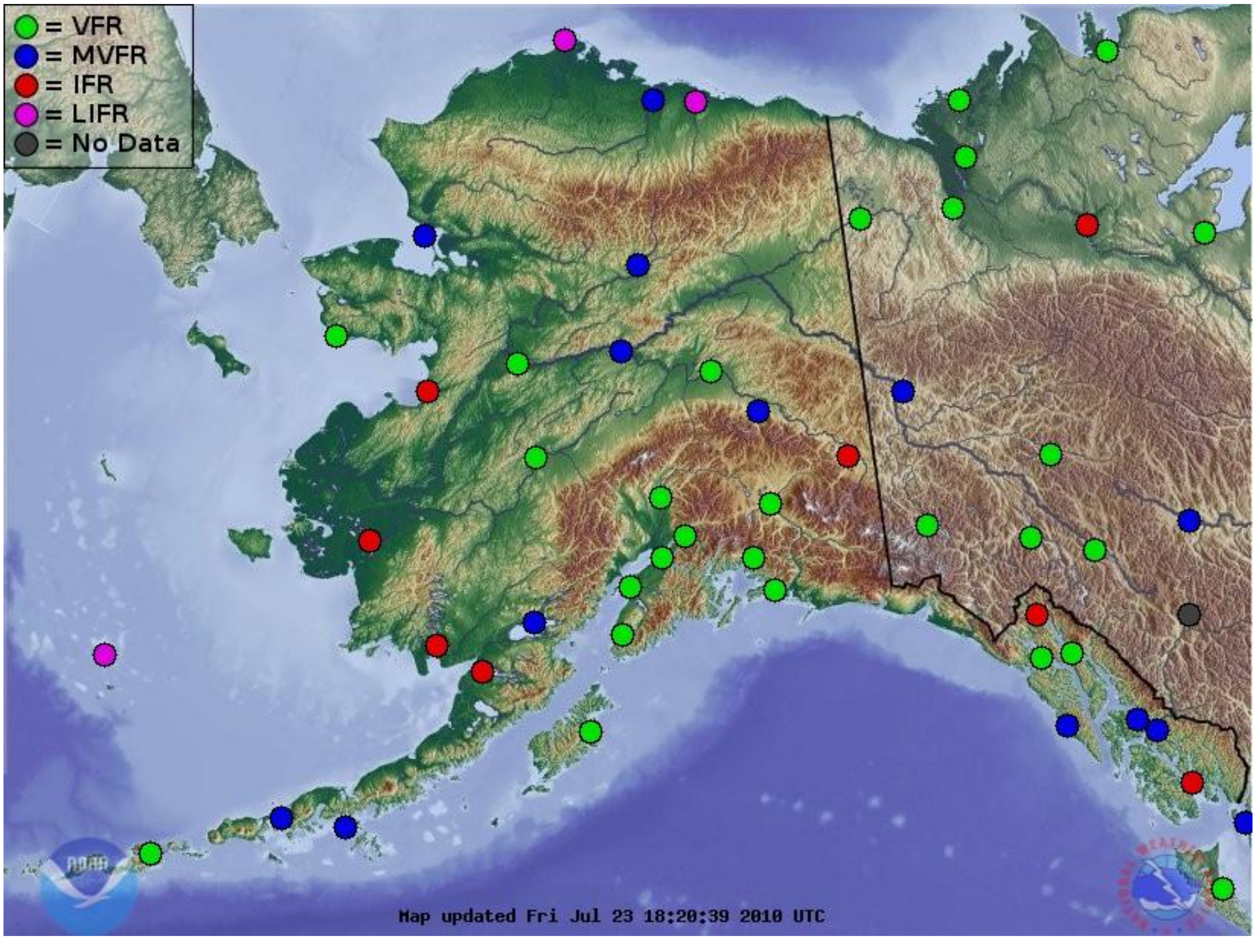
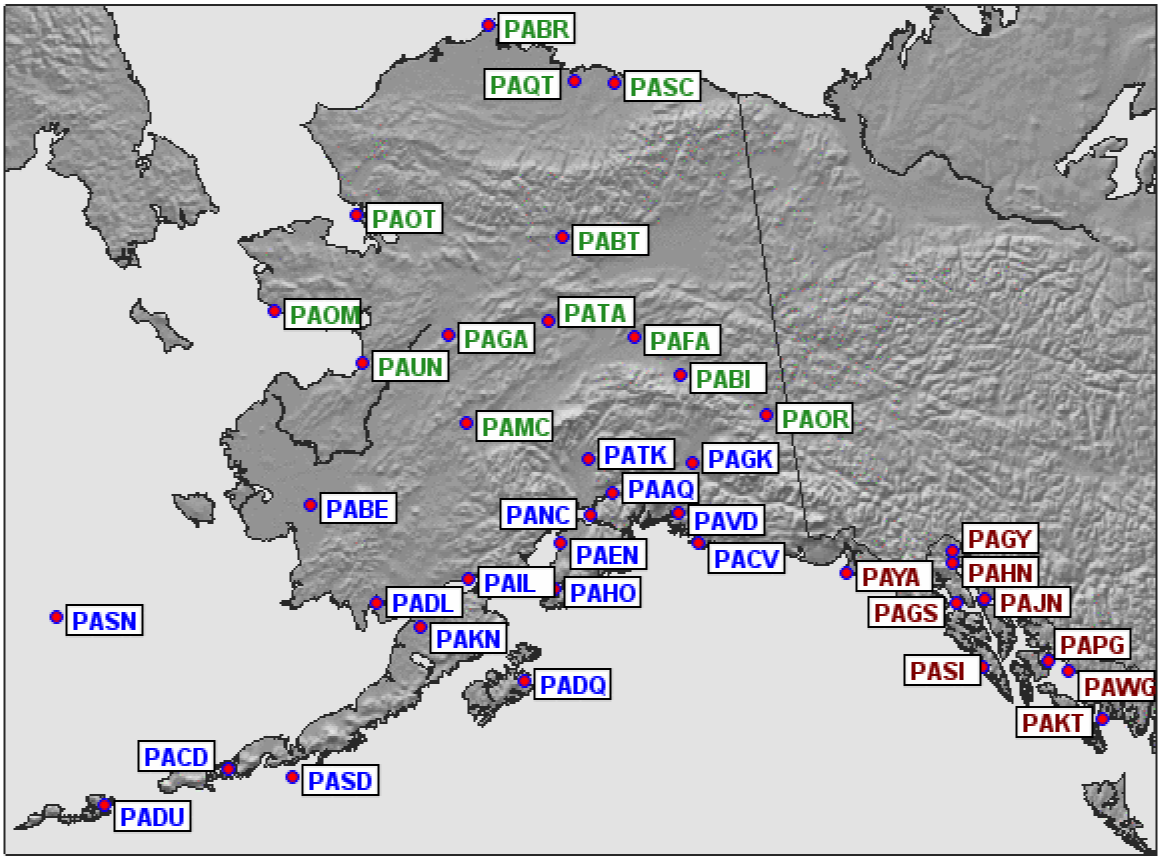
MVFR/IFR Climatology for Selected Alaska TAF Sites



Source: Chris Castellano-Alaska Aviation Weather Unit

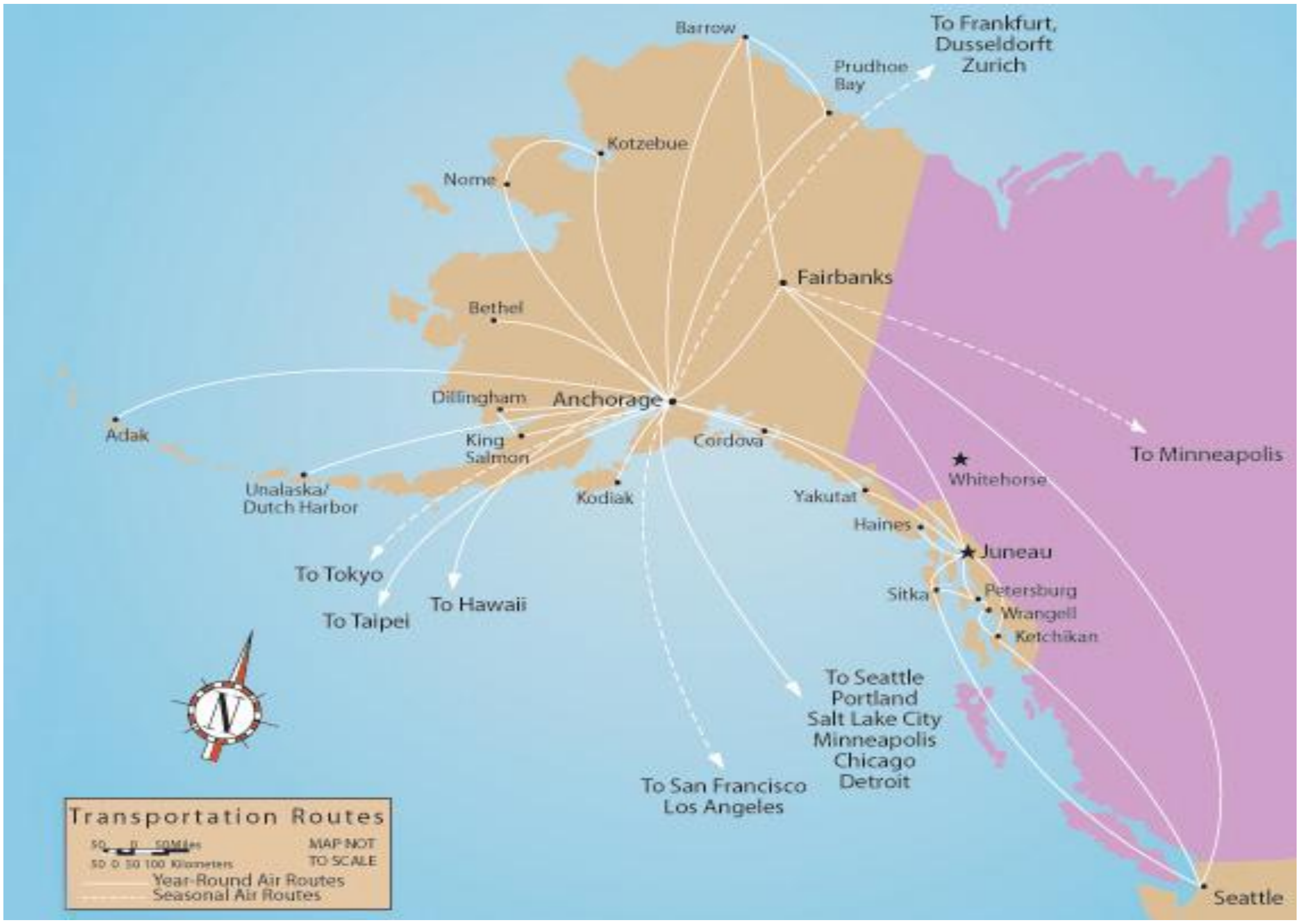
Alaska TAF Sites (in this study)

TAF ID	Location	Latitude	Longitude
PABE	Bethel, AK	60 47' N	161 50' W
PABR	Barrow, AK	71 17' N	156 46' W
PACD	Cold Bay, AK	55 13' N	162 44' W
PADQ	Kodiak, AK	57 45' N	152 29' W
PAEN	Kenai, AK	60 35' N	151 14' W
PAFA	Fairbanks, AK	64 48' N	147 52' W
PAJN	Juneau, AK	58 21' N	134 34' W
PAKN	King Salmon, AK	58 41' N	156 39' W
PAMC	McGrath, AK	62 57' N	155 36' W
PANC	Anchorage, AK	61 10' N	150 02' W
PAOM	Nome, AK	64 31' N	165 26' W
PAOT	Kotzebue, AK	66 53' N	162 36' W
PASC	Deadhorse, AK	70 12' N	148 29' W
PAVD	Valdez, AK	61 08' N	146 16' W
PAYA	Yakutat, AK	59 30' N	139 39' W



Purpose & Objectives

The purpose of this study is to create a brief climatology of MVFR/IFR conditions for selected Alaska TAF sites. Fifteen sites have been chosen based on their geographic locations and the volume of air traffic. Specifically, this study examines monthly variability, the importance of wind direction, and the two criteria responsible for MVFR and IFR conditions. Moreover, this study intends to explain significant findings using relevant climate data, an understanding of meteorological concepts, and knowledge of the local geography and topography. Two sources which aided tremendously in creating these climatologies included AVNFPS plots (MVFR/IFR frequency) and NCDC climate data.



Key Terms

VFR (Visual Flight Rules) – refers to sky conditions where the cloud ceiling is above 3000 feet and the visibility is greater than 5 statute miles.

Sub-VFR – refers to sky conditions which meet the criteria for some kind of visual flight obstruction category (either MVFR or IFR). In this case, sub-VFR is assumed to be the cumulative sum of all flight categories.

MVFR (Marginal Visual Flight Rules) – refers to sky conditions where the cloud ceiling is between 1000 and 3000 feet, and/or the visibility is between 3 and 5 statute miles.

IFR (Instrumental Flight Rules) – refers to sky conditions where the cloud ceiling is less than 1000 feet and/or the visibility is less than 3 statute miles. Two subcategories of IFR include LIFR and VLIFR. These are used to characterize very low cloud ceilings and visibilities.

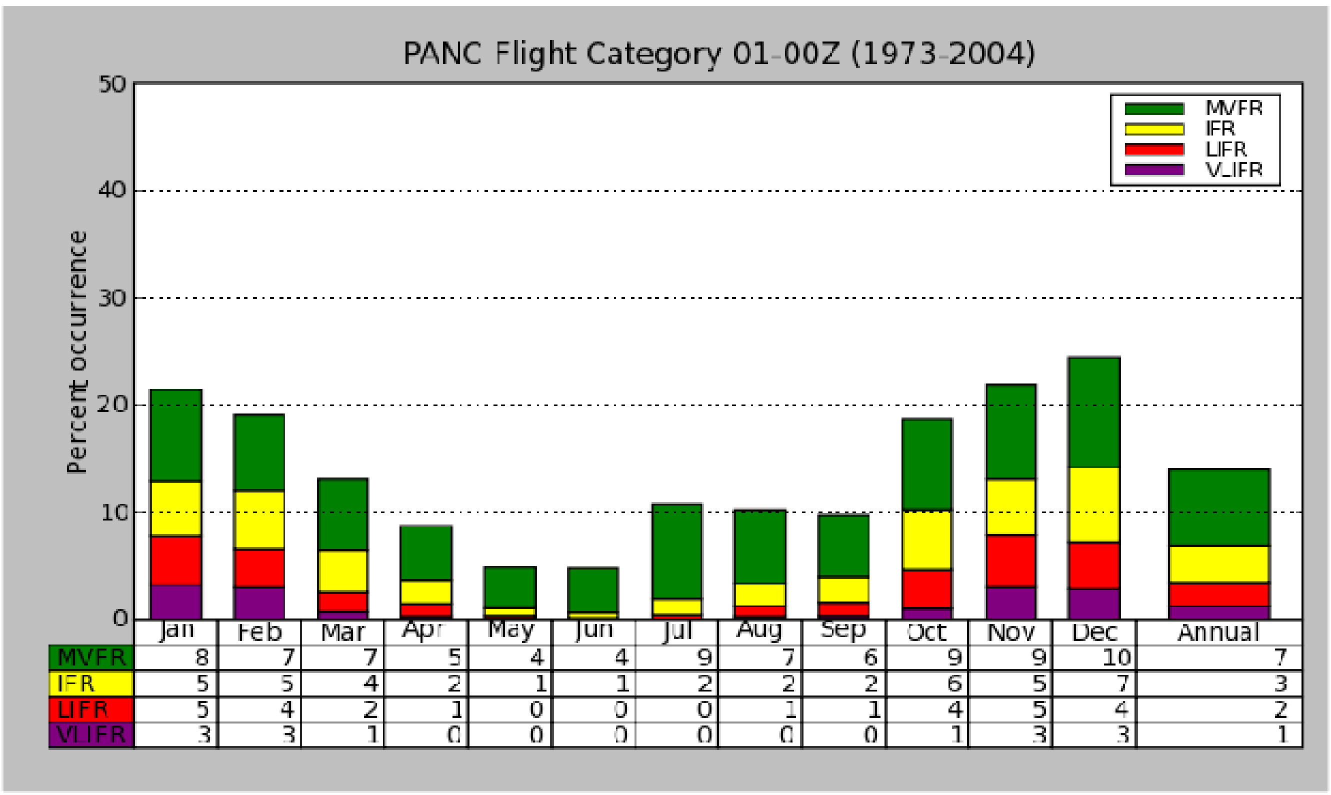
LIFR (Low Instrumental Flight Rules) – refers to sky conditions where the cloud ceiling is lower than 500 feet and/or the visibility is less than 1 statue mile.

VLIFR (Very Low Instrumental Flight Rules) – though not a conventional FAA term, may be used to describe sky conditions where the cloud ceiling is lower than 200 feet and/or the visibility is less than 0.5 statute miles. The NWS and FAA identify VLIFR conditions as a criterion for closing airports.

MVFR/IFR Climatology for Anchorage, AK

Monthly Variability

Throughout the 1973-2004 period, IFR was most common between October and February. IFR conditions occurred with at least 11% frequency during these months. Flight conditions typically improve substantially during the spring. In fact, VFR conditions are reported with 95% frequency in May and June, as opposed to 1% for IFR conditions. Annually, Anchorage experiences sub-VFR 13% of the time (24% in December) and IFR 6% of the time (14% in December).

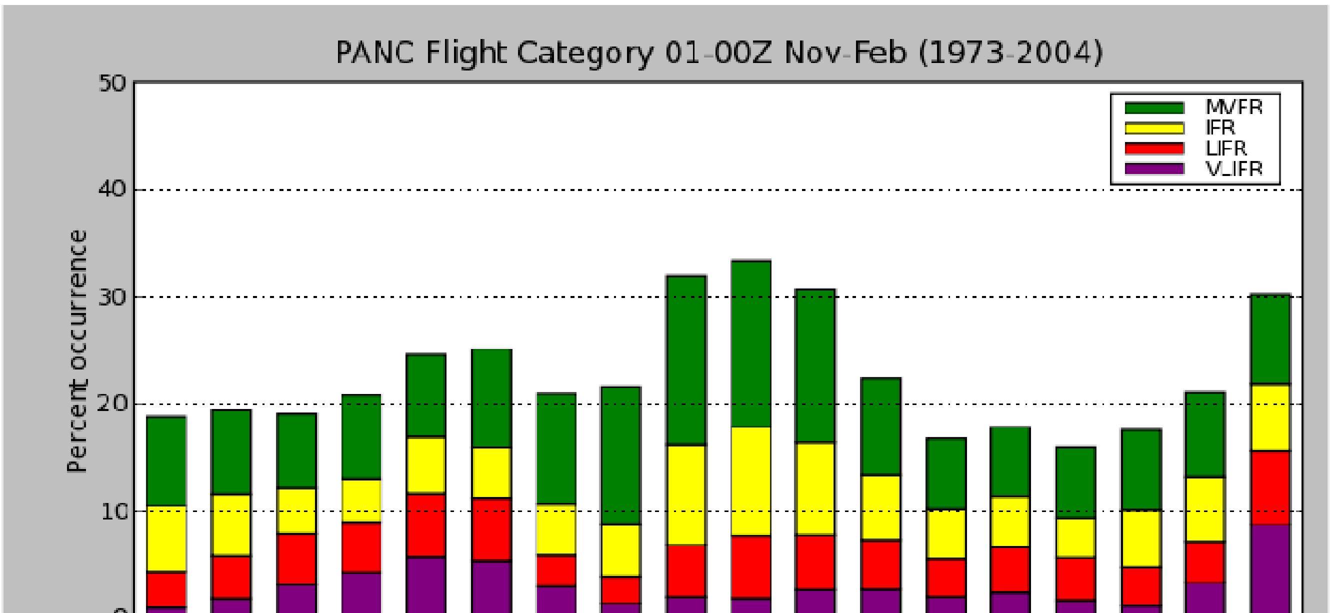


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	8	7	7	5	4	4	9	7	6	9	9	10	7
IFR	5	5	4	2	1	1	2	2	2	6	5	7	3
LIFR	5	4	2	1	0	0	0	1	1	4	5	4	2
VLIFR	3	3	1	0	0	0	0	0	0	1	3	3	1

Relevant Climate Conditions

Climatologically, the highest mean monthly relative humidity occurs concurrently with the greatest frequencies of IFR reports. Between November and January, the mean monthly daytime relative humidity exceeds 70%, implying low-level moisture and cloud cover. Additionally, the best visual flight conditions (April-June) are well-correlated with lower relative humidity ($\leq$ 55%). Regarding wind direction, calm winds are most favorable for IFR conditions, particularly in winter. Between November and February, IFR occurs with 22% frequency under calm winds (see graph below). Given Anchorage's relatively low-lying elevation and the surrounding topography, calm winds under stable atmospheric conditions inhibit vertical and horizontal mixing, especially during the winter when a persistent surface inversion is likely. Low-level inversions in conjunction with higher relative humidity near the surface will encourage low cloud ceilings. Moreover, the combination of saturated air and surface temperatures well below freezing can generate freezing fog. During winter, easterly and SSW winds also encourage IFR. Though easterly winds may imply downslope effects (Chugach

Range), under weaker pressure gradient, southeasterly fetch of relatively warm, maritime air can generate light frozen precipitation (snow and less commonly, freezing rain or sleet) as it is forced above cold, dense air near the surface. A gentle downslope will not typically erode the surface inversion, but adiabatically heat the air on the lee side of the mountains such that it becomes unstable with respect to the low-level air in Anchorage. SSW winds draw relatively warm, moist air onshore from the North Pacific and along Cook Inlet. In winter, this marine air is forced vertically above the cold land surface (frictional convergence and buoyancy instability), and adiabatically cools and condenses. If pressure differences generate a localized SE wind along Turnagain Arm, a convergence zone may develop over Anchorage and produce significant snowfall. In summer, SSW flow near the surface encourages stratiform cloud cover via marine influence. On the contrary, SSE winds promote the best visual flight conditions. These winds create a downslope effect (heating and drying of air) by flowing over the Kenai and Chugach Mountains. The diurnal variation in IFR observations reveals a slight increase during the morning, especially in late summer. Overnight, radiational cooling on land may generate a land breeze, which transports air near the surface offshore, but advects marine air aloft onshore. Under stable conditions, the marine stratiform cloud layer will remain above the cooler surface air, until solar heating can erode the inversion, and dry the lower atmosphere.

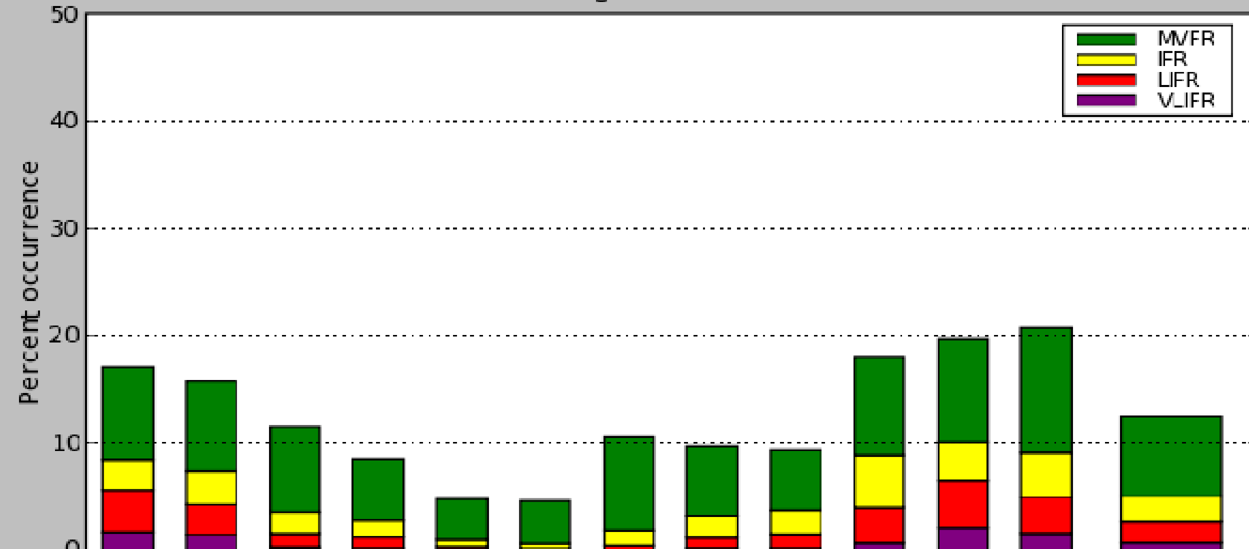


	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	8	8	7	8	8	9	10	13	16	15	14	9	7	6	7	7	8	8
IFR	6	6	4	4	5	5	5	5	9	10	9	6	5	5	4	5	6	6
LIFR	3	4	5	5	6	6	3	2	5	6	5	5	4	4	4	2	4	7
VLIFR	1	2	3	4	6	5	3	1	2	2	3	3	2	2	2	1	3	9
HOURS	14833	11284	6066	4090	2198	2005	2021	5202	2915	2434	1620	2210	1736	3055	3556	11307	1642	11732

Low Visibility vs. Low Ceiling

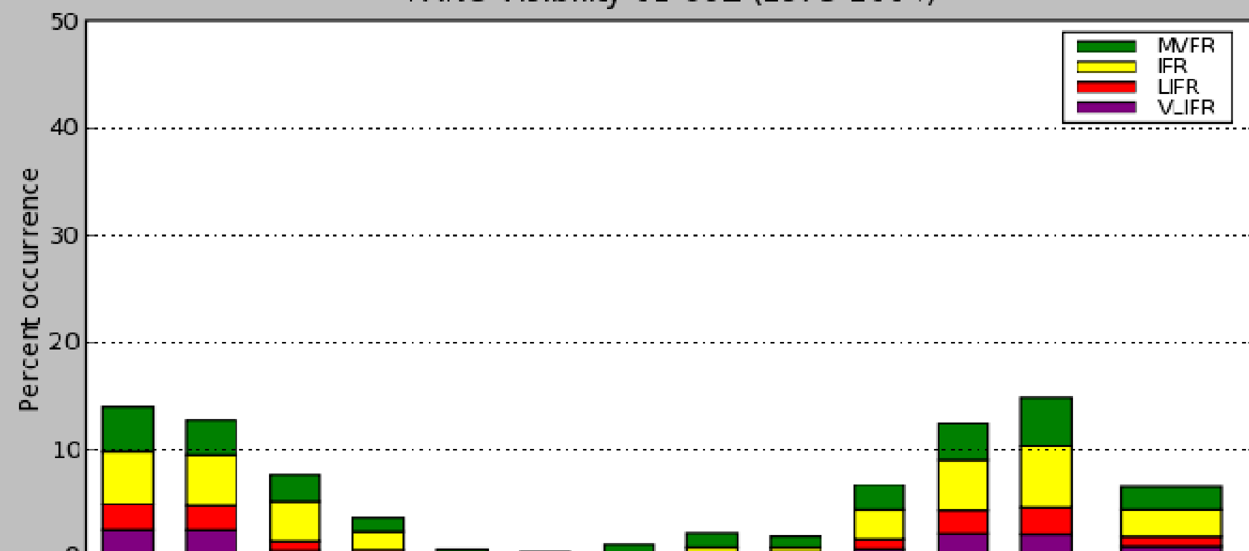
In terms of forcing IFR conditions, low ceiling and low visibility occur with very similar frequency. Annually, both low ceiling and low visibility support IFR conditions no greater than 5% of the time (see graphs below). However, low ceiling (7%) is responsible for causing a slightly higher frequency of MVFR cases than low visibility (2%). Low ceiling may be more favorable overall because low-level inversions (surface or subsidence) and low-level clouds are more common than factors that drive reduced visibility (dense fog and frozen precipitation).

PANC Ceiling 01-00Z (1973-2004)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	9	8	8	6	4	4	9	7	6	9	10	12	7
IFR	3	3	2	2	1	0	1	2	2	5	4	4	2
LIFR	4	3	1	1	0	0	0	1	1	3	4	3	2
VLIFR	2	1	0	0	0	0	0	0	0	1	2	2	1

PANC Visibility 01-00Z (1973-2004)

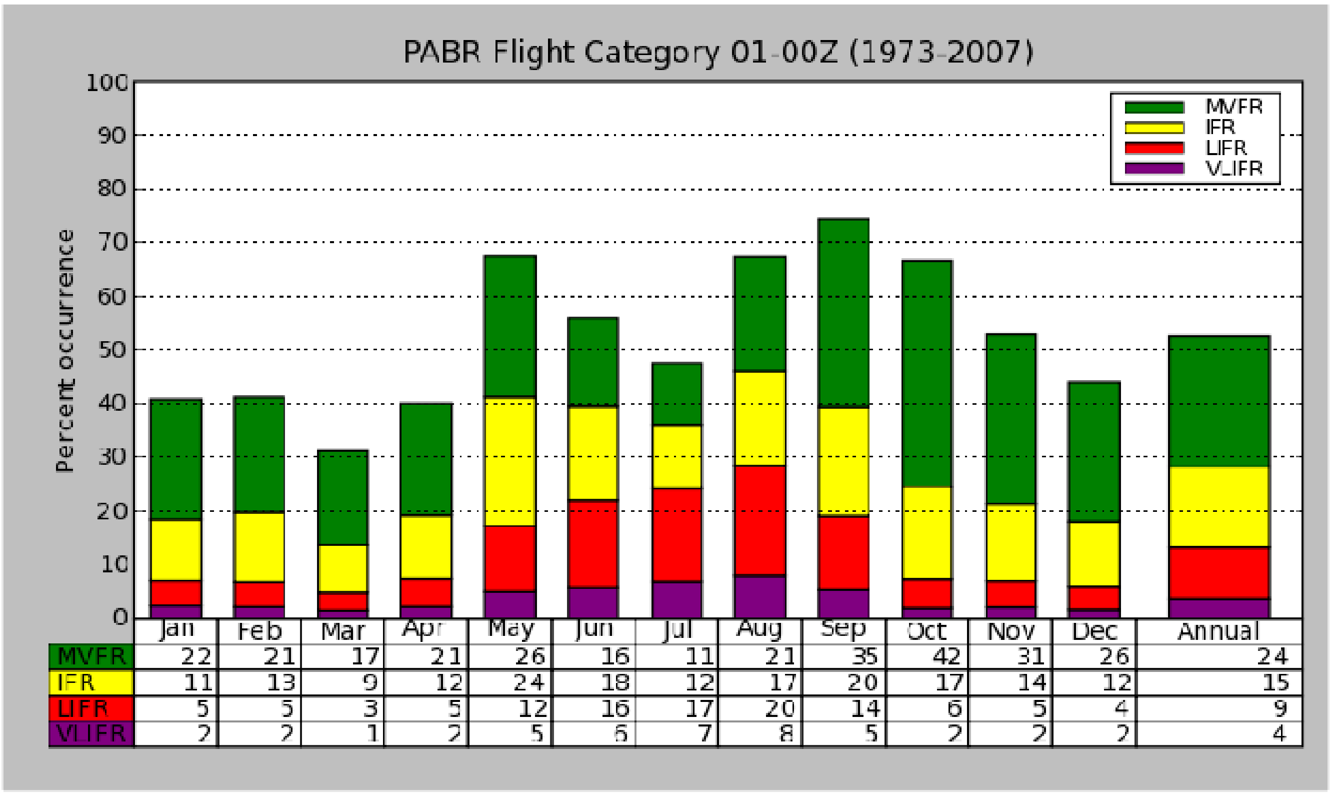


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	4	3	2	1	0	0	1	1	1	2	3	5	2
IFR	5	5	4	2	0	0	0	1	0	3	5	6	2
LIFR	2	2	1	0	0	0	0	0	0	1	2	2	1
VLIFR	2	2	1	0	0	0	0	0	0	1	2	2	1

MVFR/IFR Climatology for Barrow, AK

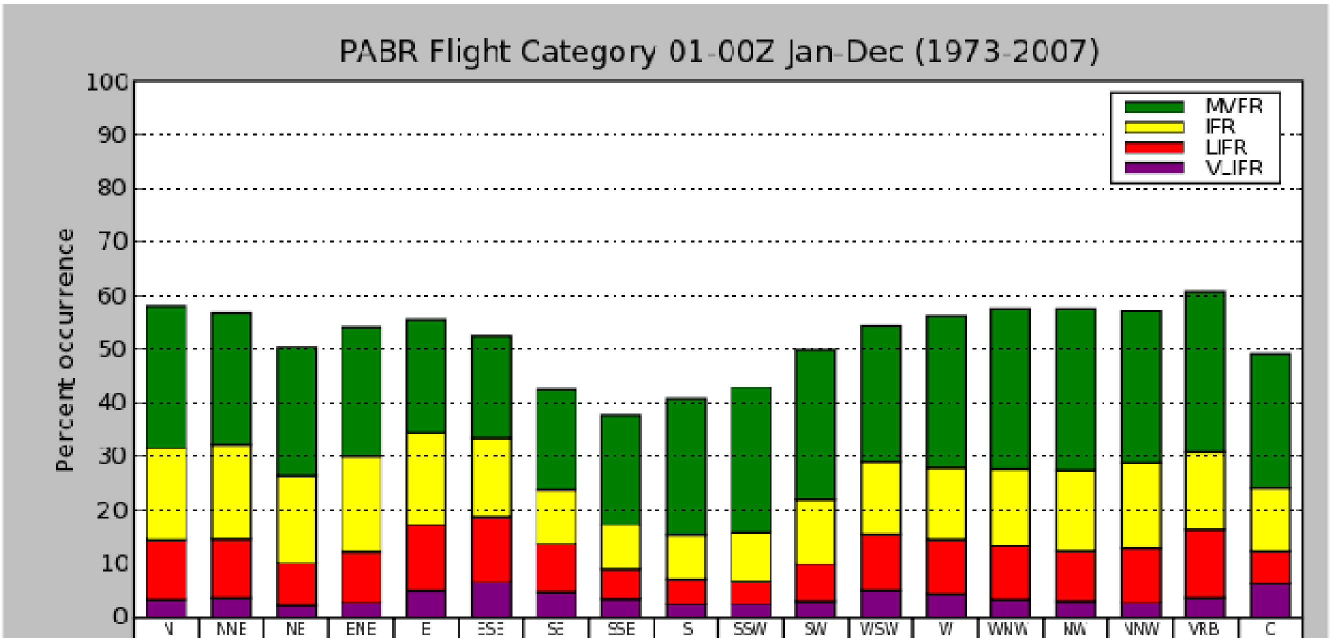
Monthly Variability

Throughout the 1973-2007 period, IFR was most common between May and September. IFR occurred with at least 36% frequency in each of these months, and even LIFR and VLIFR conditions were reported at least 22% of the time June through August. Interestingly enough, the greatest MVFR frequency occurred in October (42% of the time). The fewest IFR reports were observed during March (still, 12% frequency). Annually, Barrow experiences IFR conditions 28% of the time (45% in August), and sub-VFR conditions 52% of the time (74% in September).

