Kuigmek
One who watches river
April 2011
A newsletter for Alaska river and ice observers

Please Note....

RFC will be staffed weekends beginning April 23-24

Meet Celine Van Breukelen

A Note About Breakup Information
Spring Breakup and Ice Jam Flooding in Alaska

Welcome Back Dave!

Weather for the Winter of 2010 - 2011 and the Forecast…

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Spring Breakup Outlook for Alaska

Alaska - Pacific
River Forecast Center
6930 Sand Lake Road
Anchorage, Alaska 99502-1845
http://aprfc.arh.noaa.gov
907-266-5160
1-800-847-1739

Observers: Don't forget to mail in your 2011 Breakup Forms

Meet Celine Van Breukelen...

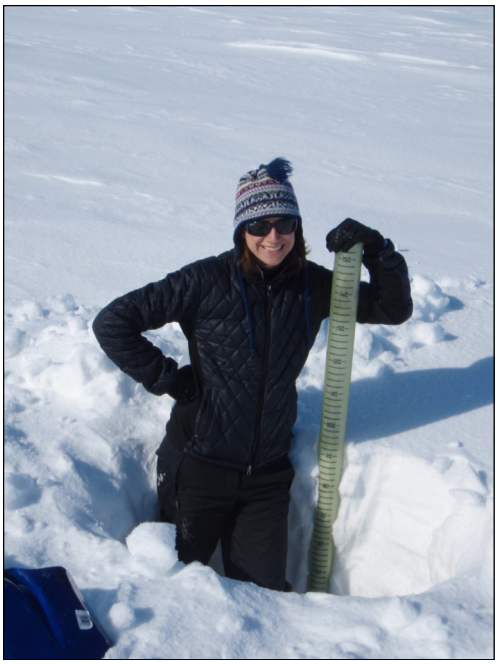
We would like to introduce you to our newest hydrologist, Celine Van Breukelen. Celine is a native Ohioan. Her love of rivers and water originated from the four years she spent rowing on Ohio State's crew team ("Go Bucks!"). After graduating with a B.S. in Industrial and Systems Engineering, she moved to Fairbanks to pursue a M.S. in Civil Engineering from the University of Alaska Fairbanks (UAF). At UAF, Celine worked at the Water and Environmental Research Center (WERC) where she used satellite imagery to analyze lake ice on the North Slope. The favorite part of working towards her Masters degree was the time she spent in the field collecting snow depth, water chemistry, and river gauge data.

Celine is an avid outdoors person, both in the summer and the winter. "I really like backcountry skiing, ice climbing, backpacking and mountain biking." She is learning how to skate ski, and is hoping to plan some sea kayaking trips this summer.

Celine says, "I really enjoy food. I love to cook, and I plan to try my hand at gardening this summer."

She adds, "I am excited about joining the RFC and look forward to working with you in the future!"

Welcome aboard Celine!



Celine takes a snow survey somewhere on the North Slope

A Note About Breakup Information:

We request your assistance in obtaining information on breakup on rivers and lakes in your area for the 2011 season. We would appreciate it if you would complete the River and Lake Breakup Information Form to the best of your knowledge and return the form to us. If you have any comments, please include them in the remarks area. The information we receive from you helps contribute to a more complete record of breakup data for Alaska and is greatly appreciated.

Use the link below to view the progress of breakup on rivers across Alaska. The breakup map will be updated as information becomes available.

http://aprfc.arh.noaa.gov/data/maps/brkup_map.html

Additional Breakup links:

View the Spring Breakup Outlook,
Spring Flood Potential Map for Alaska,
and more:

http://aprfc.arh.noaa.gov/products/productmenu.php

Spring Breakup and Ice Jam Flooding in Alaska
by Scott Lindsey

As the days grow longer and our thoughts turn to summer activities, two questions persist in the minds of those who live on or near Alaska's rivers: When will breakup happen, and will it flood this year? Breakup in much of Southcentral and Southeast Alaska means melting snow, wet sloppy conditions, dirty roads, dirty cars, and wondering when the last snow will disappear from the yard. But for residents of the many villages and towns along the large interior rivers, such as the Yukon and the Kuskokwim, breakup means no more snow machine trips to the next village, no boating until the ice has passed downstream, and the potential for minor to devastating flooding if the ice stops running downstream of the village. Predicting when breakup will occur and the likelihood of damaging flooding is a very difficult task, but there are some indicators that can help us understand what might happen and when.

Hydrologists who study the breakup process know that several factors combine to determine what the coming breakup season holds. The first is to understand how thick the ice grew over the winter, and how far it extends across the river bed. If the river level in the fall was very low, then as the water rises in the spring, the ice sheets may be narrower than the channel and will be able to move and twist and break into smaller pieces, reducing the potential for ice jam flooding. However, if the river level was high at freezeup, that ice sheet may cover most of the channel and even after the river rises in the spring, that sheet of ice will not have much opportunity to move and break up into smaller pieces, raising the possibility of ice jams and flooding. The ice thickness affects flood potential in the same manner, with thin ice being less likely to cause damaging floods and thick ice being more likely to jam and cause flooding.

