Wyoming Climate Summary—Water Year 2018

Antony R Bergantino [1]

Temperature

The period from 01 Oct 2017 through 30 Sep 2018 (Water Year 2018) was the 12th warmest Wyoming water year in the last 123 years. The state ranged from about 2.5°F below normal to 4°F above normal (Figure 1). The lower elevations of the Bighorn Basin and much of the northeast quarter of the state were coolest compared to normal, whereas the far eastern plains in the south, central Campbell County, and the central region (lower elevation areas of Fremont County and southern Natrona County into Converse County) were about normal. The rest of the state and the high elevation mountain ranges were above normal, especially throughout the southwest.

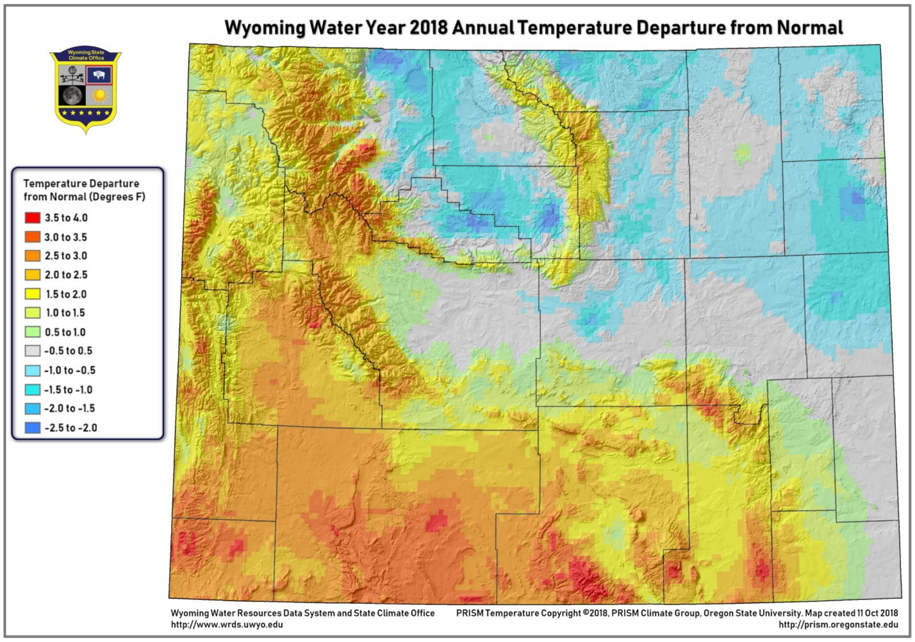

Figure 1. Wyoming Water Year 2018 Annual Temperature Departure from Normal (PRISM Climate Group, 2018)

Looking at the Climate Divisions (CD) in the state (Figure 2), the rankings show that the warmth in the higher elevations offset the relative coolness in the basins. This is seen most vividly in CD 4, the Bighorn Basin. Parts of the basin were as much as 2.5°F below normal, but the Bighorns in the east and the Absaroka Range in the west were above normal, making the CD the 20th warmest of the last 123 years. CD 3, the Green and Bear drainages, had the warmest ranking of all ten divisions and was the 4th warmest since 1895. At the opposite corner of the state, CD 6, the Belle Fourche Drainage, was the coolest. Even this, ranking as the 50th warmest, was in the warmer half of years.

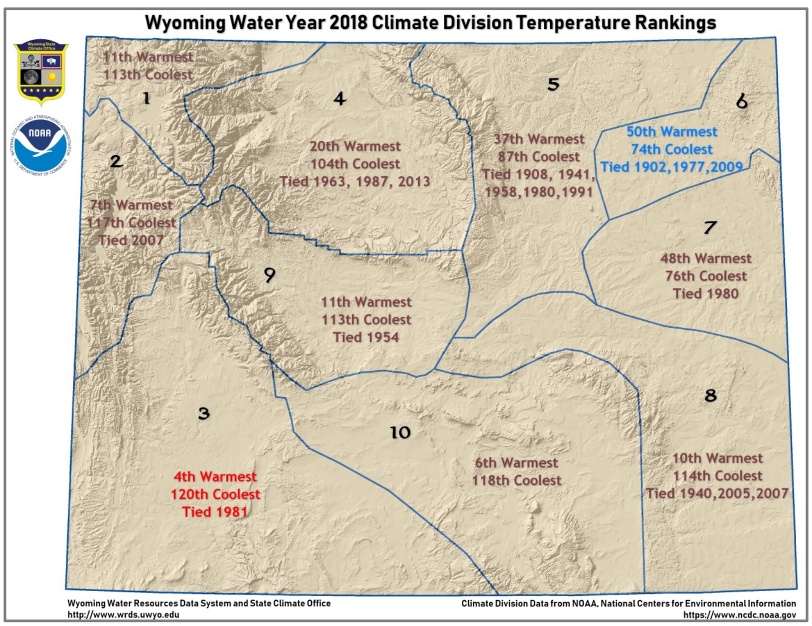

Figure 2. Wyoming Water Year 2018 Climate Division Temperature Rankings (NOAA National Centers for Environmental Information (NCEI), 2018)

Statewide, there was no one period in particular that drove the ranking. While all but three months of the water year (August, February, and October) were in the warmer half of their rankings, four isolated months pushed this water year to its rank of the 12 warmest. September was ranked 12th, January and November were both ranked 8th, and May was

[1] Wyoming State Climate Office/Water Resources Data System

ranked as the 7th warmest.

When considering the individual months, all divisions except CD 6 (the Belle Fourche drainage) were in the bottom tercile (below normal) for average temperature in October of 2017. For maximum temperature, all climate divisions were in the middle tercile (normal) except for CD 2 and CD 9 (Snake and Wind River drainages) which were in the bottom tercile. The minimum temperature drove down the average temperature ranking for the state as all climate divisions were in the bottom tercile. CD 3 (the Green and Bear drainages), ranked as the 12th coldest October since 1895, was in the bottom 10 percent.

February was the other month with a statewide ranking in the bottom third for average temperature. Like October, this was also driven more by the minimum temperature. Unlike October, though, February's minimum temperatures were not as intense across all climate divisions, rather, the statewide ranking was influenced by extreme cold in northeast Wyoming. Minimum temperatures in Climate Divisions 5, 6, and 7 (the Powder/Tongue, Belle Fourche, and Cheyenne/Niobrara drainages) were all in the bottom 10 percent of the record from 1895 to 2018.

On the other end of the thermometer, May 2018 had monthly average temperatures in the top 10 percent of years statewide and for all climate divisions except CD 9, the Wind River drainage (Table 1). The maximum temperature was only in the top 10 percent of years in four climate divisions but, again, the minimum temperatures are what drove up the average and statewide and in all climate divisions, the minimum monthly temperatures were in the top 10 percent of year in all drainage basins without exception (Table 2).

Tables 1, 2, and 3 below show the rankings for the state and for each climate division in terms of how cold and how warm each period was ranked and compared to the last 123 years. The rankings are shown for each month and for the water year as a whole. The table below shows Average Temperature rankings and the two tables on the following page show rankings for the Minimum and Maximum Temperature.

Coldest 10%	Coldest 33%	Normal	Warmest 33%	Warmest 10%

Date	Average Temperature (Coldest [C] and Warmest [W] Rankings)																					
	Wyoming		CD 1		CD 2		CD 3		CD 4		CD 5		CD 6		CD 7		CD 8		CD 9		CD 10	
	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W
Oct-17	35	89	39	85	30	94	30	94	41	83	41	83	44	80	40	84	36	88	37	87	33	91
Nov-17	116	8	100	24	100	24	120	4	102	22	97	27	99	25	104	20	120	4	111	13	119	5
Dec-17	96	28	92	32	103	21	115	9	78	46	55	69	50	74	49	75	90	34	94	30	111	13
Jan-18	117	8	119	6	122	3	120	5	113	12	101	24	89	36	74	51	112	13	114	11	119	6
Feb-18	27	98	30	95	66	59	70	55	16	109	14	111	9	116	12	113	36	89	33	92	56	69
Mar-18	93	32	88	37	78	47	98	27	92	33	82	43	72	53	86	39	100	25	93	32	99	26
Apr-18	73	52	80	45	85	40	91	34	62	63	53	72	31	94	40	85	70	55	77	48	89	36
May-18	118	7	119	6	117	8	116	9	119	6	116	9	117	8	117	8	120	5	111	14	119	6
Jun-18	97	28	83	42	84	41	106	19	91	34	89	36	90	35	89	36	104	21	87	38	106	19
Jul-18	98	27	107	18	105	20	115	10	96	29	85	40	68	57	56	69	84	41	97	28	105	20
Aug-18	60	65	70	55	69	56	89	36	59	66	49	76	44	81	34	91	55	70	65	60	74	51
Sep-18	113	12	101	24	108	17	120	5	102	23	92	33	85	40	106	19	121	4	110	15	121	4
2018	112	12	113	11	117	7	120	4	104	20	87	37	74	50	76	48	114	10	113	11	118	6

Table 1 Statewide and Climate Division Rankings for Average Temperature (NOAA NCEI Climate at a Glance, 2018)

Coldest 10%	Coldest 33%	Normal	Warmest 33%	Warmest 10%

Date	Minimum Temperature (Coldest and Warmest Rankings)																					
	Wyoming		CD 1		CD 2		CD 3		CD 4		CD 5		CD 6		CD 7		CD 8		CD 9		CD 10	
	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W
Oct-17	21	103	39	85	24	100	12	112	29	95	19	105	33	91	32	92	32	92	27	97	21	103
Nov-17	118	6	102	22	102	22	121	3	107	17	103	21	106	18	106	18	118	6	114	10	123	1
Dec-17	86	38	89	35	93	31	109	15	71	53	53	71	46	78	46	78	69	55	94	30	100	24
Jan-18	115	10	119	6	116	9	120	5	113	12	101	24	88	37	76	49	109	16	113	12	120	5
Feb-18	25	100	50	75	81	44	88	37	18	107	12	113	3	122	10	115	22	103	31	94	58	67
Mar-18	86	39	95	30	81	44	98	27	92	33	72	53	67	58	76	49	90	35	95	30	98	27
Apr-18	49	76	84	41	92	33	79	46	47	78	25	100	19	106	23	102	35	90	48	77	68	57
May-18	121	4	123	2	118	7	121	4	121	4	117	8	120	5	122	3	122	3	118	7	119	6
Jun-18	102	23	98	27	90	35	108	17	99	26	89	36	98	27	93	32	103	22	87	38	107	18
Jul-18	102	23	100	25	99	26	113	12	95	30	87	38	89	36	76	49	92	33	90	35	103	22
Aug-18	58	67	76	49	66	59	79	46	58	67	55	70	46	79	32	93	50	75	58	67	70	55
Sep-18	97	28	94	31	58	67	95	30	95	30	82	43	98	27	104	21	111	14	78	47	106	19
2018	110	14	115	9	115	9	120	4	96	28	75	49	72	52	73	51	107	17	109	15	118	6

Table 2 Statewide and Climate Division Rankings for Minimum Temperature (NOAA NCEI Climate at a Glance, 2018)

Coldest 10%	Coldest 33%	Normal	Warmest 33%	Warmest 10%

Date	Maximum Temperature (Coldest [C] and Warmest [W] Rankings)																					
	Wyoming		CD 1		CD 2		CD 3		CD 4		CD 5		CD 6		CD 7		CD 8		CD 9		CD 10	
	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W
Oct-17	45	79	44	80	36	88	46	78	46	78	50	74	50	74	47	77	43	81	40	84	42	82
Nov-17	107	17	96	28	94	30	112	12	98	26	97	27	95	29	100	24	120	4	103	21	117	7
Dec-17	105	19	93	31	110	14	120	4	86	38	62	62	47	77	55	69	98	26	102	22	115	9
Jan-18	116	9	119	6	121	4	120	5	110	15	107	18	90	35	76	49	112	13	116	9	120	5
Feb-18	31	94	21	104	40	85	57	68	18	107	19	106	16	109	15	110	52	73	36	89	57	68
Mar-18	94	31	87	38	74	51	98	27	93	32	81	44	70	55	91	34	107	18	94	31	100	25
Apr-18	86	39	83	42	84	41	96	29	82	43	73	52	48	77	59	66	90	35	88	37	96	29
May-18	112	13	116	9	112	13	115	10	105	20	111	14	113	12	110	15	108	17	103	22	116	9
Jun-18	97	28	77	48	82	43	102	23	91	34	90	35	87	38	86	39	105	20	87	38	105	20
Jul-18	95	30	104	21	101	24	113	12	92	33	80	45	57	68	39	86	80	45	100	25	103	22
Aug-18	67	58	68	57	73	52	95	30	64	61	50	75	38	87	42	83	54	71	70	55	76	49
Sep-18	117	8	105	20	118	7	124	1	108	17	93	32	71	54	97	28	122	3	121	4	124	1
2018	113	11	108	16	112	12	121	3	106	18	96	28	76	48	81	43	117	7	112	12	120	4

Table 3 Statewide and Climate Division Rankings for Maximum Temperature (NOAA NCEI Climate at a Glance, 2018)

Precipitation

Precipitation totals across the state ranged from about 25% to 205% of the 1981-2010 Normal for water year 2018. The Continental Divide split the state into two different precipitation regimes. To the west, an area which received less than normal precipitation and, to the east, one which had above normal precipitation (Figure 3). The higher elevation areas such as the Wind River Range, the Bighorn Mountains, the Laramie Range, and the eastern flanks of the Owl Creek mountains also had less than normal precipitation totals for the year.

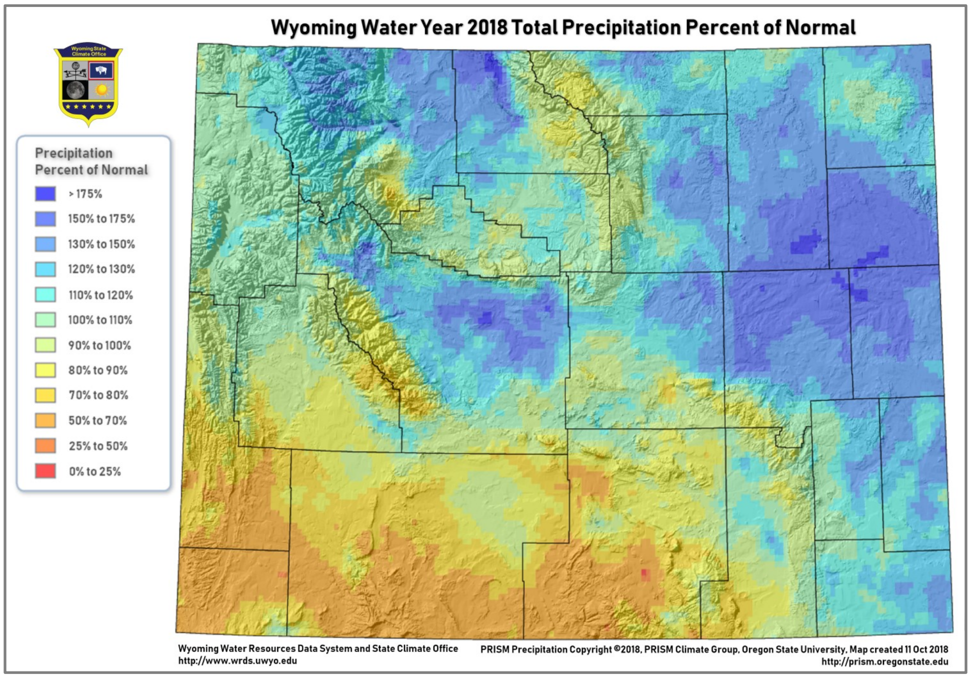

Figure 3. Wyoming Water Year 2018 Annual Precipitation Percent of Normal (PRISM Climate Group, 2018)

Climate Division 7 in the east (the Cheyenne and Niobrara drainages) had the highest percentage of normal and water year 2018 ranked as the 6th wettest year for the period 1895 to 2018. Low elevation areas of the Bighorn Basin and Wind River Basin (Climate Divisions 4 and 9) also had high percentages of normal, but the basins, as a whole, ranked much higher in terms of dryness because of being offset by the relative lack of precipitation in the surrounding higher elevations. Those two divisions (4 and 9) ranked as the 44th and 52nd wettest respectively.

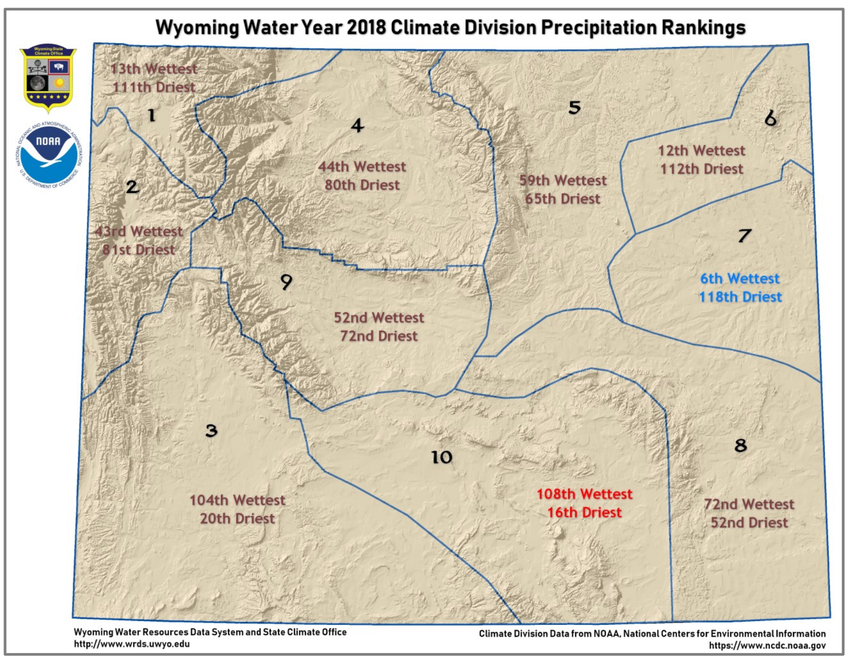

Figure 4. Wyoming Water Year 2018 Climate Division Temperature Rankings (NOAA National Centers for Environmental Information (NCEI), 2018)

Climate Division 6 (the Belle Fourche Drainage) had the second highest ranking in the state (12th wettest out of the last 123 years) and, for all months of the water year, had normal or above normal precipitation. Four months (December, May, June, and August) were in the upper tercile (above normal) of years and an additional three months (February, March, and July) were in the top 10 percent.

Climate Division 10 (the Upper Platte) receive the least precipitation compared to normal and ranked as the 16th driest of the last 123 years. All months ranked either normal or below normal.

Climate Division 1 (the Yellowstone Drainage) had two months (July and September) that were in the bottom 10 percent while three other months (November, February, and April) were in the top 10 percent.

Statewide, September 2018 was the driest month, ranking as the 12th driest since 1895. Four of the divisions (1, 2, 3, and 9) had totals for September that were in the bottom 10 percent (Table 4). While November ranked as the wettest (18th wettest since 1895), February had four divisions (1, 4, 5, and 6) that were in the top 10 percent. May, which had almost the same ranking as February only had one climate division (7, the Cheyenne and Niobrara drainages) that was in the top 10 percent for wetness.

Wyoming, as a whole, for water year 2018 was very close to normal and ranked as the 60th driest and 64th wettest year of the last 123. This ranking, though, is somewhat misleading given the stark differences east and west of the Continental Divide.

Driest 10%	Driest 33%	Normal	Wettest 33%	Wettest 10%

Date	Precipitation (Driest [D] and Wettest [W] Rankings)																					
	Wyoming		CD 1		CD 2		CD 3		CD 4		CD 5		CD 6		CD 7		CD 8		CD 9		CD 10	
	D	W	D	W	D	W	D	W	D	W	D	W	D	W	D	W	D	W	D	W	D	W
Oct-17	33	91	40	84	46	78	13	111	41	83	41	83	55	69	53	71	49	75	49	75	36	88
Nov-17	106	18	119	5	115	9	93	31	105	19	81	43	63	61	74	50	48	76	110	14	63	61
Dec-17	66	58	73	51	31	93	49	75	92	32	83	41	96	28	91	33	60	64	106	18	57	67
Jan-18	47	78	71	54	55	70	41	84	37	88	61	64	79	46	105	20	70	55	43	82	45	80
Feb-18	102	23	117	8	79	46	71	54	117	8	116	9	122	3	109	16	41	84	108	17	60	65
Mar-18	78	47	59	66	92	33	66	59	59	66	93	32	114	11	103	22	79	46	60	65	50	75
Apr-18	48	77	119	6	121	4	39	86	74	51	35	90	59	66	30	95	25	100	43	82	19	106
May-18	103	22	82	43	103	22	98	27	110	15	78	47	89	36	113	12	108	17	108	17	67	58
Jun-18	84	41	110	15	88	37	66	59	88	37	86	39	109	16	113	12	65	60	90	35	64	61
Jul-18	73	52	8	117	13	112	16	109	30	95	84	41	115	10	118	7	89	36	51	74	37	88
Aug-18	60	65	87	38	70	55	42	83	88	37	81	44	98	27	56	69	52	73	38	87	43	82
Sep-18	12	113	7	118	1	124	2	123	21	104	46	79	47	78	43	82	38	87	6	119	17	108
2018	60	64	111	13	81	43	20	104	80	44	65	59	112	12	118	6	52	72	72	52	16	108

Table 4. Statewide and Climate Division Rankings for Precipitation (NOAA NCEI Climate at a Glance, 2018)

Snowpack

April 1st snowpack in Wyoming, the amount which is commonly used in spring stream runoff forecasts, was above normal for much of the north and west. The Upper Bear, Lower Green, Little Snake, Upper North Platte, and Sweetwater basins were about 80% to 90% of normal. The Lower North Platte was the lowest at only 70% of normal.

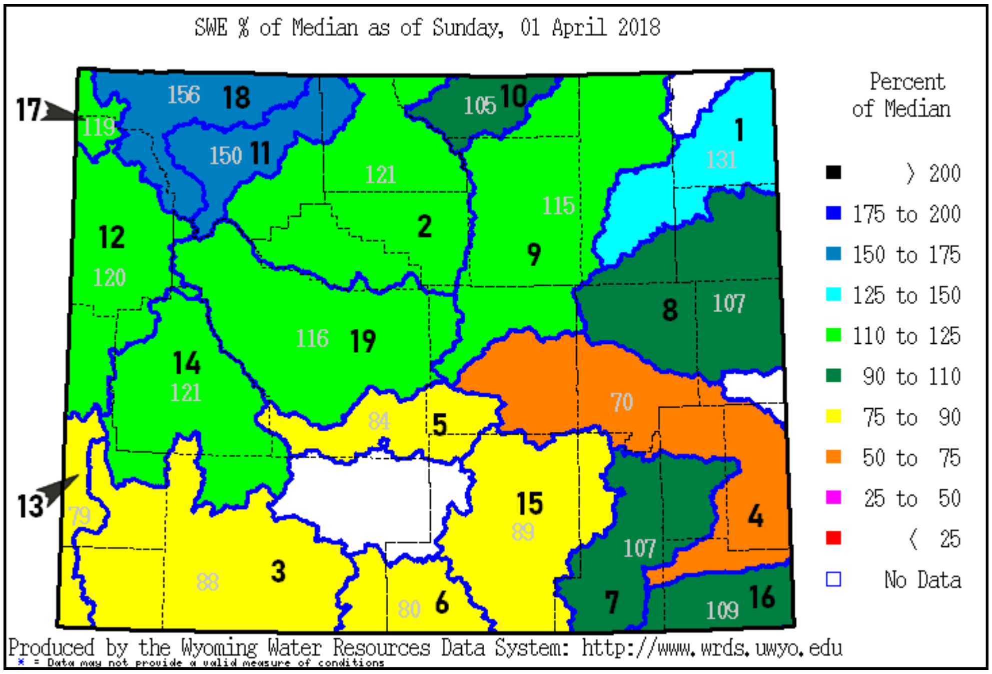

Figure 5. Basin Snow Water Equivalent Percent of Normal on the 1st of April, 2018

(1) Belle Fourche River Basin. April snowstorms pushed Snow Water Equivalent (SWE) well above normal although the start of meltout began less than a week later than the median. Final meltout took place almost exactly at the normal date.