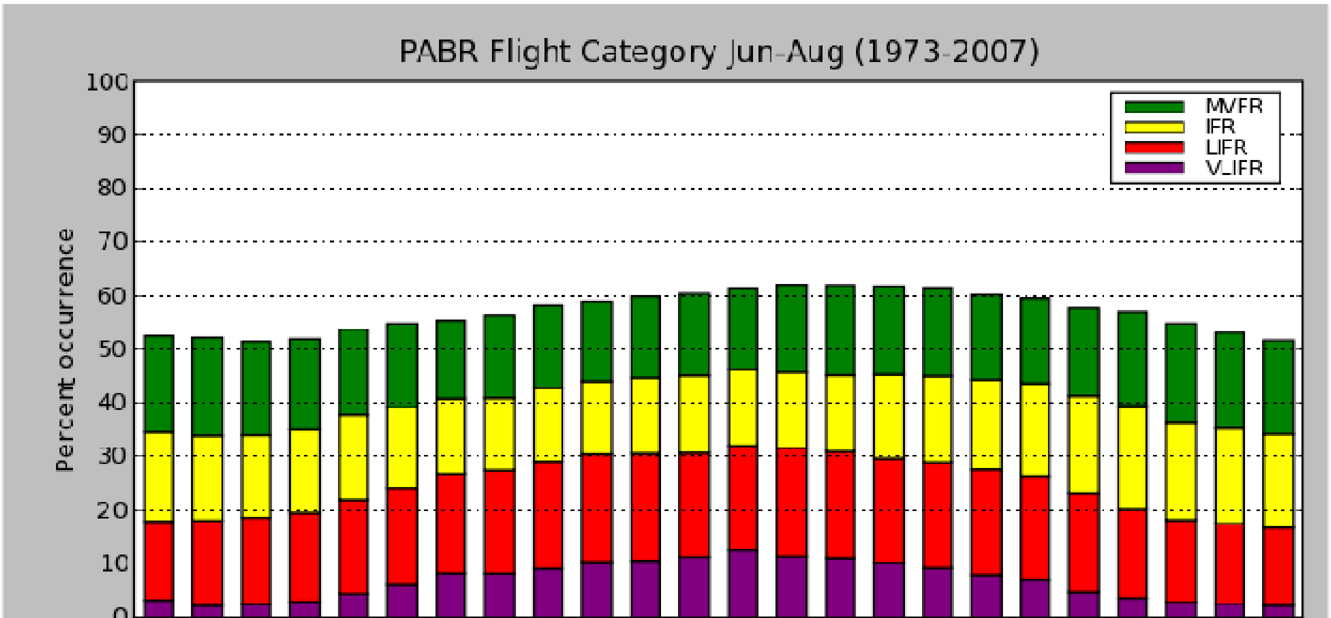


Relevant Climate Conditions

Climatologically, Barrow observes its highest monthly mean relative humidity during the May-October period, coincident with the greatest frequency of IFR reports. Mean daytime relative humidity values exceeding 80% imply persistent low-cloud cover, and overcast conditions are reported at least 21 days each month, between May and September. In terms of wind direction, IFR conditions are observed more than 20% of the time under all wind regimes except SSE, S, and SSW (see first graph below). Given its location on a small peninsula (surrounded by the Arctic Ocean) any wind between 225 and 145 degrees will transport very cold, relatively moist air onshore. Under more southerly flow, winds will advect very dry continental air. The worst visual flight conditions are most common with E, ESE, and variable winds (LIFR or worse 17% of the time). While easterly flow is favored by a strong Arctic high during summer, variable winds are unique because they are climatologically infrequent. Most IFR reports under variable winds occur during winter and early spring (December-April), when arctic storms are more common. Additionally, calm winds can generate IFR conditions in the presence of low-level moisture and either shallow surface inversions or subsidence inversions. These scenarios, which inhibit vertical mixing and trap moisture near the surface, encourage persistent fog in summer, freezing fog in fall and spring, and ice fog in winter. During summer, the worst visual flight conditions are observed in the early morning hours (see second graph below). As the sun's elevation begins to approach the horizon and solar heating decreases, surface temperatures can easily drop below freezing. The thawing and opening of sea ice near the Arctic Coast allows for a weak thermally-induced land breeze early in the day, which transports cold, maritime air (aloft) onshore. Low-level temperature inversions, which become more common toward fall, will hold this cold, marine air in the lower troposphere until daytime surface heating can vertically mix out the surface inversion and generate a sea breeze effect.



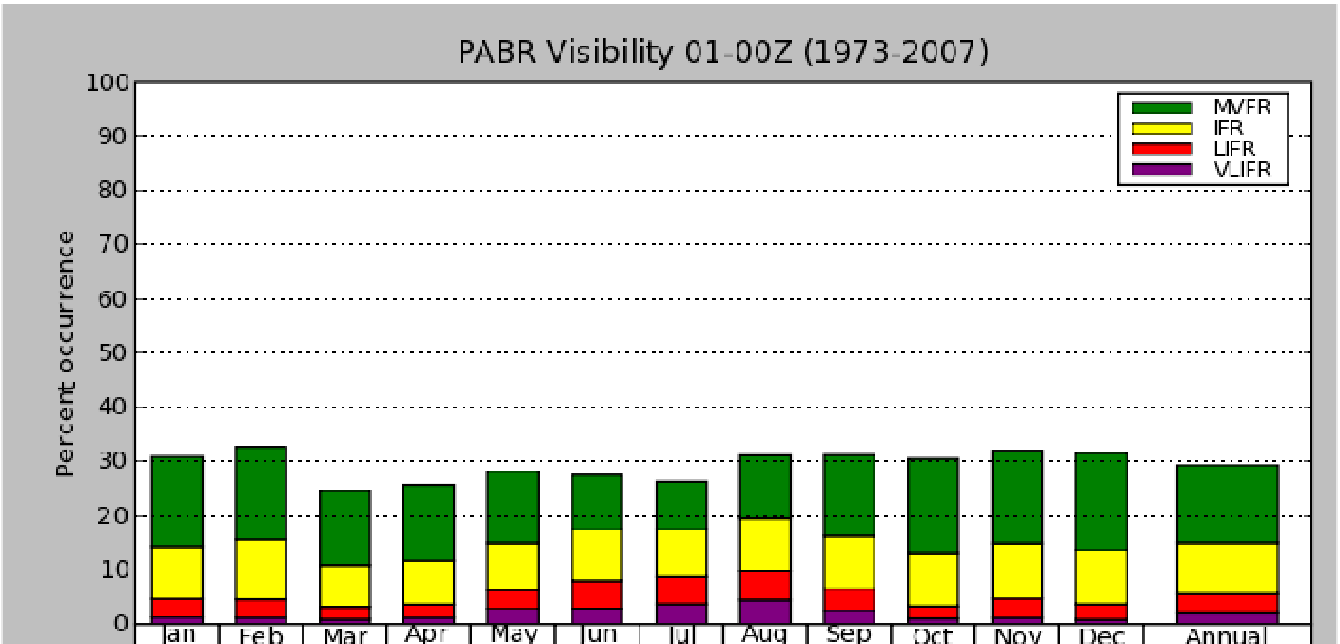
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	27	24	24	24	21	19	19	20	25	27	28	25	23	30	30	28	30	25
IFR	17	18	16	18	17	15	10	8	8	9	12	14	13	14	15	16	15	12
LIFR	11	11	8	9	12	12	9	5	5	4	7	11	10	10	9	10	13	6
VLIFR	3	4	2	3	5	7	5	4	2	3	3	5	4	3	3	3	4	6
HOURS	8754	9355	24776	50370	33851	19903	11285	11953	7648	8888	9735	13216	11787	11132	10418	13716	312	4525



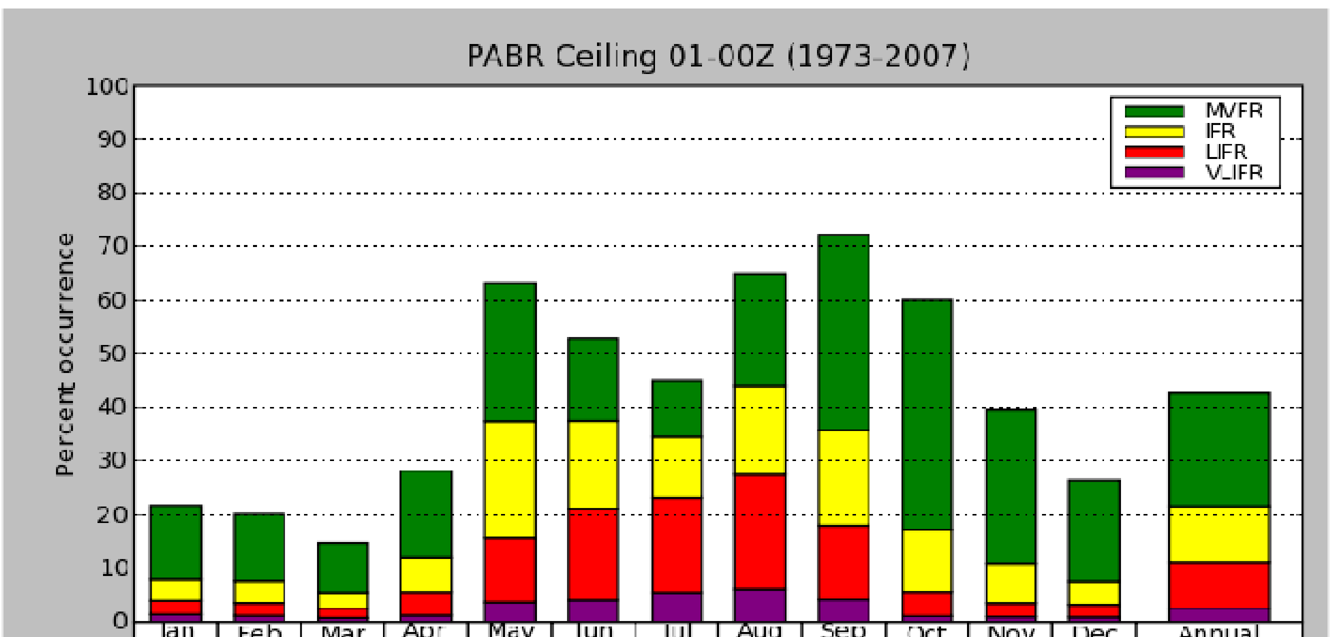
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MVFR	18	18	18	17	16	16	15	15	16	15	15	15	15	16	17	17	17	16	16	17	17	18	18	17
IFR	17	16	15	16	16	15	14	14	14	14	14	14	14	14	14	16	16	17	17	18	19	18	18	18
LIFR	15	16	16	16	18	18	19	19	20	20	20	19	20	20	20	19	20	20	19	18	16	15	15	14
VLIFR	3	2	2	3	4	6	8	8	9	10	11	11	13	11	11	10	9	8	7	5	4	3	3	2

Low Visibility vs. Low Ceiling

Overall, visual flight obstructions are influenced predominately by low cloud ceiling rather than low visibility. Between May and September, low ceiling causes IFR conditions with at least 34% frequency, while low visibility causes IFR conditions with less than 20% frequency (see graphs below). Low ceiling is responsible for IFR 45% of the time and LIFR 28% of the time in August. Despite the discrepancy, both low visibility and low ceiling are most common in August. Greater relative humidity, cloud cover, and precipitation all support lower visibilities and cloud ceilings. During winter, low visibility actually becomes more prevalent than low ceiling. This role reversal may be explained by a very deep inversion layer (higher cloud ceilings under drier surface conditions) and arctic storms that produce blowing snow and significantly reduce visibility.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	17	17	14	14	13	10	9	12	15	18	17	18	14
IFR	10	11	8	8	9	9	9	10	10	10	10	10	9
LIFR	3	3	2	2	3	5	5	5	4	2	4	3	4
VLIFR	1	1	1	1	3	3	4	4	3	1	1	1	2

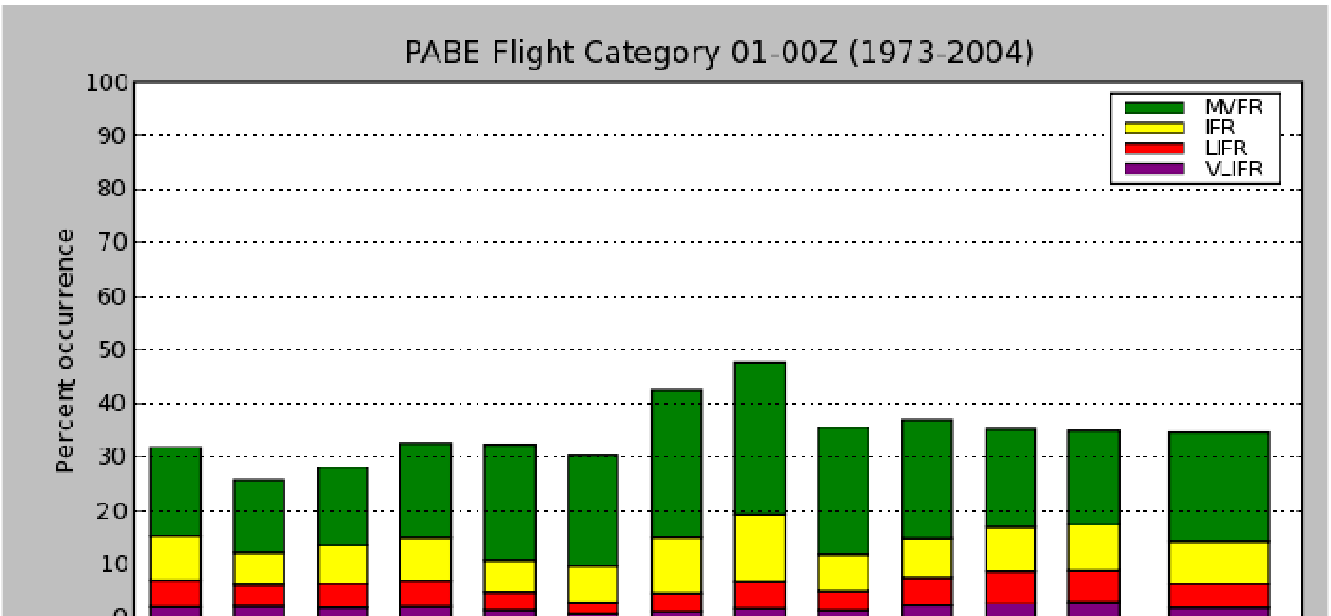


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	14	12	9	16	26	15	10	21	36	43	29	19	21
IFR	4	4	3	7	22	16	11	17	18	12	7	4	10
LIFR	3	2	2	4	12	17	18	22	14	4	3	2	9
VLIFR	1	1	1	1	4	4	5	6	4	1	1	1	3

MVFR/IFR Climatology for Bethel, AK

Monthly Variability

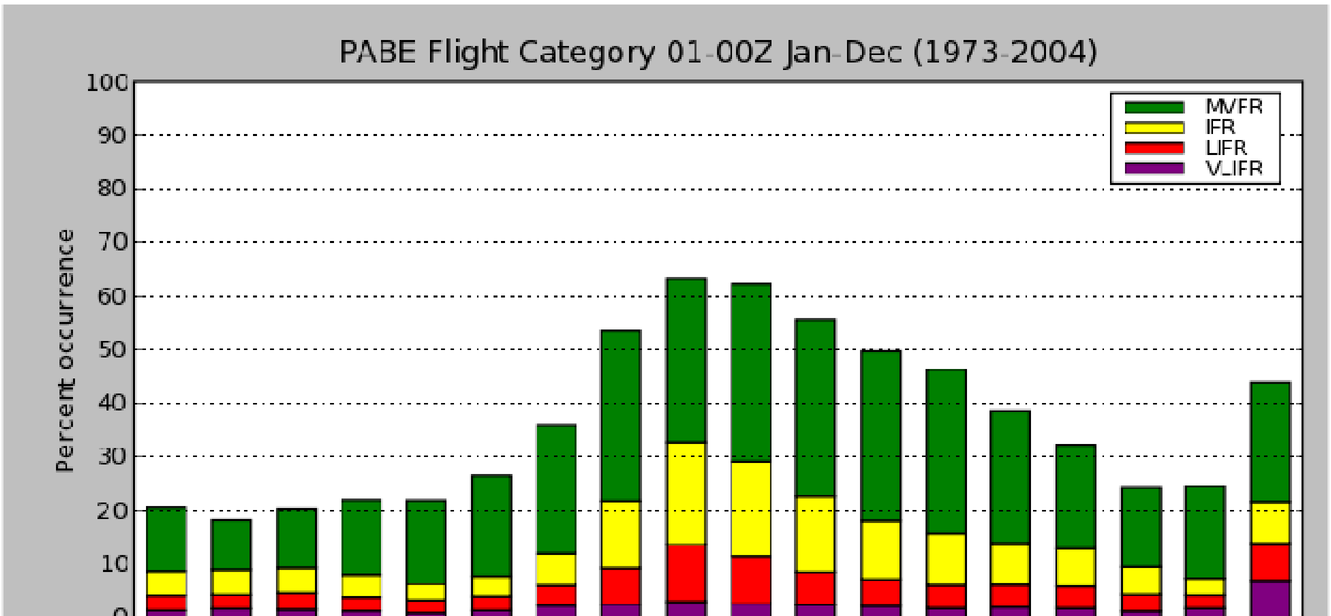
Throughout the 1973-2004 period, IFR conditions were most common in August (19% frequency), and most scarce in June (10% frequency). Annually, Bethel experiences IFR conditions 14% of the time, and sub-VFR 34% of the time (47% in August). In addition, a slight increase in IFR frequency occurs between November and January (see graph below).



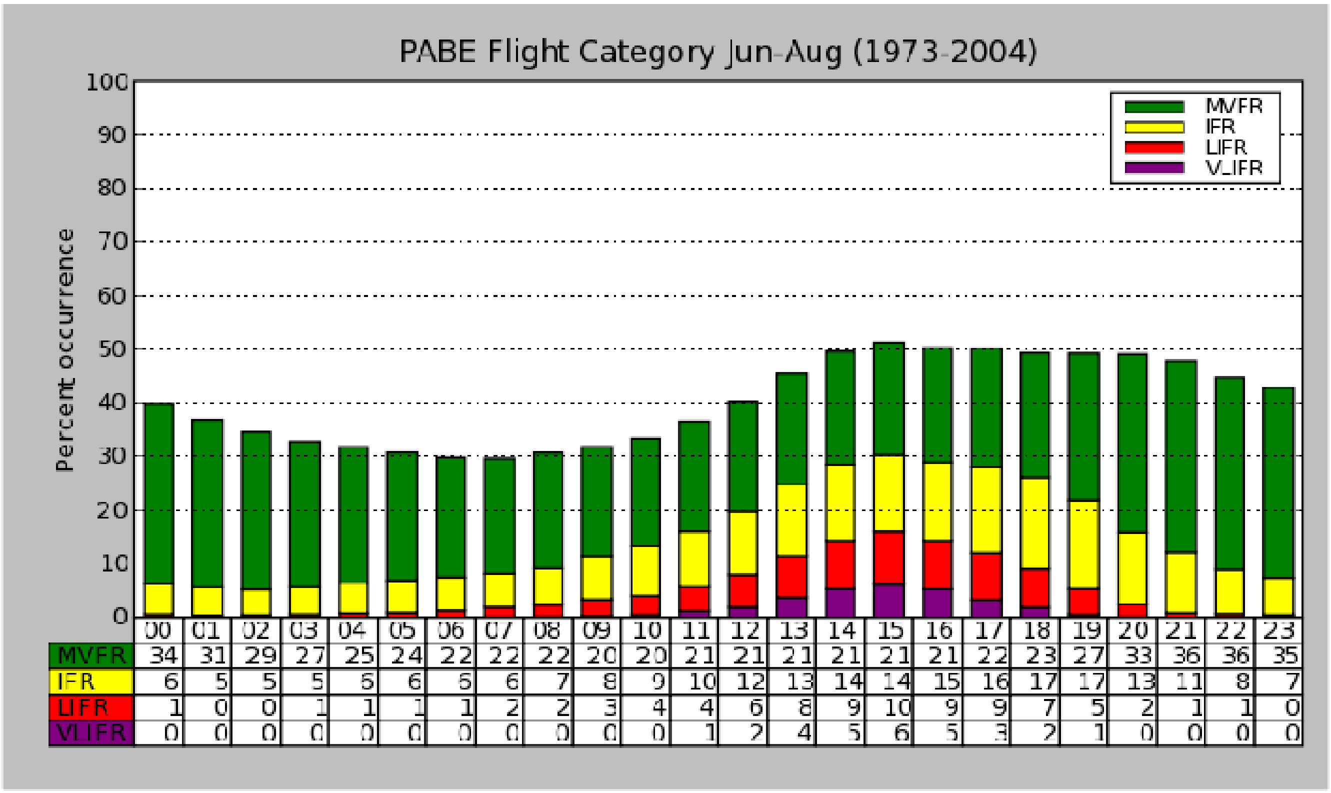
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	16	14	14	18	21	21	27	28	24	22	18	17	20
IFR	8	6	7	8	6	7	10	12	7	7	8	9	8
LIFR	5	4	4	5	3	2	3	5	4	5	6	6	4
VLIFR	2	2	2	2	2	1	1	2	1	2	3	3	2

Relevant Climate Conditions

Climatologically, the highest monthly mean relative humidity for Bethel does not occur simultaneously with the greatest IFR frequency. Though the lowest relative humidity (59% in June) is coincident with the fewest IFR observations, the greatest relative humidity occurs between November and January (over 75%). If one takes into consideration the substantial increase in average snowfall during November and December (more than 10" both months), these high relative humidity values help explain the winter rise in IFR observations. The maximum monthly precipitation (3.02" in August) occurs concurrently with both the maximum IFR and MVFR frequency. Though most correlations between IFR frequency and precipitation are coincidental, Bethel receives most of its summer precipitation through marine-influenced stratiform rain events (implies lower cloud ceilings). In terms of wind direction, the worst visual flight conditions are favored by southerly flow, which generates IFR 33% of the time and sub-VFR 63% of the time (see first graph below). These winds support strong onshore flow during summer, which advects cold, maritime air inland, and generates a marine stratus layer or even patchy morning fog. During winter, southerly flow near synoptic lows draws moisture from the Bering Sea, and can yield significant snow and strong winds. Though climatologically uncommon, calm winds also encourage IFR conditions. Calm winds in the presence of a shallow surface inversion during late fall and early winter prevent vertical mixing, and encourage low ceilings and even freezing fog (provided enough low-level moisture exists). For instance, between October and December, LIFR occurs 22% of the time under calm conditions. Diurnal variation in IFR reveals that IFR frequency increases as much as 25% between afternoon and morning during the May-Aug period (see second graph below). Strong radiational cooling overnight may generate either radiational fog (if the surface temperature reaches the dewpoint) or a weak land breeze (air between Bethel and the Kuskokwim Bay is generally unimpeded). In the case of a land breeze, cold, dense air will be transported offshore, while slightly warmer, moist air will push onshore aloft. Given a strong enough inversion, the maritime air will be trapped in the lower atmosphere, causing a marine stratus layer to persist until solar heating mixes out the inversion.



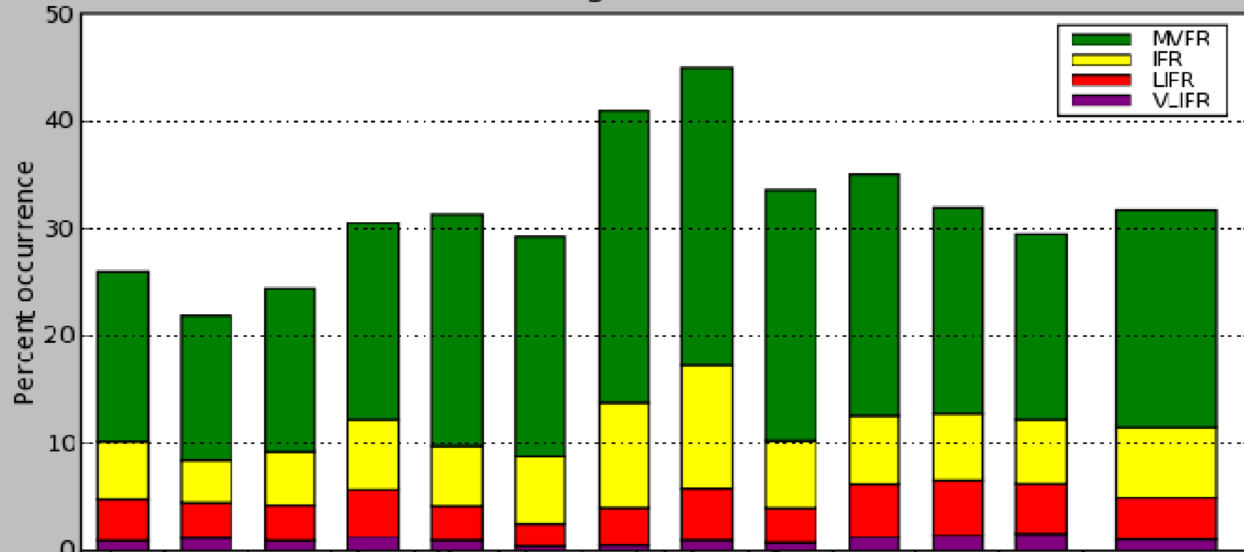
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	12	9	11	14	16	19	24	32	30	33	33	31	31	24	19	15	17	22
IFR	4	5	5	4	3	4	5	13	19	13	14	11	10	8	7	5	3	8
LIFR	3	3	3	3	2	3	4	7	11	9	6	5	4	4	4	3	2	7
VLIFR	1	2	2	1	1	1	2	3	3	3	2	2	2	2	2	1	2	7
HOURS	17475	30590	28020	20994	10525	10240	8149	15382	18265	13560	11474	14411	8046	12614	16410	22935	985	3509



Low Visibility vs. Low Ceiling

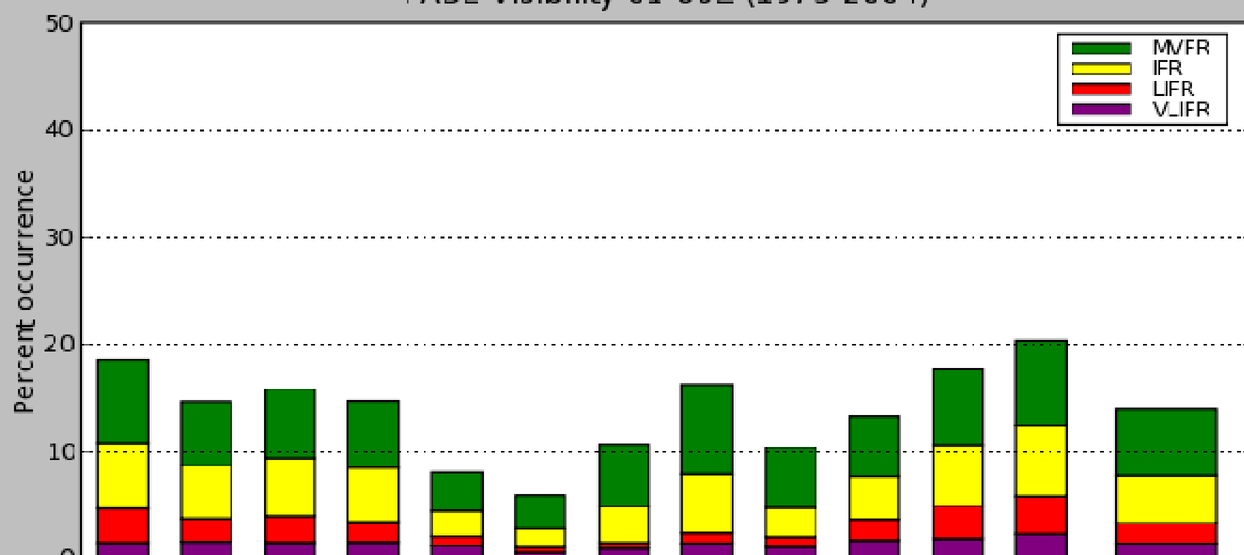
Overall, sub-VFR conditions in Bethel are predominately forced by low ceiling rather than low visibility. Annually, low ceiling causes sub-VFR conditions 32% of the time, whereas low visibility causes sub-VFR conditions only 13% of the time (see graphs below). This discrepancy is largest during summer, when onshore flow and persistent cloud cover favor low ceiling over low visibility. However, as winter approaches, both factors become nearly equal in importance. The increase in snowfall and strong wind events encourages reduced visibility between November and January.

