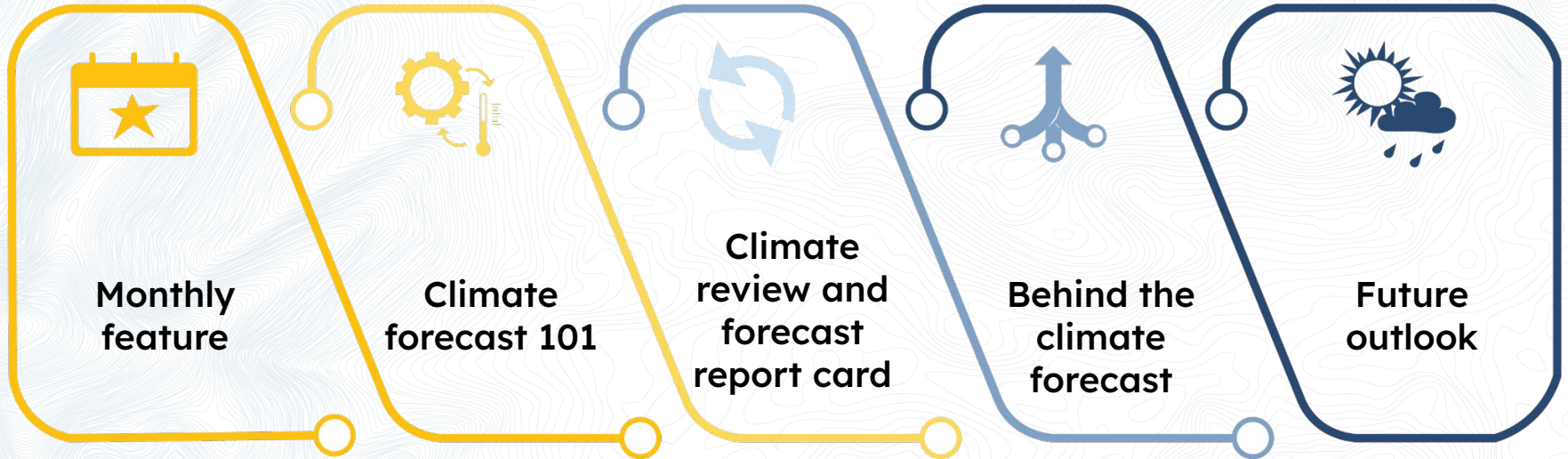




# Alaska climate outlook briefing January 2024

Rick Thoman  
ACCAP Climate Specialist





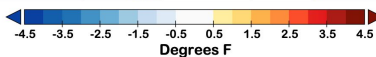
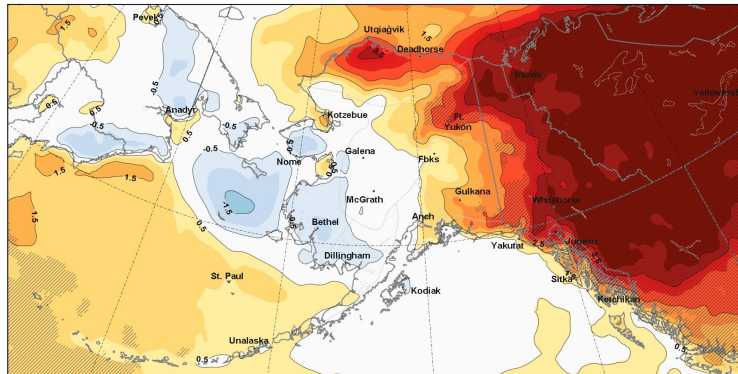
# Monthly feature



State-wide:  
12th warmest  
year since 1940

State-wide:  
Wettest year  
since 1940

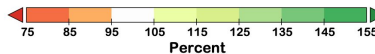
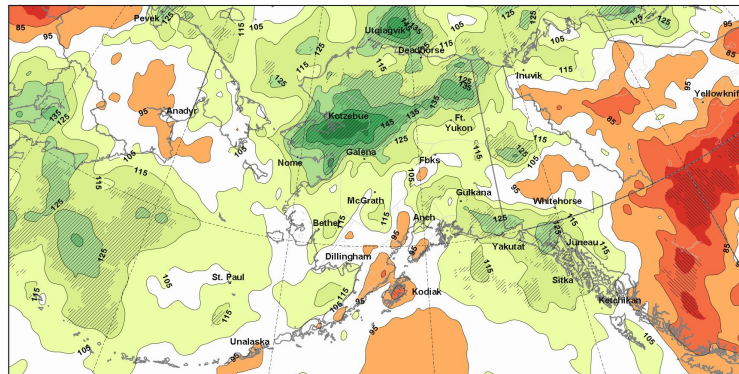
Average Temperature: Departure from Normal  
January-December 2023



Hatching = average temperature in the top 3 highest annual since 1950

1991-2020 Baseline  
ERA5 courtesy of ECMWF/Copernicus

Total Precipitation: Percent of Normal  
January-December 2023



Hatching = total precipitation in top 3 highest or lowest annual since 1950

1991-2020 Baseline  
ERA5 courtesy of ECMWF/Copernicus

# 2023 weather & climate highlights

## Alaska weather & climate headlines 2023

**Statewide** 19,000 lightning strikes July 24-25, highest 1-day total since 2019

**Kotzebue** Repeated blizzards in March, state disaster declared

**Nome** July to September, 62 days with rain

**Anchorage** 132 inches of snow in 2023; 2<sup>nd</sup> highest annual total

**Bethel** coldest Christmas since 1961

**King Salmon** 2<sup>nd</sup> wettest summer, 141% of normal

**Kodiak** driest March-April since 1972, only 34% of normal

**Juneau** severe Mendenhall River flooding from glacier lake outburst: August 6

**Wrangell** severe landslide: November 20

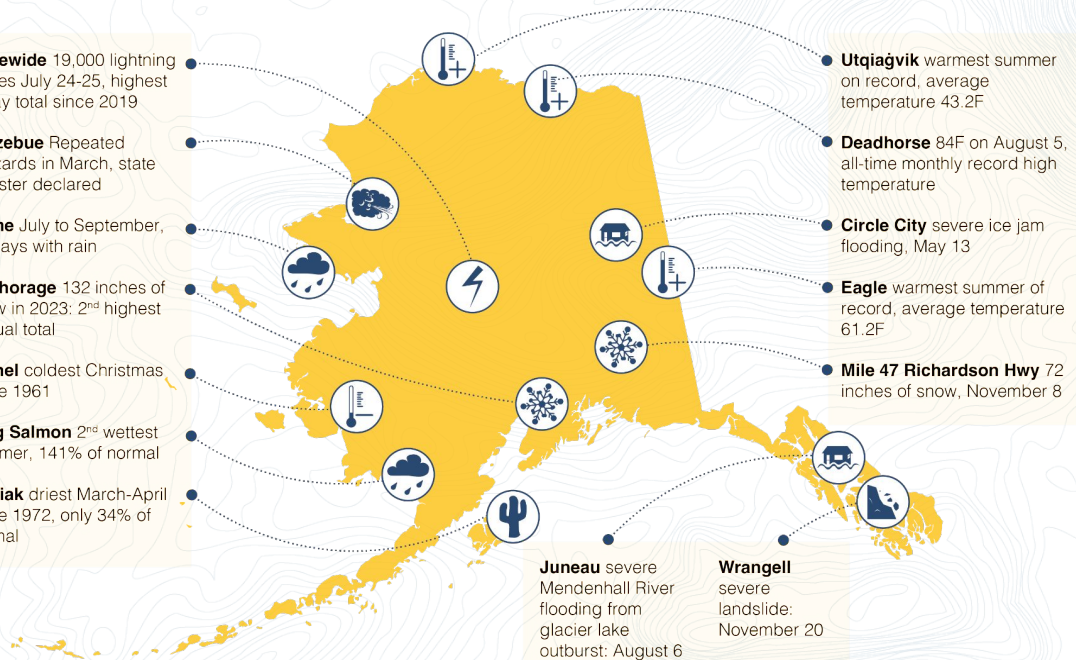
**Utqiagvik** warmest summer on record, average temperature 43.2F

**Deadhorse** 84F on August 5, all-time monthly record high temperature

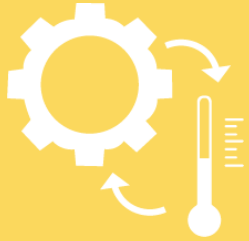
**Circle City** severe ice jam flooding, May 13

**Eagle** warmest summer of record, average temperature 61.2F

**Mile 47 Richardson Hwy** 72 inches of snow, November 8



## Climate forecast 101

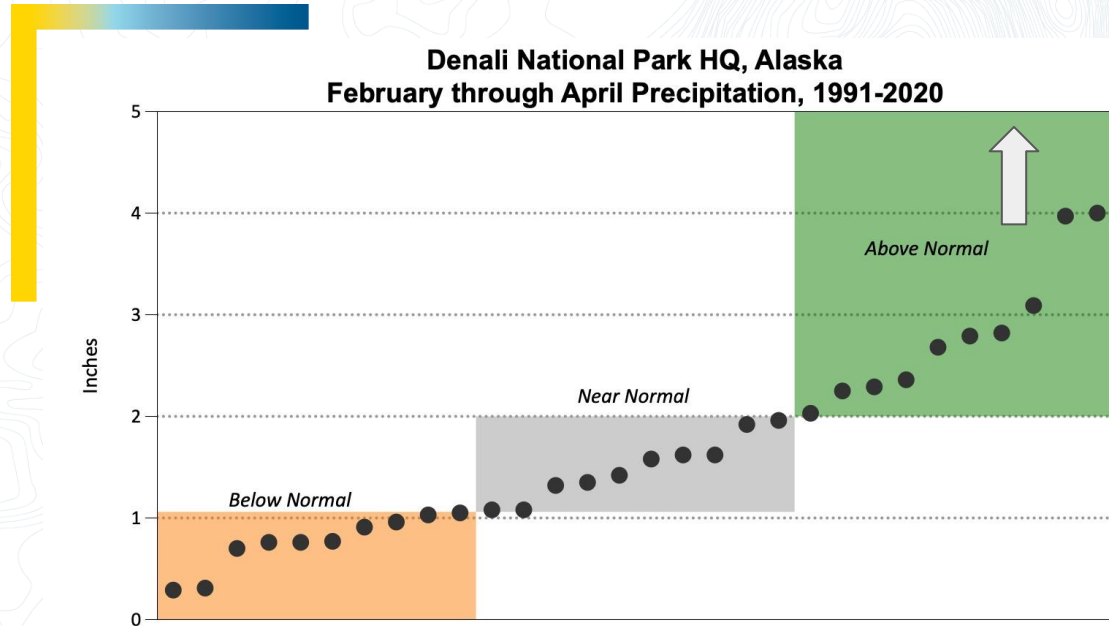


NOAA Center for Weather and Climate Prediction

**Climate Prediction Center**  
(CPC) ➤ primary NOAA/NWS  
forecast responsibility for two  
weeks to a year in the future

# The basics

- Relation to longterm normal (1991-2020)
- 3 categories
- Probabilistic
- Traditional elements
  - Temperature
    - Centered on average
  - Precipitation
    - Centered on median > can significantly differ from “normal”





What happened and how did  
previous climate outlooks perform?



