The experimental forecasts presented here can be summarized as follows:

- The 2017–18 seasonal snowfall will be slightly greater than average in Anchorage.
- The Alaska statewide temperature for the coming winter (Dec–Feb) will be warmer than normal by about 1°F.
- The maximum extent of Bering Sea ice cover will be about 40,000 km² less than the 1981–2010 average.
- The breakup date of the Tanana River at Nenana will be later than average in 2018.
Beyond the seasonal time-scale, there is also great interest in annual to decadal forecasting. For example, highway engineers must design roads with peak drainage in mind. They are also interested in forecasted changes in permafrost in relation to pavement stability. Rural communities that rely on wind power are interested in trends of wind speeds. Fishery resource managers are interested in atmospheric and oceanic conditions that drive salmon returns. With respect to salmon, some atmospheric influences on the ocean system may be predictable many months in advance.

THE EXPERIMENTAL ARCTIC PREDICTION INITIATIVE

To improve seasonal to annual forecasts and predictions, the International Arctic Research Center (IARC) at the University of Alaska Fairbanks has established an Experimental Arctic Prediction Initiative (EAPI). This initiative represents a timely opportunity for IARC to utilize its wide range of expertise and track record in research related to Arctic predictability. This initial activity of the EAPI is supported by IARC through the Alaska Center for Climate Assessment and Policy (ACCAP).

An excellent precedent for a university-based experimental forecast center is the International Research Institute (IRI) for Climate and Society at Columbia University/Lamont-Doherty Earth Observatory, established over 20 years ago (http://iri.columbia.edu/wp-content/uploads/2013/07/IRI_factsheet.pdf). The IRI publishes El Niño/La Niña forecasts every month (Figure 2). Their forecasts are widely distributed by the media and amongst the research community.

The Arctic is the canary in the coal mine for changes due to global warming. High latitudes feel the effects of temperature increases most dramatically due to feedback effects resulting from less snow and ice. The changes at high latitudes can affect global temperature and circulation patterns. It follows that seasonal to annual forecasts for the Arctic not only provide direct benefits to the region, they can be a tool for researchers across the globe to forecast the first in a cascading series of events.

The Experimental Arctic Prediction Initiative is still in development, and the specific forecasts that will be available are yet to be determined. IARC plans to meet with stakeholders to understand the forecasting needs of state/federal agencies, industry, tribes, the research community, and others.

FORECAST POSSIBILITIES

Earlier this fall, the EAPI started this process informally by asking internal (IARC/ACCAP) and external (agencies, etc.) groups for advice on possible forecast products that would be a) of interest, b) technically feasible. An additional requirement was that there be a basis for expecting at least a modest level of forecast skill. Products that extend the suite of outlooks produced by NOAA’s Climate Prediction Center were a priority. Examples from this list include:

- Seasonal snow forecast for Anchorage/Fairbanks,
- Rain on snow events in the Interior,
- Bering Sea ice coverage,
- Snowpack depth,
- Watershed-specific precipitation, and
- Cloud coverage during the winter.
FORECAST TECHNIQUES

There are any number of methods to generate long-term forecasts. Most readers are familiar with weather and climate models. These models numerically represent the state of the atmosphere at a global or regional scale using properties and equations from the atmospheric sciences. Examples of these models include: CFSv2, ECMWF, and many others. An example of a numerical forecast from the North American Multi-Model Ensemble (NMME) is shown in Figure 3. The map shows the model output forecast for December 2017 through February 2018 (generated mid-October 2017). This model-derived forecast calls for an increased likelihood of above-normal temperatures in northern and western Alaska, but equal chances of above- or below-normal temperatures in Southcentral and Southeast Alaska.

Statistical relationships are another common method of forecasting weather and climatic conditions months in advance. Any number of variables may be evaluated against one another to determine relationships between them. For example, does a warm fall in Alaska mean a warm winter will follow?