Another important factor that determines the likelihood of breakup floods is the amount of water stored as snow in the mountains and lowlands that drain into those large rivers. When a large snowpack persists into April, that snow is subject to very rapid melting if the temperatures suddenly warm significantly in late April and early May. Temperatures in the 60s and 70s can result in the snowpack over an entire basin ripening and discharging tremendous volumes of water into the river in a very short time - as occurred in the spring of 2009. Fresh snow in April also increases the albedo or reflectivity of the snowpack, causing a higher percentage of solar radiation to be reflected back into the atmosphere rather than be absorbed by the snowpack...potentially slowing or delaying the snowmelt.

The weather from April 1 to May 15 is often the most important element in determining the timing and severity of breakup. A cold April followed by a rapid warmup to seasonal May temperatures will preserve the snowpack for a rapid melt (even when the snow water equivalent is below normal), and will also keep the ice cover from deteriorating. A gradual warmup from early April through the beginning of summer will slowly bleed the snowpack away and weaken the river ice, and even a big snowpack with thick ice may not cause any flooding under this scenario. The first case creates a surge of meltwater traveling from the upstream reaches downstream and pushing a growing wall of ice and water as it goes. The ice sheets are resistant to breaking into small pieces and tend to jam up at sharp bends and shallow areas of the river, causing upstream areas to flood as the water flow is sharply restricted. This type of breakup is called a Mechanical or Dynamic breakup. The second scenario generally manifests itself with the ice moving or disintegrating at a number of locations along the river (such as where a larger tributary enter the river) at about the same time. The ice sheets in this case have deteriorated and thinned, and even a modest amount of meltwater entering the river is enough to break up those sheets into smaller pans and chunks that move more easily around the sharp bends and past the shallow areas of the river. This type of breakup is referred to as a Thermal breakup and may also be called a "mush-out" as long reaches of the river open up quickly as the ice just

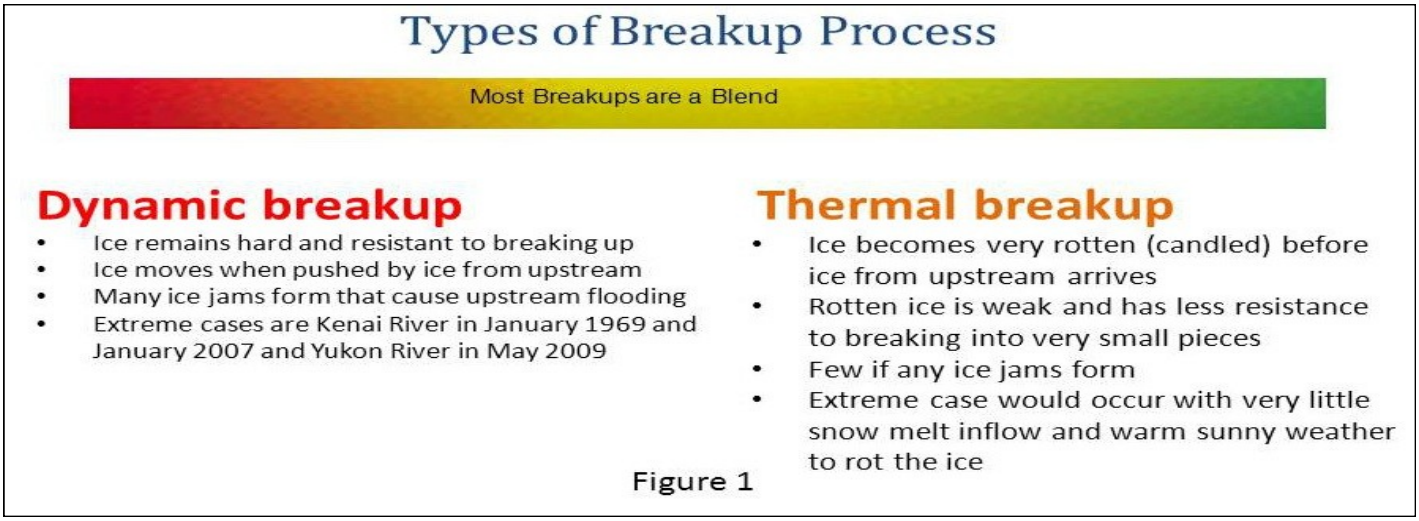


Figure 1

melts in place (Figure 1).

The 2009 and 2010 breakups illustrate how some of these factors can lead to very different breakup scenarios. For both years there were many places reporting ice thicknesses that were near normal to thicker than normal. The ice at Eagle in 2009 was 138% of normal, compared to 92% of normal in 2010 (Figure 2). Snow water equivalent was significantly higher across the state in 2009 compared both to normal and to 2010 (Figure 3). Finally, the cool spring followed by a rapid warm-up in 2009 led to a very dynamic breakup which caused major to record flooding in numerous locations along the interior rivers. The slow, gradual warm-up in 2010, combined with the low snowpack, caused almost no flooding.

