# Alaska Seasonal Strategic Analysis Tool

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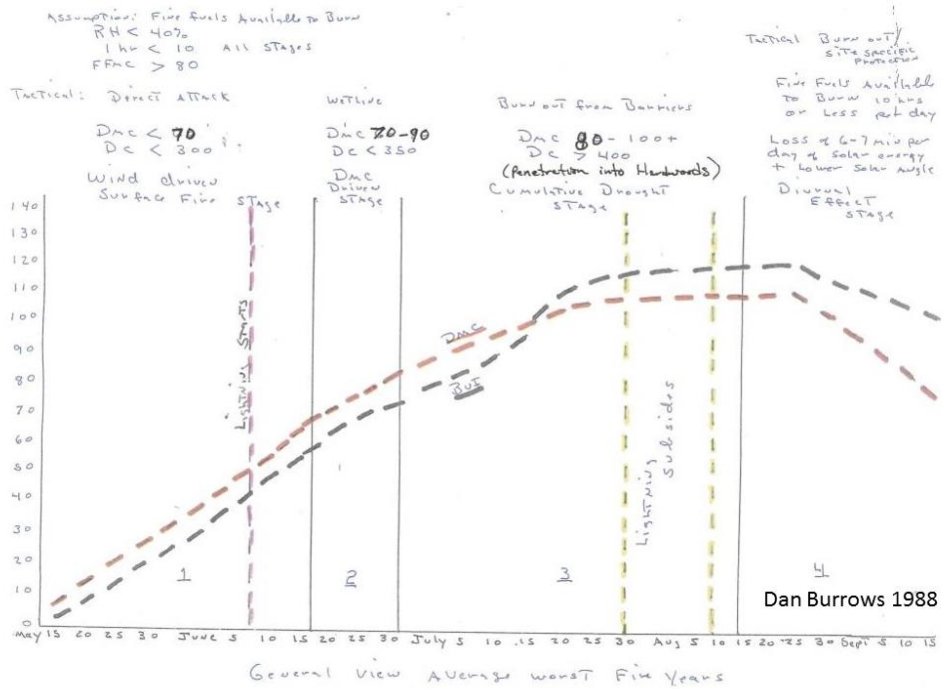
## Executive Summary

The Seasonal Strategic Analysis Tool is designed to help managers evaluate incident duration when making long-term decisions about fire management. In the late 1980s Dan Burrows plotted a worst-case fire season in Alaska, tracking BUI (Buildup Index) and DMC (Drought Moisture Code) throughout the fire season and highlighting thresholds and important events during each phase. This tool is based on the original Burrows graph. Using the Alaska Fire and Fuels database, the original Burrows graph has been updated and customized for each Predictive Service Area (PSA), and continues to highlight the four phases of the fire season.



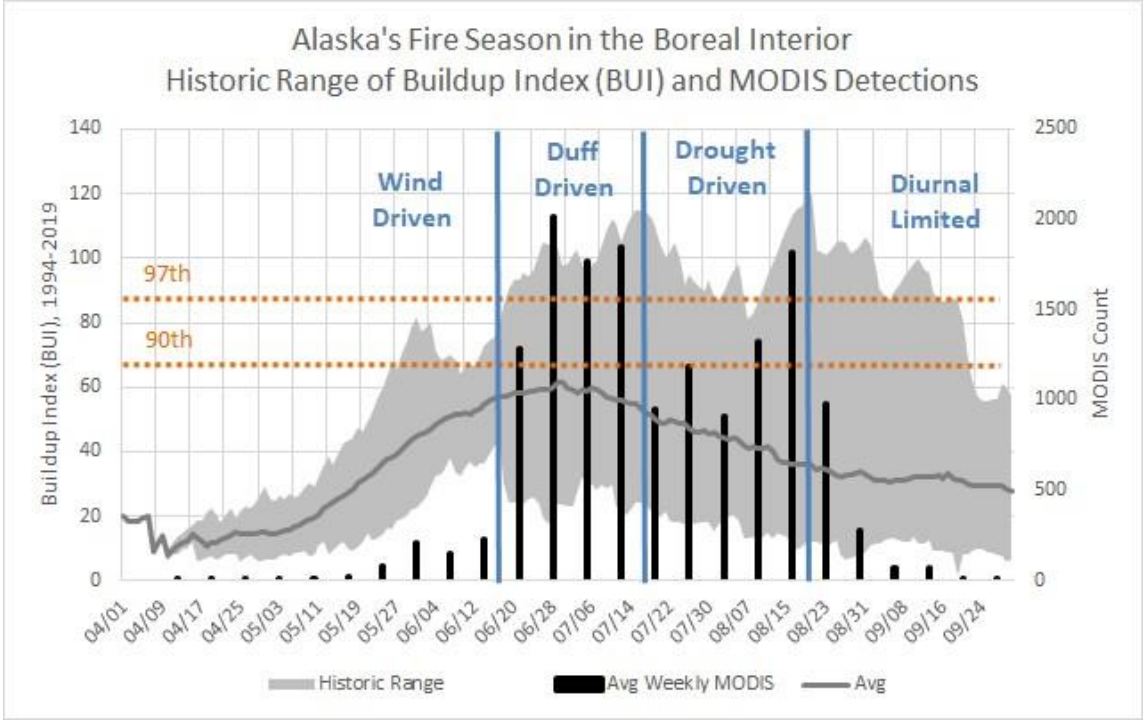

Accompanying each graph are dates and percentiles for historical dates when the BUI fell below 80 and did not recover. This criterion was used to signify the end of fire season. These dates and values, in conjunction with the graphs, can give fire managers the opportunity to compare the current fire season BUI values with historic averages, and examine the current phase of fire season to aid in decision making.

Available long-term weather data, the number of RAWS stations, and correlations made to BUI are stronger in the Interior Boreal Forest of Alaska than on the west coast in the tundra fuel types. As more data becomes available, analyses will continue to track fire season trends and update findings as necessary.

**Introduction**

There have been many efforts to define and characterize Alaska's fire season. Fire season in Alaska is normally very episodic: periods of dryness followed by periods of rain, coupled with great yearly fluctuations make it challenging to summarize. A typical fire season in Alaska has fuels drying to burnable levels during the end of May and the beginning of June. Lightning starts to become prevalent around the same time, often bringing the historic peak of fire season in late June. By the middle to end of July southwest flow begins and the Interior of Alaska begins to receive regular rains which typically end fire season. Not every year follows this trend. During some seasons, regular rain keeps fuels below burnable levels, and during others southwest flow ends early or does not materialize and August is dry enough for existing fires to once again become active. This tool is another step quantifying Alaska's fire season, building on information that has been previously summarized and using newer tools to help improve the analysis and understanding.

**Alaska's Fire Season**



**Alaska's Fire Season Categorized**

Alaska's fire season is characterized as having four distinct phases. Using the Buildup Index from the Canadian Forest Fire Danger Rating System (CFFDRS) to track season severity, the Alaska fire season can be broken down into: Wind Driven, Duff Driven, Cumulative Drought, and Diurnal Effect. These four phases are highlighted by the characteristic which defines the fire behavior and spread.

**Wind Driven Season** – approximately April 1 to June 15. Highlighted by pre green-up conditions. Fires are mainly a problem in grass and tundra fuel types during high wind events with low temperatures and low humidity. Usually ends after green-up as upper duff layers begin to dry and carry fire. The lower duff layers have not had a chance to dry, resulting in mainly surface fire.

**Duff Driven Season** – approximately June 15 to July 15. Generally, relates to longer days around the summer solstice that produce peak heating of spruce canopies and drying of the surface and immediately adjacent subsurface litter and duff fuels. Fires occurring during this period are characterized by episodic growth events related to hot, dry sunny days, and can produce high flammability despite green fuelbeds. This is normally the peak of the Alaska fire season. Resistance to control increases as the season continues and the duff continues to dry.