# Notable December-January Happenings

- Southeast Alaska: heavy snow central and northern areas
  - Juneau Airport: 64.6 inches snow in two weeks, most ever
- Interior: cold weather finally arrives: first 40s and 50s below
- North Slope & western Alaska: very mild first half of January
  - Some places in “top ten warmest”



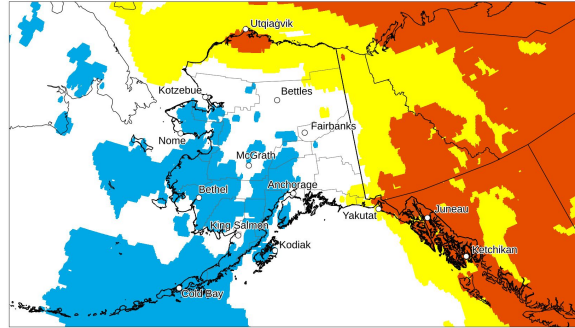
Digging out in Juneau  
January 16, 2024

Image credit: Clarise Larson/KTOO

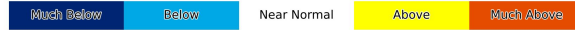
# Average temperatures

# Total precipitation

### Temperature Classification for Dec 2023

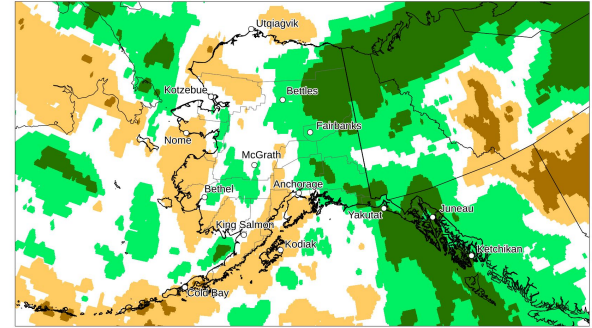


Source: ERA5 Reanalysis Map by: Brian Brettschneider

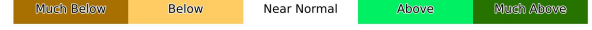


Compared to 1991-2020 Base Period

### Precipitation Classification for Dec 2023

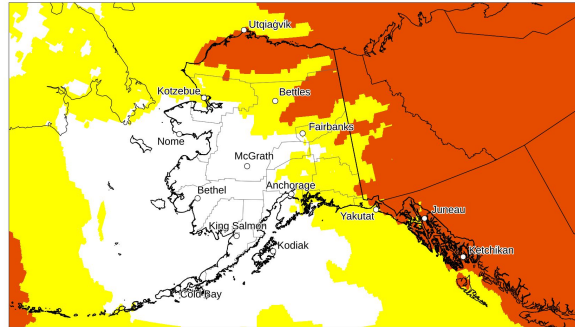


Source: ERA5 Reanalysis Map by: Brian Brettschneider

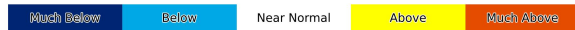


Compared to 1991-2020 Base Period

### Temperature Classification for Oct-Dec 2023

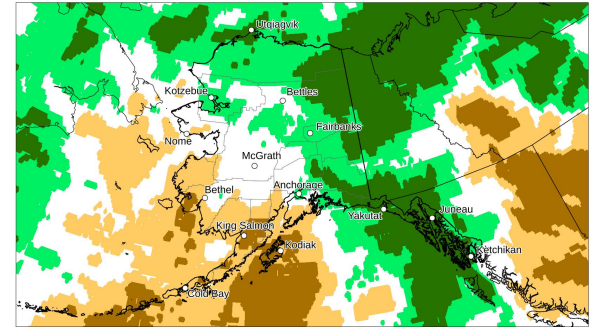


Source: ERA5 Reanalysis Map by: Brian Brettschneider

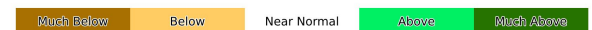


Compared to 1991-2020 Base Period

### Precipitation Classification for Oct-Dec 2023



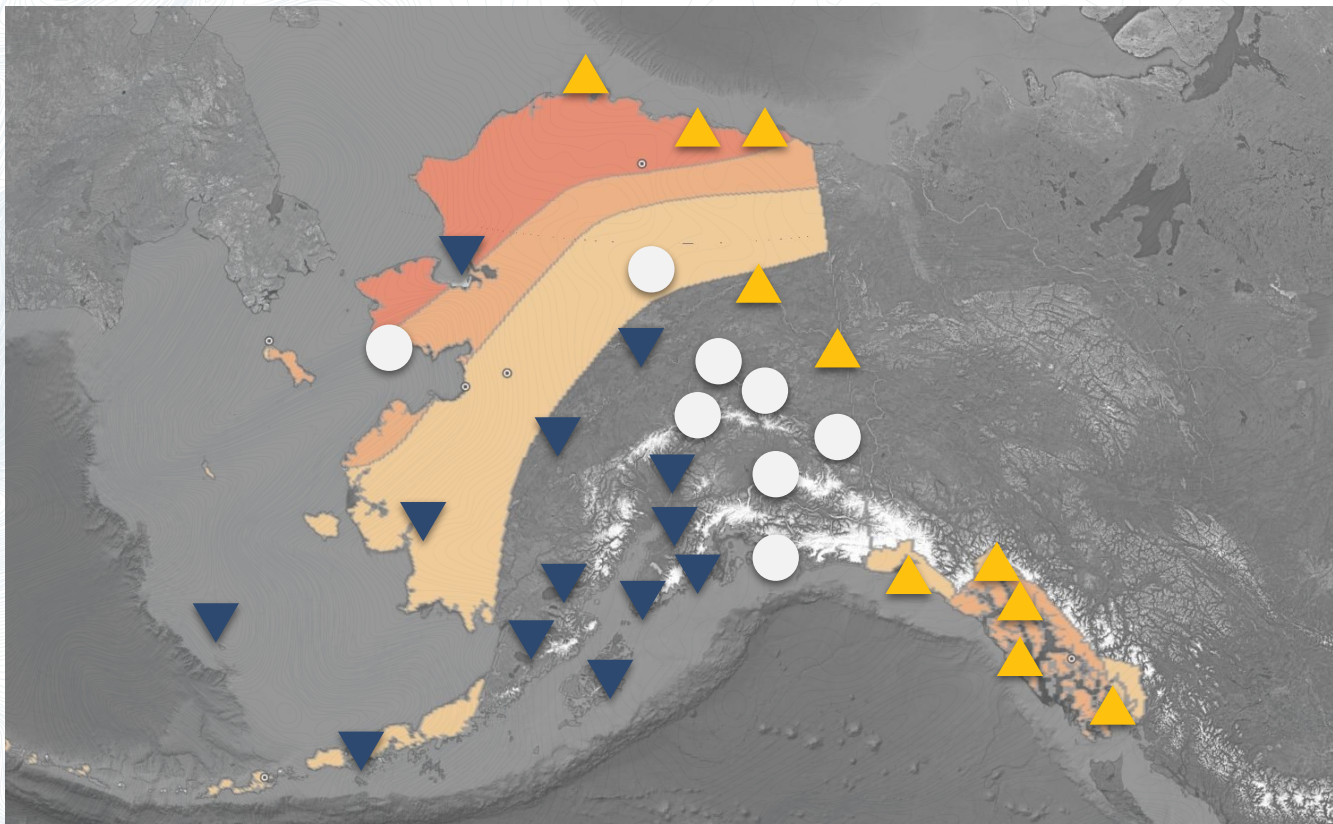
Source: ERA5 Reanalysis Map by: Brian Brettschneider