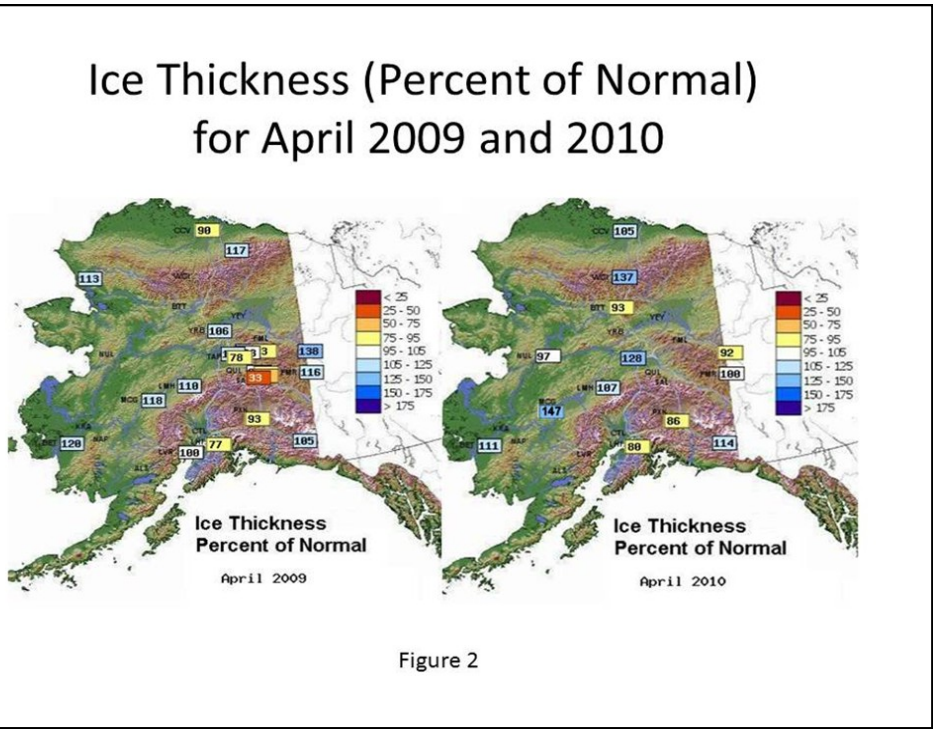


Figure 2

For 2011, it is too early to determine if severe flooding will be an issue since there are still two months remaining before breakup, but several clues point towards the possibility of moderate to severe flooding this spring. On the Kuskokwim River, a rare early winter rainfall event caused breakup to begin in November after the river had been frozen for a month. The river rose considerably and several long stretches of river became ice free as chunks and pans of ice moved down a good length of the river. The river then refroze at a higher level than it had been previously. The stretches where the jumbled breakup ice refroze may end up causing ice jams this spring as the normal fracture process may not occur when the temperatures warm. Much of northwest Alaska and the northern interior has received significantly higher than normal snowfall amounts. The Gakona River

