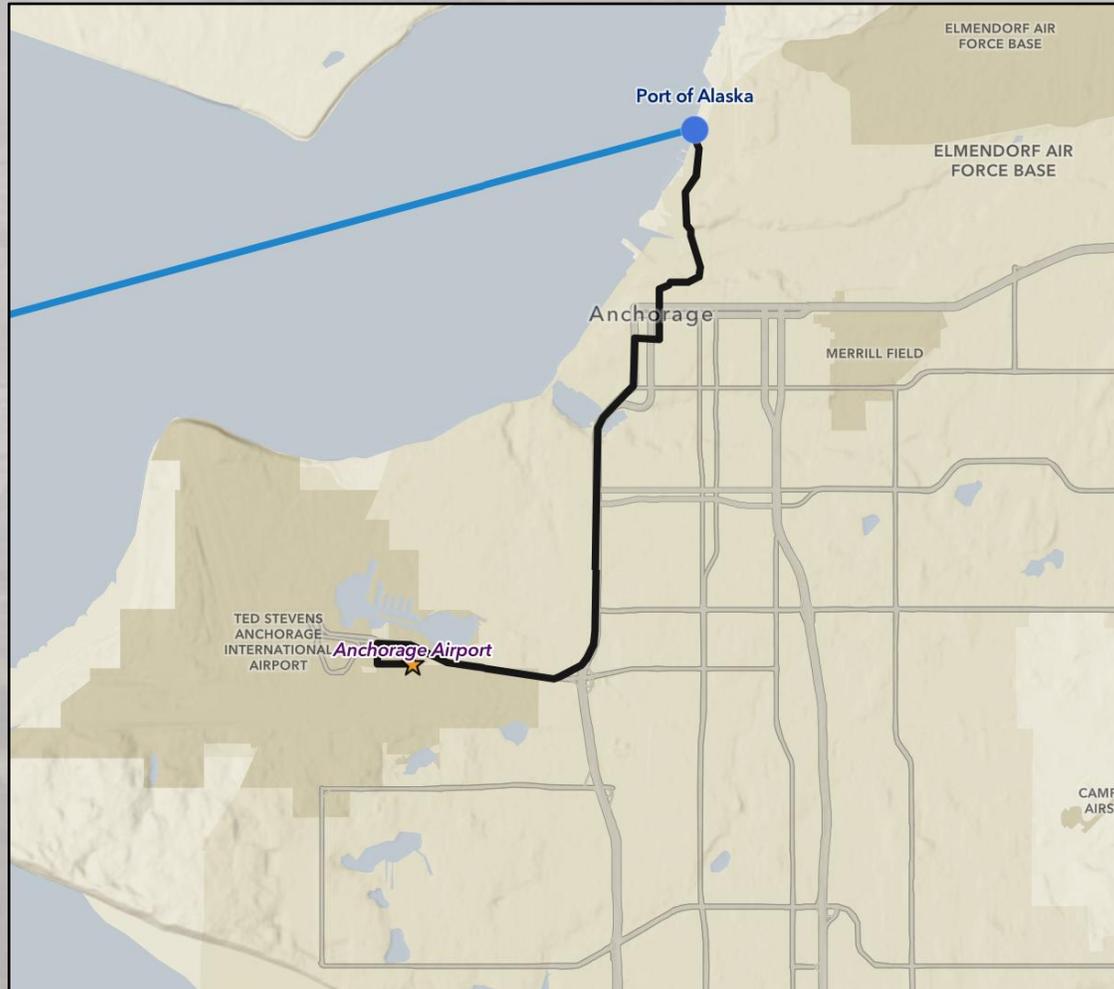


Image Credit: AFPC/Dewberry "Distribution Network" for lettuce

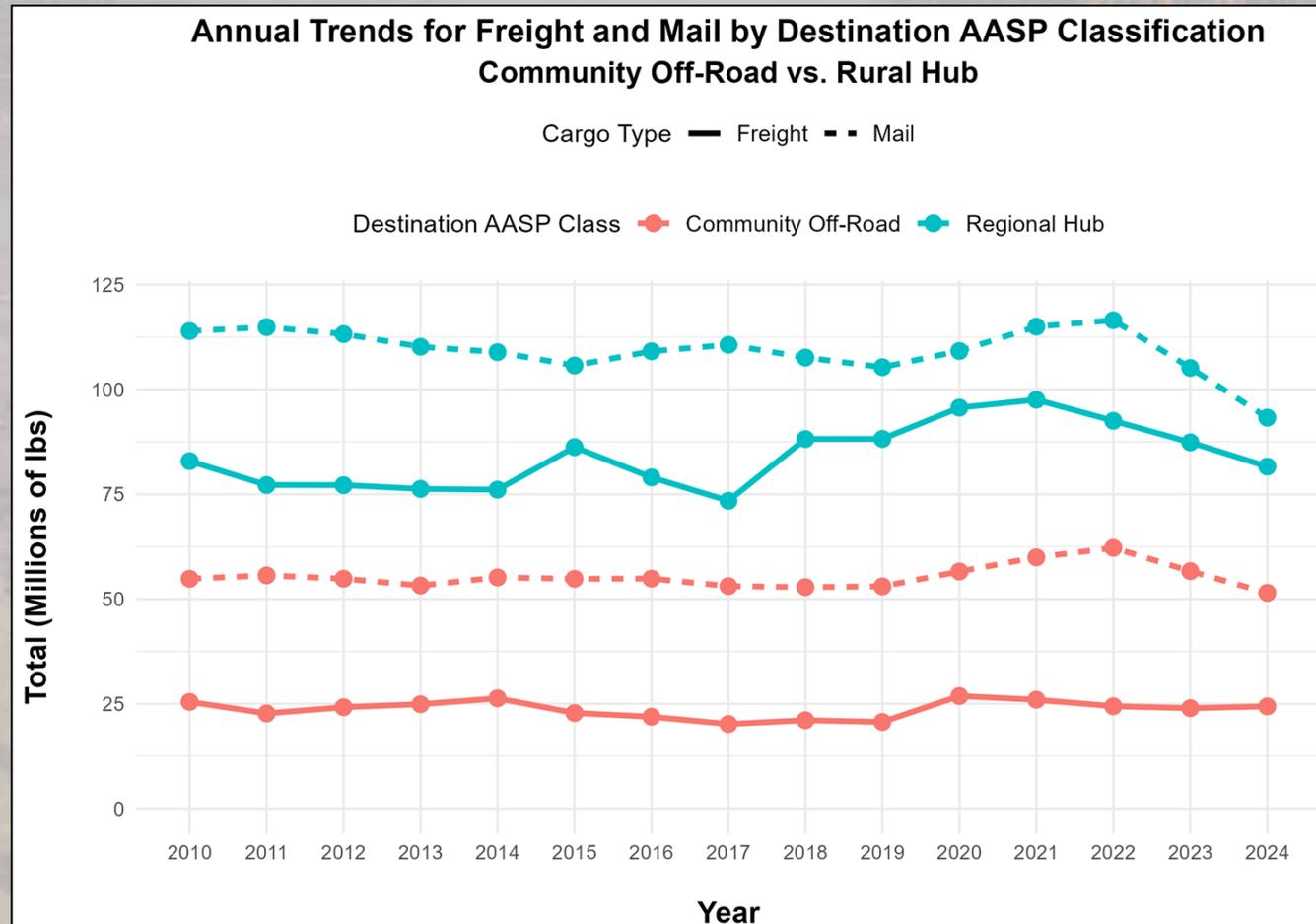
How much is flown?

USDOT BTS T-100 “Domestic Market” data

Combine with ADOT&PF airport classifications

Over 250M lbs of cargo flown to off-road communities (excl. JNU)

- ~170M to hubs
- ~75M to spoke villages

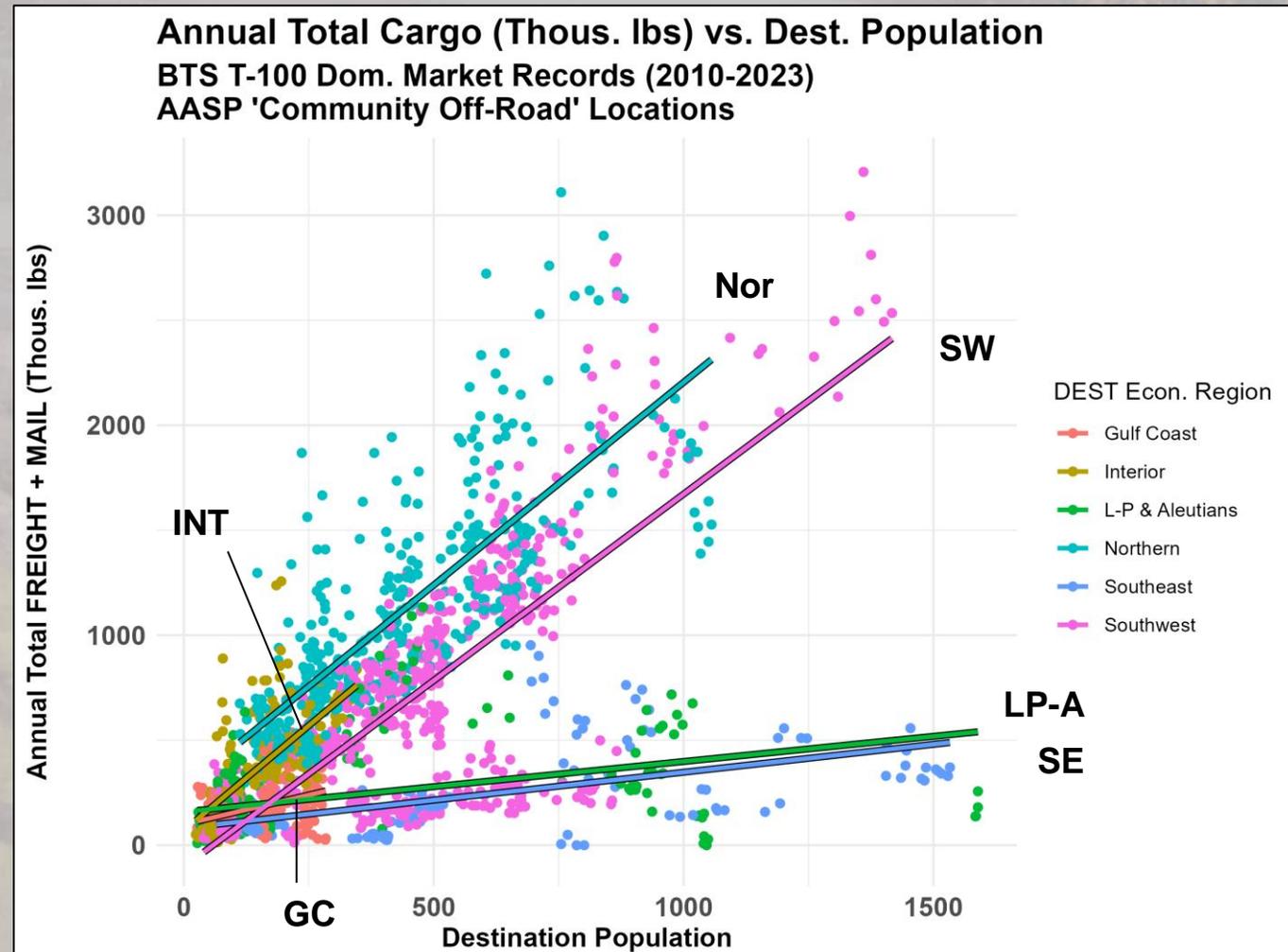


Alaska as an aviation state

Annual Cargo Volumes

Regional differences clear for communities

- Interior (2k lb/cap)
- Northern (1.9k lb/cap)
- Southwest (1.8k lbs/cap)
- Gulf Coast (560 lbs/cap)
- L-P Aleut (240 lbs/cap)
- Southeast (270 lbs/cap)



When can a plane fly?