Compared to 1991-2020 Base Period

Model-based regional analysis

# December 2023 temperature > CPC outlook and observed



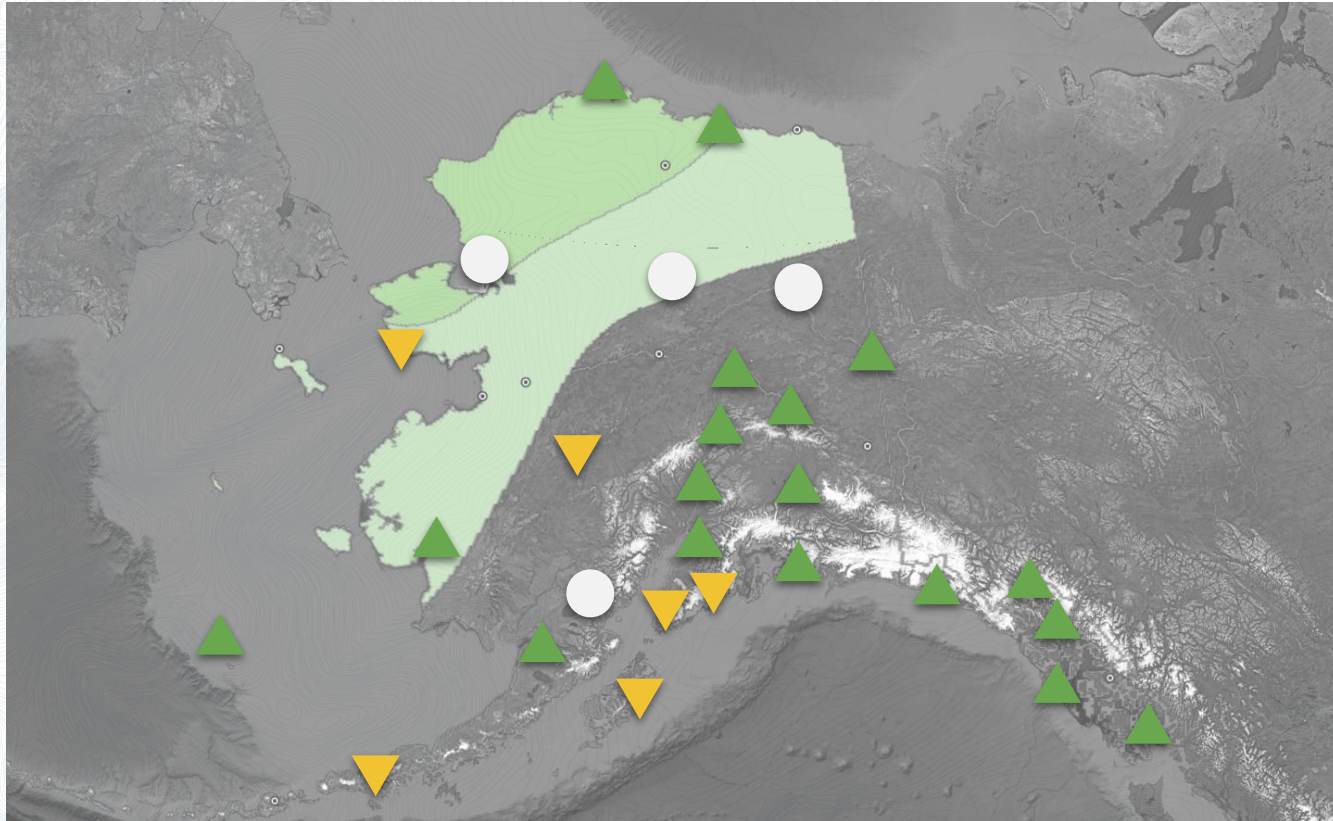
Non-EC skill  
score: +36

Percent  
correct: 57%

Mid-month  
outlook

- ▲ Above normal
- Near normal
- ▼ Below normal

# December 2023 precipitation > CPC outlook and observed



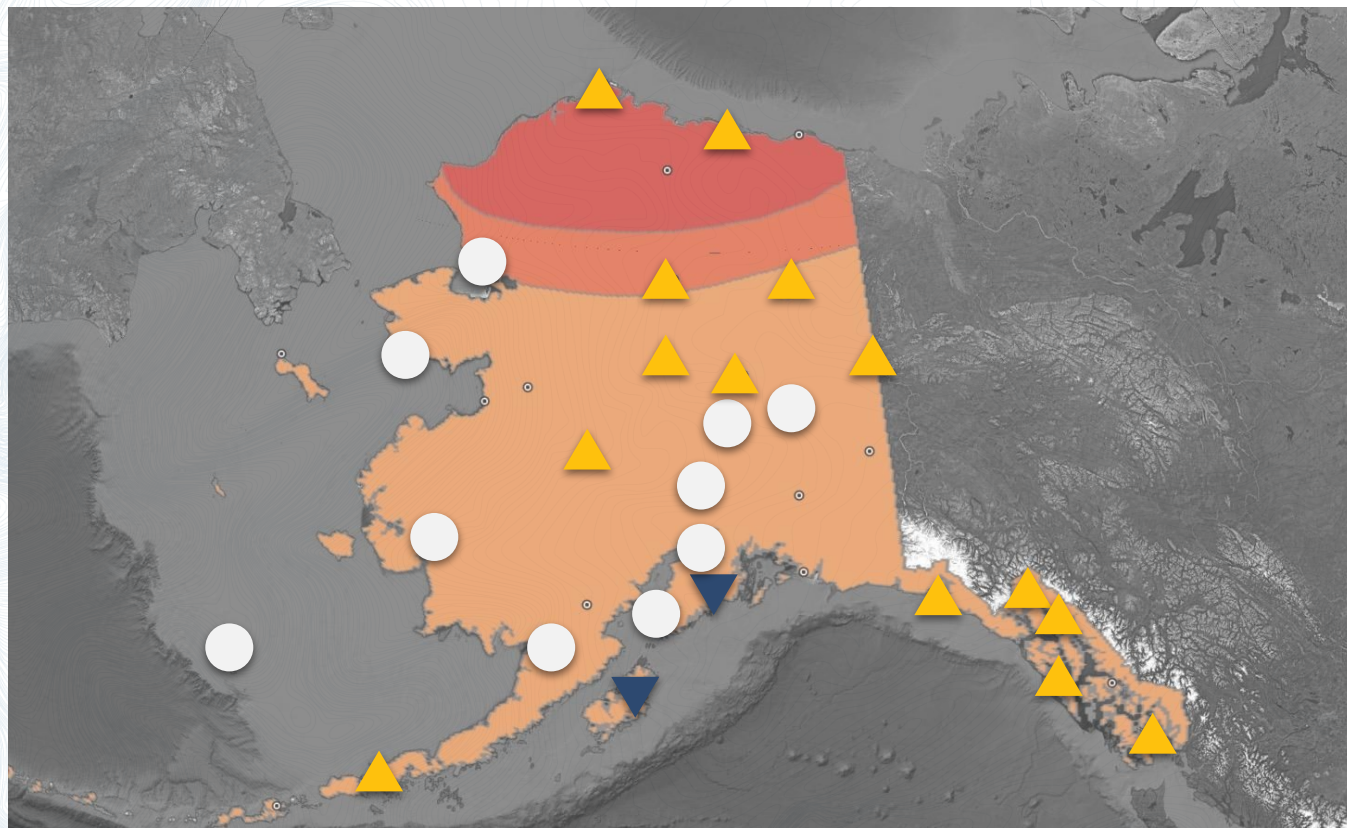
Non-EC skill  
score: +36

Percent  
correct: 57%

Mid-month  
outlook

- ▲ Above normal
- Near normal
- ▼ Below normal

# October-December 2023 temperature > CPC outlook & observed



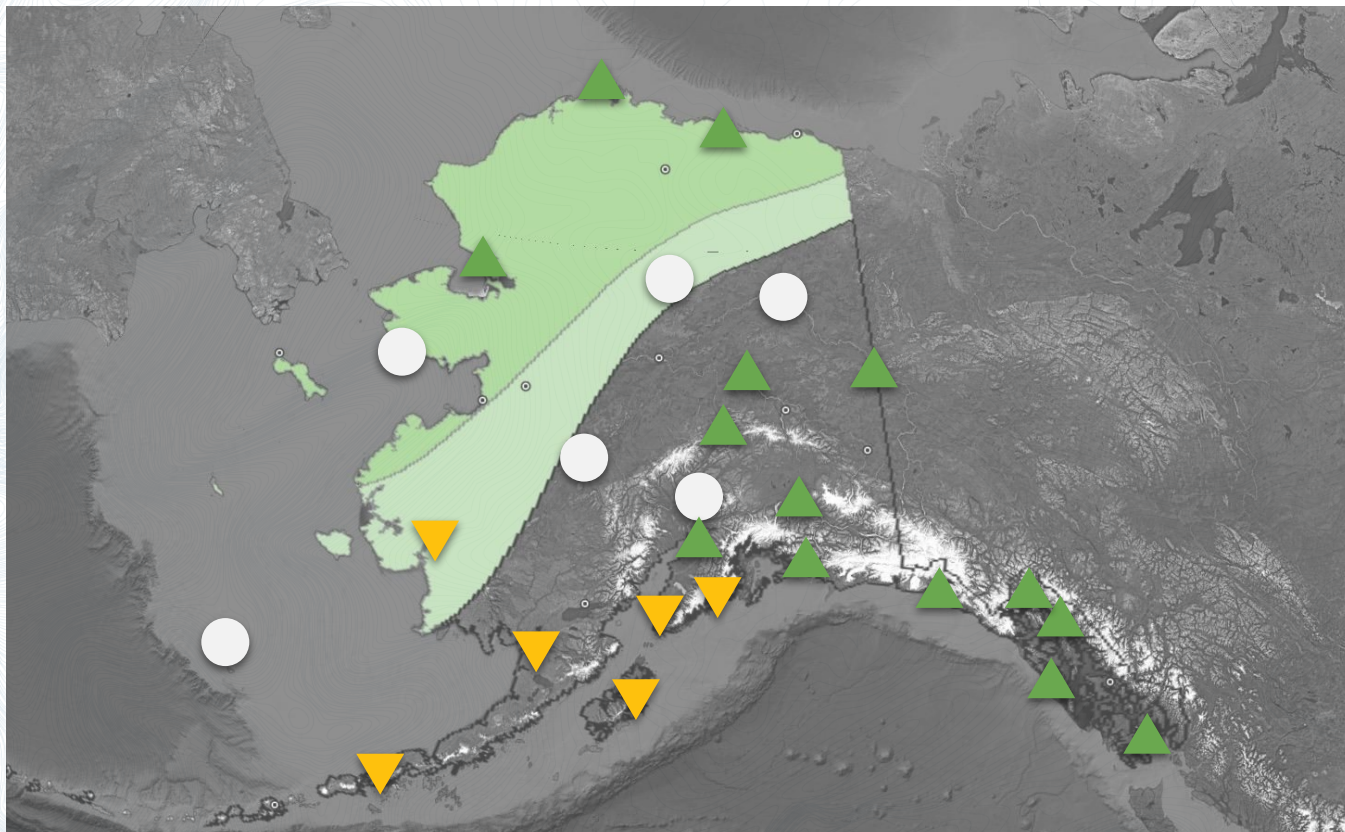
Non-EC skill  
score: +25

Percent  
correct: 50%

Mid-month  
outlook

- ▲ Above normal
- Near normal
- ▼ Below normal

# October-December 2023 precipitation > CPC outlook & observed

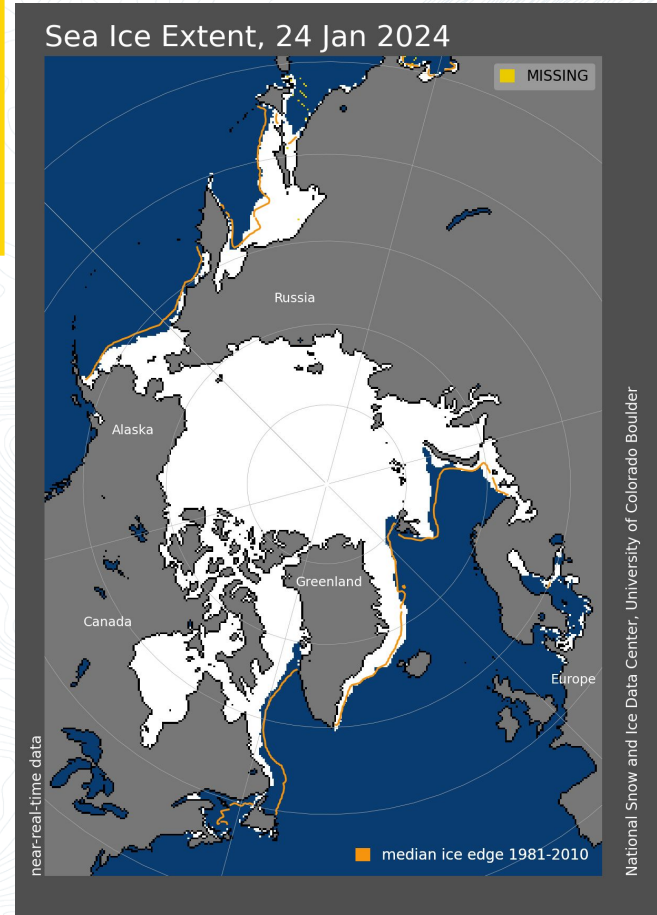
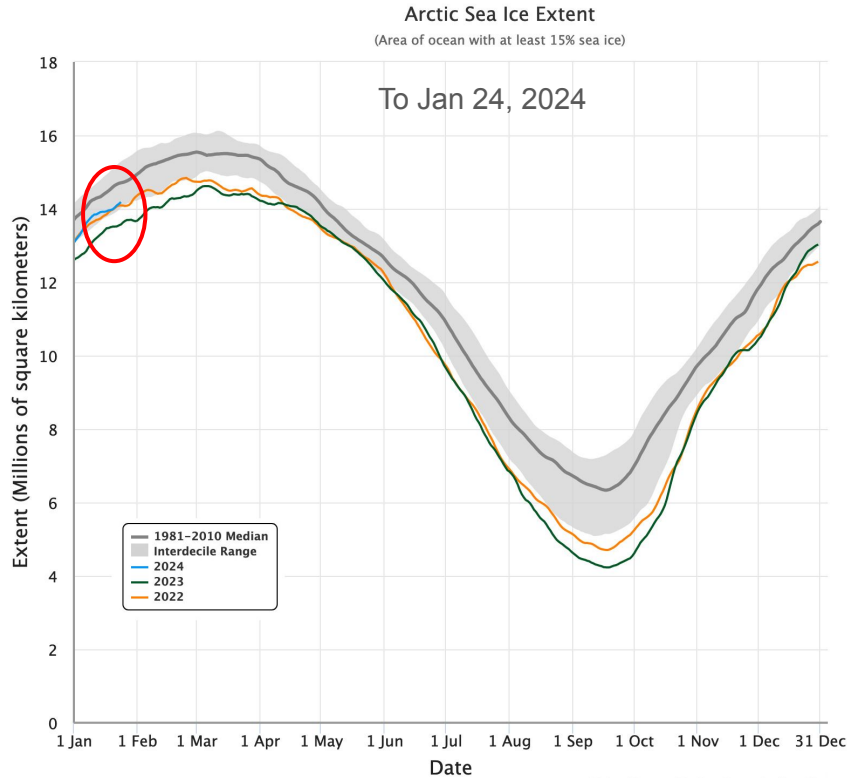


Non-EC skill  
score: +25

Percent  
correct: 50%

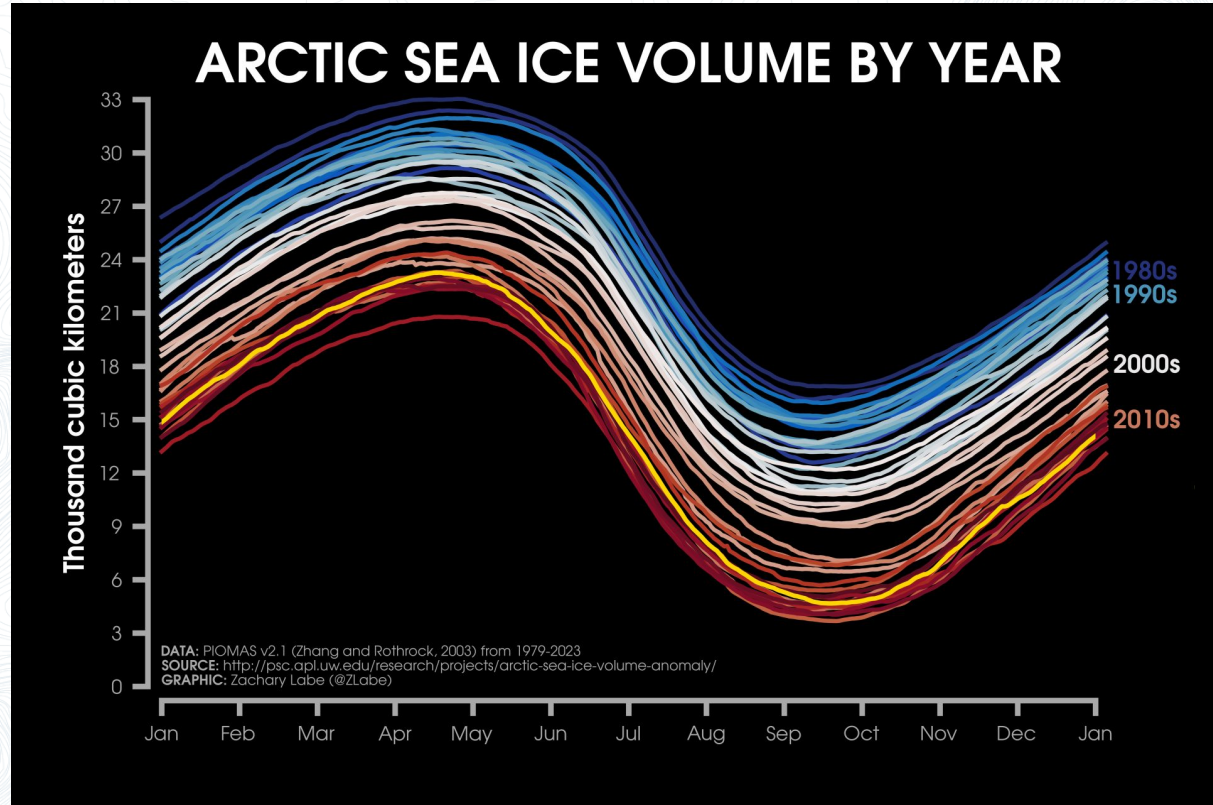
- ▲ Above normal
- Near normal
- ▼ Below normal

# Arctic wide sea ice



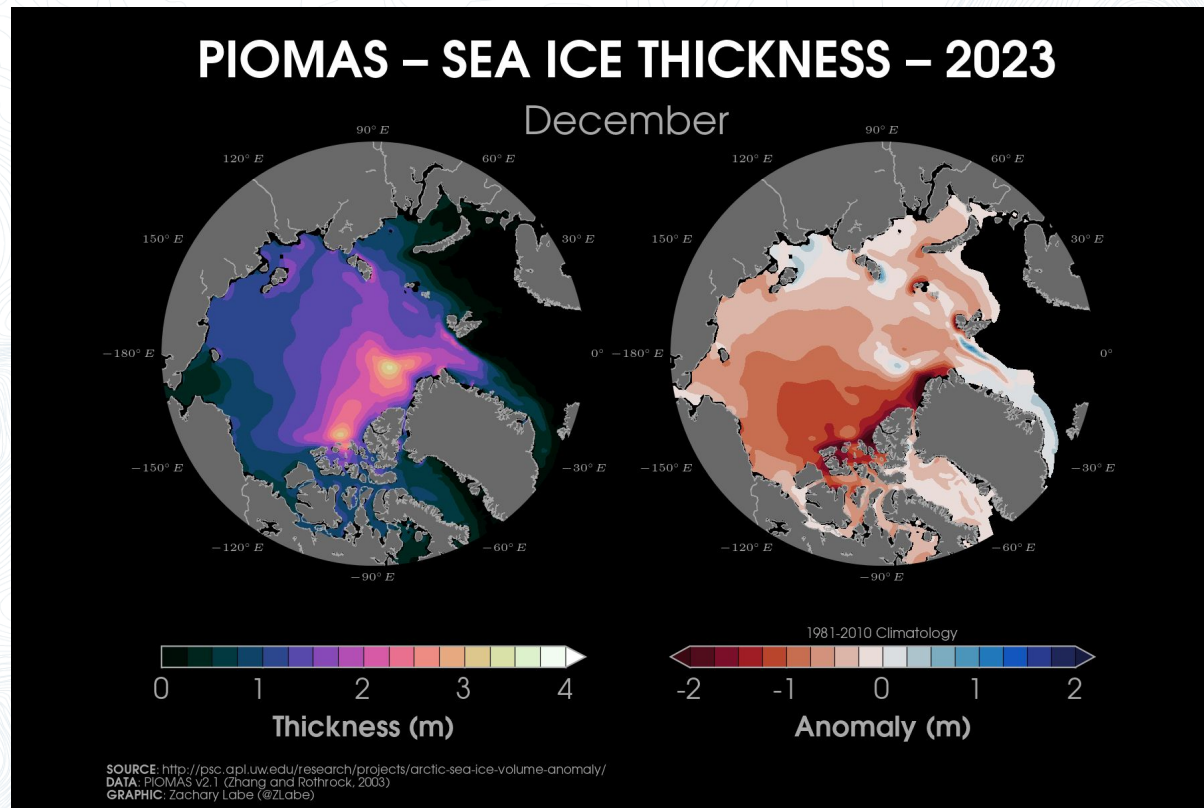
# Arctic sea ice volume

Sources:  
Data from U.  
Wa./PIOMAS data  
Graphics by Z. Labe,  
Princeton U.



