

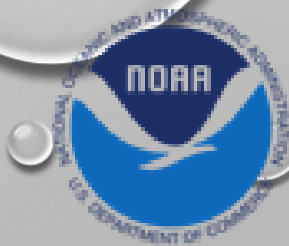
# DROUGHT IN A RAINFOREST...HOW CAN THAT BE??

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SENIOR SERVICE HYDROLOGIST/ METEOROLOGIST NWS JUNEAU

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ALASKA CLIMATE SPECIALIST ACCAP



# TODAY'S AGENDA

- BASICS: DROUGHT, RAIN FORESTS AND SOUTHEAST ALASKA
- RECENT PRECIPITATION AND HISTORICAL CONTEXT
- IMPACTS IN THE RAINFOREST
  - **HYDRO-ELECTRIC POWER GENERATION**
  - **DRINKING WATER SUPPLY**
  - **FISHERIES**
  - **WINTER SPORTS**
  - **RAINFOREST HEALTH**
  - **KETCHIKAN/PRINCE OF WALES ISLAND**
  - **WRANGELL/PETERSBURG**
- MAY AND EARLY SUMMER 2019 OUTLOOKS FROM NOAA'S CLIMATE PREDICTION CENTER



# WHAT IS DROUGHT?

- DROUGHT ORIGINATES FROM A DEFICIENCY OF PRECIPITATION OVER AN EXTENDED PERIOD OF TIME
- IMPACTS RESULT FROM THE INTERPLAY BETWEEN THE NATURAL EVENT AND THE **DEMAND PEOPLE PLACE ON WATER SUPPLY**
- DROUGHT USUALLY DEFINED BOTH CONCEPTUALLY AND OPERATIONALLY

Source: [drought.gov](http://drought.gov)



# DROUGHT IN NORTHERN CLIMATES?

- DROUGHT NOT SO CLEARLY DEFINED IN AREAS WITH LONG SNOW COVER SEASON AND LOW EVAPORATION
- TIMING IS IMPORTANT
- PRECIPITATION DROUGHT VS. SNOW DROUGHT
  - **PRECIP DROUGHT:** LESS STUFF FALLS OUT OF THE SKY (2017-19)
  - **SNOW DROUGHT:** NEAR NORMAL PRECIP BUT BELOW NORMAL SNOW ACCUMULATION CAUSED BY HIGHER THAN USUAL SNOW LEVELS...SO LOW MOUNTAIN SNOW PACK (E.G. 2014-15)



# Total Annual Precipitation Climatology: 1981-2010 Normal

## SOUTHEAST ALASKA LAND OF A LOT OF PRECIPITATION

### 1981-2010 Normal

- Under 50"
- 50" to 75"
- 75" to 100"
- 100" to 150"
- 150" to 200"
- Over 200"

### Annual Average Pcpn

Port Alexander: 163"  
Ketchikan: 141"  
Petersburg: 109"  
Craig: 101"  
Sitka: 87"  
Juneau Aprt: 62"  
Haines: 49"

Source: The Prism Climate Group

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[@Climatologist49](#)