The average (over all years) of the Alaska statewide temperature in October–November is 18.7°F and the average December–February temperature is 4.3°F. Knowing these two values is modestly interesting; however, by looking at each year’s October–November and the following December–February, a statistical relationship can be developed to see if the fall temperatures relate to the winter temperatures. In this case, there is a small but not insignificant correlation (Figure 4). A warm autumn in Alaska has a better-than-even chance of being followed by a warm winter, at least in terms of the statewide average temperature.

ANALOG FORECAST TECHNIQUES

The previous issue of the Alaska Climate Dispatch contained an article describing an analog forecasting project that ACCAP is spearheading. Simply stated, an analog forecast technique looks for atmospheric and/or oceanic matches during a time of the year (e.g., summer, fall, September, etc.) and tracks what happened during subsequent months or seasons of those “analog” years. The assumption is that conditions during one part of the year a) influence later conditions, or b) are correlated to those conditions later in the year. For example, high sea surface temperatures in the Bering Sea during the fall are strongly correlated to lower Bering Sea ice extents during the winter. In this example, we hypothesize that warmer sea surface temperatures in fall require more cold air than normal to freeze the ocean surface during the winter months, thereby delaying freezing and limiting ice growth. In other cases, similar sets of preceding conditions may reflect other atmospheric processes rather than causing the later conditions. Nevertheless, if a relationship exists, we want to take advantage of it.

Figure 3. NMME Dec–Feb temperature forecast issued in November. Source: http://www.cpc.ncep.noaa.gov/products/NMME/seasom.shtml.

Figure 4. Statistical relationship between October–November temps and the following December–February temps in Alaska. Data source: NCEI statewide temperature.
SAMPLE FORECAST NO. 1: NENANA ICE CLASSIC

River breakup is an important seasonal event across Alaska. Traveling by snowmachine along rivers is the primary method of transportation between neighboring communities during the winter months. In summer, rivers allow for the transportation of supplies via barge and provide a bounty of fish, which are an important subsistence resource.

Many people have looked into the factors that influence interior Alaska river breakup timing (see: Large-Scale Climate Controls of Interior Alaska River Breakup). The results of this, and other studies, strongly point toward temperature and cloud cover in the month preceding breakup as the driving factors; however, what happens in the mid-winter months also matters. Figure 5 show the correlation significance of January–March 700 mb heights versus Nenana Ice Classic (Tanana River at Nenana) breakup. The area south of Alaska depicted in red (drawn with green box) on the left panel shows where there is a positive correlation at the 99% confidence interval; i.e., positive 700 mb anomalies during January through March correlate to later breakup (conversely, negative 700 mb anomalies during January through March correlate to earlier breakup). The scatter plot on the right portion of the panel nicely demonstrates this relationship.

What do we do with this information? In any given year, once the March 700 mb heights are published (first week of April), we can run the analysis and find those years with similar 700 mb heights for this region in the northern Pacific Ocean. For January–March 2017, the 700 mb heights were very similar in 1960, 1966, 1973, 1996, and 1993. The average breakup date in those years was May 3. In 2017, the actual breakup date was May 1—a difference of only two days!

Can we get information about the January–March 700 mb height pattern before the end of March? The answer is yes. Figure 6 shows the CFSv2 forecast of 700 mb height anomalies for the January–March 2018 time period. It indicates a strong positive height anomaly, which indicates a late Nenana Ice Classic breakup in 2018. Of course this approach combines the uncertainty inherent to the analog seasonal forecast with the uncertainty of a numerical 700 mb height forecast several months in advance.
SAMPLE FORECAST NO. 2: ANCHORAGE SNOWFALL

Perhaps the most frequent question that I am asked as a climatologist is, “How much snow will we get this winter?” Alaskans typically tolerate the darkness of winter and endure the cold temperatures, but everyone wants a decent snow pack. Whether for skiing, snowmachine travel, wildlife/game tracking, backcountry recreation, or just kids wanting to build snowmen, everyone wants to know about snow.

Unfortunately, precipitation is more challenging than temperature to forecast months in advance. The reason has to do with frequency and small-scale (local) variability. A majority of winter precipitation might occur in 5–10 events, as in Figure 1. Figuring out the number of events months in advance is nearly impossible. Also, stations in close proximity to one another may have dramatically different precipitation totals—not the case with temperatures. Nevertheless, there are certain atmospheric and oceanic conditions that favor more or less precipitation during the cold season. In Anchorage, knowing the September–October 500 mb heights and the sea surface temperatures in the northwestern Pacific Ocean is extremely useful for determining the November through March snow totals.