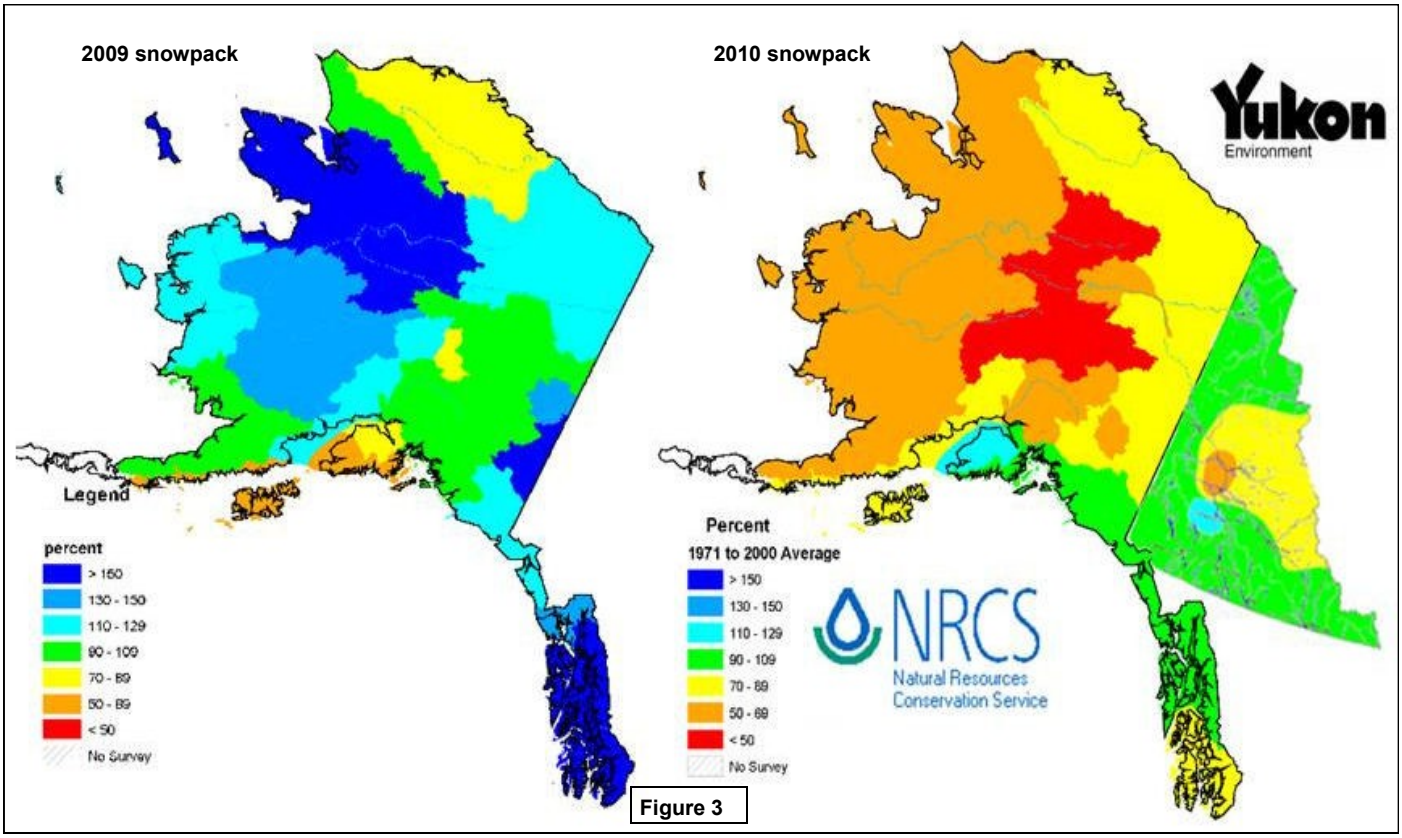
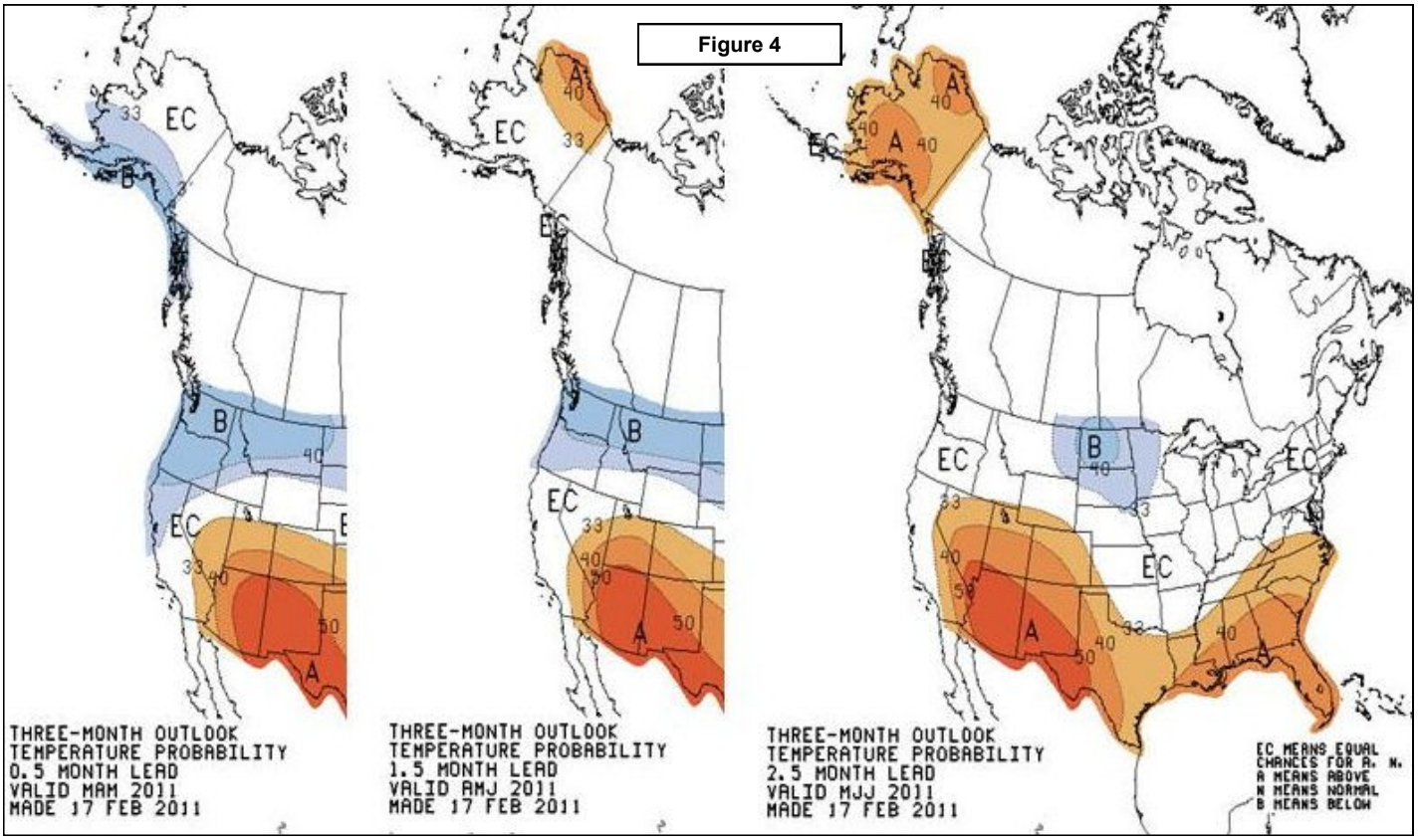


