Clear Skies for Takeoff: Ceiling and Visibility Climatology of Alaska

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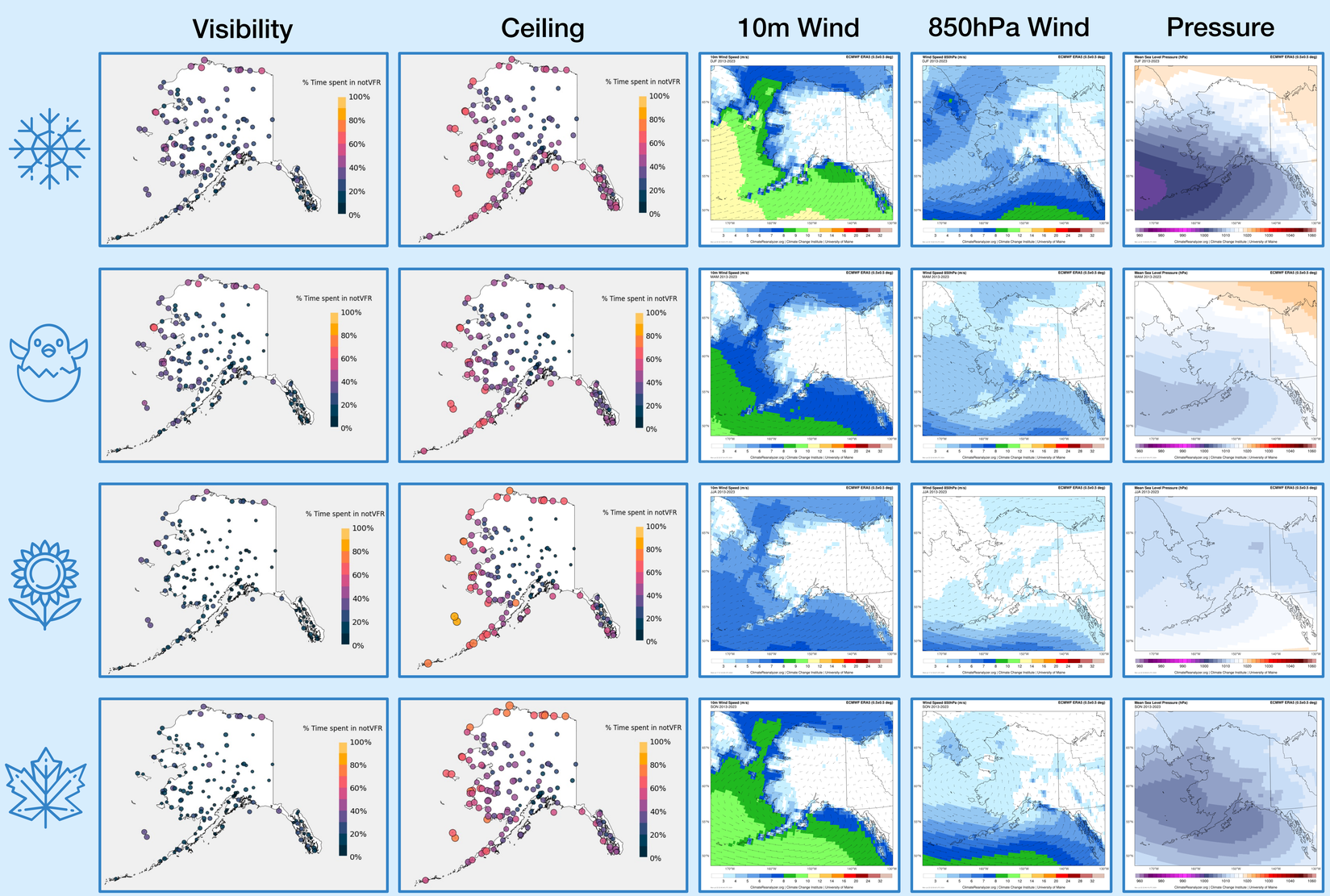
Motivation

Aviation is highly important in Alaska, especially due to the state's expansive geography. Many remote locations depend on small planes flying between small airports for transportation. Despite this, the aviation climatology of these airports is under researched. This project is an analysis of data provided by METAR (Meteorological Aerodrome Reports) to better characterize the occurrence of different ceiling and visibility conditions.