The season-to-season match between September–October 500 mb heights and SSTs in 2017 compared to all other seasons yields a set of similar match years (1973, 2008, 1967, 1972, and 1978). These five seasons produce an average of 66.1” of snow in Anchorage between November and March. The long-term correlation between these variables and November–March snow in Anchorage is a remarkably high 0.515! Since the normal snowfall during November–March is 62.8”, we expect a slightly snowier-than-average winter for Anchorage in 2017–18.

Figure 7. Left panel: Correlation significance map between September–October 500 mb heights versus Anchorage November–March snowfall. Middle panel: Map of correlation significance between September–October Sea Surface Temperature (SST) and Anchorage November–March snowfall. Right panel: Scatter plot (Anchorage Nov–Mar snowfall vs. Sep–Oct 500 mb height), together with 2017–2018 forecast.
SAMPLE FORECAST NO. 3: WINTER TEMPERATURES

The nascent La Niña declared by NOAA on November 9 may lead to cooler temperatures across the Great Land. La Niñas often, but not always, tilt the climate system toward colder than normal conditions in Alaska, especially in the southern portions. The current forecast for December–February from the NOAA’s Climate Prediction Center (http://www.cpc.ncep.noaa.gov/products/forecasts/) calls for cooler temperatures across the eastern mainland and all of Southeast. Western Alaska and the North Slope are forecast to be warmer than normal. How does this compare with a seasonal forecast of a single statewide temperature using analog correlations?

Figure 8 shows the correlation between four different atmospheric variables, as well as sea surface temperature (SST), versus December–February statewide average temperatures. The September–October variables most closely related to oceanic warmth (2-meter temperatures, 925 mb temperatures, and SST) were strongly correlated with statewide December–February temperatures. The areas of highest correlations (red shadings) extend across a wide swath of the central North Pacific Ocean.

This makes sense from an atmospheric science point of view since oceanic warmth only shows changes over a period of months (due to thermal inertia). This oceanic warmth affects air mass characteristics and atmospheric circulation.

Figure 9 shows the relationship between a weighted combination of September–October North Pacific atmosphere-ocean variables and December–February Alaska statewide temperatures. The weighting factors are based on the predictive skill of individual variables (sea level pressure, air temperatures at 2 meters and 925 mb, sea surface temperature). The results indicate moderate predictability of December–February temperatures if one knows September–October atmospheric/oceanic conditions (see left panel of Figure 9). Based on the September–October 2017 pattern match with all other years, the top five match years (2010, 1986, 1963, 2009, and 1969) had an average December–February temperature of 6.8°F (five leftmost dots on right panel in Figure 9). By comparison, the 1981–2010 average temperature was 5.7°F. This seasonal forecast is therefore 1.1°F above normal for the December–February statewide average temperature.

![Figure 8](image_url1)

Figure 8. Correlation matrix between September–October atmospheric/oceanic conditions and December–February statewide Alaska temperatures. Color scale denotes statistical significance of correlations, with

![Figure 9](image_url2)

Figure 9. Left panel: Relationship between the central North Pacific variables and Alaska December–February temperatures (left). Right panel: Yearly departures from normal December–February temperatures vs. closeness of match between 2017’s September–October North Pacific variables. Closeness of match in right panel is expressed as departure from average difference metric (Root Mean Square Error).
SAMPLE FORECAST NO. 4: BERING SEA ICE EXTENT

Communities along the Bering Sea coast are dependent on fuel and supply shipments that are restricted when sea ice is present. Having a heads-up on sea ice conditions months in advance allows for important shipping decisions to be made for deliveries. Sea ice in the Bering Sea is different than sea ice in the central Arctic. Bering Sea ice is all first-year and is much more sensitive to oceanic and atmospheric conditions than pack ice in the Arctic Ocean.