**Cumulative Drought Season** - July 15 to August 15. Fire season normally ends with precipitation events at the end of July or beginning of August. If consistent, significant rains do not occur, the deeper layers of duff continue to dry and become available to burn. Fires become increasingly difficult to suppress as resistance to extinguishment increases. Significant rain is needed to stop fire spread and decrease the elevated dryness of deep fuelbeds. Fires can easily become active again after moderate precipitation. Lightning usually subsides in the beginning of August, but existing fires can continue to burn under cumulative drying.

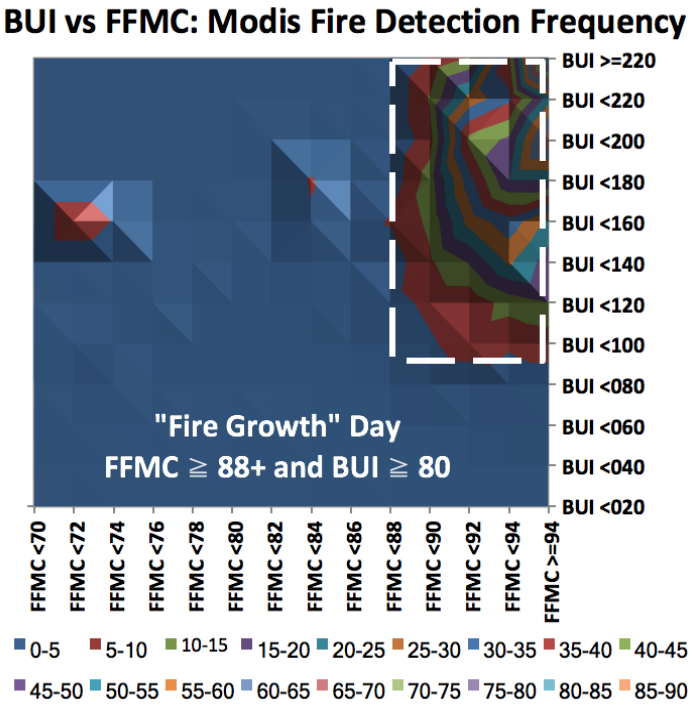
**Diurnal Effect Season** - August 15 to September 30. As the summer winds down, Alaska sees rapid loss in daylight coupled with lowering solar angle. This reduces solar heating and greatly diminishes the burn period. High levels of drought can enable fire spread even though the burn period is greatly reduced. Cooler nights require more heating for fuels to support fire spread. Even with very dry deeper fuels, the increase in darkness and cooler nights limits fire spread as the burn period decreases. Despite the loss of daylight, this is also the time when human ignitions can become prevalent or fires that have been dormant for long periods can become active.

**Predictive Service Areas (PSA)**

Predicted Service Areas are geographic areas that are delineated based on similarities of fuels, weather, and topography. Alaska is divided into 18 different Predictive Service Areas. This paper does not address PSAs that do not currently have a significant fire season or enough weather stations to perform adequate analysis. PSAs that were not analyzed were North Slope (AK00), Southeast Alaska (AK15,16,17), and Kodiak Island (AK18).

**Correlating FWI Values and Strategic Analysis of the Alaska Fire Season**

Together, FFMC and BUI represent the total fuel available for combustion. A strong correlation has been noted between MODIS detections (representing fire growth), and fuel moisture conditions using Fine Fuel Moisture Code above 88 and Build Up Index above 80 as shown in the graph below and published here: [https://www.frames.gov/documents/catalog/ziel_et_al_2015_modeling-fire-growth-potential.pdf](https://www.frames.gov/documents/catalog/ziel_et_al_2015_modeling-fire-growth-potential.pdf)



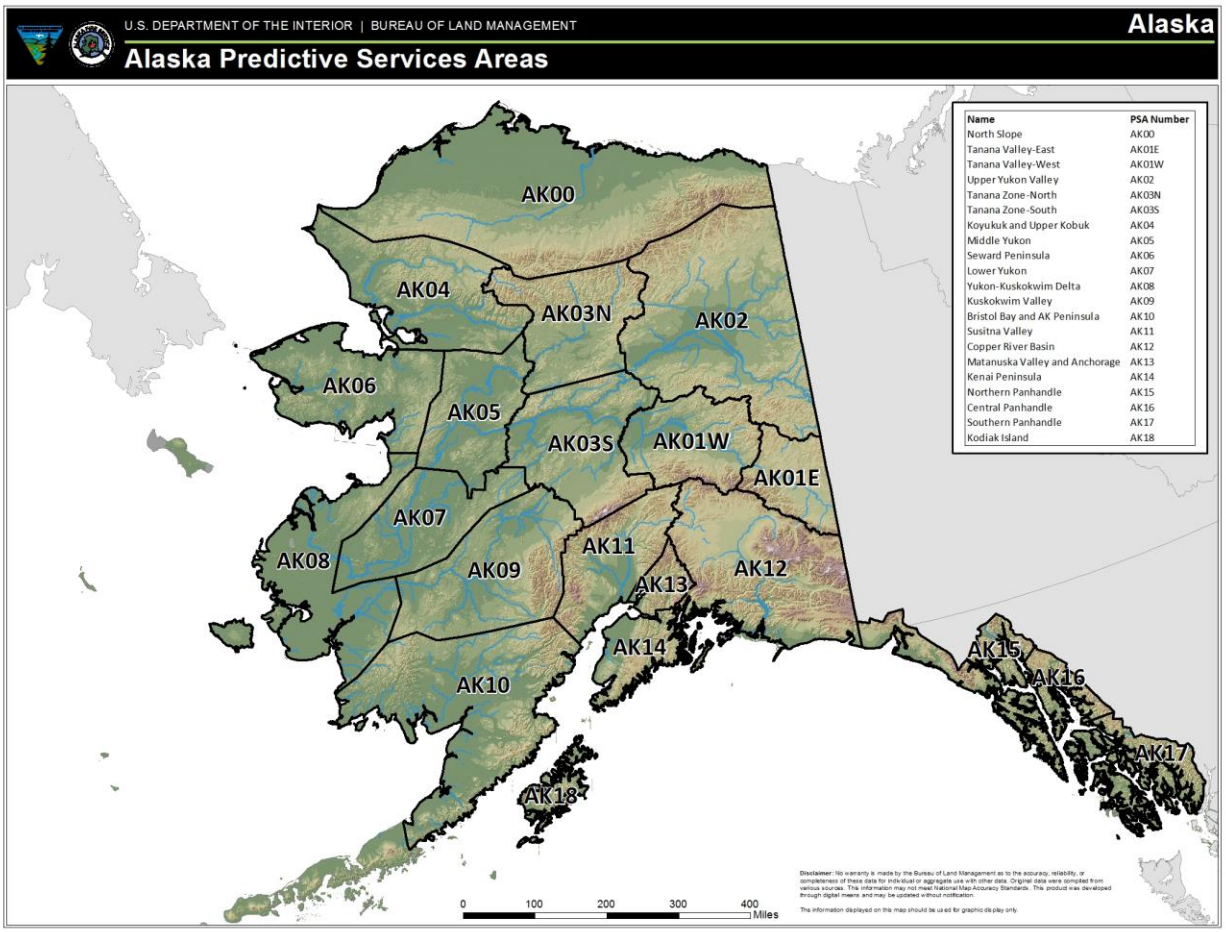

At least 80% of MODIS detections in Alaska have occurred under these conditions, which can be correlated to active fire spread. These same thresholds were used to calculate the end of historical fire seasons. The main criterion is BUI. Most typical fire seasons were considered at an end when the BUI fell below 80 and remained below 80. An additional criterion is the FFMC, which is used to describe an end to a particularly dry season, when the BUI does not fall below 80 even after September 1st. Though the FFMC is not a long-term indicator of drought, when used in conjunction with the BUI at this time of year, it helps simulate the Diurnal Effect. A dry late summer and early fall with a higher BUI does not necessarily denote conditions that support fire spread. The diminishing daylight and dropping temperatures will limit fire growth despite very dry lower fuels. Therefore, targeting the time frame where the FFMC stays below 88 recognizes that the shorter, cooler days will limit fire spread.