# Arctic sea ice thickness

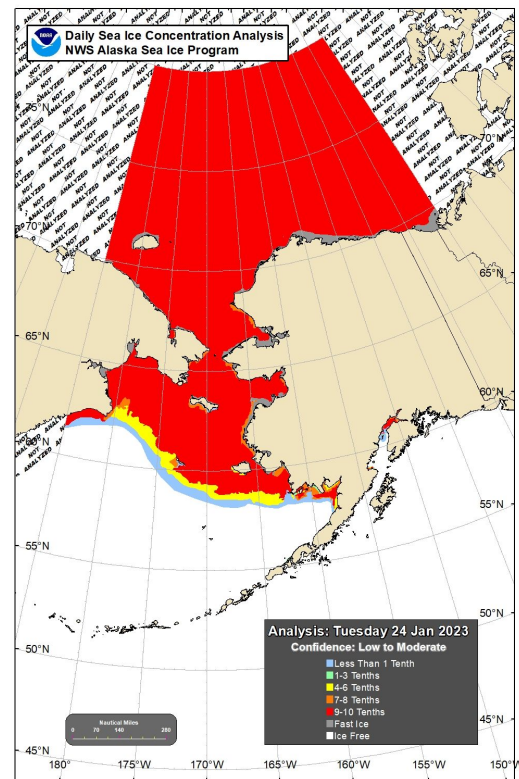
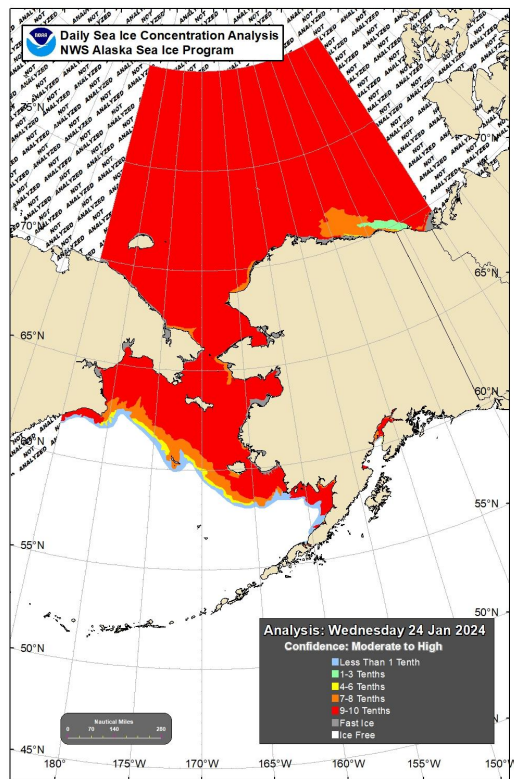
Sources:  
Data from U.  
Wa./PIOMAS data  
Graphics by Z. Labe,  
Princeton U.



January 24, 2024

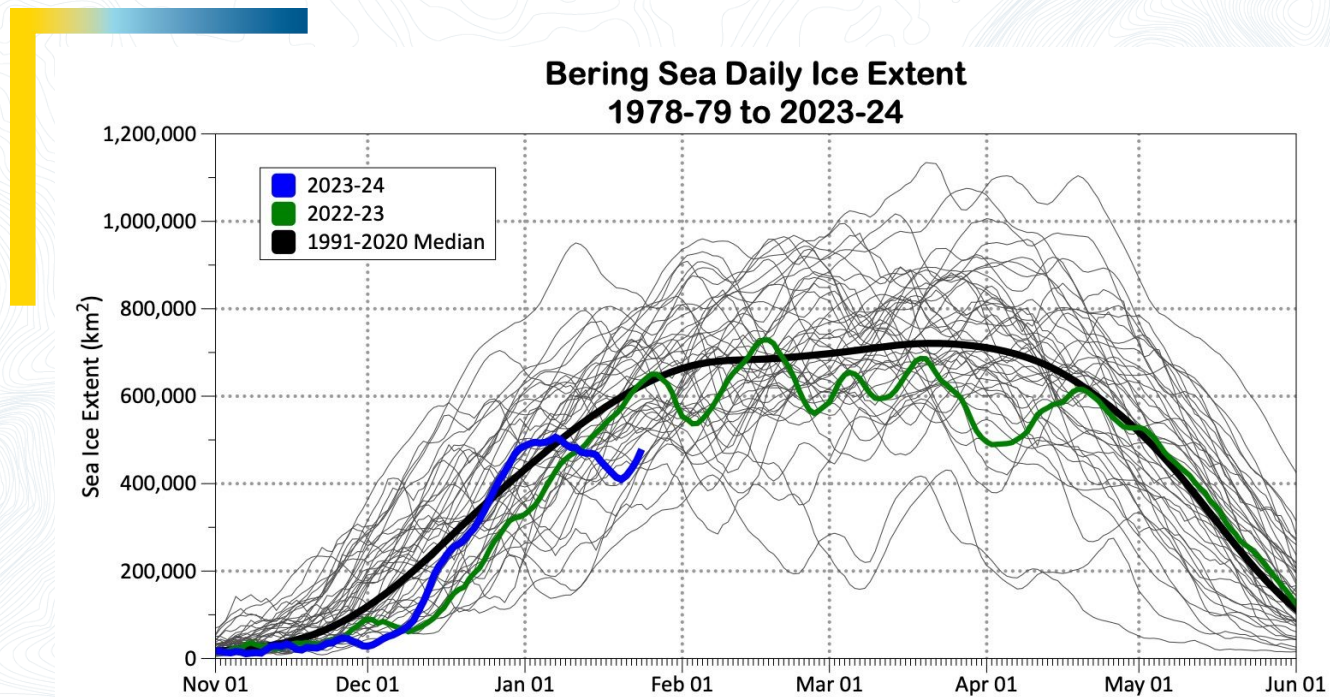
January 24, 2023

# Late January sea ice comparison

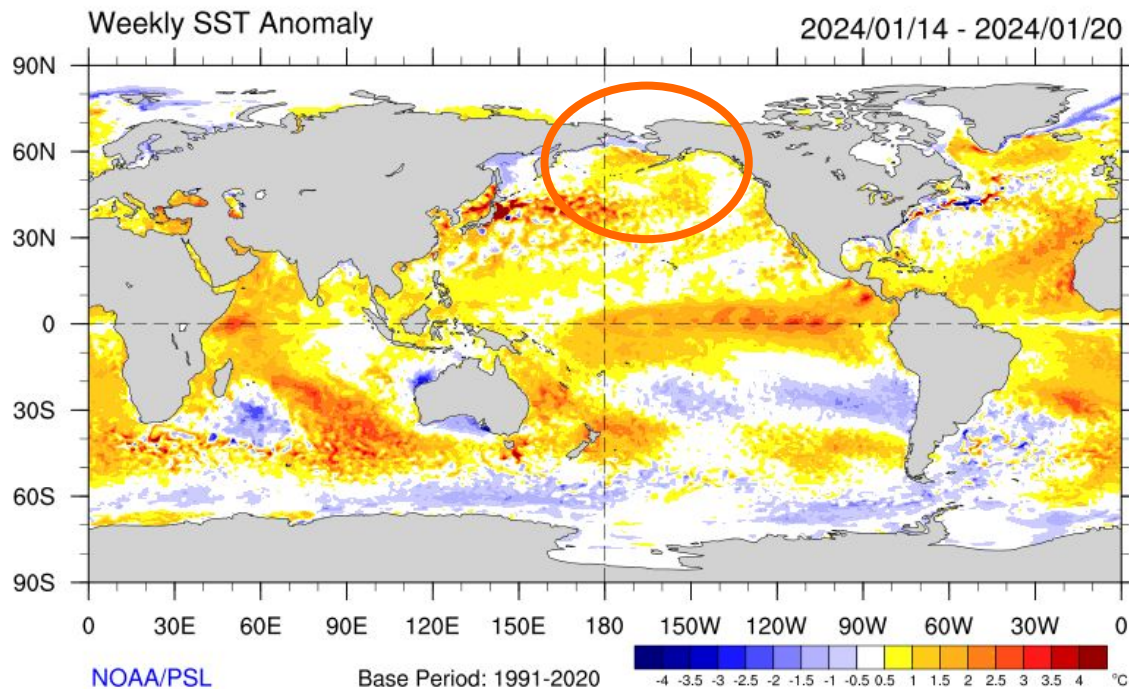


# Sea ice extent through the season

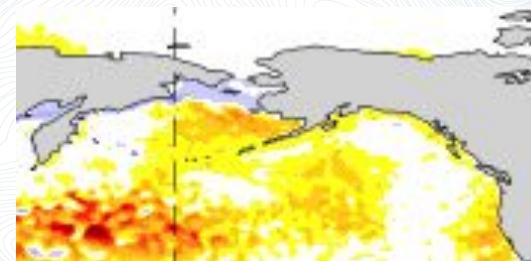
Sources:  
Data NSIDC Sea Ice Index, Version 3. Through Jan. 24, 2024.



