CID Airport Flight On Time Analysis

Agenda

Introduction

Analysis

- Aircraft Carrier
- Seasonality - Day of Week and Holidays
- Type of Delay
- Choropleth Maps

Conclusions


Introduction

Overview

- Frequent flyers that have been impacted by flight issues through delays, diversions and cancellations.
- U.S. airline cancellation rates from 2017 compared to 2018 have increased to 2.4% of all flights* and flight delays have also increased annually.
- We wanted to understand timeliness of arrivals and departures and explore why flights are delayed at CID.

Hypothesis: There is a pattern as to why flights at CID are delayed that can they be distilled down to events that a future traveler can utilize to travel during a period and with an airline carrier that reduces the likelihood of their flight being impacted by a delay.

*Source: Dept. of Transport and title is U.S. airline cancellations IM2019 YoY

Background on Data

- Extracted data from Bureau of Transportation Statistics that is part of the US Department of Transport
- Full 12 months of data – 2018
- Data included both:
    - Arrivals into CID
    - Departures from CID
- Frequency of data:
    - Month
    - Day of month
    - Day of week
- Total records: 19, 989

Variables Leveraged

Variables and key definitions:

- Frequency of data
- Airline carrier name
- Flight origin and destination
- Departure delay
- Arrivals delay
- Cancelled
- Diverted
- Type of delay:
  - Carrier
  - Weather
  - NAS
  - Late aircraft