Figure 3

Figure 4



at Gakona Junction has a large build-up of Aufeis in the river channel, which might lead to local flooding. Finally, the three month climate outlooks for Fairbanks call for equal chances of temperatures being above, near, or below normal for the period of March through June. The May through July outlook calls for a 75% chance of near or above normal temperatures (Figure 4). If the spring temperatures remain cool during March and April before warming up considerably, the chances of ice jam flooding will rise accordingly Currently, the flood potential from snowmelt and ice jams for breakup this spring is rated as above average. This means that communities that only flood in years with extreme breakups have a higher chance of flooding this year. Communities that experience minor flooding on a regular basis have a higher chance of experiencing moderate or major flooding. As snow depth and ice thickness data is gathered in early April, and the climate outlooks for April and May become more clear, the forecast for the severity and timing of breakup will come into better focus.

Dave takes a snow survey at Hatcher Pass

Welcome Back Dave!

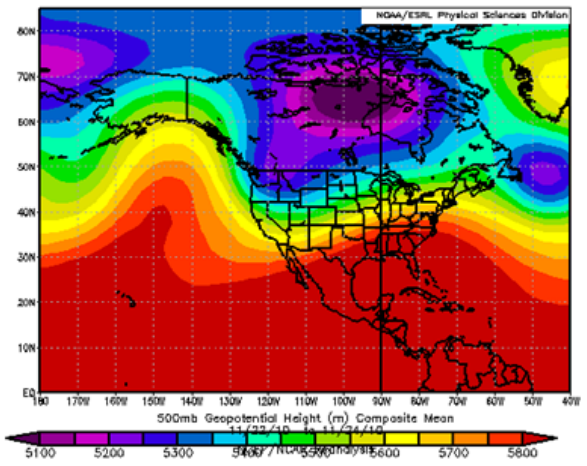
Dave Streubel left the Alaska Pacific River Forecast Center in August 2008. He accepted a Hydrologist position at the National Weather Service (NWS) Western Region Headquarters in Salt Lake City, Utah. "My last two and a half years were spent working on projects that supported hydrologic operations in Western Region." One of those projects involved working with the United States Geological Survey southern California debris flow program to improve NWS Weather Forecast Office's ability to forecast flash floods and debris flows in recent wildfire burn areas.

Dave returns to us in early April as the Development and Operations Hydrologist (DOH). The DOH position is part of the RFC management team, and among other managerial functions, directs the implementation and operational support for hydrologic forecasting technology used in the RFC. The DOH is also the point of contact for hydrologic research publications and other scientific developments.

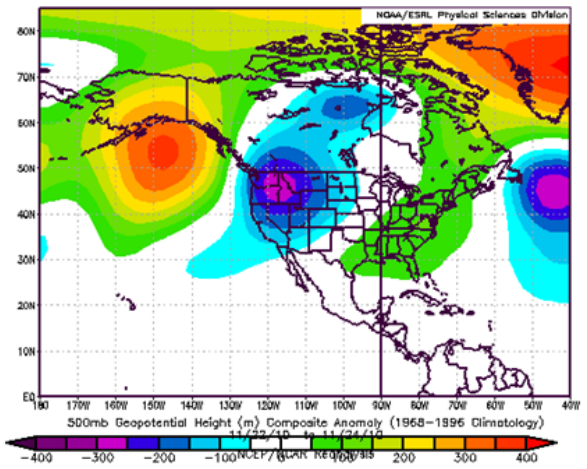
Please join us in giving Dave a warm welcome back to Alaska!