(2) Bighorn River Basin. Spring snows made for an above normal snowpack and meltout began about a week later than normal. The basin was melted out almost a full two weeks before normal.

(3) Lower Green River Basin. Snowpack was about two inches less than normal SWE. Meltout began about two weeks later than normal but finished about a week and a half early.

(4) Lower North Platte River Basin. A poor snowpack reached its peak about as normal but melted out close to two weeks early.

(5) Sweetwater River Basin. Peak snowpack occurred about the normal time but was about three inches below normal SWE. The basin was melted out at the beginning of a June, just a few days earlier than normal.

(6) Little Snake River Basin. Peak snowpack was a few days later than normal but close to three inches of SWE less than normal. Meltout came a little over a week earlier than normal.

(7) Laramie River Basin. This basin peaked right about on schedule compared to normal. SWE was higher than normal but melted out about two weeks earlier than normal.

(8) Cheyenne River Basin. The basin had normal snowpack until the last week in March when storms pushed the SWE up two inches above normal. The peak came a few days later than normal and meltout finished near to the normal date.

(9) Powder River Basin. The peak SWE was reached a few days early but was almost three inches above normal. The basin melted out a little less than a week before normal.

(10) Tongue River Basin. The basin was under normal up until the first part of February. Peak SWE was more than a week later than normal and the SWE, itself, above normal. Meltout came about a week earlier than normal.

(11) Shoshone River Basin. The northwest part of the state received much precipitation and the Shoshone had a peak SWE that was over 12 inches above normal. The peak came at about normal and meltout ended only a day or two early.

(12) Snake River Basin. Peak SWE was about eight inches above normal and the peak was about a week late. The meltout date was only a few days earlier than normal.

(13) Upper Bear River Basin. The peak SWE in this basin was more of a plateau that spanned the normal peak date. Meltout began about a week late and finished about a week early.

(14) Upper Green River Basin. The peak SWE was under five inches above normal and came almost two weeks late. This was one of the few basins that melted out later than normal, although only by a few days.

(15) Upper North Platte River Basin. Peak SWE was just under an inch below normal and occurred right at normal. Final meltout took place more than two weeks early, though.

(16) South Platte River Basin. While peak SWE occurred as normal and was a bit above normal, the basin melted out about two weeks early.

(17) Madison-Gallatin River Basins. This basin peaked about two weeks late with about two inches of SWE more than normal. Even so, meltout occurred close to normal.

(18) Yellowstone River Basin. The basin had above normal SWE for the entire season. It peaked right about normal and finished meltout a few days later than normal.

(19) Wind River Basin. At about two inches of SWE higher than normal, the basin peaked a few days later and melted out a few days early.

Basin snowpack may be monitored using various products available at http://www.wrds.uwyo.edu/wrds/nrcs/nrcs.html

Drought

The start of the 2018 water year showed a state with three areas of drought; south central, a small portion in Goshen and Platte counties, and an area covering the far northeast part of the state (Figure 6). While the first two areas were strictly D0 (Abnormally Dry), the latter included an area of D1 (Moderate Drought) stretching across the northern parts of Campbell and Crook counties.

After a brief expansion which saw the two eastern areas merge and cover about half of the eastern quarter of Wyoming starting in mid-December and lasting into the first part of February, only the south central drought remained by mid -April. By this time the D0 had spread all the way to the western border, covering almost all of Uinta County as well as a large portion of southern Lincoln County. Additionally, D1 formed in the central areas around the Carbon and Sweetwater county border.

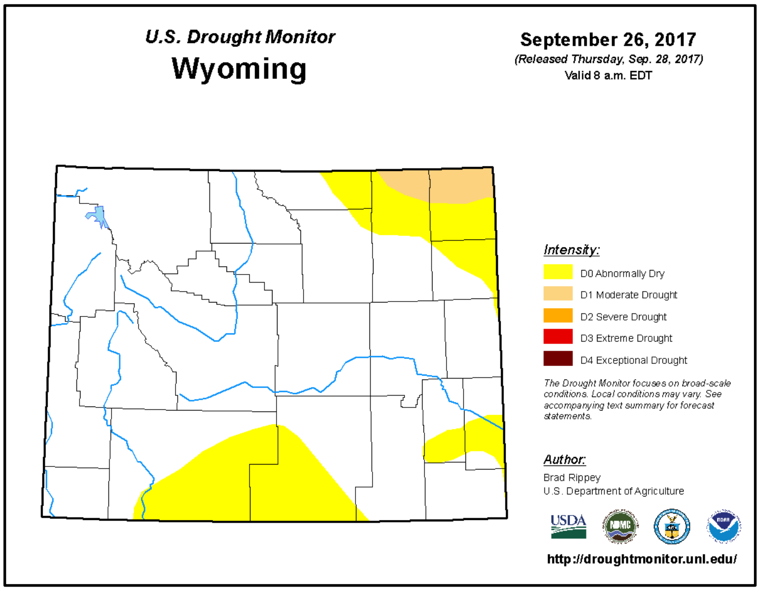

Figure 6. US Drought Monitor showing conditions at the start of Water Year 2018

The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.

High evaporative demand fueled by the warm temperatures in July and September and especially by the lack of precipitation in those months caused both the D0 and the D1 areas to continue to expand through the summer with the D1 entering southwestern Albany County by 10 July. By the end of July, D1 conditions expanded westward to the Stateline covering much of Uinta County as well as the southwest corner of Lincoln County. At the same time, D2 (Severe Drought) covered the southern two-thirds of the border area between Carbon and Sweetwater counties.

By mid-August, almost all of Sweetwater County was in D0 to D2 and D0 had spread two-thirds of the way north into Lincoln County. By the 21st of August, a swath of D0 covered the western part of the state all the way to the Montana border, although conditions quickly improved for the Yellowstone National Park area in the following weeks. In mid-September, D0 covered all of Sublette County and the far southern part of Fremont County.

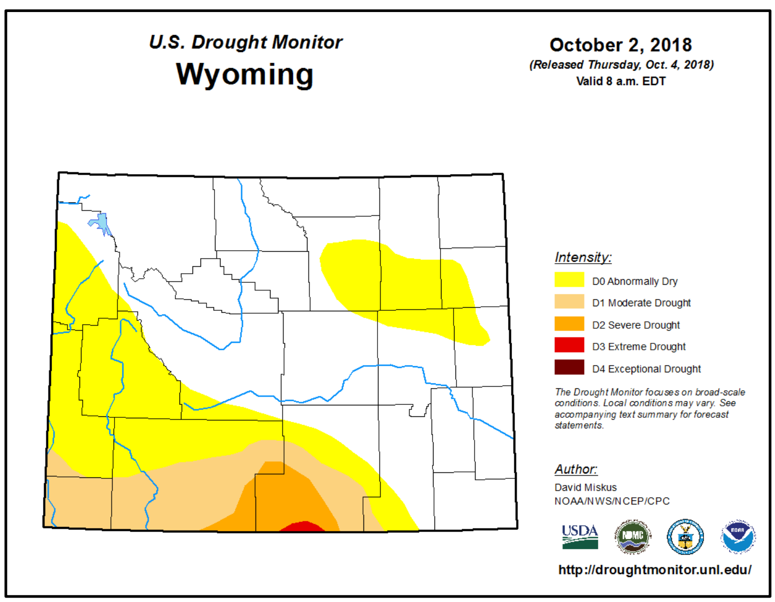

Figure 7. US Drought Monitor showing conditions at the end of Water Year 2018

The end of the 2018 water year (Figure 7) saw the first D3 (Severe Drought) in Wyoming since the 6th of September 2016. D0 conditions began to emerge in the northeast part of Wyoming again during the last week of the water year.

Figure 8 shows a timeline of drought in Wyoming during the 2018 water year. The chart shows the percentage of the state in each category of drought. Over 10 percent of Wyoming was in D0 or greater for the entire year. And about two percent of the state was in D1 or worse for the same

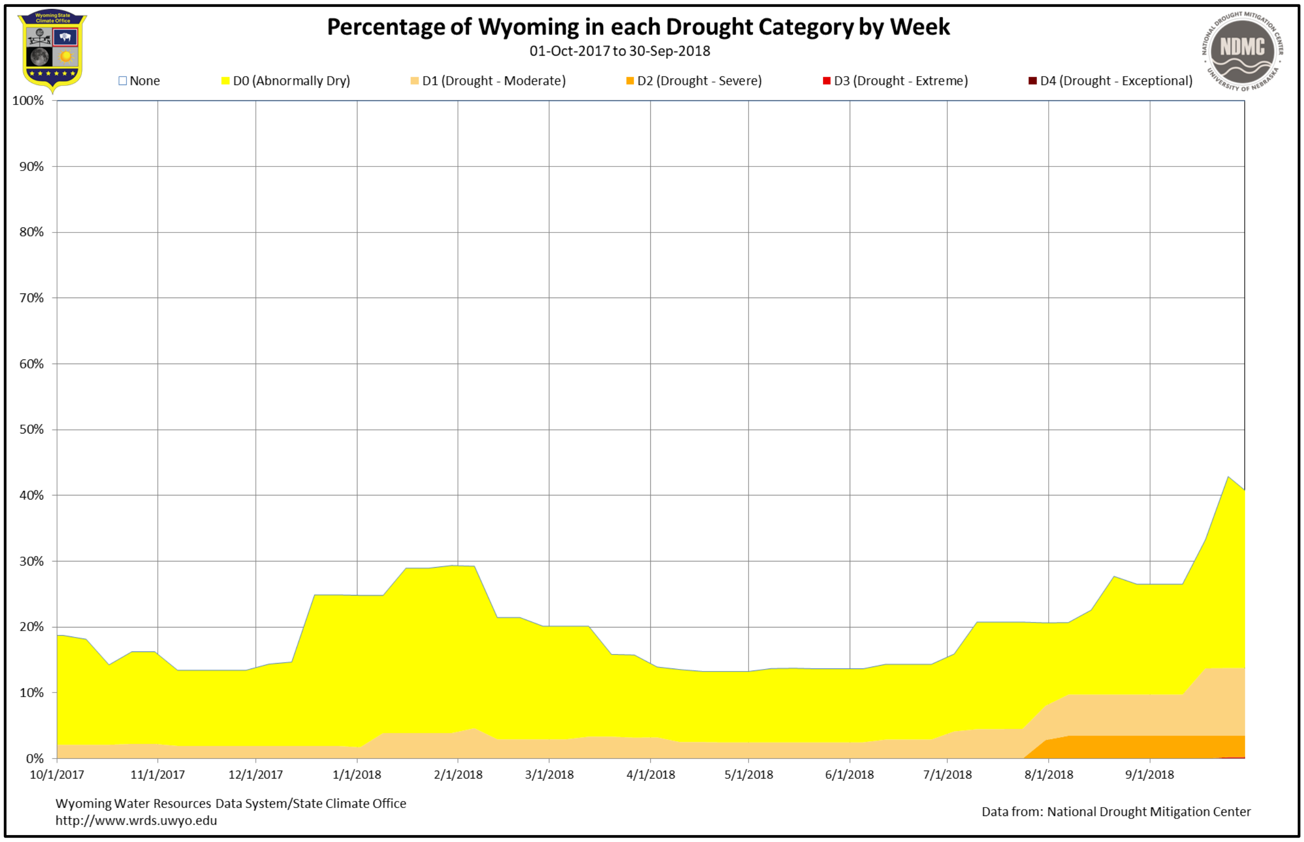

Figure 8. Timeline of drought intensities and geographic extent for Water Year 2018

period. The increased drought levels and area in southwest and south central Wyoming can be seen starting in the first third of July as a result of above normal temperatures and below normal precipitation amounts (Tables 1-4).

Severe Weather and Natural Disasters

Avalanches

Three fatalities were reported in Wyoming resulting from avalanches. On 29 December 2017 five snowmobilers were caught with one buried and killed. On 17 February an avalanche caught and killed a skier near Wilson. On 22 April a snowmobiler was caught and killed west of Togwotee Pass.

Figure 9. Mesocyclone that spawned Laramie EF3 tornado, 06 June 2018 Photo: Tony Bergantino

Tornadoes

Thirteen tornadoes were reported in Wyoming between late May and the end of July. Almost three times as many warnings were issued this year compared to the average of 19 per year from 2006 to 2017. Three of the thirteen tornadoes were EF3 and two were rated at EF2. The EF3 tornadoes were the first confirmed tornadoes of that intensity since 1987 when the state's lone F4 tornado went through Teton County. Since the start of records in 1950, Wyoming has only had a dozen EF3 or greater tornadoes. The EF3 in Laramie on the 6th of June was the strongest ever in Albany County dating back to 1950. The map in Figure 10 shows the dates and locations of confirmed tornadoes in Wyoming during the 2018 tornado season.

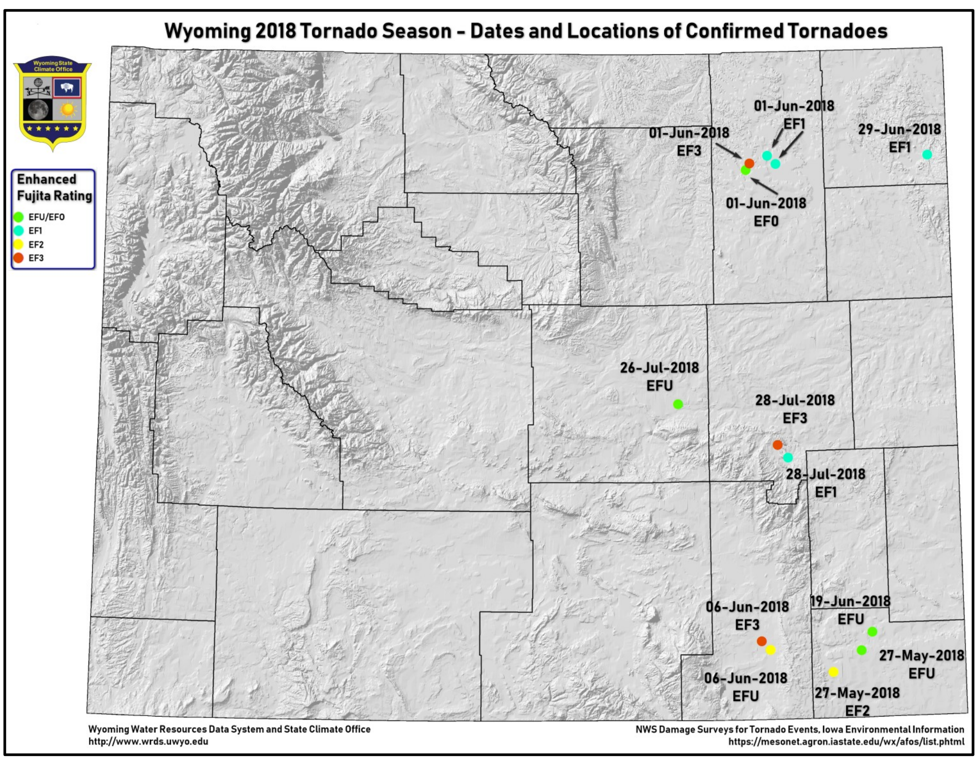

Figure 10. Map showing locations, intensities, and dates of tornadoes in Wyoming during the 1918 season (NWS Damage Surveys)

Hail

Numerous hail storms impacted the state in 2018 and, while most of these were on the eastern plains, Fremont, Sweetwater, Hot Springs, Park, Big Horn, Sublette, and Washakie counties were not without incidents. Lusk saw a particularly severe storm on the 24th of July when hailstones up to 1.75" in diameter caused property damage across the town. On the 26th of July severe thunderstorms hit Lovell, also producing 1.75" diameter hail, and causing extensive property damage. On the 27th of July, Buffalo was hit by golf-ball size hail which caused property damage in the form of broken windows, damaged siding, and, in the surrounding areas, crop damage. (NCDC Storm Events Database, 2018). The 29th of July saw Cheyenne pounded with damaging hail resulting in over a 1,000 insurance claims for property damage. (Casper Star Tribute, 2018).

Floods

A combination of rain and melting snowpack caused flooding along the Wind River in June while the Green River was also in flood stage. In Teton County, a mudslide that blocked an irrigation ditch caused flood damage to six homes south of Jackson. Rains also caused minor flooding along the Shoshone River in northern Wyoming. Rain and snowmelt also caused Ten Sleep Creek to overflow into a local campground. Heavy rains in late May caused Big Goose Creek near Sheridan to rise which caused street flooding as well as flooding of numerous basements. Additionally, thunderstorms and hail caused urban flooding in other locations such as Casper in late May, and Laramie in June. (NCDC Storm Events Database, 2018).

Fires

During the summer of 2018, much of Wyoming lay under smoke-filled skies which either blocked the sun completely or turned it into a distinct blood-red circle. Much of this smoke originated out of state from as far away as the Ranch and Carr fires in northern California.

Within the borders of the state, there were nearly 75 fires reported this season. Almost two-thirds of these were under 100 acres in size.

Another five fires were between 1,000 and 10,000 acres while the top seven ranged from 12,073 acres to the largest, the Roosevelt Fire in the far west part of the state, at over 62,000 acres. The fires combined had a total of almost 245,000 acres burned.

The 245,000 acres is almost twice the average annual acres burned over the last 16 years and 2018 had the highest number of burned acres since the 2012 Drought when almost 475,000 acres burned. In the last 16 years, 2018 had the third highest acreage, falling just below the number of acres burned in 2006.

The total number of fires per year is a bit less significant since there could be several small fires that burn less acreage than just one large fire. However, the 74 fires in 2018 was above the approximately 55 fire yearly average from 2003 to 2018, and 2018 ranked as the 6th highest in terms of fire-count.

At the end of the September, fire activity around the state was at a minimum and mostly constrained to mop-up operations.

Figure 11 below shows smoke from the Badger Creek fire drifting over Jelm Mountain southwest of Laramie. The photo was taken on the 12th of June, one day after the fire started.

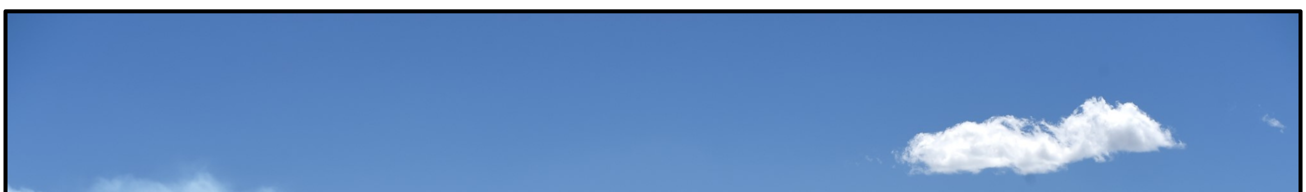

Figure 11. Badger Creek fire seen from Laramie, 12 June 2018 Photo: Tony Bergantino

Fire	Date Reported	Acres Burned	Fire	Date Reported	Acres Burned
Roosevelt	15-Sep-2018	62,042	Boxelder	20-Jun-2018	36
Terek	09-Jul-2018	47,901	Turner Draw	15-Jul-2018	33
Britania Mountain	28-Aug-2018	32,193	Basin Creek	28-Sep-2018	31
Ryan	16-Sep-2018	28,784	Skull Creek	13-Aug-2018	29
Badger Creek	11-Jun-2018	21,404	Butte	08-Aug-2018	25
Laney Rim	30-Jul-2018	13,183	Fence Creek	09-Jul-2018	25
Marten Creek	16-Sep-2018	12,073	Buffalo Creek	16-Jul-2018	24
Denver Jake	14-Aug-2018	7,247	Mckenzie	06-Jul-2018	19
Zimmerman	30-Jul-2018	6,289	Horse Pasture	30-Jun-2018	15
Black Butte	29-Jul-2018	4,937	Patterson	09-Jul-2018	14
Black Mountain	17-Sep-2018	2,100	Little Missouri	31-Jul-2018	11
Weintz	15-Jun-2018	1,990	Sulphur Creek	05-Aug-2018	10
Yellow Mountain	29-Sep-2018	482	Highway 31	30-Jul-2018	10
Alkali Flats	05-Jul-2018	434	Jake	22-Jun-2018	10
Rattlesnake	06-Aug-2018	354	Buffalo North	07-Aug-2018	9
Tater Ridge	08-Aug-2018	346	Coal Gulch	23-Jul-2018	8
Reno	16-Jul-2018	299	Big Antelope Basin	06-Aug-2018	8
Baker Cabin	08-Jul-2018	250	Beck	11-Jun-2018	7
Bixby	01-Aug-2018	247	Willow Creek	12-Jul-2018	7
Big Ridge	29-Jul-2018	205	286	15-Aug-2018	6
Red Butte	08-Aug-2018	176	Chameleon	30-Aug-2018	6
Haul	16-Jul-2018	152	Highway 2	06-Aug-2018	5
King Draw	14-Jul-2018	151	Gravel Pit	05-Aug-2018	5
Shirttail Butte	10-Jul-2018	142	Sweet Clover	17-Jul-2018	5
Hampton	22-Jun-2018	123	Geary	03-Sep-2018	4
Spotted Horse Creek	17-Aug-2018	110	Mud Lake	27-Jul-2018	4
Olmstead Creek	02-Jul-2018	105	Blue Ridge	06-Jul-2018	4
Evans Draw	10-Sep-2018	90	Shed	04-Aug-2018	3
Brush	12-Jul-2018	89	Leigh Canyon	15-Sep-2018	3
Enduro	06-Aug-2018	79	259	12-Sep-2018	3
Lower Nowood	06-Aug-2018	78	Lxr Creek	31-Jul-2018	3
North Bobcat	30-Jul-2018	65	Ek Road	21-Aug-2018	2
Diamond	10-Sep-2018	65	Cabin Camp	03-Jul-2018	2
Fire Trail	12-Aug-2018	61	Million Creek	11-Jun-2018	1
Martin	10-Jul-2018	51	Spring Creek	17-Aug-2018	1
Devils Slide	22-Jun-2018	42	Pitch Draw	16-Jul-2018	1
Coalbank	22-Jul-2018	37	Schoonover Road	29-Jun-2018	1

Table 5. List of fires, dates, and acres burned during the 2018 fire season. (EcoWest, 2018)

Streamflow and Reservoirs

Streams in Wyoming ended the water year ranging from Low to Much Above Normal. Figure 12 shows USGS streamflow gauges in the state. Most of the gauges are in the 25th to 75th percentile which is the normal range although there are a number of stations, mostly in the northern half of the state that are in the 76 to 90 percentile, or above normal. There are about a dozen stations around the state in the 10th to 24th percentile, or below normal. While not an absolute, the south and southwest generally has a higher number of stations running below normal while the north and northeast have more running above normal.

Reservoirs on the 1st of June were in good shape and many had filled to over 80 percent of capacity from the spring runoff (Figure 14). Storage in the reservoir system amounted to a bit over 10 million acre-feet (Figure 13).