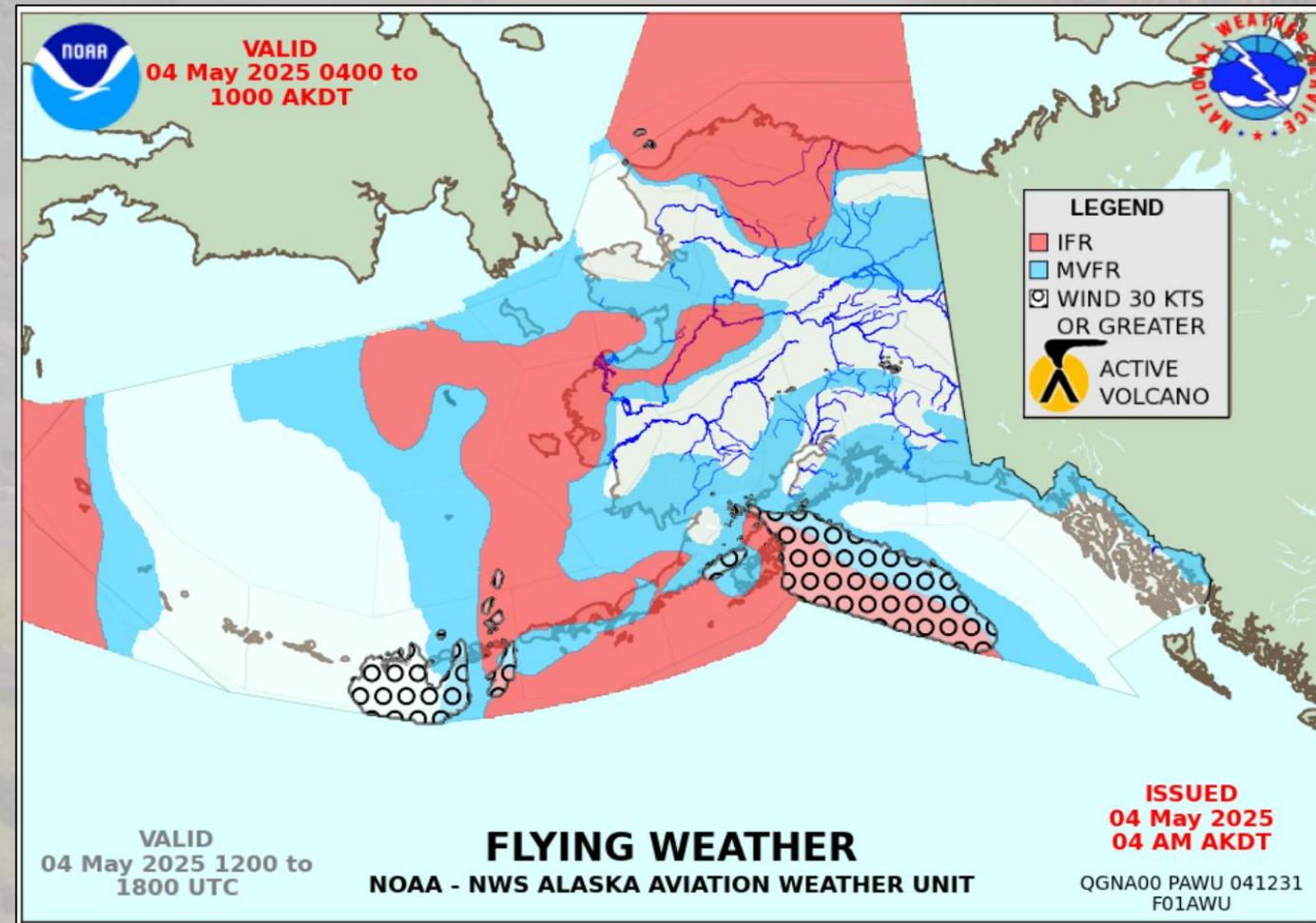


When can a plane fly?

Alaska is a very cloudy place and flying is dangerous

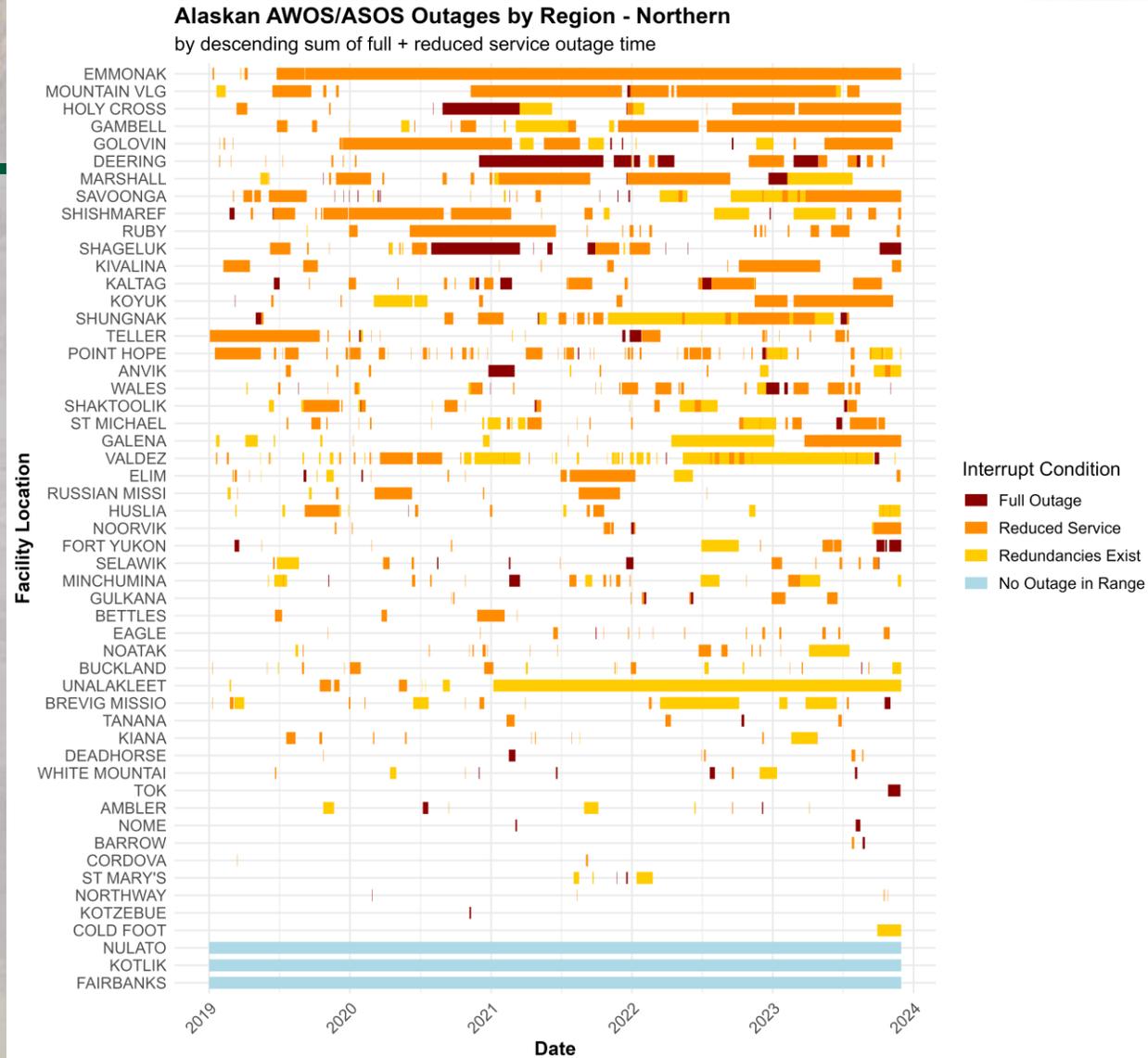
“IFR” weather denotes where the cloud ceiling and visibility are very low

“Certified weather” reports required for many flights



When can a plane fly?

Outage Length (Percentile)	FAA Unit Full Outages (Days)	FAA Unit Reduced Service (Days)
25 th	0.8	1.1
Median (50th)	3.3	4.4
75 th	10.5	14.8
90 th	25.5	54.5
Max	154; 201; 231; 316; 805	637; 665; 699; 858; 1,545

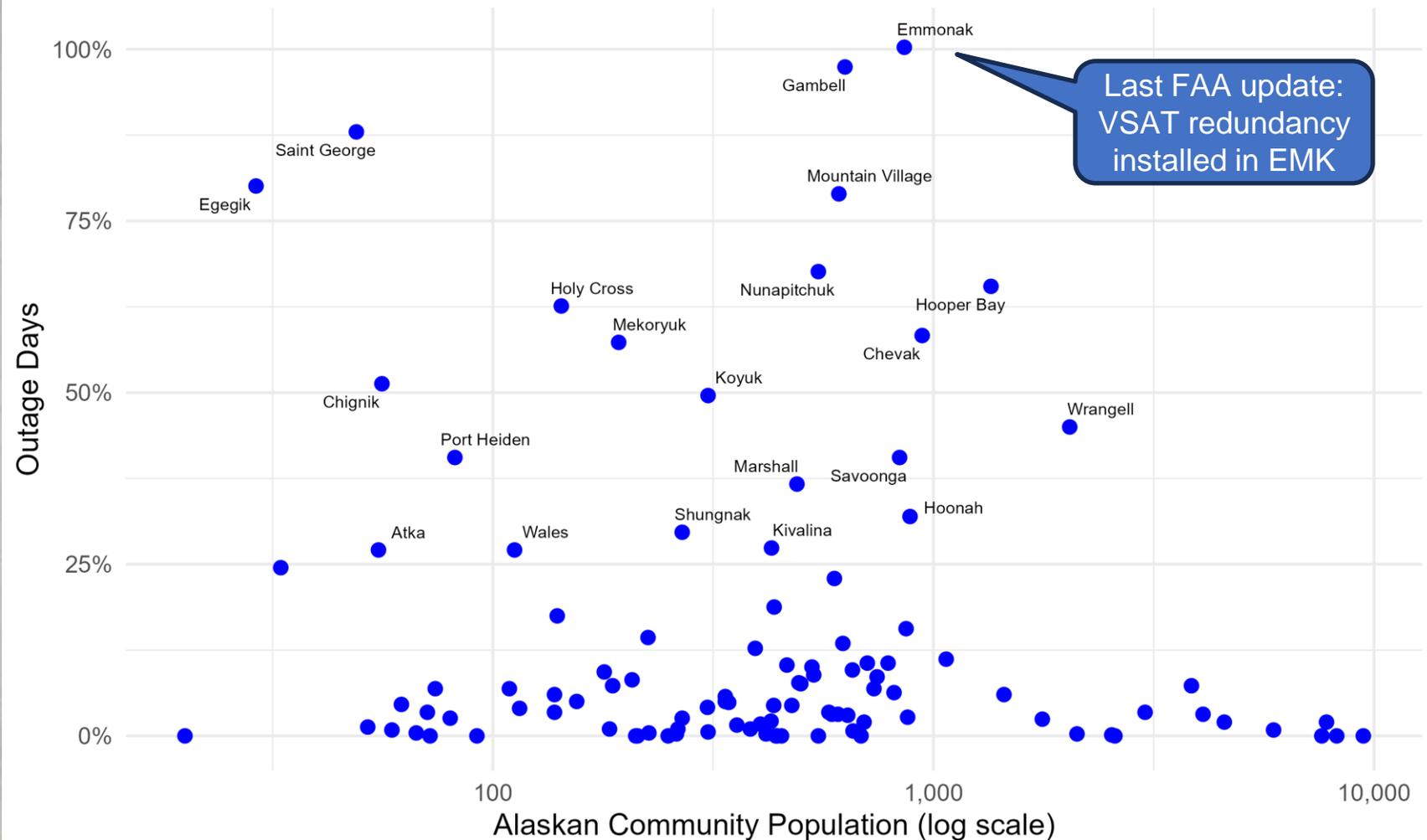


Contact: Mike Jones (UAA-ISER) msjones6@alaska.edu
 Source: FAA data on unscheduled station outages.
 Data trimmed to 01/01/2019 - 11/30/2023; Void codes omitted.
 'Open' codes assumed to denote ongoing issues when missing an event 'end date'.

Outages over space & time, at rural community level

Alaskan AWOS/ASOS Outages

(Telco) Outage Days (2022-2023) by Population



Source: FAA data on unscheduled station outages. 01/01/2022 - 11/30/2023. Void codes omitted.

'Open' codes assumed ongoing when missing an event 'end date'.

Population data drawn from AK DOL&WD July 2023 community-level estimates.