Weather for the Winter of 2010 - 2011 and the Forecast...
by Eric Holloway

The weather for the winter of 2010 through early 2011 has been a mixture of ups and downs to say the very least. I know that this sounds like any other winter but what I think stands out in everybody's mind this winter season has to be the significant warm up and freezing rain event during the month of November. An anomalously high ridge of high pressure formed over the pacific, creating a strong flow that was from the south or southwest. Below are graphs of the 500mb heights (which can imply flow aloft) and the anomaly, that indicates heights during that period was abnormally high by as much as 350 meters for Nov. 22 - 24, 2010. A weather pattern like this was enough to begin a breakup scenario on the Kuskokwim River.



Mean geopotential 500mb heights for 11/22/10 to 11/24/10



Anomaly of geopotential 500mb heights for 11/22/10 to 11/24/10

Other weather highlights from this winter include the high winds in the middle of January across south central Alaska, the big snow in the Interior and North Slope in late February, and the below normal temperatures and above normal snowfall over the southeast in February. In the broader picture of this winter's weather, November registered well above normal temperatures for the Arctic, Interior, South Central and northern Southeast Alaska, with far above normal precipitation in these areas as well. During December statewide temperatures were generally much colder than normal, especially across the interior. The exception was across the North Slope, where slightly above normal temperatures were reported. As a whole, precipitation was down by as much as half the normal amount, with Northwest Alaska posting the only positive precipitation anomaly. Temperatures turned above normal for January across Alaska with the highest deviations occurring in the Interior and west coast. January precipitation was above normal along the west coast and southeast portions of the state, with well below normal conditions for the Interior and south central.

What does all this mean? Well a wise man, once told me, "to understand the future, we must understand the past." As many of you may very well know, we have been under the influence of a La Nina pattern since the middle of last summer. As you can see from the following table of the three month averages of sea surface temperatures on the equator have turned less than 0.5, the definition of La Nina, during June, July, and August and moderate La Nina, values of between -1.0 and -1.5, have been with us during the fall and winter.

	2010	2011
Dec, Jan, Feb	1.7	-1.3
Jan, Feb, Mar	1.5	-1.2
Feb, Mar, Apr	1.2	
Mar, Apr, May	0.8	
Apr, May, Jun	0.3	
May, Jun, Jul	-0.2	
Jun, Jul, Aug	-0.6	
Jul, Aug, Sep	-1.0	
Aug, Sep, Oct	-1.3	
Sep, Oct, Nov	-1.4	
Oct, Nov, Dec	-1.4	
Nov, Dec, Jan	-1.4	

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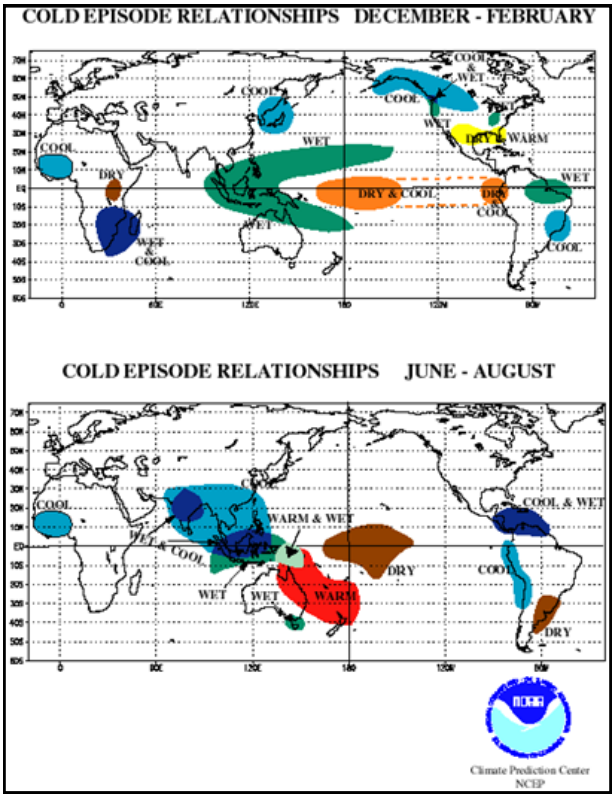
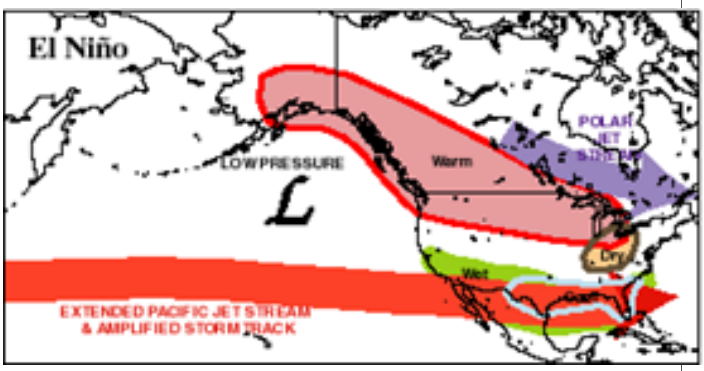
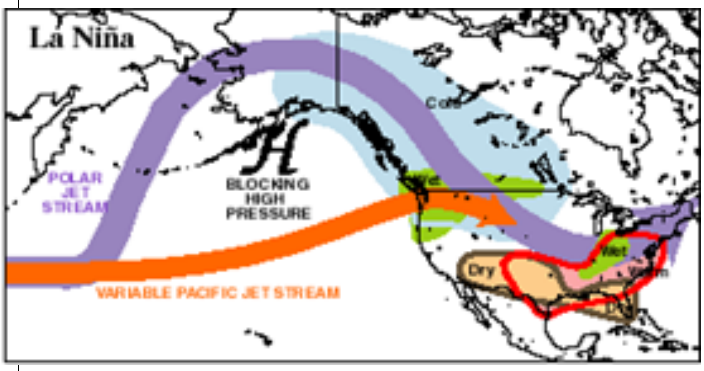
A classic La Nina pattern can affect the atmospheric flow across the eastern North Pacific, as shown in the next two diagrams.