Bering Sea ice typically peaks between the end of March and the end of April. In some years, the ice surrounds St. Paul Island. Since St. Paul is a major port for the Bering Sea crabbing fleet, the seasonal sea ice maximum is of great interest to the residents of St. Paul and affects many aspects of the fishing industry in the spring months.

Conditions in the Bering Sea during the early and middle portions of the winter are enormously important to determining the extent of sea ice late in the spring. Ice does not form in a vacuum, it requires cold sea surface temperatures and cold air temperatures. Without both of these, it is difficult or impossible for sea ice to form.

The 925 mb temperatures in the Bering Sea during the core winter months (December–February) show a strong negative correlation with the maximum extent of sea ice in the spring. Figure 10 graphically shows this relationship. Purple colors on the left panel indicate a strong inverse relationship; i.e., low 925 mb temperatures correlate with high sea ice. This is not at all surprising since low air temperatures help to cool the ocean and directly form sea ice. The low air temperatures in the winter months can also be a manifestation of ice that may have formed in those months.

The scatter plot on the right side of Figure 10 shows the very strong relationship between December–February temperatures at 925 mb in the Bering Sea with the maximum ice extent. The correlation of -0.748 is exceptionally strong. It is apparent from Figure 10 that a prediction of December–February temperatures in the Bering Sea would provide key information on the maximum Bering Sea ice extent to be expected in a particular year. Using the analog tool with October’s ocean/atmosphere fields over the North Pacific (0°–60°N, 150°E–95°W) as predictors, we find that the best analog years for predicted December–February 2017–18 air temperatures at 925 mb in the Bering Sea are 2010, 1986, 2016, 2007, and 2011. Averaged over these years, the maximum Bering Sea ice extent was 664,000 km², which is approximately 40,000 km² below the average of 704,000 km² for the 1981–2010 climatological reference period. The predicted maximum extent is therefore about 6% below the average for 1981–2010.

CONCLUSION

This article highlights several areas where relationships exist between atmospheric and oceanic conditions in one portion of the year and climate conditions in the Alaska region several months later. Whether it is sea ice, breakup, snowfall, or winter temperatures, precursor conditions are useful for estimating seasonal conditions based on statistical relationships. Statistical relationships emerged in our experiments with forecasts for the variables reported here, although such relationships did not emerge in our attempts to forecast other user-desired variables (e.g., fall cloud cover, freezing rain events, Interior snowfall). In some cases, the predictive effort was limited by the availability of historical data. In other cases, the connections to antecedent atmospheric and ocean variables may simply be too weak to make seasonable forecasts viable by the analog method.

The Experimental Arctic Prediction Initiative (EAPI) provides a new opportunity to demonstrate excellence and expertise in Arctic systems and prediction from within the University of Alaska Fairbanks research institutes. The EAPI is also an opportunity to provide forecasts with utility for a broad range of stakeholders. It is crucial to build as many bridges as possible with the residents of Alaska and the Arctic, as well as developing new relationships with those that are impacted by what happens in the Arctic. IARC and ACCAP welcome input and feedback from users as they pursue these opportunities in the coming months. The analog tool is available for use at http://data.61n150w.com/analogs.php. Comments and suggestions can be sent to Brian Brettschneider (bbrettschneider@outlook.com) or Tina Buxbaum (tmbuxbaum@alaska.edu).

SEA ICE: SUMMER AND AUTUMN, 2017

John Walsh, Chief Scientist, International Arctic Research Center, UAF

Sea ice in Alaska’s northern waters reached its minimum extent for 2017 on September 25. The date of the minimum was nearly 2 weeks later than the average for the post-1979 period. According to the satellite passive microwave data of the National Snow and Ice Data Center, the date of the Chukchi/Beaufort sea ice minimum has ranged from August 14 in 1980 to October 2 in 1991. Only 2012 had distinctly less ice in the Chukchi/Beaufort seas at the time of the minimum, although 2016 and 2007 had minimum extents similar to 2017 (Figure 11). There are no other examples of such a retreat in the pre-satellite decades back to 1850 (based on the Alaska Historical Sea Ice Atlas, http://seaiceatlas.snap.uaf.edu/).