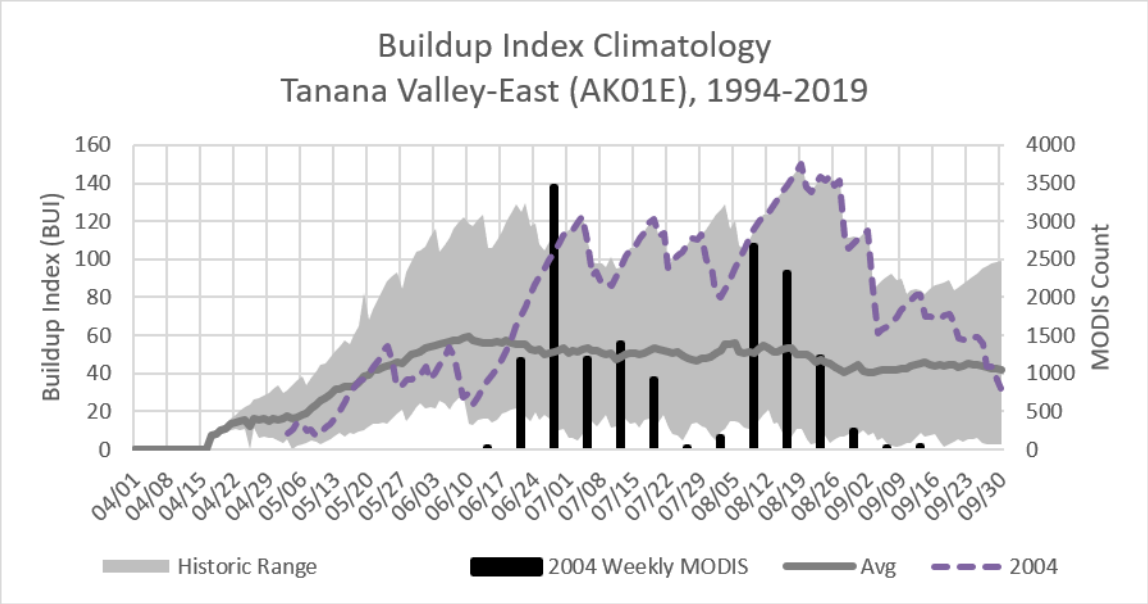
Historical season ending percentiles were calculated for each PSA based on available weather station data from the Alaska Fire and Fuels database. Season end dates were analyzed for each weather station with a minimum of 10 years of data beginning with 2000. Weather observations from before 2000 are spare and may not be relevant to current weather conditions. These dates were then entered into the Term module in RERAP 7.03. As data for more years become available, the term files will be updated.

**Applicability and Use**

The graphs in Appendix A provide historical ranges for BUI, Average BUI, and MODIS detections by week, framed in reference to the four phases of the Alaska fire season and two historically significant fire seasons for the PSA. Tracking seasonal progression will help place the current fire season in a well referenced historical context.

## Appendix A: Information by PSA






| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/10 | Duff Driven - Resistance to control |
| 50% | 8/8 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 9/5 | Diurnal - Short burn window, good RH recovery |
| 90% | 9/30 | |

Stations analyzed:

Alcan Hwy MI-1244 (ALHA2) 2000-2019

Chicken (CKNA2) 2000-2019

Dry Creek (DRY) 2000-2019

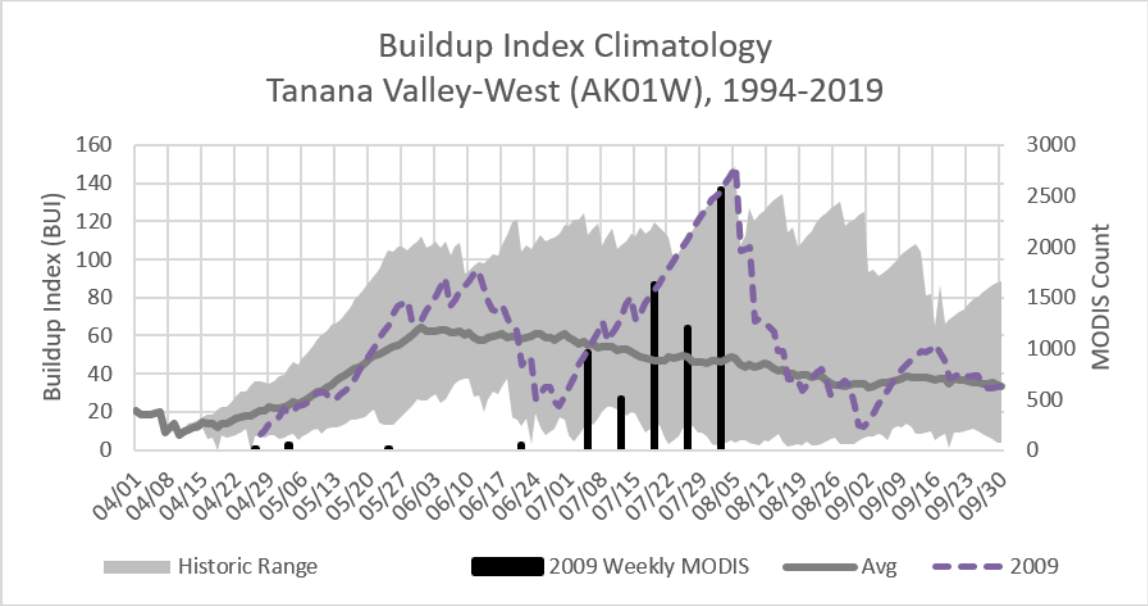
Northway (PAOR) 2000-2019

T Lake (TEEA2) 2000-2019

Jatahmund Lake (TETA2) 2000-2019

Tok (TKFA2) 2000-2019

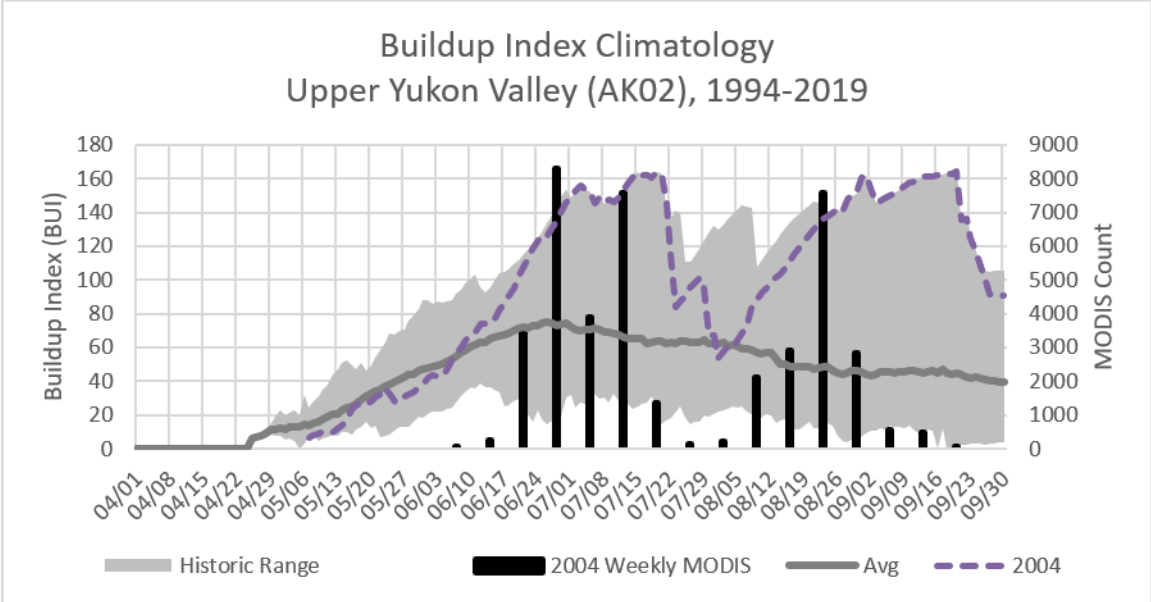
Tok River Valley (TKRA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/3 | Duff Driven - Resistance to control |
| 50% | 8/1 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/31 | Diurnal - Short burn window, good RH recovery |
| 90% | 9/26 | |