Methods and Dataset

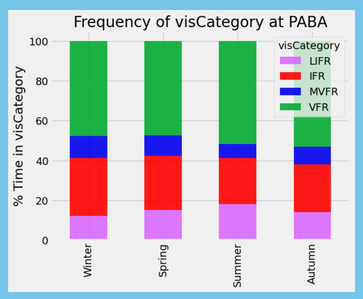
- Analyzed METAR data from 146 Alaskan airports from January 1, 2013 to December 31, 2023 prepared as a Parquet dataset
- Computed percent time spent in non-VFR flight categories (MVFR, IFR, and LIFR) associated with potentially hazardous flight conditions due to low ceilings or poor visibility
- Reviewed examples of airports that experience persistent non-VFR flight conditions
- Compared aviation climatology to weather patterns throughout seasons

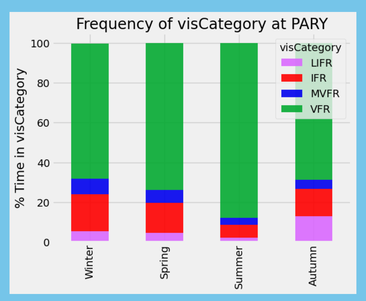


Visibility Examples

PABA is an airport on Alaska's north coast and sees some of the poorest visibility of Alaska's airports. Unlike many examples observed, there is no significant seasonal trend.

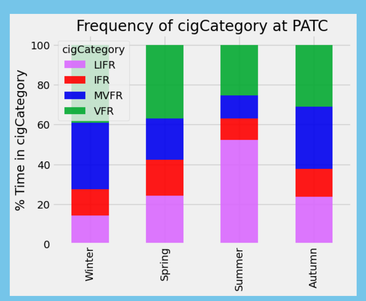
In contrast, PARY has worse visibility in the winter than in the summer south of Alaska's northern mountains.

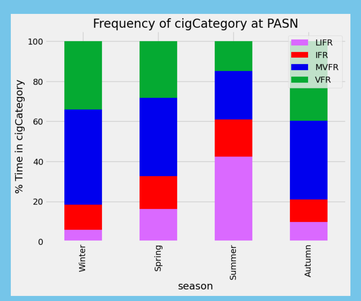




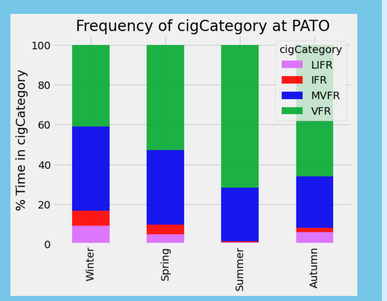
Ceiling Examples

PATC, an airport on the west coast of Alaska, experiences some of the lowest ceilings and worst overall aviation weather conditions in Alaska. In the summer, pilots must fly by LIFR flight rules over 50% of the time. PASN is an example of Aleutian Island weather conditions.





Similarly to visibility, mountains usually have somewhat worse ceilings in the winter than in the summer. PATO is an airport located in Alaska's southern mountain range.



Conclusions

Alaska's coasts and islands tend to have the worst flight conditions, particularly in the northern and western regions, and especially in the summer. Low ceilings commonly form along coasts due to warm air blowing over cold ocean water.

Mountains in Alaska experience more adverse aviation weather in the winter. The low-pressure system known as the Aleutian Low occurs during this season, along with turbulent winds in the mountain ranges.

Alaska has a complex climatology due to its diverse topography, dramatic seasonal variations and position between two global circulation cells. Further study could greatly benefit aviation weather products throughout the state.

References

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