Figure 12 shows the coverage of sea ice in mid-September at the approximate time of the ice minimum. The extensive areas of open water in the Chukchi and Beaufort seas during late summer followed an unusually early ice retreat in the spring, as described in the previous issue of the Alaska Climate Dispatch. Through much of the summer, the Chukchi/Beaufort sea ice was at or near the lowest on record, as indicated by the mid-August portion of Figure 11. According to a report by the Alaska Dispatch News, the absence of sea ice near Alaska’s northwest coast during the early summer forced walruses to the shore of the Chukchi Sea earlier than in any other year on record. The extensive open water also contributed to unusually warm air temperatures over the Beaufort and Chukchi Seas and in northern Alaska through the summer and into autumn. At Utqiagvik (Barrow), for example, temperatures were warmer than the 1981–2010 "normal" monthly temperatures by 6.2°F in July, 2.2°F in August, 4.2°F in September, and 8.8°F in October.

Figure 11. Sea ice extent (km²) in the Chukchi and Beaufort Seas from mid-August through early October of each year from 2007 through 2017. Thick line denotes 2017. Colored circles show the ice extents on the date of each year’s minimum ice extent in the Chukchi/Beaufort Seas. Figure provided by R. Thoman/National Weather Service Alaska Region Environmental and Scientific Services Division. Data are from the Multisensor Analyzed Sea Ice Extent (MASIE) product of the National Snow and Ice Data Center.

Figure 12. Sea ice concentrations on September 25, 2017, the approximate date of the 2017 minimum sea ice extent in the Chukchi/Beaufort Seas. Ice concentrations (percentage of surface covered by ice) are shown by the color bar to the right of the map. Source: National Snow and Ice Data Center, http://nsidc.org/arcticseainews/2017/09/.
With the large expanse of open water during the warm season, substantial amounts of solar radiation are absorbed at the ocean surface and stored in the upper water column. The slow release of this heat during autumn delays the freeze-up. Figure 13 shows that large amounts of open water remained in the Chukchi Sea even after the first week of November. In past decades (pre-2007), the Chukchi Sea was nearly completely frozen by this time of year. Figure 13 also shows that the freeze-up of the Chukchi and Beaufort seas during autumn 2017 followed a double-advance pattern characteristic of recent low-ice years: the ice edge advances southward from the main pack, while ice also forms along the coast and advances offshore. In early November, ice had formed along the entire length of the Beaufort coast and parts of the Chukchi coast, including the waters of Kotzebue Sound. Ice was also forming along parts of the Russian coastline of the Chukchi Sea.

On the pan-Arctic scale, the minimum sea ice extent in September was the fourth-lowest on record. Figure 14 shows that the pan-Arctic extent was on track to be the second- or third-lowest on record through early August, when cold temperatures slowed the retreat. The minimum pan-Arctic extent occurred on September 13, about 12 days before the minimum in the Chukchi/Beaufort seas. The 2017 pan-Arctic minimum was slightly greater than the 2016 minimum, and the recovery of the ice in October and early November was also faster than in 2016. The fact that the minimum in 2017 was greater than in several recent years is consistent with absence of a statistically significant trend in September pan-Arctic sea ice over the period 2007–2017. Decadal variations of trends in a particular season are manifestations of internal variability and consistent with climate model simulations, which indicate that decadal trends in the present climate can be expected to vary widely from weakly positive to strongly negative.
CLIMATE REVIEW
MAY–OCTOBER 2017

By Rick Thoman, National Weather Service, Alaska Region

MAY

May was mild, though not excessively so, over most of Alaska. The National Centers for Environmental Information (NCEI) ranked 2017 among the warmest 20% of Mays since 1925 on the statewide level, but it was still the coolest May in Alaska since 2013. Precipitation rebounded sharply from the dry April of 2017, with this May being tied for 10th wettest.

Break-up of ice on the major rivers in Alaska was significantly later than the past several springs but near the average date for recent decades. The ice went out on the Yukon River at Eagle May 4. On the Tanana River at Nenana, the ice went out at noon on May 1, while on the Kuskokwim River at Bethel break-up was May 6. The North Slope was a different story, as river ice broke unusually early, and rivers were largely open and flowing by Memorial Day.