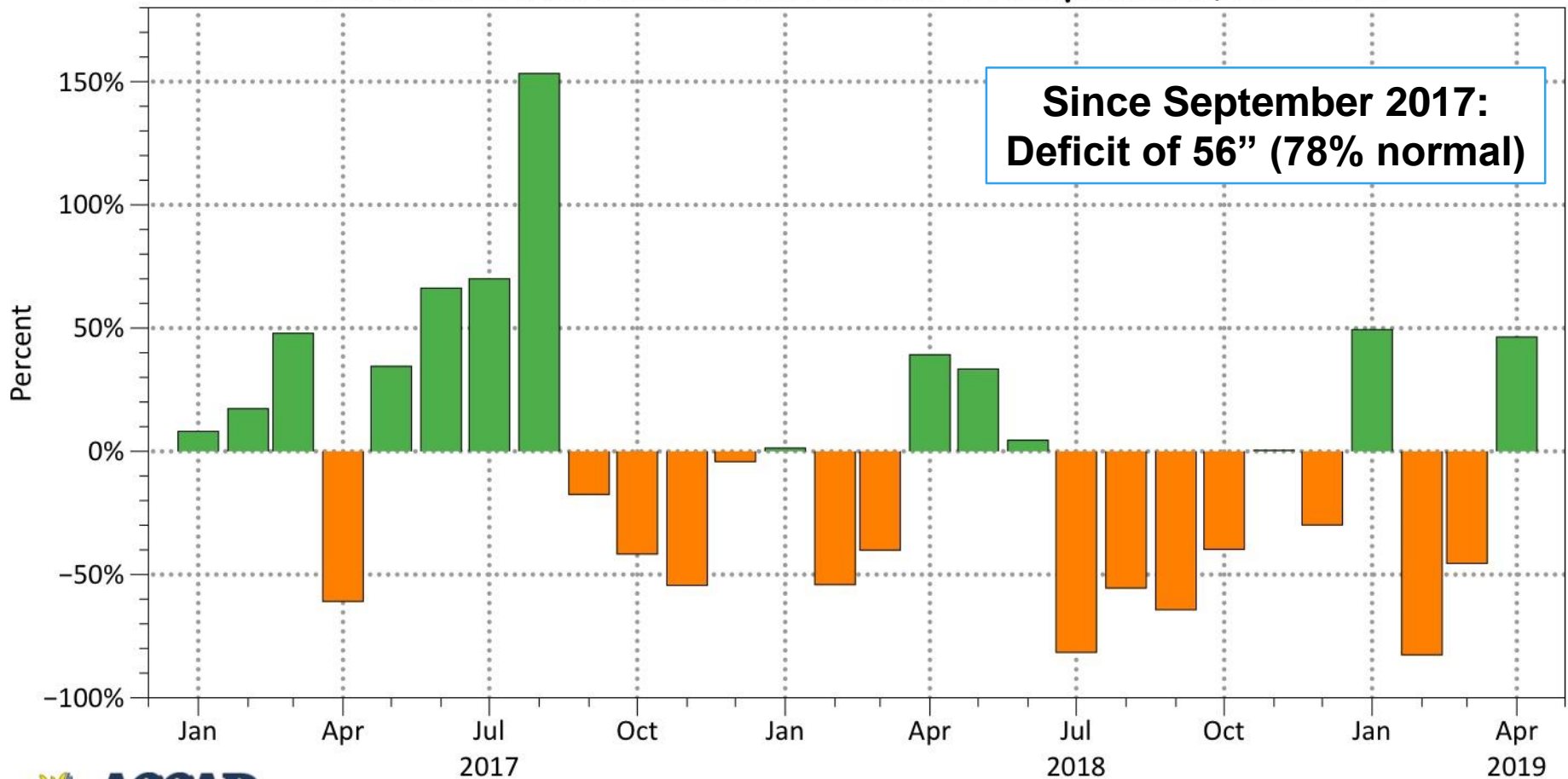
# OVERVIEW OF PRECIPITATION IN CONTEXT

- LOCATION SPECIFIC
  - KETCHIKAN
  - ANNETTE ISLAND
  - SITKA, JUNEAU, YAKUTAT
- REGIONAL CONTEXT
  - CLIMATE DIVISIONS

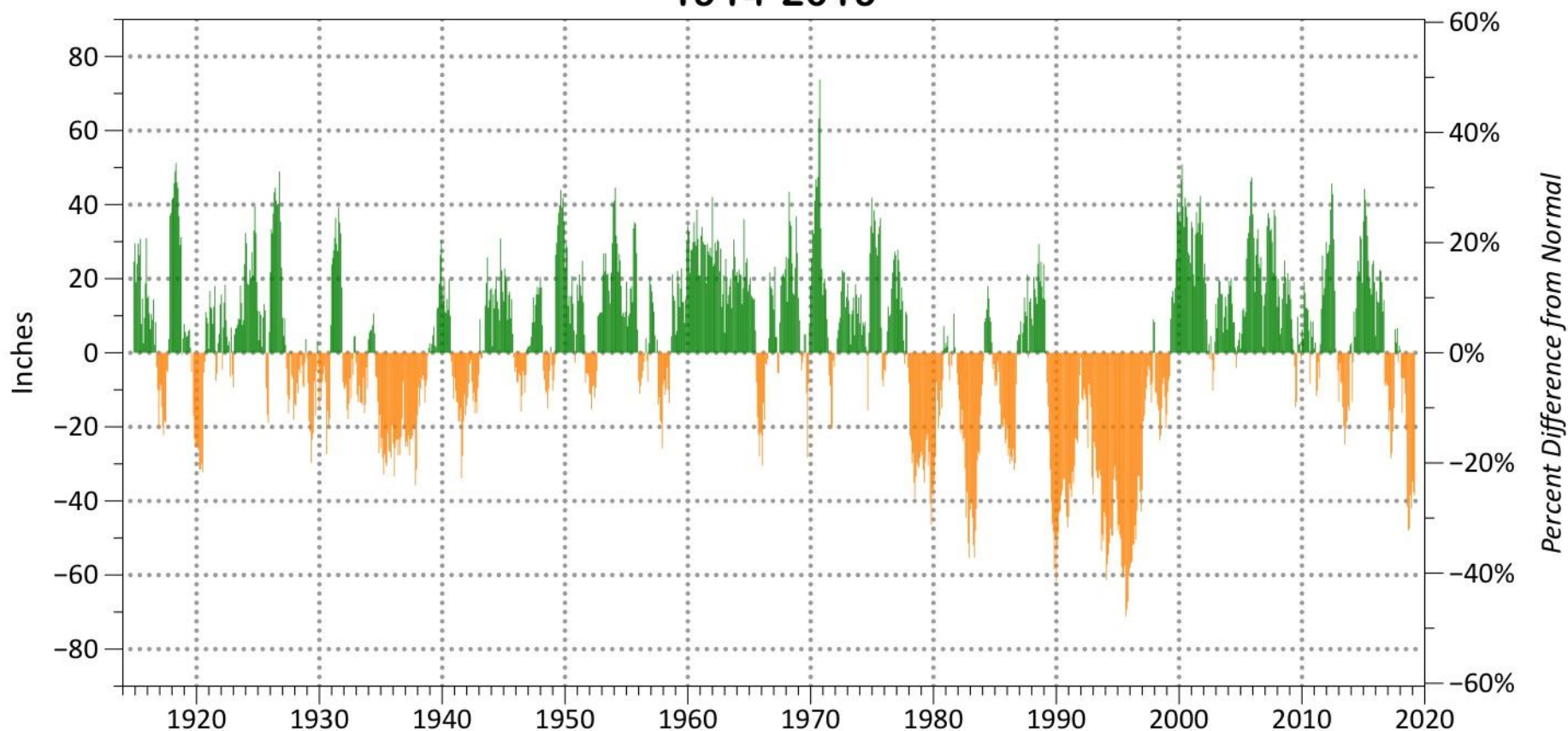


# KETCHIKAN MONTHLY PRECIPITATION

Ketchikan, Alaska  