Stations analyzed:

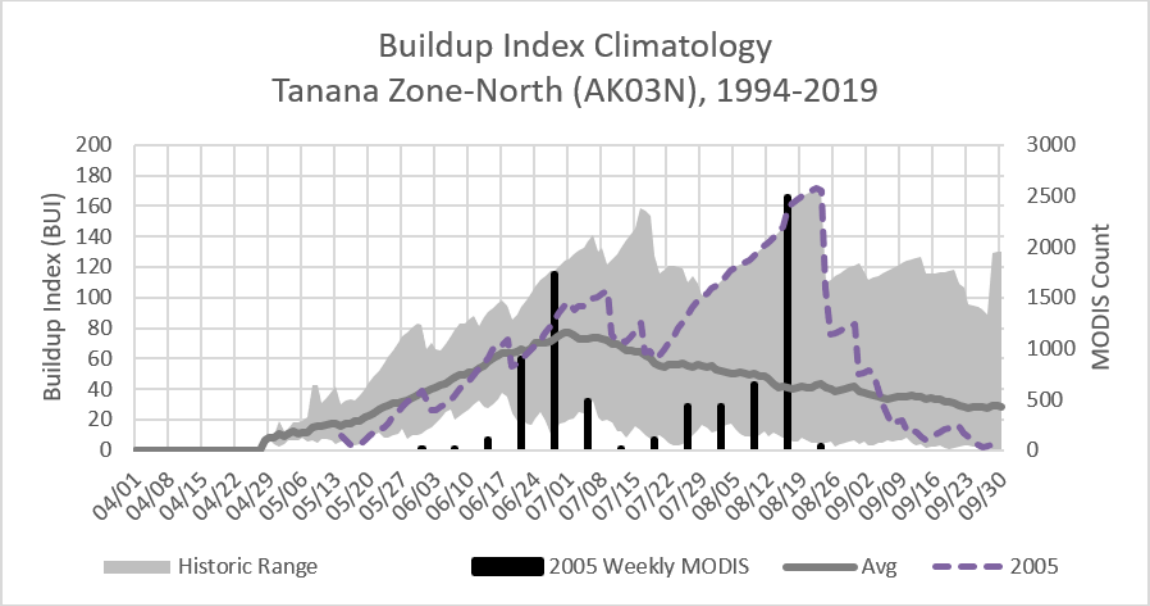
Angel Creek (AGLA2) 2001-2019
Blair Lakes (BKSA2) 2009-2019
Bolio (BTAA2) 2005-2019
Chatanika (CHTA2) 2001-2019
Caribou Peak (CPKA2) 2003-2019
Donnelly (DOYA2) 2005-2019
Fairbanks (FRBA2) 2000-2019
Good Pasture (GDPA2) 2000-2019
George Creek (GECA2) 2000-2019
Jarvis Creek (JCKA2) 2009-2019
Manchu (MANA2) 2005-2019
Oklahoma (OKLA2) 2008-2019
Fort Greely (PABI) 2000-2019
Fairbanks Airport (PAFA) 2000-2019
Nenana ASOS (PANN) 2000-2019
Salcha (SLRA2) 2000-2019
Small Arms Range (SRGA2) 2005-2019
Gold King (TTLA2) 2007-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/25 | Cumulative Drought - Resistance to Extinguishment |
| 50% | 8/19 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 9/11 | Diurnal - Short burn window, good RH recovery |
| 90% | 9/30 | |

Stations analyzed:

Helmut Mountain (AWRA2) 2000-2019
Ben Creek (BENA2) 2000-2019
Birch Creek (BIRA2) 2000-2019
Chalkyitsik (CIKA2) 2000-2019
Chicken (CKNA2) 2000-2019
Eagle (EGYA2) 2000-2019
Fort Yukon (FYRA2) 2008-2019
Graphite Lake (GRFA2) 2000-2019
Hodzana (HOZA2) 2000-2019
Little Black (LBKA2) 2000-2019
Lost Creek (LSTA2) 2000-2019
Preacher Creek (PCKA2) 2000-2019
Salmon Trout (SMTA2) 2000-2019
Vunzik Lake (VNKA2) 2000-2019
Beaver (WBQA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/16 | Duff Driven - Resistance to control |
| 50% | 8/9 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/31 | Diurnal - Short burn window, good RH recovery |

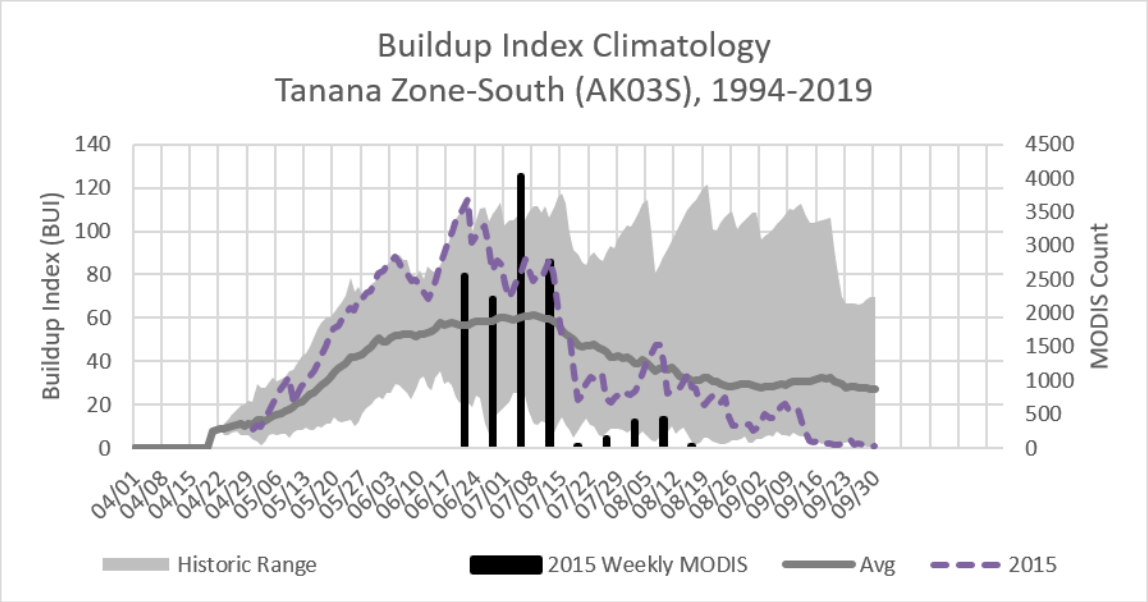
Stations analyzed:

Kanuti (KANA2) 2000-2019

Norutak Lake (NRUA2) 2000-2019

Bettles (PABT) 2000-2019

Seven Mile (SMIA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/6 | Duff Driven - Resistance to control |
| 50% | 7/29 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/20 | |
| 90% | 9/8 | Diurnal - Short burn window, good RH recovery |