May brought significant weather to parts of the state. On the 21st a storm brought very heavy rains to the Panhandle. Most notably, Little Port Walter, on the southeast coast of Baranof Island, recorded a whopping 8.52” of rain, the highest daily rainfall in May of record there. May 25 and 26 were unusually cold and even snowy over parts of Alaska. Heavy snow fell at Utqiagvik (Barrow) from the afternoon on May 25 into the early morning hours of May 26. The snowfall totaled 5.6”, making this the greatest 24-hour snowfall of record for May (Figure 15).

In Denali National Park, the Memorial Day Weekend got off to a snowy start. Most of the park received accumulating snow on the morning of May 25, with 6” accumulating at Eielson Visitors Center. Additional snow fell during the early morning of May 26 in the western part of the park, with 3” of new snow at Eielson. The snow extended to the southeast, where several inches accumulated over Thompson Pass, on the Richardson Highway above Valdez. Wet snow fell briefly at Fairbanks on the morning of the 26th, making this the latest snowfall there since June 4, 2006. The cool weather extended far to the south: a record low temperature was set at Kodiak Airport on May 26, when the thermometer dipped to 32°F, the latest in the season freezing temperature since 1977.

With the cool weather late in the month, wildfire activity was very limited during May, with only about 250 acres burned. This is the lowest May total since 2012, due to some well timed rains and very limited thunderstorm activity late in the month.

JUNE

June was a comparatively warm month over a large part of Alaska. NCEI analysis put this month at 2.2°F warmer than the 20th century average, putting 2017 in the warmest 15% of Junes in the last 93 years. However, both the North Slope and Southeast Alaska were cooler than normal. As often happens in the summer, rainfall varied widely over the state. Much of western Alaska was drier than normal, but the central Interior was significantly wetter than average. Southcentral was a real mixed bag, while much of Southeast was significantly wetter than normal.
Chilly weather lingered on the North Slope during the first week of the month. The temperature at Utqiaġvik (Barrow) did not get above freezing until June 8, and the high temperature June 6 of 28°F is the lowest high temperature so late in the season since 1988. Over western Alaska, it was a different story. The average temperature at Nome for the week of June 4–10 of 61.8°F was easily the warmest week of record so early in the summer in the Gold Rush City. The eastern Interior and Copper River Basin had a short but notable spell of hot weather early in the month. On June 9, Fairbanks reported a high temperature of 90°F, the second earliest occurrence of record of a temperature of 90°F or higher, and the high of 89°F at Northway on the same day was the warmest of record so early in the summer. At Gulkana, the high of 87°F was the highest temperature so early in the summer since 1957. In most places this turned out to be the highest temperature of the summer.

Southeast Alaska was persistently damp: June in Juneau typically has the fewest number of days with measurable precipitation of any month in the year. However, this year there were 23 days with measurable precipitation, which ties with 1963 as the third greatest for any June.

Wildfire activity picked up in June, though overall activity still less than usual. The Alaska Interagency Coordination Center reported 130 new fires in June, with a total of 176,000 acres had burned by the end of the month. This is 73% of median acreage burned through the end of June. Significant fires requiring manned response included the North Robertson Fire, west of Tok, and the Bell Creek Fire that came within two miles of the Kuskokwim River community of Crooked Creek. The small MP 308.5 Richardson Highway fire broke out near Birch Lake on the evening of June 9 and was quickly brought under control, but not before closing the highway for several hours. On the Kenai Peninsula, the East Fork Fire, south of the Sterling Highway, sent smoke into the greater Anchorage area on the morning of the 17th.

July

July was another very mild month for Alaska as a whole. NCEI ranked 2017 as the third warmest July in Alaska since 1925, behind only 1993 and 2004. The warmth in central Interior and North Slope was especially notable. Several long-term climate stations in the central Interior, including McGrath (63.7°F), Tanana (65.8°F) and Bettles (64.4°F) all recorded not only the warmest July of record but also the warmest calendar month of record. At Utqiaġvik (Barrow), the average temperature of 46.0°F made this the warmest July of record.