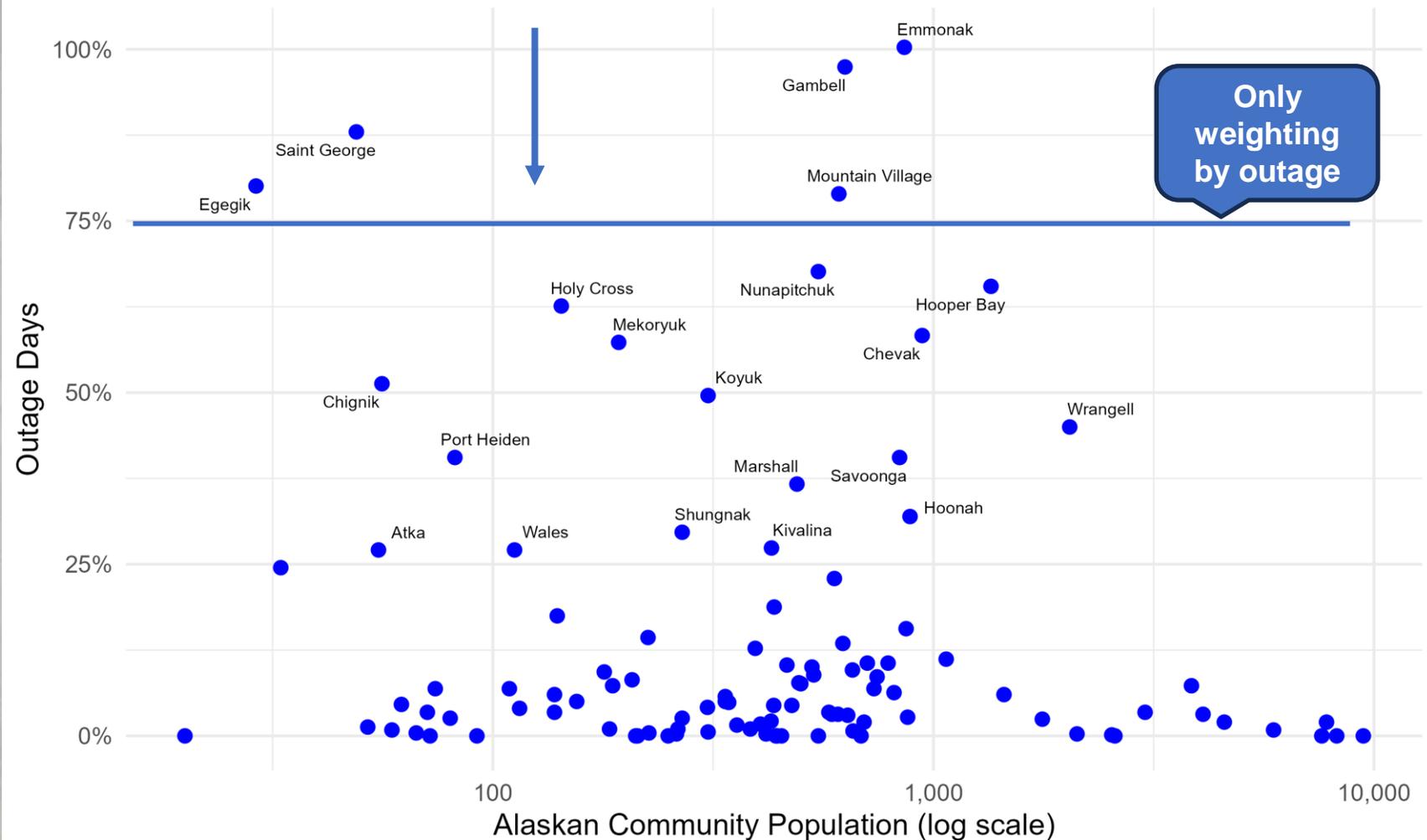
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The following airports do not have specific census population data in DOL&WD files:
Eureka, Birchwood, Clarks Point, Middleton Island, Minchumina, Portage, Deadhorse

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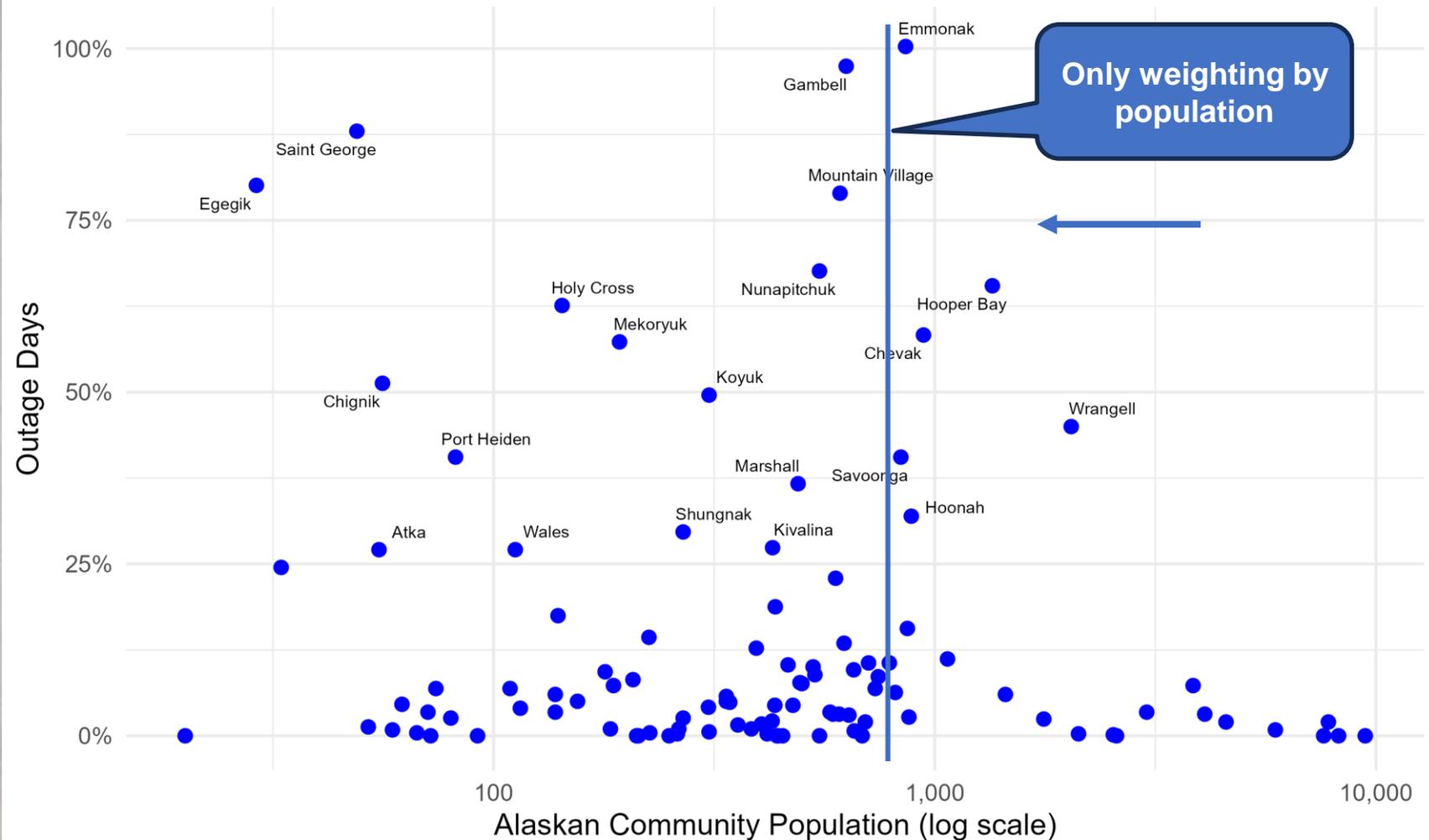


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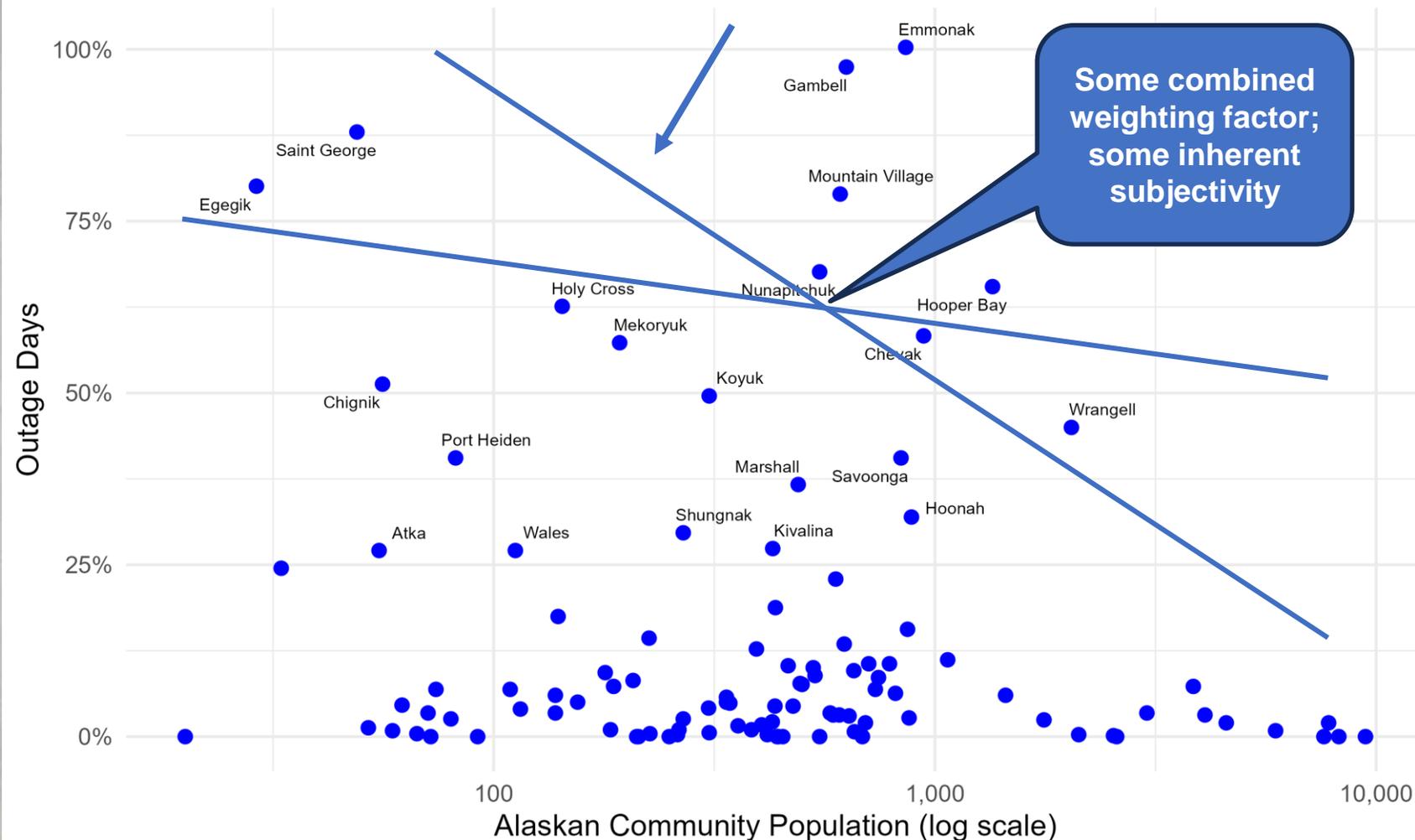
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Outages over space & time, at rural community level

Other factors?
Remoteness, Pax & Cargo Volumes, Dependency, Weather, others?

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Delivery reliability driving dynamics

Outages, weather constraints



Image Credit: DOT-SWA

Lack of FAA-mandated authorization to fly

Other aviation issues: (runway plowing, maintenance, logistical issues, labor constraints, platform availability)

Backlogs at hubs, overwhelming very low cold storage capacity; Loading, Unloading challenges in extreme temps



Cascading effect reducing flow/preservation of cargo to other communities; backups into ANC

Food Spoilage, Delays



Less fresh food, lower quality, increased cost



Trade offs: time and temperature

In many hubs, well known that bush carrier chill storage is severely lacking (statewide inventory study forthcoming)



Mainline carrier
(above)



Bush carrier
(left)

... also, loading/unloading times may be a big temp. 'shock'



Storekeeper perspectives on improving dietary intake in 12 rural remote western Alaska communities: the “Got Neqpiaq?” project

Kathryn R. Koller ^a, Christie A. Flanagan ^b, Jennifer Nu^c, Flora R. Lee^d, Christine Desnoyers^e, Amanda Walch^f, Lucinda Alexie^g, Andrea Bersamin^h and Timothy K. Thomas ⁱ

Fruit and vegetable availability and sales

At least one store in every community sold fresh produce. In general, fresh produce sold well. However, food spoilage due to air shipping delays, primarily during winter months, was a challenge. Storekeepers reported profit losses of up to 50% due to food spoilage and the cost was assumed by the store and passed onto customers. One storekeeper lamented, “... *there’s times they come in ... too rotten from the travelling*”. Another stated, “*You learn once it gets below a certain temperature outside, you learn not to even try getting certain items ...*” While the majority of stores do not have trouble storing fresh produce, they order only enough to shelve when delivered and do not keep additional inventory.