Stations analyzed:

Denali Visitor Center (DVCA2) 2008-2019

Livengood (LIVA2) 2000-2019

Lake Minchumina (LMHA2) 2000-2019

McKinley River (MKLA2) 2000-2019

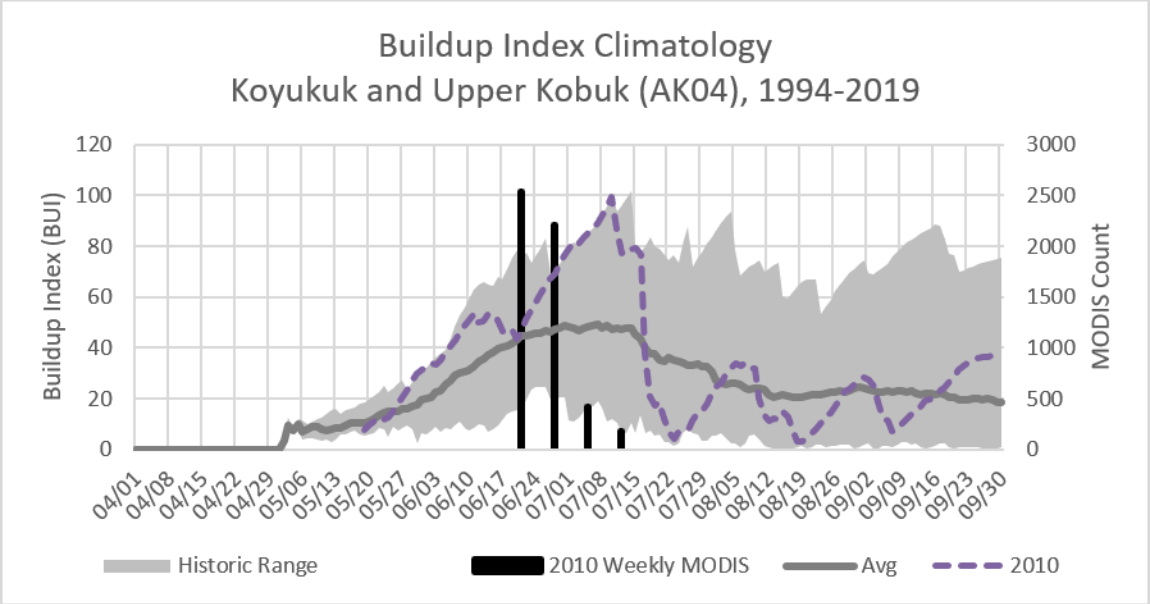
Poorman (PMNA2) 2000-2019

Tanana (PATA) 2000-2019

Round Lake (RNDA2) 2000-2019

Wonder Lake (WONA2) 2000-2017

Wein Lake (WNLA2) 2000-2017




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/9 | Duff Driven - Resistance to control |
| 50% | 7/24 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/8 | |
| 90% | 8/19 | |

Stations analyzed:

Kavat Creek (KAVA2)2000-2019

Kelly (KELA2) 2000-2019

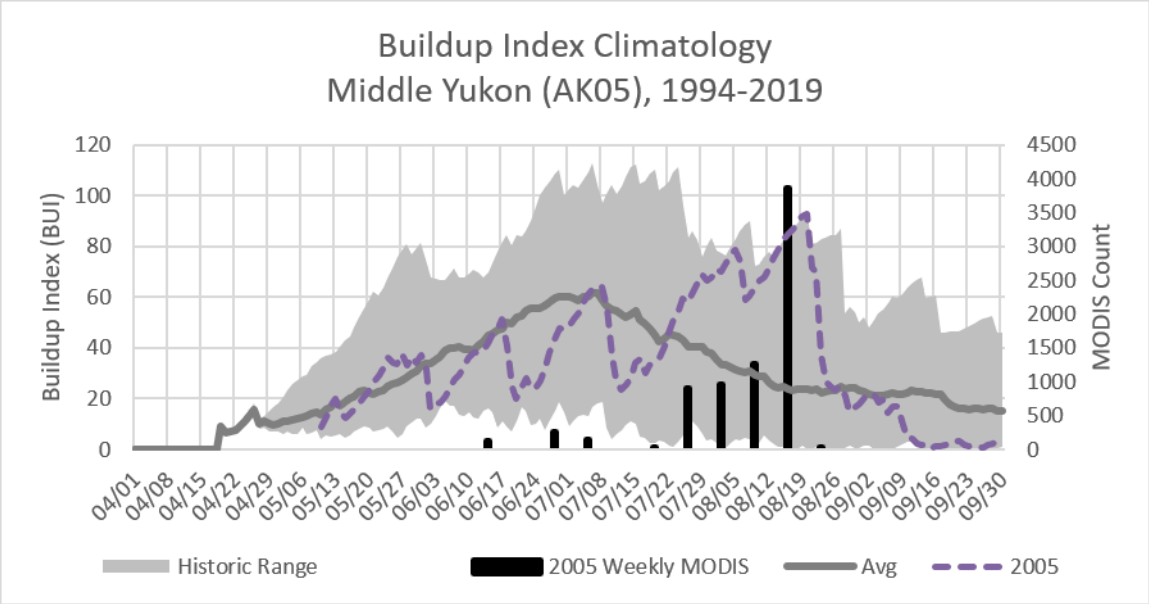
Noatak (KTZA2) 2000-2019

Ambler (PAFM) 2000-2019

Kotzebue (PAOT) 2000-2019

Kiana (SRKA2) 2000-2019

Selawik (SWKA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/7 | Duff Driven - Resistance to control |
| 50% | 7/22 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/5 | |
| 90% | 8/16 | |

Stations analyzed:

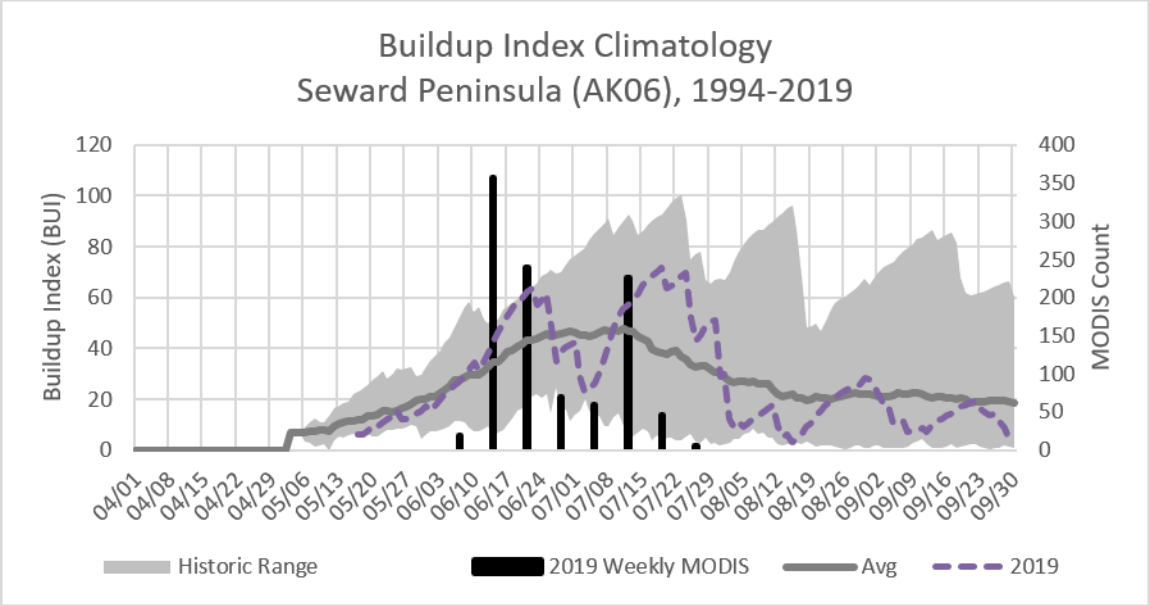
Cottonwood (COTA2) 2000-2019

Hogatza River (HOGA2) 2000-2019

Kaiyuh (KAIA2) 2000-2019

Koyukuk (KOYA2) 2000-2019

Poorman (PMNA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/10 | Weather station data is marginal in western PSAs (AK06, AK08, AK10). BUI is currently being used until more data is compiled for better analysis. |
| 50% | 7/25 | |
| 75% | 8/8 | |
| 90% | 8/18 | |