PABE Ceiling 01-00Z (1973-2004)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	16	14	15	18	22	20	27	28	23	22	19	17	20
IFR	5	4	5	6	6	6	10	11	6	6	6	6	7
LIFR	4	3	3	4	3	2	3	5	3	5	5	5	4
VLIFR	1	1	1	1	1	0	1	1	1	1	1	2	1

PABE Visibility 01-00Z (1973-2004)

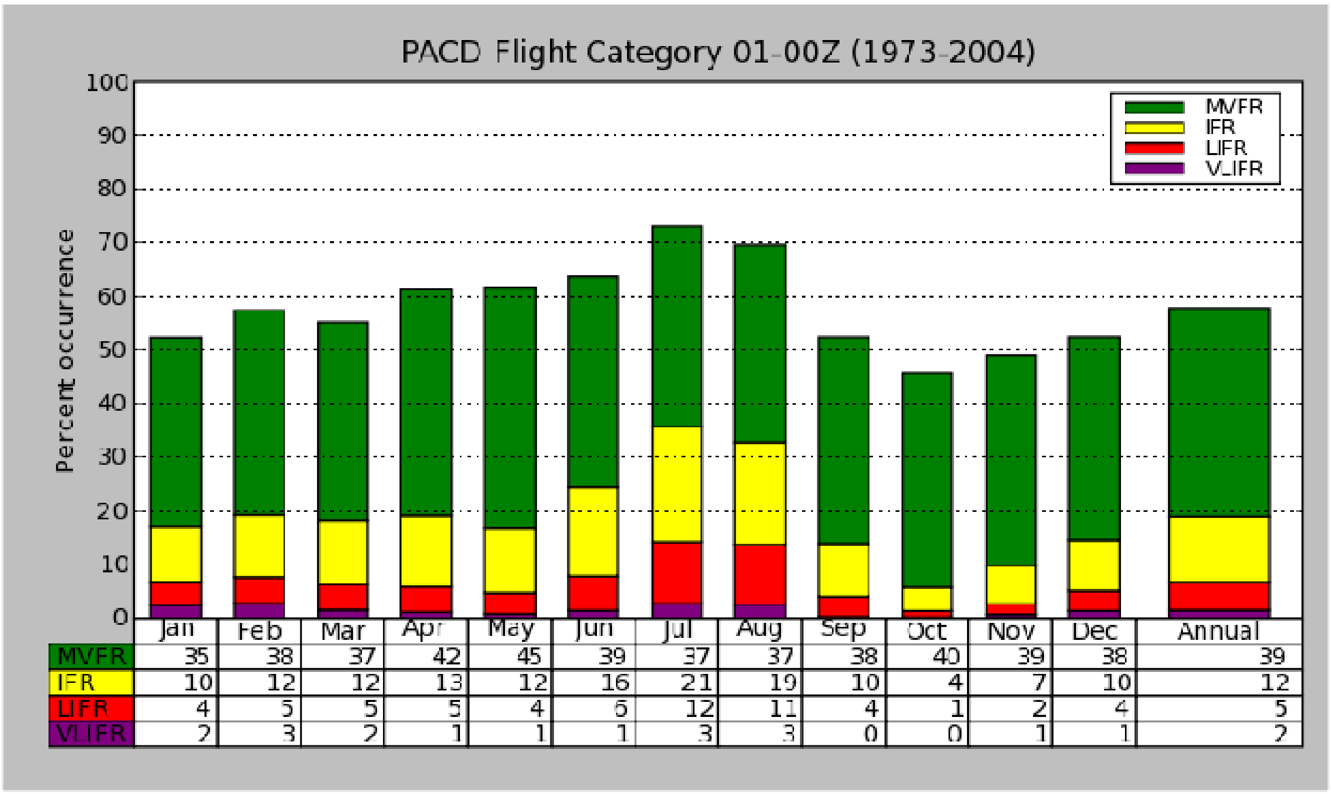


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	8	6	6	6	4	3	6	8	6	6	7	8	6
IFR	6	5	5	5	2	2	3	5	3	4	6	7	4
LIFR	3	2	2	2	1	0	1	1	1	2	3	4	2
VLIFR	2	2	2	2	1	1	1	1	1	2	2	2	1

MVFR/IFR Climatology for Cold Bay, AK

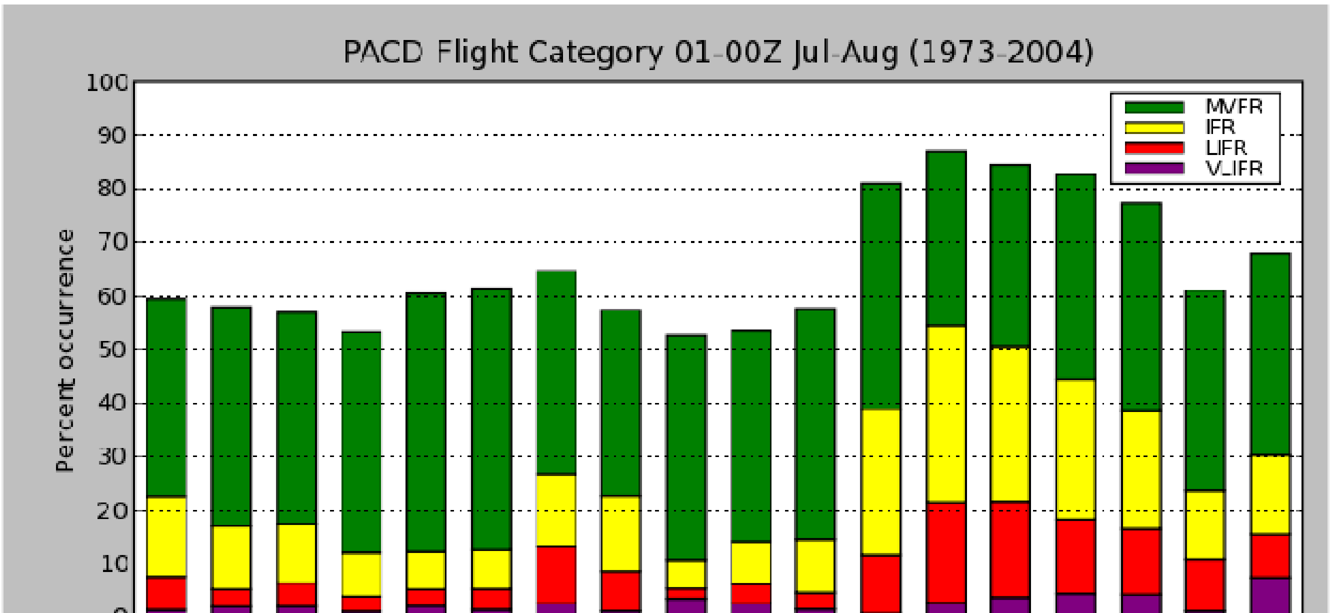
Monthly Variability

Throughout the 1973-2004 period, IFR was most common in July and August (at least 33% frequency). The fewest IFR reports were observed in October, with only 5% frequency. Annually, Cold Bay experiences IFR conditions 19% of the time, and sub-VFR conditions 58% of the time (at least 70% in July and August). Interestingly enough, though IFR frequency varied between 5% (October) and 36% (August), MVFR frequency remained relatively constant on a month-to-month basis (see graph below).

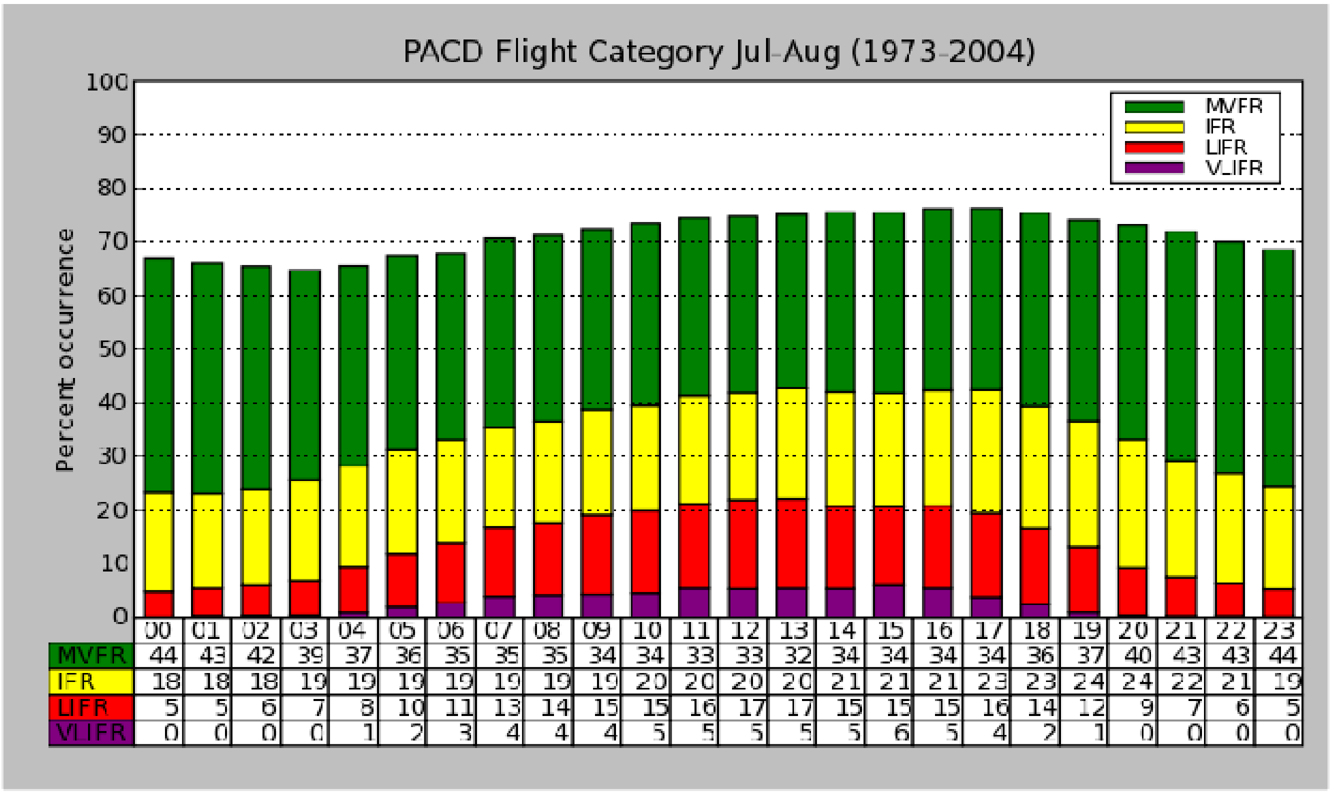


Relevant Climate Conditions

Though fairly humid year-round, Cold Bay experiences maxima in relative humidity during the summer and winter seasons. Relative humidity values above 80% almost guarantee low-level cloud cover, and thus help explain the high frequency of IFR in July and August. NCDC climatology also indicates that July and August are the two cloudiest months (at least 28 days of cloud cover), thereby supporting this hypothesis. In addition, the sharp drop in IFR frequency between August and October corresponds to a definitive decrease in monthly relative humidity (3% each month). A comparison of wind direction and IFR suggests that westerly and northwesterly winds are highly conducive to IFR conditions, especially during summer. Under westerly flow, IFR occurs 33% of the time and sub-VFR occurs 71% of the time (see first graph below). Assuming the same wind direction for the months of July and August, Cold Bay reports IFR weather with 55% frequency and even LIFR (or worse) weather with 22% frequency. Overall, sub-VFR conditions are observed almost 90% of the time in the presence of westerly winds during the July-Aug period. Westerly and northwesterly winds transport cold, maritime air over Cold Bay, often causing fog and persistent stratiform cloud cover. During summer, greater nighttime cooling over land can generate a shallow overnight land breeze. The resulting circulation will transport cool, maritime air (aloft) onshore, setting up a marine stratus layer under a stable atmosphere. This stratus layer will remain until surface heating can either cause vertical mixing or a sea breeze effect (which pushes the marine layer offshore again). In July and August, IFR frequency increases from 23% to over 40% between afternoon and morning (see second graph below). Northwest winds in winter may be associated with intense synoptic lows that can produce significant snowfall and dangerous winds. Due to the surrounding topography, easterly and southwesterly winds are least favorable for IFR. These winds not only advect drier, land-based air (flow is parallel to land) over Cold Bay, but can also create a downslope effect (mountainous topography), which further dries and heats the air.

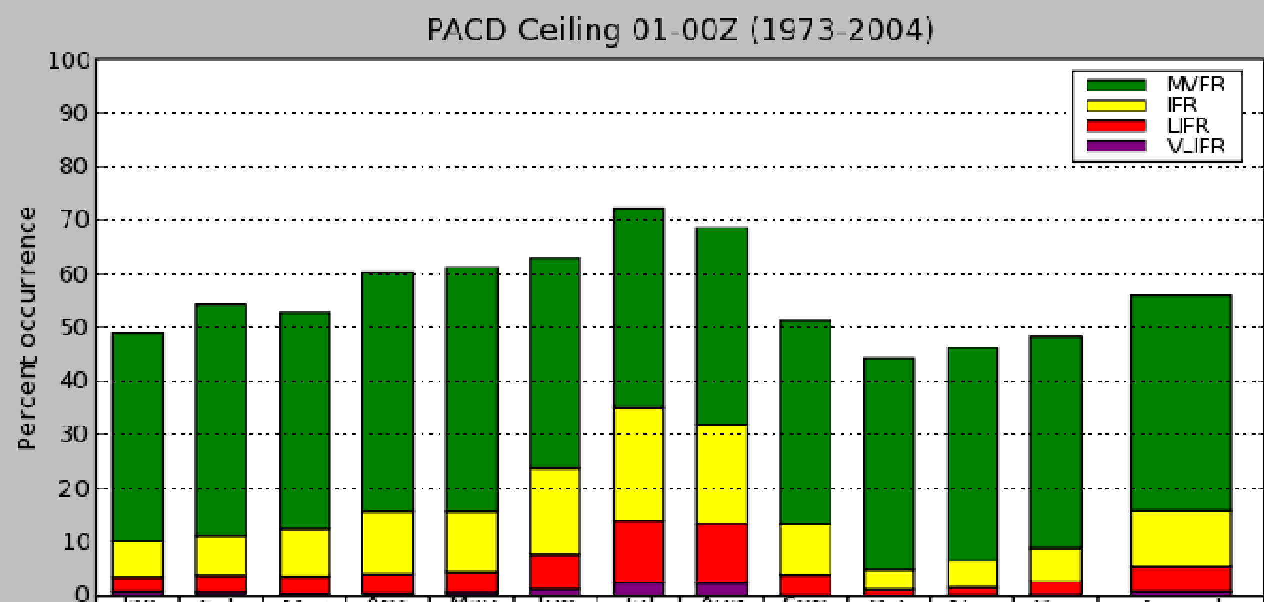


	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	37	41	39	41	48	49	38	35	42	39	43	42	33	34	38	39	37	37
IFR	15	12	11	8	7	7	14	14	5	8	10	27	33	29	26	22	13	15
LIFR	6	3	4	3	3	4	11	7	2	4	3	11	19	18	14	12	10	8
VLIFR	2	2	2	1	2	2	3	1	4	3	2	1	3	4	5	4	1	8
HOURS	1102	601	437	755	570	1695	7384	9339	460	175	354	3622	5720	6025	3804	3040	80	992

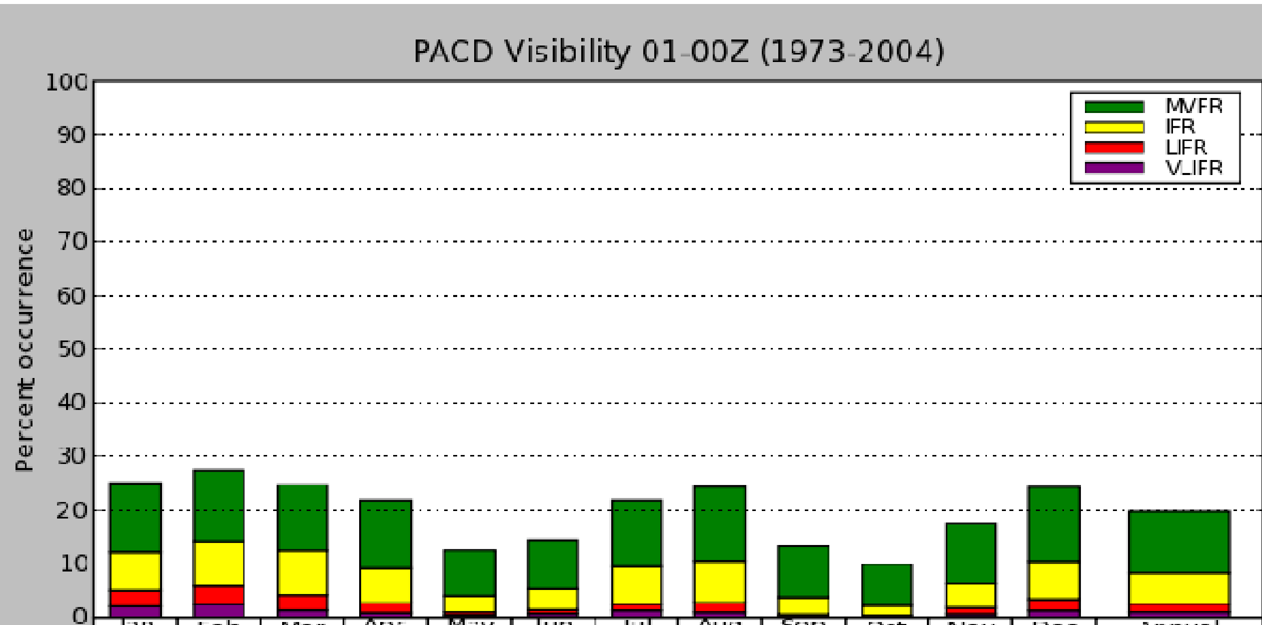


Low Visibility vs. Low Ceiling

In Cold Bay, an overwhelming majority of sub-VFR observations are forced by low ceiling (see graphs below). Annually, low ceiling is responsible for 56% of all sub-VFR reports (low visibility, 20%) and 16% of IFR reports (low visibility, 9%). The greatest discrepancy occurs in summer, due to persistent low-level cloud cover, onshore flow, and shallow nighttime land breeze circulations. During winter, as the likelihood of heavy snowfall and severe winds increases, low visibility becomes much more relevant.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	39	43	40	44	46	39	37	37	38	39	40	39	40
IFR	7	7	9	12	11	16	21	19	9	4	5	6	10
LIFR	3	3	3	4	4	6	12	11	4	1	1	2	5
VLIFR	1	1	0	0	1	1	2	2	0	0	0	0	1

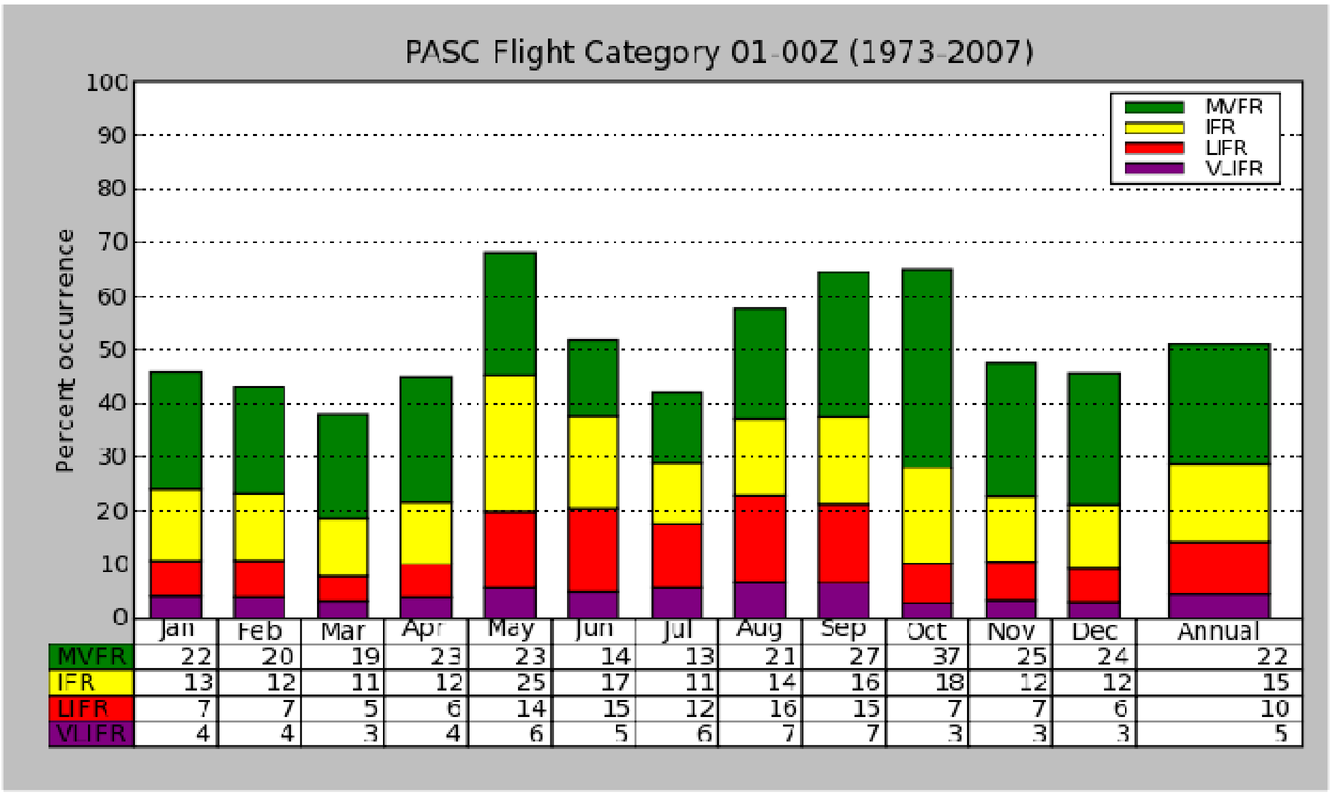


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	13	13	12	13	8	9	12	14	9	8	11	14	11
IFR	7	8	8	6	3	4	7	8	3	2	4	7	6
LIFR	3	3	3	2	1	1	1	2	0	0	1	2	2
VLIFR	2	2	1	1	0	1	1	1	0	0	1	1	1

MVFR/IFR Climatology for Deadhorse, AK

Monthly Variability

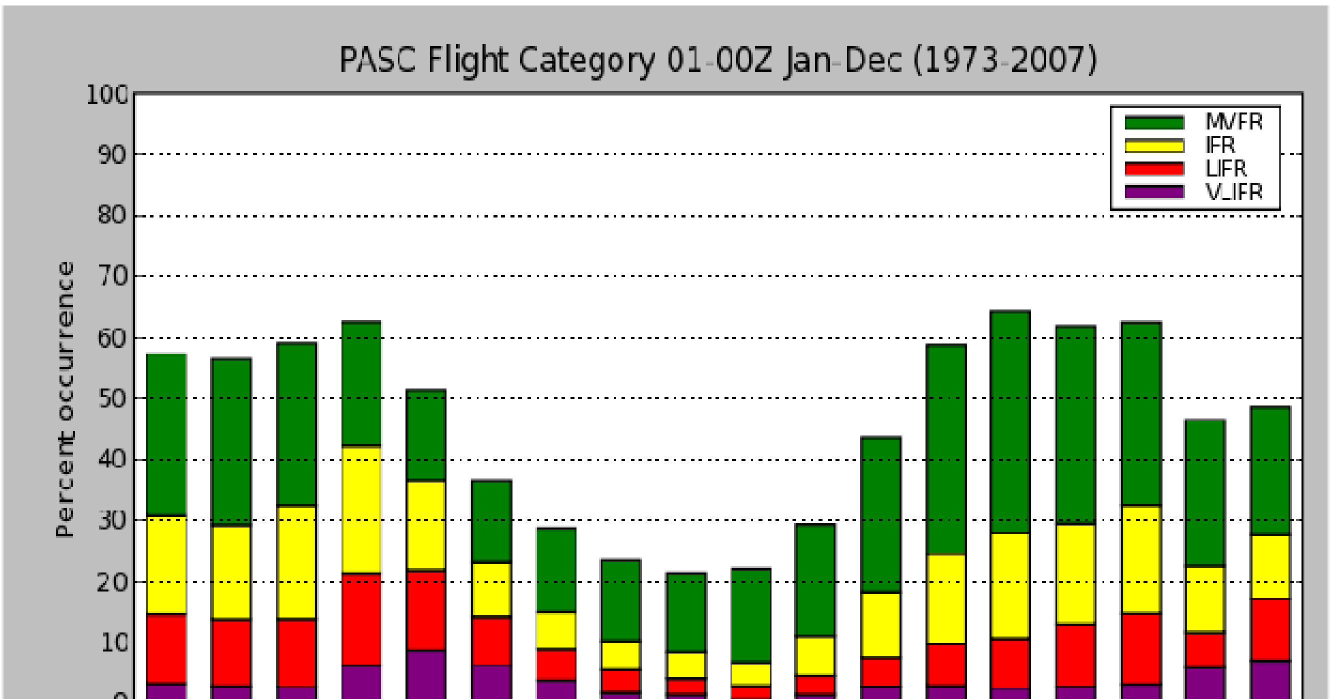
Throughout the 1973-2007 period, IFR was most common between May and September. IFR occurred with more than 35% frequency in every month excluding July. In addition, each month between May and September observed LIFR conditions with at least 18% frequency. Interestingly enough, the greatest frequency of MVFR occurs in October (37%). Though the best visual flight conditions were observed in March, IFR was still reported an impressive 19% of the time. Annually, Deadhorse experiences sub-VFR conditions 52% of the time (68% in May), and IFR conditions 30% of the time (45% in May).



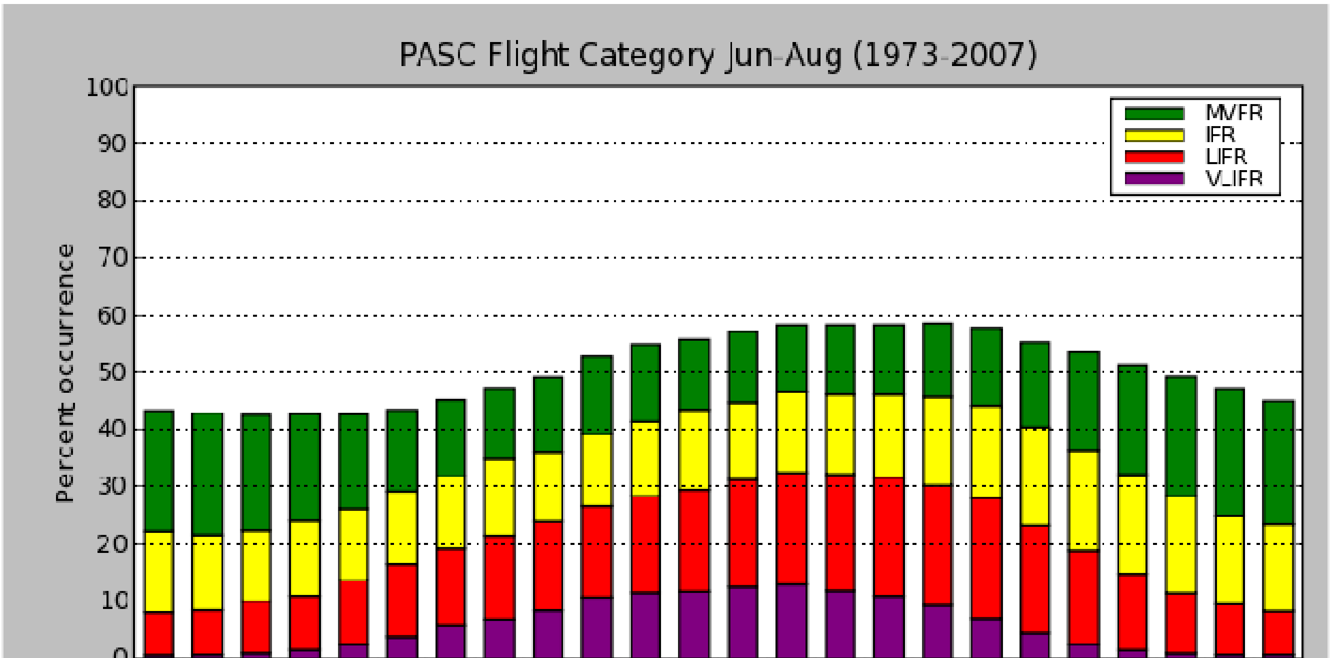
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	22	20	19	23	23	14	13	21	27	37	25	24	22
IFR	13	12	11	12	25	17	11	14	16	18	12	12	15
LIFR	7	7	5	6	14	15	12	16	15	7	7	6	10
VLIFR	4	4	3	4	6	5	6	7	7	3	3	3	5

Relevant Climate Conditions

Climatologically, the Deadhorse/Prudhoe Bay area experiences very similar conditions to Barrow. The highest monthly mean relative humidity occurs between May and October, while the lowest monthly mean relative humidity occurs in late winter. In this respect, relative humidity is fairly well-correlated with IFR frequency. The dramatic increase in IFR reports between April and May is possibly due to the existence of either a shallow surface inversion or inversion layers aloft. As surface heating increases toward late spring, the typically deep wintertime surface inversion becomes gradually thinner, and may even disappear while leaving an inversion layer aloft. Local industrial and aviation activity causes substantial anthropogenic pollution, and under a very stable atmosphere, these pollutants (and other aerosols) cannot be vertically mixed out of the boundary layer. Given these conditions, calms winds associated with arctic highs further inhibit vertical mixing by generating strong subsidence inversions. A comparison of wind direction and IFR indicates that almost any wind lacking a southerly component is conducive to visual flight obstructions. For Deadhorse, the prevailing wind (ENE) is also most favorable for IFR conditions. Under ENE flow, IFR occurs 41% of the time, and sub-VFR 61% of the time (see first graph below). As in the case of Barrow, southerly winds advect drier continental air over, which helps disperse the marine stratiform layer. Onshore flow can transport sea smoke (particles and crystals from sea ice), marine aerosols, and very cold (somewhat moist) air over the Arctic Coast. In winter, sea smoke and aerosols can act as condensation nuclei, and lead to the formation of ice fog. As the sea ice thaws in summer and releases some moisture, onshore flow will bring cold, maritime air inland. In addition, greater radiational cooling over land (especially in late summer as the sun approaches the horizon again) may generate a weak land breeze circulation. This process transports cold maritime air (aloft) onshore, which becomes trapped at low levels due to very stable conditions. This marine stratus layer (and often fog) will remain over the Arctic Coast until surface heating can either stimulate vertical mixing or push the marine layer offshore via a sea breeze. During the July-August period, IFR frequency increases by 25% between late afternoon and morning (see second graph below).



	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	25	27	27	20	15	13	14	13	13	15	18	25	34	36	32	30	24	21
IFR	16	15	19	21	15	9	6	5	4	4	7	11	15	17	17	18	11	10
LIFR	11	11	11	15	13	8	5	4	3	2	3	5	7	8	10	12	6	10
VLIFR	3	3	3	5	9	6	4	2	2	1	1	3	3	3	3	3	6	7
HOURS	4013	6229	18237	58989	23798	8612	3180	3113	2733	6061	19912	42063	13405	7715	4708	5379	347	9880

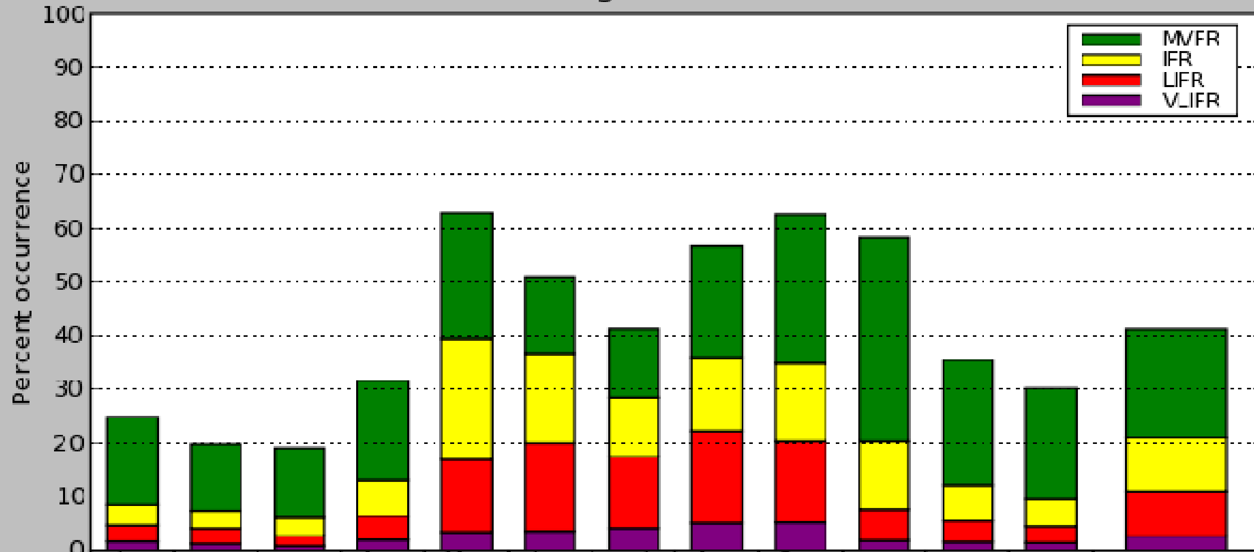


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MVFR	21	21	20	19	16	14	13	12	13	14	14	12	12	12	12	12	13	14	15	17	19	21	22	22
IFR	14	13	12	13	13	13	13	13	12	13	13	14	13	14	14	14	15	16	17	18	17	17	16	15
LIFR	7	8	9	9	11	13	14	15	16	16	17	18	19	20	20	21	21	21	19	16	13	10	9	8
VLIFR	1	1	1	2	2	4	6	7	8	11	11	12	12	13	12	11	9	7	4	3	1	1	1	1

Low Visibility vs. Low Ceiling

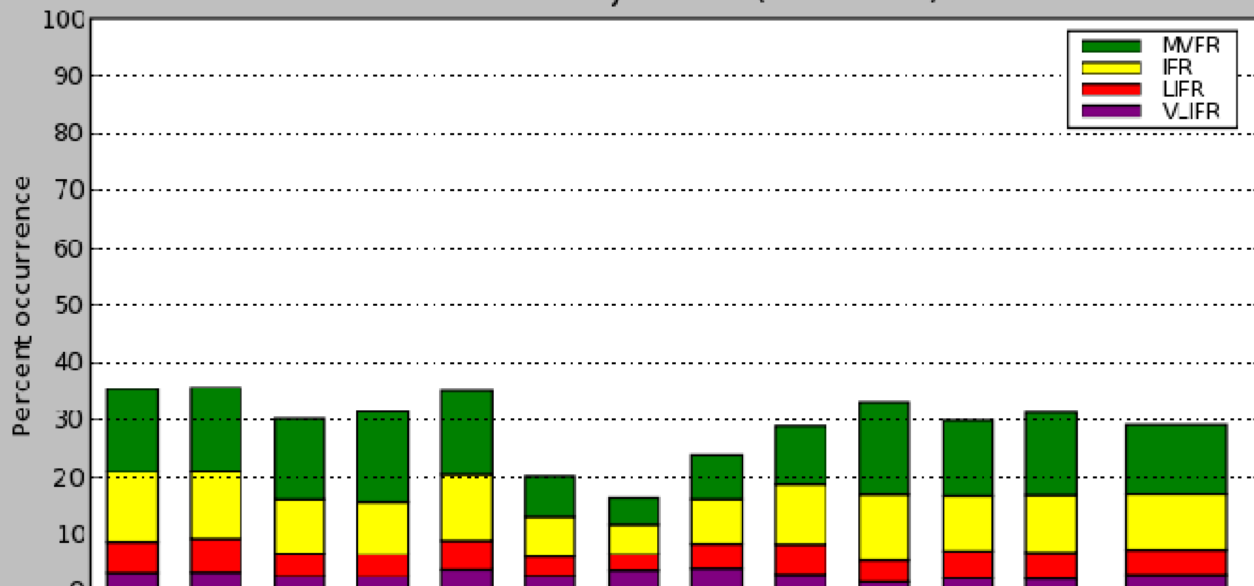
Overall, a majority of visual flight obstructions are caused by low ceiling. The discrepancy is largest in late spring and summer, when Deadhorse is subject to higher relative humidity, onshore flow, and land breeze circulations. On the contrary, low visibility dominates over low ceiling during winter. Very deep inversions, combined with decreased relative humidity, discourage the formation of low-level clouds. Most IFR reports result from snow, blowing snow, or ice fog. Annually, low ceiling causes sub-VFR conditions 41% of the time, whereas low visibility causes sub-VFR conditions 29% of the time (see graphs below).