Aircraft Carrier Analysis

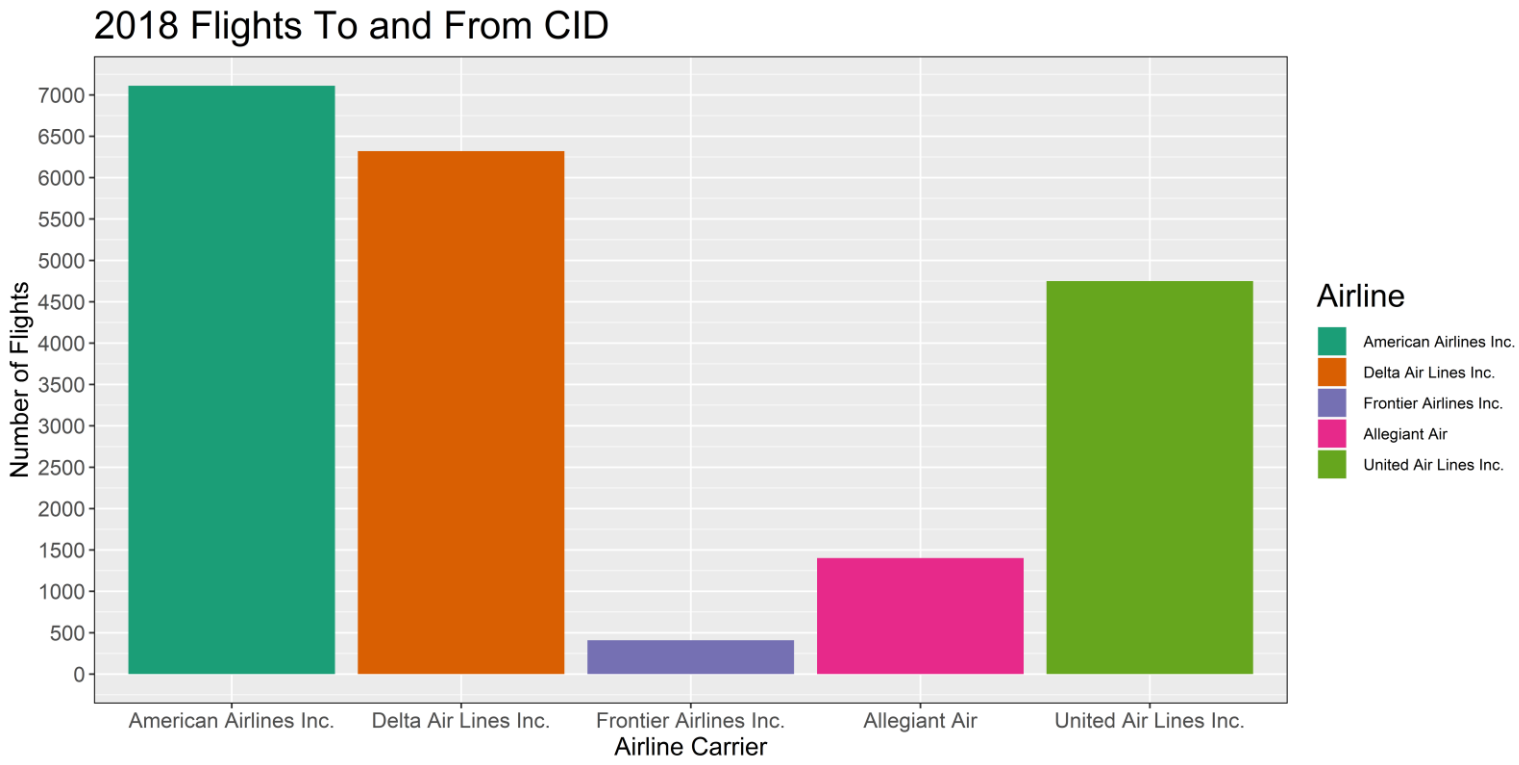
Now Boarding

Number of Flights by Airline Carrier

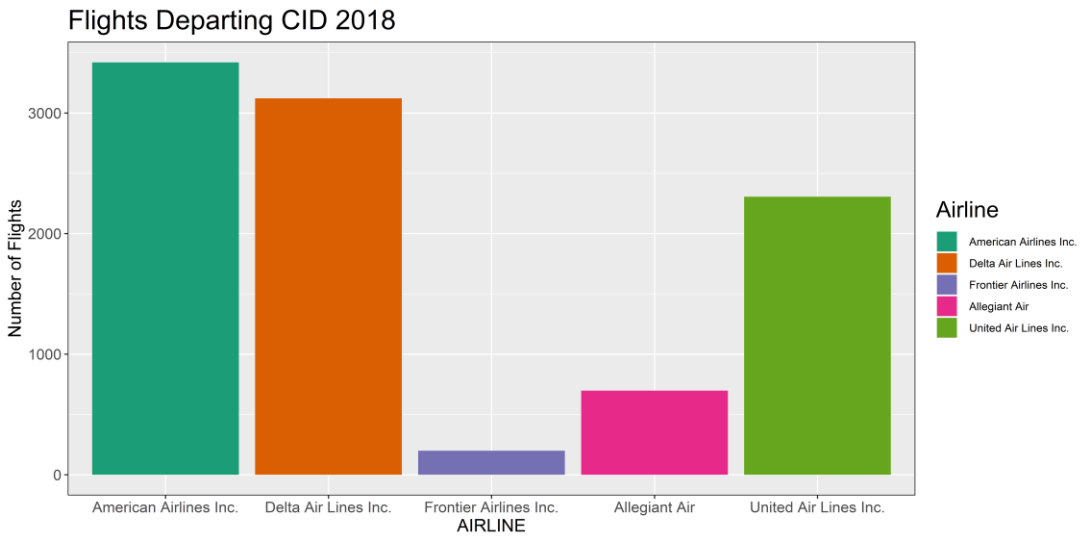
What airlines service Cedar Rapids?

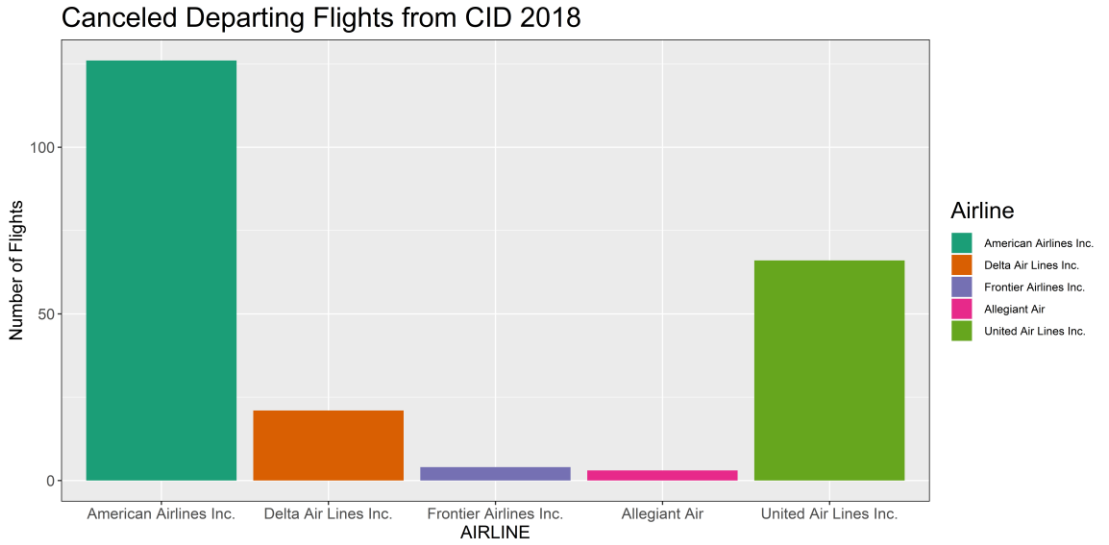
Initial questions:

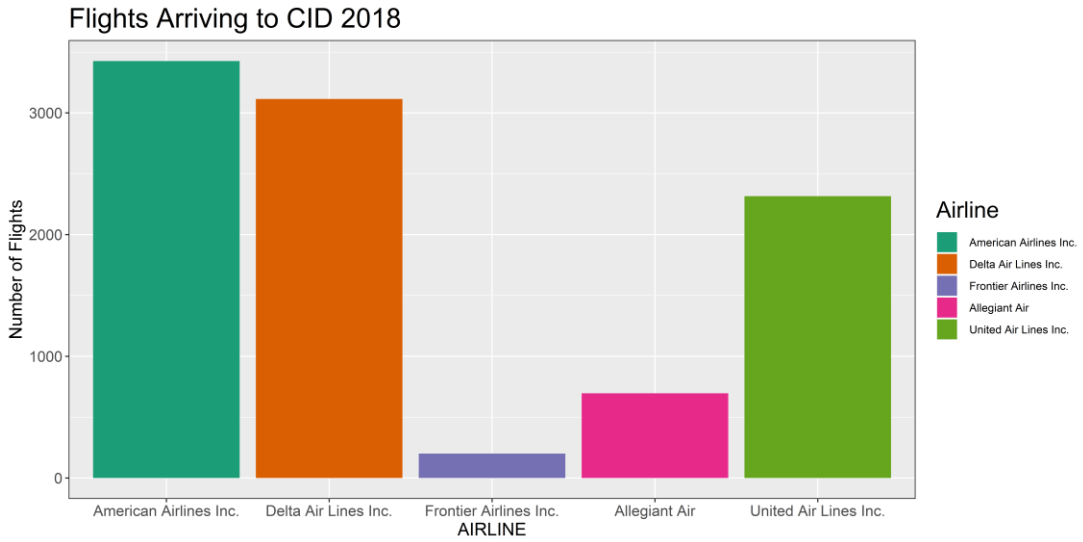
- Why such variations in number of flights per airline?
- All airlines flying all year?
- Trends maintained with further stratification and granularity?

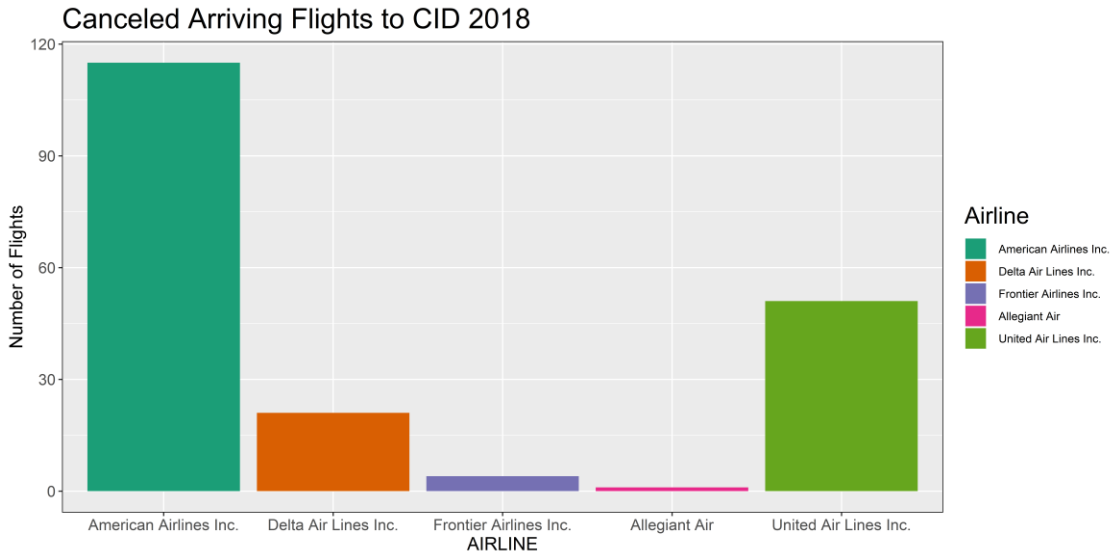


To and From


Flights Departing CID 2018
Number of Flights
3000
2000
1000
0
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.
AIRLINE
Airline
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.