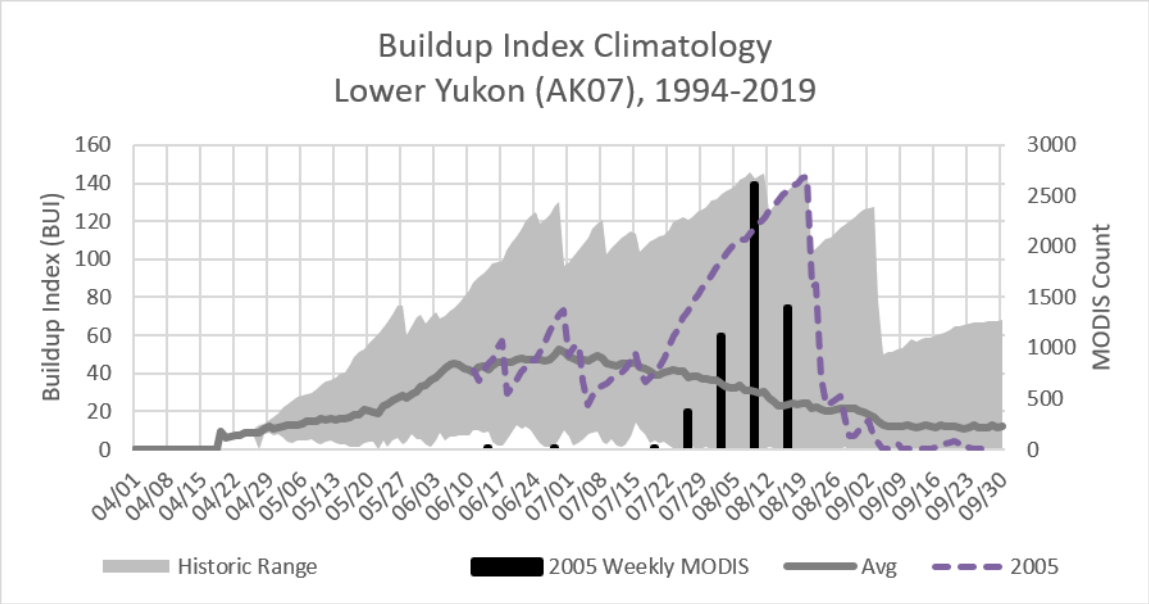
Stations analyzed:

Haycock (HAYA2) 2000-2019

Hoodoo Hill (HDOA2) 2000-2019

Nome (PAOM) 2000-2019

Quartz Creek (QRZA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/2 | Duff Driven - Resistance to control |
| 50% | 7/23 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/13 | |
| 90% | 8/29 | |

Stations analyzed:

Farewell (FWLA2) 2000-2019

Flat (MCWA2) 2000-2019

McGrath (PAMC) 2000-2019

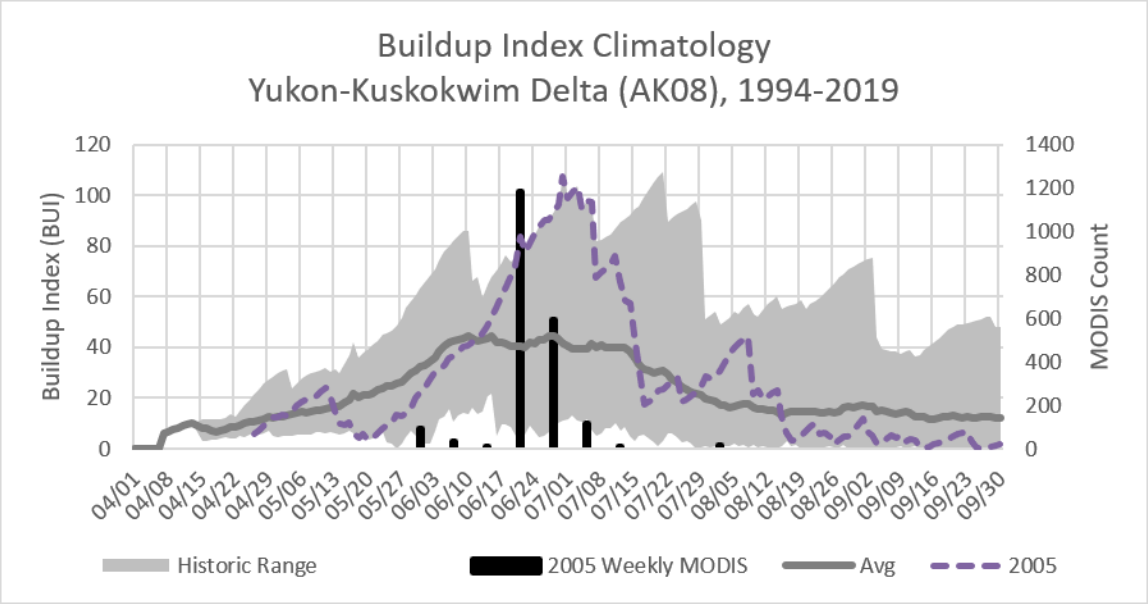
Aniak (PANI) 2000-2019

Stoney River (SRVA2) 2000-2019

Stoney (STNA2) 2000-2019

Telida (TLDA2) 2000-2019

Innoko Flats (NKOA2) 2000-2019

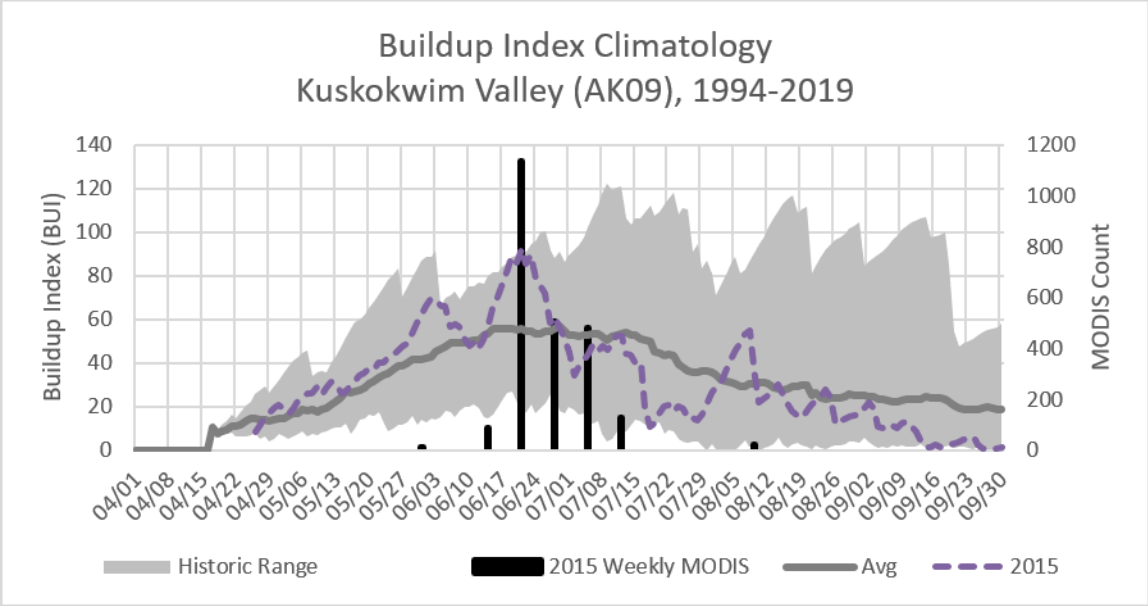



| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/2 | Weather station data is marginal in western PSAs (AK06, AK08, AK10). BUI is currently being used until more data is compiled for better analysis. |
| 50% | 7/16 | |
| 75% | 7/29 | |
| 90% | 8/7 | |