By the end of the water year, reservoir releases lowered storage considerably although six (Alcova, Bighorn Lake, Boysen, Flaming Gorge, Keyhole, and Kortes) were still above 80 percent of normal (Figure 16). Storage was down to just under 9 million acre-feet on the 30th of September (Figure 15). (http://www.wrds.uwyo.edu/surface_water/teacups.html)

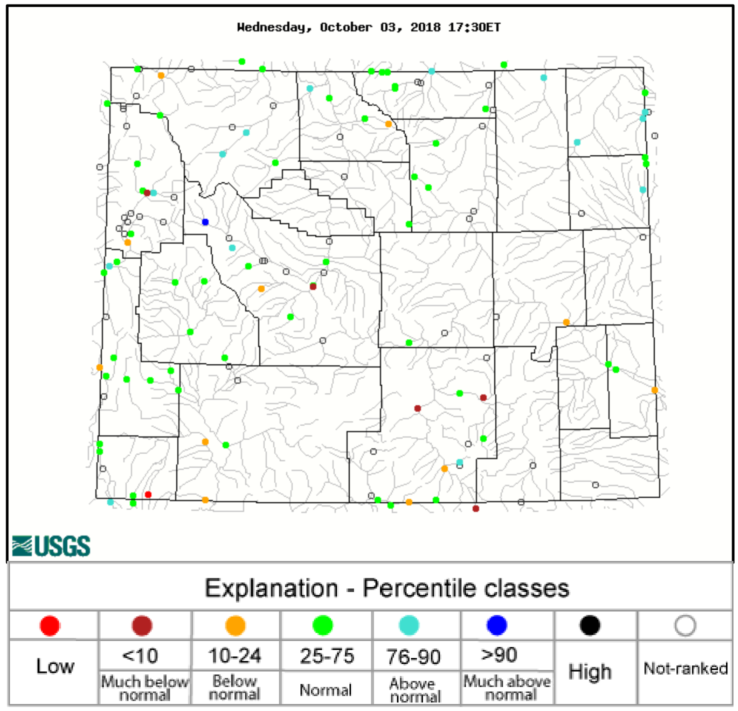

Figure 12. Streamflow percentiles in Wyoming at the end of Water Year 2018 (NWIS, 2018)

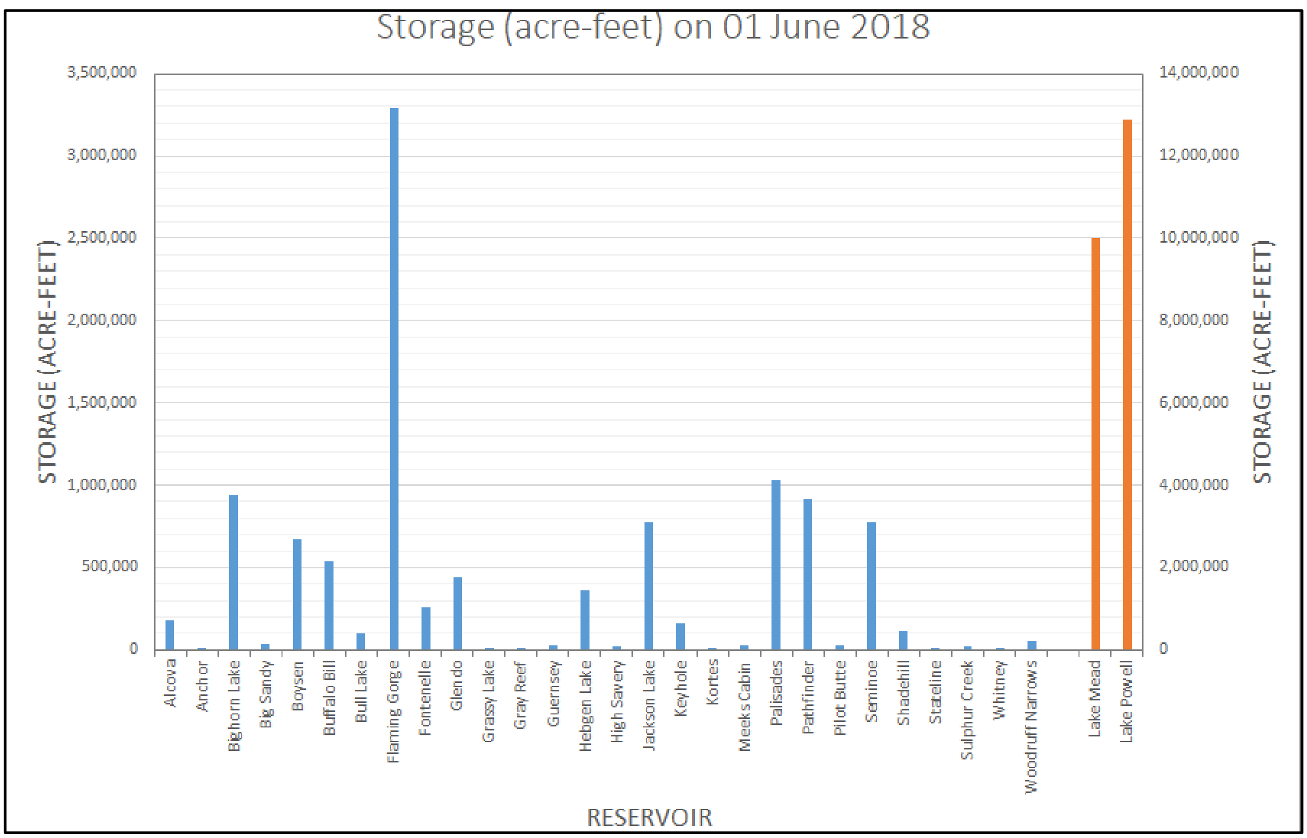

Figure 13. Amount of reservoir storage in acre-feet on 01 June 2018

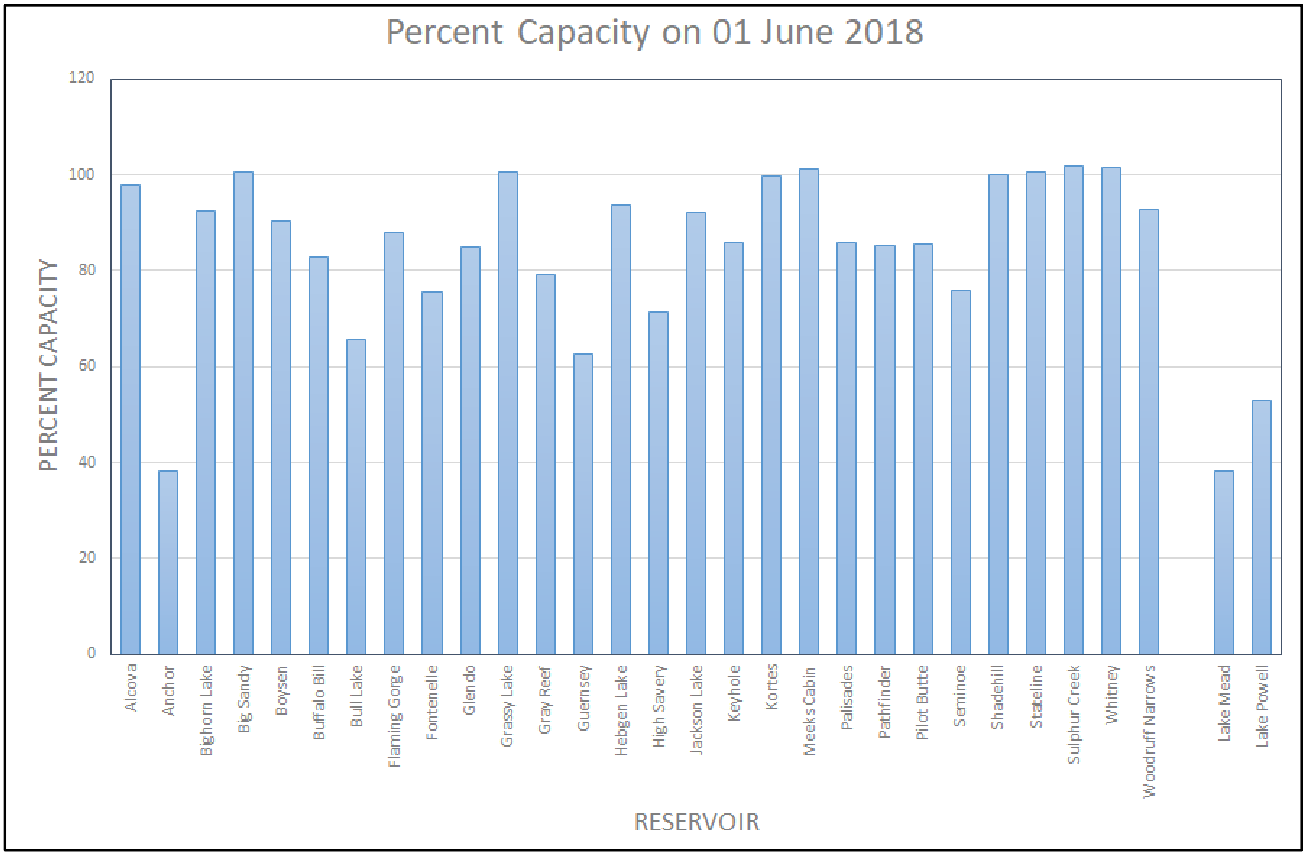

Figure 14. Percent of capacity for reservoirs on 01 June 2018

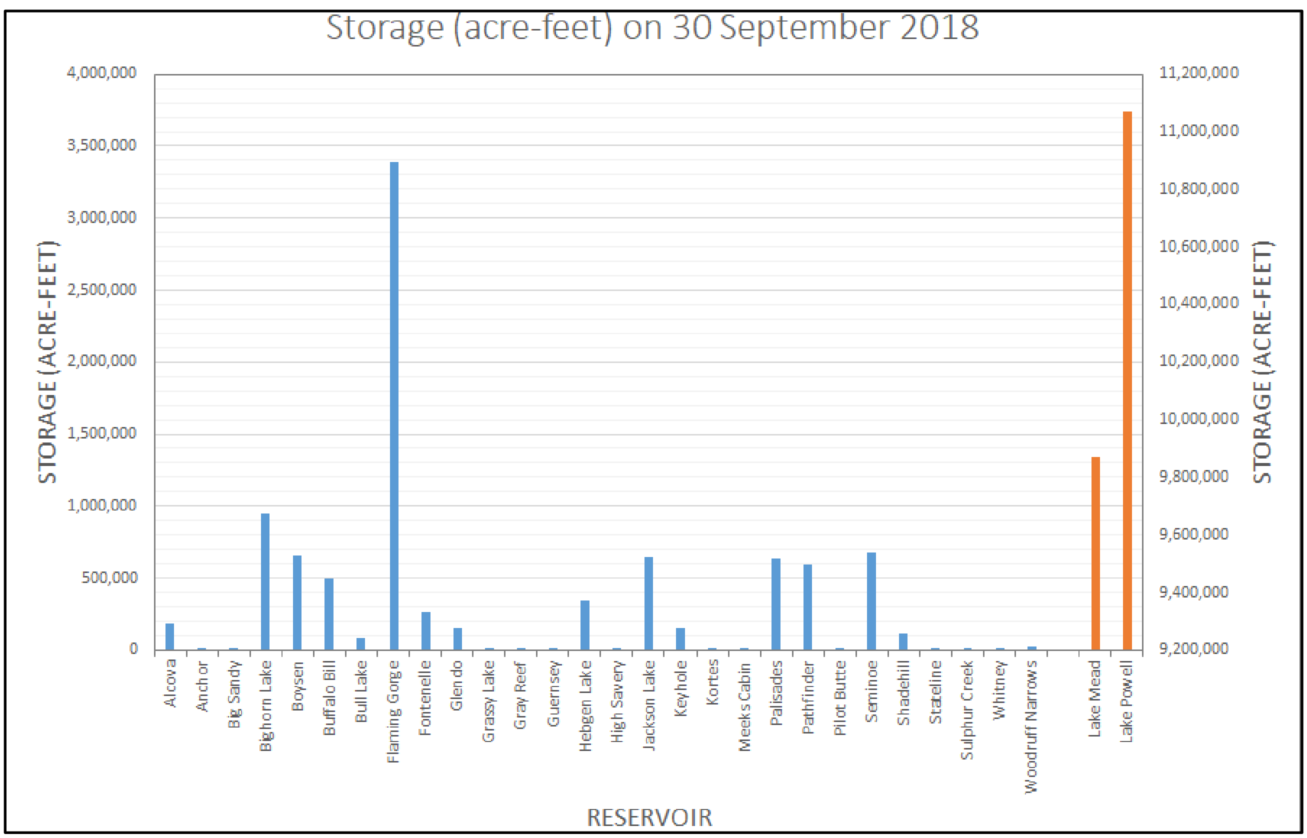

Figure 15. Amount of reservoir storage in acre-feet remaining at the end of water year 2018

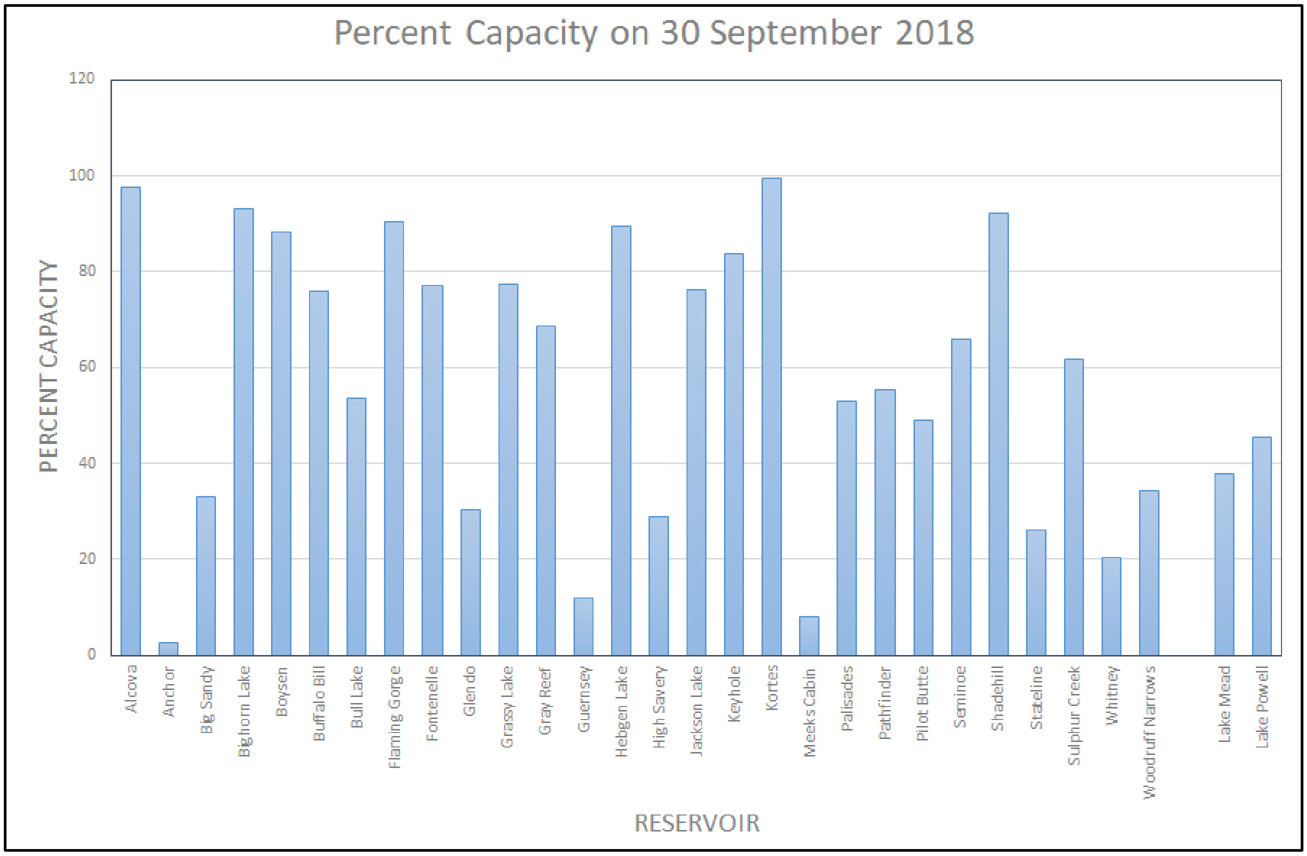

Figure 16. Percent of capacity for reservoirs remaining at the end of water year 2018

Wind

Wind patterns for the sixteen cities for which the Water Resources Data System and State Climate Office produces wind roses for maintained the same basic signature compared to the 2006 to 2015 averages. There may be variations month-to-month but the shapes of the roses are very similar as far as dominant directions when compared on an annual basis. Where there are differences, they are mainly that the frequency of wind speed ranges from a particular direction may vary. Appendix A shows a comparison of the annual wind rose to the 10-year average for each of the sixteen cities.

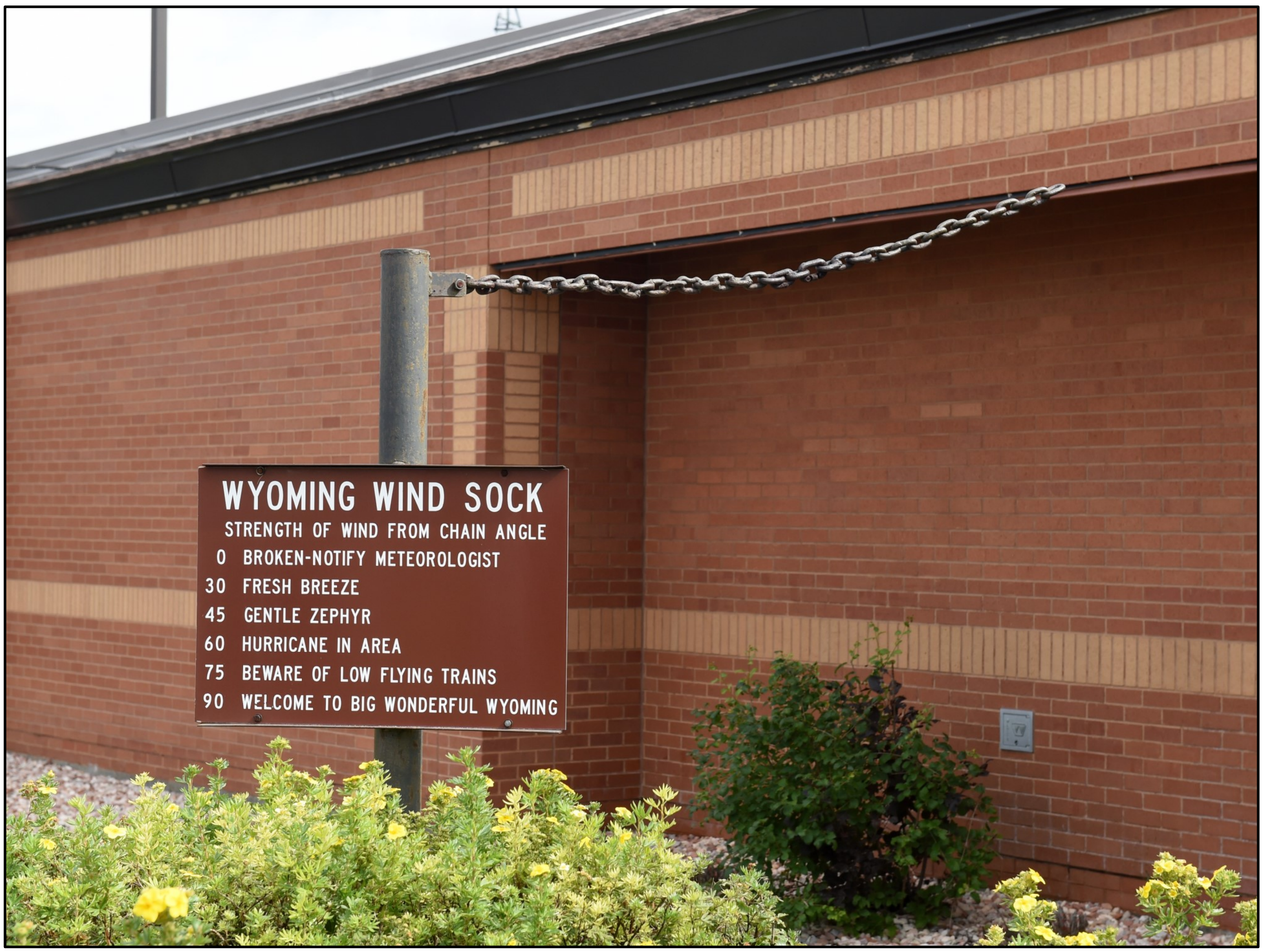

Figure 17. Wind Sock at Cheyenne National Weather Service Office — Photo: Tony Bergantino

Outlook for Water Year 2019

There is about a 70 to 75% chance of El Niño forming in the coming months and continuing into 2019. Conditions were still neutral at the end of water year 2018, but sea surface temperatures are continuing to increase across the equatorial regions of the Pacific.

El Niño events have varying influence on Wyoming given the state’s geographic location at the boundary between impacts. For example, temperature tends to be higher during El Niño conditions compared to neutral conditions when it occurs in the January through March period, while in the July through September period the temperatures tend to be less than during neutral conditions.

For precipitation, the July through September period is usually wetter than during neutral conditions. For April through June precipitation is often higher in the west and lower in the east compared to what is seen during neutral conditions.

During January through March, the northwest is usually drier while the southeast trends toward being wetter than neutral conditions. The northeast and southwest generally do not see much difference in precipitation compared to a neutral Pacific.

Currently, the three-month outlook for the January through March period is calling for higher chances of above normal temperatures statewide with those chances being better than 50% in the western third of Wyoming. The chances for below normal precipitation are greater in the northern quarter of the state, slightly better for above normal in the far southeast and indeterminate elsewhere (Figure 18).

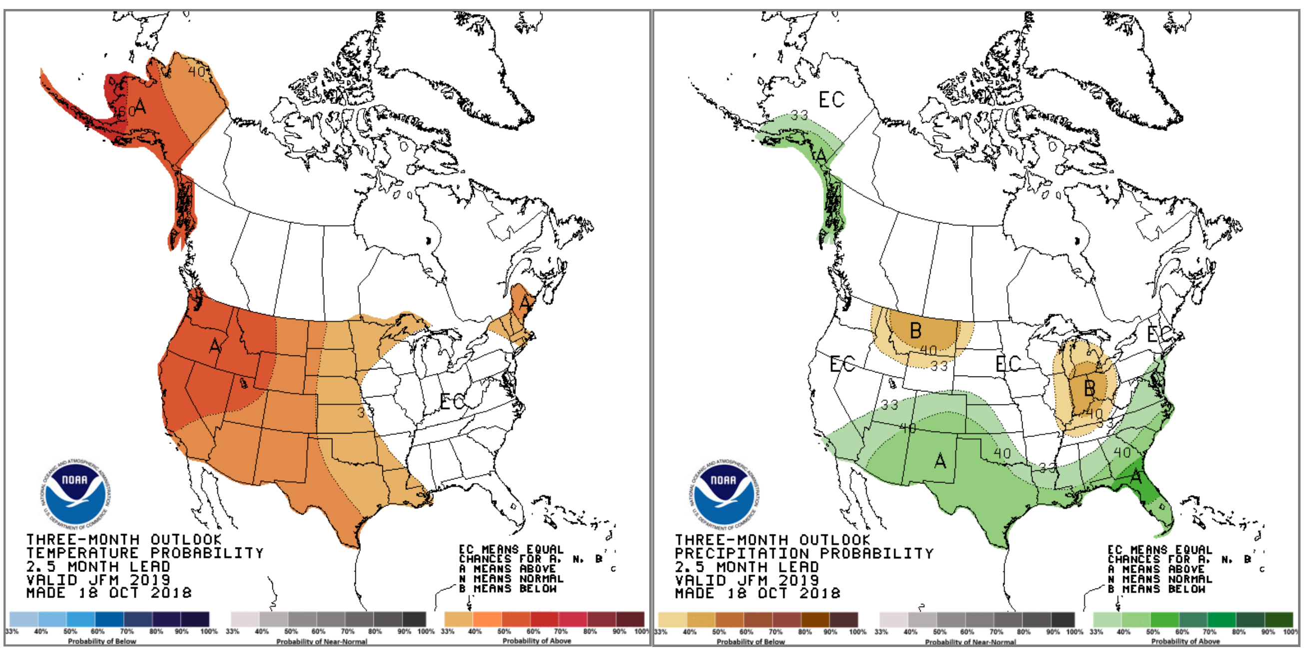

Figure 18. Three-month temperature (left) and precipitation (right) outlook for Jan-Mar 2019. (Climate Prediction Center, 2018)

For the second quarter of 2019 (months of April, May, and June) the temperatures are again expected to be above normal for most of the state although the chances are greatest in the southwest and diminish somewhat toward the northeast. The far northeast region of the state has equal chances for above, below, or normal temperatures. Precipitation is unknown for the entire state during this period and could be above, below, or normal.