Frequent spoilage on arrival



Foundational research questions

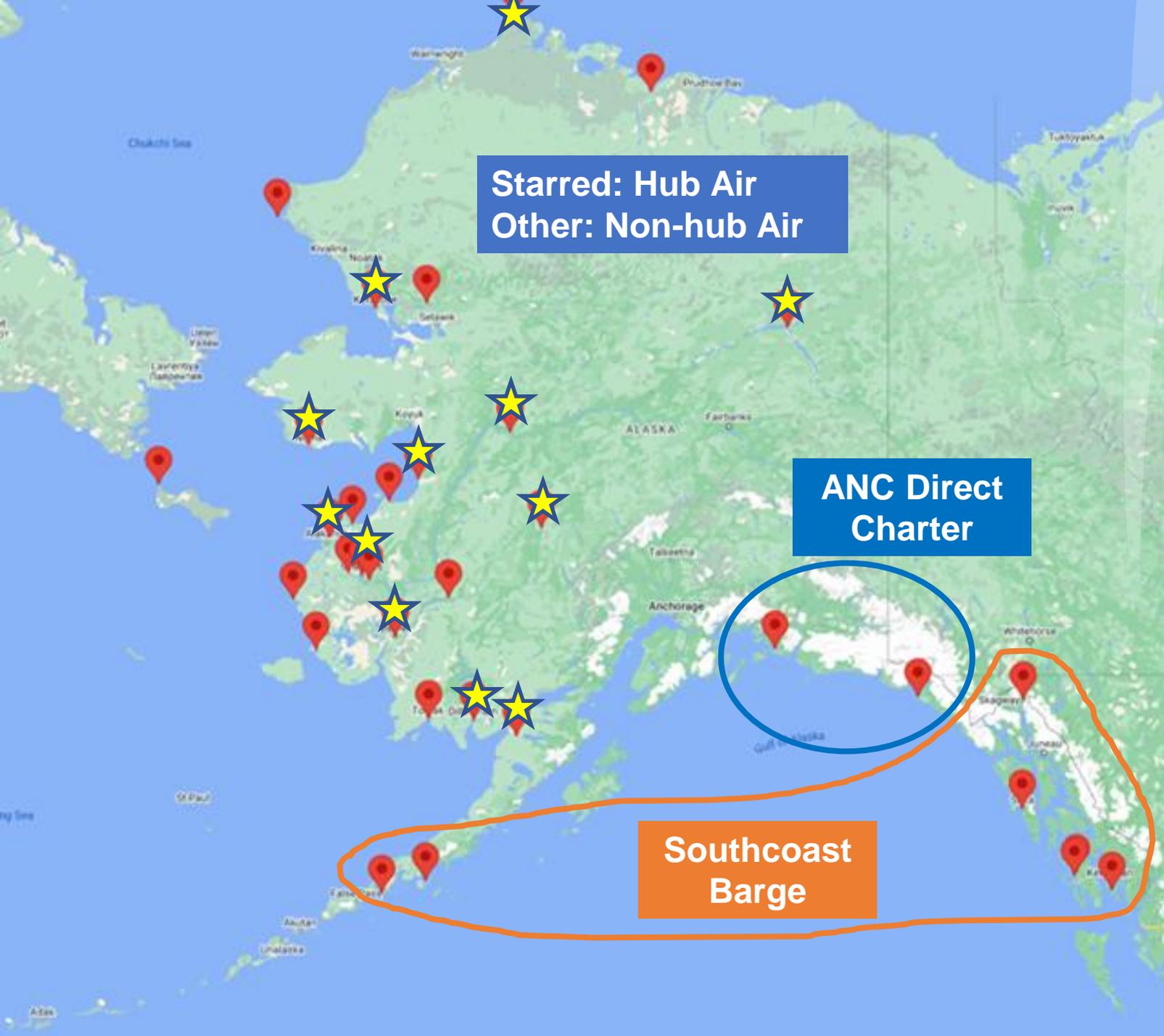
Does supply chain mode impact the availability of fresh produce and the intensity of spoilage-in-transit?

- ... and is there variation across seasons?

Which leads into [ongoing work]...

Does the performance of the aviation supply chain impact the availability and spoilage intensity of fresh food in rural groceries?





Starred: Hub Air
Other: Non-hub Air

ANC Direct
Charter

Southcoast
Barge

Alaska Commercial Co.
grocery store locations and
groupings by produce
supply mode (air/barge) and
remoteness (hub/non-hub)

- 1) Southcoast barge
- 2) Direct ANC charters (non-hub)
- 3) Hub Air
- 4) Non-hub Air

Retail grocery: AC stores

Sales quantities (not prices) by UPC-
store-month

Matching 'nonsellable-on-arrival' data
– i.e., spoilage in transit

UPCs consistently clustered under
three main and sub-categories

- GROUP → DEPARTMENT → **CLASS** →
UPC

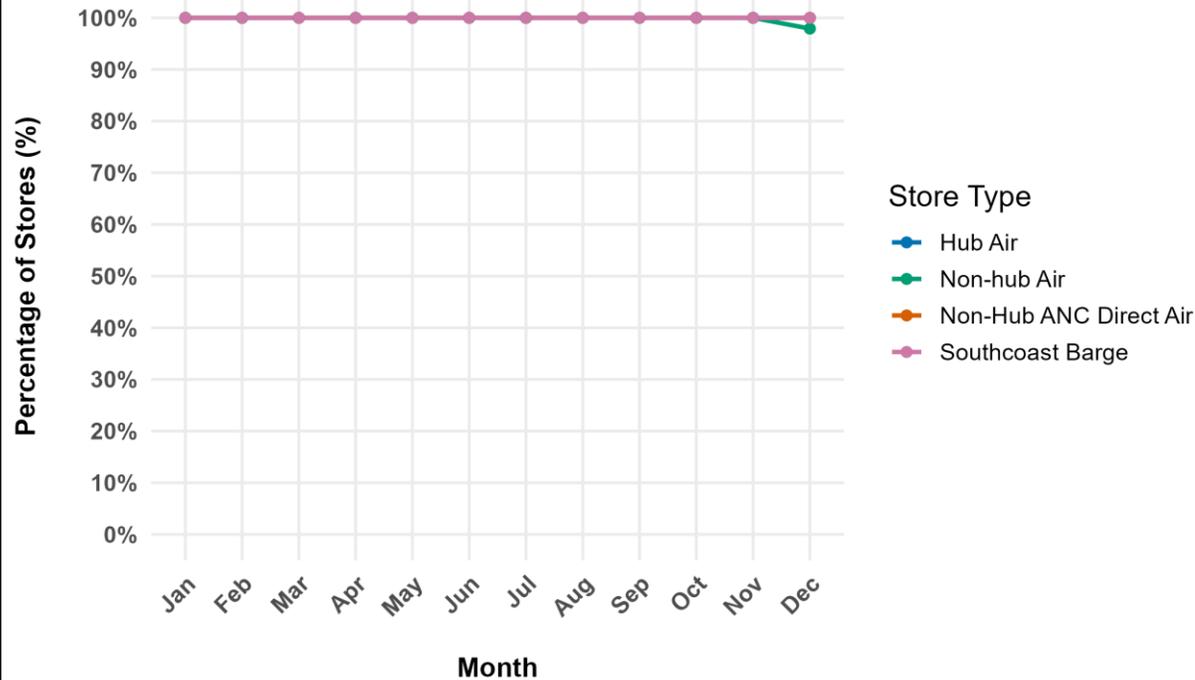
Product class categories within 'Produce'

Apples	Bananas
Berries	<i>Bulk Nuts*</i>
Celery	Citrus Fruit
Cooking Vegetables	<i>Envelope Mixes*</i>
Fresh Mushrooms	<i>Garden seeds*</i>
Grapes	Lettuce
Melons	<i>Natural Foods*</i>
Onions	Pears
Peppers	Pkgd Prepared Salads
Potatoes	Salad Vegetables
<i>Snack Foods*</i>	Soft Fruit
Specialty Fruit	Specialty Veg.
Tomatoes	Value Added Fruit
Valued Added Veg	<i>Dried Fruits/Veg*</i>
<i>Tofu/Vegetarian*</i>	<i>Plant/Garden; Juice*</i>

“Any positive sales” varies by product

**Percentage of AC Stores with Positive Sales:
By Store Produce Supply Routes**

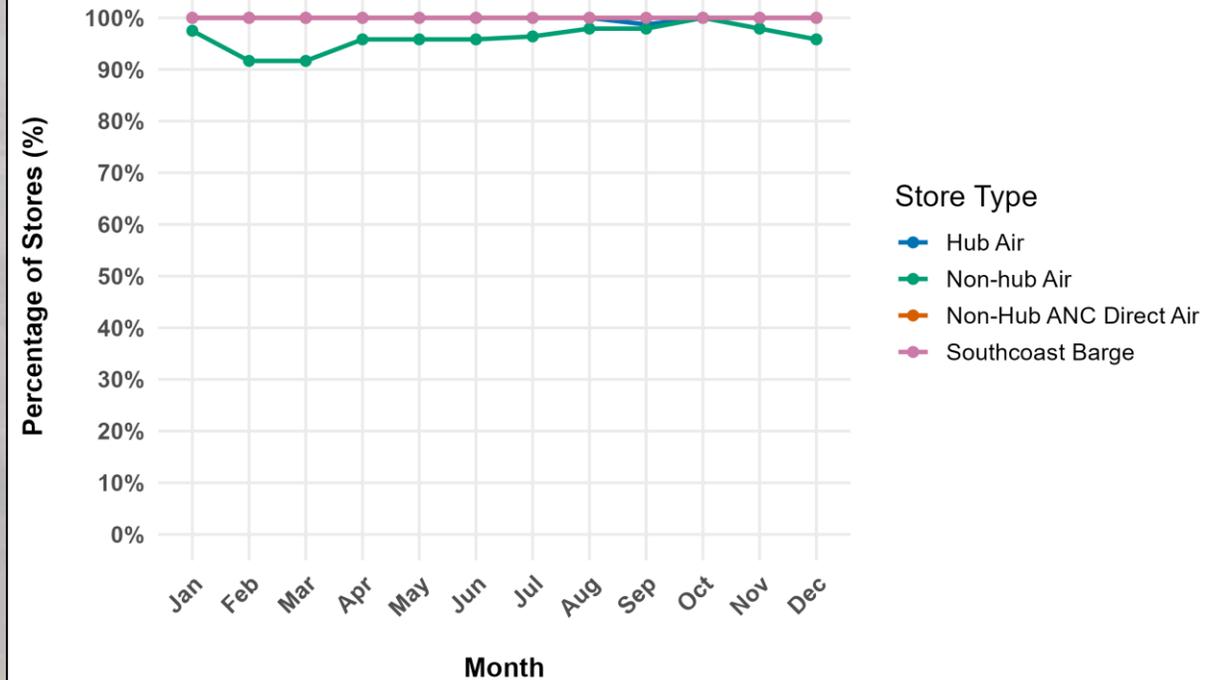
Produce - Apples (2018-2023)



Contact: Mike Jones (UAA-ISER) msjones6@alaska.edu.
Data from AC Store Sales Records. Excludes specific seasonal anomalies.
Last Updated: January 23, 2025

**Percentage of AC Stores with Positive Sales:
By Store Produce Supply Routes**

Produce - Bananas (2018-2023)