PASC Ceiling 01-00Z (1973-2007)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	16	12	13	19	23	14	13	21	28	38	23	21	20
IFR	4	3	3	7	23	17	11	14	15	13	7	5	10
LIFR	3	3	2	4	13	16	13	17	15	6	4	3	8
VLIFR	2	1	1	2	3	4	4	5	5	2	2	1	3

PASC Visibility 01-00Z (1973-2007)

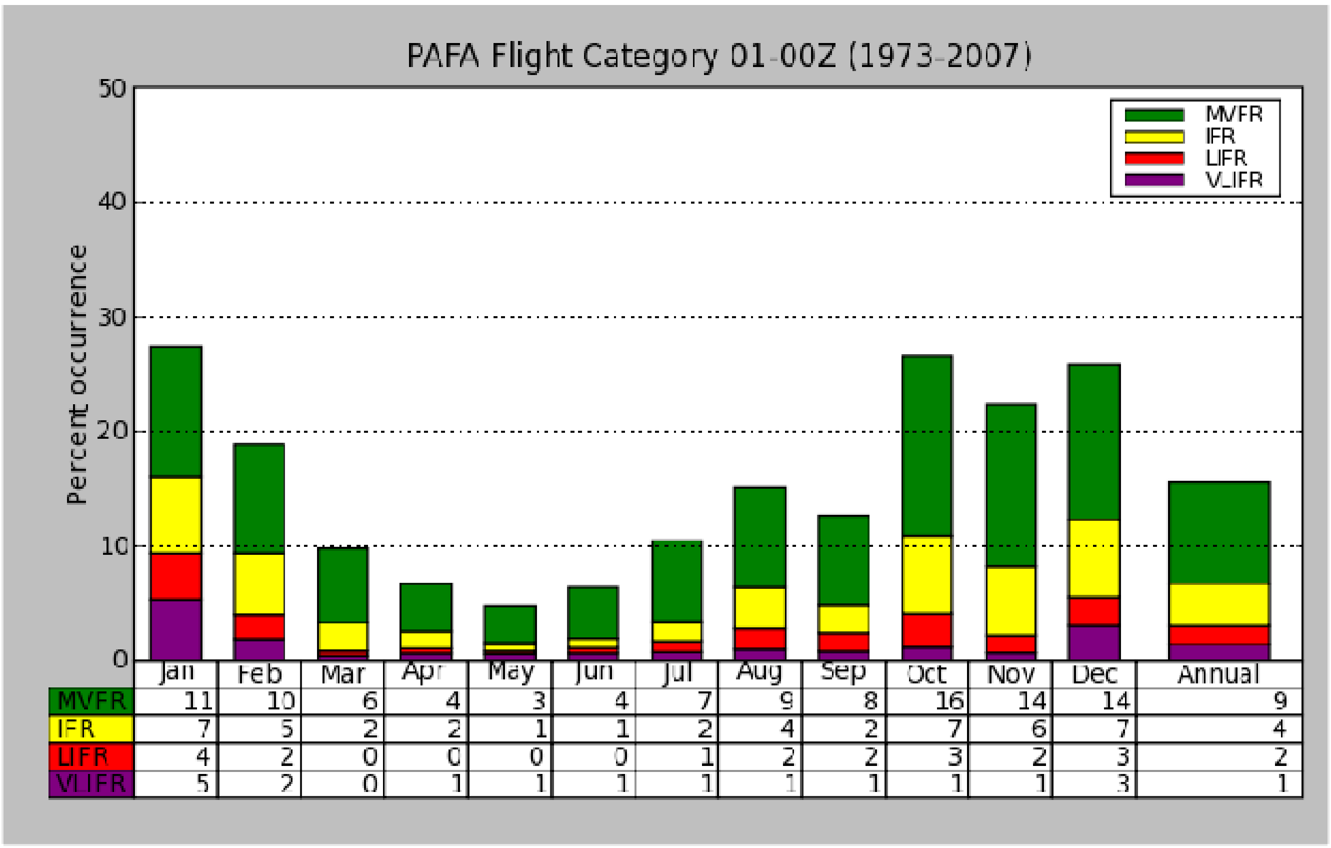


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	14	15	14	16	15	7	5	8	10	16	13	14	12
IFR	12	12	9	9	12	7	5	8	11	11	10	10	10
LIFR	5	6	4	4	5	3	3	4	5	4	5	5	4
VLIFR	3	4	3	3	4	3	4	4	3	2	2	2	3

MVFR/IFR Climatology for Fairbanks, AK

Monthly Variability:

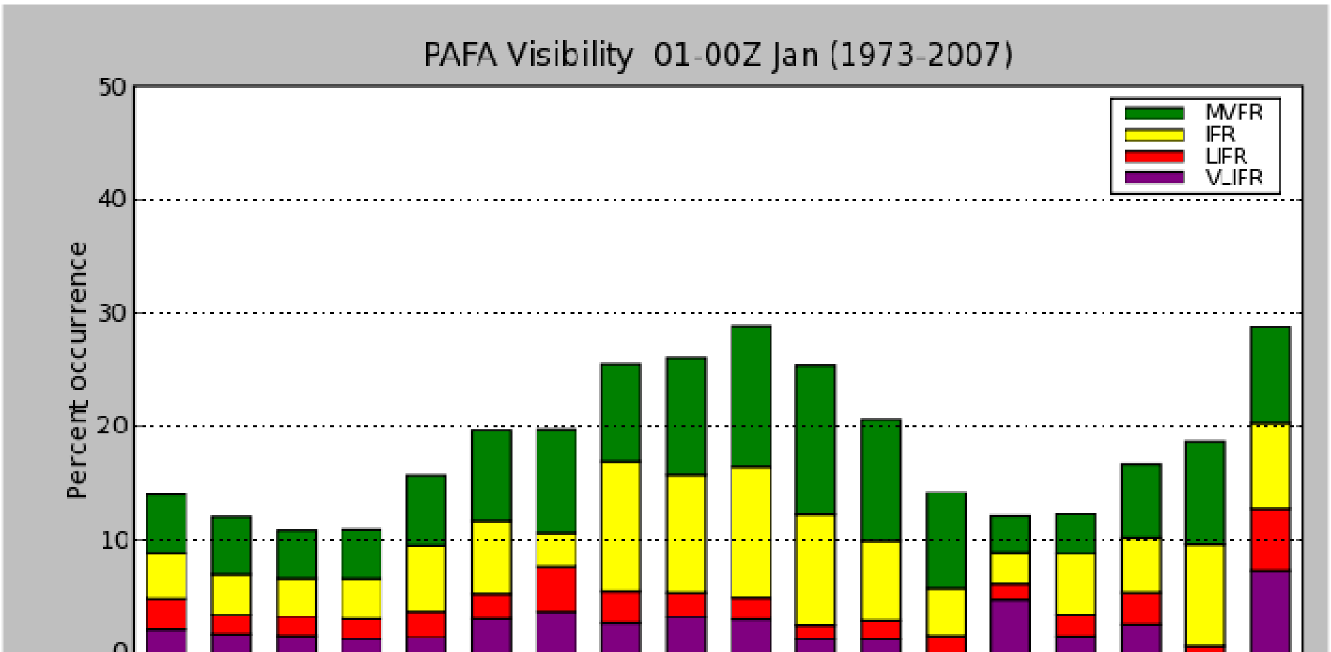
Throughout the 1973-2007 period, IFR was most common between October and February(at least 9% frequency). Like Anchorage, flight conditions drastically improve during the spring season, with IFR reported only 3% of the time between April and June. Overall, Fairbanks experiences sub-VFR conditions 16% of the time (27% in January), and IFR conditions only 7% of the time (16% in January).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	11	10	6	4	3	4	7	9	8	16	14	14	9
IFR	7	5	2	2	1	1	2	4	2	7	6	7	4
LIFR	4	2	0	0	0	0	1	2	2	3	2	3	2
VLIFR	5	2	0	1	1	1	1	1	1	1	1	3	1

Relevant Climate Conditions:

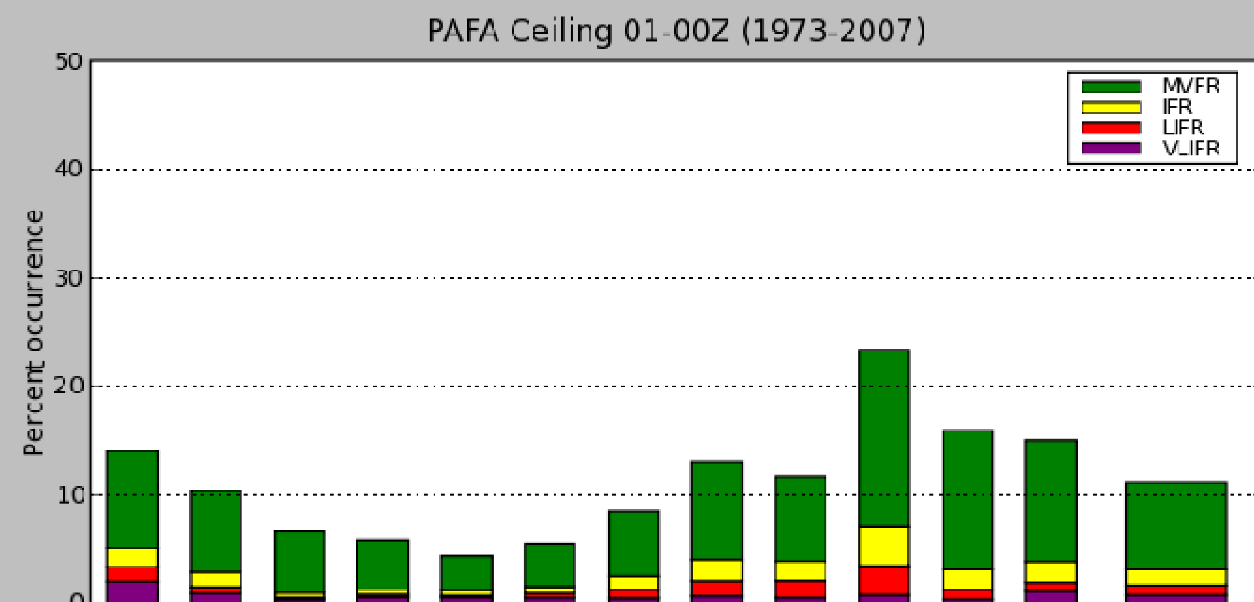
Climatologically, the highest monthly mean relative humidity is coincident with the greatest frequency of IFR observations. Between October and February, mean daytime relative humidity remains above 65% (above 70% November through January). As one might expect, where IFR reports were rare (April-June), mean daytime relative humidity is quite low (less than 45%). The relationship between winds and flight category indicates that IFR is most common under light or calm winds, as well as winds between 145 (SE) and 225 (SW) degrees (see graph below). Calm winds associated with strong low-level inversions during the winter season inhibit vertical mixing. As a result, any low-level clouds, aerosols, or pollutants will remain trapped below the inversion layer, increasing the probability for IFR conditions. If the dewpoint depression is small enough near the surface, low-level clouds will develop and persist, causing IFR due to low cloud ceiling. Aerosols and other pollutants can either create hazy skies or act as condensation nuclei, thus limiting visibility. The combination of extremely frigid air temperatures and a nearly saturated environment may even generate ice fog. As the graph below illustrates, low visibility forces IFR conditions 20% of the time under calm conditions. Winds from the SE, S, or SW occur less frequently during winter, but are possible when arctic fronts and associated surface lows migrate across the interior and bring the possibility of snow and blowing snow. In addition, weak southerly flow can generate adiabatic heating along the north slopes of the Alaska Range. Buoyancy effects will force the adiabatically warmed air to remain above the surface, thus trapping cold, dense air, as well as any low-level moisture. Diurnal frequency of IFR suggests little diurnal variability, except in late summer. Given small amounts of surface moisture (following a rain event), significant radiational cooling under calm, clear skies may generate radiation fog (on rare occasions) if the air temperature reaches the dewpoint.



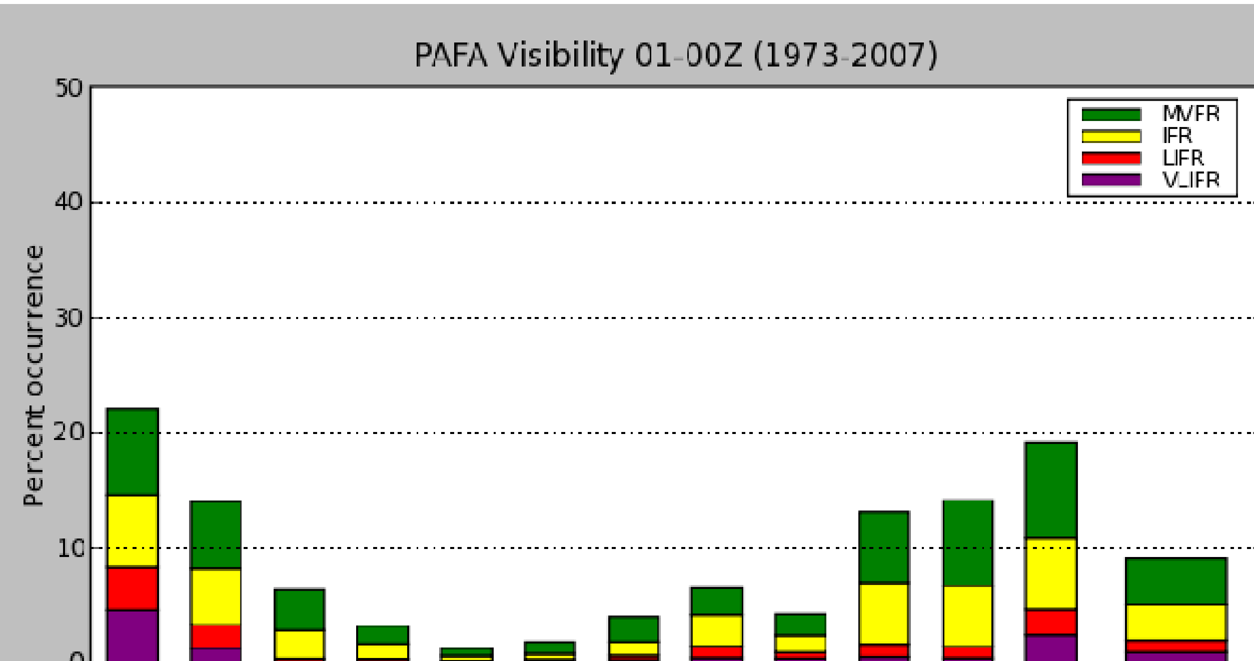
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	5	5	4	4	6	8	9	9	10	12	13	11	8	3	3	7	9	9
IFR	4	4	3	4	6	6	3	11	10	12	10	7	4	3	5	5	9	8
LIFR	3	2	2	2	2	2	4	3	2	2	1	2	2	1	2	3	1	5
VLIFR	2	2	2	1	1	3	4	3	3	3	1	1	0	5	1	2	0	7
HOURS	2495	2477	1817	995	263	211	139	277	584	694	523	565	204	213	289	1434	107	12631

Low Visibility vs. Low Ceiling

In terms of forcing IFR conditions, low visibility is generally preferred over low ceiling, especially during the winter (see graphs below). Since the temperature inversion is typically fairly deep, IFR due to low cloud ceiling only occurs with a small low-level dewpoint depression. Given the increase in snowfall (over 12” in November and December) and potential for ice fog, visibilities are typically reduced in winter. During the spring and summer, neither low visibility nor low cloud ceiling are common. The inversion disappears, the relative humidity decreases, and precipitation tends to fall in liquid form (convective rainfall in summer).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	9	8	6	5	3	4	6	9	8	16	13	11	8
IFR	2	1	0	1	1	1	1	2	2	4	2	2	1
LIFR	1	1	0	0	0	0	1	1	2	3	1	1	1
VLIFR	2	1	0	1	1	1	0	1	1	1	0	1	1

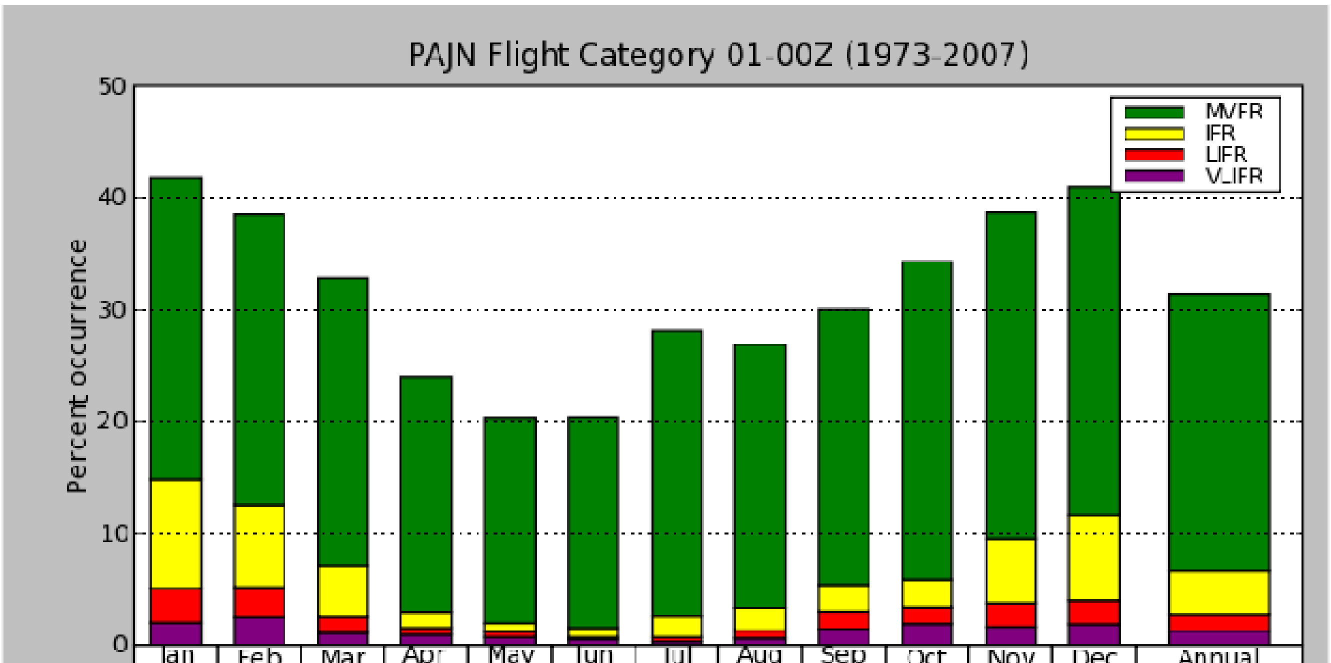


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	7	6	4	2	1	1	2	2	2	6	7	8	4
IFR	6	5	2	1	0	0	1	3	1	5	5	6	3
LIFR	4	2	0	0	0	0	0	1	0	1	1	2	1
VLIFR	5	1	0	0	0	0	0	0	0	1	0	2	1

MVFR/IFR Climatology for Juneau, AK

Monthly Variability

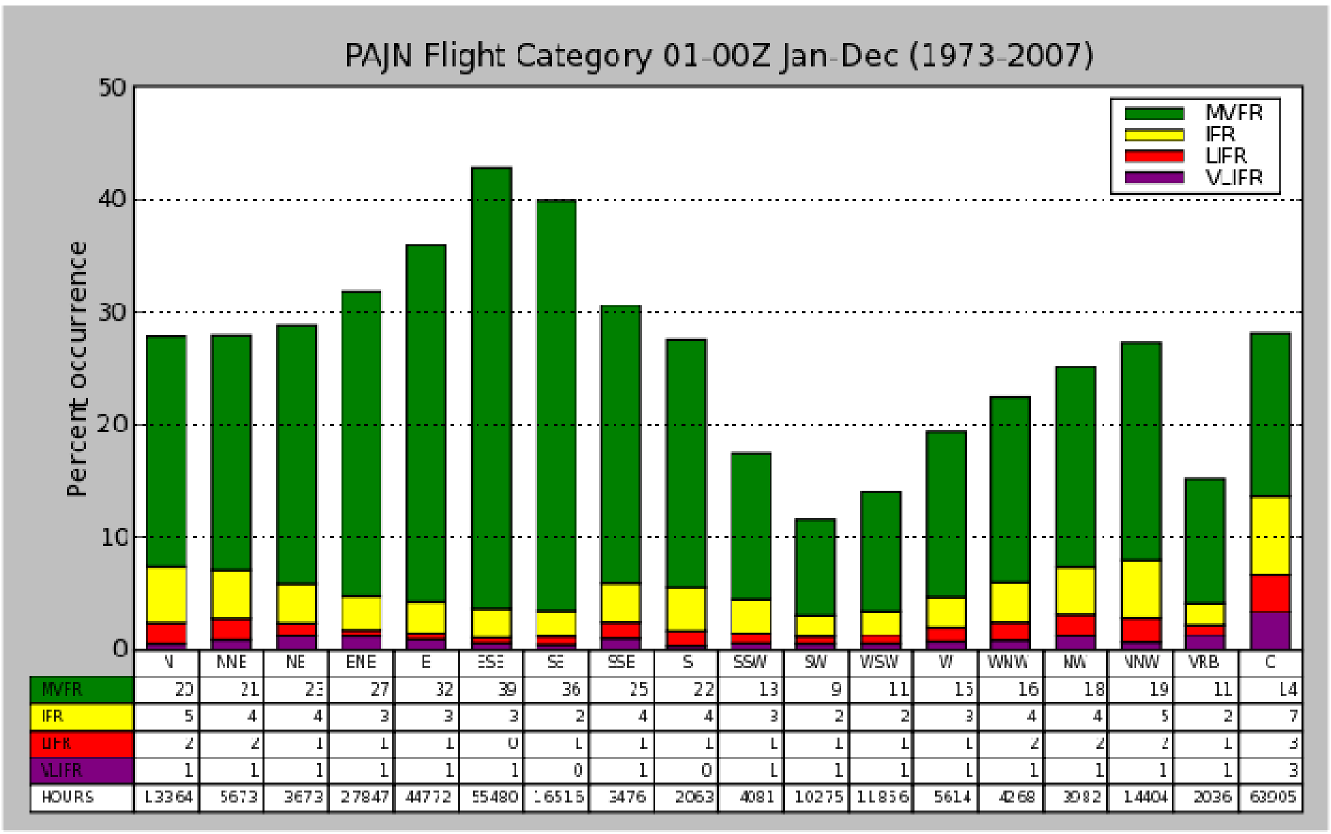
Throughout the 1973-2007 period, IFR was most common between November and February. During these months, IFR occurs with at least 10% frequency. The fewest IFR reports are observed in May and June, with only 2% frequency. Annually, Juneau experiences sub-VFR conditions 31% of the time (42% in January), and IFR only 6% of the time (15% in January). As the graph below suggests, unlike the majority of Alaska stations, Juneau's IFR tendency reveals a nearly normal monthly distribution. In addition, there exists a disproportionate ratio between MVFR frequency and IFR frequency (25% versus 6%).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	27	26	26	21	18	19	26	23	25	28	29	29	25
IFR	10	7	5	1	1	1	2	2	2	2	6	8	4
LIFR	3	3	1	1	0	0	0	1	1	2	2	2	1
VLIFR	2	2	1	1	1	1	0	1	1	2	2	2	1

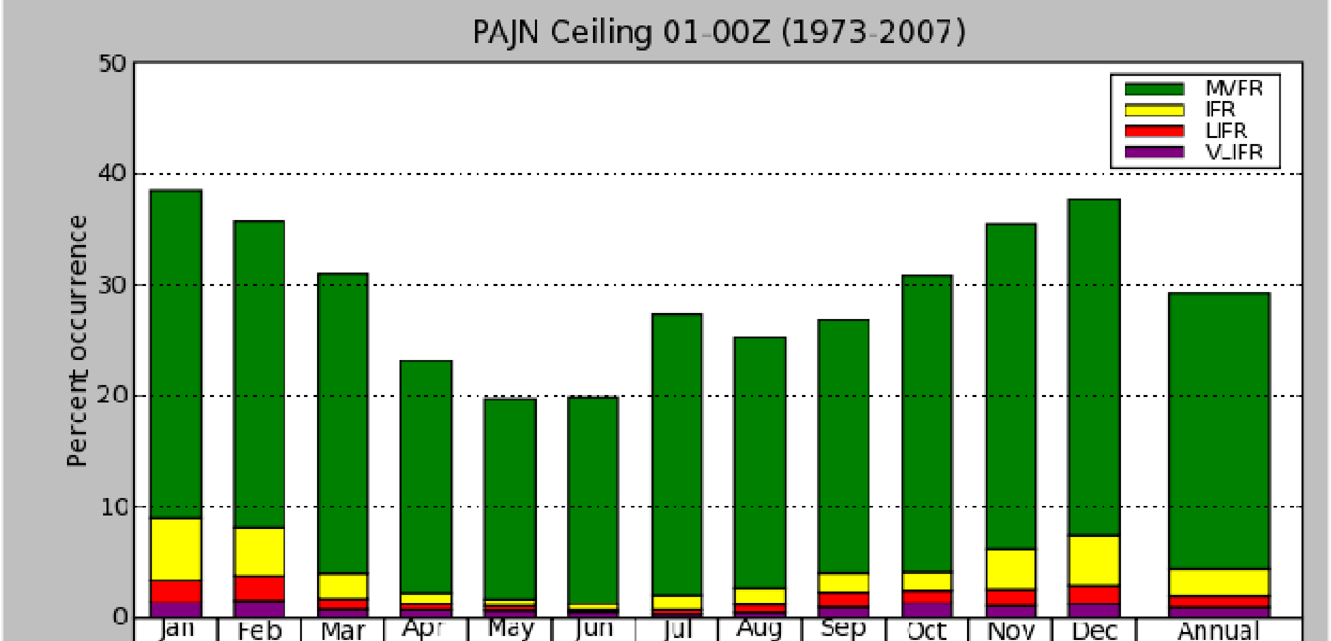
Relevant Climate Conditions

Climatologically, Juneau's highest and lowest monthly mean relative humidity occurs in December (80%) and May (59%), respectively. In this regard, relative humidity and IFR frequency are very well-correlated. Relative humidity near 80% almost guarantees low-level cloud cover and encourages precipitation in more temperate climates. Though monthly precipitation decreases significantly after October, the southern progression of the jet stream allows for a substantial rise in snowfall. During summer and fall, weak synoptic lows track near the southeast coast, giving Juneau steady rainfall, but in winter, these storms often migrate far enough south to support heavy snow events. For instance, average monthly snowfall increases from only 1.1” in October to 21.2” in December, and 26.7” in January. Given Juneau's maritime polar climate (cool and wet), stratiform cloud cover is typical year-round (Juneau experiences 280 cloudy days annually). Despite the frequent presence of stratiform clouds, ceiling rarely reaches IFR criterion (only in the case of fog). Juneau's vicinity to the Pacific helps moderate surface temperatures, thereby inhibiting surface inversions, while the nearby mountains encourage uplift. As the graph below indicates, the relationship between wind direction and flight category is rather complicated. ESE winds cause IFR conditions only 4% of the time, but are climatologically favored, and do generate the highest frequency of sub-VFR conditions (43%) overall. During spring and fall, ESE are often associated with frontal zones (warm fronts) that generate stratiform rainfall and thus support MVFR conditions. In winter, northerly winds can induce IFR conditions if associated with snow on the northern side of a synoptic low. Interestingly enough, IFR and calm winds have the most direct correlation (IFR occurs with 13% frequency). This relationship may be a result of the local topography. Since the city is located in a realtively low-lying area surrounded by mountainous terrain, Juneau is very susceptible to fog under a moist air mass. With higher terrain surrounding the city, calm winds will prevent the dispersion of this moist air, and allow dense fog to form and persist. Juneau experiences little diurnal variation in IFR frequency, except for a slight morning increase during early fall. Given the presence of surface moisture, radiational cooling under generally clear nights can produce radiation fog if the air temperature reaches the dewpoint.