Percent Difference from Normal Precipitation, 2017-19

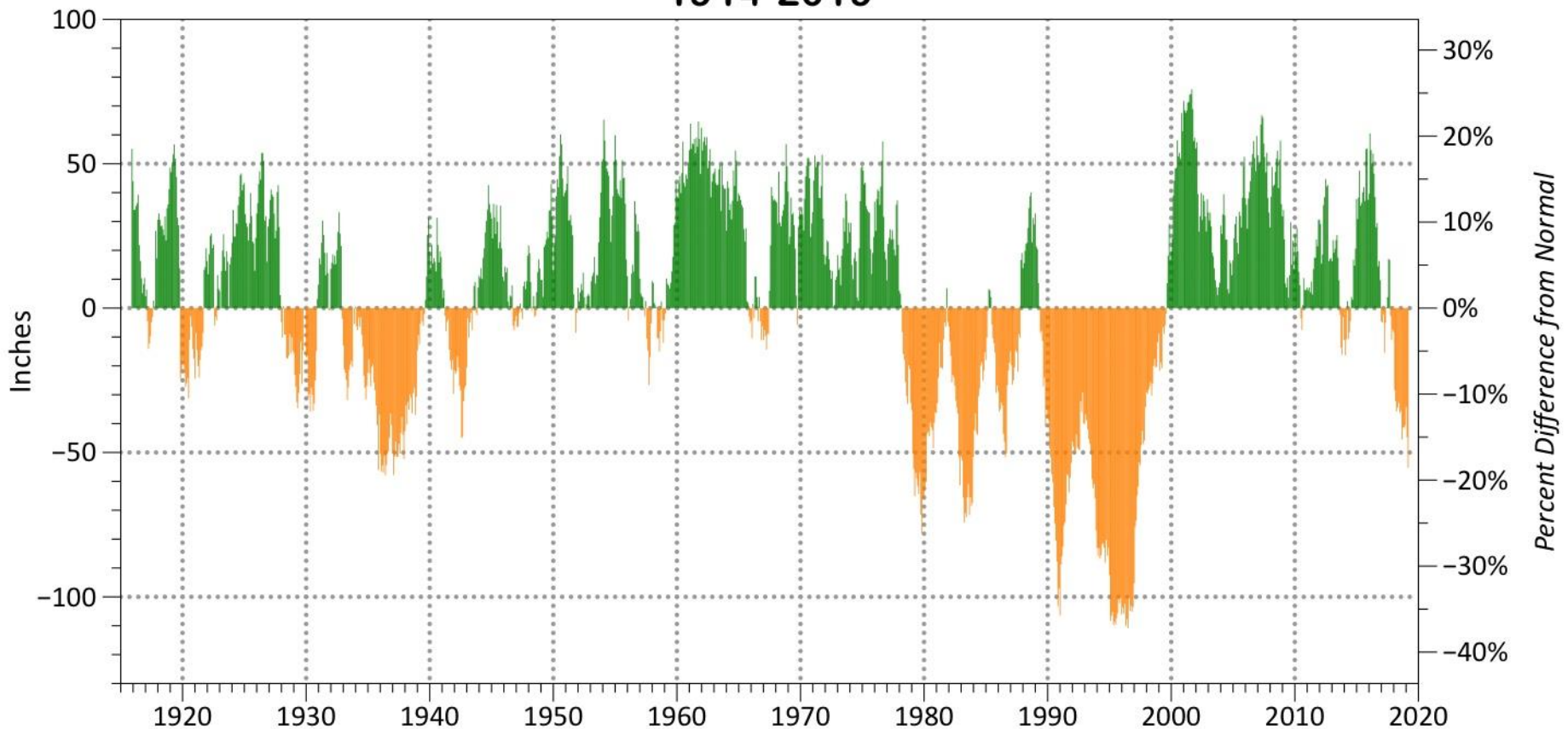


# Ketchikan Airport 12-Month Precipitation Departure from Normal 1914-2019

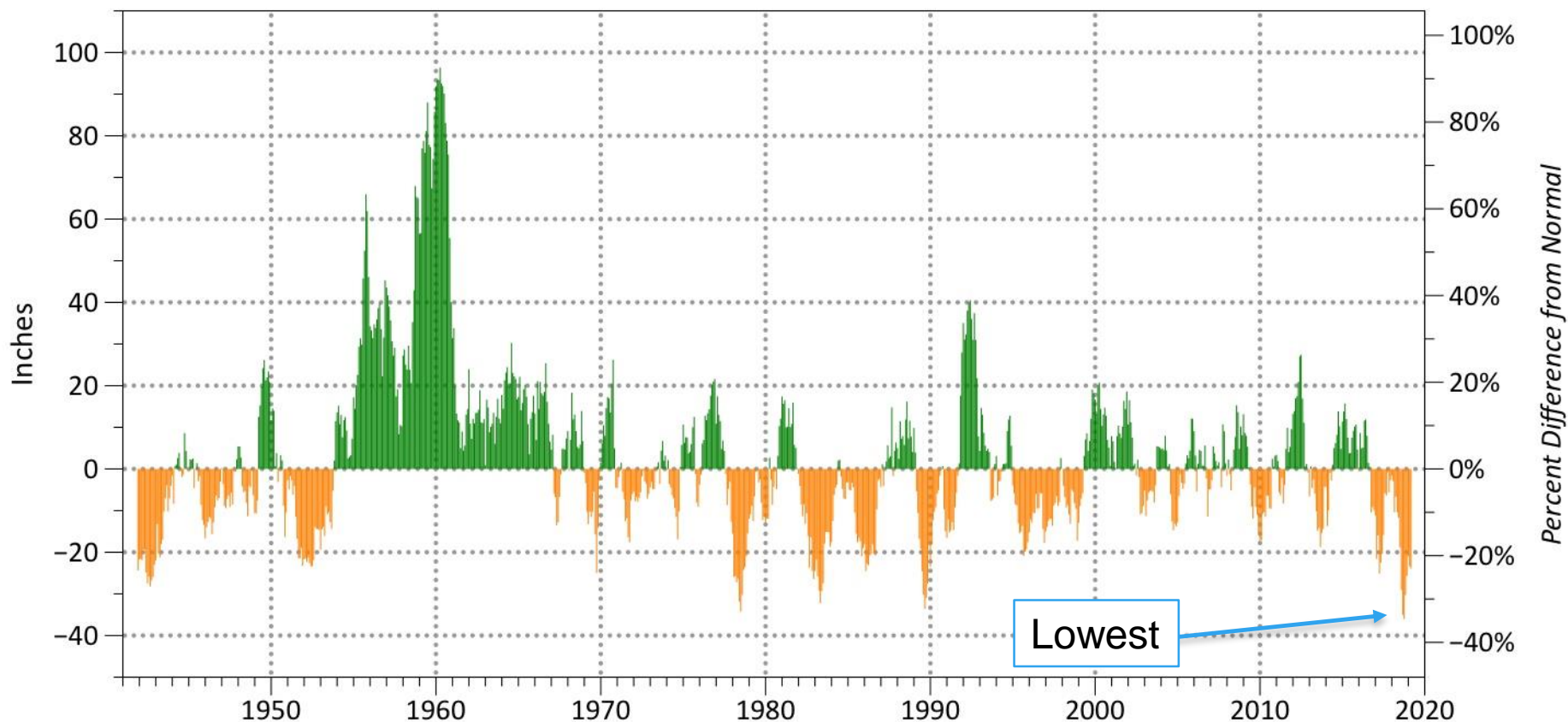




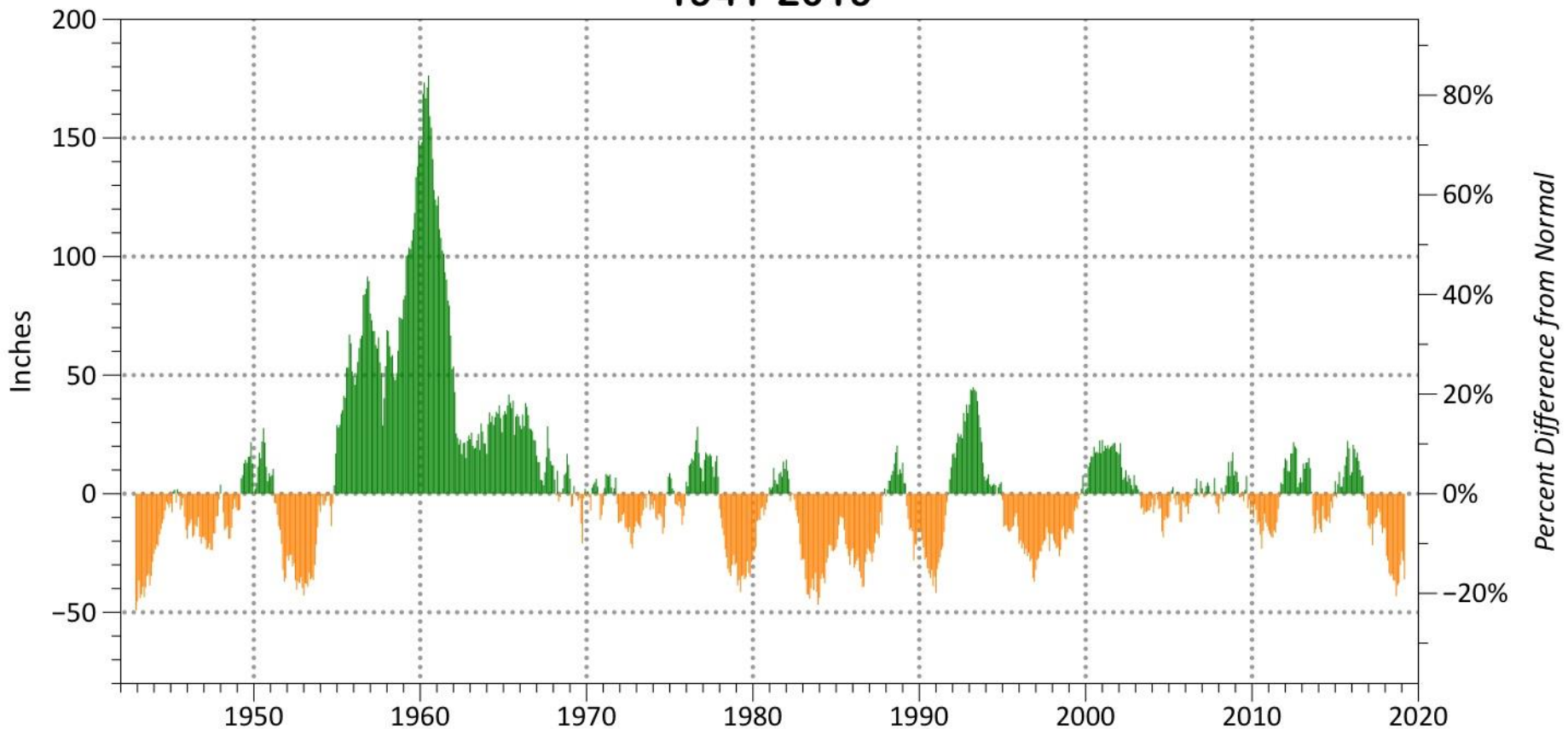
# Ketchikan Airport 24-Month Precipitation Departure from Normal 1914-2019