During the final quarter of the water year (July, August, and September of 2019) temperatures are, again, expected to be above normal for most of the state with some uncertainty in the far northeast corner. The odds of above normal temperatures for this period increase toward the southwest and in the far southwestern quarter the chances are better than 50% for having above normal temperatures. The signal for precipitation is a bit stronger during this three-month period and the odds slightly favor below normal precipitation in the northwest while the rest of the state still has even chances for above, below, or normal precipitation. (Climate Prediction Center, 2018).

The seasonal outlook calls for drought persisting in the south and southwest through at least the end of calendar year 2018.

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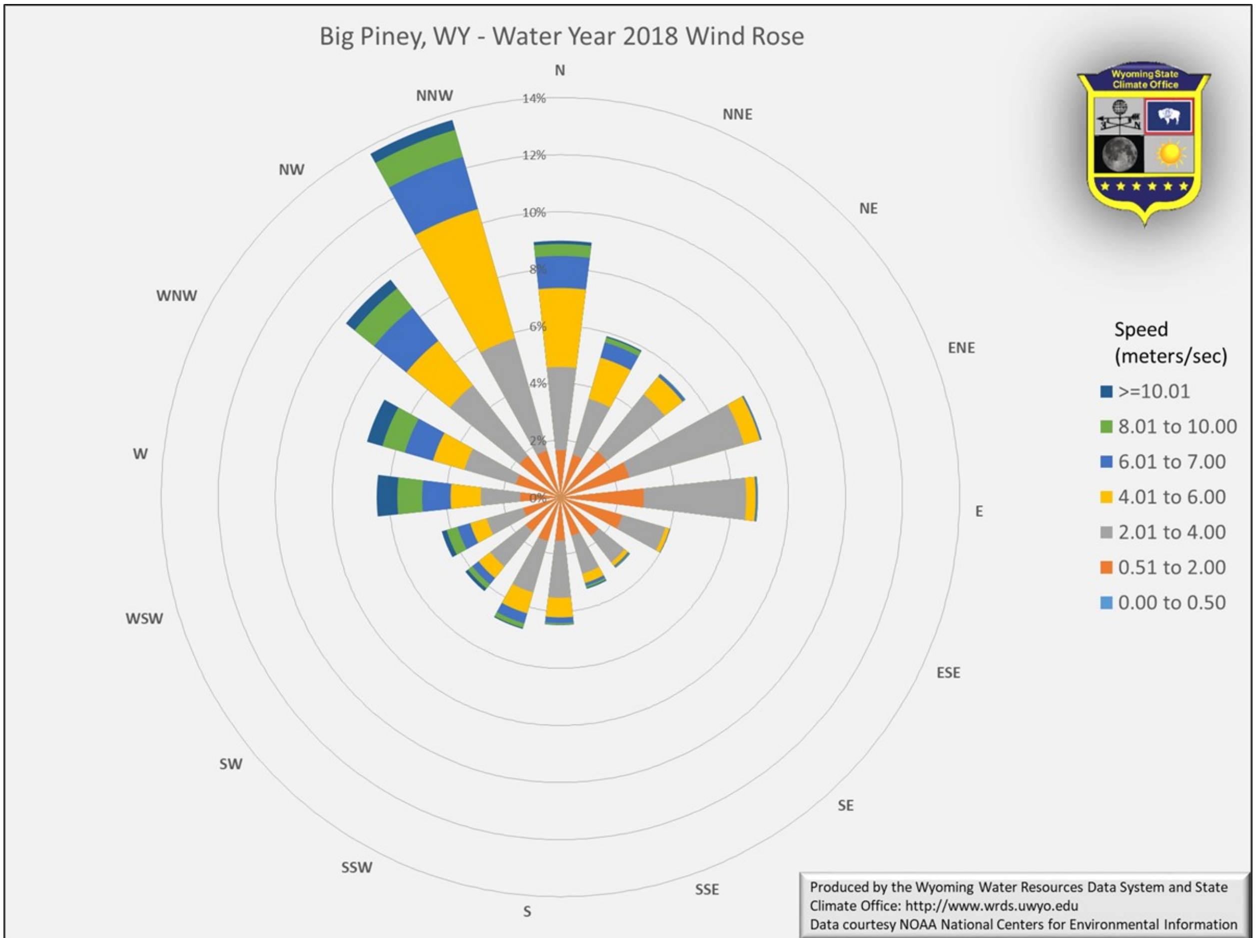
Appendix A

Wind



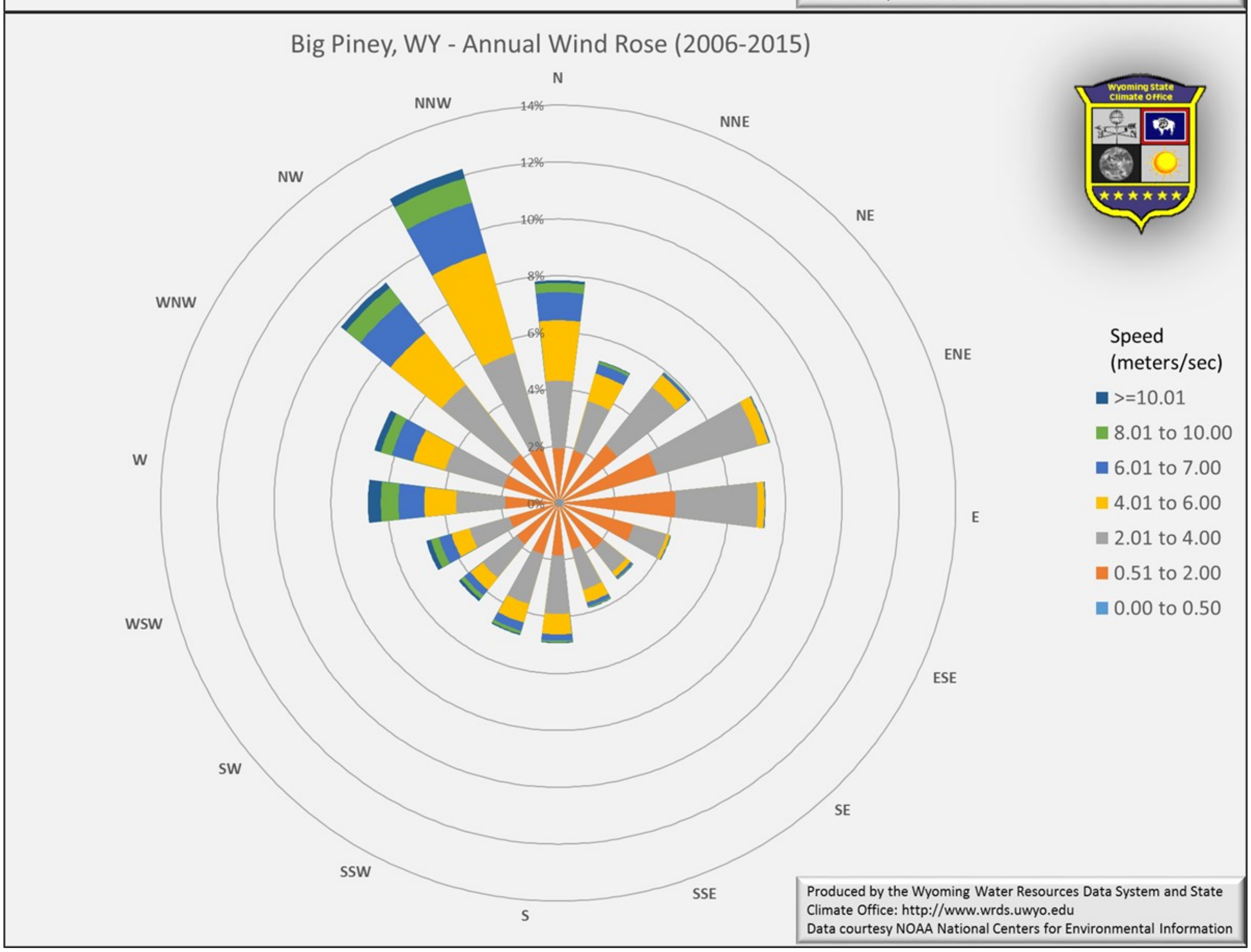
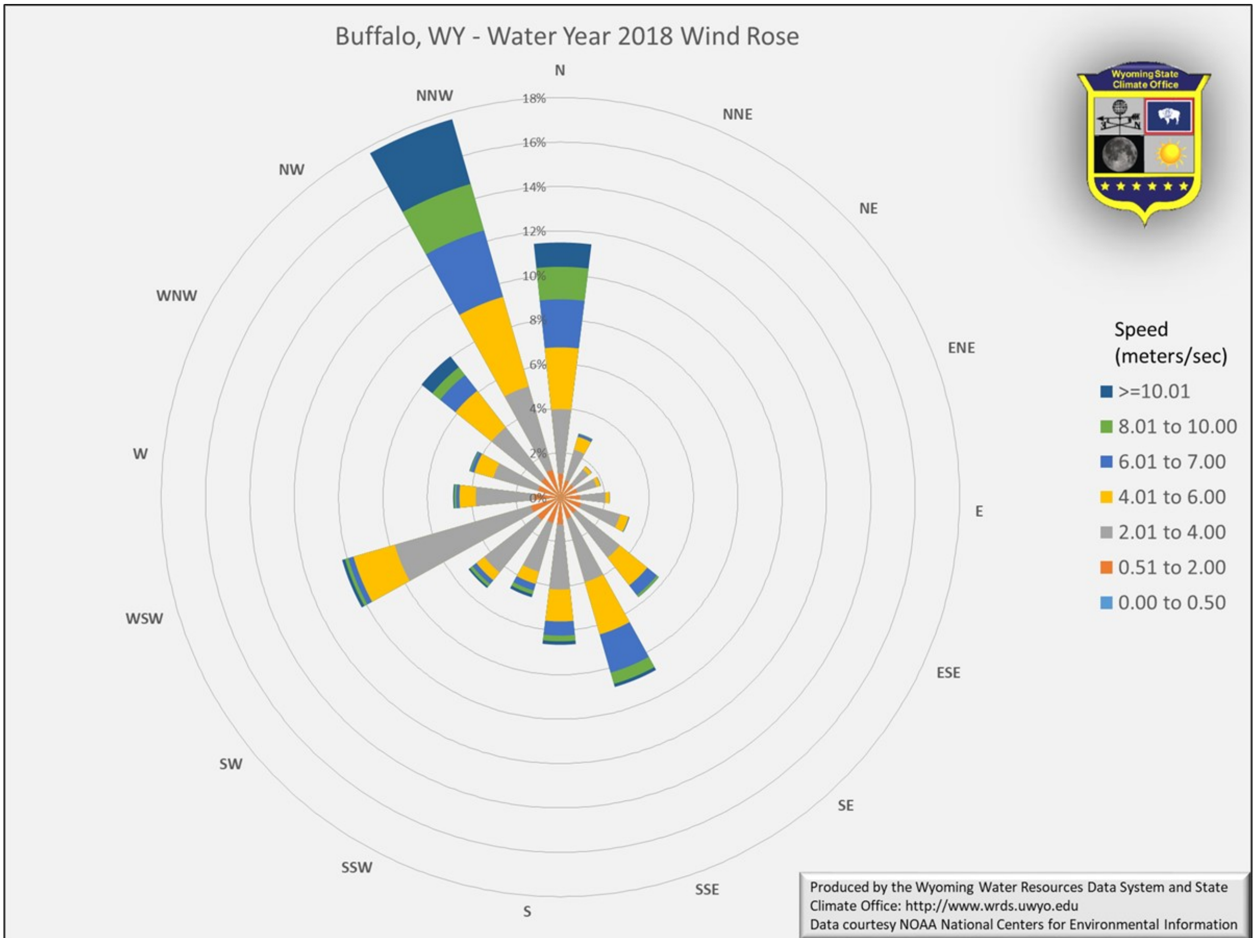


Figure 19. Big Piney Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



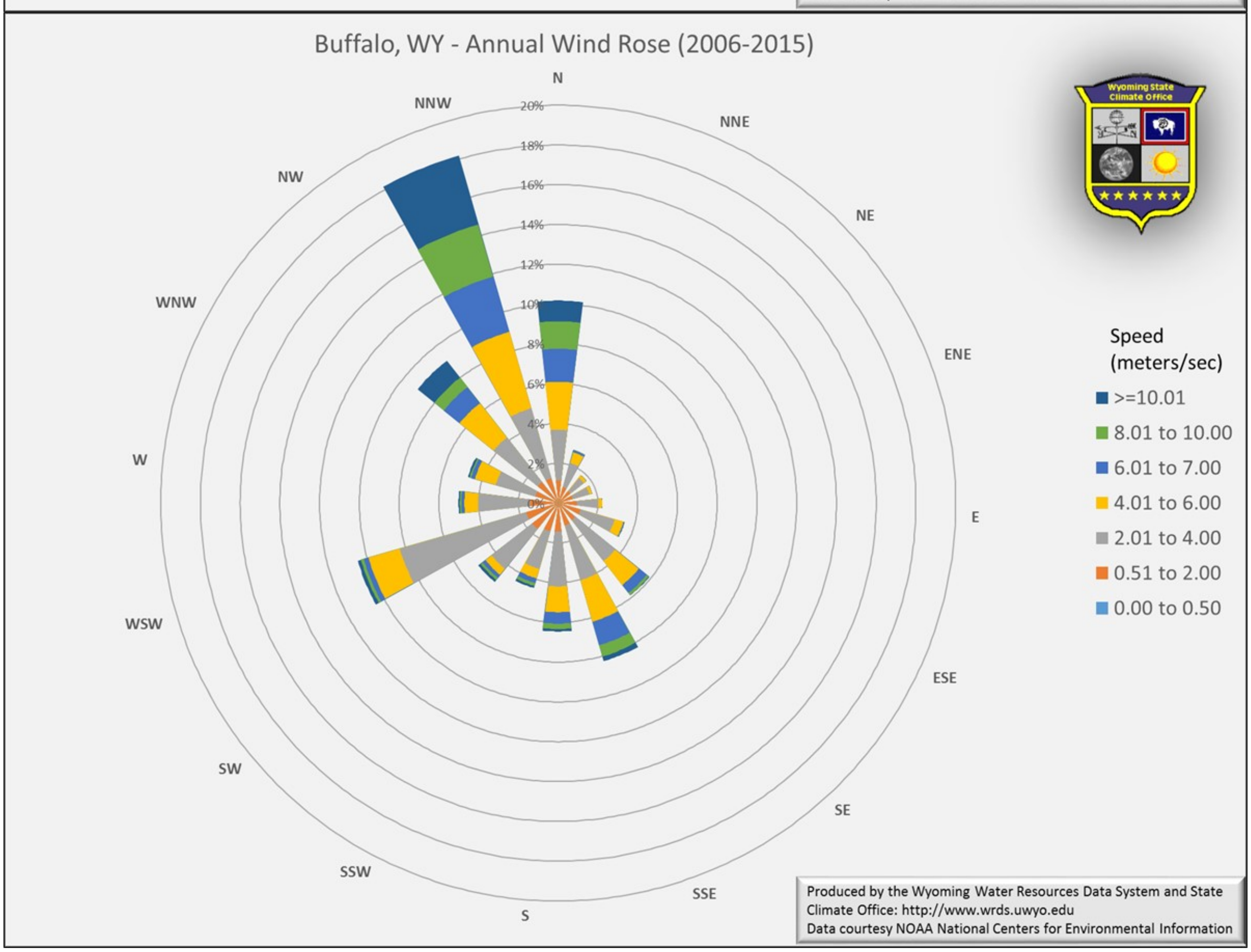
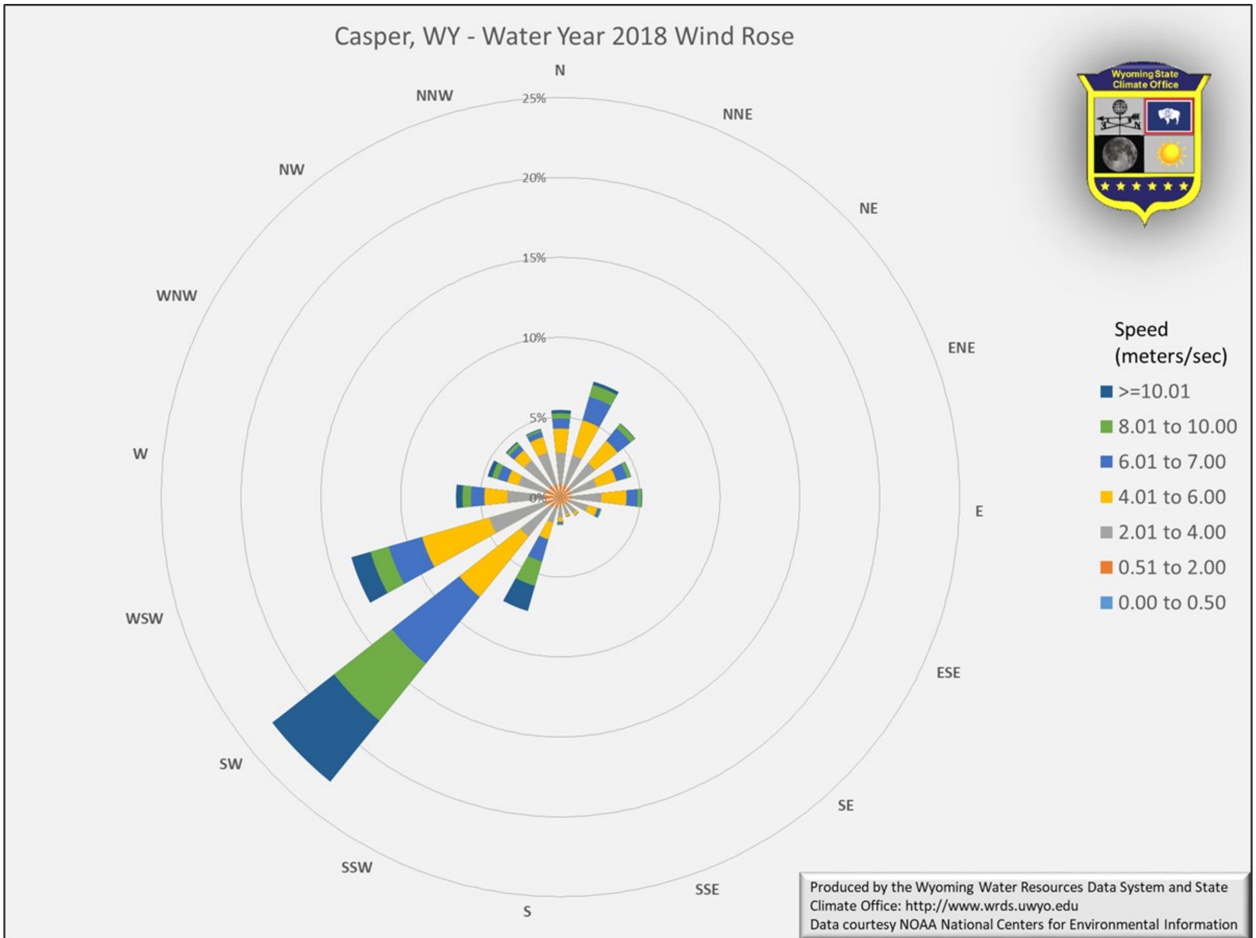


Figure 20. Buffalo Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



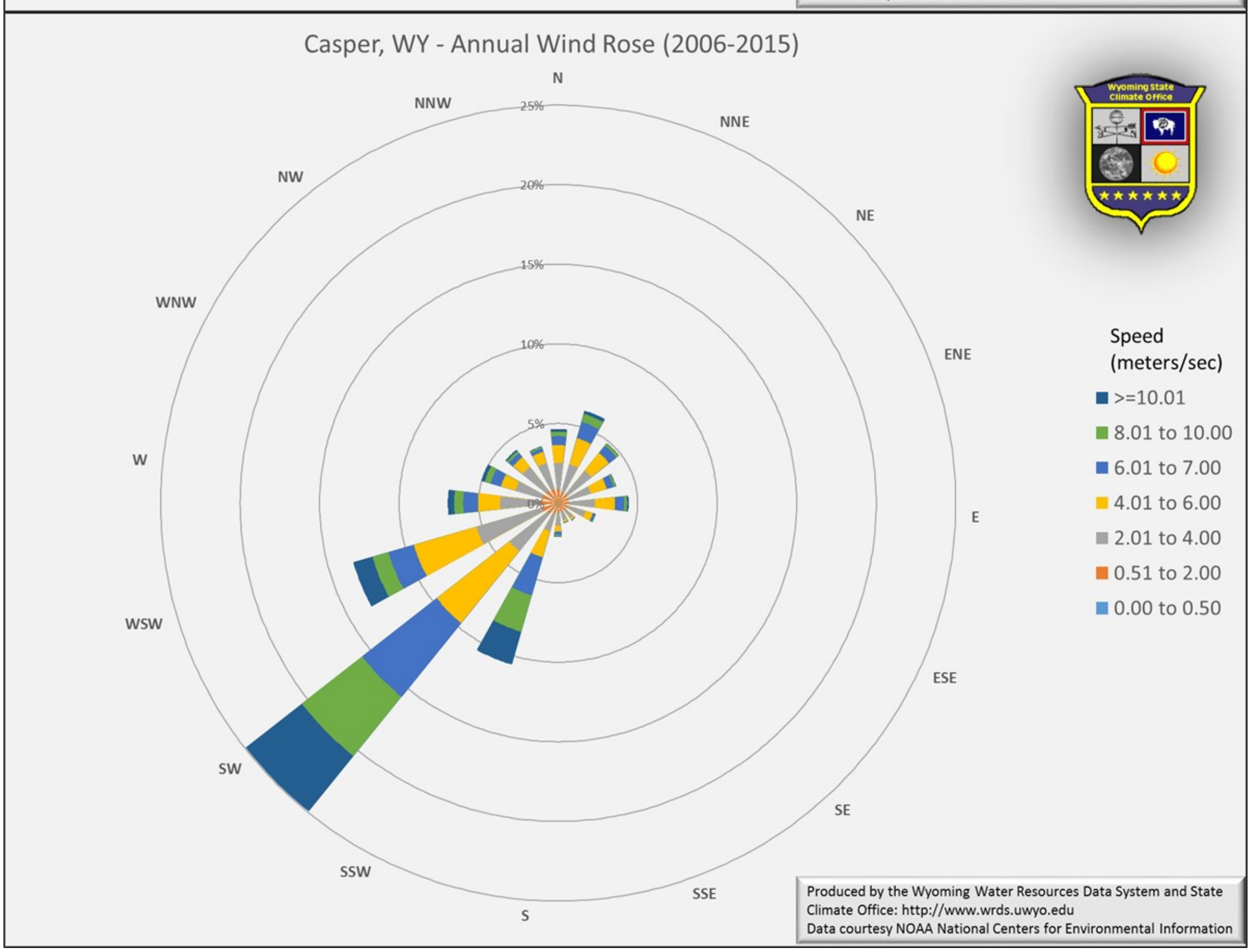
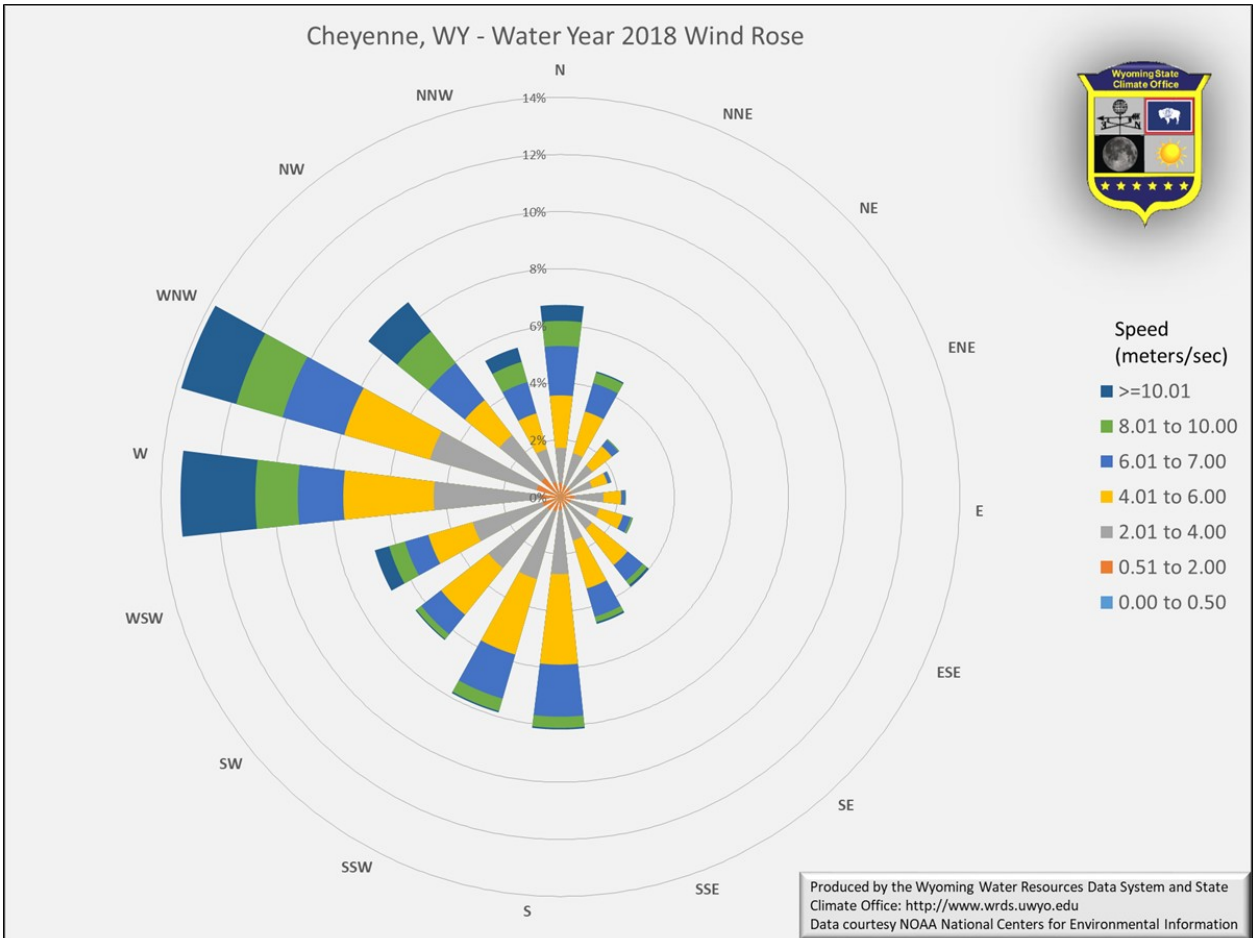