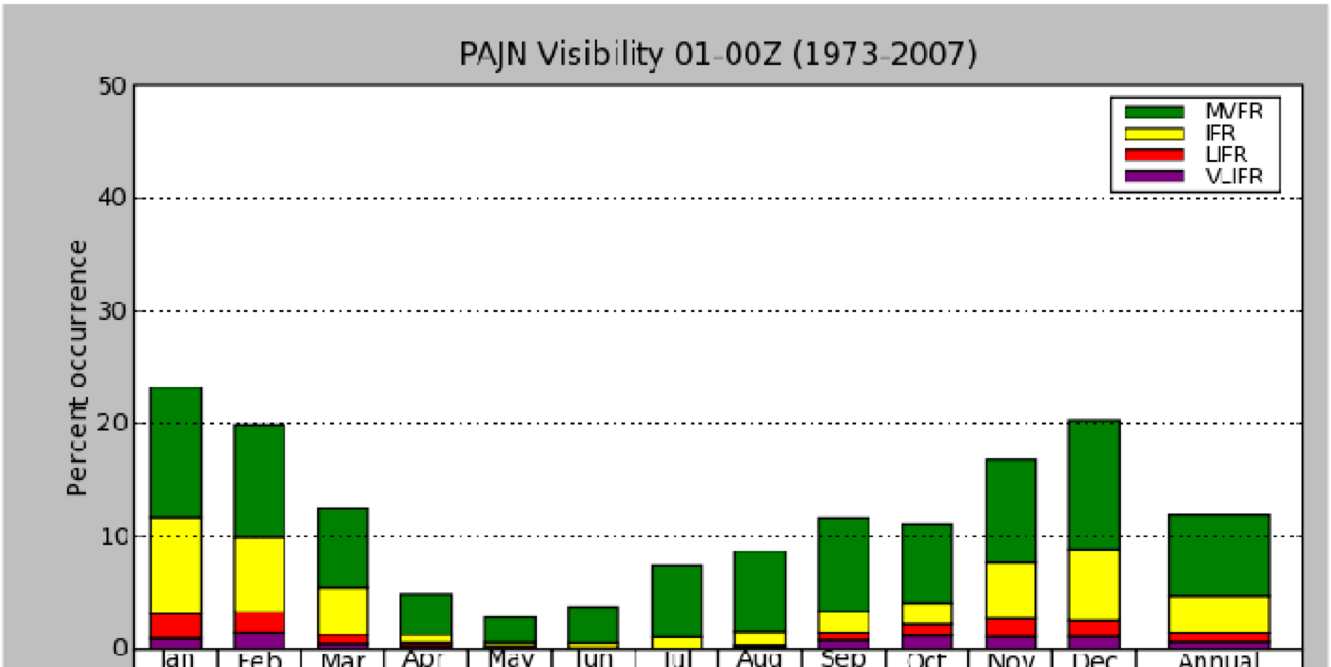


Low Visibility vs. Low Ceiling

In terms of forcing IFR conditions, low ceiling and low visibility rarely act alone. On a yearly basis, low ceiling and low visibility alone cause IFR 4% and 5% of the time, respectively, compared with a 6% overall frequency of IFR (see graphs below). The only preference for either criterion occurs during winter, when snowfall substantially decreases visibility. However, given the large discrepancy in MVFR observations, most visual flight obstructions overall result from cloud ceiling rather than reduced visibility.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	29	28	27	21	18	19	25	23	23	27	29	30	25
IFR	6	4	2	1	1	1	1	1	2	2	4	5	2
LIFR	2	2	1	1	0	0	0	1	1	1	1	2	1
V_IFR	1	2	1	1	1	1	0	0	1	1	1	1	1

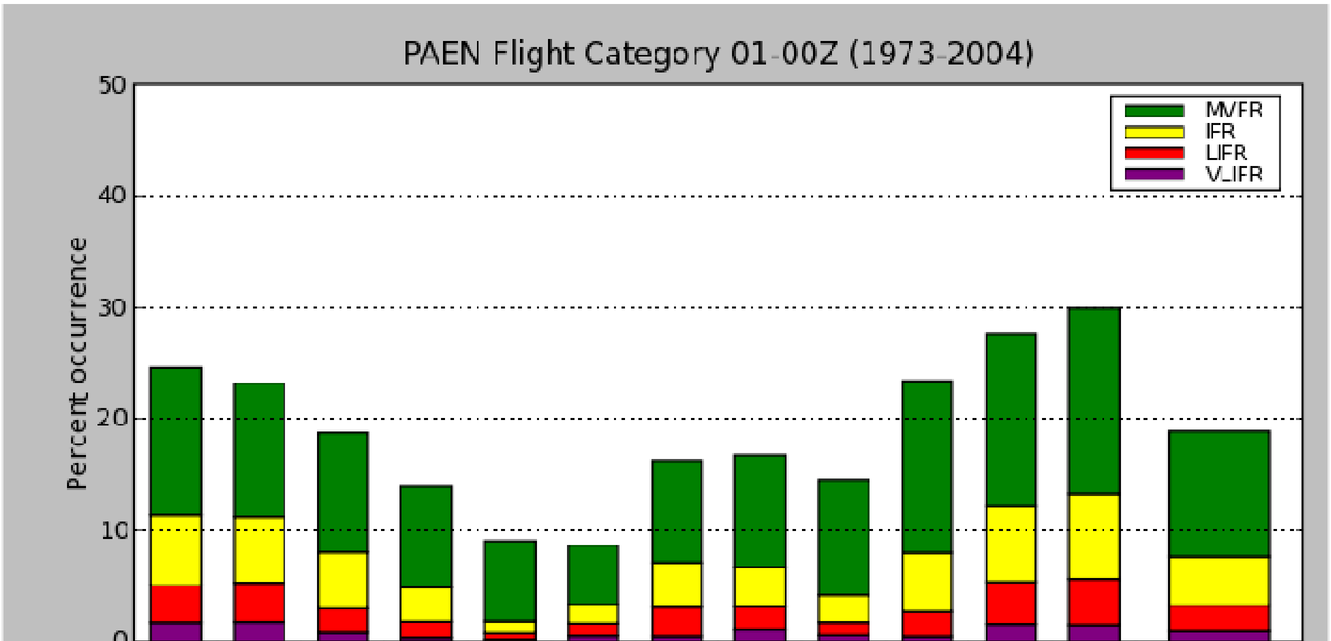


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	12	10	7	3	2	3	6	7	8	7	9	11	7
IFR	9	7	4	1	0	0	1	1	2	2	5	6	3
LIFR	2	2	1	0	0	0	0	0	1	1	2	1	1
V_IFR	1	1	0	0	0	0	0	0	1	1	1	1	1

MVFR/IFR Climatology for Kenai, AK

Monthly Variability

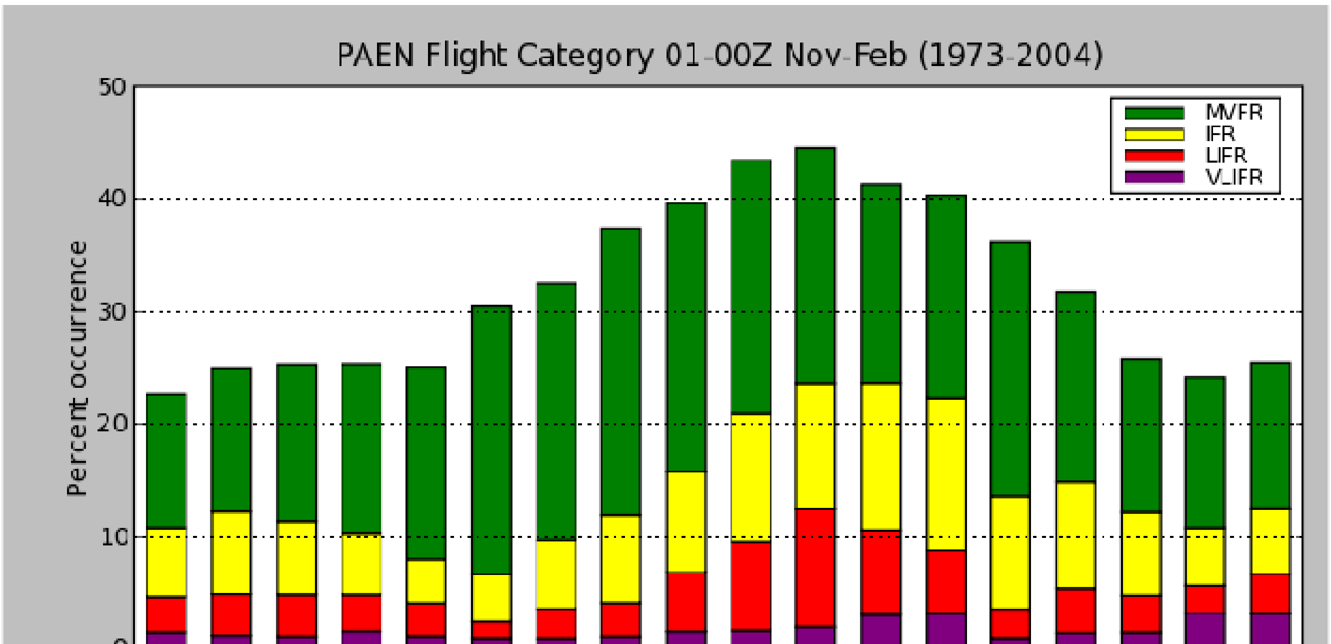
Throughout the 1973-2004 period, IFR was most common between November and February. During these months, IFR conditions occurred with at least 11% frequency. The fewest IFR observations were reported in May (only 2% frequency). Annually, Kenai experiences sub-VFR conditions 18% of the time (31% in December), and IFR conditions 7% of the time (14% in December).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	13	12	11	9	7	5	9	10	10	15	16	17	11
IFR	6	6	5	3	1	2	4	4	2	5	7	8	4
LIFR	3	3	2	1	1	1	3	2	1	2	4	4	2
VLIFR	2	2	1	0	0	1	0	1	1	0	2	2	1

Relevant Climate Conditions

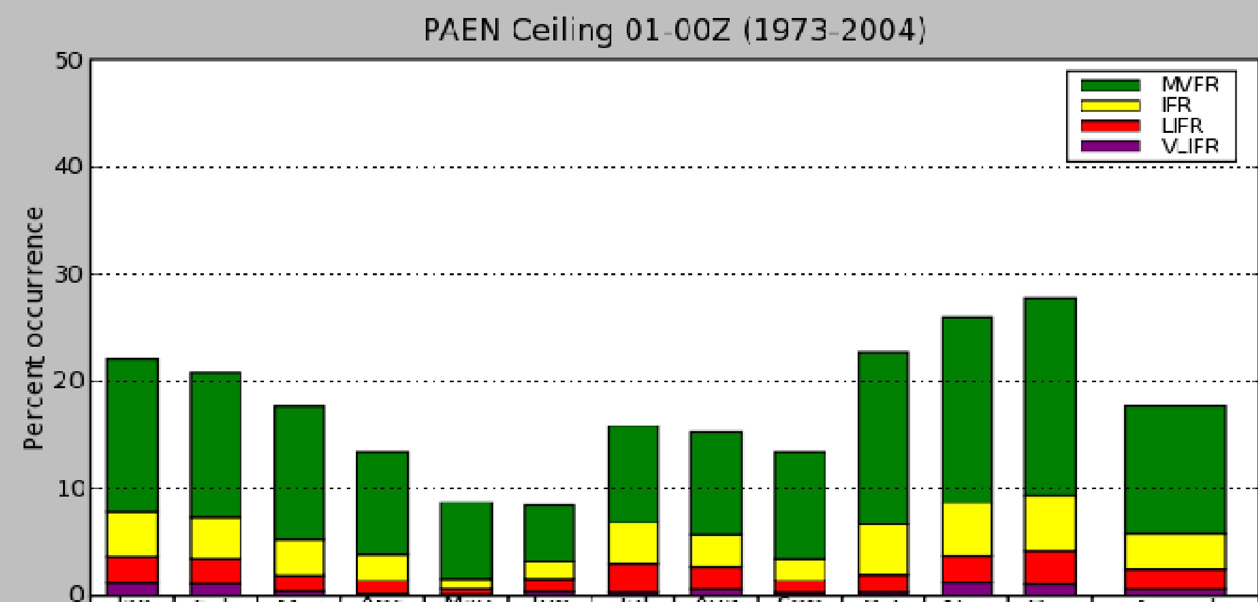
Climatologically, the highest monthly mean relative humidity occurs between January and February, coincident with the greatest IFR frequency. Likewise, the lowest relative humidity is observed in May, the month with the fewest IFR reports. Though liquid equivalent precipitation declines toward winter, Kenai experiences a significant increase in snowfall (over 9" each month between November and February). A comparison of wind direction and IFR reveals that calm winds, NNE winds, and and southwesterly winds favor IFR conditions. NNE winds are common due to the typical track of synoptic lows (Gulf of Alaska), and can be associated with wind-driven snow on the northwest quadrant of these cyclones. Though climatologically less frequent, southwesterly winds generally cause the worst flight conditions, particularly during the winter and summer seasons. Between November and February, IFR occurs 23% of the time when southwest winds are prevailing (see graph below). Southwesterly flow in winter advects relatively warm, moist air from the Gulf of Alaska and Cook Inlet (maintaining a constant moisture source), and can enhance vertical motion and latent heat release. In summer, southwest winds support onshore flow of relatively cool, maritime air. If the lower atmosphere is stable, the colder marine air will be trapped below the warmer air over land, allowing for stratiform cloud cover to develop. This process may be enhanced by an overnight land breeze, by which thermal and pressure differences drive land-based air (at the surface) offshore and marine air (above the surface) onshore. In fact, the diurnal variation in IFR reveals a slight increase during the morning hours. Moreover, in the presence of a low-level inversion, moist onshore flow may help produce fog or even freezing fog with sub-freezing surface temperatures. Calm winds are also conducive to IFR conditions, particularly during winter. The combination of calm conditions and low-level inversions prevents vertical and horizontal mixing of aerosols and clouds. Easterly flow often suppresses IFR due to downslope heating and drying of air on the lee side of the Kenai mountains.



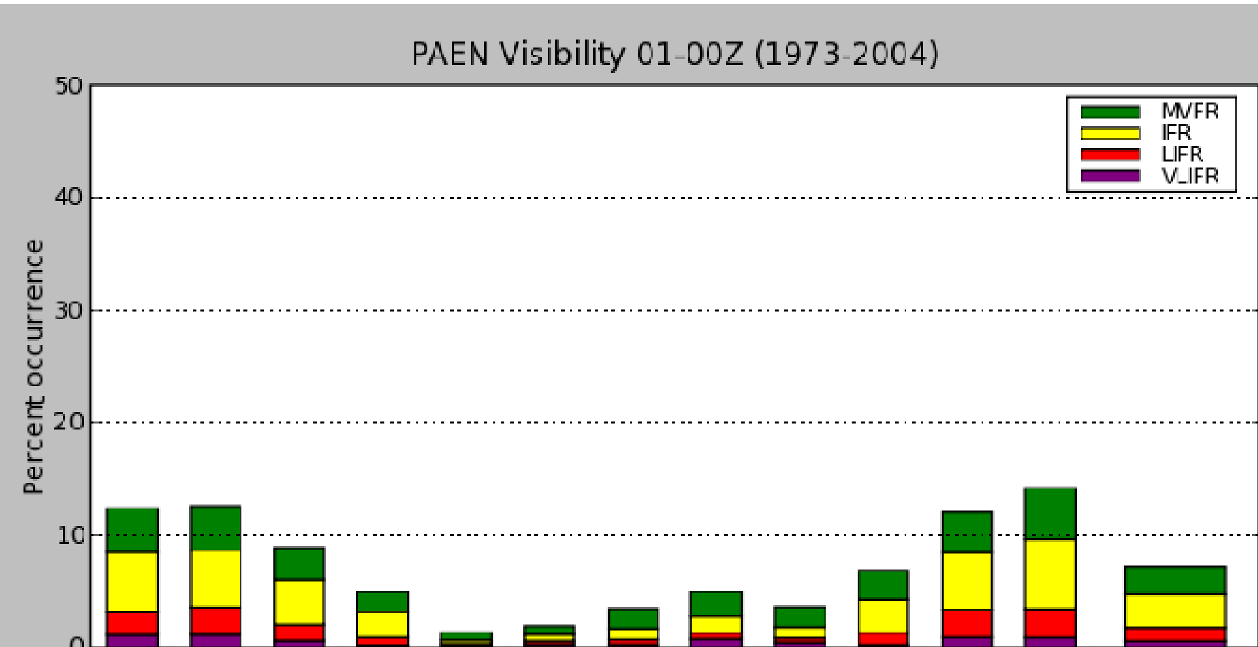
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	12	13	14	15	17	24	23	25	24	23	21	18	13	23	17	14	13	13
IFR	6	7	7	5	4	4	6	8	9	11	11	13	13	10	9	7	5	6
LIFR	3	4	4	3	3	2	3	3	5	3	10	8	6	3	4	3	2	4
VLIFR	2	1	1	2	1	1	1	1	2	2	2	3	3	1	2	2	3	3
HOURS	7140	20688	19402	6197	1345	936	998	2311	2103	1211	575	352	180	286	461	2677	711	18230

Low Visibility vs. Low Ceiling

In general, neither low visibility nor low ceiling are particularly common for forcing IFR, but low ceiling causes a noticeably higher percentage of MVFR conditions. Annually, low ceiling forces sub-VFR conditions 18%, whereas low visibility forces sub-VFR conditions only 8% of the time (see graphs below). Both low visibility and low ceiling occur more frequently in winter than in summer, due to higher relative humidity, snowfall, and temperature inversions.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	14	13	12	10	7	5	9	10	10	16	17	18	12
IFR	4	4	3	2	1	2	4	3	2	5	5	5	3
LIFR	3	2	1	1	0	1	3	2	1	2	3	3	2
VLIFR	1	1	0	0	0	0	0	1	0	0	1	1	1

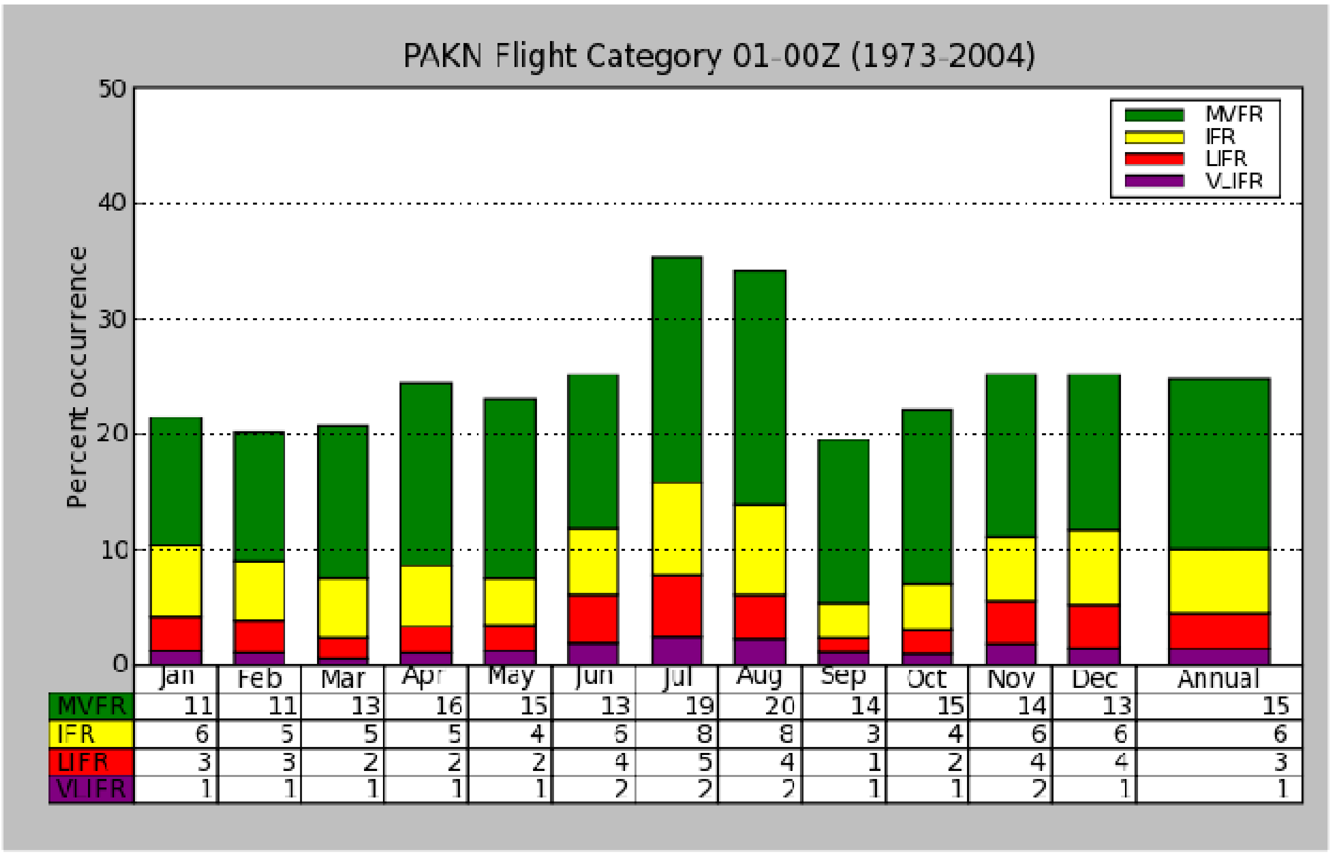


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	4	4	3	2	1	1	2	2	2	3	4	5	3
IFR	5	5	4	2	0	1	1	1	1	3	5	6	3
LIFR	2	2	1	1	0	0	0	1	0	1	2	3	1
VLIFR	1	1	1	0	0	0	0	1	0	0	1	1	1

MVFR/IFR Climatology for King Salmon, AK

Monthly Variation

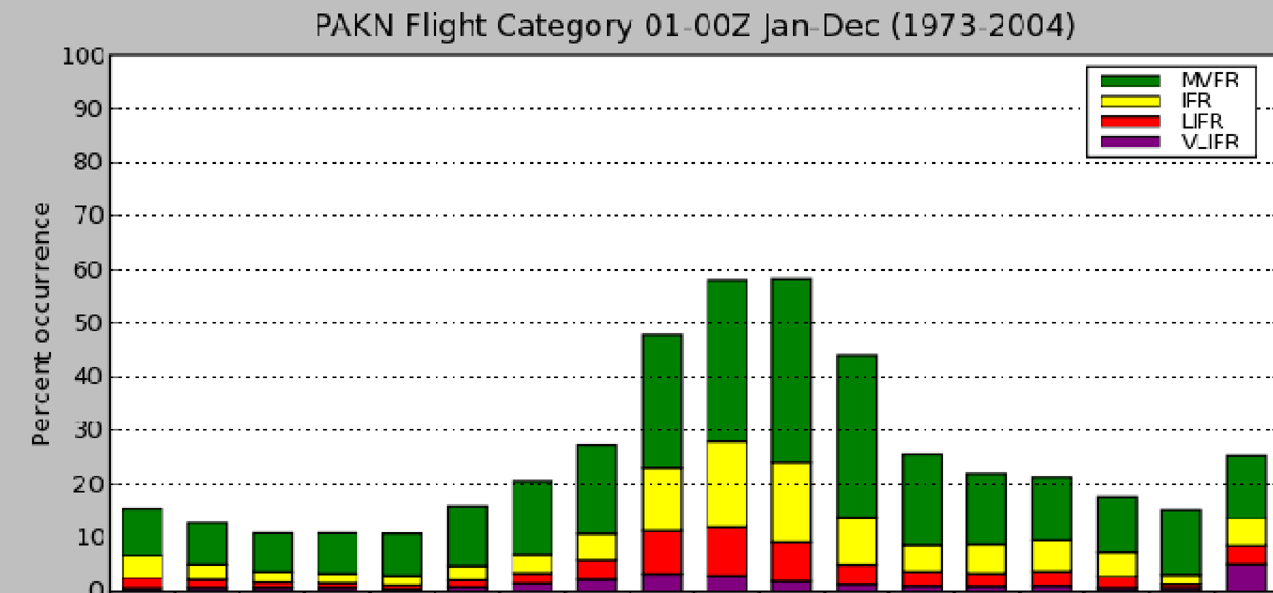
Throughout the 1973-2004 period, IFR was most common during July and August (at least 14% frequency). Although the fewest IFR reports were observed in September (only 5% frequency), the graph below illustrates a slight increase in late fall and early winter. Annually, King Salmon experiences sub-VFR conditions 25% of the time (34% in July), and IFR conditions 10% of the time (15% in July).



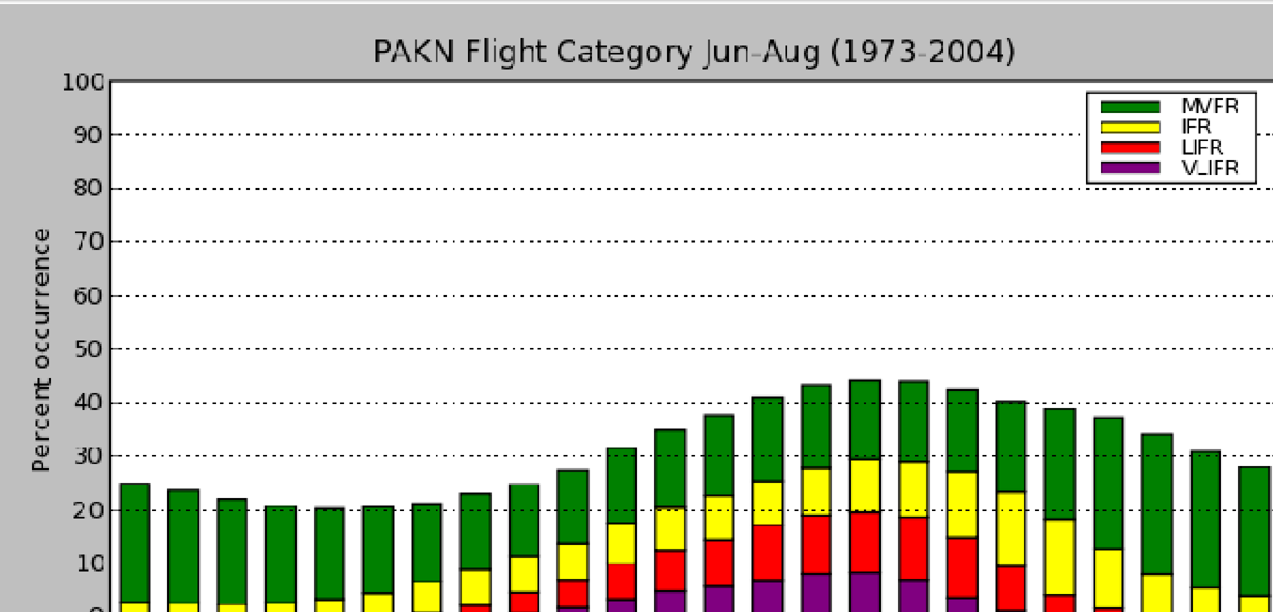
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	11	11	13	16	15	13	19	20	14	15	14	13	15
IFR	6	5	5	5	4	6	8	8	3	4	6	6	6
LIFR	3	3	2	2	2	4	5	4	1	2	4	4	3
VLIFR	1	1	1	1	1	2	2	2	1	1	2	1	1

Relevant Climate Conditions

Climatologically, the highest monthly mean relative humidity occurs between November and January, and is not coincident with greatest IFR frequency. However, mean relative humidity greater than 75% does account for an increase in IFR observations during late fall. In addition, the lowest monthly relative humidity (55% in May) is not concurrent with the smallest IFR frequency. While relative humidity and IFR frequency are not-well correlated, King Salmon does record its maximum number of cloudy days (25) in July and August. The slight rise in IFR during late fall may also be supported by an increase in average snowfall (over 8" in December and January). An examination of wind direction reveals that IFR conditions most commonly arise with S, SSW, and SW winds. Under these wind regimes, IFR occurs at least 23% of the time (see first graph below). South-to-southwest flow draws moisture from Bristol Bay (onshore flow), and can be associated with nearby synoptic lows, which bring inclement weather to southwestern Alaska. IFR frequency under SSW winds is most pronounced during the summer, especially in the morning hours. Greater overnight radiational cooling over land can generate a shallow land breeze effect, which brings cool, maritime air (aloft) inland, and creates a marine stratus layer under stable conditions. These stratiform clouds remain trapped in the lower troposphere until surface heating can either support vertical mixing (remove inversions or decrease stability) or produce a sea breeze (which pushes the marine layer back offshore). Over the July-Aug period, IFR frequency escalates from only 2% in the afternoon to nearly 30% by mid-morning (see second graph below). Easterly and northeasterly winds promote the best flying weather. These winds advect dry continental air and cause downslope effects (adiabatic heating) as air flows from the higher terrain east and northeast of the city.



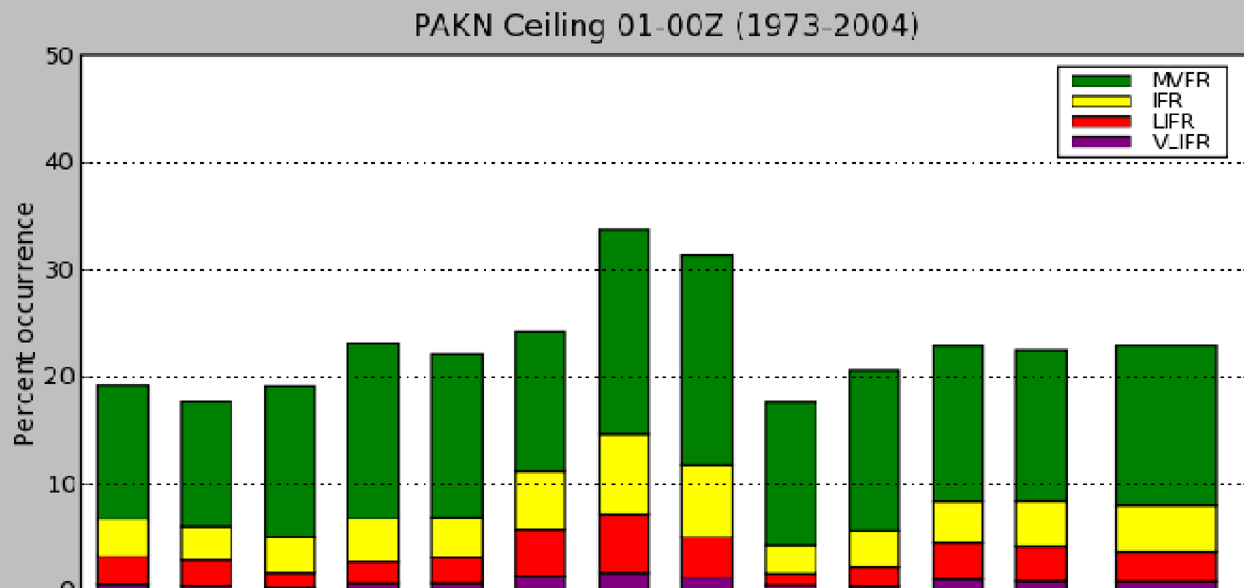
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	9	8	7	8	8	11	13	16	25	30	34	30	17	13	12	10	12	12
IFR	4	3	2	2	2	3	4	5	12	16	15	9	5	5	6	5	2	5
LIFR	2	2	1	1	1	1	2	4	8	9	7	4	3	2	3	2	1	3
VLIFR	1	1	1	1	0	1	1	2	3	3	2	1	1	1	1	1	1	5
HOURS	28515	16156	11973	18557	25133	13393	13383	28844	15124	14720	12550	15134	7996	7186	7431	25544	1787	13457



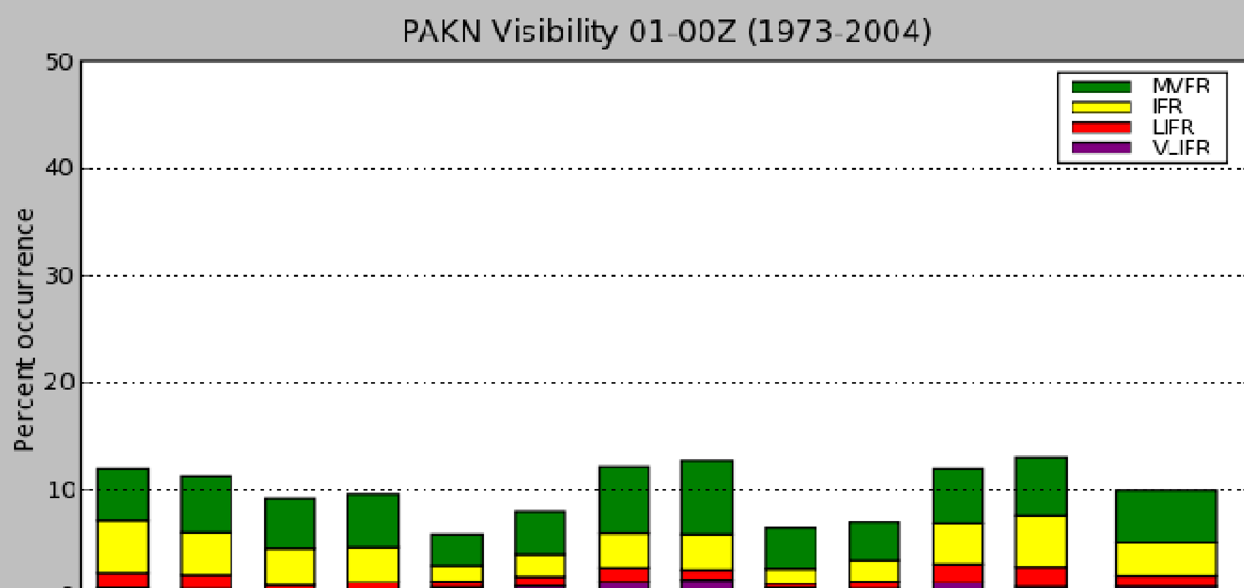
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MVFR	22	21	20	18	17	16	15	14	13	13	14	14	15	16	16	15	15	15	17	21	25	26	25	24
IFR	3	2	2	3	3	4	6	7	7	7	8	8	8	8	9	10	10	12	14	14	11	7	5	4
LIFR	0	0	0	0	0	0	1	2	4	5	7	8	9	10	11	11	12	11	8	4	2	1	0	0
VLIFR	0	0	0	0	0	0	0	0	1	2	3	5	6	7	8	8	7	4	1	0	0	0	0	0

Low Visibility vs. Low Ceiling

Overall, visual flight obstructions are predominately caused by low ceiling in King Salmon. The discrepancy in IFR forcing is largest during summer, due to strong onshore flow (marine stratus clouds), but nonexistent in winter, as snowfall reduces visibility and the land-breeze circulation disappears. Annually, low ceiling forces sub-VFR conditions 23% of the time, whereas low visibility forces sub-VFR only 10% of the time (see graphs below).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	12	12	14	16	15	13	19	20	13	15	15	14	15
IFR	4	3	3	4	4	5	7	7	3	3	4	4	4
LIFR	3	2	1	2	2	4	5	4	1	2	3	3	3
VLIFR	1	1	0	1	1	1	2	1	1	0	1	1	1

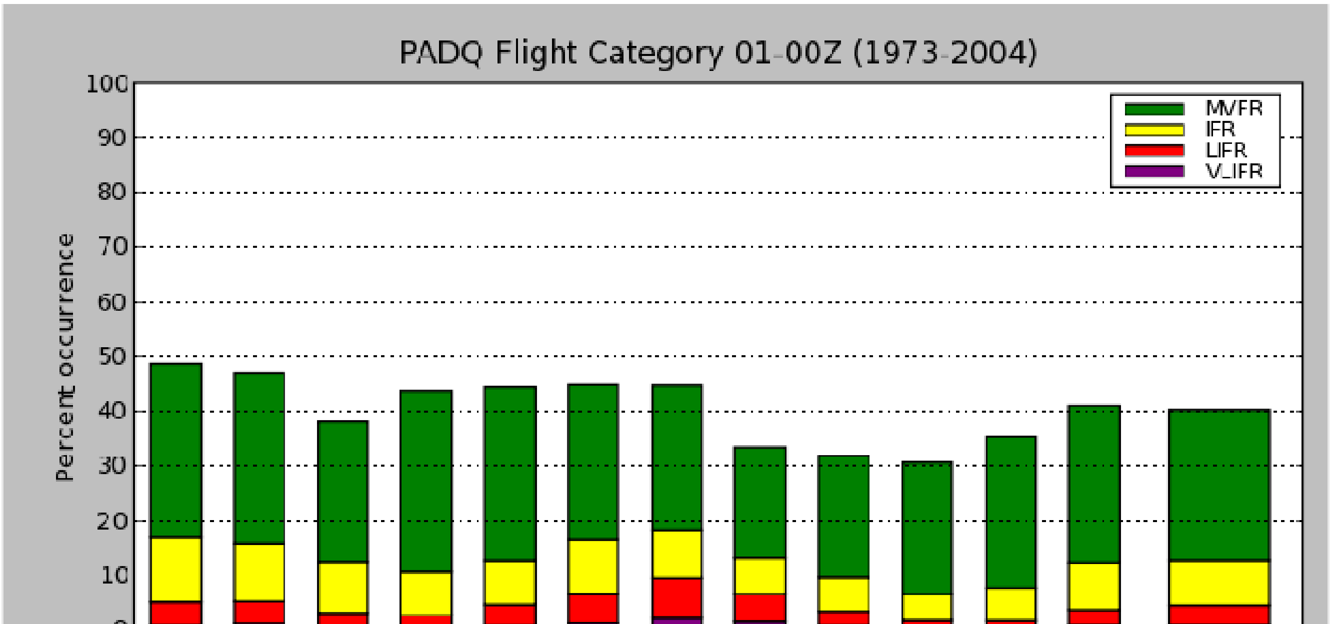


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	5	5	5	5	3	4	6	7	4	4	5	5	5
IFR	5	4	3	3	1	2	3	3	1	2	4	5	3
LIFR	1	1	1	1	1	1	1	1	0	1	2	2	1
VLIFR	1	1	0	1	1	1	1	2	1	1	1	1	1