A local forecaster with the National Weather Service, John Papineau, attempted to further delineate the effects of La Nina for Alaska. His findings include:

- 69% more days of blocking (high pressure over the Bering Strait) occurred during La Nina winters when compared with El Nino winters (this has certainly been the case for much of February and March, and to a lesser extent in January). The key here is a blocking ridge over the Bering Sea and Western AK would favor cold air advection from the Russian Arctic over the state.

- Temperatures in Alaska were below normal, with modest correlation (seems to hold true for much of February and March).

- Winters produce abnormally cool temps across the entire state. The amplitude of temperature anomaly was the largest in the interior, where oceanic influences is minimal.

What does the future hold? Folks at the Climate Prediction Center (CPC) certainly take into account that the current La Nina episode looks to be weakening across the equatorial Pacific Ocean. The 90 day outlook for the months of April, May and June indicate an increased probability of above normal temperatures over the northern third of the state, while the rest of the state has an equal chance of below, normal, or above normal temperatures. But keep in mind that La Nina is only one contributor to weather patterns in Alaska, and other factors - like which state the Pacific Decadal Oscillation (PDO) is in, the specific pattern of the Pacific North American pattern (which tends to affect the polar jet stream), and local effects, including radiative cooling and local winds - all play a role in the recorded weather and forecast probability. This short article only focuses on the climatological aspects of this past winter, and the current and forecast state of La Nina, which may not explain the complete weather picture.

Forecast from CPC:

http://www.cpc.ncep.noaa.gov/index.php

Find us on Facebook!

We are at: US National Weather Service Alaska

You can get weather and flooding updates, as well as post on our wall. Any breakup observations, pictures, or comments would be greatly appreciated.

Spring Breakup Outlook for Alaska

The flood potential from snowmelt and ice jams this Spring breakup season is currently rated as average for much of the state, with several areas having an above average threat of flooding. Breakup dates are expected to be several days later than the average breakup dates. This forecast is based on observed snowpack, ice thickness reports, and long range temperature forecasts.

Ice - April ice thickness data are available for a limited number of observing sites in Alaska. Measurements indicate that ice thickness and accumulated freezing degree days are normal on the Yukon and Kuskokwim Rivers. Ice thickness in southcentral Alaska and some sites in the Tanana Valley are thinner than normal. The Gakona River in the Copper River basin has accumulated a significant amount of aufeis near the highway at Gakona Junction, and is at a greater risk of flooding than normal. Also, an abnormal fall breakup event on the Kuskokwim River in November left stretches of jumbled breakup ice that refroze, which may affect the breakup process and cause additional ice jams during spring breakup. A similar situation with a freezeup ice jam occurred on the Tanana River just downstream of Manley Hot Springs, leading to jumbled ice that refroze with higher water levels than usual for early winter. Accumulated freezing degree days are below normal values in southcentral and southeast Alaska.

Snow - An analysis of the April 1 snowpack by the Natural Resources Conservation Service (NRCS) indicates a below normal snowpack throughout southcentral and southwest Alaska. There is near normal snowpack on the North Slope and eastern Brooks Range, as well as the Yukon River upstream of Tanana and in southeast Alaska. The snowpack in western Alaska is well above (between 110% and 150%) normal. There is enough snow in most areas of the state to produce significant snowmelt runoff peaks and potential flooding if subjected to a rapid warming pattern. For more details on the snowpack, please refer to the various snow graph options at the APRFC web site at: http://aprfc.arh.noaa.gov or on the NRCS web site at http://ambcs.org.