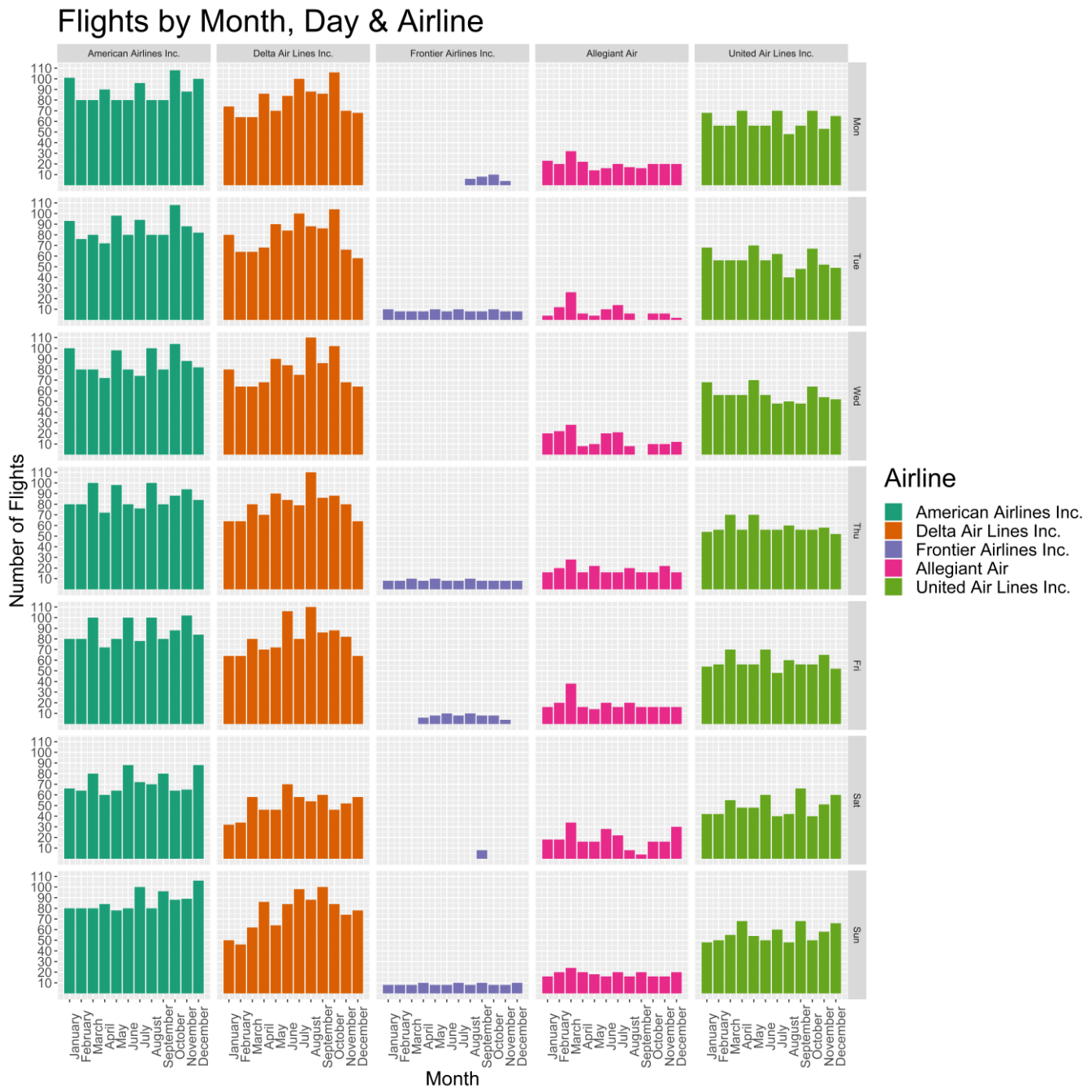

Canceled Departing Flights from CID 2018
Number of Flights
100
50
0
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.
AIRLINE
Airline
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.