Figure 21. Casper Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



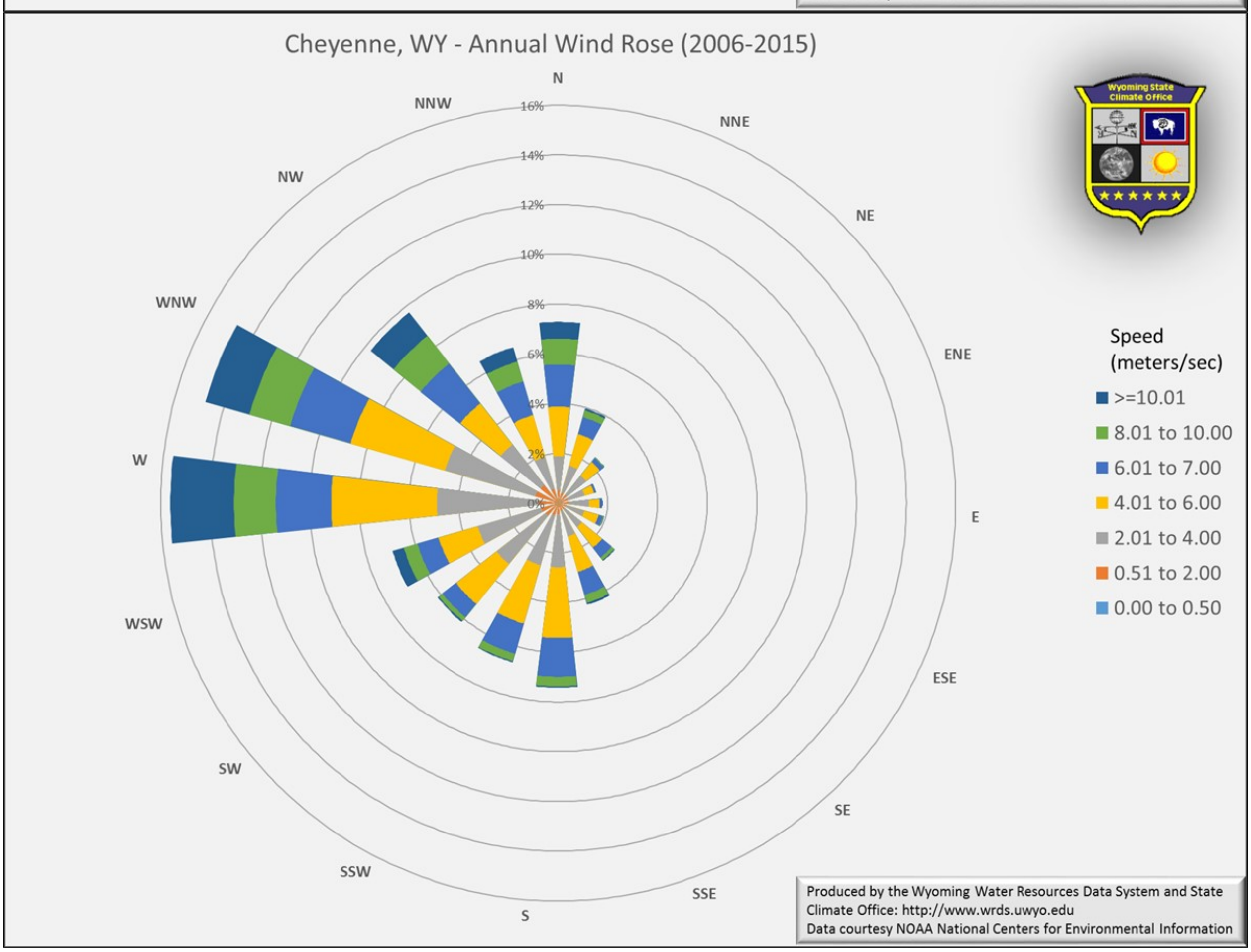
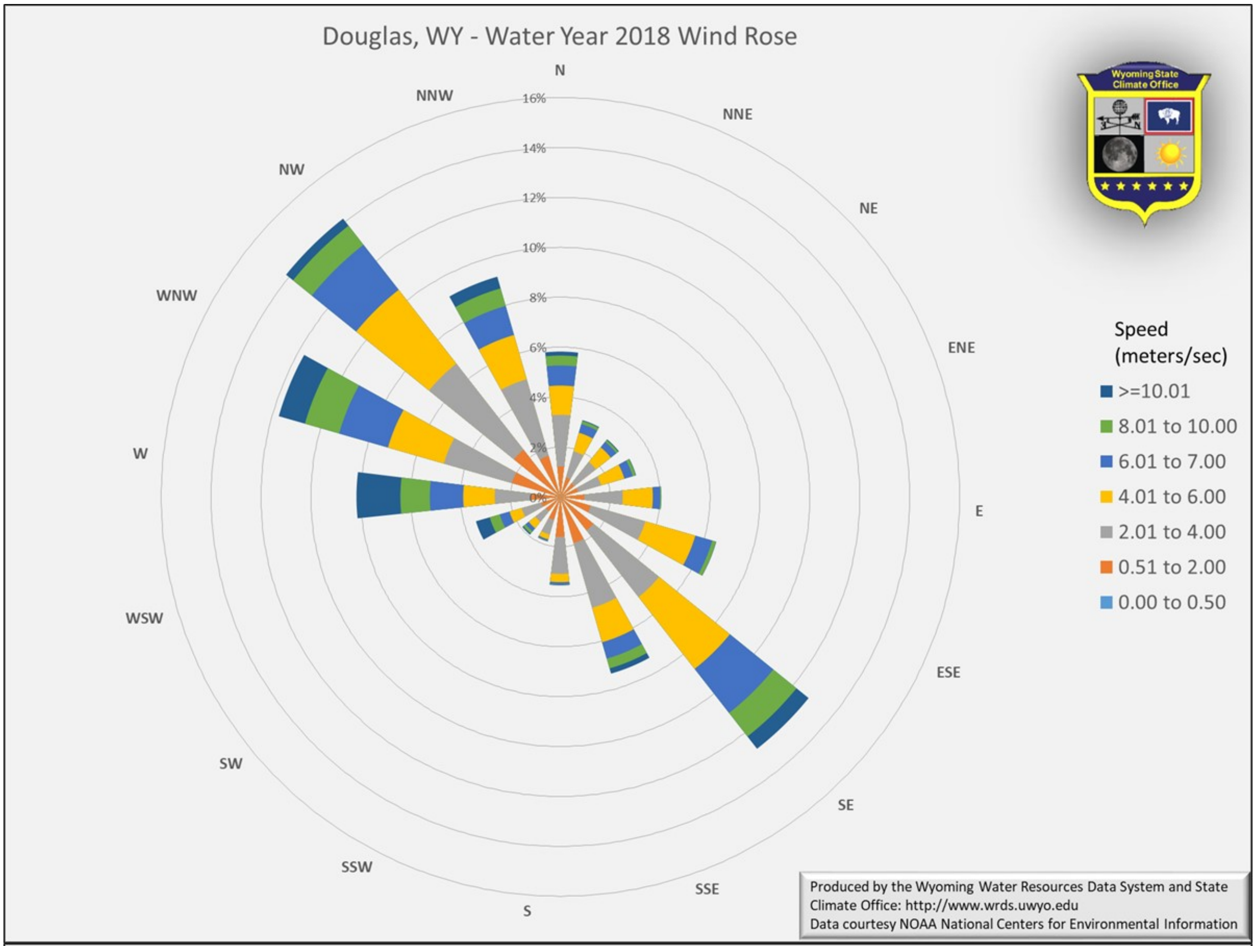


Figure 22. Cheyenne Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



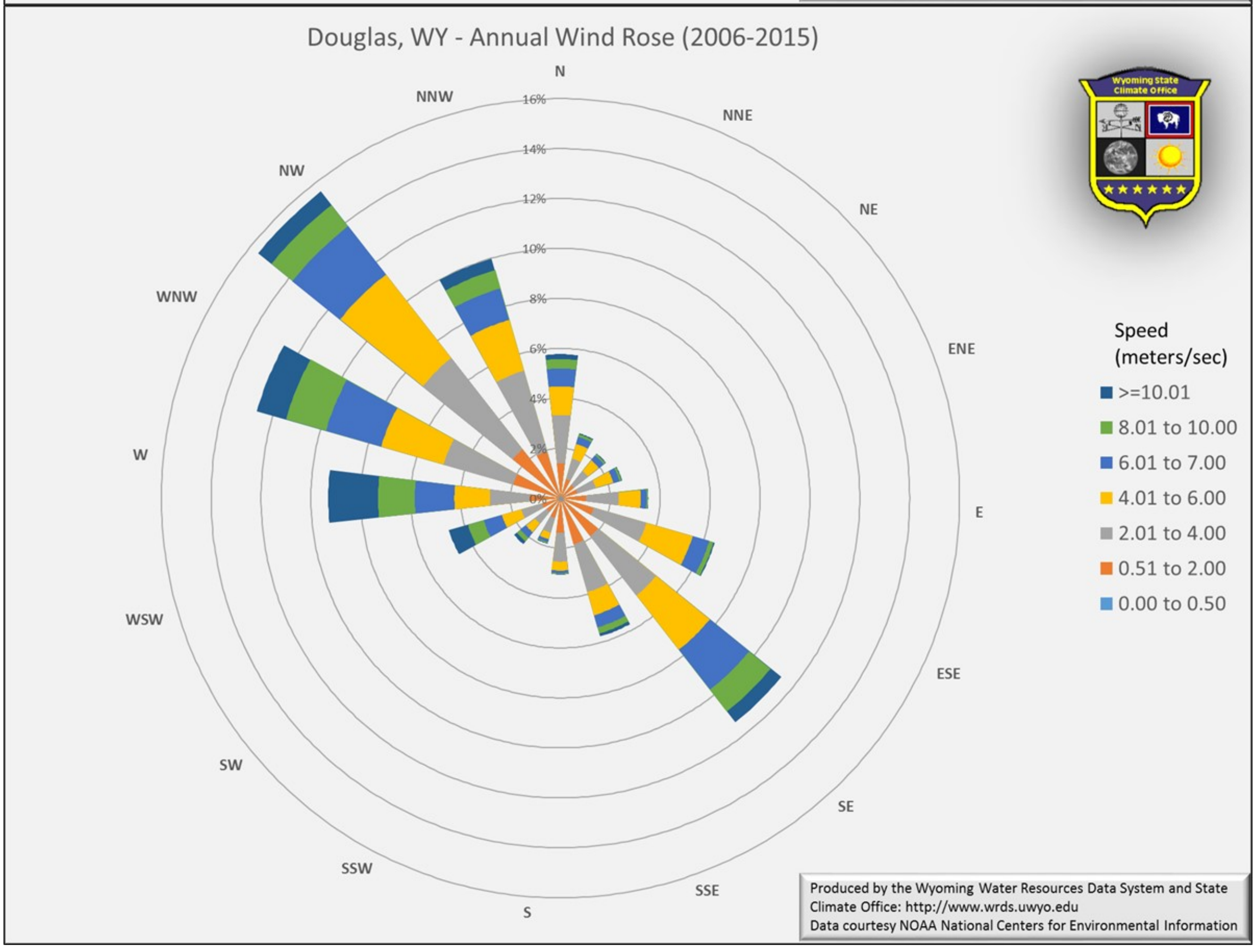
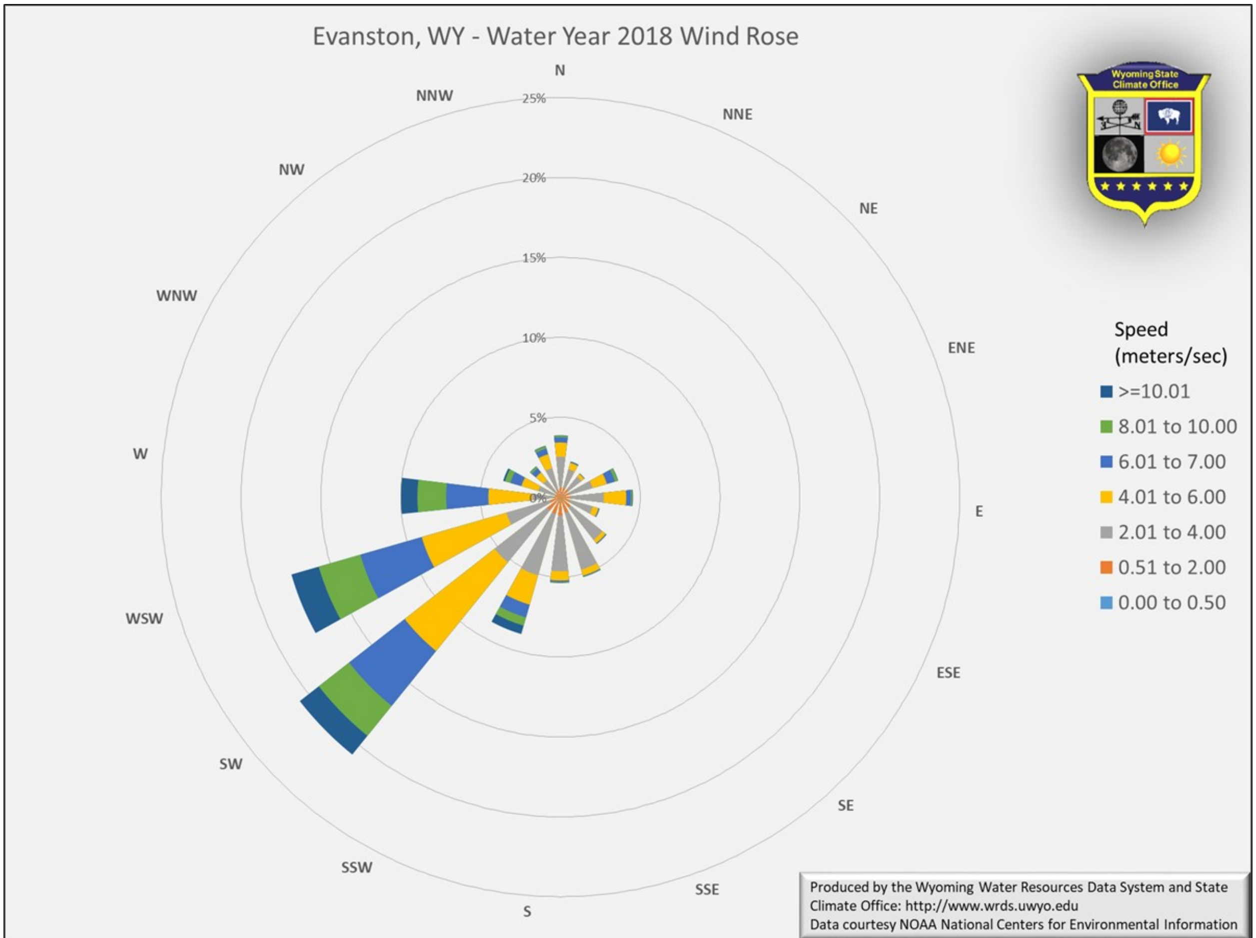


Figure 23. Douglas Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



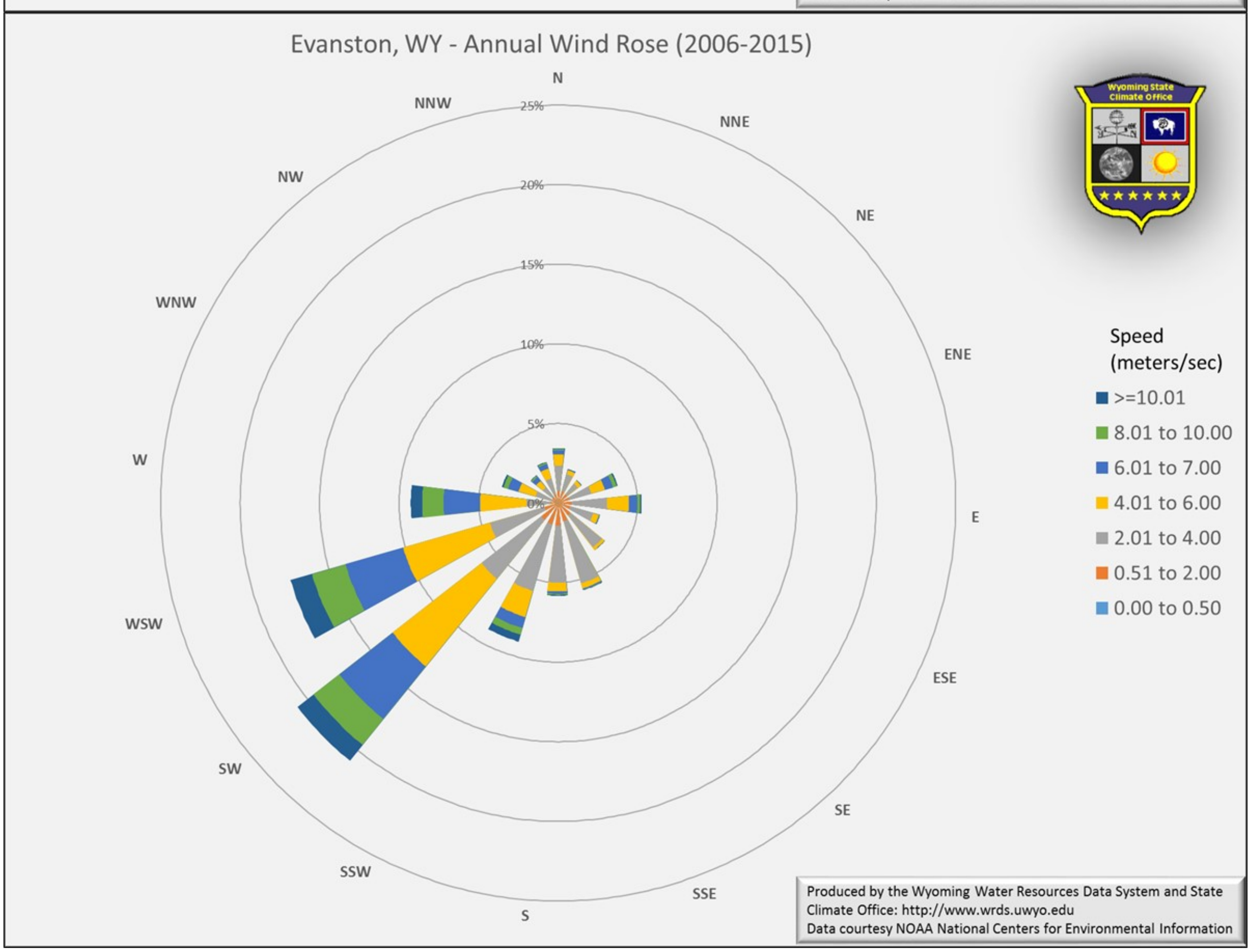
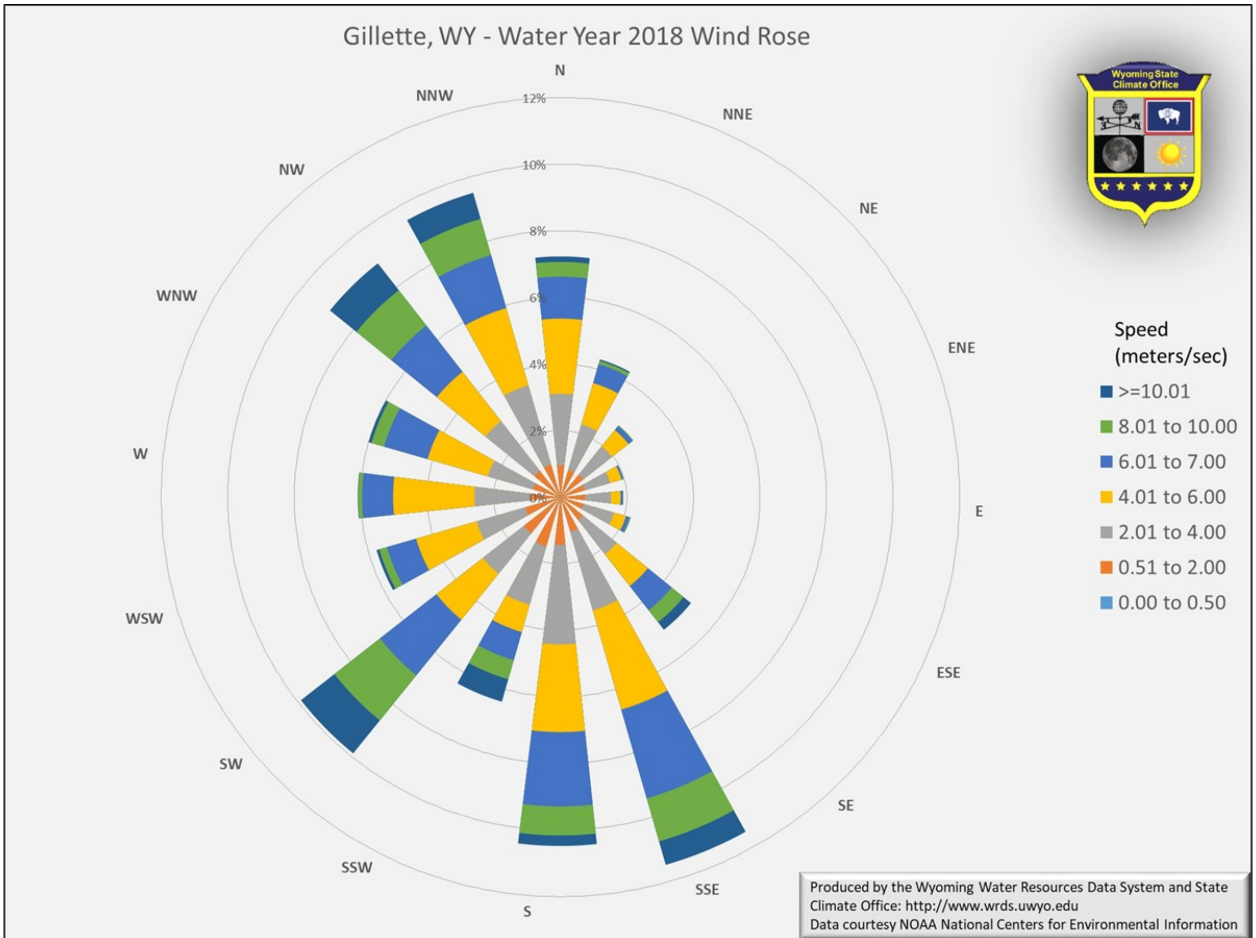