Weather - Current outlooks from the Climate Prediction Center (CPC) for the next two weeks continue to show below normal temperatures and precipitation over most of the state. The most important factor determining the severity of breakup remains the weather during April and May. The current 90 day outlook for the months of April, May, and June indicates a greater probability of above normal temperatures over the northern third of the state, while the rest of the state has an equal chance of normal, below normal, or above normal temperatures. Although current trends in the ENSO climate signal predict that La Nina conditions will continue to weaken in the coming months, La Nina persists and typically results in cooler than average spring surface air temperatures and a later breakup date. For more information on the outlooks for this spring, please refer to the Climate Prediction Center web site at:

http://www.cpc.ncep.noaa.gov

The following table gives an estimation of flood potential and basin runoff volumes for various locations around the state. The table was created from our Spring Breakup Outlook dated April 8, 2011. Check our web site for the most current product. The potential for minor flooding is not reflected in the table.

Snowmelt Runoff Volume...expected water volume from snowmelt during the melt season.

Flood Potential...the likelihood of flooding from snowmelt and/or ice jams.

Average Breakup Dates are for 1970 through 2010, and are calculated for locations with at least five years of data.

RIVER - REACH	SNOWMELT RUNOFF VOL	FLOOD POTENTIAL	AVERAGE BREAKUP DATE	NO. OF YEARS RECORD	FORECAST BREAKUP DATE
SE Panhandle	Average				
Kenai River	Below				
Anchor River	Below				
Matanuska River	Below				
Susitna River Gold Creek Sunshine	Below	 Low Low	 05/01	 21	 04/30-05/07
Yentna River Lake Creek	Below	 Low	 05/01	 20	 04/29-05/05
Skwentna River Skwentna	Below	 Low	 04/30	 17	 04/29-05/05
Copper Basin Gakona River Gulkana River	Below	 High Low	 04/30 04/30	 25 23	 04/27-05/07 04/27-05/05

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RIVER - REACH	SNOWMELT RUNOFF VOLUME	FLOOD POTENTIAL	AVERAGE BREAKUP DATE	NO. OF YEARS RECORD	FORECAST BREAKUP DATE
Chena River	Average				
Chena Lakes Project		Low			
Fairbanks		Low	04/26	25	04/25-05/02
Tanana River	Below				
Northway		Low	04/23	25	04/20-04/30
Salcha		Low-Mod			
Fairbanks		Low	04/29	13	04/28-05/04
Nenana		Low	05/02	37	05/01-05/07
Manley		Low	05/03	19	04/29-05/12
Kuskokwim R (Upr)	Below				
Nikolai		Low	04/23	26	04/22-04/29
McGrath		Low-Mod	05/07	37	05/06-05/13
Kuskokwim R (Lwr)	Below				
Stony River		Low	05/06	23	05/04-05/11
Sleetmute		Low-Mod	05/05	22	05/03-05/10
Red Devil		Low-Mod	05/06	25	05/04-05/11
Crooked Creek		Low-Mod	05/07	25	05/05-05/12
Aniak		Low-Mod	05/07	28	05/05-05/12
Kalskag		Low-Mod	05/08	22	05/06-05/13
Tuluksak		Low-Mod	05/09	19	05/08-05/15
Akiak		Low-Mod	05/10	25	05/08-05/16
Kwethluk		Mod			
Bethel		Low-Mod	05/12	40	05/11-05/18
Yukon River (Upr)	Average				
Eagle		Low	05/05	31	05/04-05/10
Circle		Low-Mod	05/09	29	05/08-05/14
Fort Yukon		Low	05/10	28	05/09-05/15
Beaver		Low	05/10	16	05/10-05/16
Stevens Village		Low	05/11	16	05/11-05/17
Rampart		Low	05/12	17	05/11-05/17
Yukon R (Mid)	Average				
Tanana		Low	05/10	26	05/09-05/15
Ruby		Low	05/11	27	05/11-05/17
Galena		Low-Mod	05/12	28	05/11-05/17
Koyukuk		Low-Mod			
Nulato		Low-Mod	05/12	15	05/11-05/17
Kaltag		Low	05/14	35	05/13-05/19
Anvik		Low	05/16	24	05/15-05/21
Yukon R (Lwr)	Average				
Holy Cross		Low	05/15	24	05/14-05/20
Russian Mission		Low	05/15	26	05/14-05/20
Pilot Station		Low	05/17	14	05/16-05/23
Mountain Village		Low	05/18	24	05/17-05/24
Alakanuk/Emmonak		Low-Mod	05/23	26	05/21-05/28
Koyukuk River	Average				
Bettles		Low	05/09	29	05/09-05/16
Allakaket		Low	05/10	24	05/10-05/16
Hughes		Low-Mod	05/10	23	05/10-05/16
Buckland River	Above	Mod	05/18	20	05/16-05/24
Kobuk River	Above				
Kobuk		Mod	05/16	31	05/15-05/21
Shungnak		Low	05/17	21	05/17-05/23
Ambler		Low	05/18	28	05/17-05/23
Noatak River	Above	Low-Mod	05/20	16	05/19-05/25
Colville River	Average				
at Umiat		Low	05/25	12	05/21-05/28
at Colville		Low	06/01	14	05/28-06/04