Flights Arriving to CID 2018
Number of Flights
3000
2000
1000
0
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.
AIRLINE
Airline
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.


Canceled Arriving Flights to CID 2018
Number of Flights
120
90
60
30
0
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.
AIRLINE
Airline
American Airlines Inc.
Delta Air Lines Inc.
Frontier Airlines Inc.
Allegiant Air
United Air Lines Inc.

A Year in Cedar Rapids

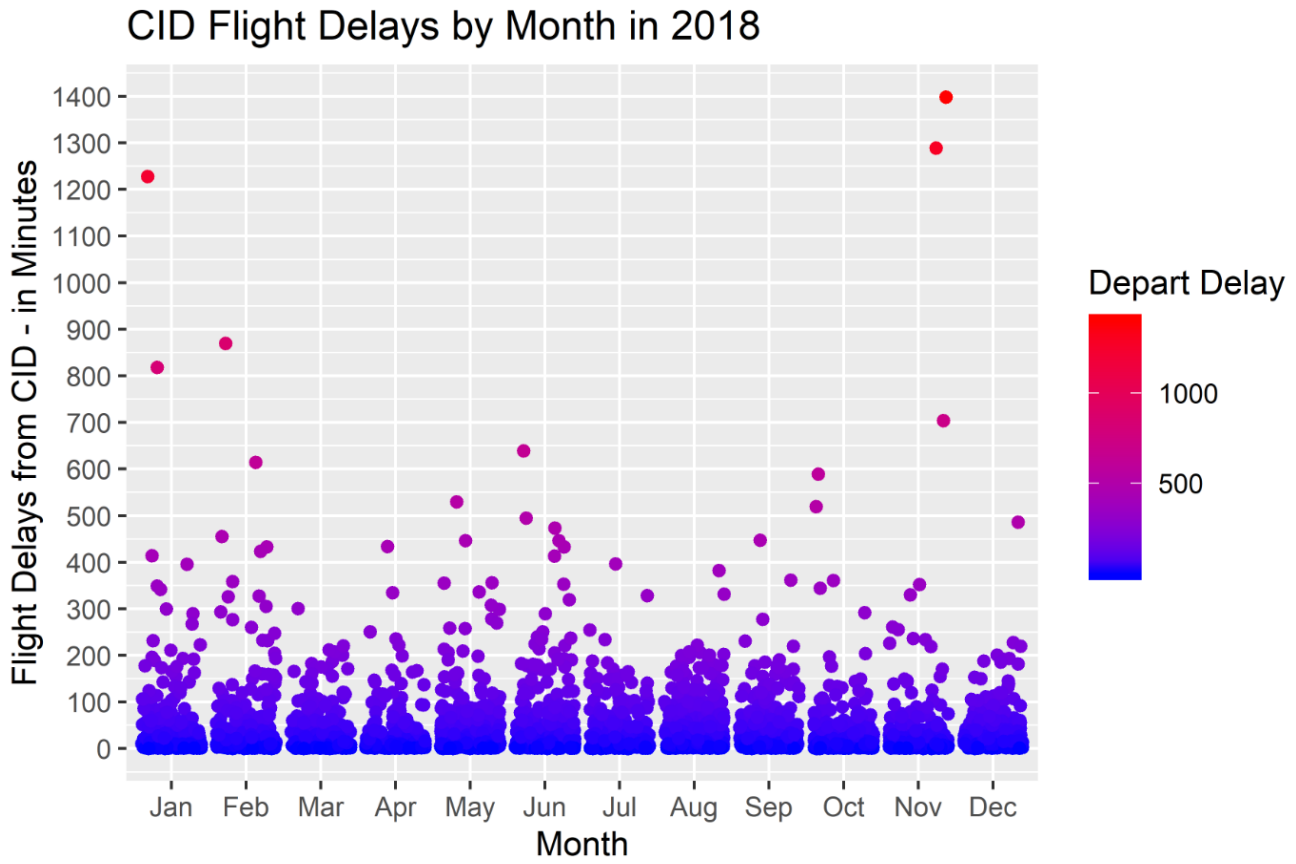
- High vs Low volume airlines
  - "Budget Airlines"
- Flights per month on trend with peak U.S. travel seasons