Rainfall was a real “mixed-bag” around the state during July. St. Paul Island measured 3.83” of rain during the month, making this the wettest July in more than half a century. In contrast both King Salmon and Cold Bay were significantly drier than average. Southeast Alaska was generally wetter than normal. The Interior saw a big range in precipitation, as is common in the summer. One particularly notable thunderstorm occurred in the Fairbanks area on the 3rd, when some places north of the city recorded upwards of 2” of rain in an hour from a slow-moving thunderstorm. Southeast and Southcentral Alaska did not share in the general warmth and had a somewhat gloomy July. Overall temperatures were mostly near to a bit below normal in this region, along with near to above normal rainfall.

July was an active month for wildfire, with more than 440,000 acres burned statewide during the month. The Campbell River and White Mountain Creek fires, both in the Arctic National Wildfire Refuge of northeast Alaska, were the two largest fires in the state (Figure 16). Not coincidently, the northeast Interior had significantly below normal rainfall during this time (see sidebar page 12).
August was a more typical month across Alaska than July. Temperatures overall averaged above normal in most areas, though not dramatically so. In contrast, most of Southeast was significantly cooler than normal. Rainfall was above normal over much of the state, though there was a small area in the Alaska Range and Copper River Basin that were drier than normal, as was parts of western Alaska. For the state as a whole, NCEI ranked this as the 8th wettest August since 1925.

Perhaps the most outstanding weather event of August was the hot day in Southeast on the 5th (Figure 17). At the northern end of the Panhandle, the temperature soared to 93°F at the Skagway Airport before a sea breeze cooled the temperature. This is the highest temperature of record in the Skagway area. At the other end of the Panhandle, the high of 86°F at Annette was the highest temperature so late in the summer since 1990.

Over the 2017 wildfire season, 353 fires burned just over 650,000 acres in the state. This is about 30% more acreage burned than 2016 but is still very much a “near normal” season. Humans started 200 fires that consumed 6,894 acres, while lightning ignited 153 fires that burned a total of 646,010 acres. In 2017, the typical acreage burned in Alaska was reflected by a fairly normal trend across the boreal region in the Buildup Index (BUI). BUI is a metric used by fire managers to estimate fire danger, based on temperature, precipitation, and relative humidity. Figure 18 shows that the BUI across Interior Alaska in 2017 (purple line) essentially paralleled the climatological average (grey line). However, it is noteworthy to reflect on how disproportionately the impact of a “normal” season can fall on specific areas in a landscape this large. For instance, while there were no significant peaks in the overall trend, local conditions in the Upper Yukon area in northeast Alaska were significantly warmer and drier. Consistent with the Upper Yukon BUI trend (dashed purple line), the season was extended and fairly severe in that large corner of the state, with periods of high fire danger (BUI ≥ 80) from mid-June into mid-August. More than 410,000 acres (63% of the 2017 Alaska total) were burned in the Upper Yukon area during this period (AICC 2017).
SEPTEMBER

September was a mild month overall across Alaska. The NCEI reported that the average temperature was 2.0°F above the 20th century normal, making this the mildest September since 2010. Precipitation statewide also averaged above normal, though not nearly as much as August. As is often the case, the highest precipitation totals for the month occurred in Prince William Sound, with several sea level locations exceeding two feet of rain during September. However, the largest departures as percentage of normal occurred over the western Interior and central North Slope, where twice or more of normal precipitation fell. Significant snowfall was largely confined to the high elevations of the Brooks Range during September.

The first week of the month brought very warm weather to much of the state. This was especially the case in southern Southeast, where temperatures topped out in the 80s in many locations on the 5th and 6th. High temperatures of 84°F at both Beaver Falls and Hyder came within 1° of the highest reliable temperature of record in Alaska for the month of September. At Ketchikan, the high of 80°F on September 5 is the highest temperature so late in the season since 1937. The low temperature at Anchorage International Airport on September 13 was 55°F, the warmest low temperature so late in the season in Anchorage. Additionally, Anchorage Airport did not record a freezing temperature at all in September, the first time that has happened in more than a decade.