Figure 24. Evanston Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



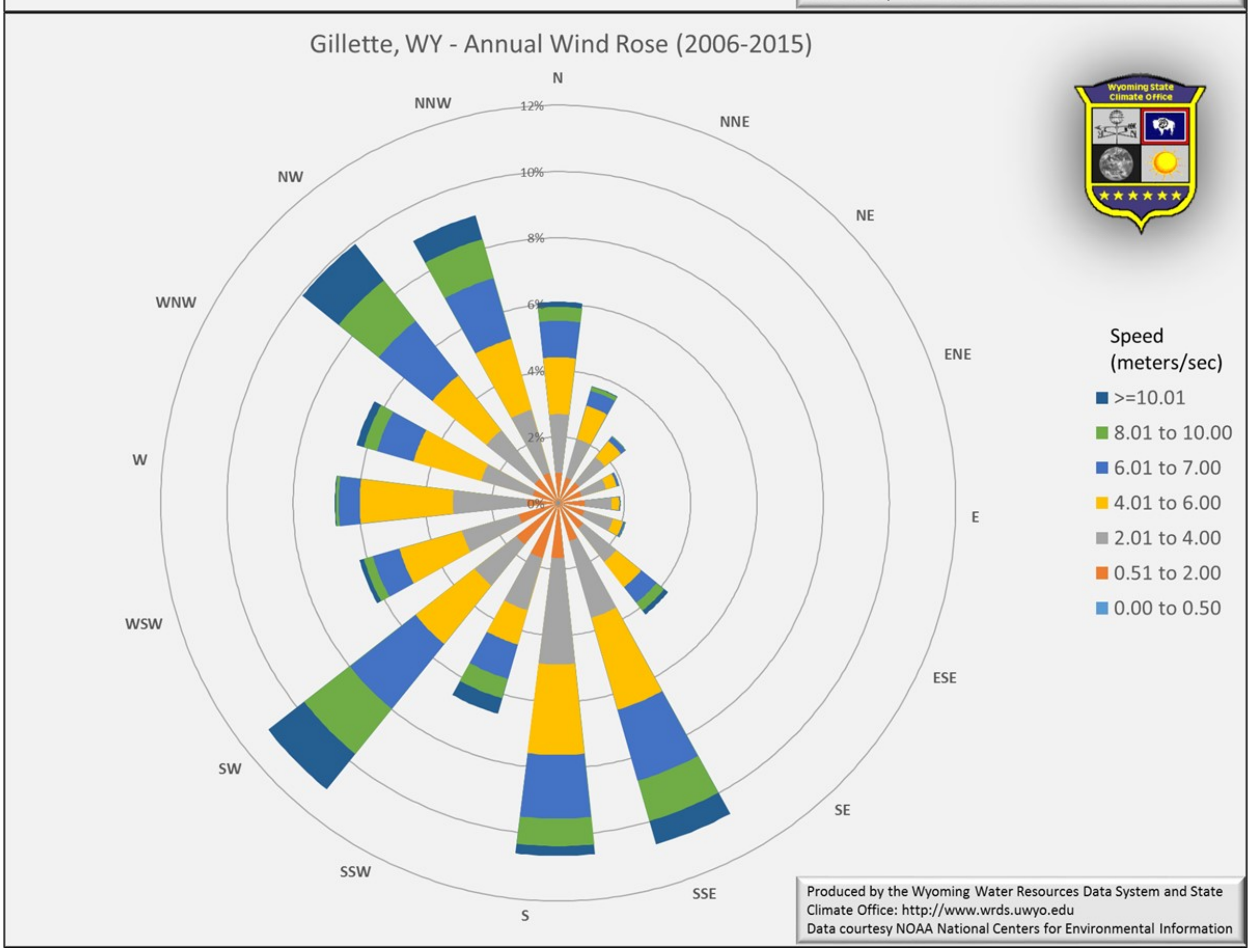
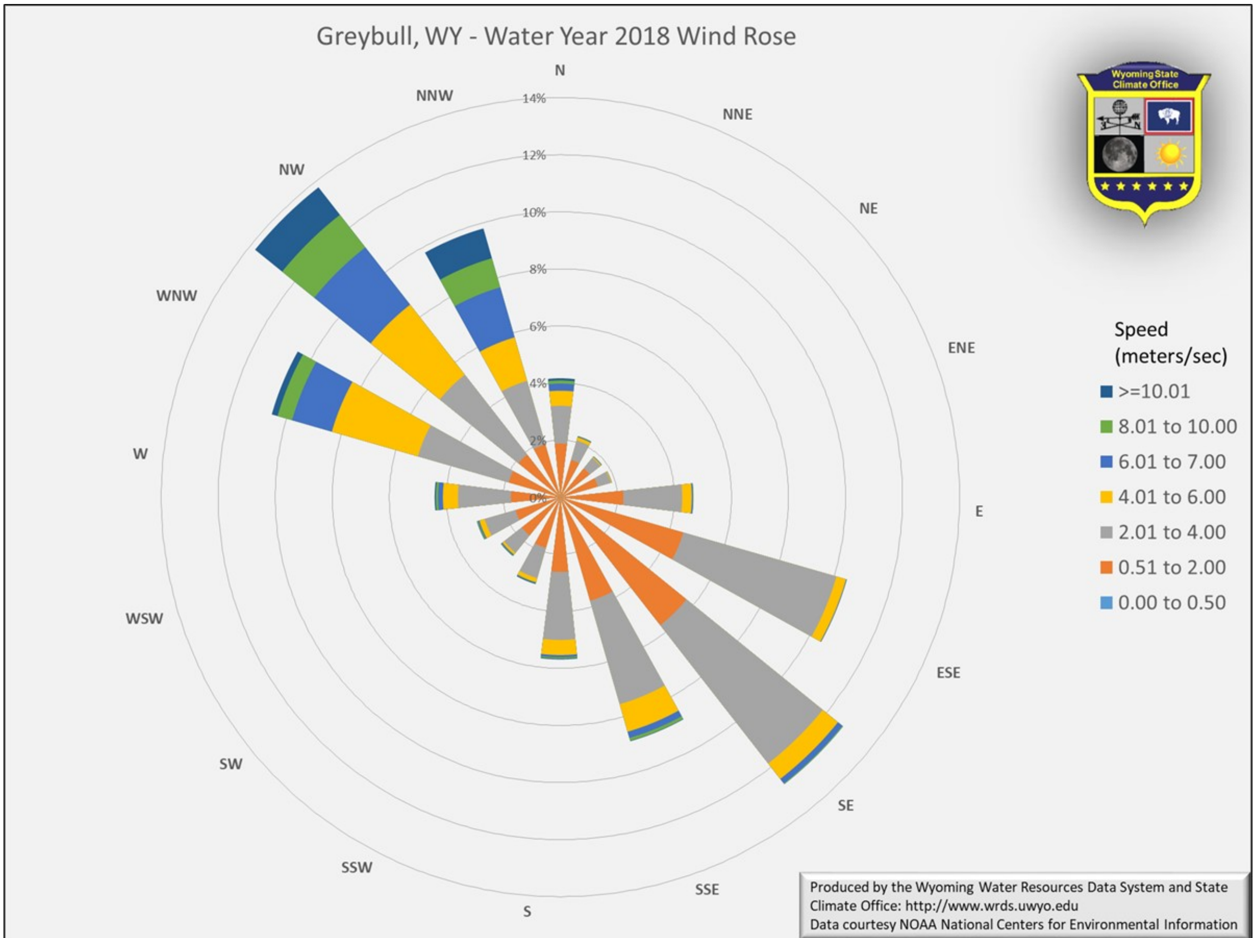


Figure 25. Gillette Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



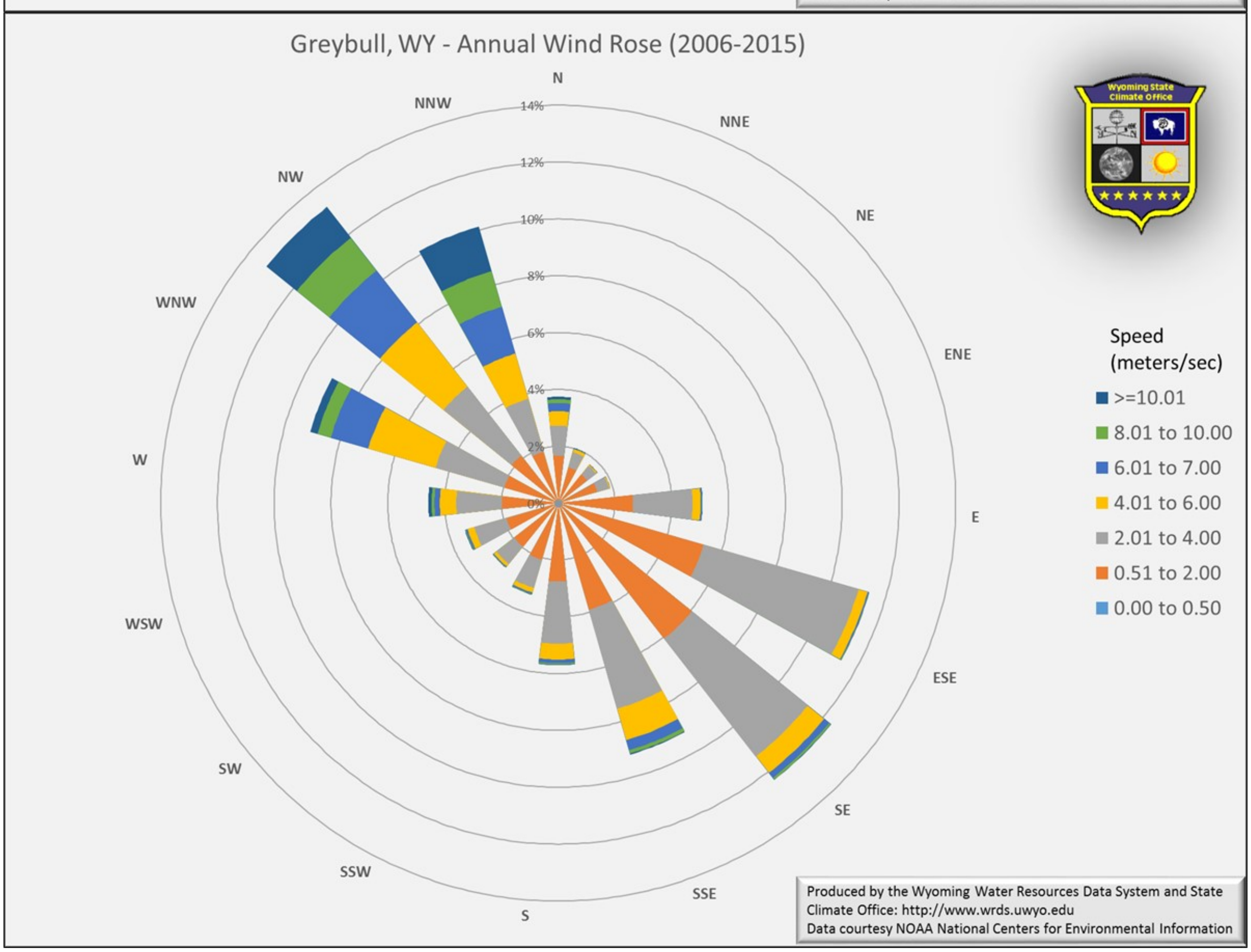
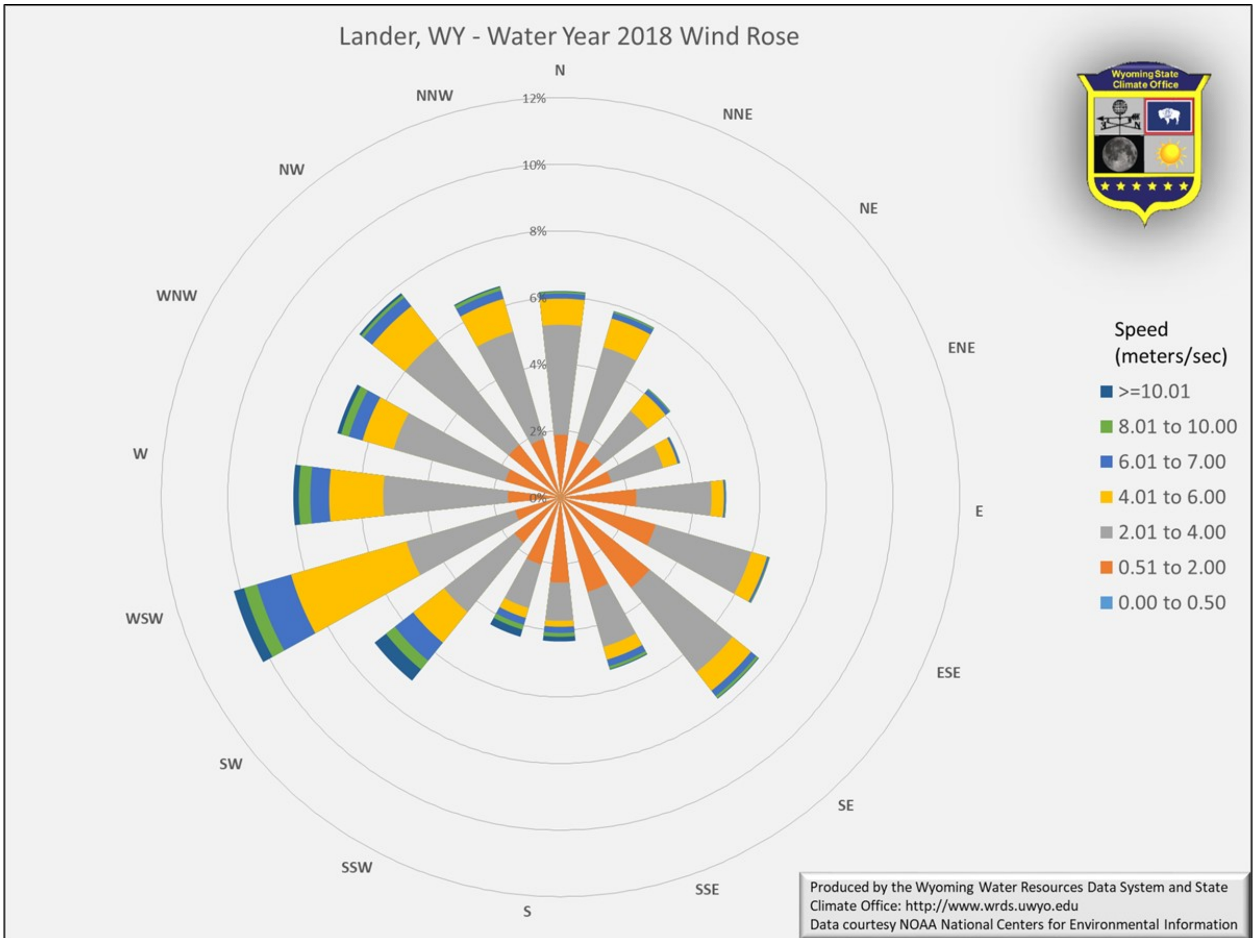


Figure 26. Greybull Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



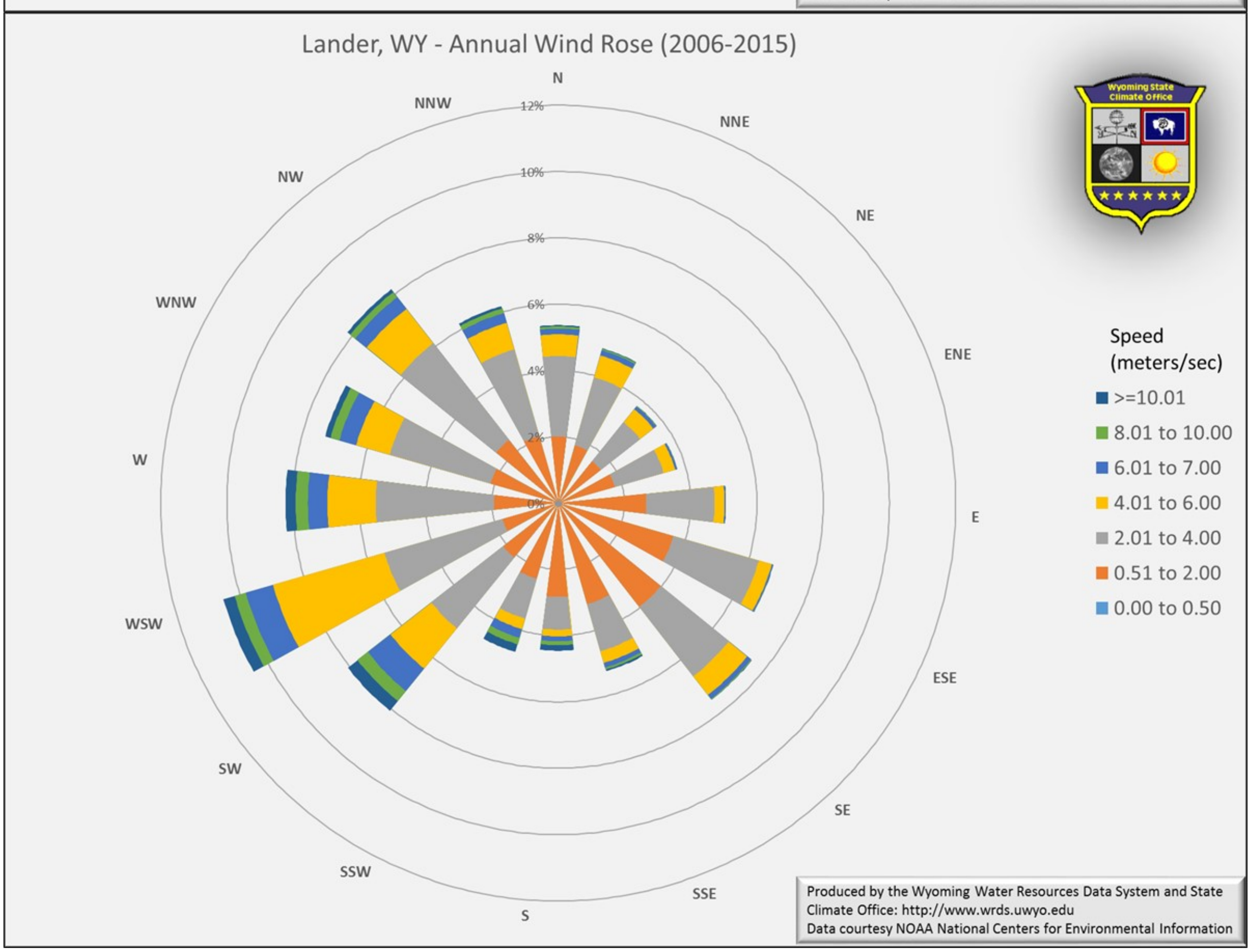
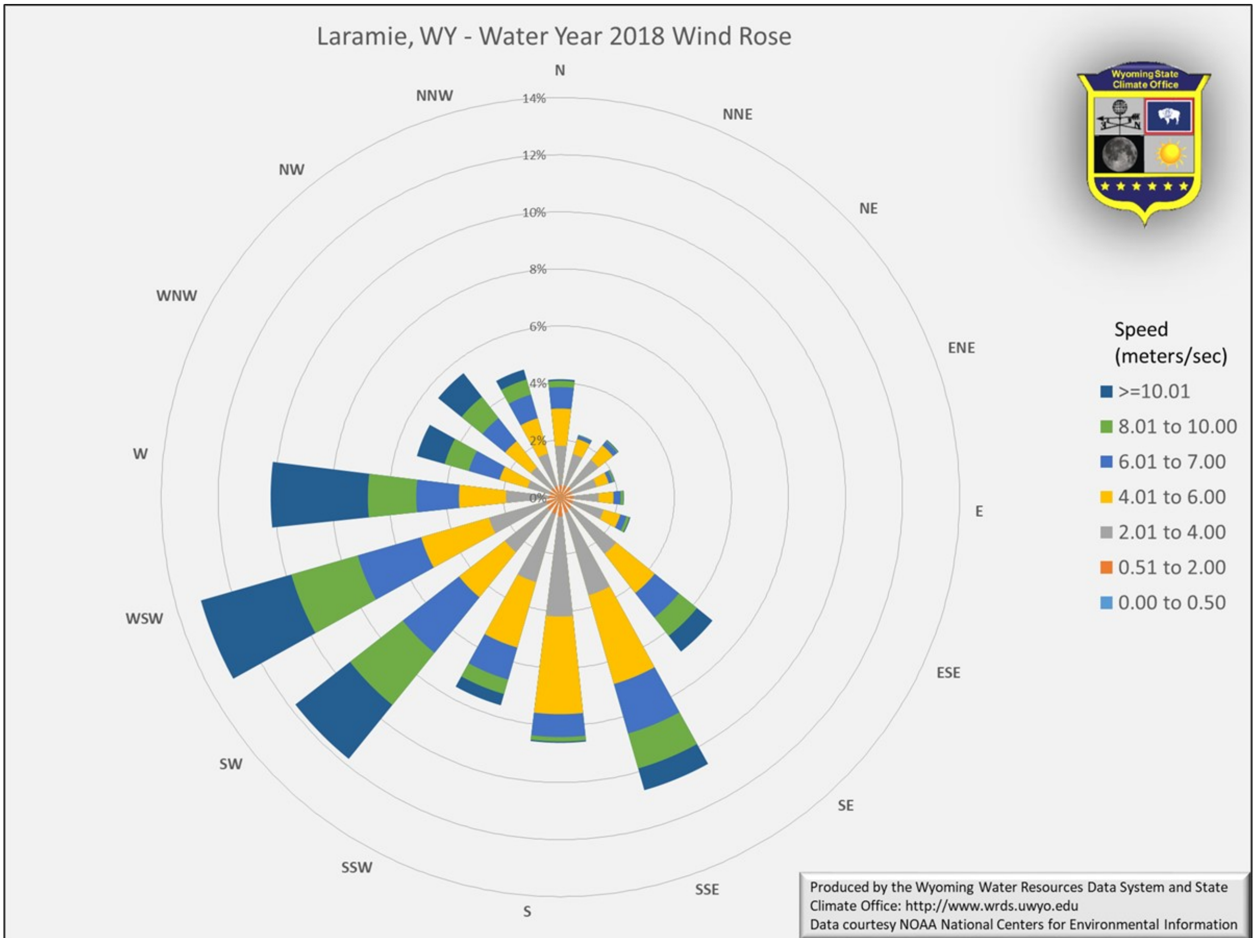