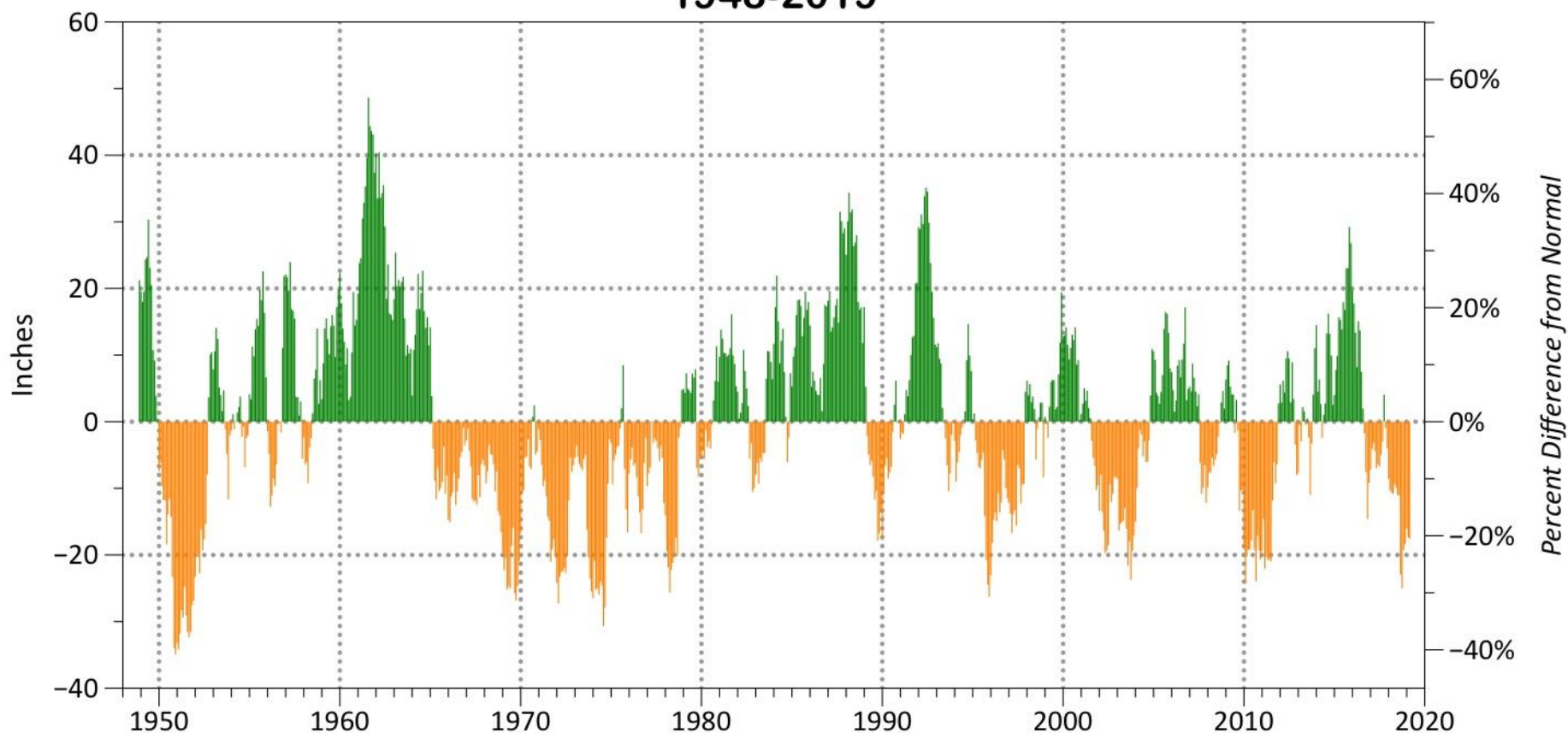
# Annette Airport 12-Month Precipitation Departure from Normal 1941-2019



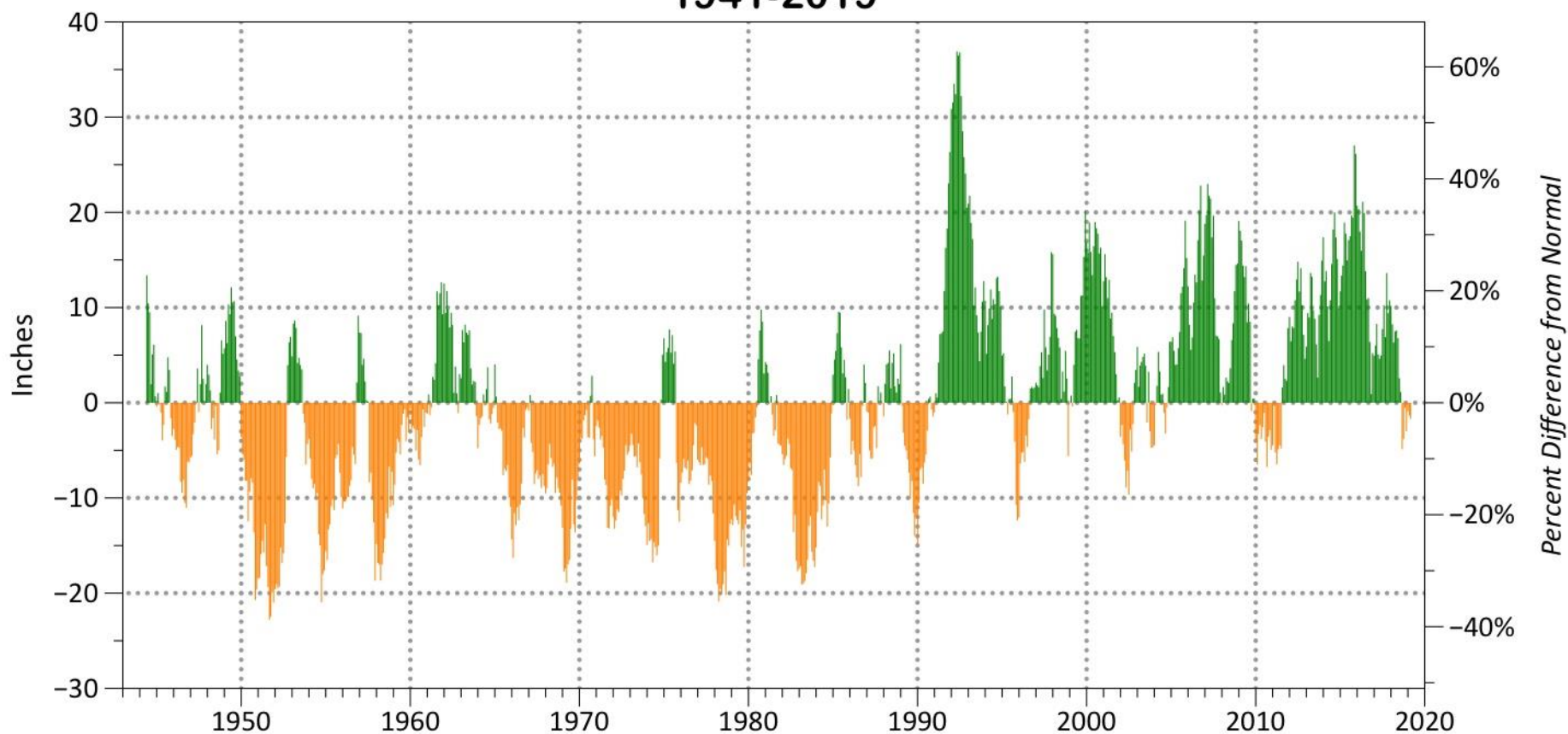
# Annette Airport 24-Month Precipitation Departure from Normal 1941-2019