MVFR/IFR Climatology for Kodiak, AK

Monthly Variability

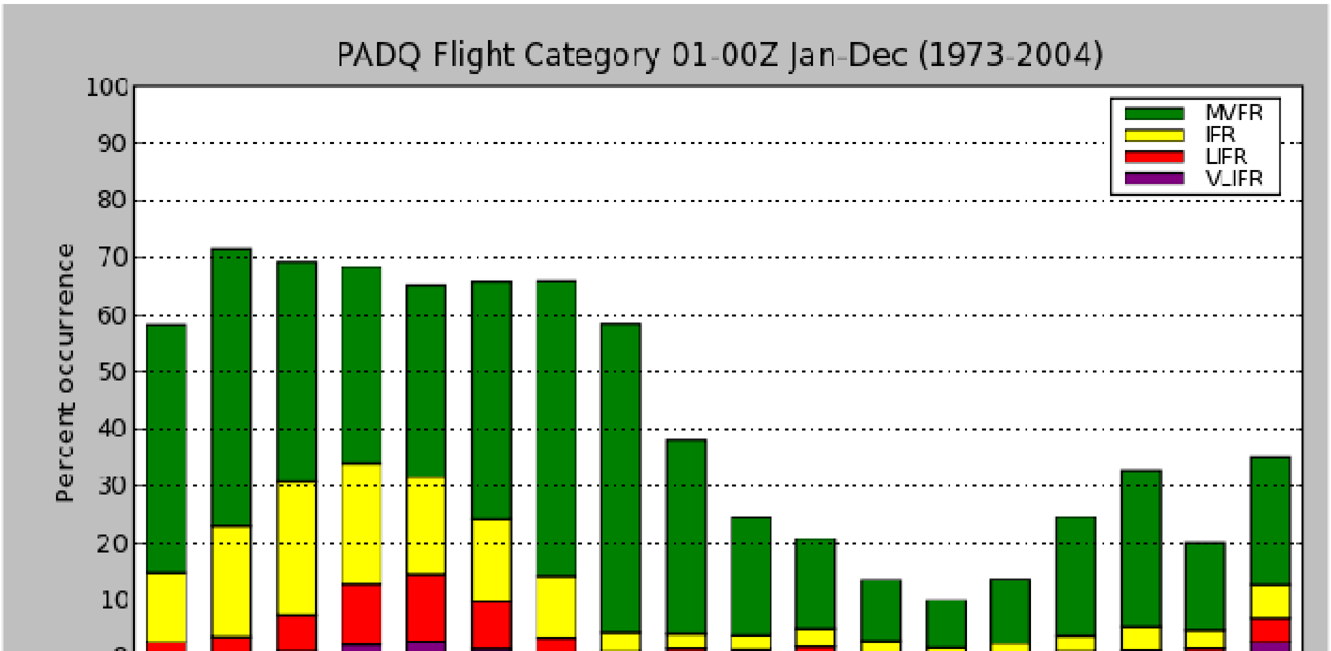
Throughout the 1973-2004 period, IFR conditions exhibit a bimodal monthly trend. IFR is most common in January and July (at least 17% frequency), with gradual decreases in between both months. The smallest frequency of IFR reports occurs during October (only 7%). Annually, Kodiak experiences sub-VFR 28% of the time (49% in January), and IFR 13% of the time (18% in July).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	32	31	26	33	32	28	26	20	22	24	28	29	28
IFR	12	11	9	8	8	10	9	7	6	5	6	9	8
LIFR	4	4	3	2	4	5	7	5	3	2	1	3	4
VLIFR	1	1	1	1	1	1	2	2	1	0	0	1	1

Relevant Climate Conditions

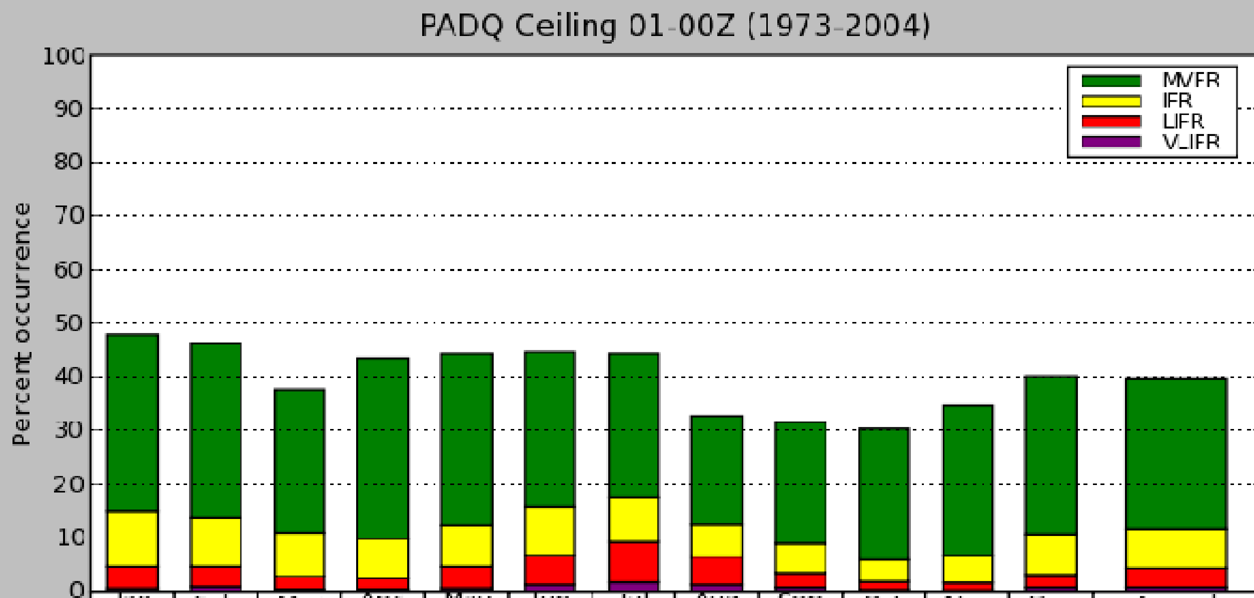
Climatologically, the mean monthly relative humidity reveals a similar bimodal distribution. The maximum values occur in January (75%) and July (77%), coincident with the greatest IFR frequency. In addition, the lowest monthly relative humidity occurs in early spring and fall (68% in March, April, and October), which corresponds to the simultaneous decline in IFR reports. The increase in IFR observations during December and January is most likely influenced by the general storm track of synoptic lows. These systems typically pass to the south and east and can bring significant wind-driven snow, and thus drastically reduce visibilities. Though precipitation decreases toward summer, relative humidity remains fairly high, suggesting substantial low-level cloud cover. In fact, July records the greatest number of cloud days, with 22 on average. A summertime morning stratus layer becomes likely due a shallow overnight land breeze. Greater radiational cooling over land will cause cool, maritime air to move inland (aloft), bringing the marine stratus layer with it. If the lower atmosphere is very stable, these stratiform clouds will remain until surface heating can generate vertical mixing (reduce the low-level stability) or induce a daytime sea breeze (force the marine layer back offshore). More importantly, the predominant early summer winds are from the ENE, which supports a persistent onshore flow. As the graph below illustrates, IFR occurs most commonly with NE, ENE, and E winds (at least 30% of the time). Calm winds in the presence of surface or subsidence inversions also encourage IFR conditions by inhibiting vertical and horizontal mixing, and even allowing fog to persist (given enough moisture near the surface). On the contrary, westerly winds substantially inhibit IFR conditions since they generate downslope flow, and may even be associated with an anomalously high-latitude subtropical high.



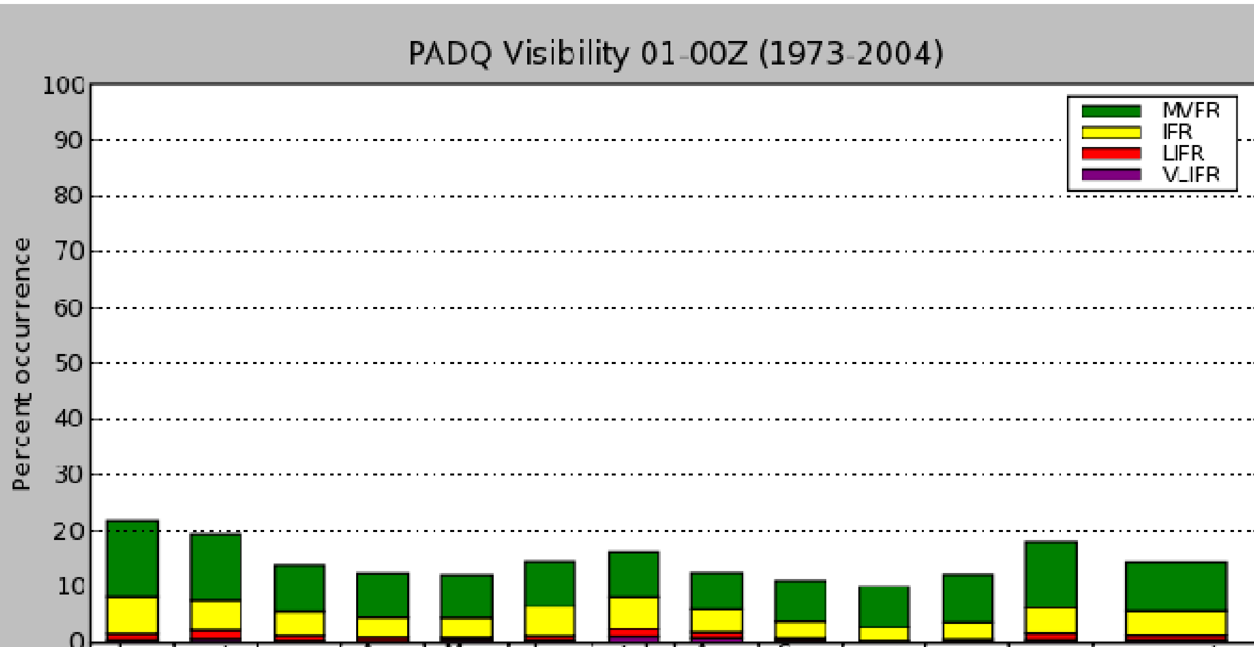
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	43	48	39	34	34	42	52	54	34	20	16	11	3	11	21	27	15	22
IFR	12	19	23	21	17	14	11	3	3	3	3	2	1	2	3	4	3	6
LIFR	2	3	6	10	12	8	3	1	1	1	1	1	0	1	1	1	1	4
VLIFR	0	0	1	2	3	2	1	0	0	0	1	0	0	0	0	0	1	3
HOURS	3483	5578	12776	27059	17337	20397	13563	13818	5510	7631	7523	10056	16060	37877	42986	15409	1647	11627

Low Visibility vs. Low Ceiling

Overall, IFR conditions in Kodiak are generated more frequently with low ceiling than low visibility. Annually, low cloud ceiling accounts for 40% of sub-VFR and 12% of IFR conditions, whereas low visibility causes only 14% of sub-VFR and 5% of IFR conditions (see graphs below). Low ceiling tends to be favored year-round given the fact that mean monthly relative humidity never drops below 70%. The greatest discrepancy in IFR occurs in June and July, strong onshore flow favors low-level cloud cover rather than reduced visibility. Visibility becomes more important during January, where Kodiak is susceptible to heavy, wind-driven snow events.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	33	32	27	34	32	29	27	20	23	25	28	29	28
IFR	10	9	8	7	8	9	8	6	5	4	5	8	7
LIFR	4	4	2	2	4	5	8	5	3	2	1	2	4
VLIFR	1	1	0	0	1	1	2	1	1	0	0	1	1

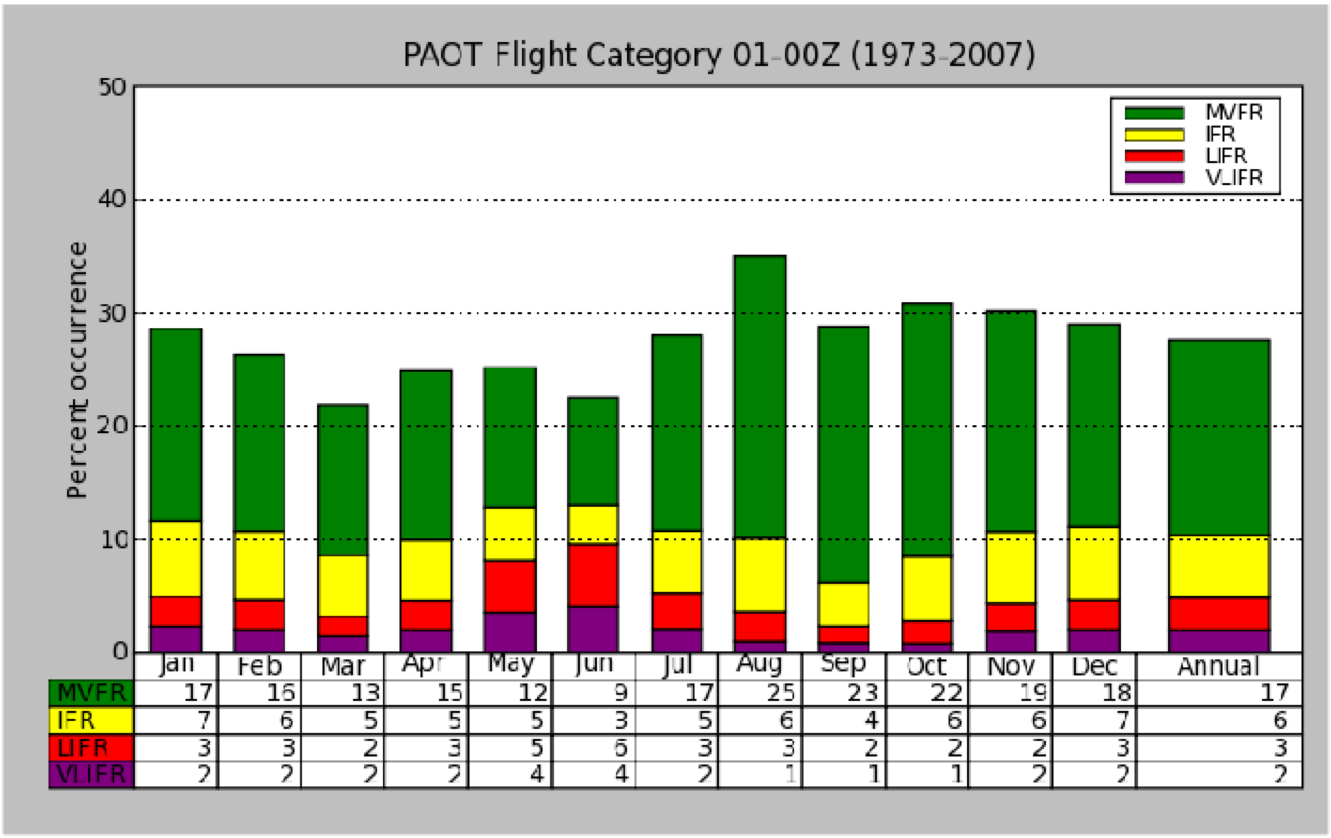


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	14	12	9	8	8	8	8	6	7	7	8	12	9
IFR	7	5	4	4	4	5	6	4	3	2	3	5	4
LIFR	1	2	1	1	0	1	1	1	0	0	0	1	1
VLIFR	0	1	0	0	1	0	1	1	0	0	0	0	0

MVFR/IFR Climatology for Kotzebue, AK

Monthly Variability

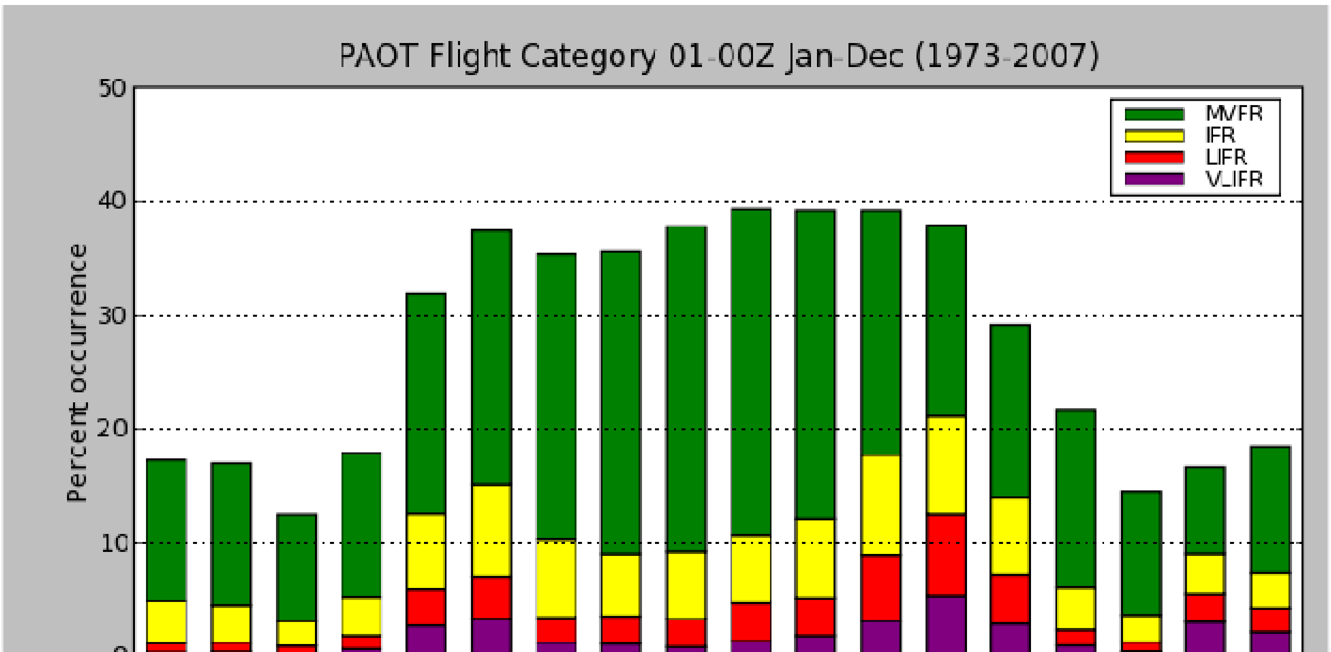
Throughout the 1973-2007 period, IFR was most common during May and June (at least 13% frequency). Interestingly enough, the fewest reports of MVFR were also observed in these months. The graph below indicates a rather unique relationship between IFR frequency and MVFR frequency, where the two are generally negatively correlated. Annually, Kotzebue experiences sub-VFR conditions 28% of the time (35% in August), and IFR conditions 11% of the time (14% in May).



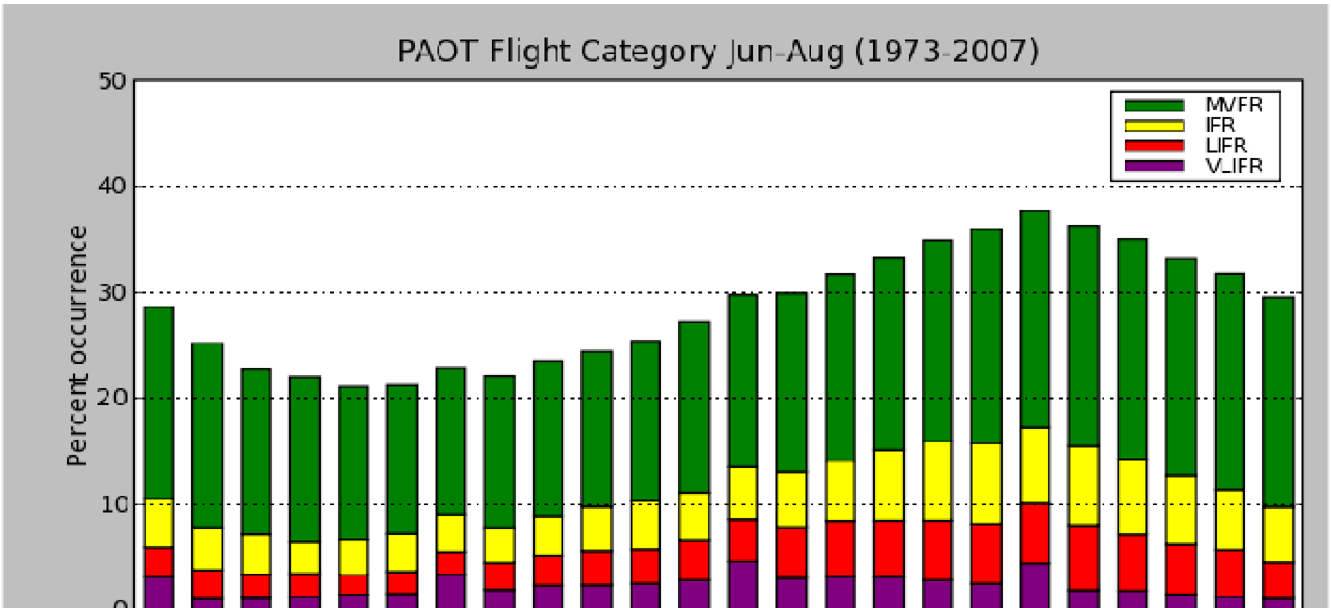
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	17	16	13	15	12	9	17	25	23	22	19	18	17
IFR	7	6	5	5	5	3	5	6	4	6	6	7	6
LIFR	3	3	2	3	5	6	3	3	2	2	2	3	3
V_IFR	2	2	2	2	4	4	2	1	1	1	2	2	2

Relevant Climate Conditions

Climatologically, the highest monthly mean relative humidity occurs in May (78%), and the second lowest in September (73%). In this regard, IFR frequency is fairly well-correlated with relative humidity. A strong relationship also exists between precipitation, cloud cover, and MVFR frequency. Kotzebue observes its maximum precipitation (2.00") and number of cloudy days (21) in August. Though precipitation and sub-VFR conditions are merely coincidental for most sites in this study, Kotzebue's summer rainfall is almost always stratiform, and thus helps explain the significant rise in MVFR reports. The increase in IFR observations between November and January is likely due to increased snowfall (8-9" each month). Additionally, wintertime surface inversions in the presence of low-level moisture can encourage low ceilings and even freezing fog. A comparison of wind direction and IFR reveals that westerly winds are most favorable for IFR conditions (see first graph below). Given Kotzebue's location, west winds promote the onshore flow of cold, maritime air. Because the marine surface is nearly always colder than the land surface during the summer months, a dominant sea breeze can persist, thereby reinforcing the onshore flow. Due to buoyancy, the colder maritime air may remain trapped below the warmer continental air unless daytime solar heating is strong enough to heat and dry out the marine layer. Over the June-August period, sub-VFR frequency increases from 22% to 37% between afternoon and late morning (see second graph below). Westerly winds also tend to be prevailing during late spring, when colder land temperatures are less favorable for a dominant sea breeze. Since low-level inversions are common during spring, higher IFR frequencies in May and June may thus result from the advection of cold, moist air which becomes trapped near the surface under very stable conditions. ESE winds can encourage IFR when associated with synoptic lows in the northern Bering Sea. If they migrate far enough north, these storms can bring strong winds and snow events to northeastern Alaska. Northeasterly winds typically promote the best flying weather, as they advect dry, continental air and generate a downslope effect over the mountains northeast of Kotzebue.



	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	12	13	9	13	19	22	25	26	29	29	27	21	17	15	16	11	8	11
IFR	4	3	2	3	7	8	7	6	6	6	7	9	9	7	4	2	4	3
LIFR	1	1	1	1	3	4	2	2	2	3	3	6	7	4	1	1	2	2
VLIFR	0	0	0	1	3	3	1	1	1	1	2	3	5	3	1	1	3	2
HOURS	14251	13626	20377	35473	34892	27461	10273	11798	7016	6750	7901	17146	21203	25433	11064	13253	387	11817

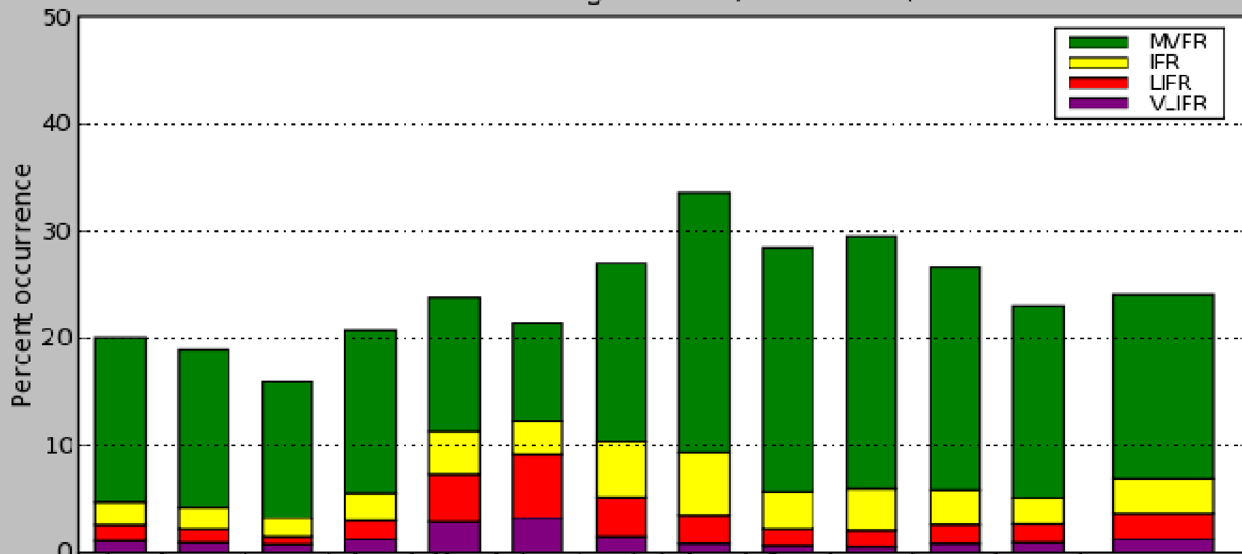


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MVFR	18	17	16	16	14	14	14	14	15	15	15	16	16	17	18	18	19	20	20	21	21	20	20	20
IFR	5	4	4	3	3	4	4	3	4	4	5	5	5	5	6	7	8	8	7	8	7	7	6	5
LIFR	3	3	2	2	2	2	2	3	3	3	3	4	4	5	5	5	6	6	6	6	5	5	4	3
VLIFR	3	1	1	1	1	2	3	2	2	2	2	3	5	3	3	3	3	2	4	2	2	1	1	1

Low Visibility vs. Low Ceiling

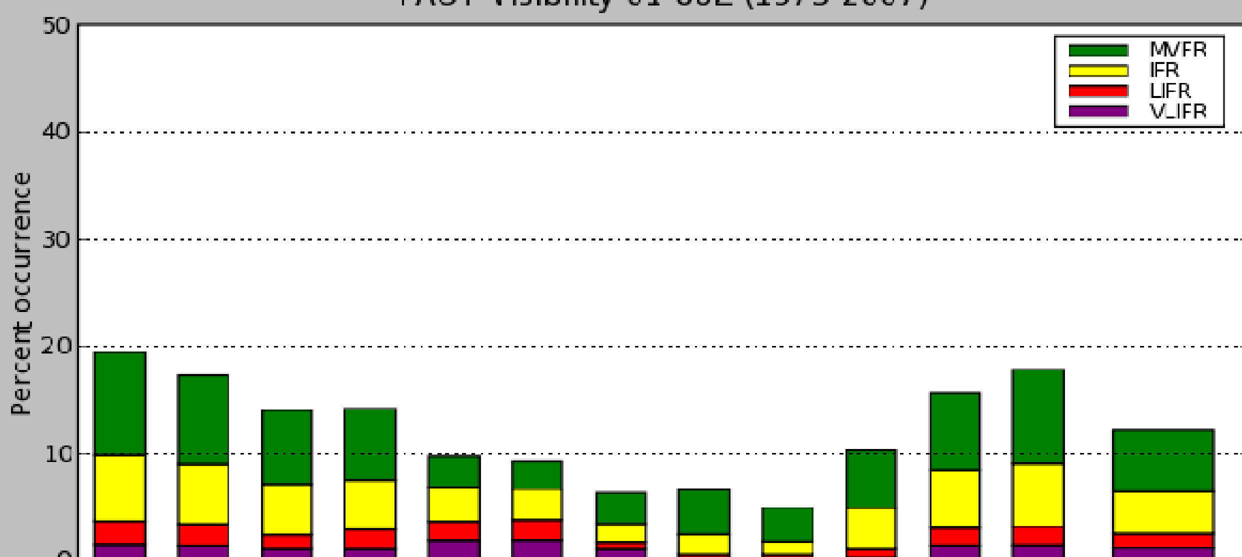
Overall, visual flight obstructions are primarily caused by low ceiling, especially during summer. Annually, low ceiling forces sub-VFR conditions 23% of the time; whereas low visibility forces sub-VFR conditions only 12% of the time (see graphs below). An evaluation of IFR frequency reveals a seasonal variation regarding which factor is most responsible for IFR conditions. During summer, IFR is predominately caused by low ceiling rather than low visibility, and in winter, the opposite scenario takes place. This seasonal dependency is likely related to the type of inclement weather – stratiform rainfall and onshore flow in summer versus snowfall and high wind events in winter.