# Global sea surface temperature departure from normal

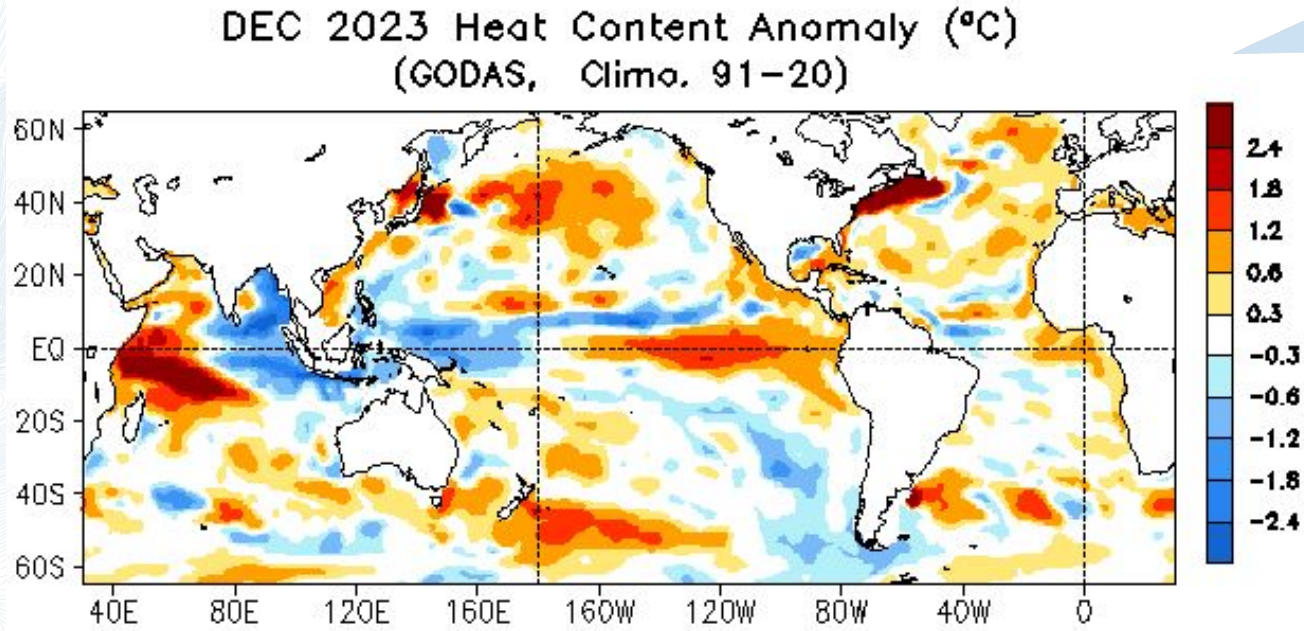


PDO for Dec 2024:  
-1.02



Sources: PDO Index from JMA

# Upper Ocean heat anomaly in upper 300 meters



Slight warming in  
Gulf of Alaska

Sources:  
CPC

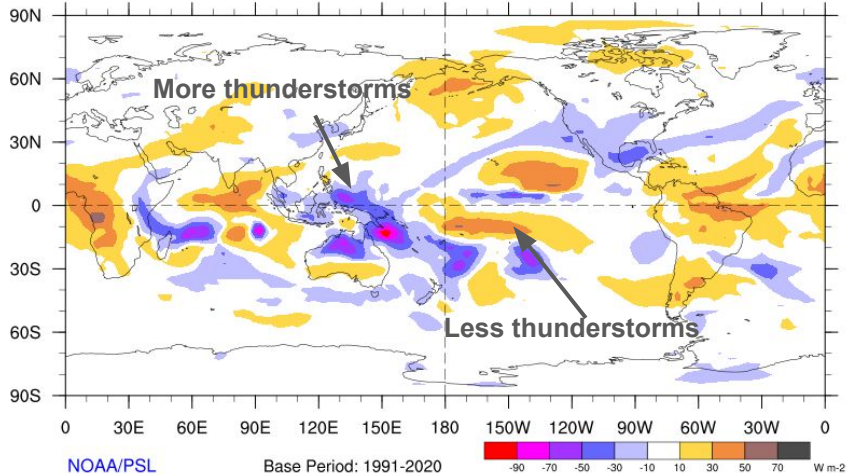
# Tropical Pacific atmosphere

Oct-Dec 2023  
Oceanic Niño  
Index: +1.9

**Deep tropical convection**  
Via “outgoing longwave radiation”



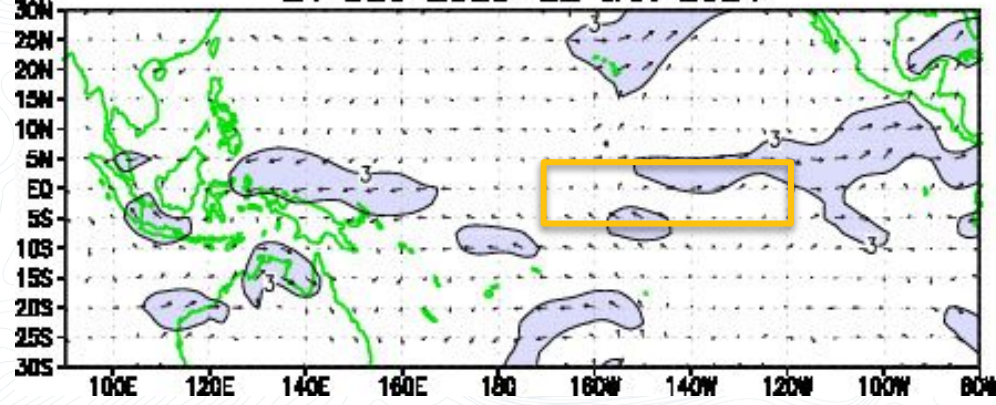
7-Day Average OLR Anomaly 2024/01/17 - 2024/01/23



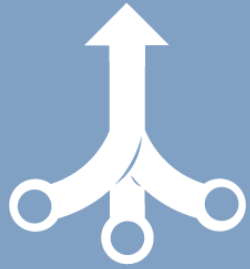
**Trade winds weaker**  
than average, Niño Region 3.4



**CDAS B50-hPa Wind Anoma**  
**24 DEC 2023-22 JAN 2024**



Behind the  
climate  
forecast



**El Niño/La Niña (ENSO)** > expert evaluation

**Statistical** > using the past

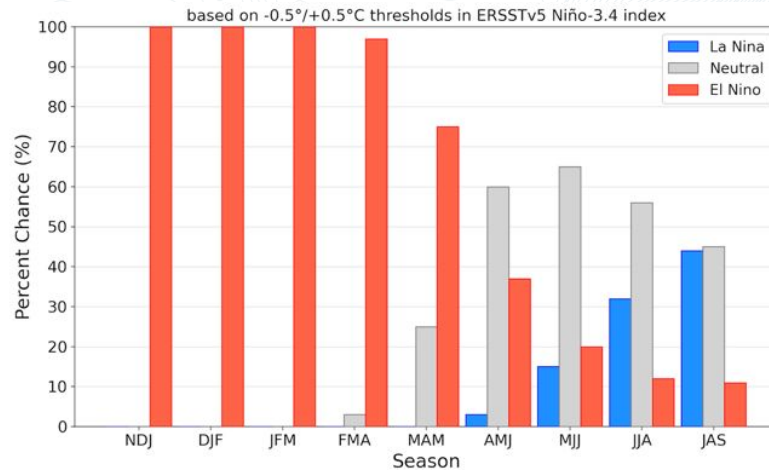
**Dynamical models** > All physics, all the time

- Sea surface temperatures
- Temperature & precipitation
- Sea ice

# CPC Niño 3.4 forecasts > experts

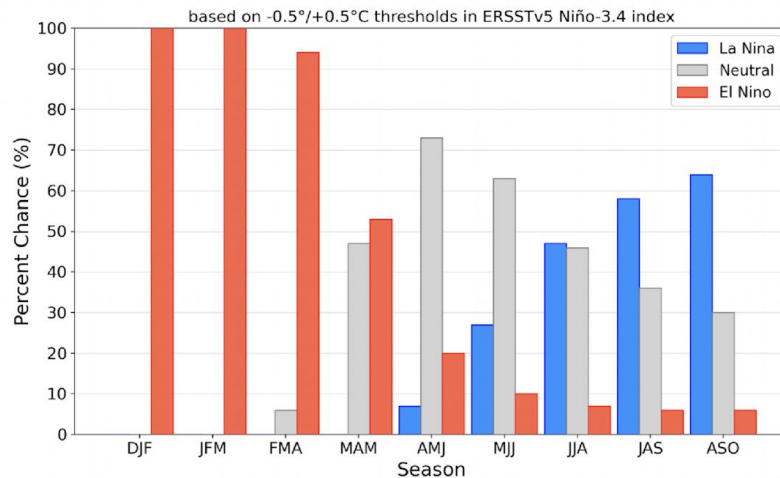
- **Strong El Niño** reached early autumn (ASO)
- El Niño **expected to weaken** rapidly but continue into spring 2024

December 2023



January 2024

ENSO Alert System  
Status: **El Niño Advisory**



**Statistical  
guidance** ➤  
using the  
past to  
predict the  
future

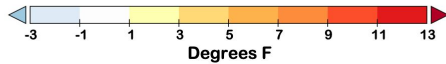
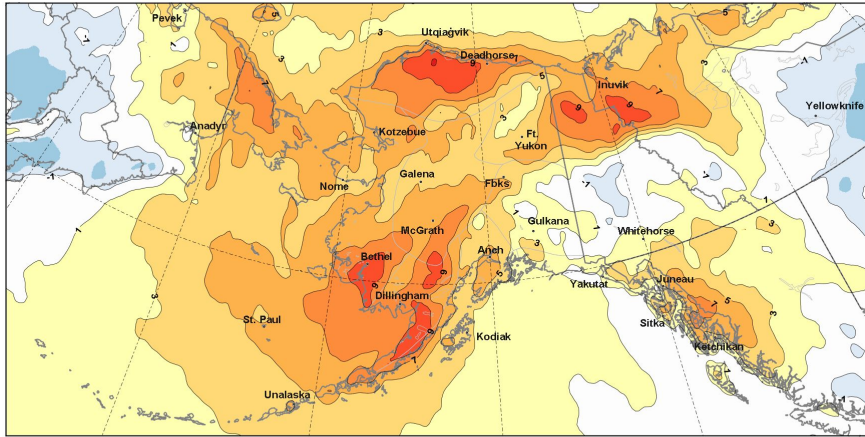
- Long term trends
- Optimum climate normals:  
Alaska trends the past 15 years
  - Update to new normals means  
OCN less informative next few  
years
- Past El Niño events

# February half century trends

## Temperature trend over 50 years



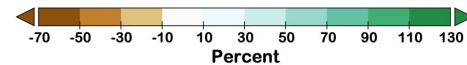
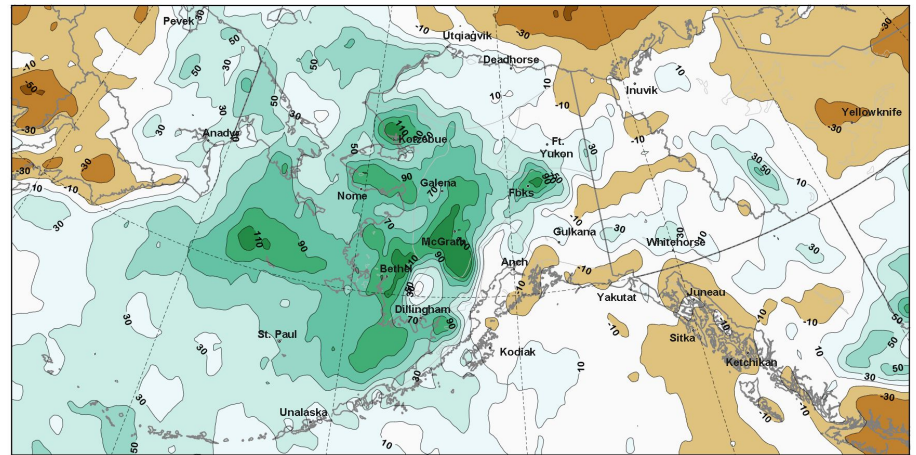
Total Change in February Average Temperature  
1974-2023