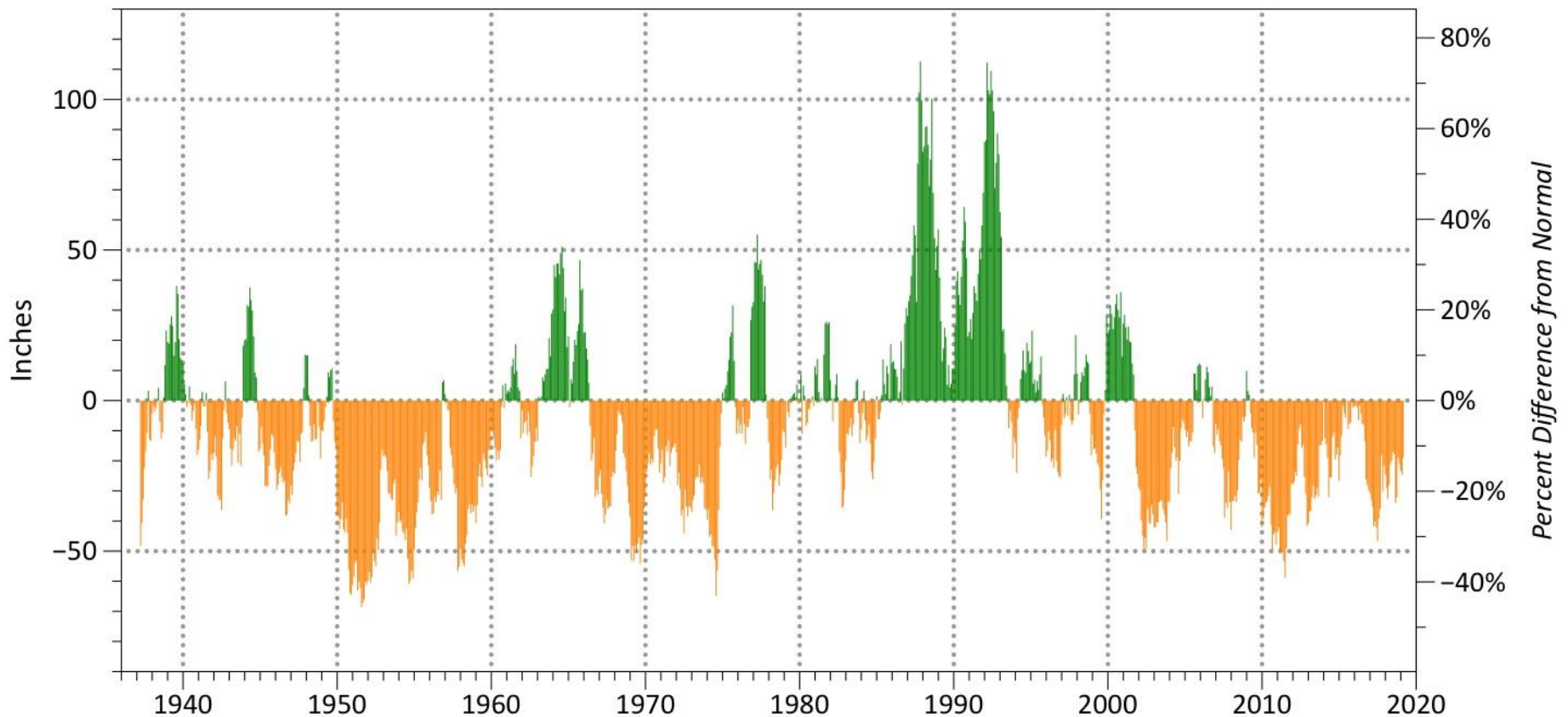
# Sitka Airport 12-Month Precipitation Departure from Normal 1948-2019



# Juneau Airport 12-Month Precipitation Departure from Normal 1941-2019



# Yakutat Airport 12-Month Precipitation Departure from Normal 1936-2019



# STANDARDIZED PRECIPITATION INDEX

- PUTS “DEPARTURES FROM NORMAL” INTO CONTEXT
  - REQUIRES ONLY PRECIPITATION DATA
- TAKES INTO ACCOUNT SEASONAL CLIMATOLOGY OF PLACE/REGION AND USEFUL FOR MULTIPLE DROUGHT “FLAVORS”
- COMPUTED FOR TIME SCALES OF WEEKS TO YEARS
- WIDELY USED TO MONITOR DROUGHT
  - RECOMMEND BY WORLD METEOROLOGICAL ORGANIZATION(WMO) IN 2009



# WHY USE CLIMATE DIVISIONS?





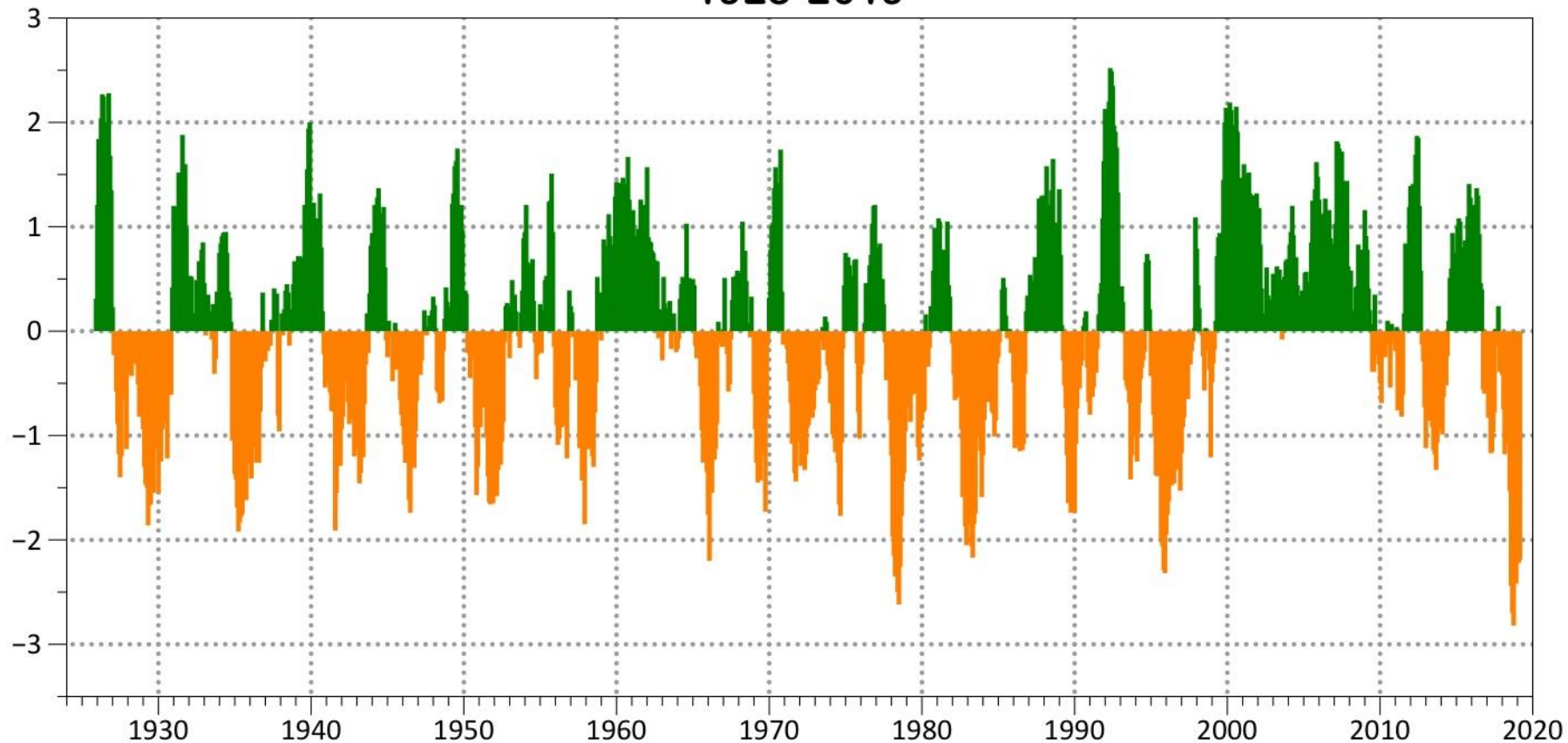
# WHY USE CLIMATE DIVISIONS?

- AREAS WITH BROADLY SIMILAR CLIMATE RESPONSE
- MAXIMIZES AVAILABLE INFORMATION
- REDUCES IMPACT OF MISSING DATA
- BUT...MAY NOT REFLECT LOCAL CONDITIONS (ESPECIALLY PRECIPITATION)