Heavy rains returned to Southeast Alaska in early September, leading to a second series of damaging mudslides in less than 2 weeks in several locations, including Sitka and Skagway. Probably the highest impact weather in the state in September was a slow-moving storm that produced a long period of strong west to southwest winds at Utqiagvik (Barrow) September 28–30 (Figure 20). The long fetch over the ice-free Chukchi Sea caused significant coastal erosion and flooding. The average wind speed at the Utqiagvik airport on September 29 was 29 mph with a peak gust of 47 mph. North Slope Borough officials reported that about 3,700 feet of a beach road were destroyed, preventing access to a lagoon area that is used as a backup site to land whales. The community’s freshwater supply was threatened, and the bluff at the historic Barrow town site suffered significant erosion, threatening a number of homes. Preliminary damage estimates were placed at $10,000,000, and Alaska’s Governor declared a state disaster because of the impacts.
OCTOBER

October temperatures averaged above normal over almost all areas except for a few areas in Southeast. For the state as a whole, this ranked as the 12th warmest October since 1925. Total precipitation was also generally above average, and a large swath of mainland Alaska received twice or more of normal. Continuing the trend of the past 15 years, the average temperature in October at Utqiaġvik (Barrow) was 24.1°F, making this the 8th warmest October there in the past 98 years. Because of the decline of autumn sea ice in recent years, seven of the ten warmest Octobers in Utqiaġvik have occurred since 2003.

The mild temperatures slowed freeze-up of mainland Alaska rivers, and snowfall was less than normal at many lower elevations south of the Yukon River. Anchorage saw only half an inch of snow during the month, and Fairbank’s 5.2” of snow made this the 5th consecutive October with significantly below normal snowfall. Fairbanks was drenched with summer-like rainfall from late on October 9 into the evening of October 10. Unlike summer, the precipitation started as snow before changing to sustained moderate rain. The Fairbanks Airport recorded a 24-hour total of 1.54” of rain and melted snow, by far the highest 24-hour total of record in October. In the Interior north of the Yukon River, more of the precipitation fell as snow. Bettles measured 21.9” of snow, the 4th highest October snowfall total in the past 73 years.

The weakening remnants of Typhoon Lan at least indirectly brought a wide variety of impactful weather to the state late in the month. A moist storm spawned by the remnants of the typhoon brought heavy snow to parts of the middle and upper Susitna Valley on October 24 and 25. Snowfall accumulations of 8–10” were reported in the Skwentna and Talkeetna areas before the snow changed to rain. Along the Parks Highway from near Hurricane Gulch to Broad Pass, the Alaska Department of Transportation reported up to 40” of new snow, causing major delays on the main road connection between Anchorage and Fairbanks. Daily record high temperatures were set at the Anchorage International Airport on October 26 and 27, including a high of 51°F on October 26. The warmth was accompanied by damaging winds in parts of Anchorage on October 26. Especially hard hit were the hillside and south Anchorage, where there was considerable property damage, and about 3000 people were without power at some time during the storm. The Juneau area was hit by flooding and mudslides October 26–27 as heavy rains fell across northern Southeast. Rainfall totals for the two days included 3.37” at the Juneau Airport, with amounts in excess of 4” in the Mendenhall Valley and in downtown Juneau. Homes and business along Jordan Avenue and Cascade Street flooded as Jordan Creek was above flood stage for almost 24 hours October 27–28 (Figure 21). A mudslide closed Calhoun Avenue in downtown Juneau near the Governor’s Mansion, and there were additional minor debris flows on Franklin Street.

There was a short but sharp cold spell during the latter half of the month. Cold Bay reported a low temperature of 19°F on the 24th, the lowest temperature there so early in the season. On the 23rd Iliamna picked up about 8–10” of snow in less than 12 hours, and Anchorage received its only measurable snow of the month on the 21st and 22nd.

Figure 21. Juneau resident Amy Jenson walks through a flooded parking lot at the Jordan Creek Condominiums on October 27. Photo courtesy Alex McCarthy/Juneau Empire.

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