PAOT Ceiling 01-00Z (1973-2007)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	15	15	13	15	13	9	17	24	23	24	21	18	17
IFR	2	2	2	3	4	3	5	6	3	4	3	2	3
LIFR	1	1	1	2	5	6	4	3	2	2	2	2	2
VLIFR	1	1	1	1	3	3	2	1	1	1	1	1	1

PAOT Visibility 01-00Z (1973-2007)

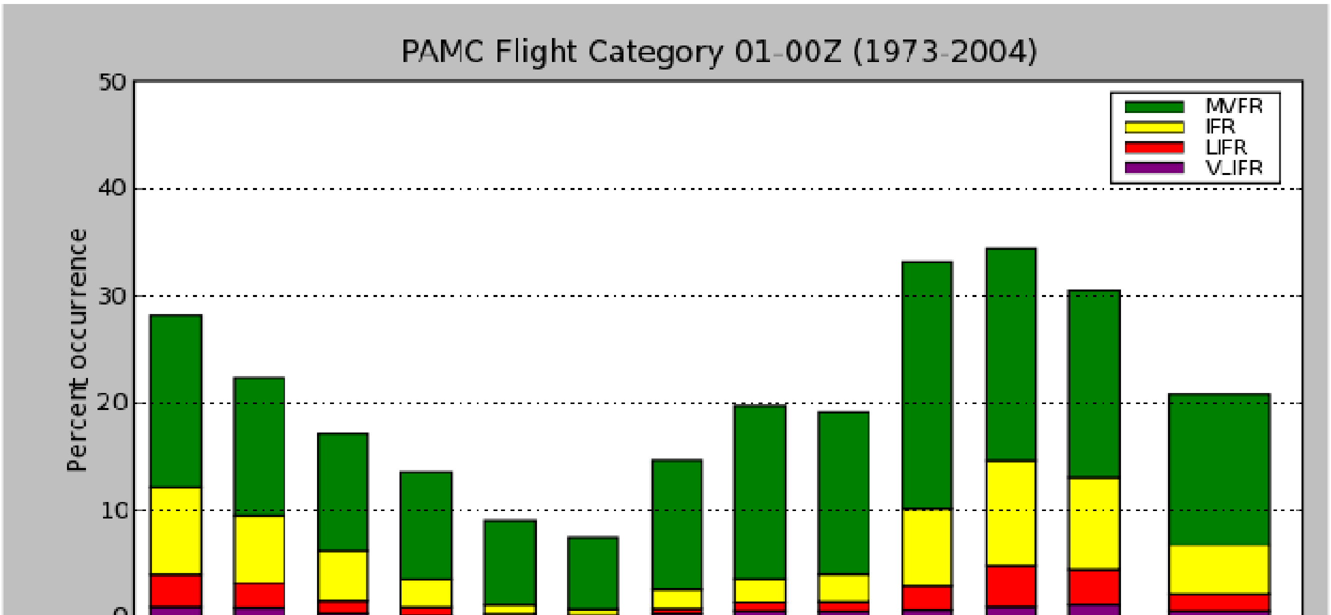


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	10	8	7	7	3	3	3	4	3	5	7	9	6
IFR	6	6	5	5	3	3	2	2	1	4	5	6	4
LIFR	2	2	1	2	2	2	1	0	0	1	2	2	1
VLIFR	2	1	1	1	2	2	1	0	0	0	1	2	1

MVFR/IFR Climatology for McGrath, AK

Monthly Variability

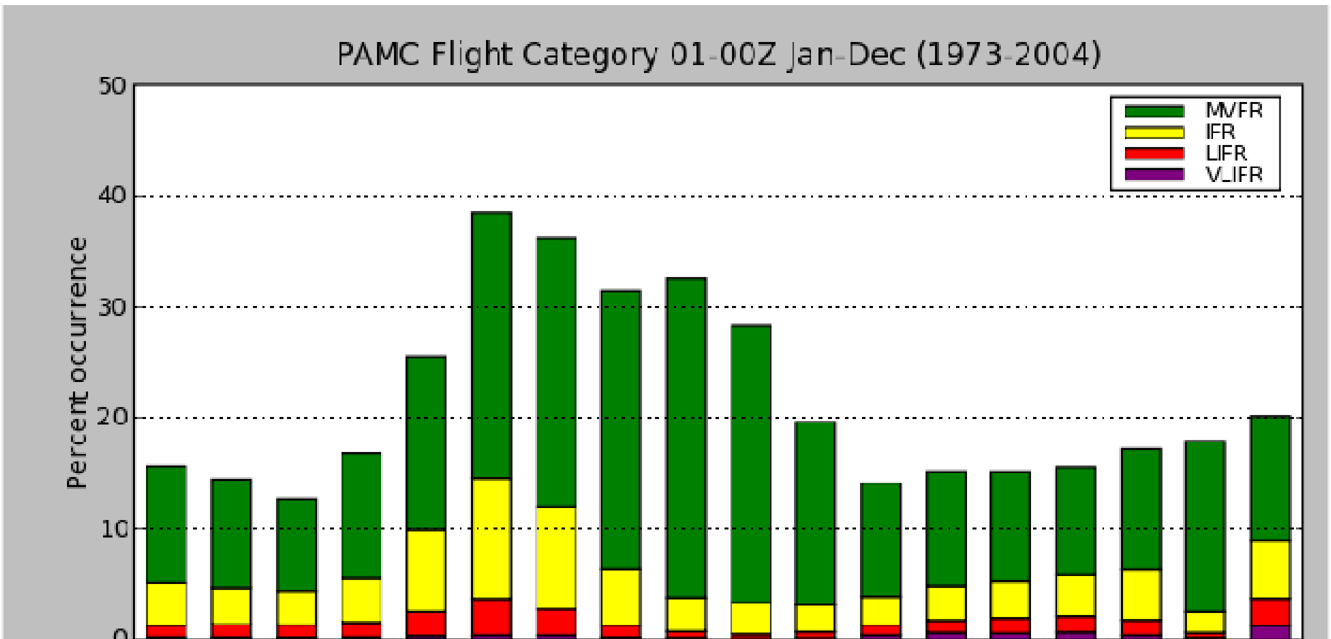
Throughout the 1973-2004 period, IFR was common between October and January (at least 10% frequency). The fewest IFR reports occurred in May and June, with only 1% frequency each month. Annually, McGrath experiences sub-VFR conditions 22% of the time (35% in November), and IFR 8% of the time (15% in November).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	16	13	11	10	8	7	12	16	15	23	20	17	14
IFR	8	6	5	3	1	1	2	2	3	7	10	9	5
LIFR	3	2	1	1	0	0	0	1	1	2	4	3	2
VLIFR	1	1	0	0	0	0	0	1	1	1	1	1	1

Relevant Climate Conditions

Climatologically, McGrath is quite similar to Fairbanks, but receives slightly more precipitation. The highest monthly mean relative humidity occurs between October and January, coincident with the greatest IFR frequency. Relative humidity values of at least 70% in these months imply low-level cloud cover and encourage precipitation. In addition, the lowest monthly relative humidity occurs in May and June (44% and 47% respectively), and corresponds to the smallest IFR frequency. A rise in IFR reports during late fall may very well result from the substantial increase in average monthly snowfall (over 15" between November and January). Though McGrath receives its greatest number of cloud days (23) in August, most summer rain events are convective rather than stratiform (higher cloud ceilings and mid-level moisture). A comparison of wind direction and IFR indicates that ESE winds generate the worst visual flight conditions (see graph below). Under ESE flow, IFR occurs 14% of the time, and sub-VFR 38% of the time. Though ESE winds may generate a downslope effect over the Alaska Range (if the pressure gradient is strong enough), the combination of nearby topography (higher terrain to the west) and the winter synoptic pattern can trap cold, dense air in the western Kuskokwin Valley. Moreover, any air which undergoes substantial adiabatic heating on the leeward side of the Alaska Range will likely be displaced above the cold valley air. A persistent wintertime surface inversion inhibits vertical mixing and may encourage low ceilings or even ice fog in the presence of enough low-level moisture. Calm winds, which are climatologically most common in McGrath, further enhance IFR conditions under surface or subsidence inversions. Interestingly enough, southerly winds are most favorable for MVFR conditions (MVFR occurs 29% of the time). Southerly flow encourages both precipitation (through local orographic uplift) and stratiform cloud cover by advecting maritime air from Bristol Bay. The diurnal variation in IFR observations indicates a slight increase during the morning as late summer approaches (see graph below). Strong radiational cooling will generate a fairly shallow surface inversion, and may even cause radiation fog if the surface temperature reaches the dewpoint.

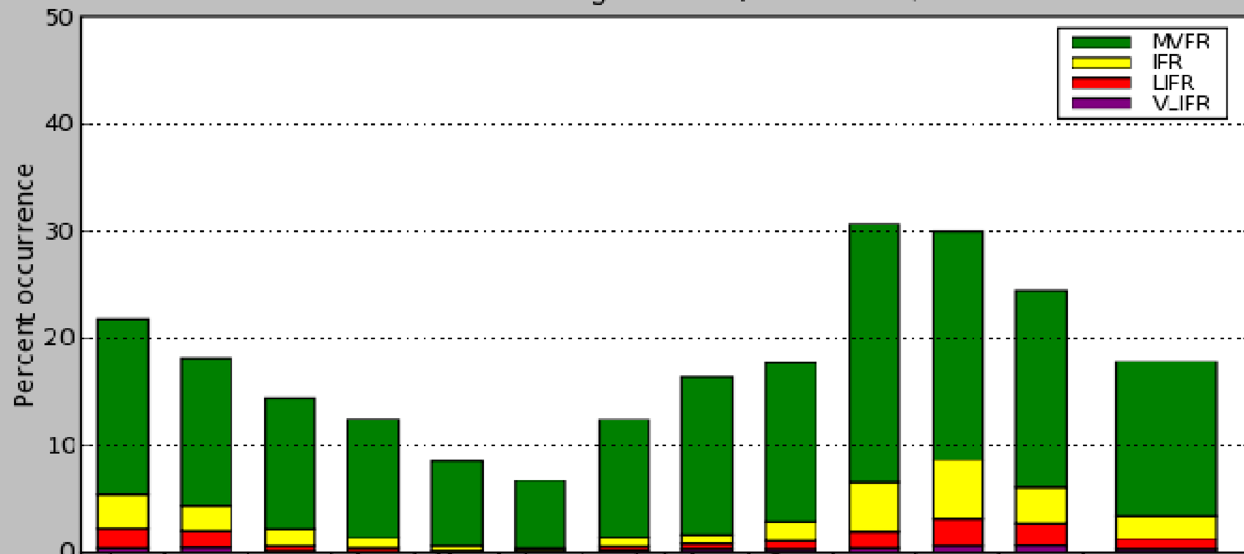


	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	10	10	8	11	16	24	24	25	29	25	17	10	10	10	10	11	15	11
IFR	4	3	3	4	7	11	9	5	3	3	2	3	3	3	4	5	2	5
LIFR	1	1	1	1	2	3	2	1	1	0	1	1	1	1	1	1	0	2
VLIFR	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1
HOURS	18135	10015	4753	8666	8039	11533	8762	12018	12227	10126	8600	14135	14276	18026	14485	21822	3810	68494

Low Visibility vs. Low Ceiling

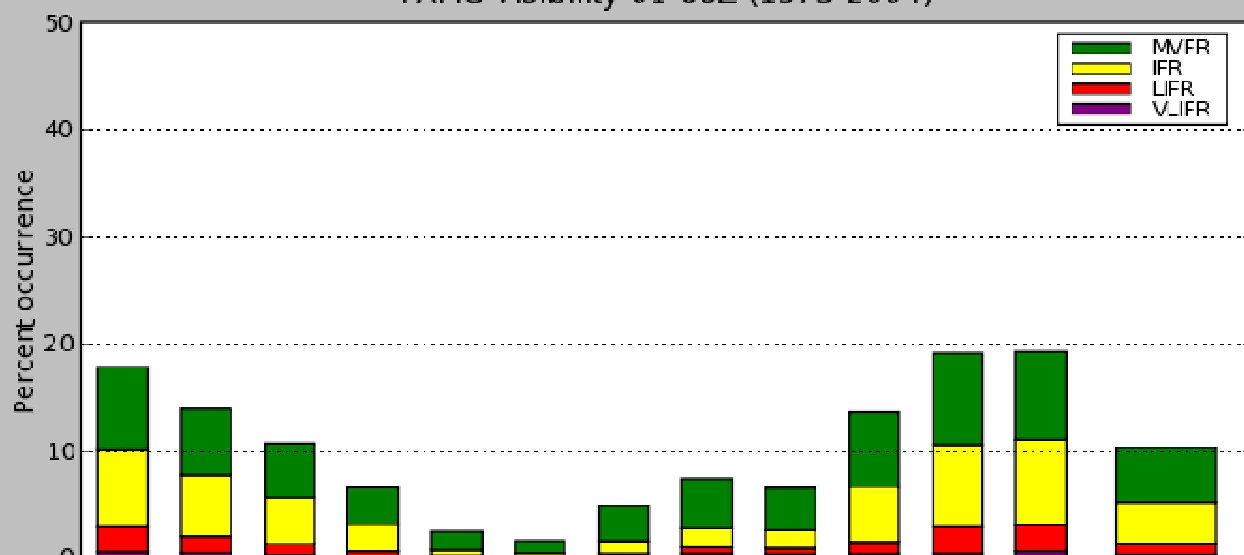
In general, low ceiling is responsible for a majority of visual flight obstructions at McGrath. Annually, low ceiling causes sub-VFR 17% of the time, whereas low visibility cause sub-VFR 10% of the time (see graphs below). On the contrary, low visibility generates IFR more frequently, especially between November and January when snowfall significantly reduces the visibility.

PAMC Ceiling 01-00Z (1973-2004)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	16	14	12	11	8	6	11	15	15	24	21	18	14
IFR	3	2	2	1	0	0	1	1	2	5	6	3	2
LIFR	2	2	0	0	0	0	0	1	1	2	2	2	1
VLIFR	0	0	0	0	0	0	0	0	0	0	1	1	0

PAMC Visibility 01-00Z (1973-2004)

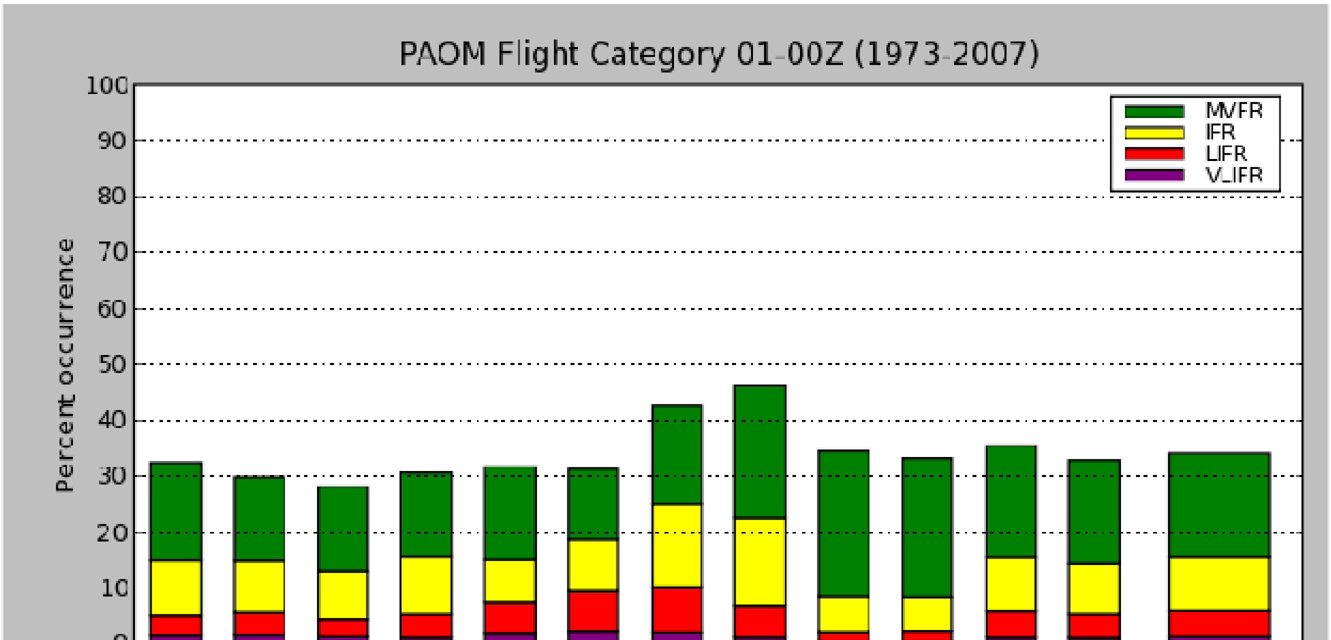


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	8	6	5	3	2	1	3	5	4	7	8	8	5
IFR	7	6	4	3	1	0	1	2	2	5	8	8	4
LIFR	2	2	1	1	0	0	0	1	1	1	3	2	1
VLIFR	1	1	0	0	0	0	0	0	0	0	0	1	0

MVFR/IFR Climatology for Nome, AK

Monthly Variability

Throughout the 1973-2007 period, IFR was most common in July and August. During these two months, IFR occurs with at least 23% frequency, sub-VFR occurs with at least 42% frequency. Interestingly enough, the next two months (September and October), exhibit the fewest IFR reports (only 9% frequency). Annually, Nome experiences sub-VFR conditions 33% of the time (47% in August), and IFR or worse 15% of the time (25% in July).

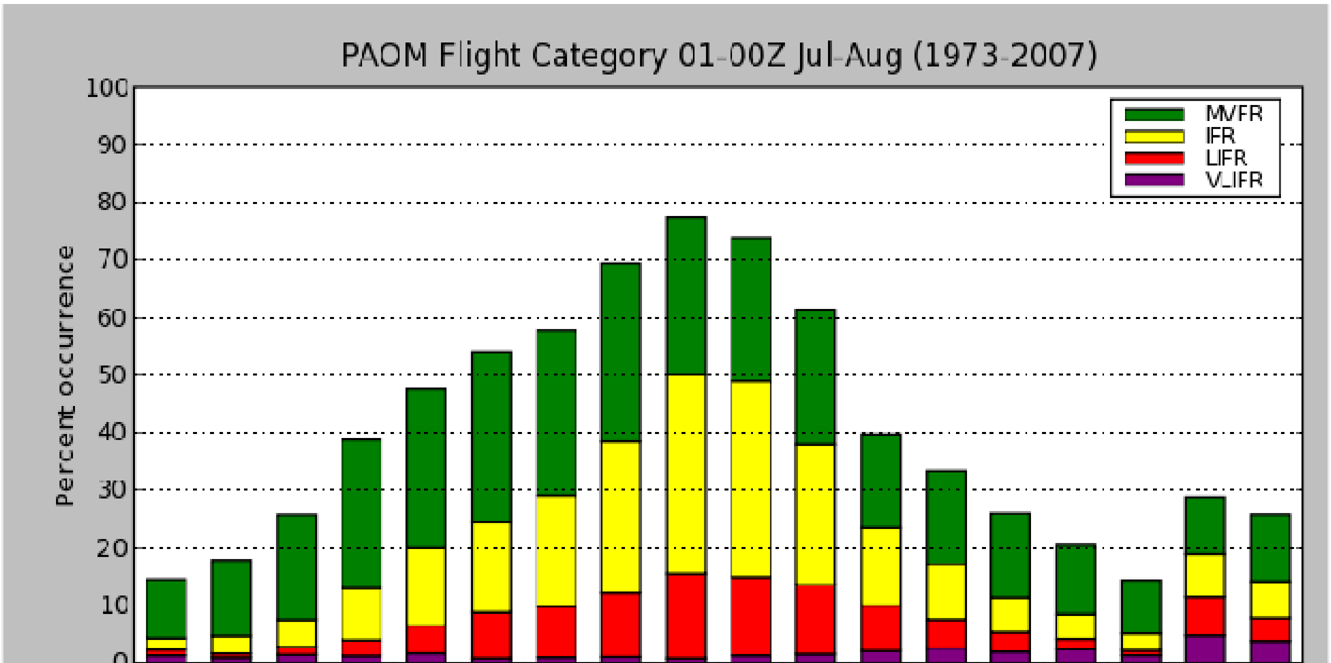


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	17	15	15	15	17	12	17	24	26	25	20	18	18
IFR	10	9	9	10	8	9	15	16	6	6	10	9	10
LIFR	3	4	3	4	6	7	8	6	2	2	5	4	4
VLIFR	2	2	1	1	2	2	2	1	1	1	1	1	1

Relevant Climate Conditions

Climatologically, the highest mean monthly relative humidity (78%) is observed during July and August, and occurs in conjunction with the greatest frequency of IFR reports. Again, relative humidity near 80% strongly encourages low-level cloud cover and precipitation. Like Kotzebue, Nome observes its greatest monthly precipitation (3.23" in August) during the same month as its greatest frequency of sub-VFR conditions. As in the case of Kotzebue, Nome receives most of its summer precipitation from marine-influenced stratiform rain events. Additionally, Nome experiences its most persistent cloud cover in August, with 22 cloudy days on average. A comparison of wind direction and IFR frequency reveals that IFR conditions are most favored by southerly winds. Given its location (surrounded by water to the south), southerly winds provide onshore flow and transport very cold, maritime air over the Seward Peninsula. This phenomenon becomes enhanced in summer, as differential land/water heating creates a dominant sea breeze. The resulting circulation forces cold, moist air (near the surface) onshore, which remains trapped below the warmer air over land due to buoyancy. A marine stratus layer, or even fog (given sufficient surface moisture), will remain until daytime heating can induce vertical mixing and burn off the clouds. Under southerly flow, IFR and

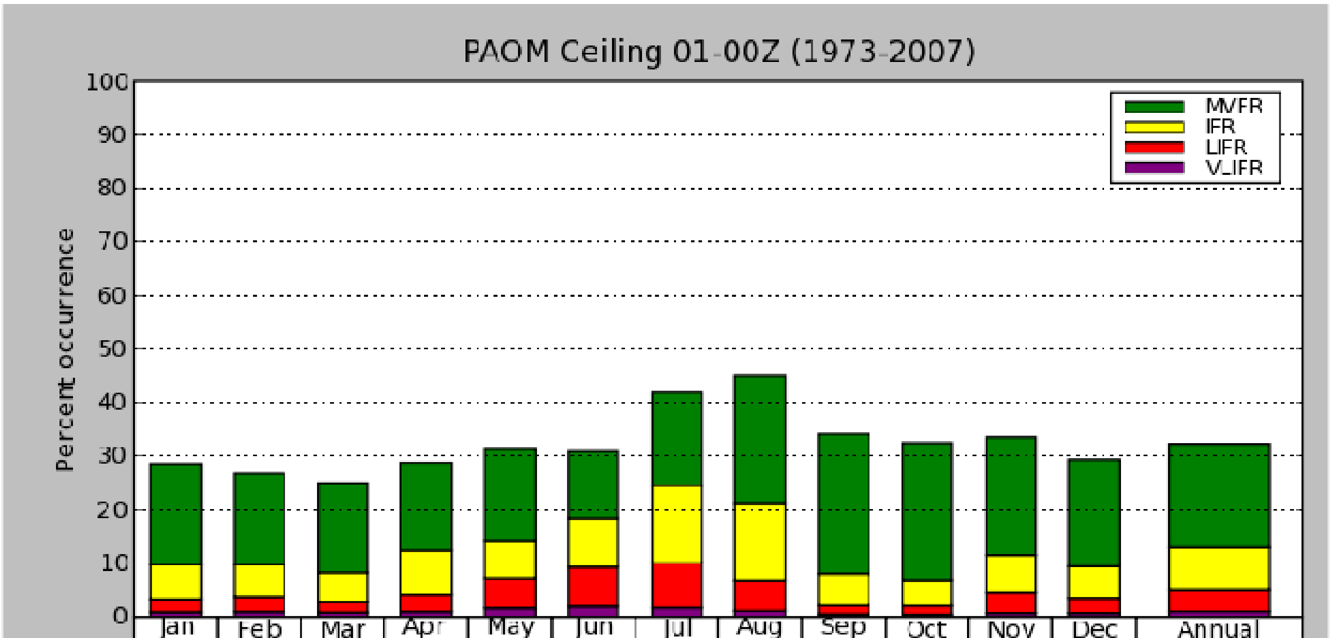
LIFR are reported 50% and 16% of the time, respectively (see graph below). During winter, arctic fronts and synoptic lows near the Bering Strait can bring a combination of strong southeasterly winds and snowfall. Northerly winds (between NW and NE) tend to suppress IFR conditions because these wind regimes advect drier air over land toward the station. Nome experiences little diurnal variability in IFR, but as suggested by sea breeze effects, there does exist a slight morning increase during the summer months.



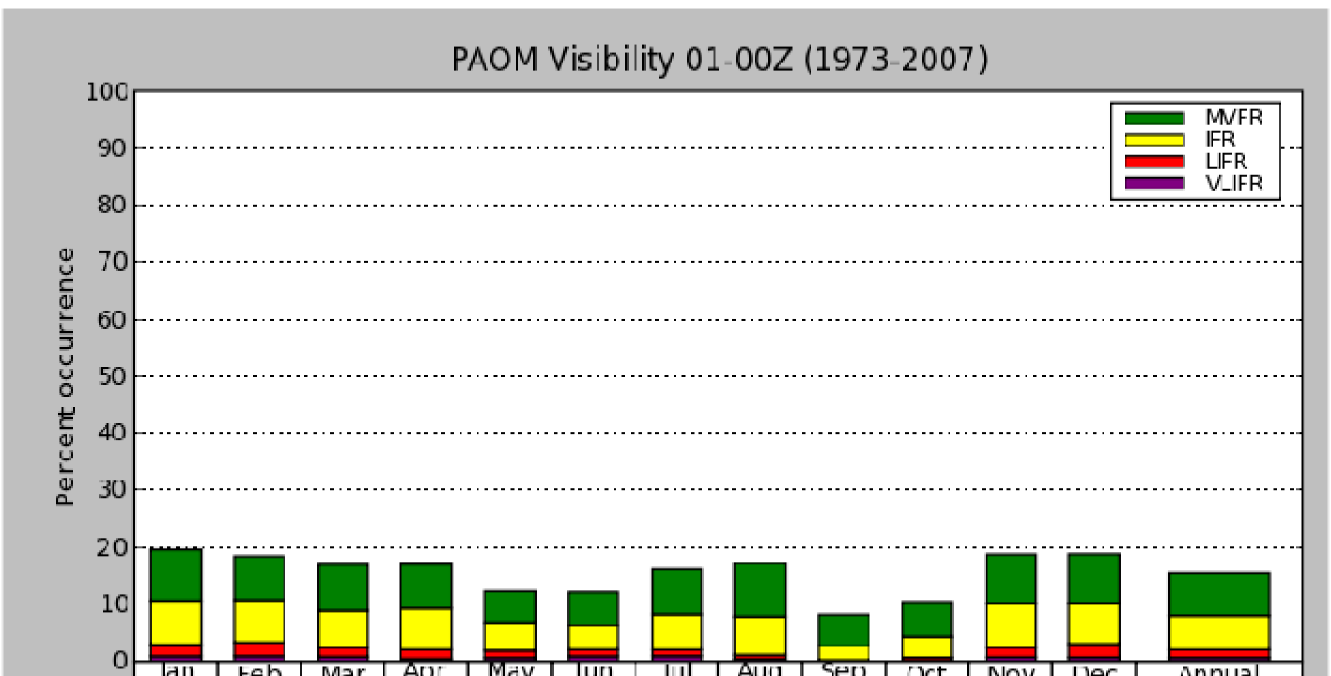
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	10	13	18	25	28	30	29	31	27	25	24	16	16	15	12	9	10	12
IFR	2	3	5	9	13	16	19	26	34	34	24	13	10	6	4	3	7	6
LIFR	1	1	1	3	5	8	9	11	15	14	12	8	5	3	2	1	7	4
VLIFR	1	1	1	1	2	1	1	1	1	1	2	2	3	2	2	1	5	4
HOURS	1991	1288	1380	2893	1926	2370	2797	3520	3129	3452	3856	7243	3151	2504	1653	2850	169	2628

Low Visibility vs. Low Ceiling

Overall, visual flight obstructions are influenced predominately by low cloud ceiling rather than low visibility. Annually, low cloud ceiling causes sub-VFR 32% of the time, whereas low visibility causes such conditions only 15% of the time (see graphs below). This discrepancy is most significant during the summer, and encouraged by low-level cloud cover and onshore flow (marine stratus layer). In winter, IFR conditions show no preference to either criterion. Winter snow events and predominately offshore flow act to reduce visibility and advect cold, dry continental air over Nome (higher cloud ceiling).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	19	17	17	16	17	12	17	24	26	26	22	20	19
IFR	6	6	5	8	7	9	15	14	6	5	7	6	8
LIFR	2	3	2	3	6	7	8	6	2	2	4	3	4
VLIFR	1	1	1	1	2	2	2	1	0	0	1	1	1

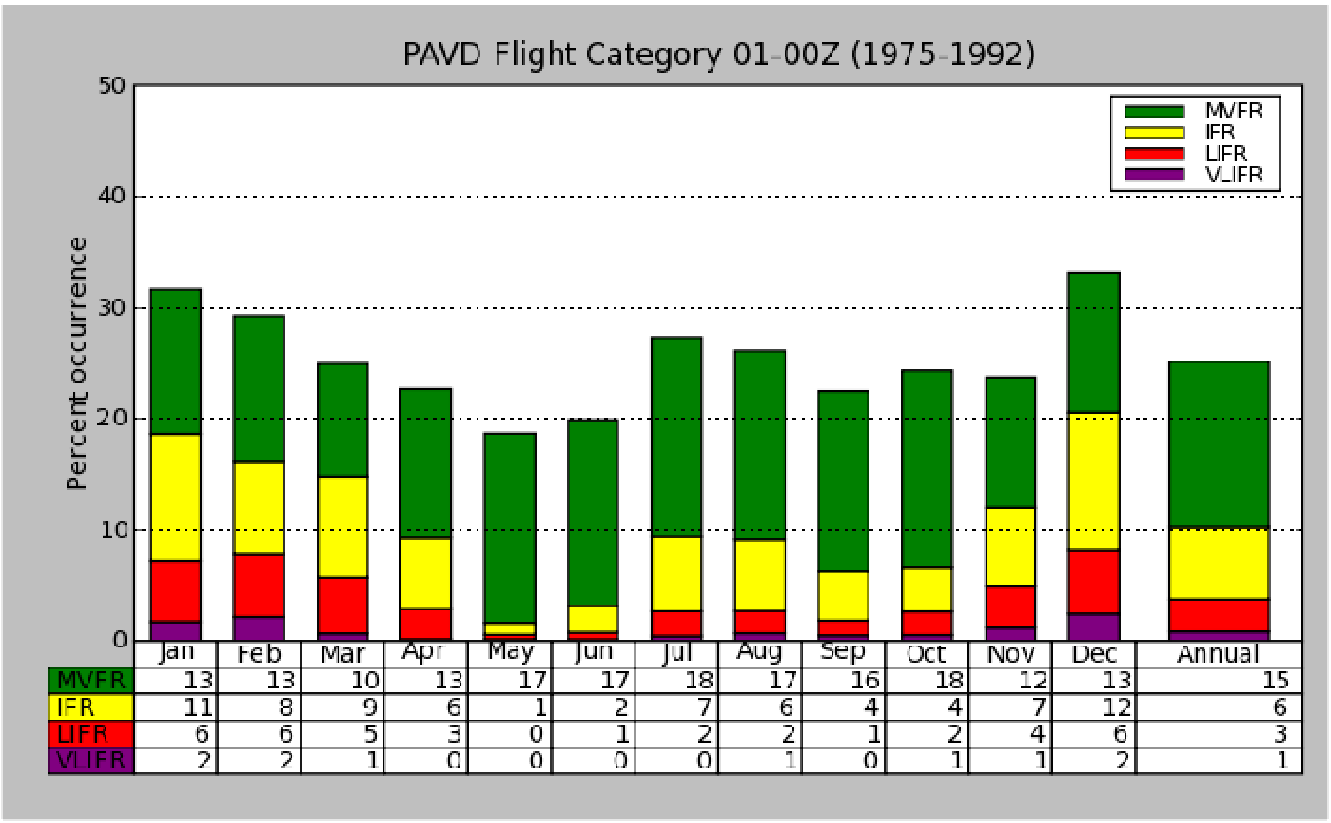


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	9	8	8	8	5	6	8	9	5	6	9	9	7
IFR	8	7	6	7	5	4	6	7	2	4	8	7	6
LIFR	2	2	2	2	1	1	1	1	0	1	2	2	1
VLIFR	1	1	1	0	1	1	1	0	0	0	1	1	1

MVFR/IFR Climatology for Valdez, AK

Monthly Variability

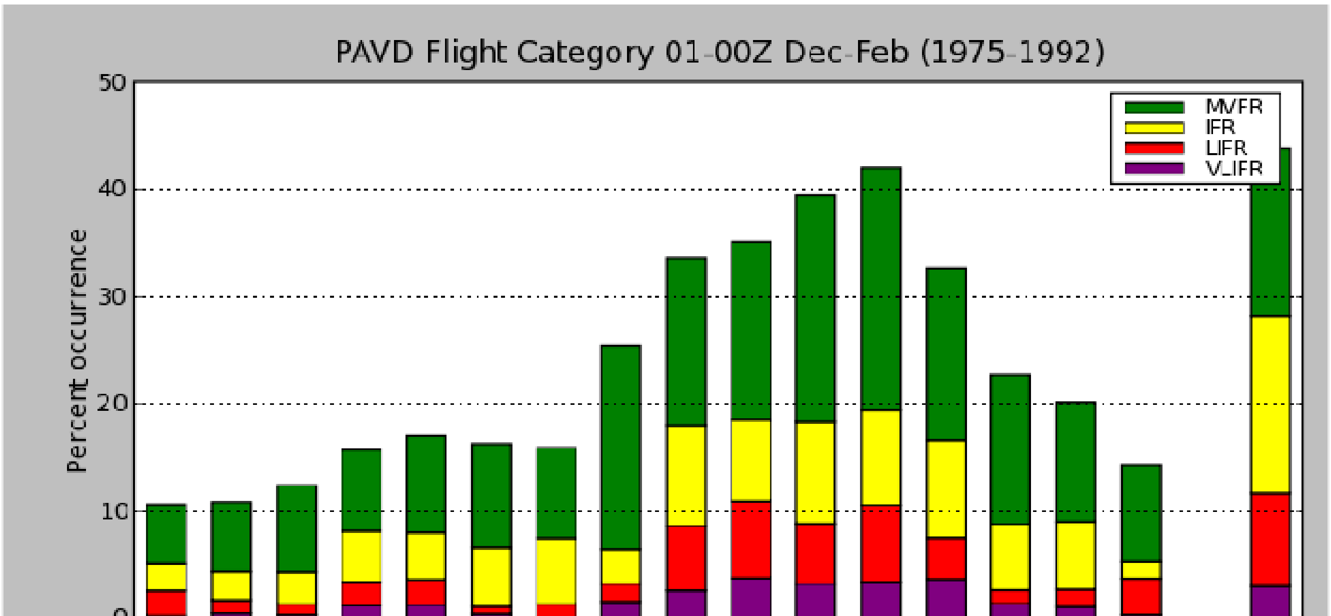
Throughout the 1975-1992 period, IFR was most common between December and February (over 15% frequency), while the fewest IFR reports occurred in May and June (less than 4% frequency). Annually, Valdez experiences sub-VFR conditions 25% of the time (33% in December), and IFR 10% of the time (20% in December). As the graph below illustrates, one intriguing aspect of this climatology is the spike in IFR frequency for the July-August period.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	13	13	10	13	17	17	18	17	16	18	12	13	15
IFR	11	8	9	6	1	2	7	6	4	4	7	12	6
LIFR	6	6	5	3	0	1	2	2	1	2	4	6	3
VLIFR	2	2	1	0	0	0	0	1	0	1	1	2	1

Relevant Climate Conditions

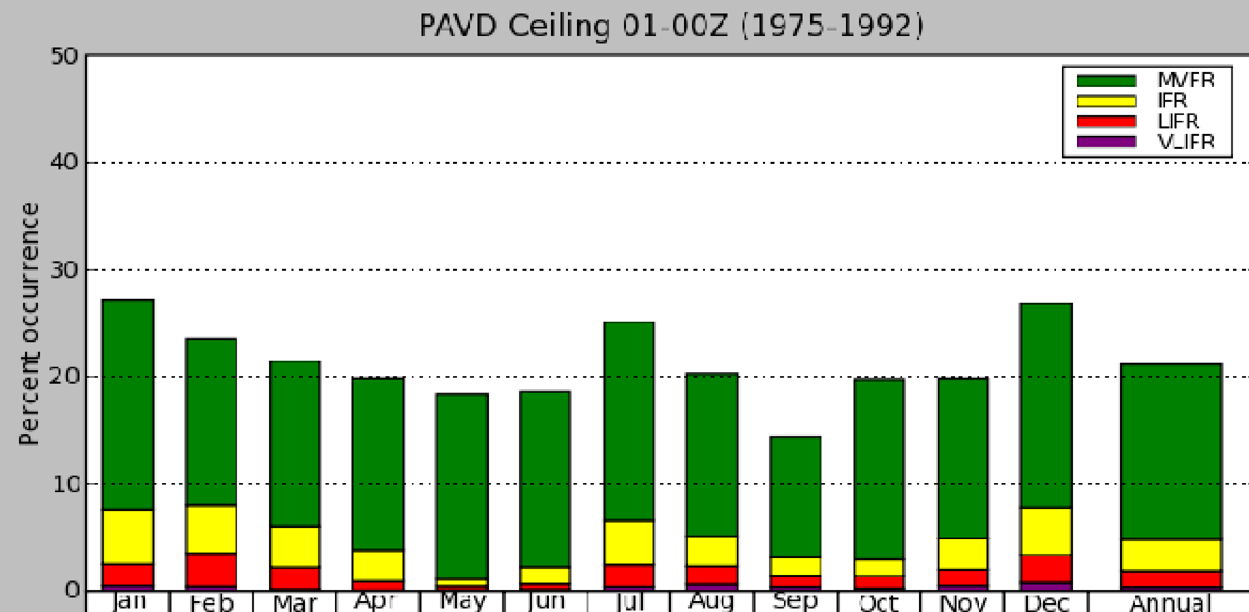
In general, a strong relationship exists between the monthly variability in both IFR frequency and relative humidity. The highest mean relative humidity occurs in December (75%), while the second lowest mean relative humidity occurs in May (60%). Moreover, the sudden increase in IFR observations between June and July also corresponds to a definitive rise in mean relative humidity. During winter, the substantial rise in IFR observations likely results from rather frequent heavy snow events. In fact, Valdez receives greater than 65” of snow on average in both December and January. A comparison of wind direction and IFR reveals very different scenarios for the winter and summer seasons. During winter, any wind direction between 180 degrees (S) and 270 degrees (W) encourages IFR conditions. These winds transport moisture from the relatively warm Prince William Sound and Gulf of Alaska, and can even create orographic lift (mountainous terrain lies directly north and east of Valdez). South and southwesterly flow associated with synoptic lows near the Prince William Sound may help produce extremely heavy snowfall. However, as the graph below suggests, calm winds are most ideal for IFR conditions (IFR occurs with 28% frequency). The interaction between topography, low-level inversions, and calm winds prevents horizontal and vertical mixing, keeping low-level moisture near the surface. These conditions, combined with sub-freezing temperatures, also encourage freezing fog events. On the contrary, northeasterly winds often cause poor visual flight conditions in summer. Though downslope effects typically inhibit low ceilings and visibilities, in the case of Valdez, its proximity to both mountains and water causes a strong inversion aloft. Air flowing over the nearby mountains undergoes adiabatic heating, but the marine influence helps maintain cool, moist air near the surface. If the downslope winds are not strong enough to remove the marine environment, low-level clouds, and even fog, will persist. The diurnal variation in sub-VFR frequency reveals a substantial increase between late afternoon and mid-morning, due to the alternating land breeze/sea breeze circulations. During the month of July, sub-VFR conditions are observed less than 15% of the time in the afternoon, but more than 40% of the time in the morning hours.