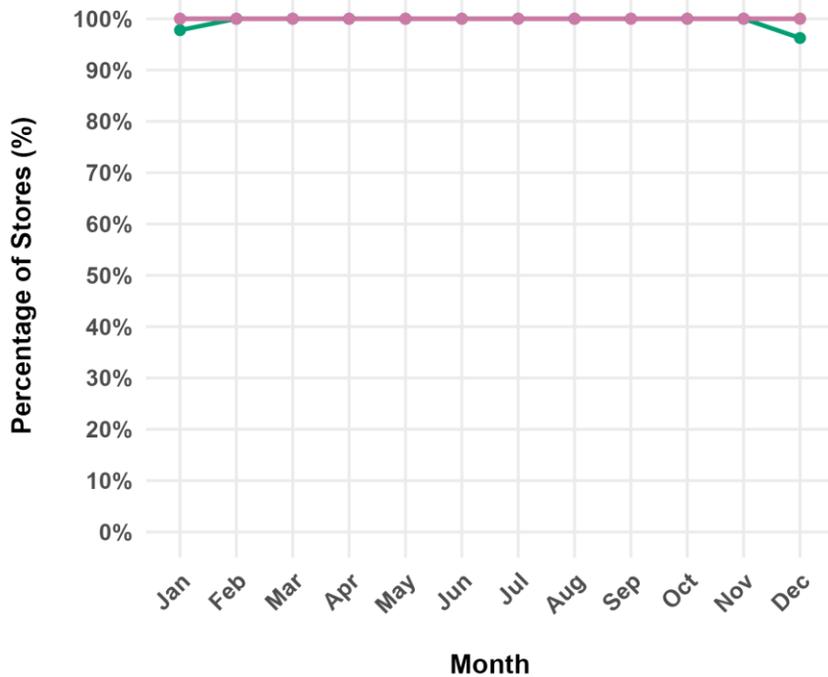


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“Any positive sales” varies by product

**Percentage of AC Stores with Positive Sales:
By Store Produce Supply Routes**

Produce - Lettuce (2018-2023)



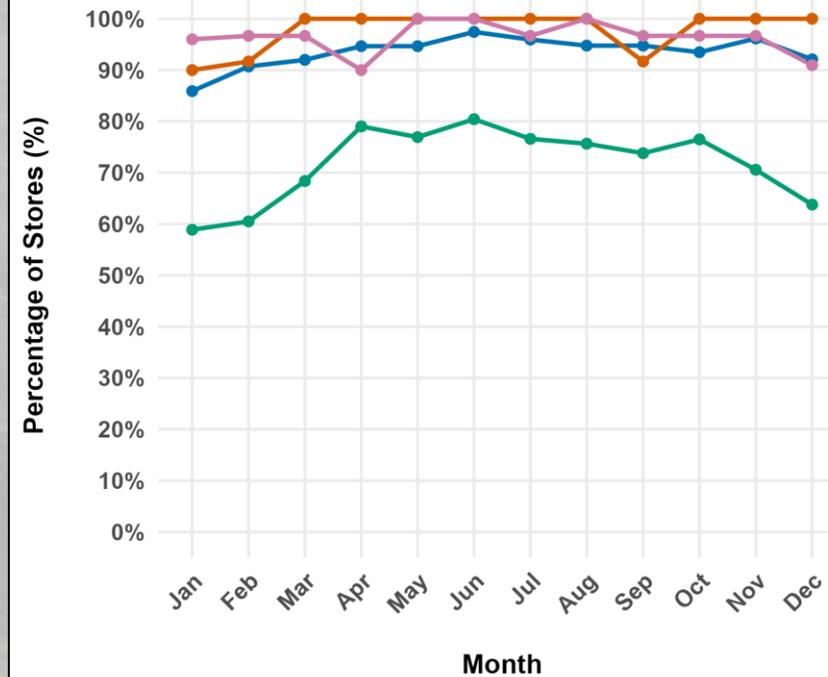
Store Type

- Hub Air
- Non-hub Air
- Non-Hub ANC Direct Air
- Southcoast Barge

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Data from AC Store Sales Records. Excludes specific seasonal anomalies.
Last Updated: January 23, 2025

**Percentage of AC Stores with Positive Sales:
By Store Produce Supply Routes**

Produce - Pkgd Prepared Salad (2018-2023)

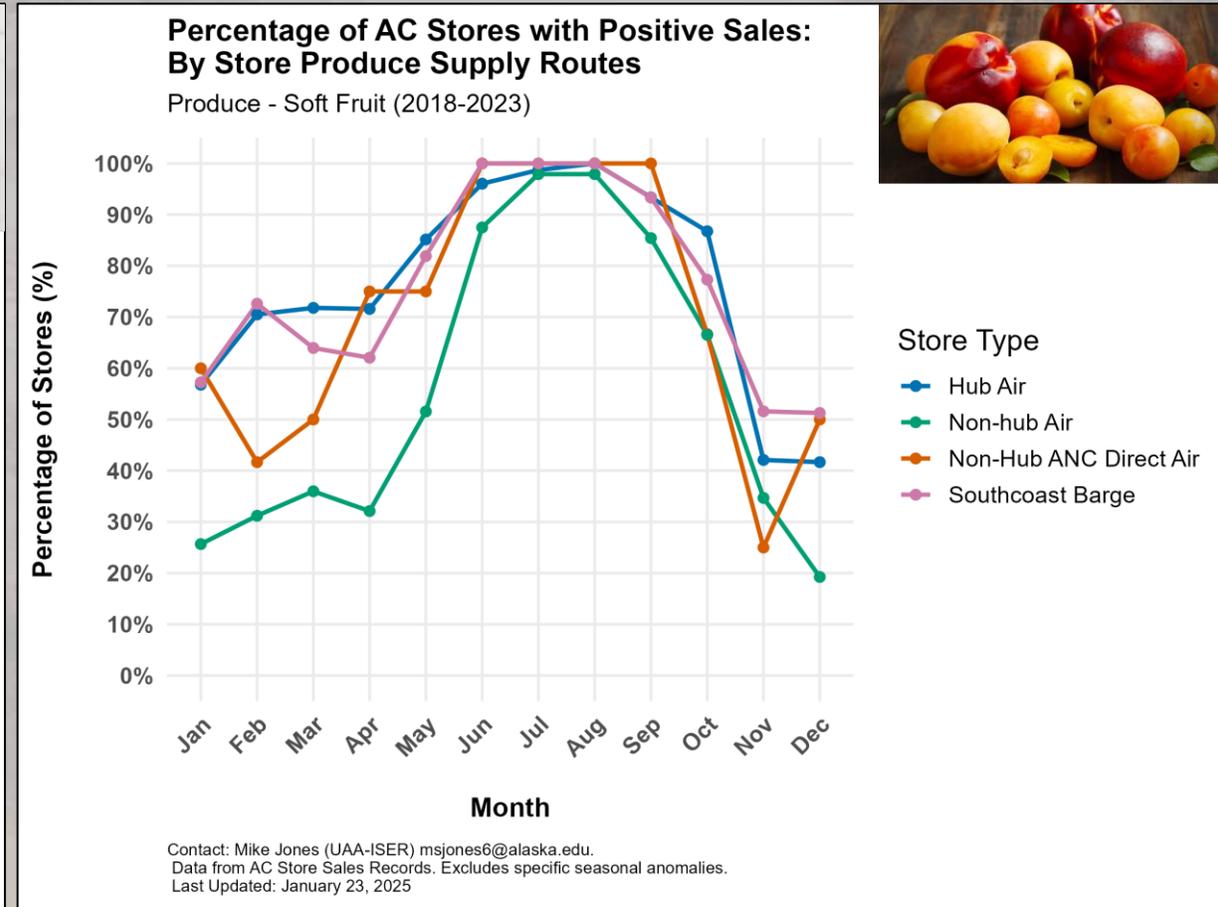
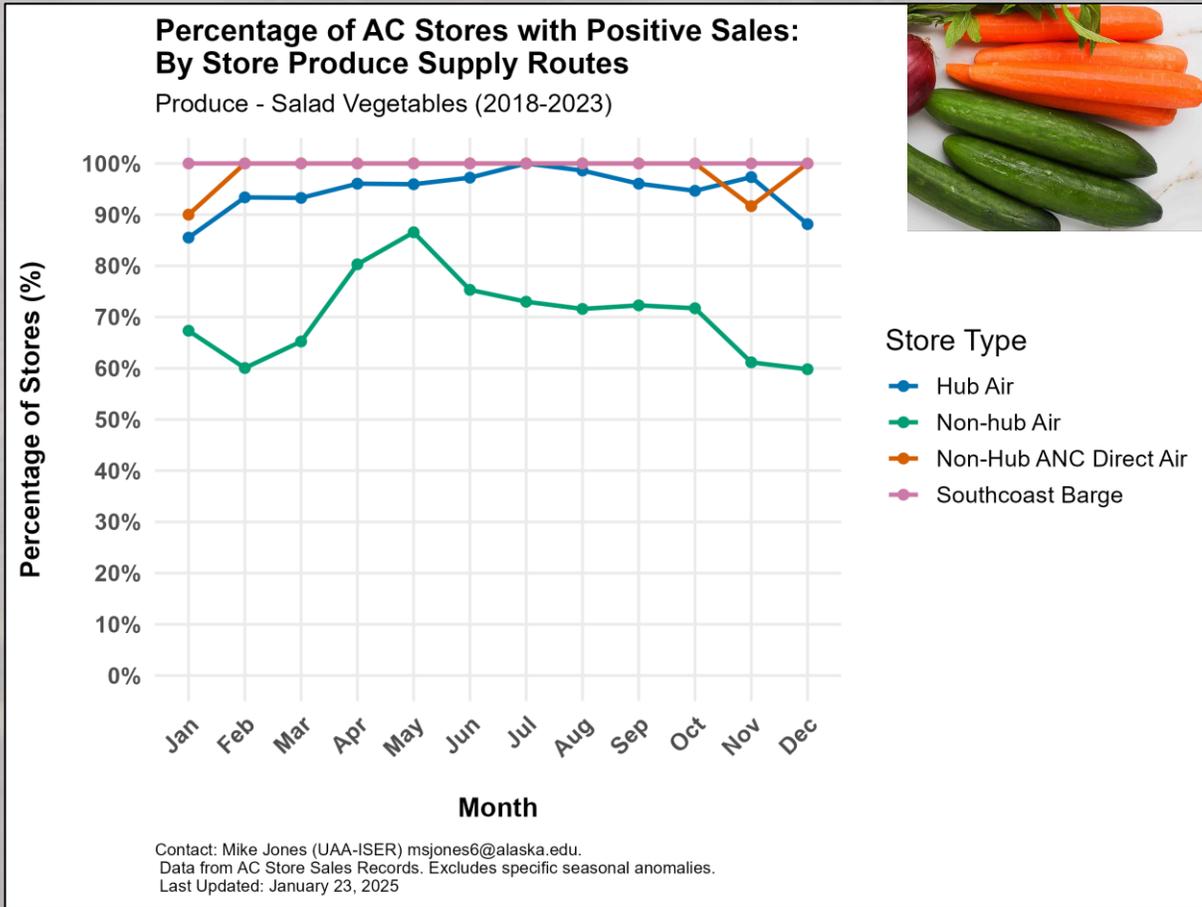