Stations analyzed:

Bethel (PABE) 2000-2019

Reindeer River (RDRA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 6/29 | Duff Driven - Resistance to control |
| 50% | 7/17 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/1 | |
| 90% | 8/15 | |

Stations analyzed:

Farewell (FWLA2) 2000-2019

Flat (MCWA2) 2000-2019

McGrath (PAMC) 2000-2019

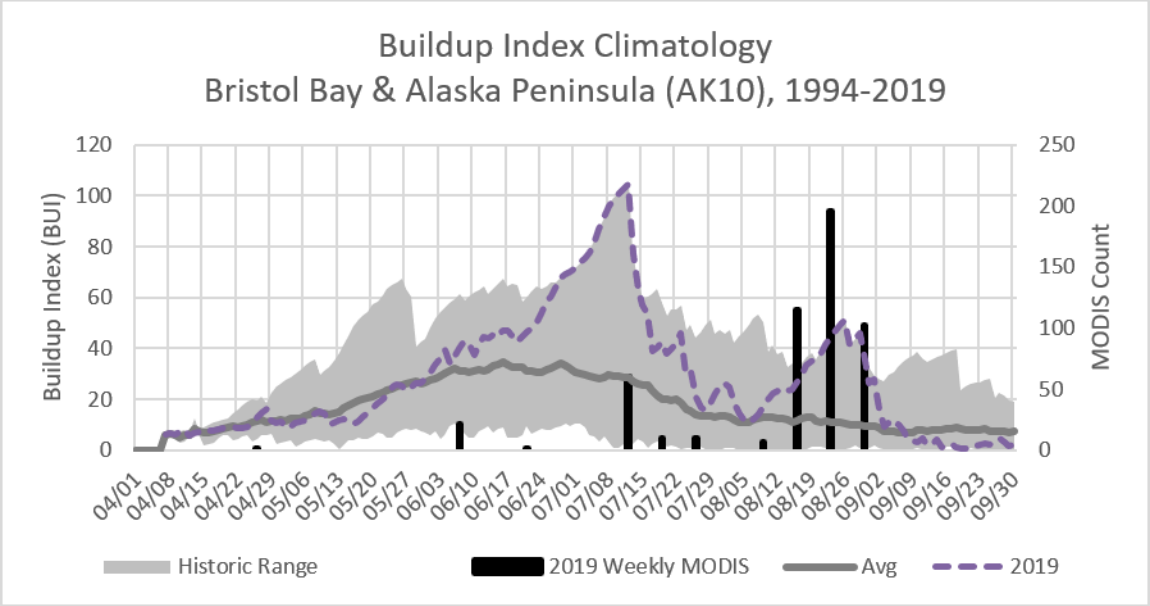
Aniak (PANI) 2000-2019

Stoney River (SRVA2) 2000-2019

Stoney (STNA2) 2000-2019

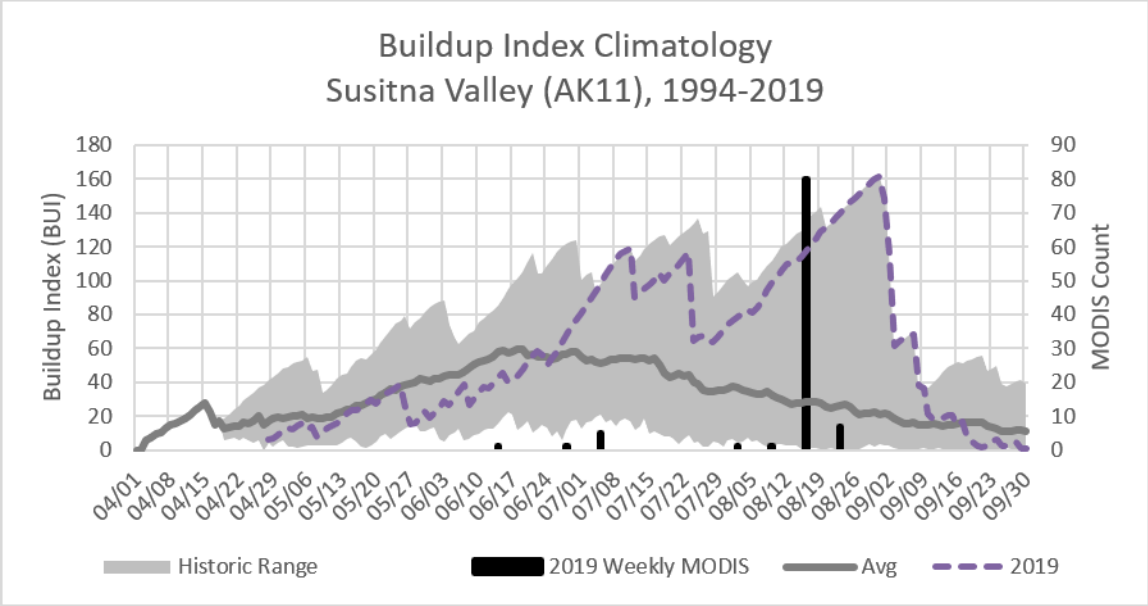
Telida (TLDA2) 2000-2019

Innoko Flats (NKOA2) 2000-2019



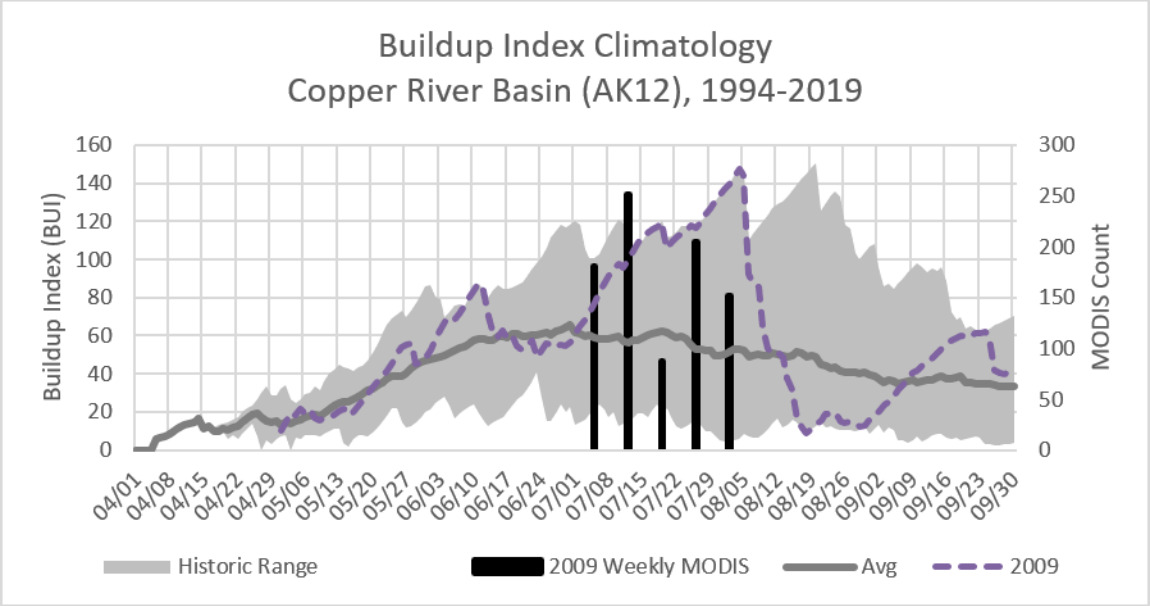

| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/1 | Weather station data is marginal in western PSAs (AK06, AK08, AK10). BUI is currently being used until more data is compiled for better analysis. |
| 50% | 7/25 | |
| 75% | 8/17 | |
| 90% | 9/6 | |