Figure 27. Lander Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



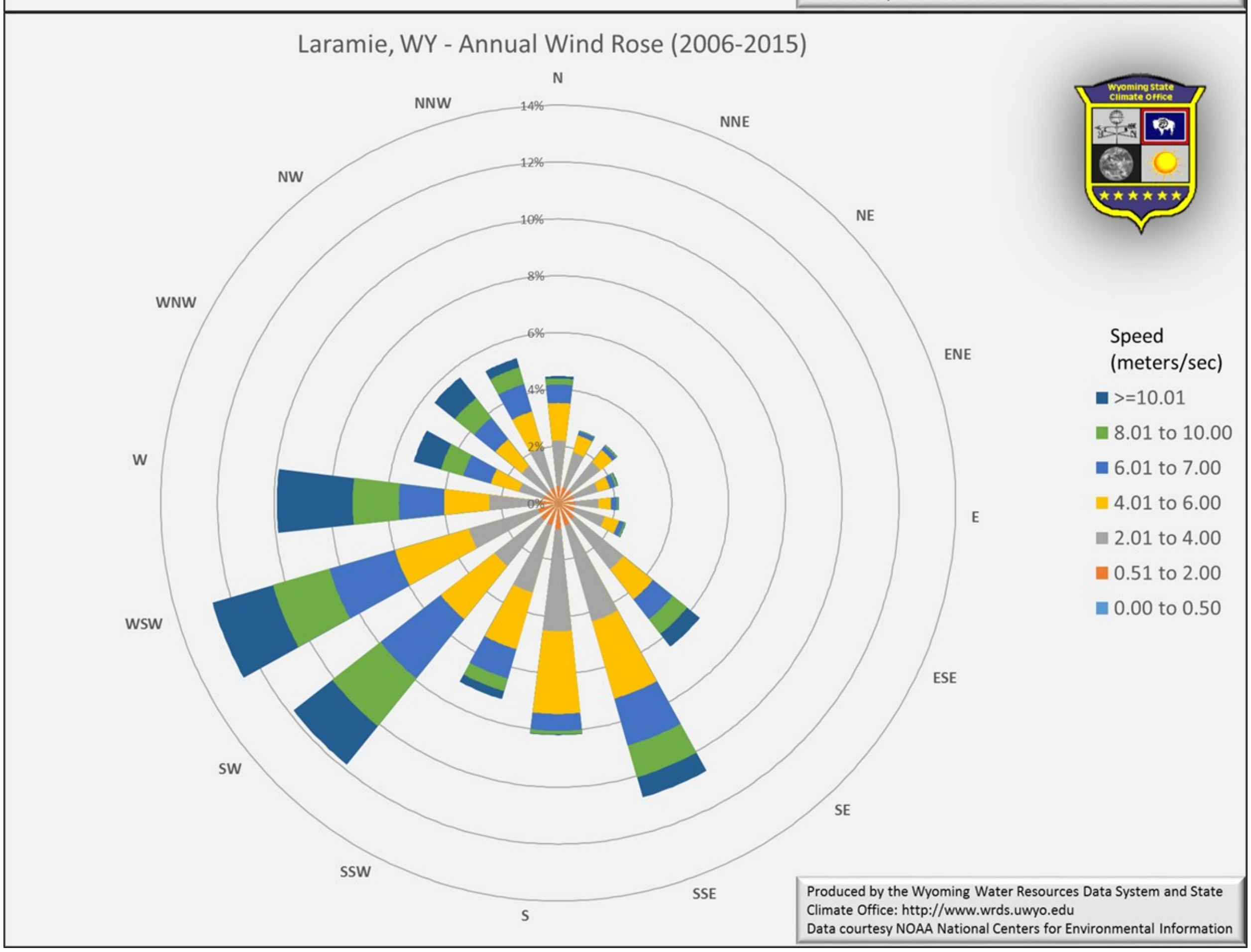
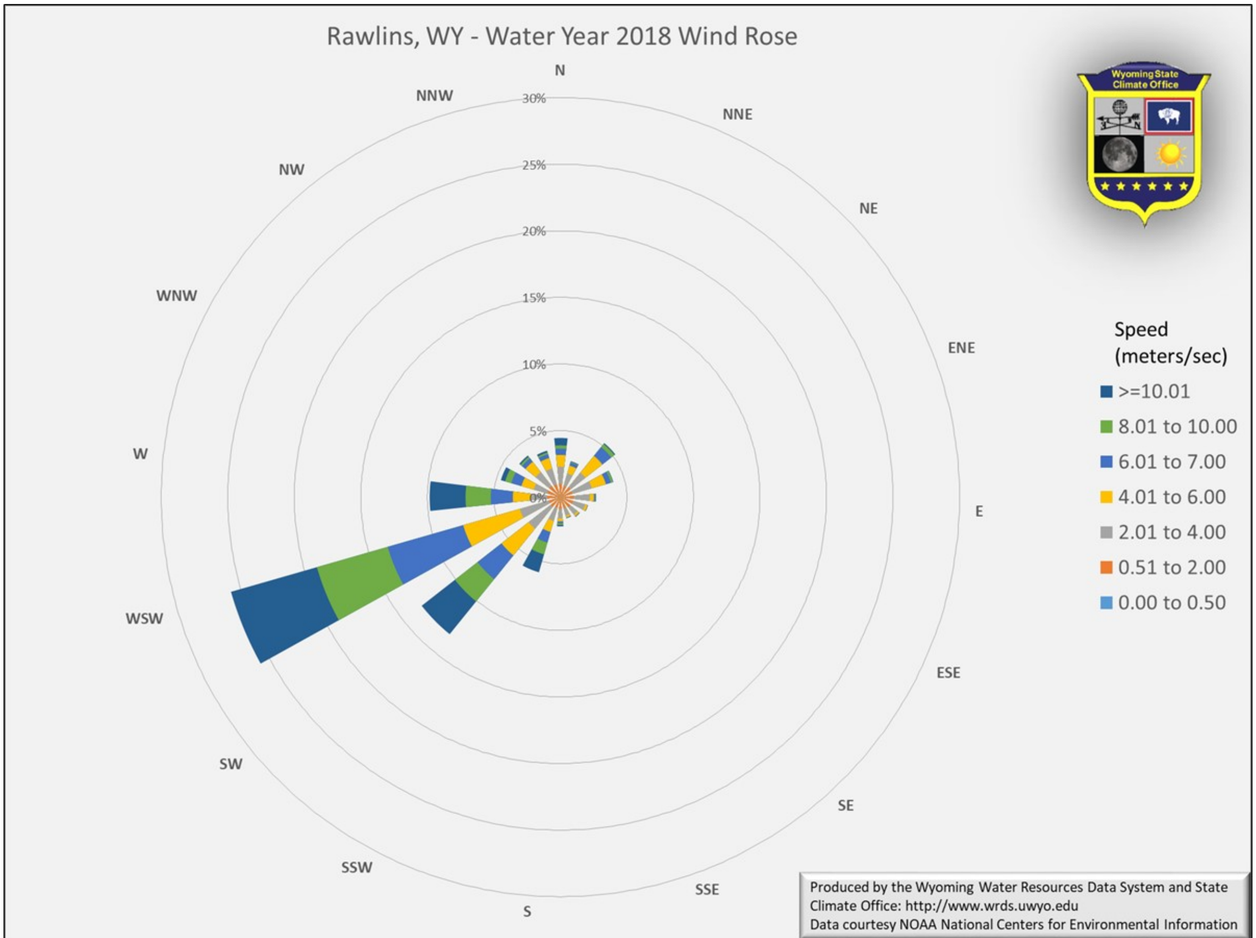


Figure 28. Laramie Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



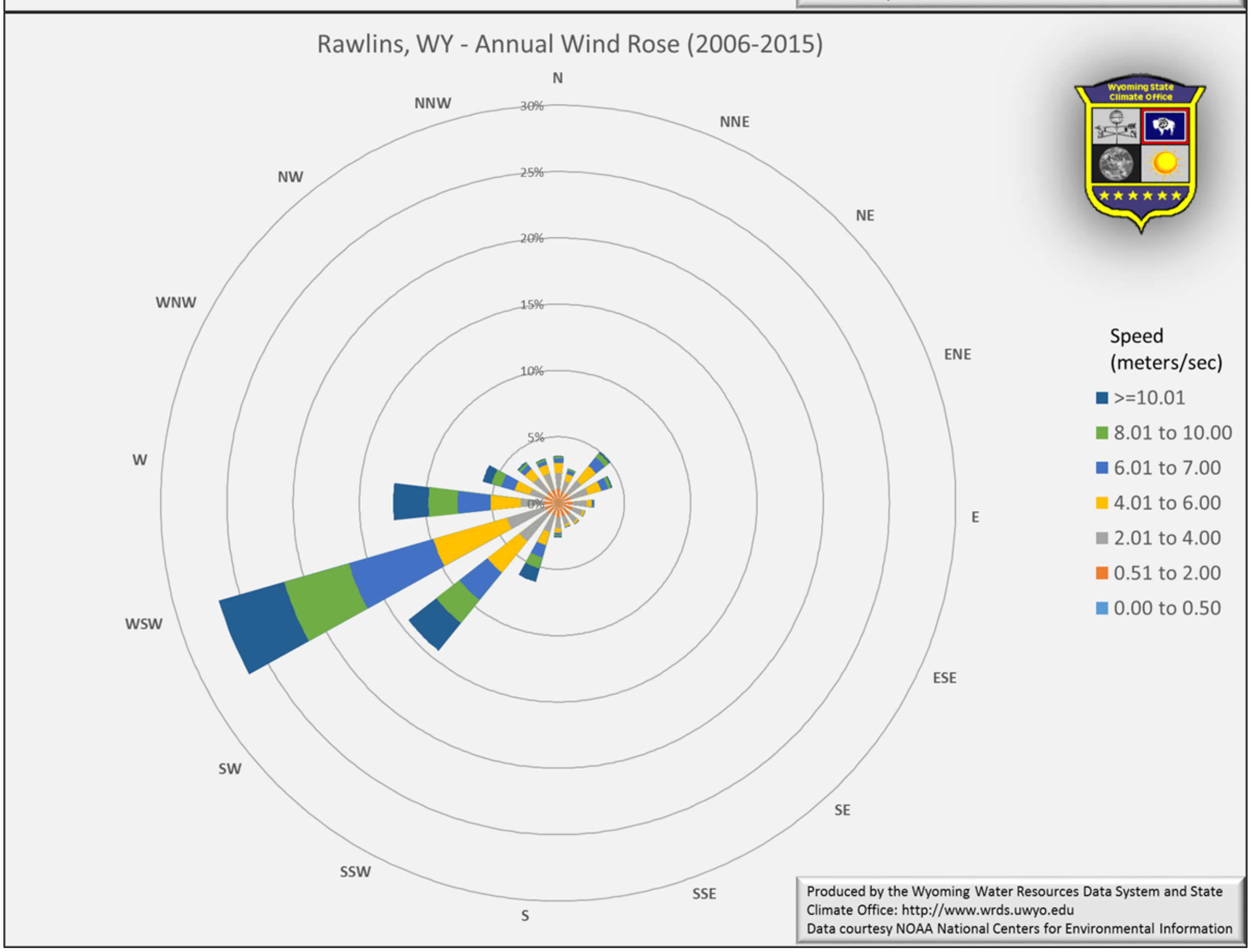
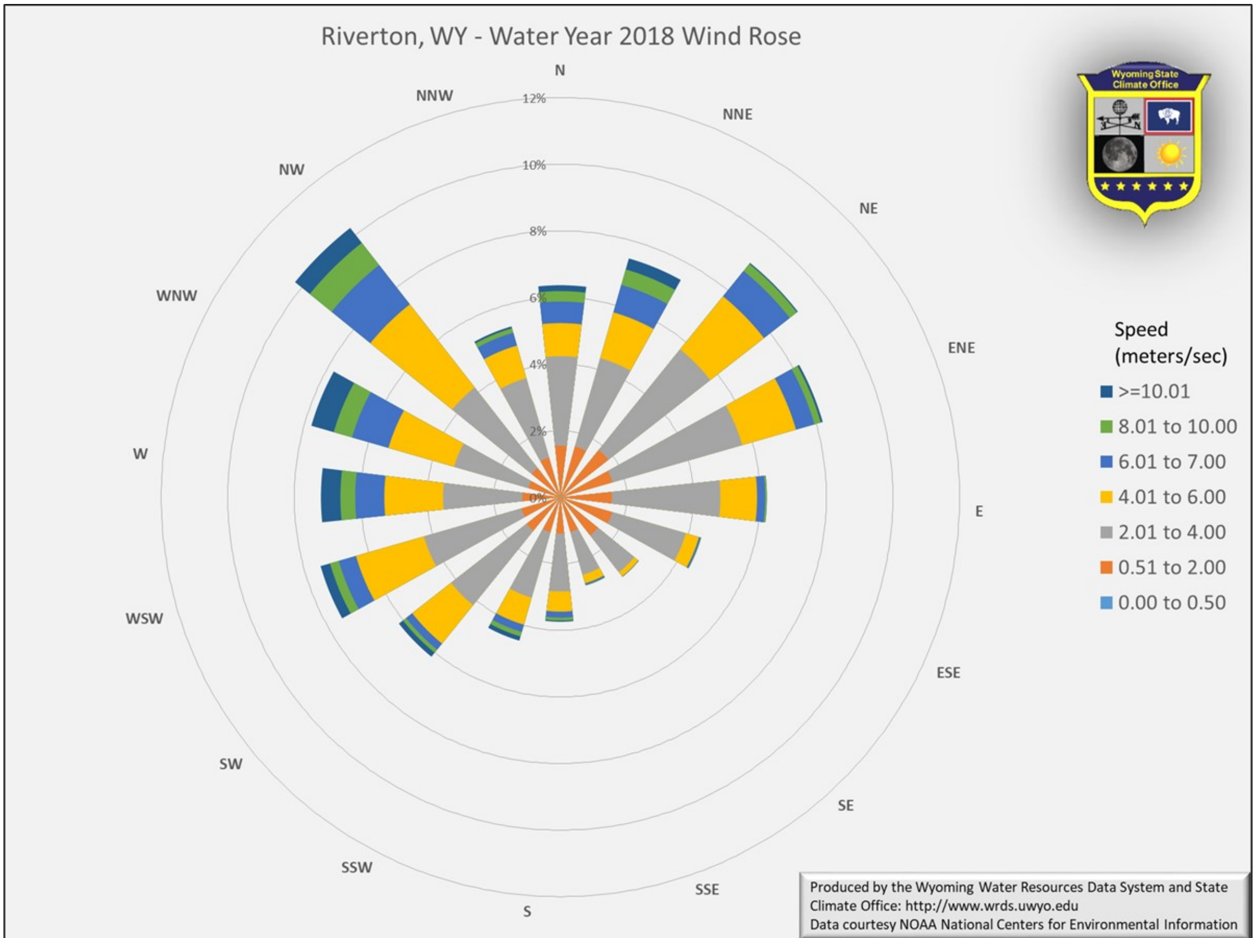


Figure 29. Rawlins Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



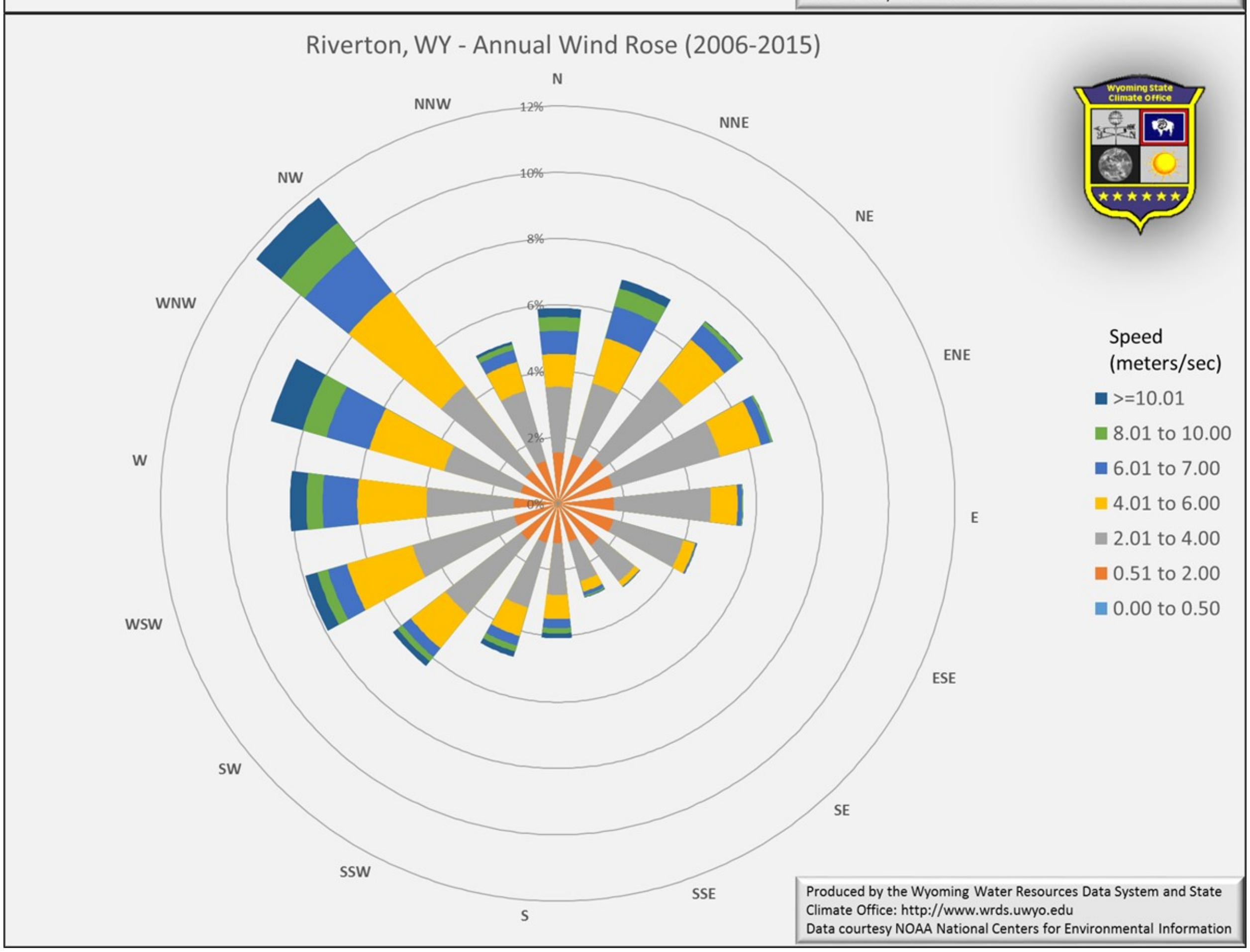
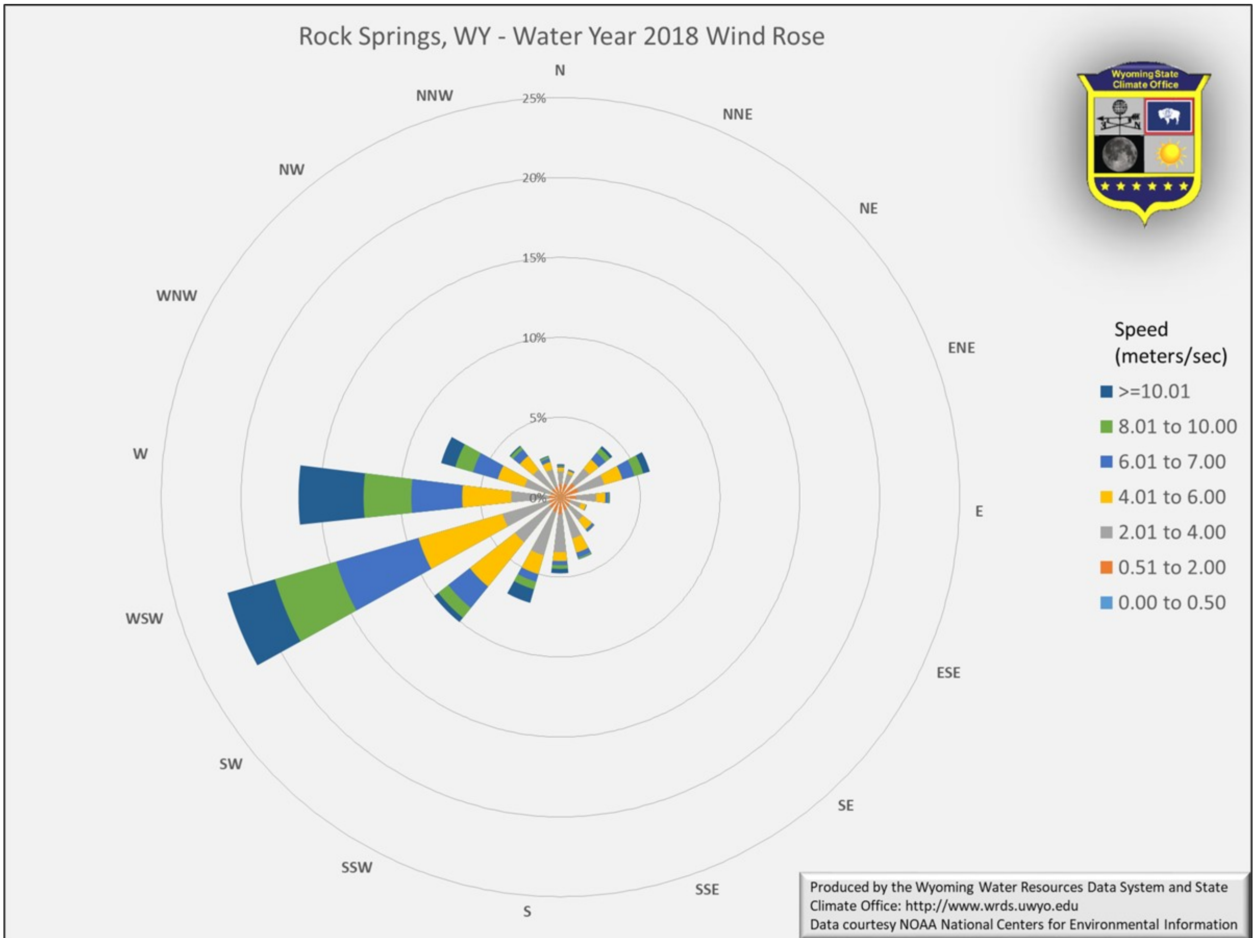