Store Type

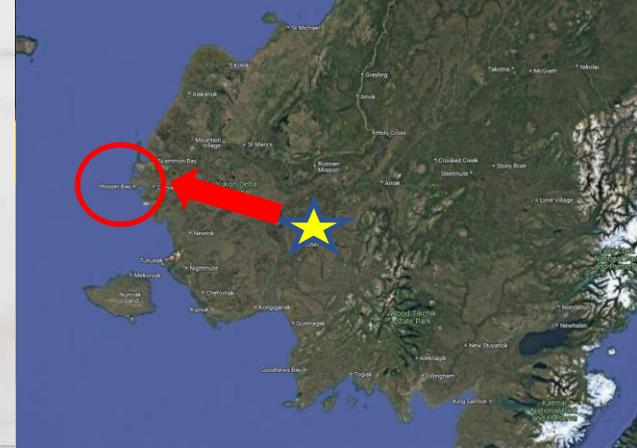
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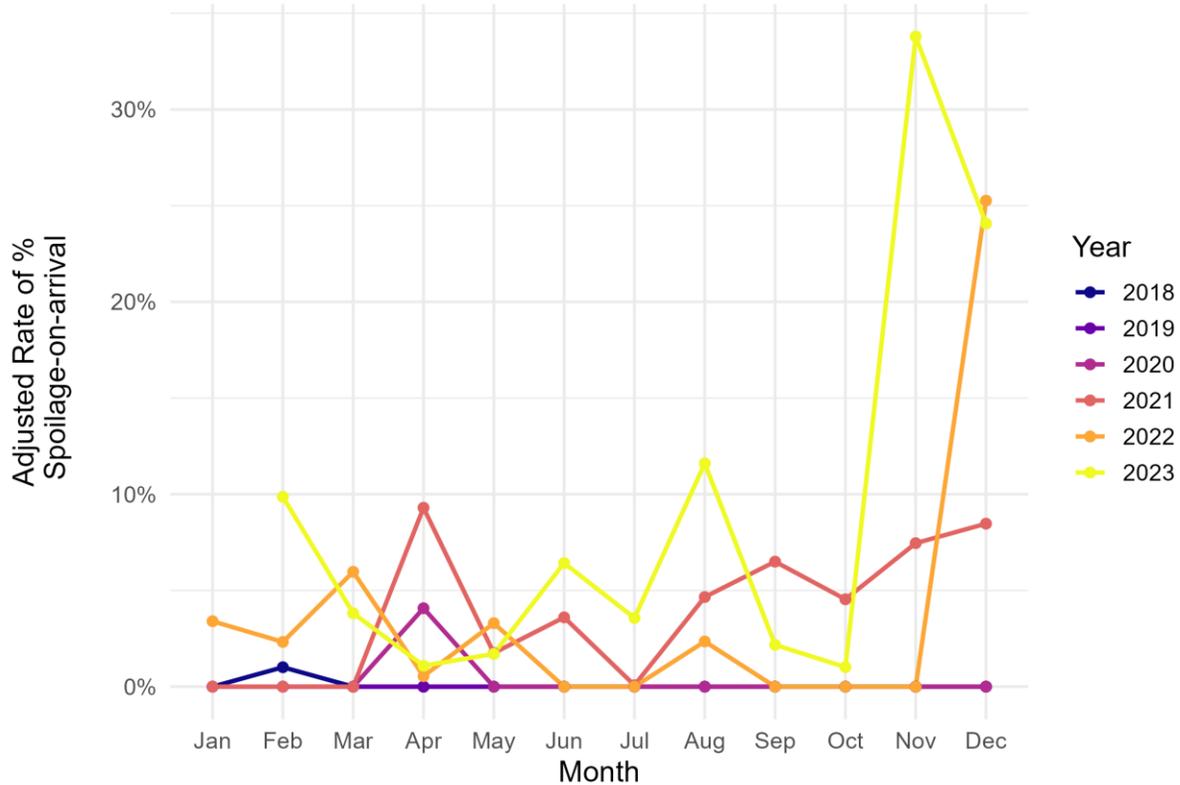
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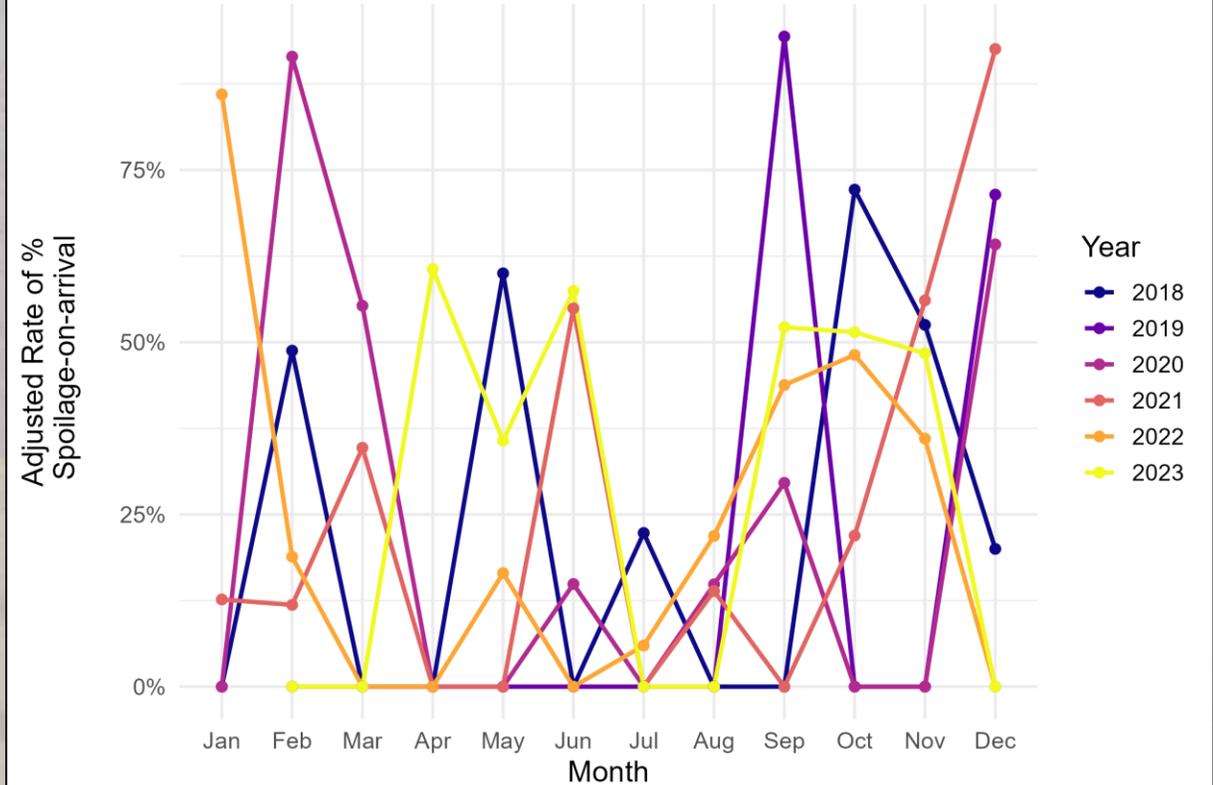
Bethel (hub) vs. Hooper Bay (spoke)



Seasonality of Spoilage in Rural AK: Case Studies
Salad Vegetables in Bethel (Main)



Seasonality of Spoilage in Rural AK: Case Studies
Salad Vegetables in Hooper Bay

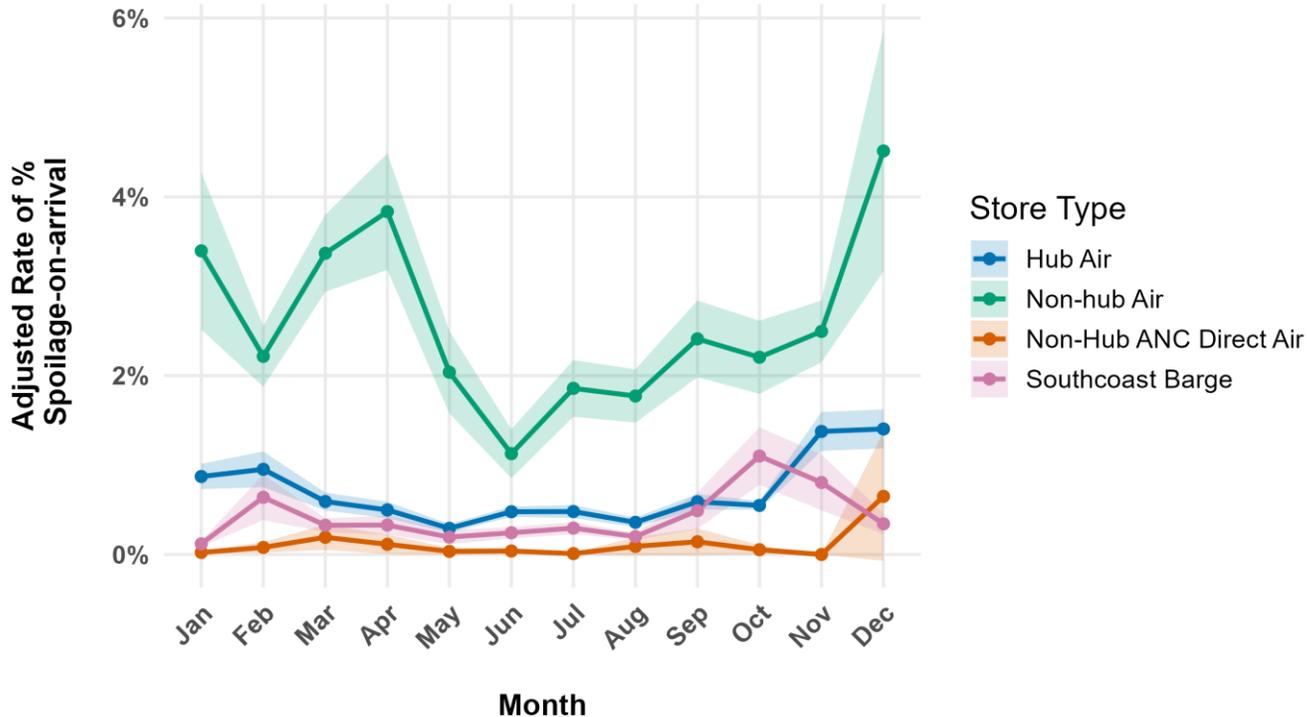


Apples



Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

Produce - Apples (2018-2023)



Contact: Mike Jones (UAA-ISER) msjones6@alaska.edu.
 Data from AC Store Sales and 'Nonsellable-on-arrival' records.
 Vegetables exclude 'Pumpkins Per Lb' due high weight and the extreme Halloween spike.
 Hub locations defined by AK DOT&PF AASP airport classifications.
 Last Updated: January 24, 2025

Interpretation:

“On average, in January, about 3.4% of apples sent to (all) ‘Non-hub’ village stores were spoiled-on-arrival”

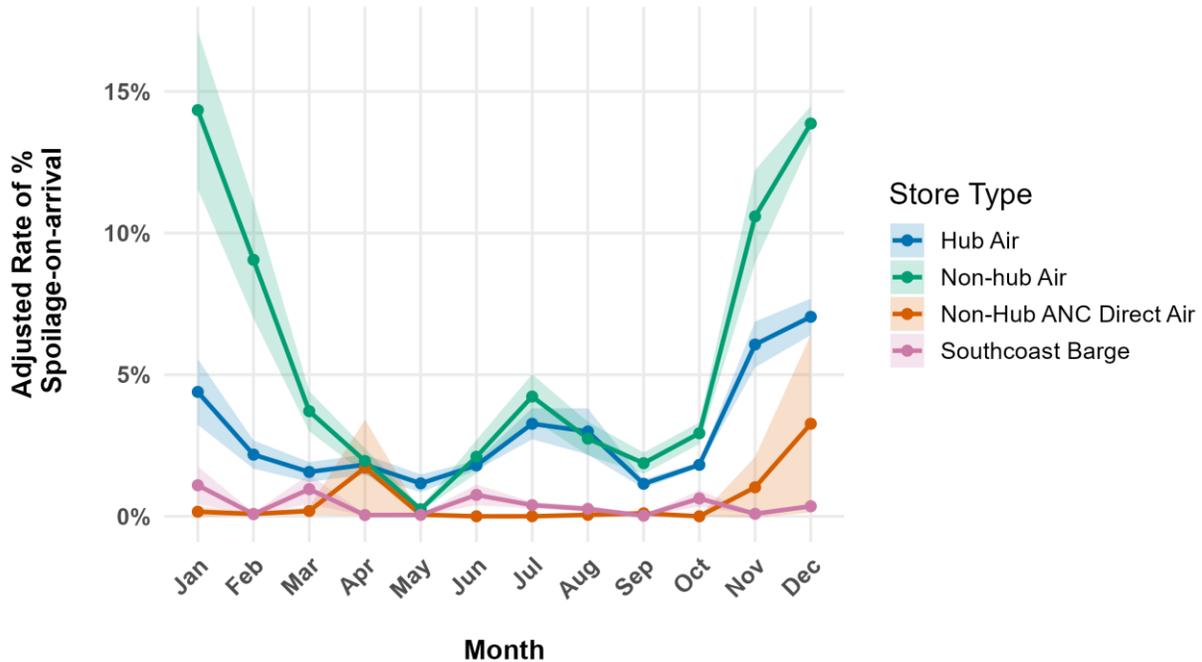
(denominator is [sales + spoilage-on-arrival] and excludes in-store shrink)

Bananas



Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

Produce - Bananas (2018-2023)