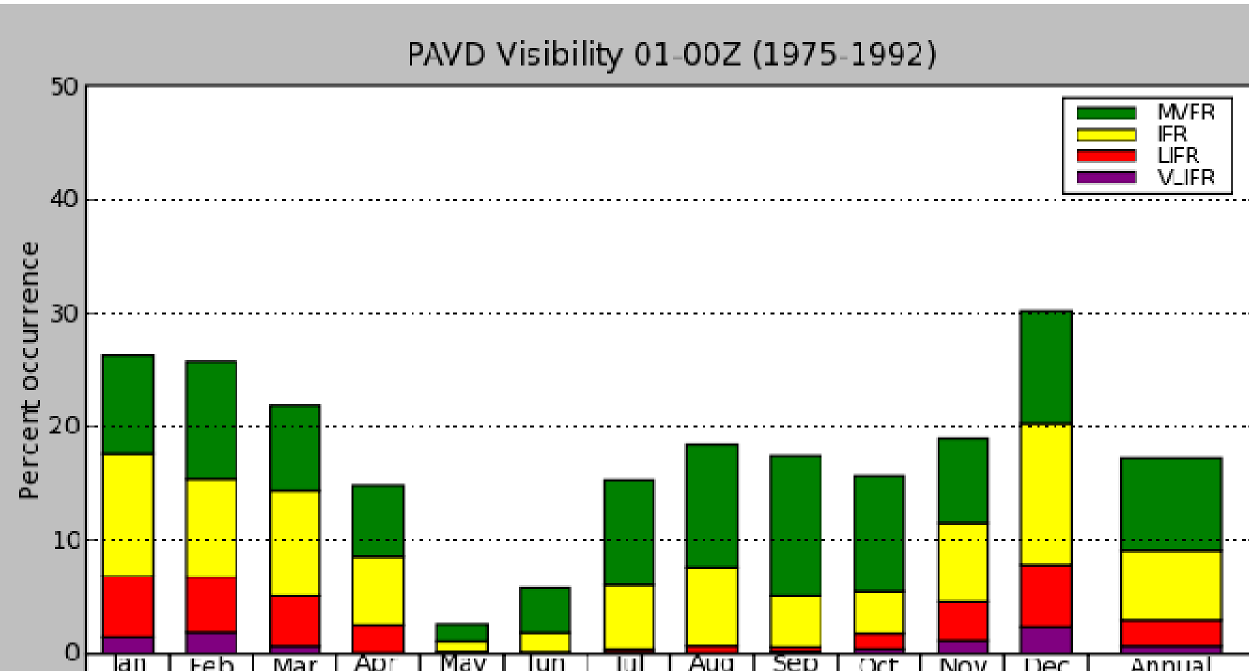
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	5	7	8	8	9	10	8	19	16	17	21	23	16	14	11	9	0	16
IFR	3	3	3	5	4	5	6	3	9	8	10	9	9	6	6	2	0	16
LIFR	2	1	1	2	2	1	1	2	6	7	6	7	4	1	2	3	0	9
VLIFR	0	1	0	1	1	0	0	2	3	4	3	3	4	1	1	0	0	3
HOURS	415	530	553	865	386	224	137	127	85	80	62	199	160	162	184	298	0	4381

Low Visibility vs. Low Ceiling

Overall, low visibility is responsible for the majority of IFR observations, particularly in winter when heavy snow, strong winds, and freezing fog are fairly common. Low ceiling and low visibility are both quite rare in spring, given the decrease in relative humidity, snowfall, and total precipitation. Annually, low visibility causes IFR conditions 9% of the time, whereas low ceiling causes IFR conditions only 5% of the time (see graphs below).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	20	16	15	16	17	16	19	15	11	17	15	19	16
IFR	5	4	4	3	1	2	4	3	2	2	3	4	3
LIFR	2	3	2	1	0	1	2	2	1	1	1	3	2
VLIFR	1	0	0	0	0	0	0	1	0	0	0	1	0

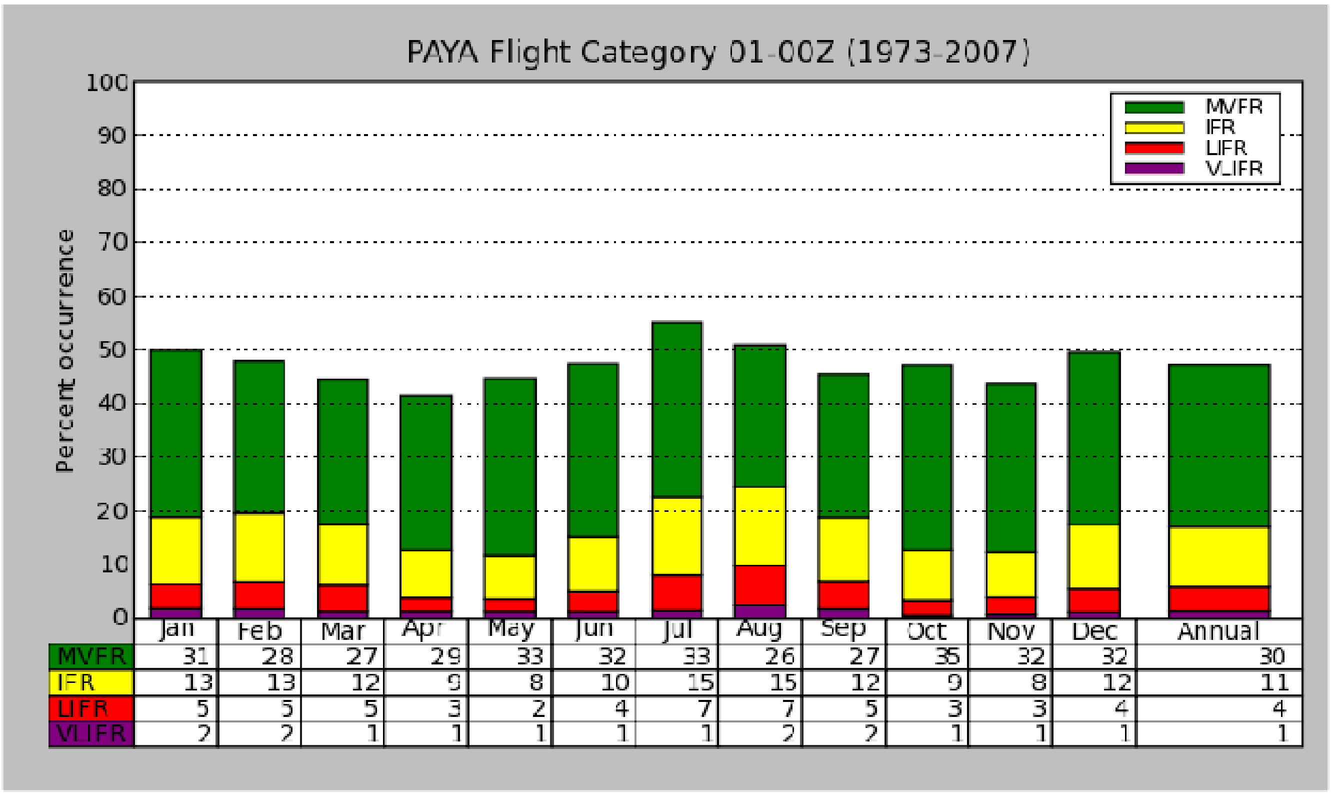


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	9	10	7	6	2	4	9	11	12	10	7	10	8
IFR	11	9	9	6	1	2	6	7	5	4	7	12	6
LIFR	5	5	5	2	0	0	0	1	0	1	3	5	2
VLIFR	1	2	1	0	0	0	0	0	0	0	1	2	1

MVFR/IFR Climatology for Yakutat, AK

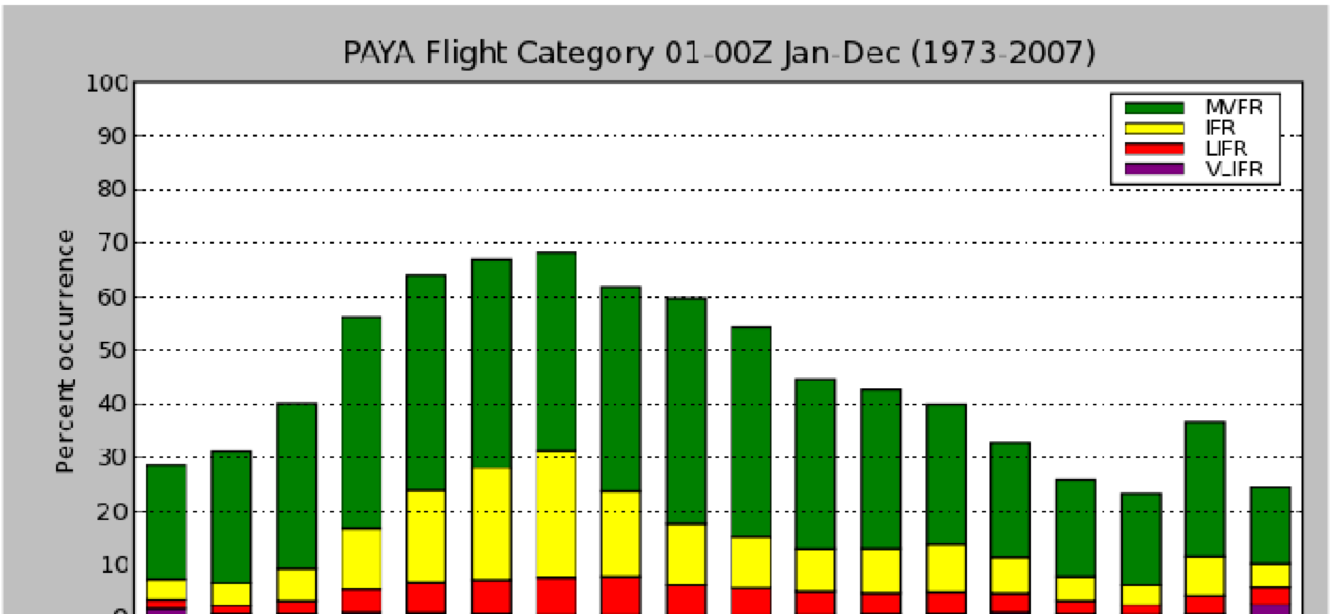
Monthly Variability

Throughout the 1973-2007 period, IFR was most common during July and August (at least 23% frequency), with another slight increase between December and February. The fewest IFR observations were reported in the April-May and October-November periods (less than 14% frequency). Annually, Yakutat experiences sub-VFR conditions 46% of the time (56% in July), and IFR conditions 16% of the time (24% in August).

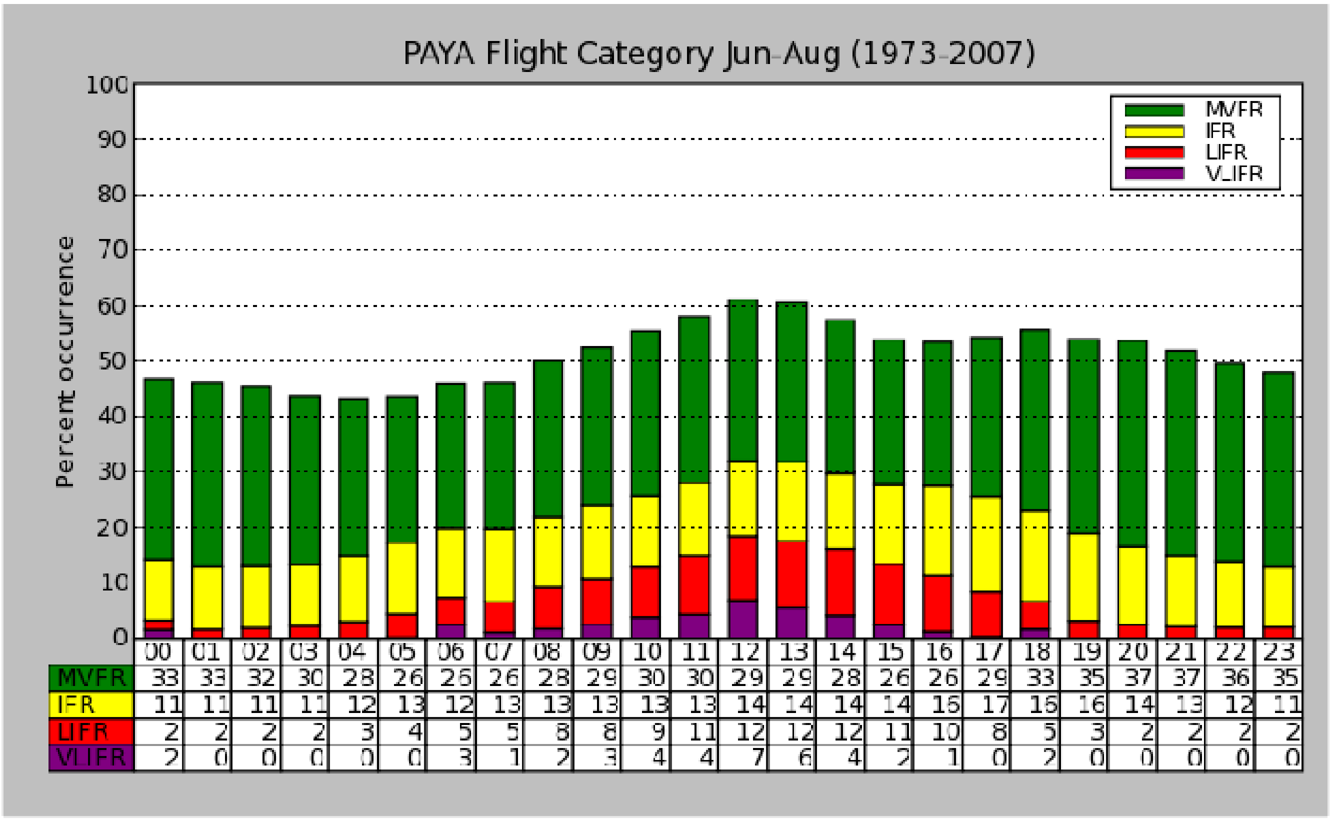


Relevant Climate Conditions

Climatologically, the highest monthly mean relative humidity occurs in December (85%). Though not coincident with the greatest IFR frequency, this does correspond to the wintertime increase in IFR reports. Surprisingly, the early fall decline in IFR frequency occurs simultaneously with an upward trend in monthly relative humidity. On the contrary, the lowest relative humidity (68% in April) is well-correlated with the springtime decrease in IFR. The maximum number of cloudy days are observed in August and October (25 days each month), the months with the greatest IFR and MVFR frequency, respectively. Consistent with monthly relative humidity and IFR frequency, April has the fewest number of the cloudy days, with 21 on average. In addition to the rise in relative humidity, significant snowfall (over 36" between December and February), likely forces an increase in IFR reports during winter. An analysis of wind direction reveals that SE and ESE winds are particularly favorable for IFR conditions, especially in winter (see first graph below). Southeasterly winds associated with synoptic lows in the Gulf of Alaska can bring steady rain and/or snow to the southeast Alaska coast. Since the eastern Gulf of Alaska is a common final destination for deep, cold-core cyclones before they decay and migrate southward with the jet stream, these storms often remain nearly stationary, with heavy precipitation near the occlusion zone. ESE winds in summer can create downslope heating on the western side of the coastal range, but given the cold, dense maritime air immediately along the southeast Alaska coast, air which undergoes considerable adiabatic heating is forced to remain aloft due to buoyancy. The interaction of these two air masses (maritime polar and continental polar) creates an inversion layer which traps cool, moist air below dry, warm air. Diurnal variation in IFR frequency indicates that summertime IFR increases by more than 15% frequency between late afternoon and early morning (see second graph below). This phenomenon is likely due to the alternation of thermally-induced land breezes (overnight) and sea breezes (daytime). Greater nighttime cooling over land will generate a land breeze, bringing the marine stratus layer onshore, whereas greater daytime heating over land will either push the marine layer offshore or burn off the low-level clouds. Northerly and northwesterly flows are typically associated with fair weather. These winds can produce the strongest downslope effects (highest peaks in the vicinity, less marine interference) from the Wrangell-St. Elias Mountains.



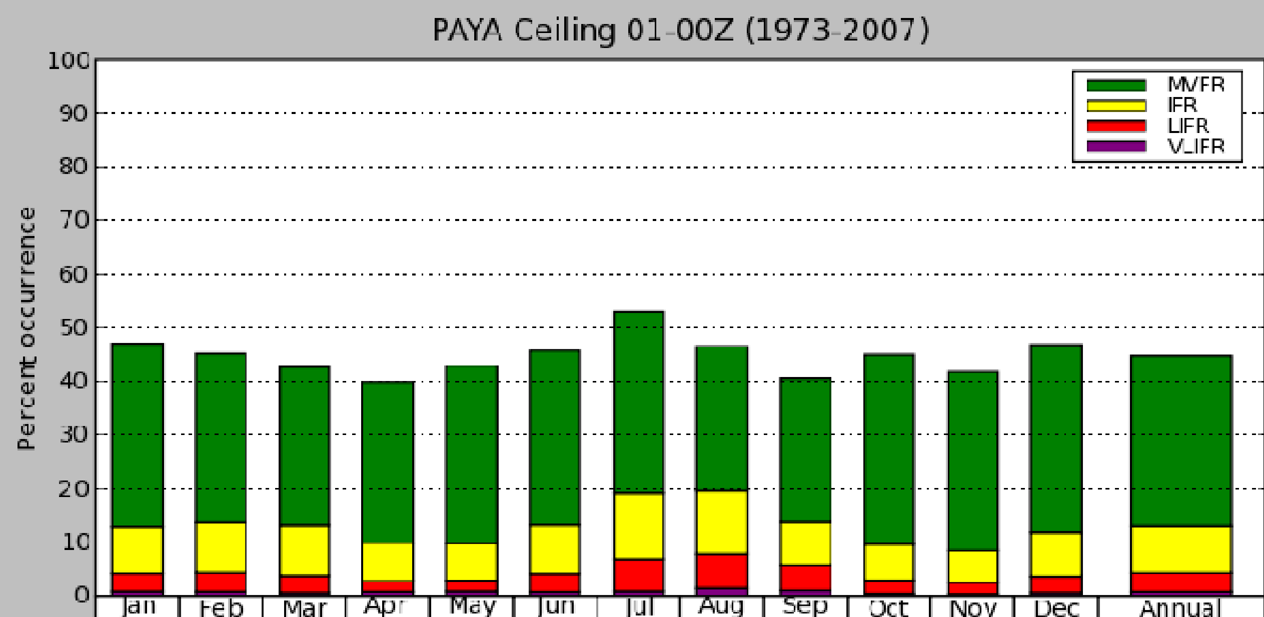
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRB	C
MVFR	21	24	31	39	40	39	37	38	42	39	32	30	26	21	18	17	25	14
IFR	4	4	6	11	17	21	24	16	12	10	8	8	9	7	4	4	7	5
LIFR	2	2	2	4	6	6	7	7	6	5	4	4	4	4	3	2	3	3
VLIFR	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
HOURS	3346	4627	11241	53194	37753	27186	18324	11616	5352	4359	5601	10231	5252	7526	3290	7587	8201	60644



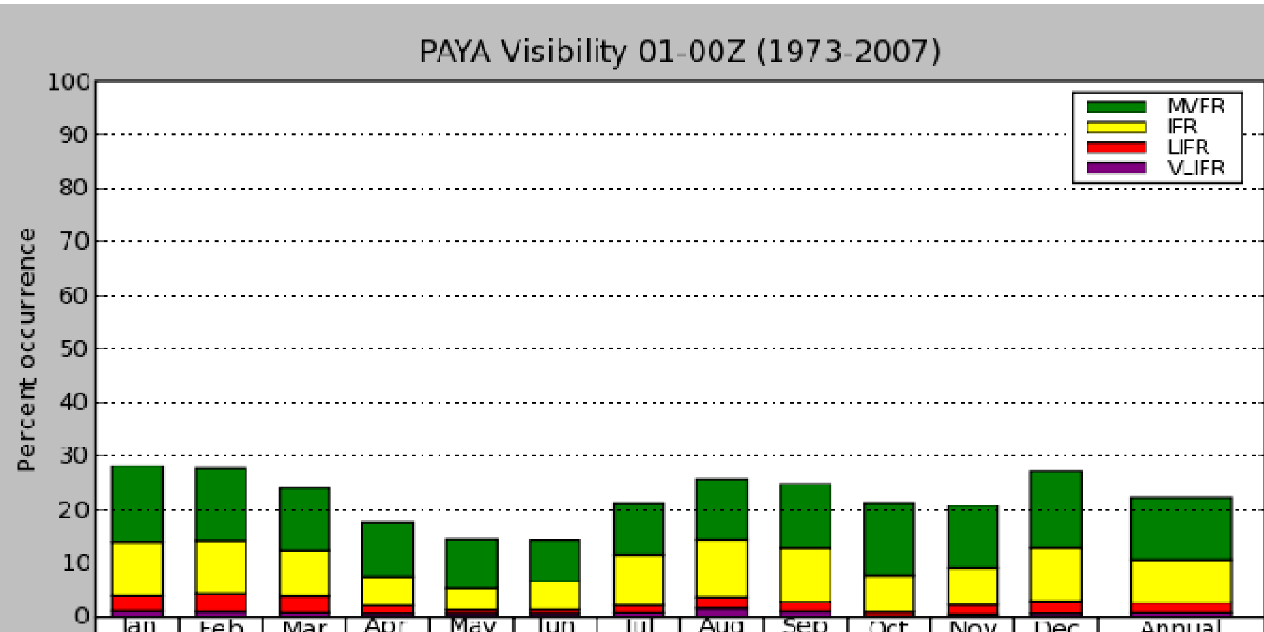
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MVFR	33	33	32	30	28	26	26	26	28	29	30	30	29	29	28	26	26	29	33	35	37	37	36	35
IFR	11	11	11	11	12	13	12	13	13	13	13	13	14	14	14	14	16	17	16	16	14	13	12	11
LIFR	2	2	2	2	3	4	5	5	8	8	9	11	12	12	12	11	10	8	5	3	2	2	2	2
VLIFR	2	0	0	0	0	0	3	1	2	3	4	4	7	6	4	2	1	0	2	0	0	0	0	0

Low Visibility vs. Low Ceiling

In terms of forcing IFR, neither low visibility nor low ceilings are particularly favored over the other. However, low ceiling is responsible for a much greater percentage of MVFR cases. Yakutat's surrounding topography, persistent stratiform precipitation, and high relative humidity year-round are more conducive to reducing ceiling height rather than visibility. Annually, low ceiling causes sub-VFR conditions 45% of the time, whereas low visibility causes sub-VFR only 23% of the time (see graphs below).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	34	31	30	30	33	33	34	27	27	35	33	35	32
IFR	9	10	9	7	7	9	12	12	8	7	6	8	9
LIFR	3	4	3	2	2	3	6	6	5	3	2	3	4
VLIFR	1	1	1	1	1	1	1	1	1	0	0	1	1



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MVFR	14	13	12	10	9	8	10	11	12	14	12	14	12
IFR	10	10	8	5	4	5	9	11	10	7	7	10	8
LIFR	3	3	3	1	1	1	1	2	2	1	2	2	2
VLIFR	1	1	1	1	1	1	1	2	1	0	0	1	1

Key Points for Each TAF Site

Anchorage (PANC)
- IFR conditions most frequent between October and February
- Sub-VFR conditions rarely occur in May and June
- IFR favored by calm winds (especially during winter) and south-to-southwest flow
- SSE winds least favorable for IFR conditions

Barrow (PABR)
- IFR conditions most frequent between May and September, but MVFR conditions most frequent in October
- IFR conditions favored by any wind direction between 225 degrees and 135 degrees (ENE is the climatologically prevailing wind)
- Southerly flow least favorable for IFR conditions
- In summer, greatest IFR frequency occurs during the morning
- IFR conditions predominately caused by low ceilings in summer and low visibility in winter

Bethel (PABE)
- IFR conditions most frequent in August
- IFR favored by southerly flow and calm winds (particularly in winter)
- Northerly-to-easterly winds least favorable for IFR conditions
- In summer, greatest IFR frequency overwhelmingly occurs during the morning
- Sub-VFR conditions primarily caused by low ceilings, especially in summer
- Low ceilings most common in summer, but low visibility most common in winter

Cold Bay (PACD)
- IFR conditions most frequent in July and August
- IFR conditions least frequent in October
- IFR favored by west-to-northwest flow, especially in summer
- Easterly and southwesterly winds least favorable for IFR conditions
- In summer, greatest IFR frequency overwhelmingly occurs during the morning
- Sub-VFR conditions primarily caused by low ceilings, especially in summer
- Low ceilings most common in summer, but low visibility most common in winter

Deadhorse (PASC)
- IFR conditions most frequent between May and September (excluding July), but MVFR conditions most frequent in October
- Sub-VFR conditions favored by any wind direction between 270 degrees and 90 degrees (ENE winds are climatologically prevailing)
- Southerly flow least favorable for IFR conditions
- In summer, greatest IFR frequency occurs during the early morning hours
- IFR conditions predominately caused by low ceilings in summer and by low visibility in winter

Fairbanks (PAFA)
- IFR conditions most frequent between October and February
- Sub-VFR conditions very rare between April and June
- Calm winds and southerly flow favor IFR conditions (calm winds are climatologically prevailing)
- In winter, IFR conditions primarily forced by low visibility rather than low ceiling

Juneau (PAJN)
- Sub-VFR conditions most frequent between November and February
- Sub-VFR conditions least frequent in May and June
- MVFR dominates over IFR
- IFR favored by calm winds
- MVFR favored by ESE winds (ESE winds are climatologically prevailing)
- Sub-VFR conditions predominately caused by low ceilings

Kenai (PAEN)
- IFR conditions most frequent between November and February
- Sub-VFR conditions least frequent in May and June
- IFR favored by southwesterly flow
- Easterly winds least favorable for IFR conditions
- In summer, greatest IFR frequency occurs during the morning
- MVFR conditions predominately caused by low ceilings

King Salmon (PAKN)
- Sub-VFR conditions most frequent in July and August
- IFR conditions least frequent in September
- IFR favored by south-to-southwest flow
- Easterly and northeasterly winds least favorable for IFR conditions
- In summer, greatest IFR frequency overwhelmingly occurs during the morning
- Sub-VFR conditions primarily caused by low ceilings, especially in summer

Kodiak (PADQ)
- Greatest IFR frequency occurs in January and July (bimodal trend)
- IFR favored by east-to-northeast winds
- Westerly flow least favorable for IFR conditions
- In summer, greatest IFR frequency occurs during the morning
- Sub-VFR conditions predominately caused by low ceilings

Kotzebue (PAOT)
- IFR conditions most frequent in May and June
- Greatest MVFR (and collective sub-VFR) frequency occurs in August
- IFR favored by westerly flow, but MVFR favored by southerly flow
- Northeasterly winds least favorable for IFR conditions
- In summer, greatest IFR frequency occurs during the morning
- IFR conditions predominately caused by low ceilings in summer and low visibility in winter
- Low ceilings most common in summer, but low visibility most common in winter

McGrath (PAMC)
- IFR conditions most frequent between October and January
- Sub-VFR conditions least frequent in May and June
- IFR favored by ESE winds and calm winds (particularly in winter), but MVFR favored by southerly flow
- Northeasterly winds least favorable for sub-VFR conditions
- MVFR conditions predominately caused by low ceilings, but IFR conditions more often forced by low visibilities

Nome (PAOM)
- IFR conditions most frequent in July and August
- IFR conditions least frequent in September and October
- IFR heavily favored by southerly winds, particularly in summer
- Northerly winds least favorable for IFR conditions
- Sub-VFR conditions caused predominately by low ceiling, especially in summer

Valdez (PAVD)
- IFR conditions most frequent between December and February
- IFR conditions least frequent in May and June
- In winter, IFR conditions favored by calm winds and southerly-to-westerly flow, but discouraged by north-to-northeasterly flow
- In summer, IFR conditions favored by weak northeasterly winds
- In summer, greatest IFR frequency occurs during the morning
- IFR conditions primarily caused by low visibilities, especially in winter

Yakutat (PAYA)
- IFR conditions most frequent in July and August
- IFR favored by southeasterly flow
- Northerly and northeasterly winds least favorable for IFR conditions
- In summer, greatest IFR frequency overwhelmingly occurs during the morning
- Sub-VFR conditions primarily caused by low ceilings