Stations analyzed:
Port Alsworth (ALSA2) 2000-2019
Kilbuck (KILA2) 2000-2019
Dillingham (PADL) 2000-2019
Iliamna (PAIL) 2000-2019



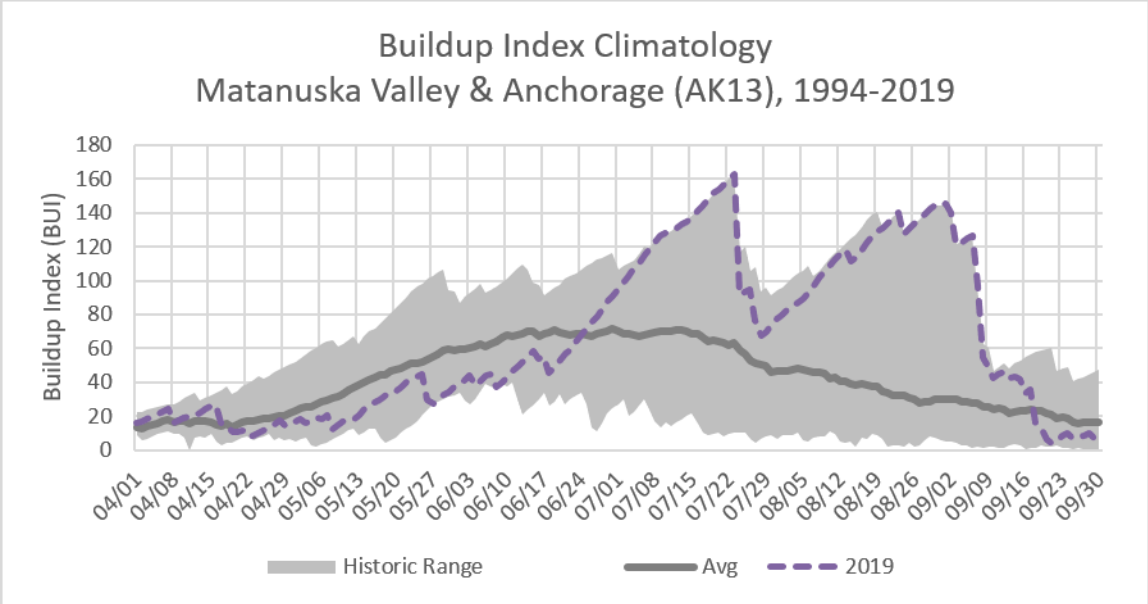

| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 6/28 | Duff Driven - Resistance to control |
| 50% | 7/16 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/2 | |
| 90% | 8/17 | |

Stations analyzed:
Bentalit (BLSA2) 2000-2019
Talkeetna (PATK) 2000-2019
Willow (WOWA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/21 | Duff Driven - Resistance to control |
| 50% | 8/11 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 9/1 | Diurnal - Short burn window, good RH recovery |
| 90% | 9/17 | |

Stations analyzed:
Chisana (CSNA2) 2000-2019
Strelna (CXCA2) 2000-2019
Chistochina (CZOA2) 2000-2019
Klawasi (KLAA2) 2000-2019
Kenny Lake (KNY) 2000-2019
May Creek (MCKA2) 2000-2019
Gulkana (PAGK) 2000-2019
Paxson (PXKA2) 2000-2019
Renee (RENA2) 2000-2019
Slana (SSZ) 2000-2019
Tazlina Lodge (TZL) 2000-2019
Tazlina Village (TZV) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 6/30 | Duff Driven - Resistance to control |
| 50% | 7/19 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/7 | |
| 90% | 8/23 | |

Stations analyzed:

Big Lake (BGQA2) 2000-2019

Campbell Creek (CBKA2) 2008-2019

Eagle Creek (ERVA2) 2009-2019

Girdwood (GDWA2) 2000-2019

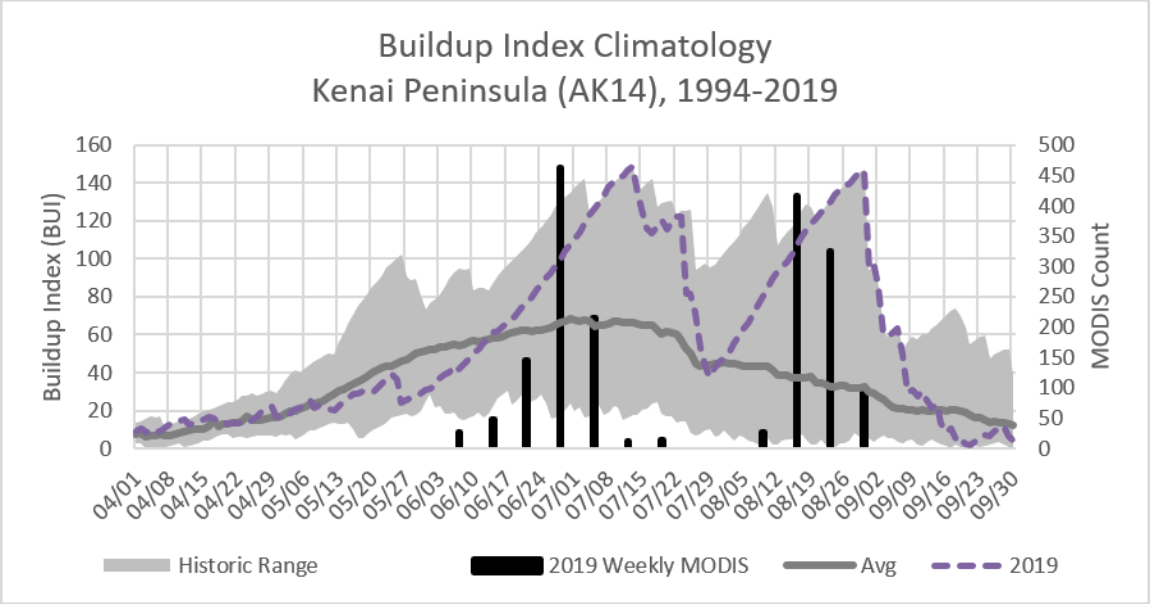
Grazelka Range (GRZA2) 2005-2019

Palmer (PAAQ) 2000-2019

Anchorage (PANC) 2000-2019

Pt. Mac (PMZA2) 2008-2019

Rabbit Creek (RBTA2) 2000-2019




| Percentile | Term Date | Season Characteristics |
|---|---|---|
| 25% | 7/8 | Duff Driven - Resistance to control |
| 50% | 7/28 | Cumulative Drought - Resistance to Extinguishment |
| 75% | 8/8 | |
| 90% | 8/14 | |

Stations analyzed:

Broadview (BDVA2) 2000-2019

Granite (GRAA2) 2000-2019

Homer (HMEA2) 2000-2019

Kenai NWR (KNAA2) 2000-2019

Kenai Lake (KNLA2) 2000-2019

Ninilchik (NCKA2) 2000-2019

Kenai (PAEN) 2000-2019

Homer Airport (PAHO) 2000-201

Skilak Guard Station (SGSA2) 2000-2019

Swanson River (SWNA2) 2000-2019

Soldotna (SXQ) 2000-2014

Soldotna (SDFA2) 2013-2019