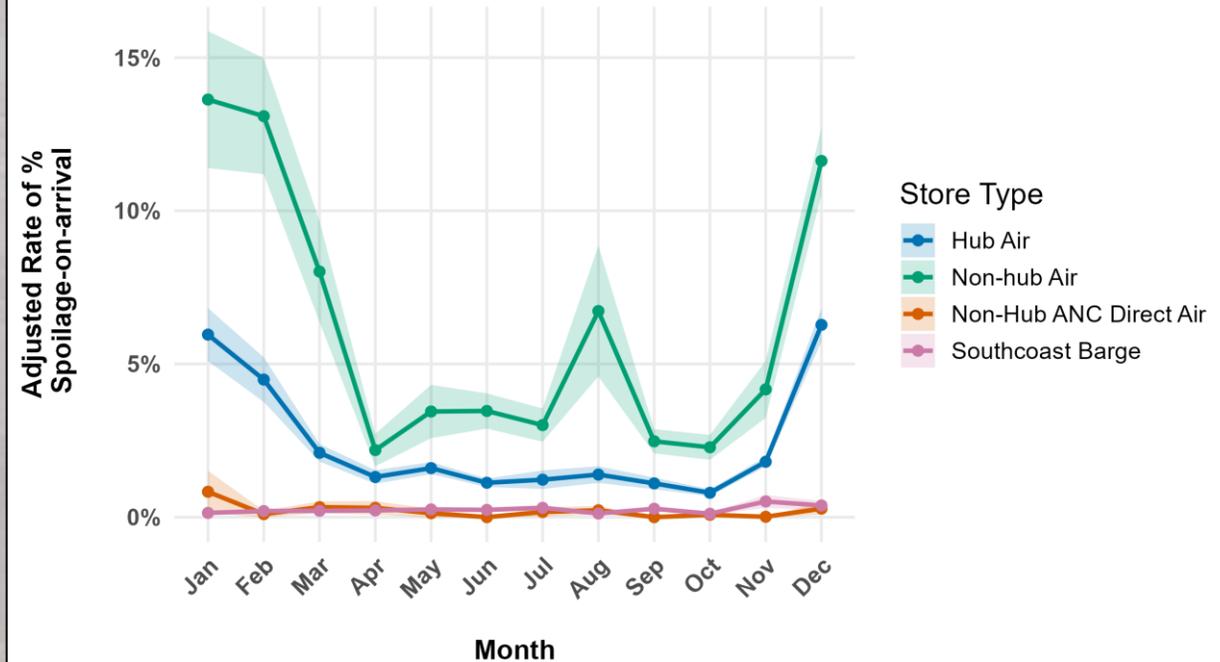
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Potatoes



Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

Produce - Potatoes (2018-2023)



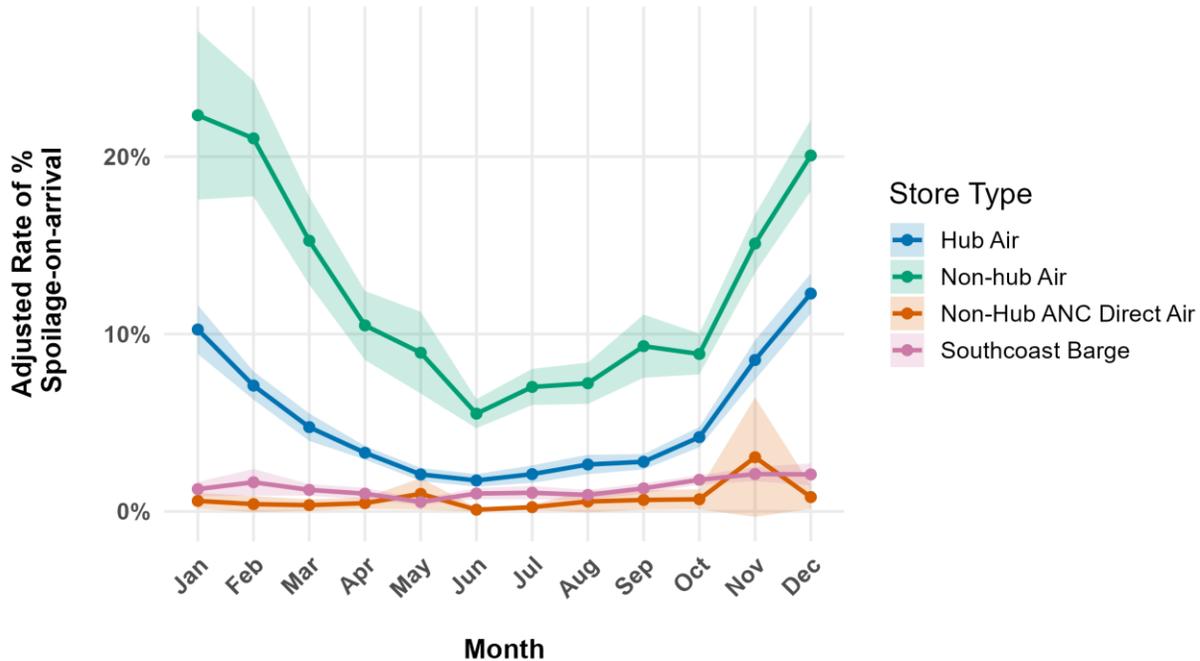
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Tomatoes



Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

Produce - Tomatoes (2018-2023)



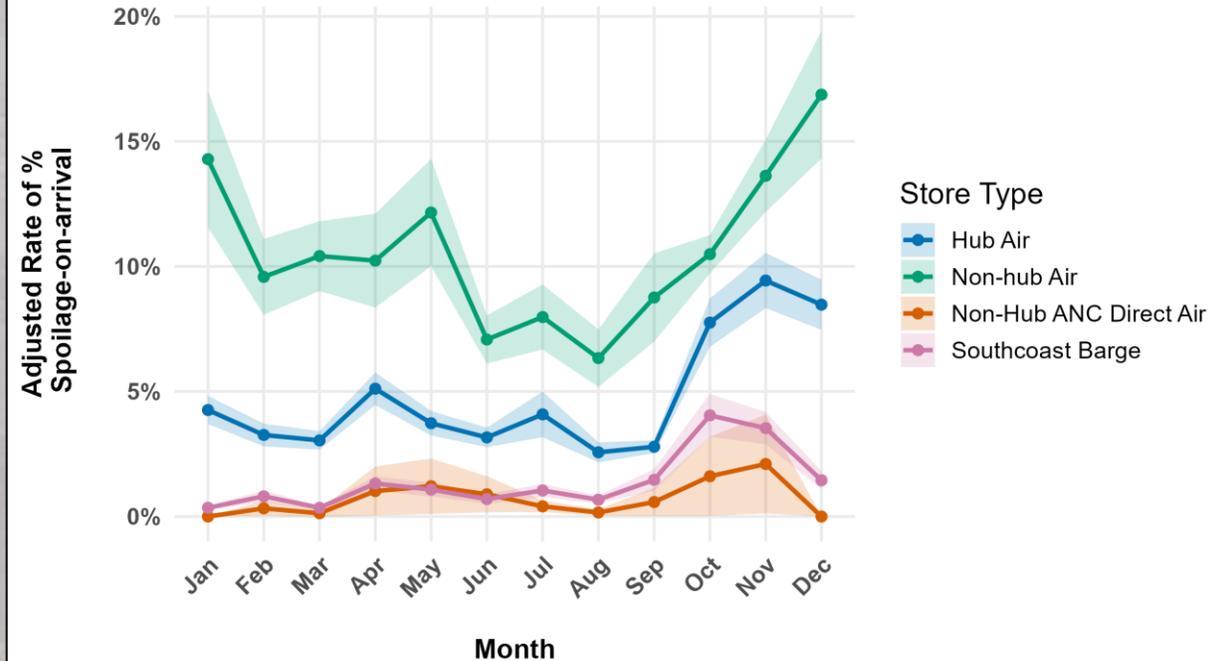
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Lettuce



Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

Produce - Lettuce (2018-2023)



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Berries

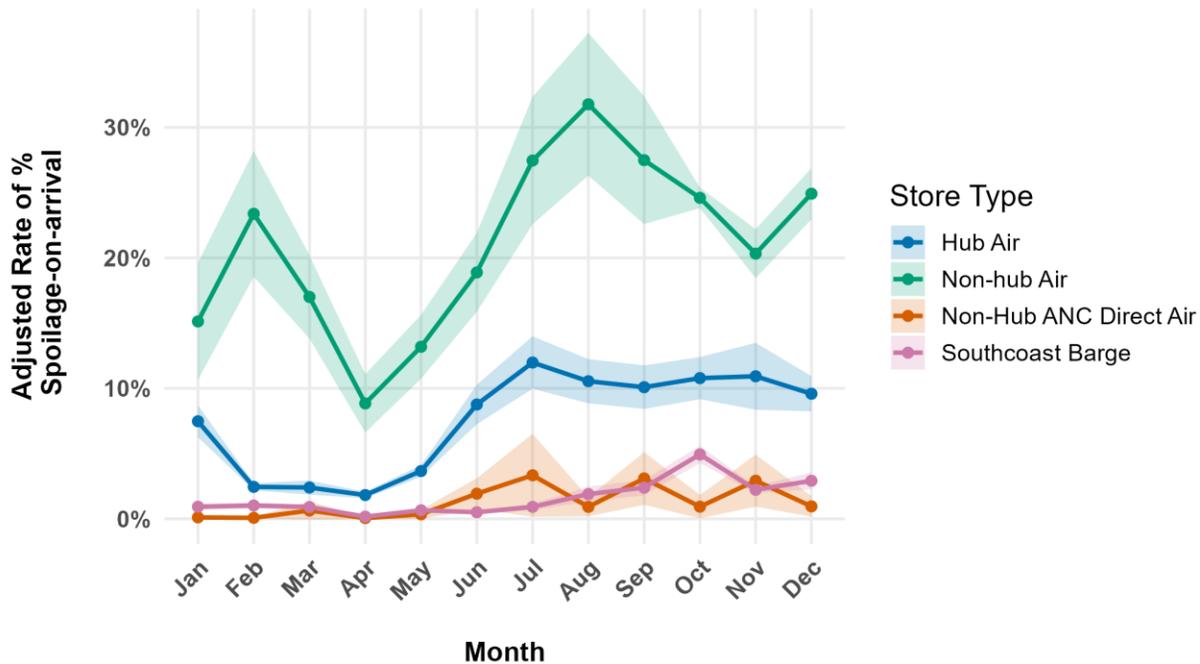


Salad Veg.



Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

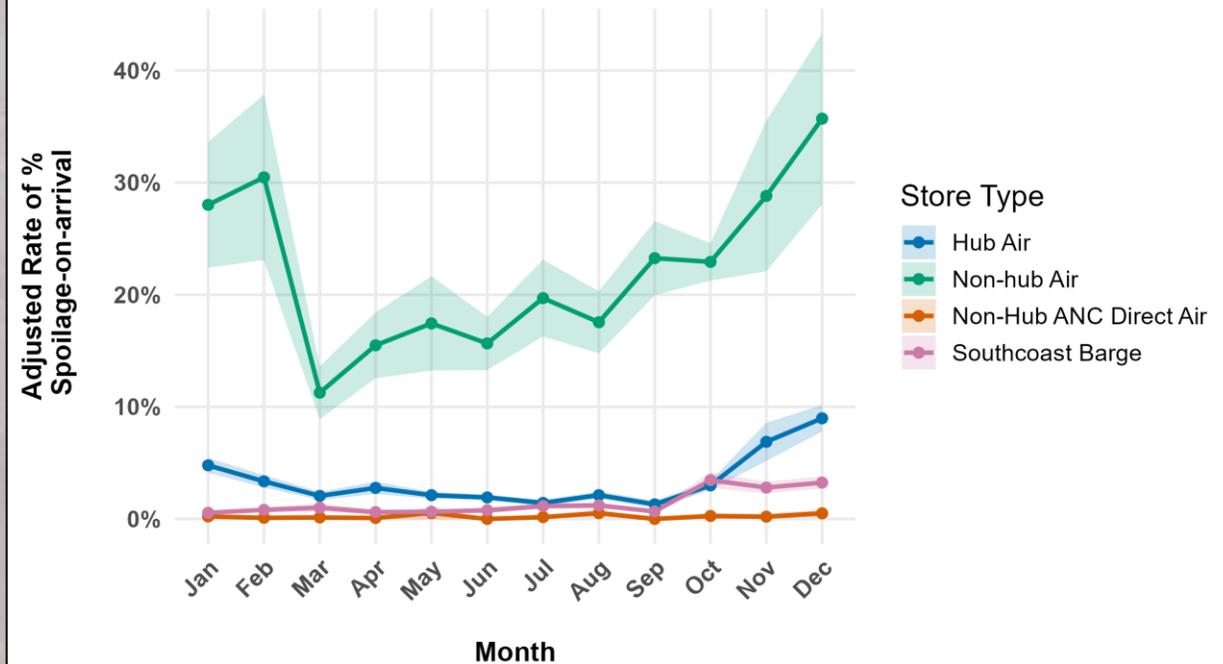
Produce - Berries (2018-2023)