Figure 30. Riverton Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



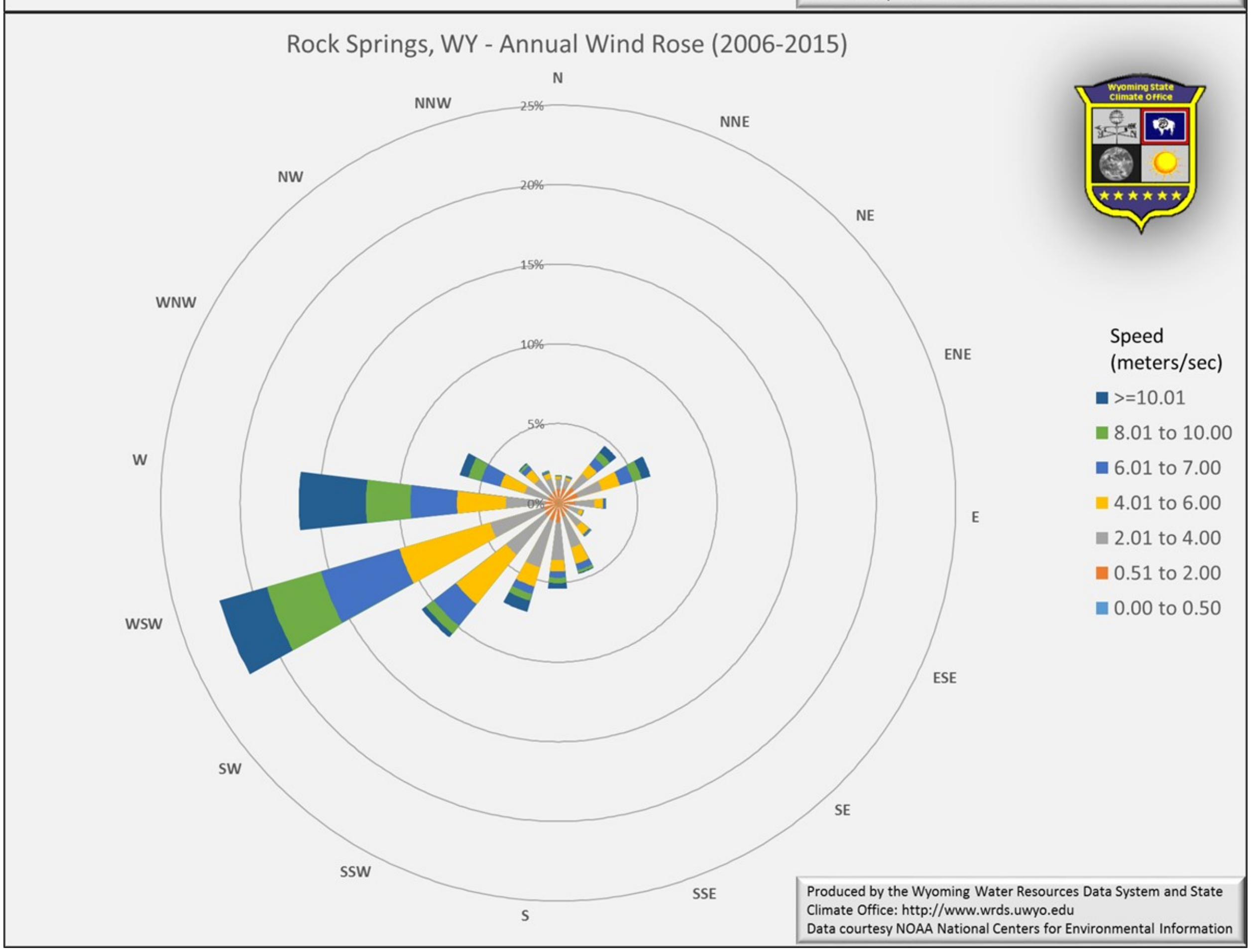
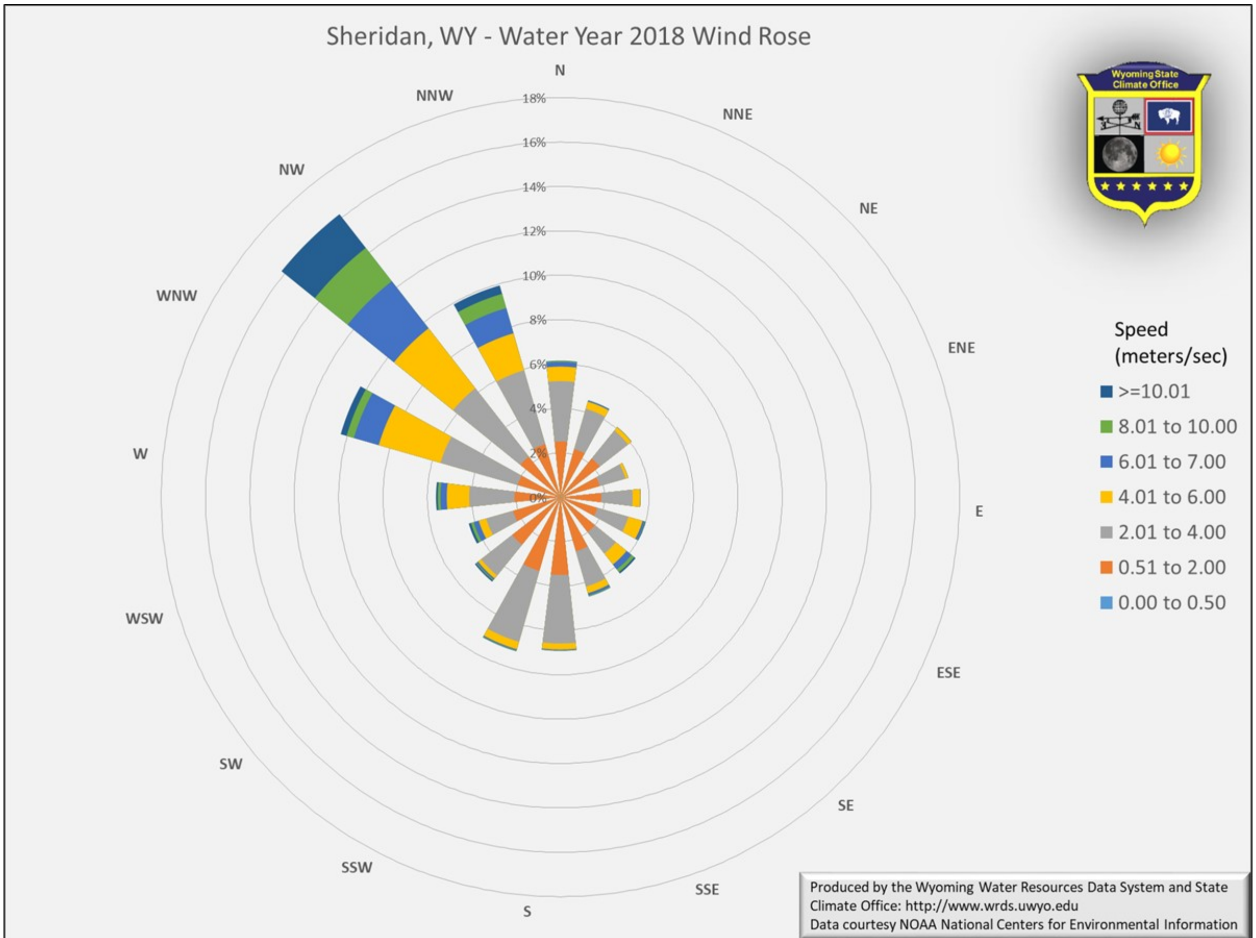


Figure 31. Rock Springs Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



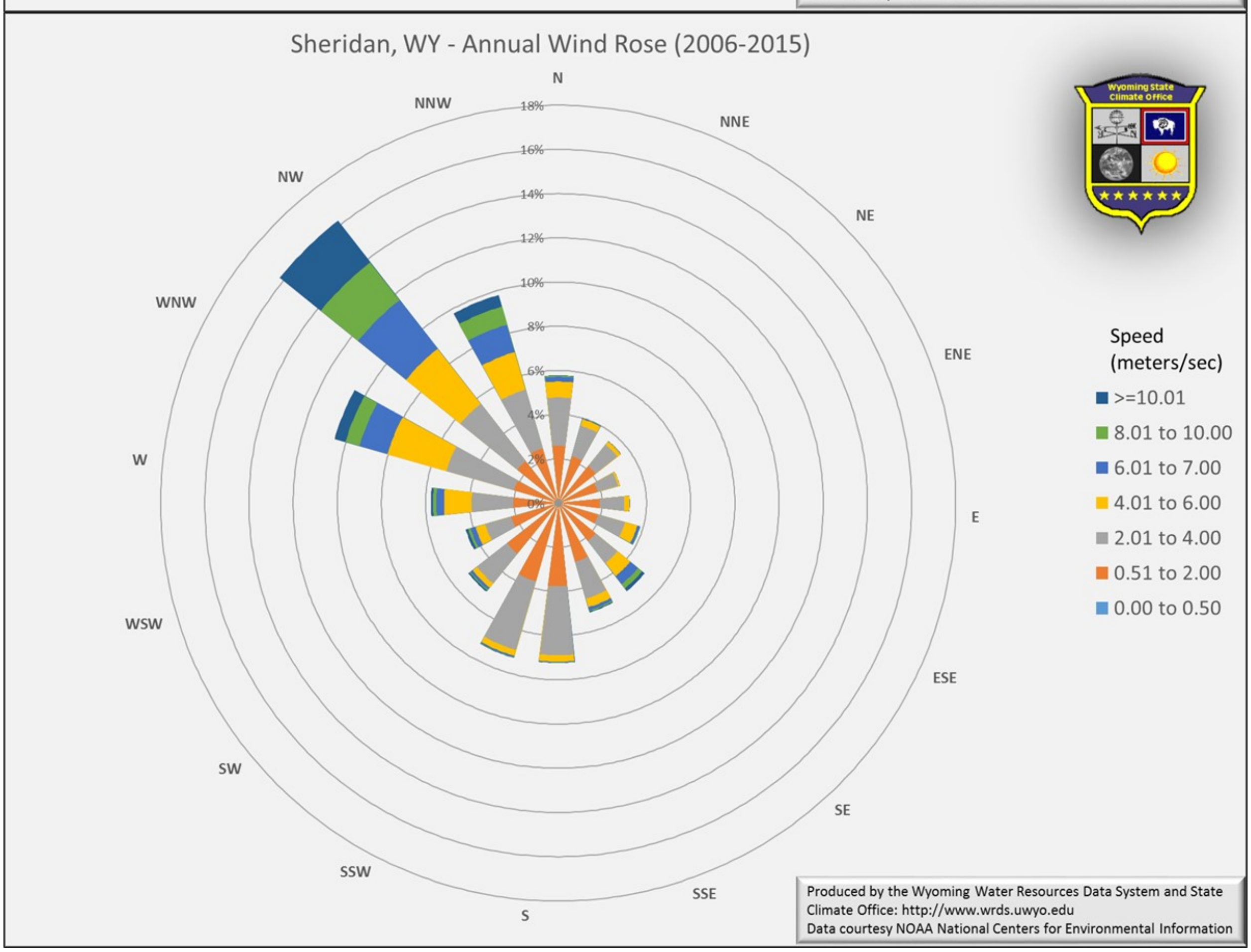
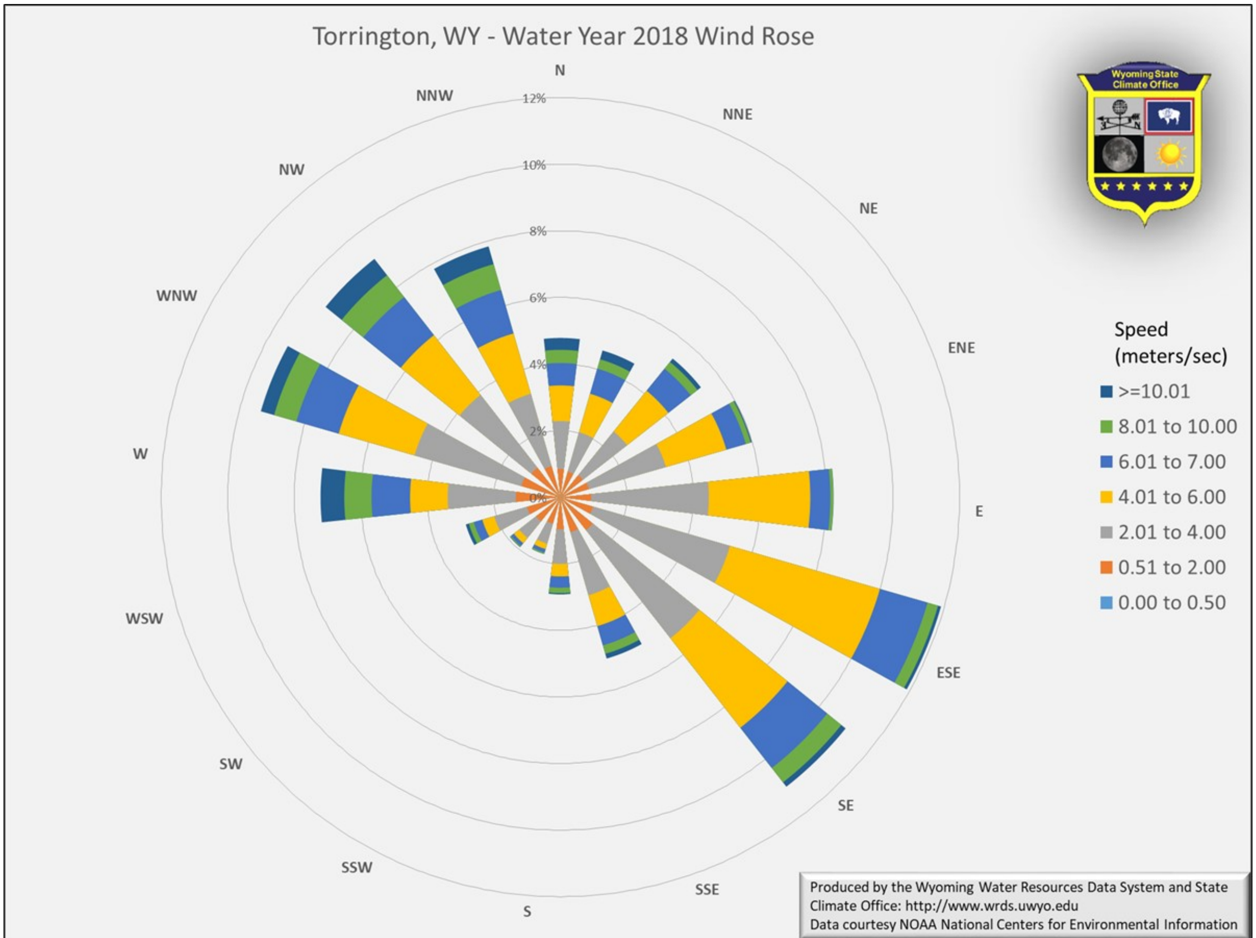


Figure 32. Sheridan Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



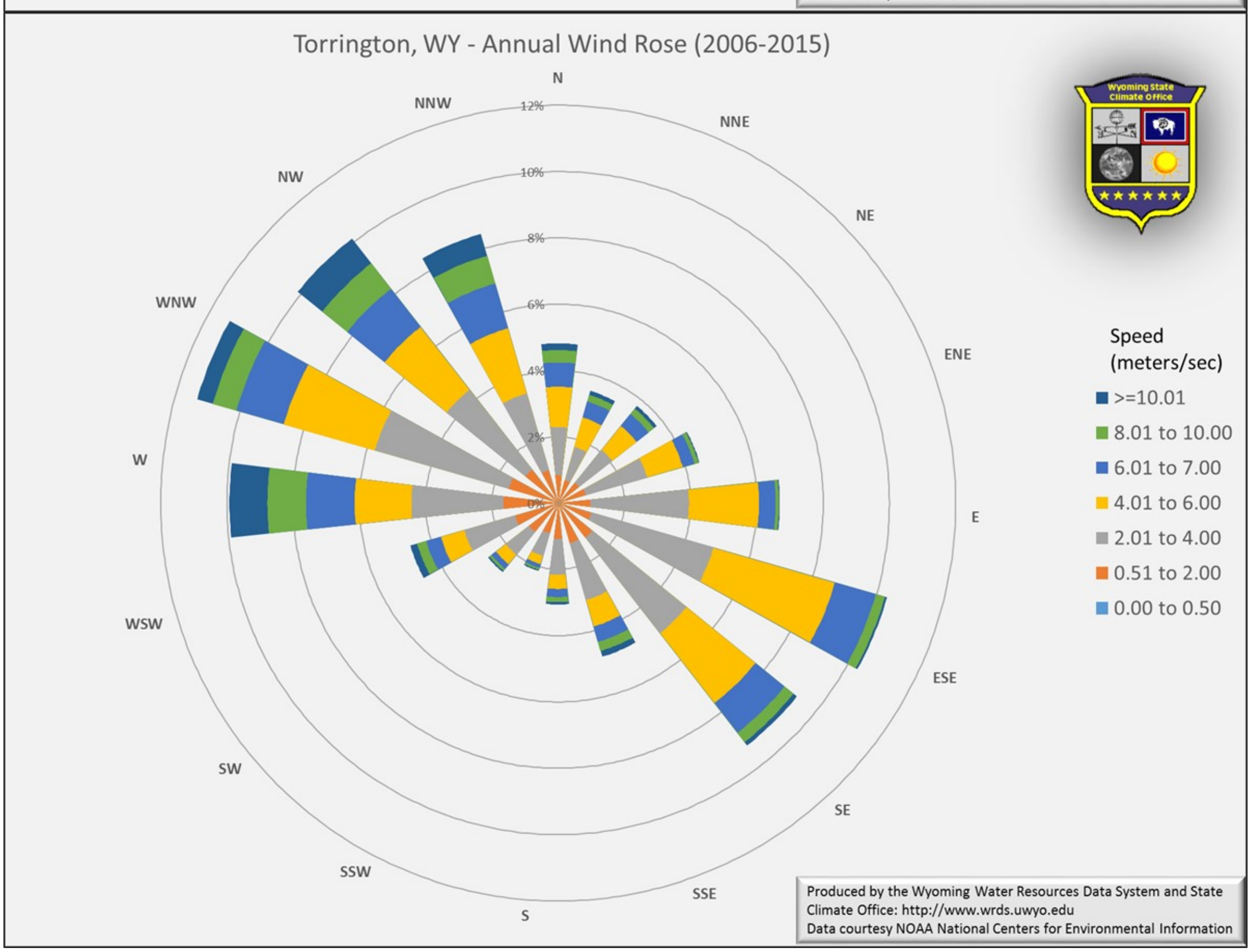
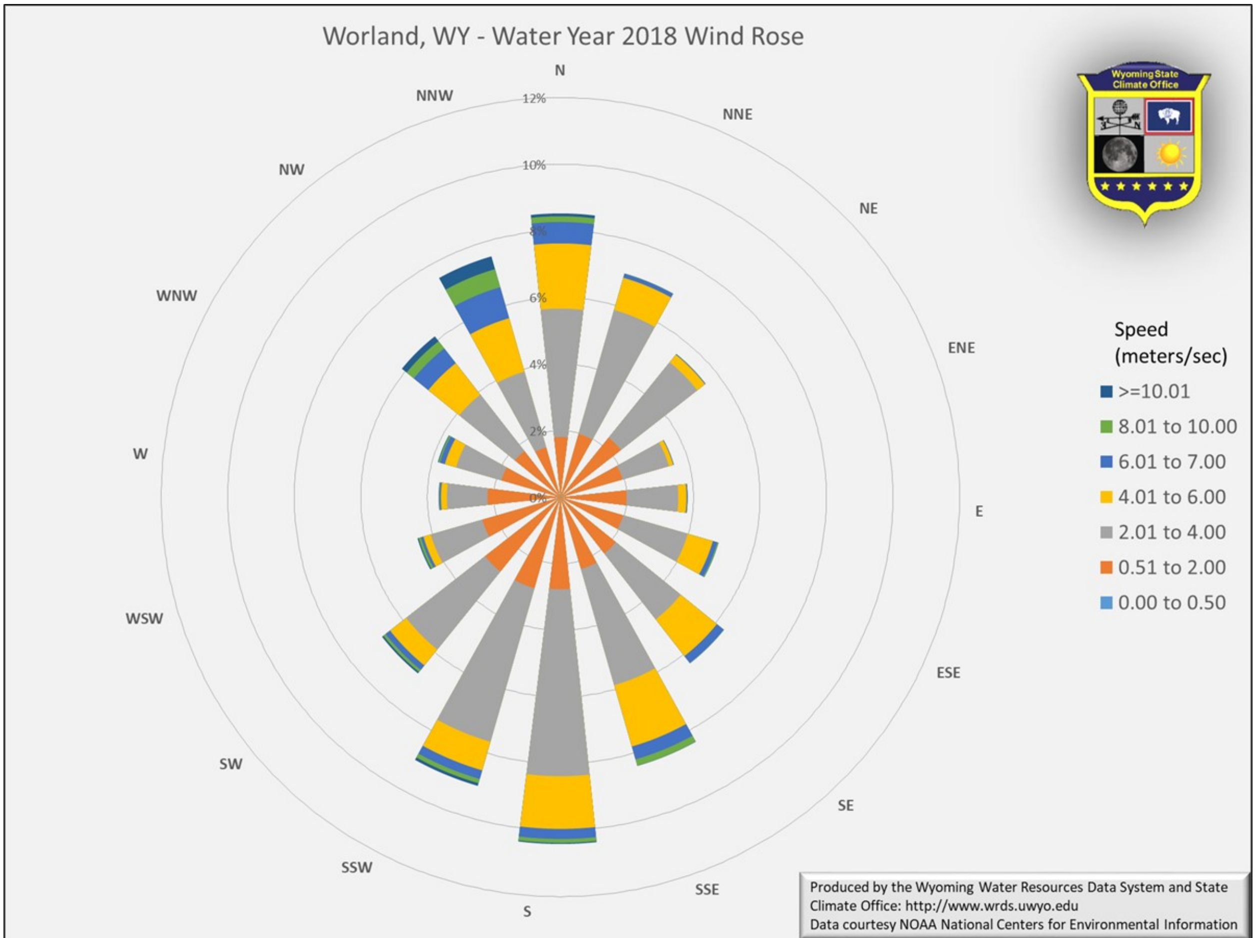


Figure 33. Torrington Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)



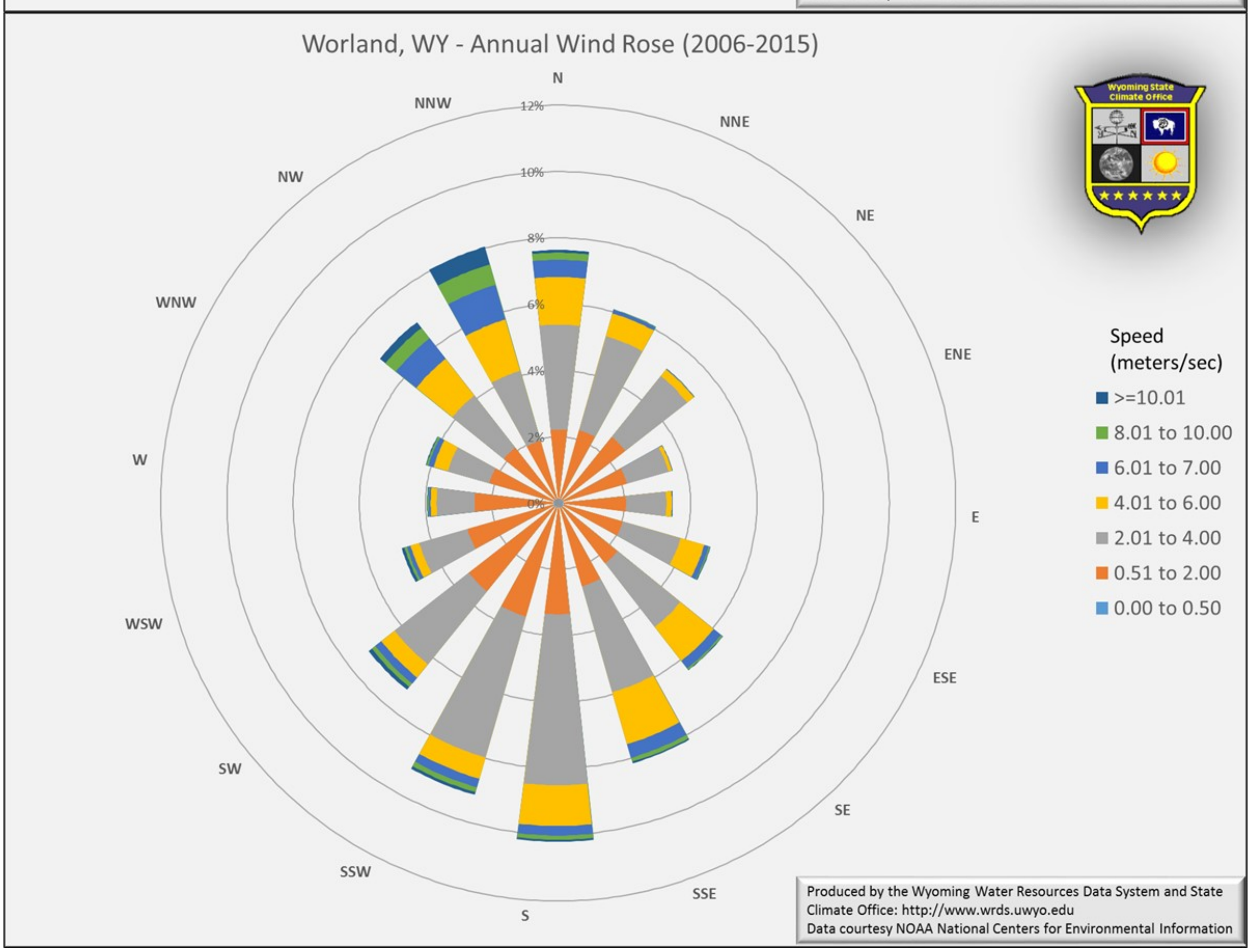


Figure 34. Worland Water Year 2018 Wind Rose (top) compared to 2006-2015 Average (bottom)