## Precipitation trend over 50 years





Percent Change in February Average Precipitation  
1974-2023

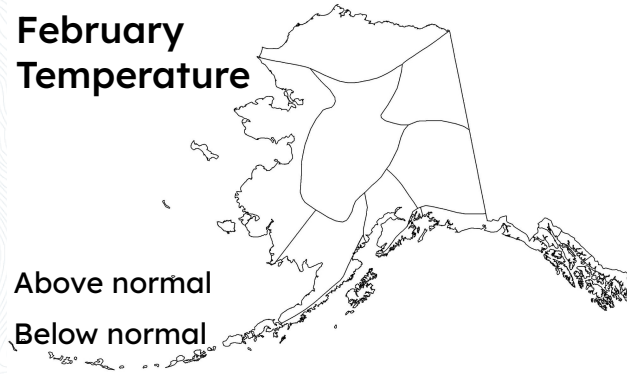


# 2009 to 2023 trends

Past 15 years compared to 1991-2020

## February Temperature



 Above normal  
 Below normal

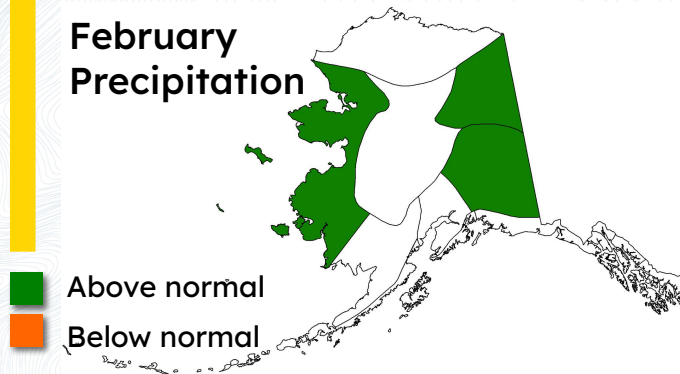


## Feb-April Temperature

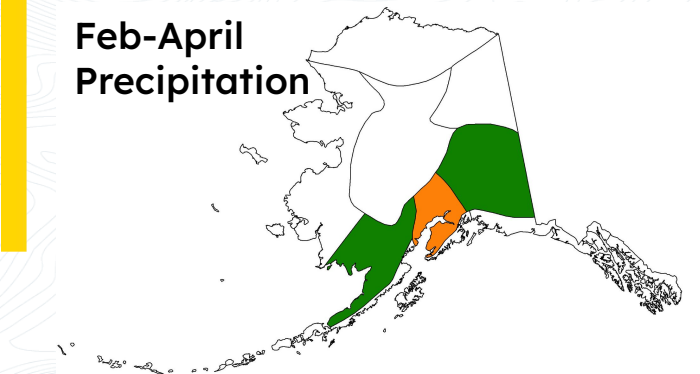


## February Precipitation

 Above normal  
 Below normal



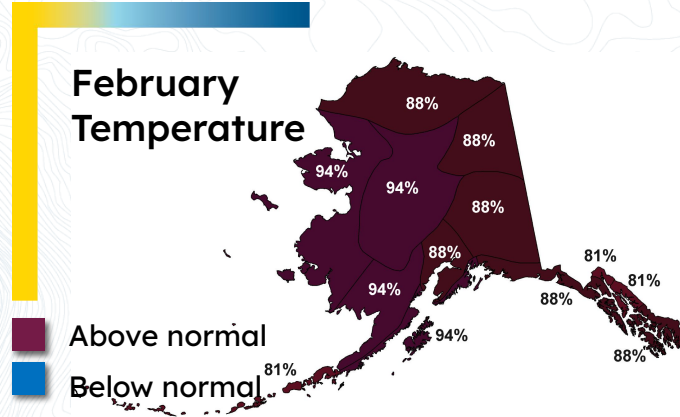
## Feb-April Precipitation



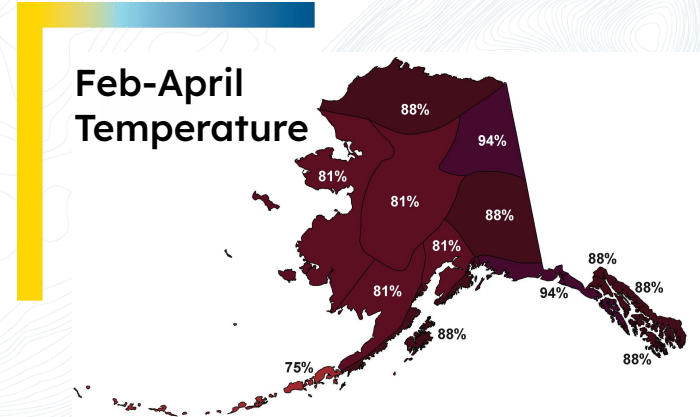
# 16 El Niño since 1976

Percent years above average

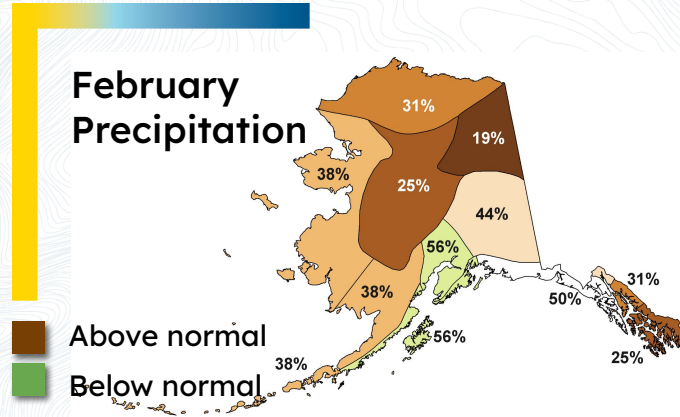
## February Temperature



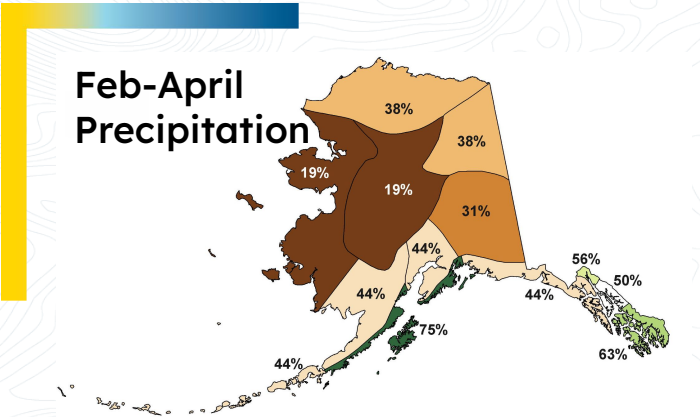
## Feb-April Temperature



## February Precipitation



## Feb-April Precipitation



# Dynamic model forecasts

## Current suite of Dynamic Climate Models

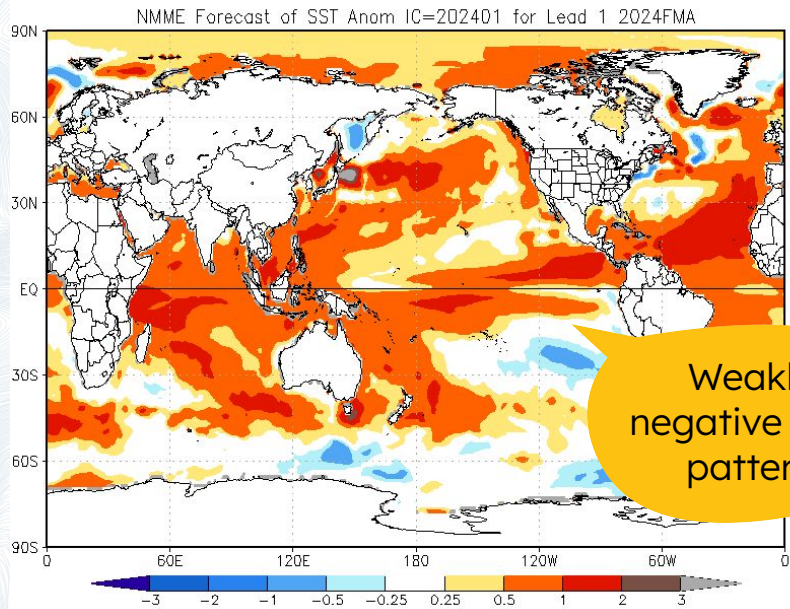
- CPC Experimental Sea Ice Ensemble
- World Climate Service Multi-Model Ensemble
- North American Multi-Model Ensemble (**NMME**)

## What's being forecast

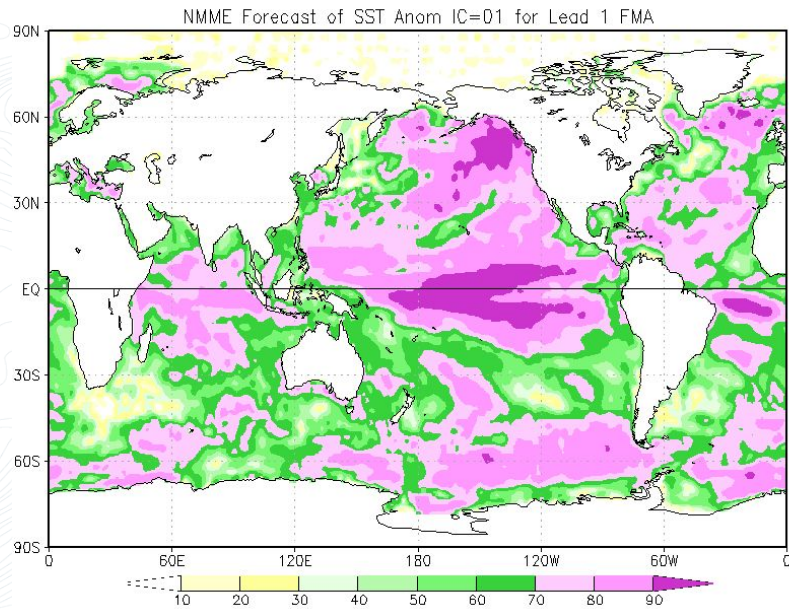
- Sea surface temperatures
- Sea ice forecast
- Temperature and precip relative to normal

# February-April 2024 sea surface temperature ➤ NNME

**Forecast**  
departure from normal

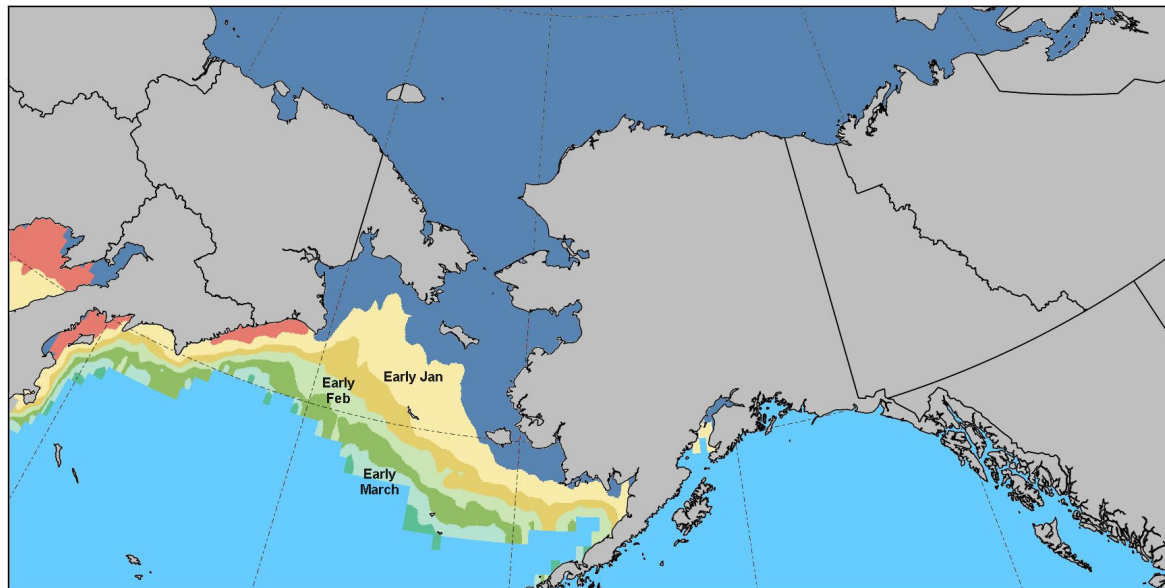


**Skill**  
of the forecast



Experimental  
sea ice  
forecast ➤  
CPC (late  
December  
outlook)

Sea Ice Freeze-up: First Date Concentration  $\geq 15$  Percent  
Autumn/Winter 2023-24



# February 2024 calibrated probability forecast ➤ NNME

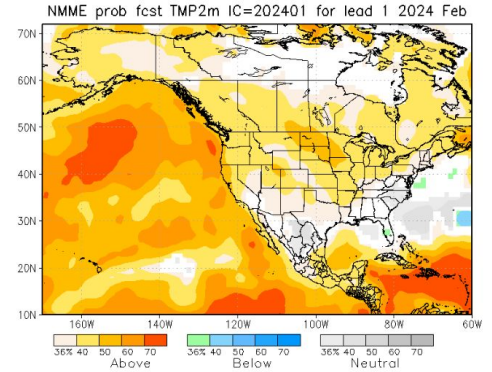
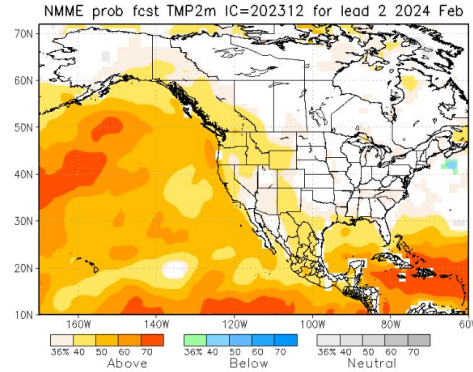
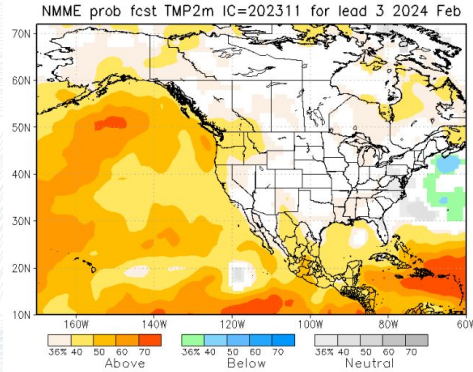
Forecast from →

November

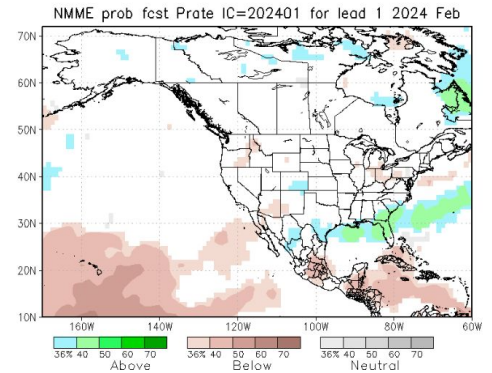
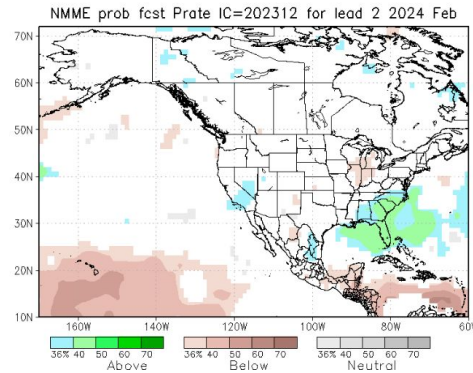
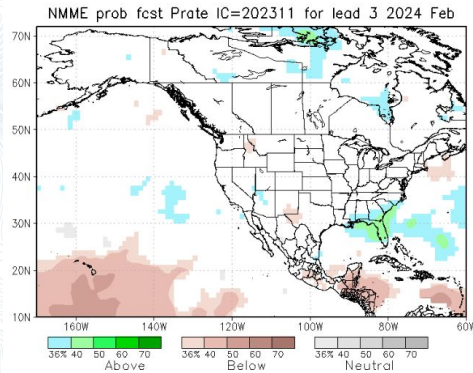
December