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Alaska Commercial Company Spoiled-on-arrival Seasonality: By Store Produce Supply Routes (Pooled)

Produce - Salad Vegetables (2018-2023)



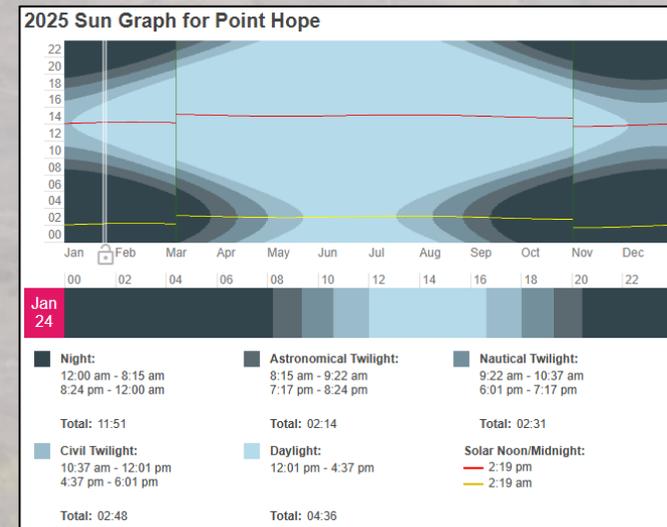
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Modeling spoilage

Fractional logit model (0-100% spoilage by product-month-store)

Controlling for store, product, year 'fixed effects'

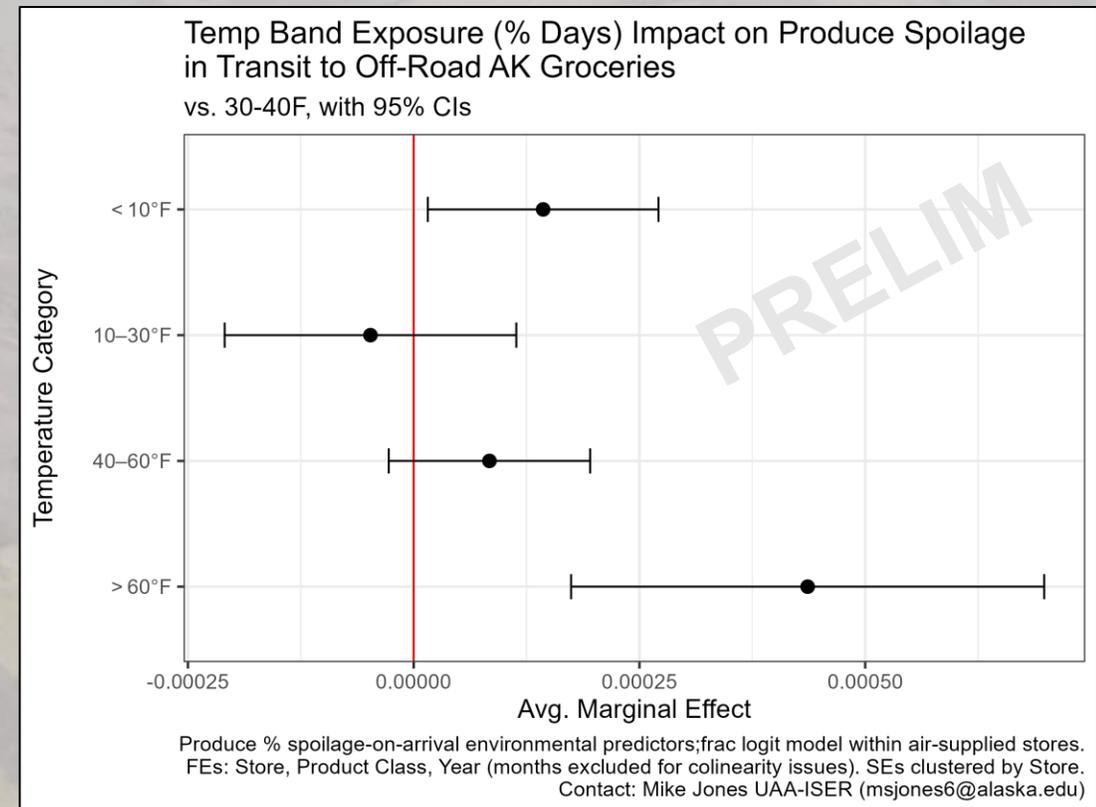
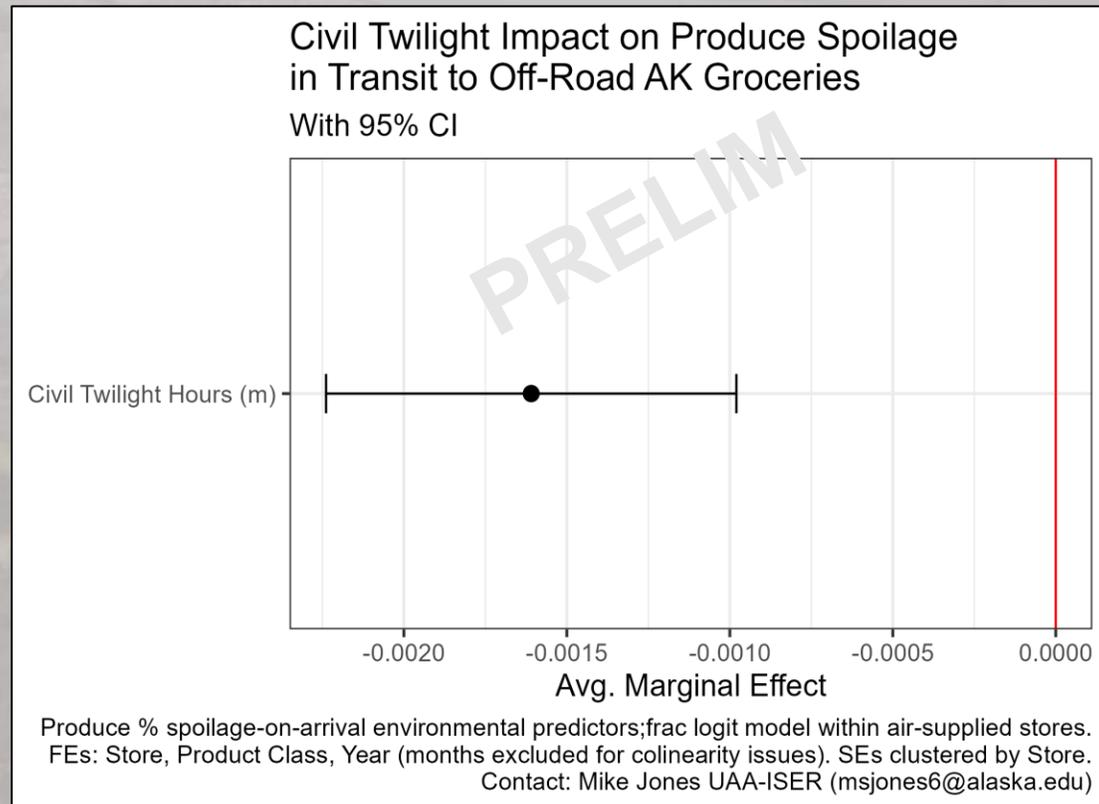
- Civil Twilight Hours: Impacting flight windows and exacerbating any infrastructure disruptions, particularly into rural-remote areas with VFR operations
- Temperature in Community: Loading, unloading, ambient temp ahead of transit; Estimated with NOAA (thanks Brian B!) with a gridded reanalysis approach



Modeling spoilage (prelim results)

Fractional logit model (0-100% spoilage by product-month-store)

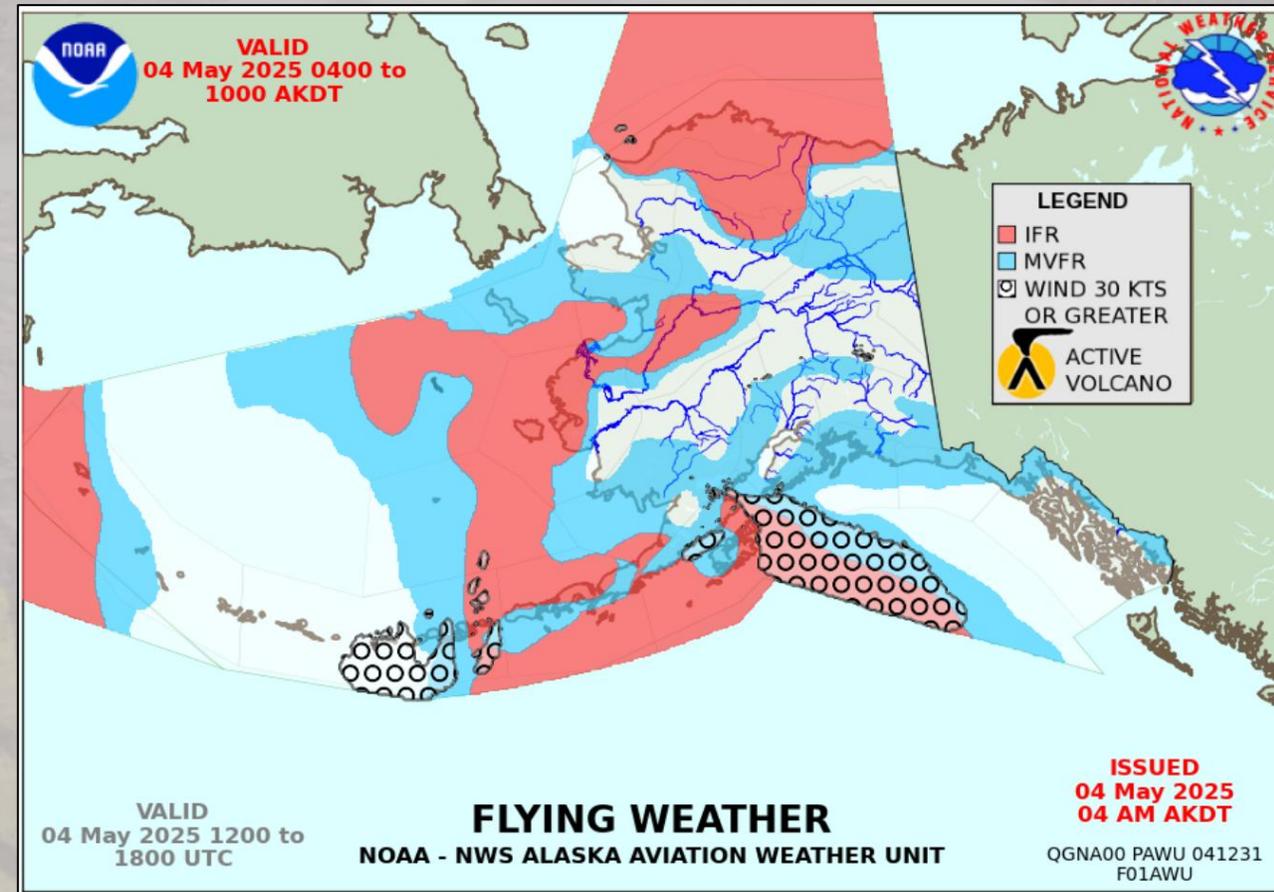
Controlling for store, product, year 'fixed effects'



Expansion targets

Bring in:

- Weather conditions
- Explicit METAR gaps, other infrastructure issues
- Other runway closures
- Air traffic
- Understand lagged impacts
- Seasonal product selection



Thank you!

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SPECIAL THANKS TO:

**GREG DYER, KYLE HILL, DC KATHERINE KEITH, CATHY CAHILL,
AK DOT-SWA (MELANY, REBECCA, RYAN, TROY), & VANESSA
COLLIER, CAROLYN TIX, FAITH GREEN, KATIE LONGUEVAN AT
UAA-ISER, the AK AIR CARRIER ASSOCIATION**

This work is funded in part by G00014956 “UAA Drone Program” (State of Alaska)



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