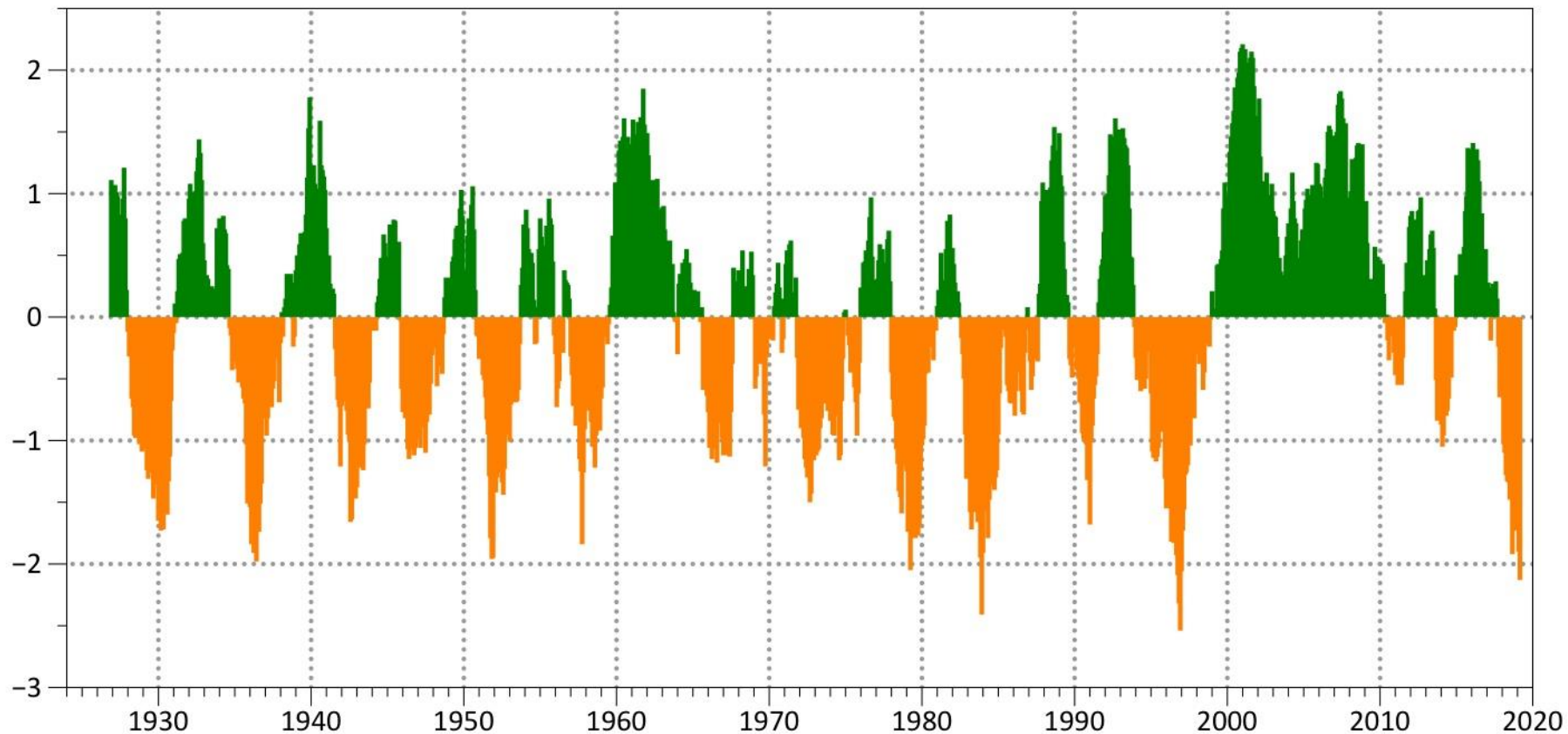
# SOUTHERN SOUTHEAST

## Southern Southeast Alaska (Climate Division 12) 12-Month Standardized Precipitation Index 1925-2019



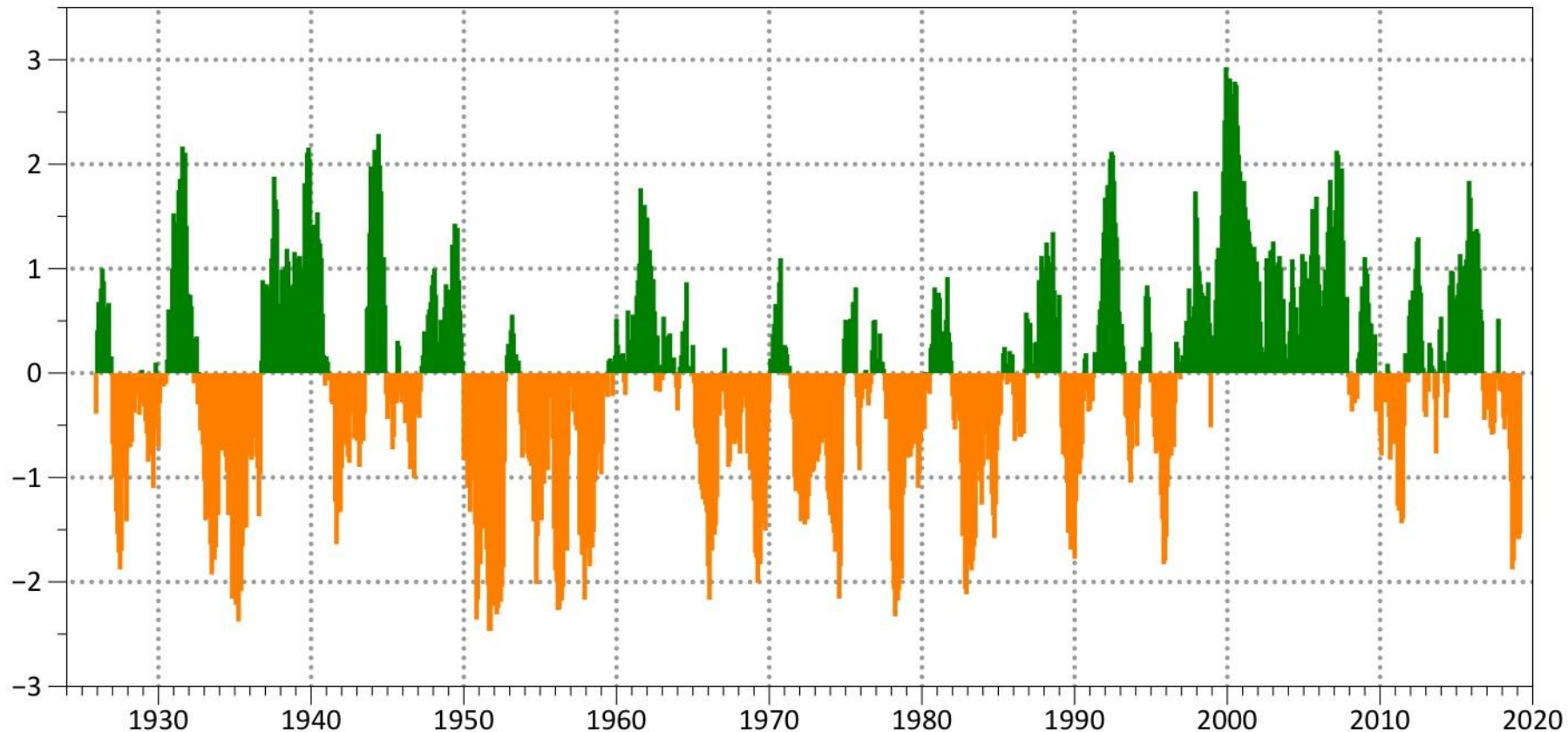
# SOUTHERN SOUTHEAST

## Southern Southeast Alaska (Climate Division 12) 24-Month Standardized Precipitation Index 1925-2019



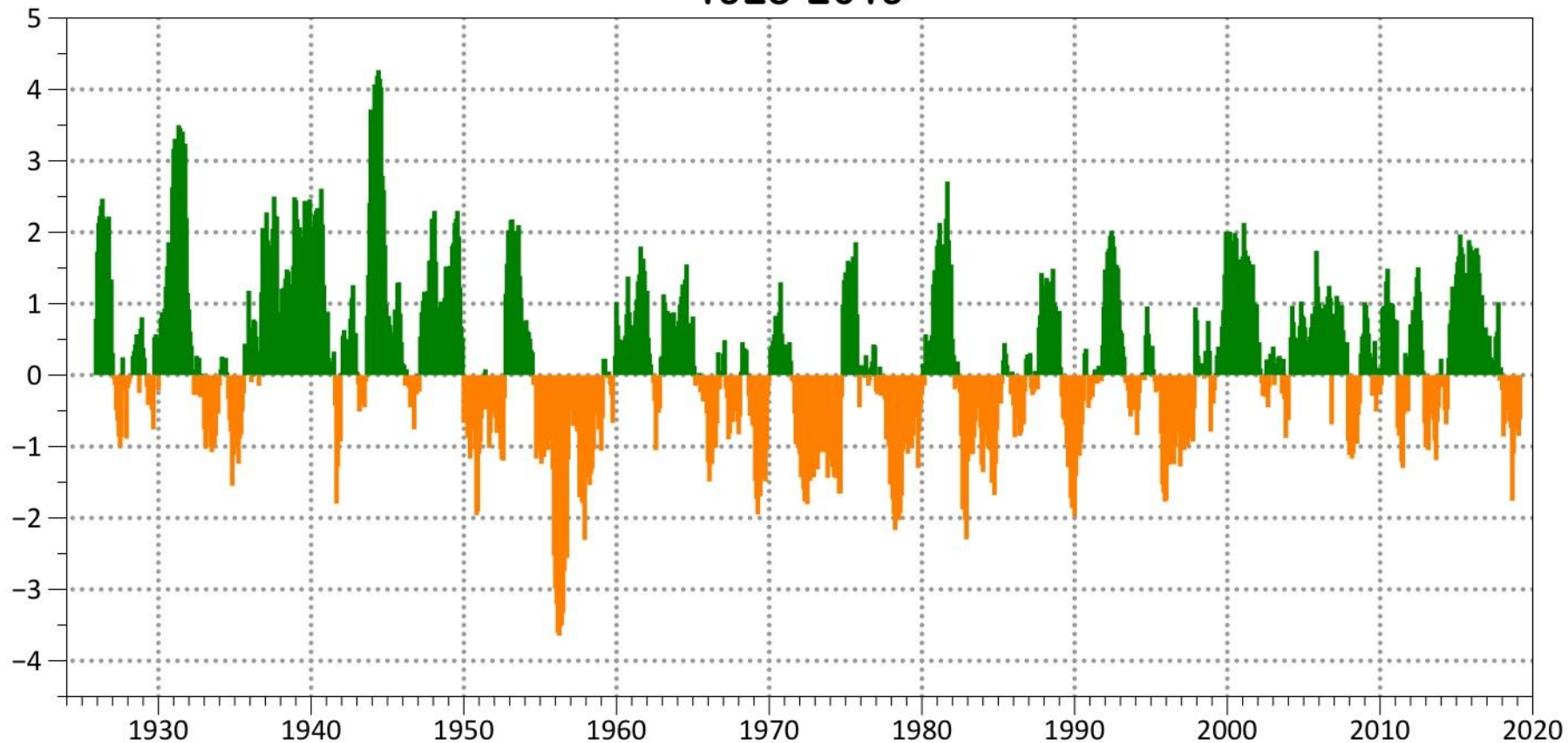
# CENTRAL SOUTHEAST

## Central Southeast Alaska (Climate Division 11) 12-Month Standardized Precipitation Index 1925-2019



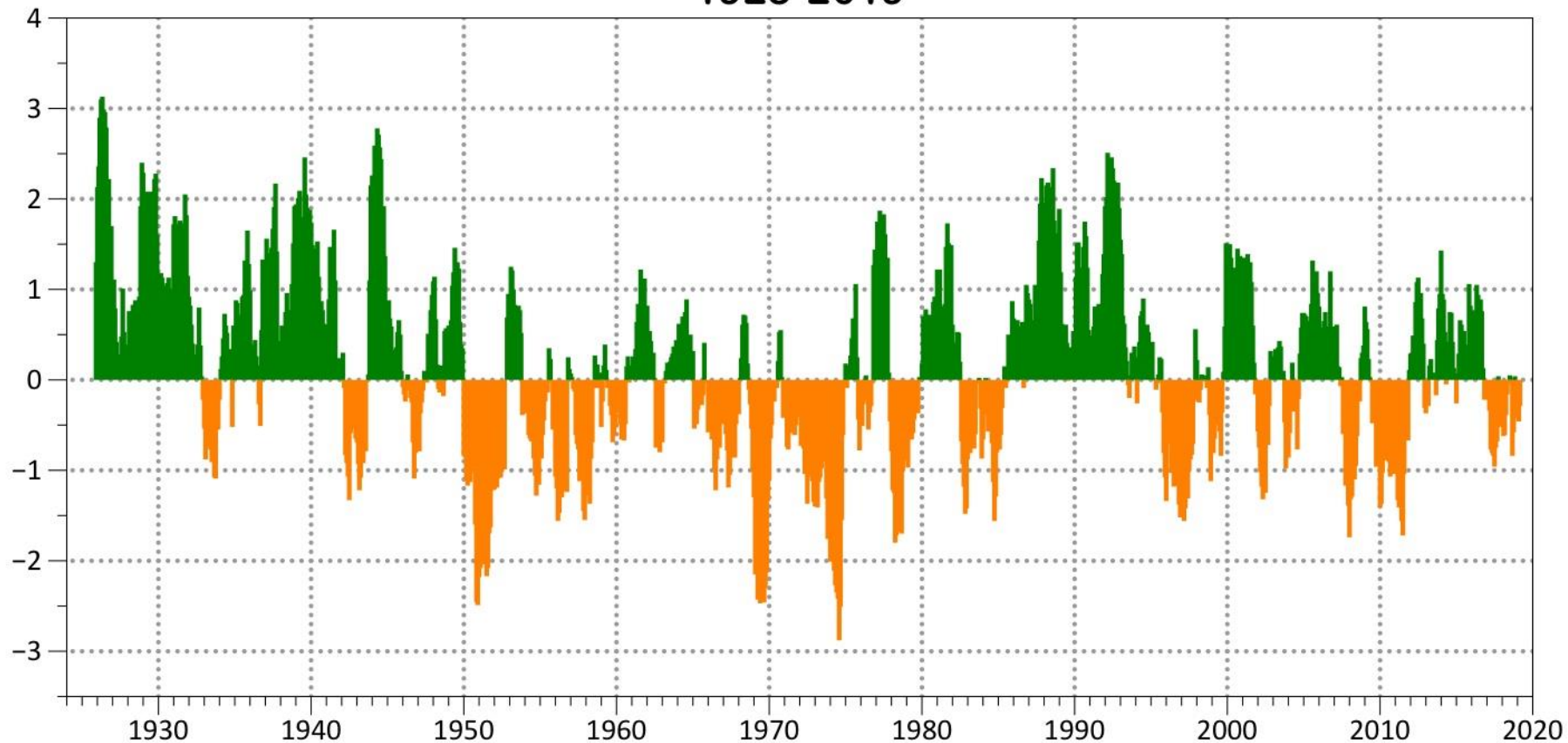
# NORTHERN SOUTHEAST

## Northern Southeast Alaska (Climate Division 10) 12-Month Standardized Precipitation Index 1925-2019



# NORTHEAST GULF COAST

## Northeast Gulf of Alaska Coast (Climate Division 09) 12-Month Standardized Precipitation Index 1925-2019



# IMPACTS IN THE RAINFOREST

## HYDRO-ELECTRIC POWER GENERATION

### TYPES OF DAMS/RESERVOIRS

- ALPINE LAKE (LAKE TAPPED FROM BELOW)
- RUN-OF-RIVER
- STORAGE DAMS
  - EARTHEN
  - DAMMED LAKES



Blue Lake Dam near Sitka  
(Dammed Lake)



Long Lake, lake tapped (Snettisham  
Hydroelectric near Juneau)



Falls Creek near Gustavus  
(Run-of-River)

### Impacts:

#### NO hydro-electric generation

- Pass-on cost of expensive diesel to general public (higher electric bills)

### REASONS OF IMPACTS:

- LACK OF PRECIPITATION IN THE WET SEASON TO REFILL DAMS/RESERVOIRS
- NOT ENOUGH SNOWMELT(SNOW DROUGHT)
- NOT A PART OF THE USA/CANADA CONTINENTAL POWER GRID

# IMPACTS IN THE RAINFOREST

## DRINKING WATER SUPPLY

Community drinking water sources:

- Ground Water aquifer
- Surface water (pulls from streams)
- Reservoirs



Salmon Creek Reservoir near Juneau

Impacts:

### Water Restrictions

- On the public (reduce water usage)
- Seafood processors (limited plant usage)

Reasons of impacts:

- Small reservoir storage means you are susceptible to short duration precipitation deficits.
- Low snow pack (snow drought), less water to fill reservoirs in spring/early summer.
- Low stream flows - delay/lack of snowmelt (snow drought) in dry summers.