January

Temperature



Precipitation

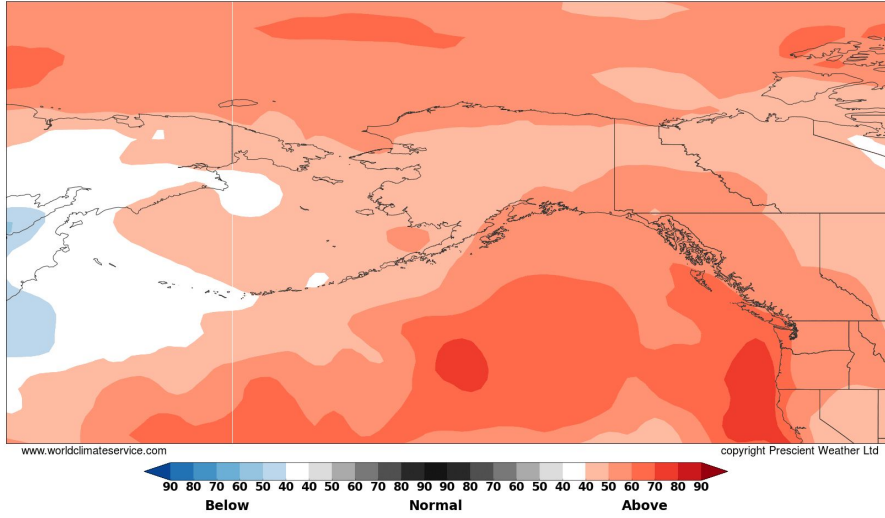


# February 2024 outlooks > World Climate Service

## Temperature



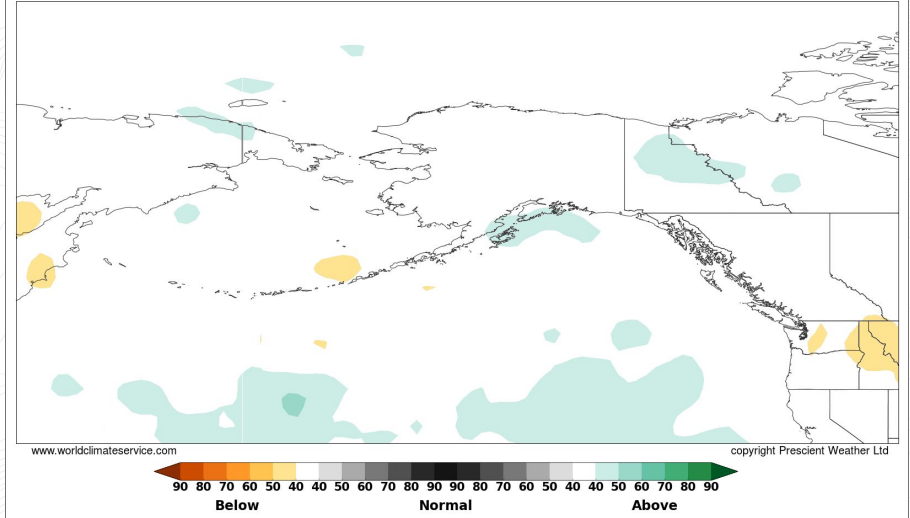
Multi-Model T2m Probability Above/Normal/Below  
Forecast Valid February 2024  
Initialized January 2024 1991-2020 Climatology



## Precipitation



Multi-Model Precipitation Probability Above/Normal/Below  
Forecast Valid February 2024  
Initialized January 2024 1991-2020 Climatology



Bias Corrected, Skill Weighted CFS + ECMWF

# Feb-April 2024 calibrated probability forecast ➤ NNME

Forecast from →

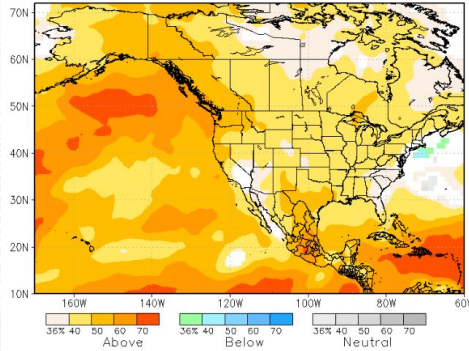
November

December

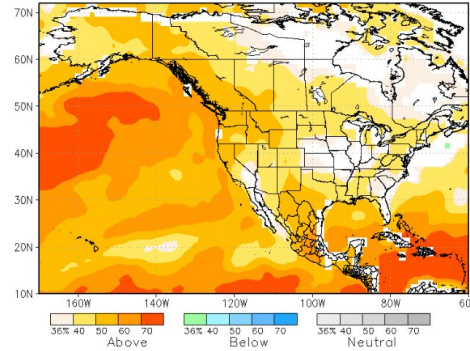
January

Temperature

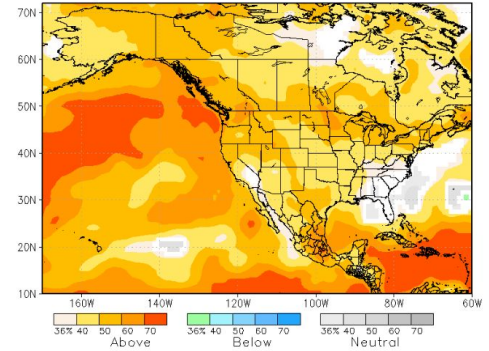
NNME prob fcast TMP2m IC=202311 for lead 3 2024 FMA



NNME prob fcast TMP2m IC=202312 for lead 2 2024 FMA

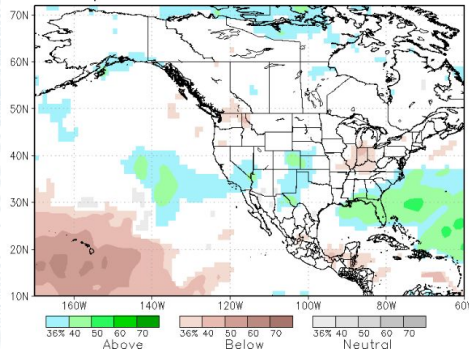


NNME prob fcast TMP2m IC=202401 for lead 1 2024 FMA

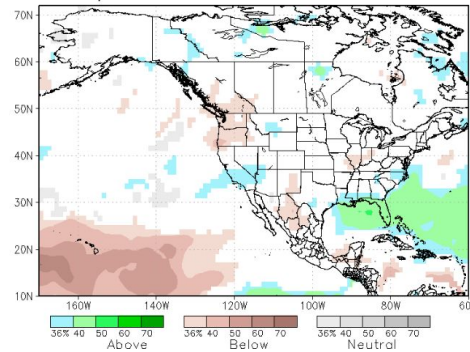


Precipitation

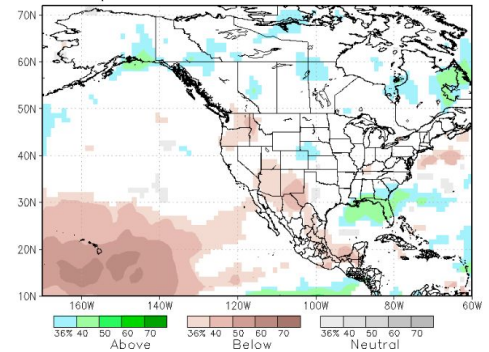
NNME prob fcast Prate IC=202311 for lead 3 2024 FMA



NNME prob fcast Prate IC=202312 for lead 2 2024 FMA



NNME prob fcast Prate IC=202401 for lead 1 2024 FMA

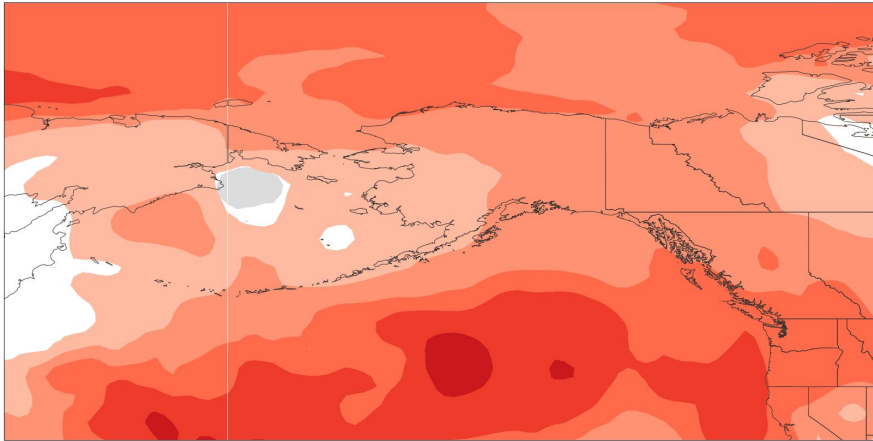


# Feb-April 2024 outlooks > World Climate Service

## Temperature



Multi-Model T2m Probability Above/Normal/Below  
Forecast Valid Feb 2024 - Apr 2024  
Initialized January 2024 1991-2020 Climatology



www.worldclimateservice.com

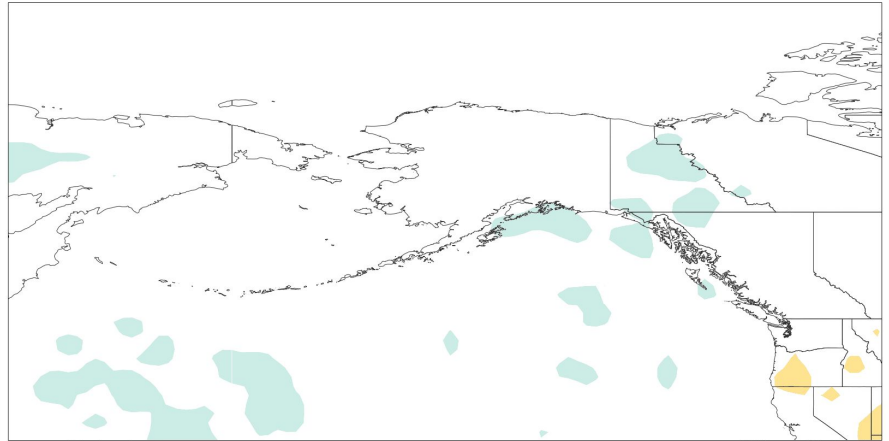
copyright Prescient Weather Ltd



## Precipitation



Multi-Model Precipitation Probability Above/Normal/Below  
Forecast Valid Feb 2024 - Apr 2024  
Initialized January 2024 1991-2020 Climatology



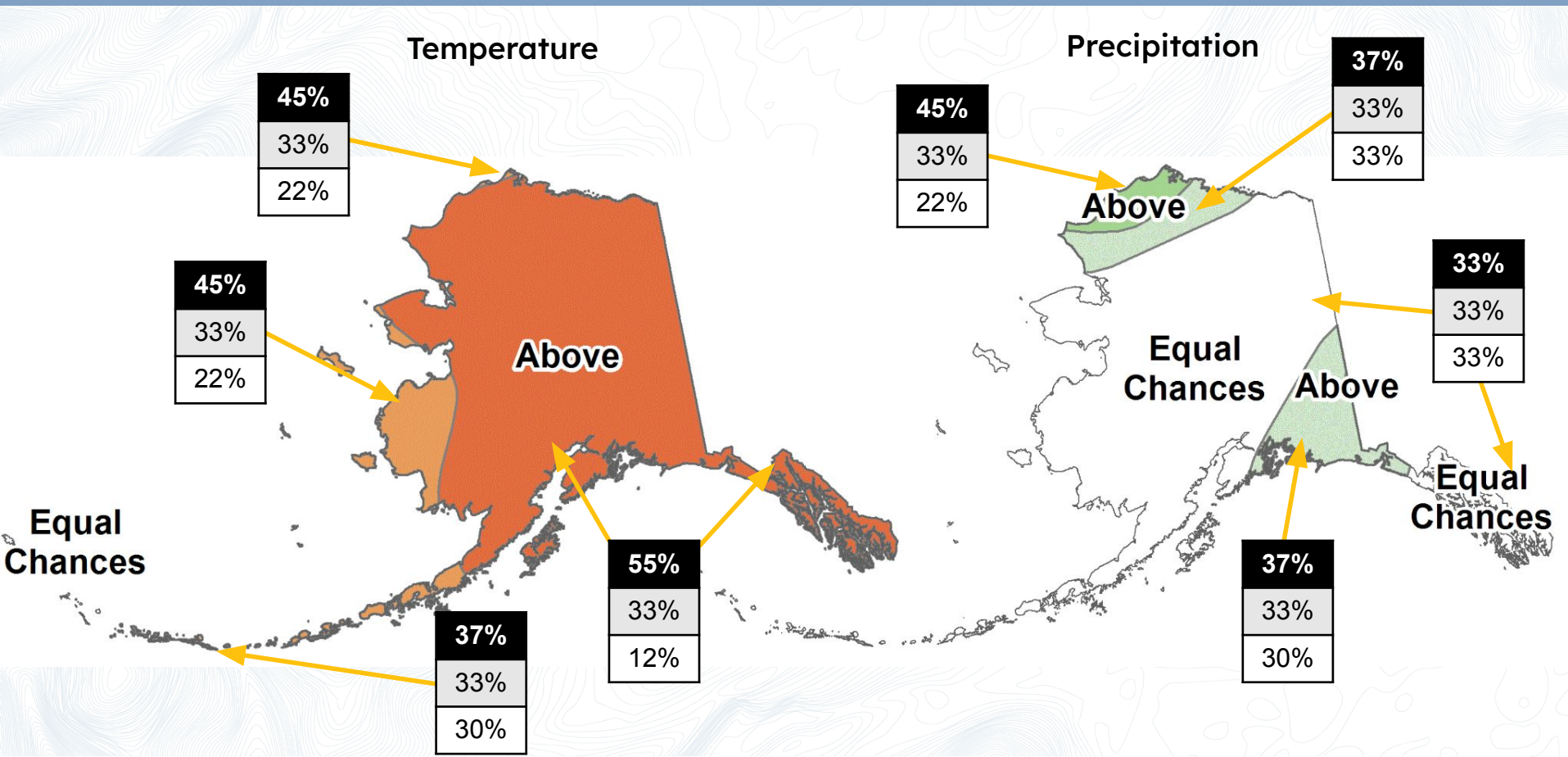
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Bias Corrected, Skill Weighted CFS + ECMWF

# Feb-April 2024 outlooks from December

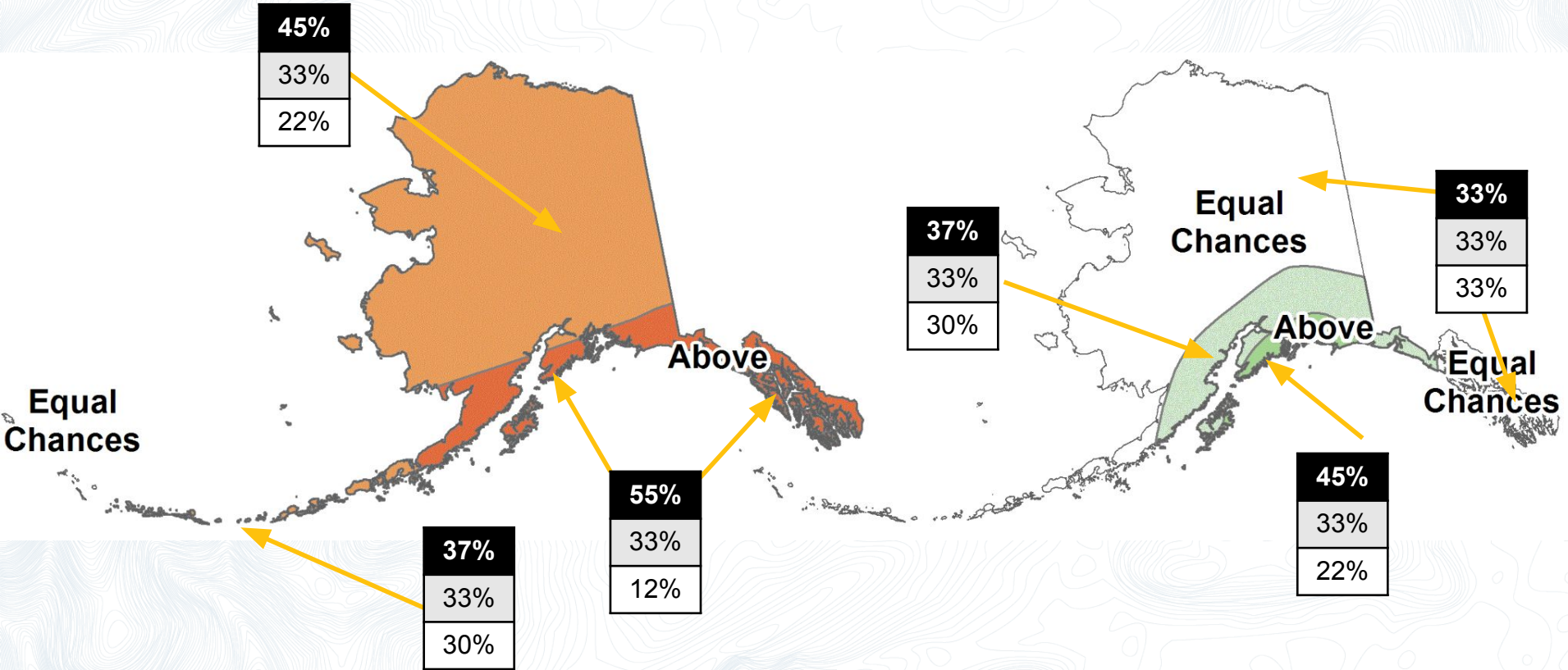


Future  
outlook

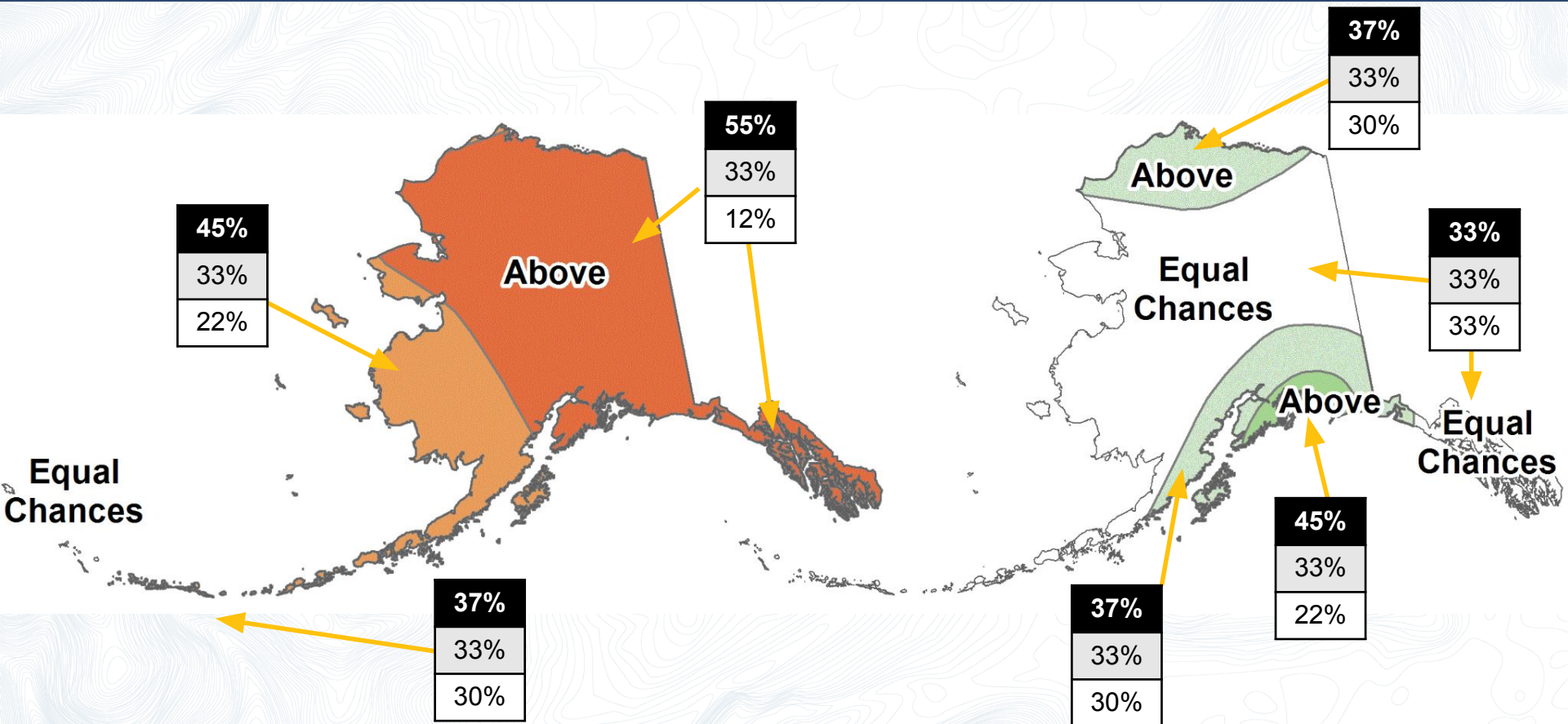


And the answer is...

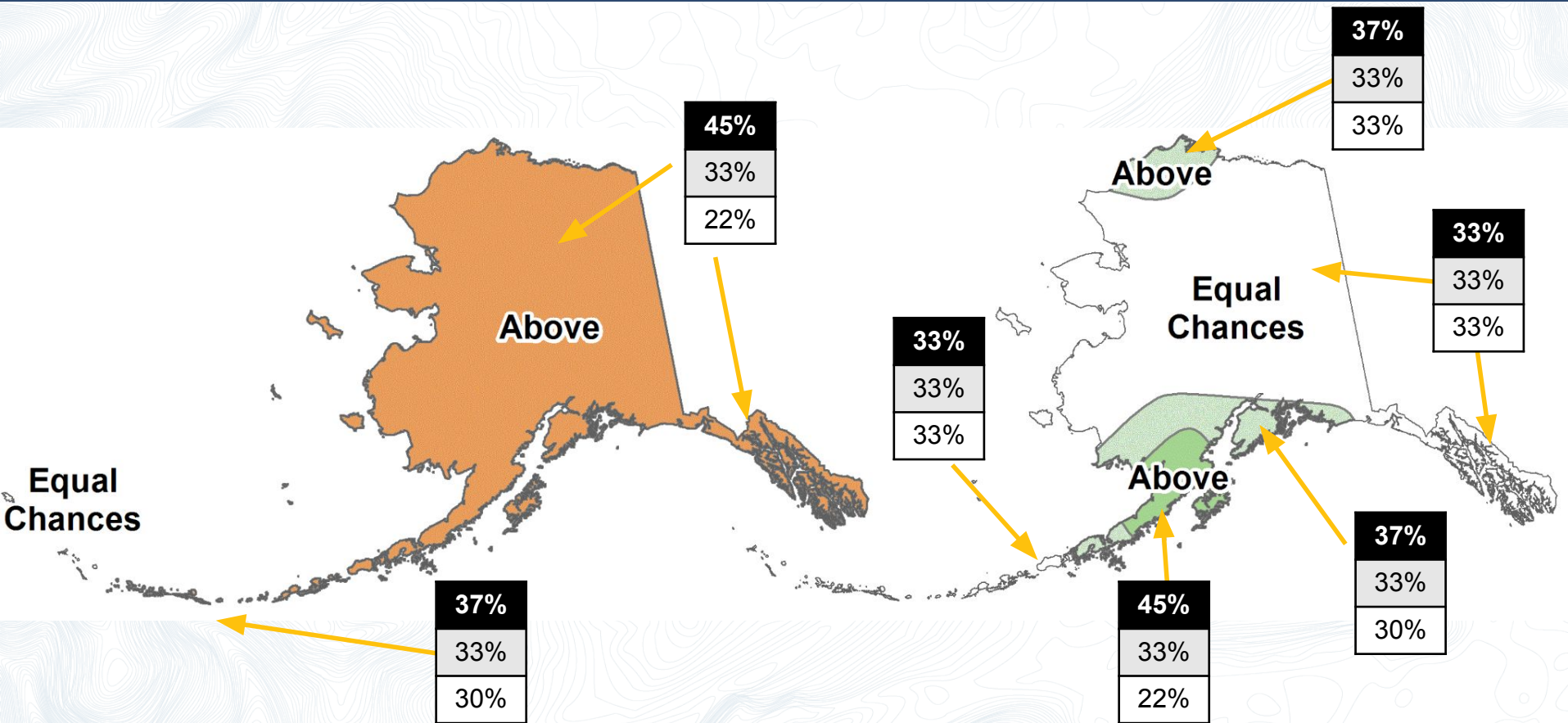
# CPC February 2024 outlooks



# CPC February-April 2024 outlooks



# Look ahead Spring 2024



# Upcoming ACCAP webinars

Upcoming ACCAP webinars [accap.uaf.edu/events](https://accap.uaf.edu/events)

- February 16 ▶ NWS Climate Outlook Briefing

Email Rick Thoman [rthoman@alaska.edu](mailto:rthoman@alaska.edu)



The screenshot shows the ACCAP website header with navigation links: About, Webinars, Resources, News, Contact. The main heading is "ACCAP Climate and Weather Webinars". Below it, a section titled "Upcoming webinars" lists three events:

Date	Day	Topic	Speaker
17	Jan	Arctic Report Card: Background and Key Finding	Rick Thoman (ACCAP), Zack Labe (Princeton University and NOAA GFDL), Erik Schoen (International Arctic Research Center), and Roberta Glenn (Alaska Arctic Observatory and Knowledge Hub)
24	Jan	Flooding and Environmental History in the Upper Tanana Region near Manh Choh	Jessica Cherry, NOAA's Regional Climate Service Director for Alaska, part of the National Environmental Satellite, Data, and Information Service.
26	Jan	January 2024 NWS Alaska Climate Outlook Briefing	Rick Thoman, Alaska Center for Climate Assessment and Policy

Each event includes a "Find out more" link. To the right of the list, there is a registration section titled "We strongly encourage registration for webinars." with a "Sign up below to learn about upcoming webinars:" form containing fields for Name and Email Address.



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