# IMPACTS IN THE RAINFOREST FISHERIES

## Fishery activities across Southeast Alaska:

- Commercial fishing
- Recreation(sport) fishing
- Traditional(subsistence/personal use) fishing
- Fish hatcheries (aquaculture)



Dip netters for Sockeye Salmon  
source:

"Changing Water Dynamics USDA FS Dec 2017"

## Impacts:

- Fish kills
- Economic loss
- Loss of food resources
- Potential job loss

## Reasons of impacts:

- Low stream flows: lack of rainfall and snowmelt(snow drought) during spawning periods
- Above normal water temperature
- Low dissolved oxygen

# IMPACTS IN THE RAINFOREST

## RAINFOREST HEALTH

### Forest activities:

- Timber harvest industry
- Cultural values to Alaska Natives



### Impacts:

- Yellow-cedar mortality increase
- Economic loss to small communities
- Potential job layoffs
- Increased threats to trees from insect and pathogens from changing water dynamics as a result higher temperatures and longer growing season (Hollingsworth et al. 2017)

### Reason for impacts:

- Snow drought

source:

”Changing Water Dynamics USDA  
FS Dec 2017”

# REVIEW OF 2017-2019 MODERATE/SEVERE DROUGHT IMPACTS

- City of Wrangell water officials impose water restrictions.
- Swan Lake Dam hydro-electric power generation suspended due to low reservoir levels, lowest levels since construction(1984).
- Black bear lake dam on Prince of Wales Island suspended power generation due to low levels.
- Higher electric cost of using diesel generation for power passed on to communities
- Petersburg on diesel generation(winter of 2018/19)
- AEL&P stops providing power to interruptible power customs from low reservoir levels.

## System Info - Swan-Tyee Control System (STICS)

The following STICS Dashboard is a digital communication link that provides the public and system operators with the ability to see SEAPA's Swan Lake and Tyee Lake generation and transmission data.

### Reservoir Level and Power Produced Trends



City and Borough of Wrangell

March 13 · 🌐

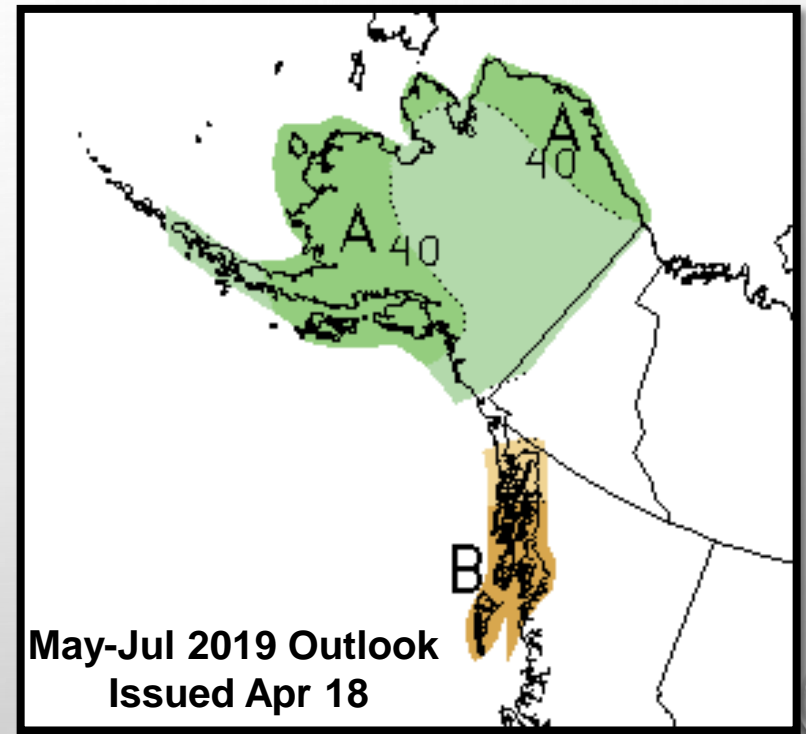
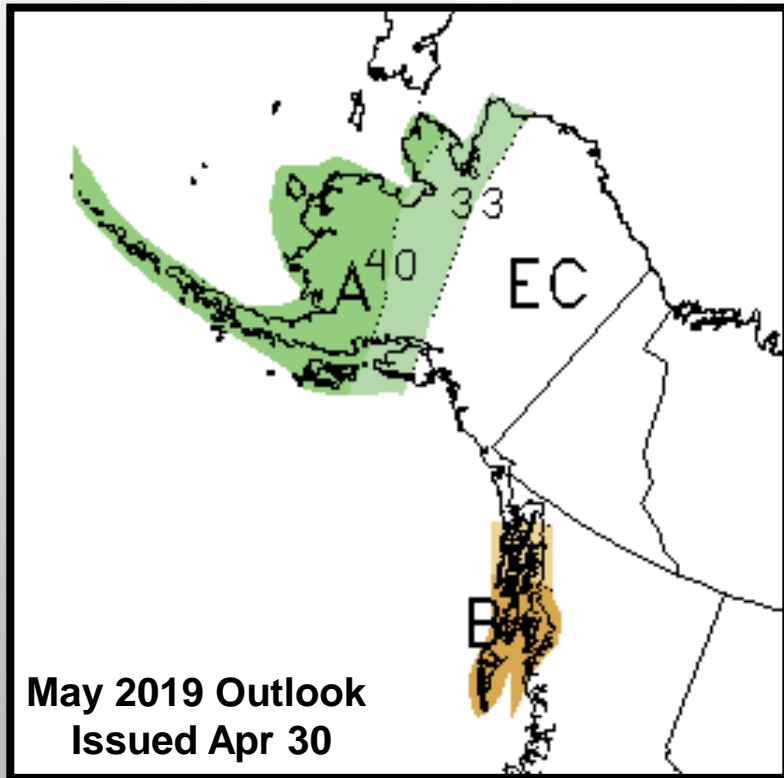
Borough Declares  
Stage III CRITICAL  
Water Level

Effective immediately, the City and Borough of Wrangell has declared a Stage III - Critical water level, and we need your help! It is estimated that there is approximately one month's worth of water supply in the reservoirs at this time.

The City and Borough of Wrangell has moved from a Stage I - Watch to a Stage III - Critical level due to the extreme low drop in our reservoirs' water levels, and all customers are required to initiate Stage III water restrictions. In discussing climate outlooks with NOAA, predictions are for drier and colder than normal conditions through March 2018. Additionally, their 3-month outlook indicates that below-normal temperatures are more likely for the Alaska panhandle. With continued predictions for drier-than-normal weather conditions, the Stage III water restrictions have been escalated for all of Wrangell beginning March 13, 2018.

The Stage III water restrictions will be aggressively monitored and strictly enforced. It is critical that all water customers suspend all non-essential water use. Water customers are encouraged to review and become familiar with the Stage III restrictions, as outlined in the Water Shortage Management Plan (copies on-line and at City Hall).

# WHAT'S COMING UP: CLIMATE PREDICTION CENTER OUTLOOKS



# SUMMARY

- ONGOING DROUGHT IN SOUTHERN SOUTHEAST MOST SIGNIFICANT DROUGHT DURING THE WET SEASON IN 40+ YEARS
- IMPACTS OF SUSTAINED PRECIPITATION DEFICIT ARE WIDE-RANGING EVEN IN A RAIN FOREST AND THEY CHANGE OVER TIME.
- CLIMATE OUTLOOKS CALL FOR CONTINUING PRECIPITATION DEFICITS