Delays by Seasonal Analysis

Seasonality - Flight Delays by Month

Departing Flights



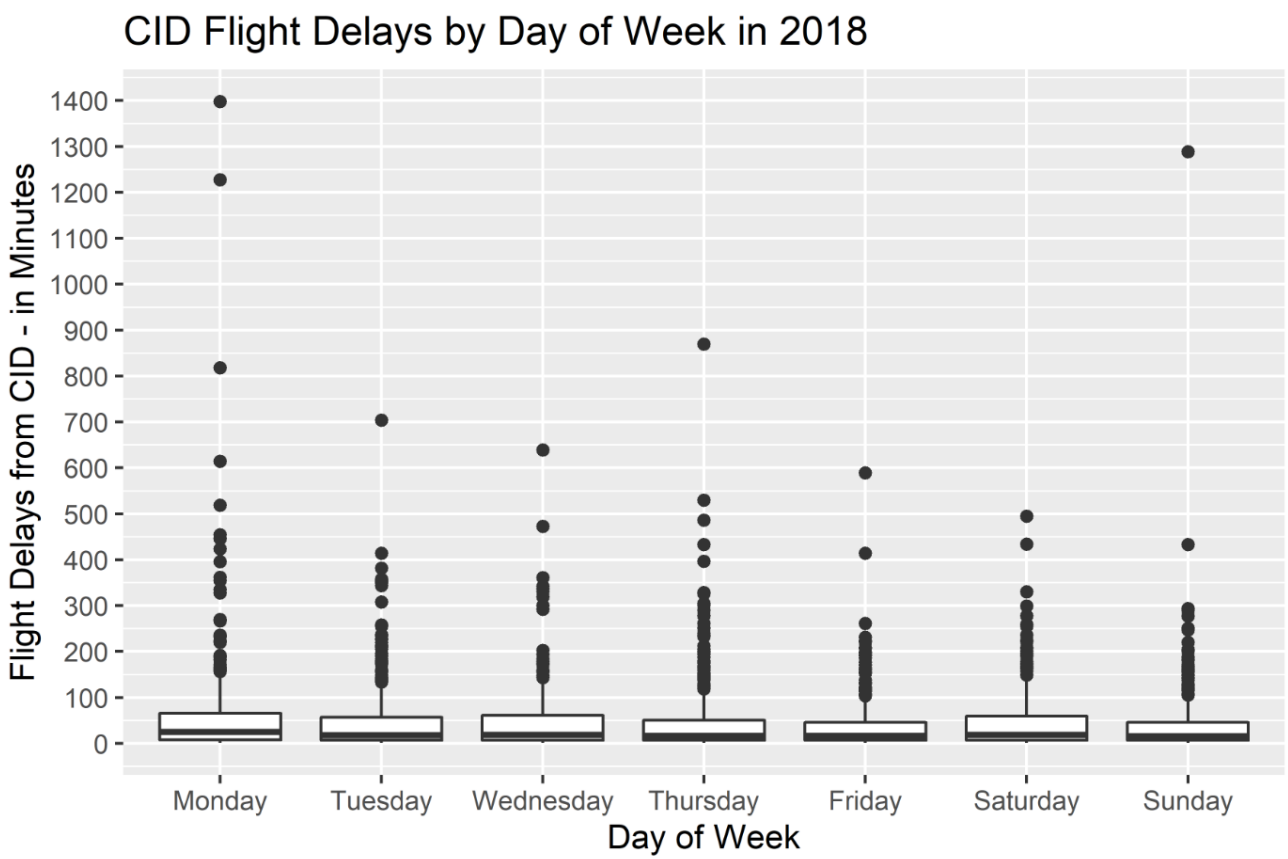
Statistics Summary – By Month in 2018

MONTH	Num_Delays	Mean_delay	Median_delay	Standard_Deviation
Jan	251	54.7689	20	112.3174
Feb	230	58.1217	18.5	103.1425
Mar	221	38.7783	16	52.3613
Apr	182	36.0934	11.5	60.8912
May	246	51.2236	21	78.0857
Jun	292	55.8733	22.5	87.1132
Jul	246	41.6748	18	55.025
Aug	296	47.75	25	57.7896
Sep	222	46.3108	22	62.4108
Oct	261	34.9617	13	66.3445
Nov	224	50.0759	15.5	142.0864
Dec	235	39.617	21	53.4507

Best Months to Travel
Worst Months to Travel

Seasonality – Flight Delays by Week

Departing Flights



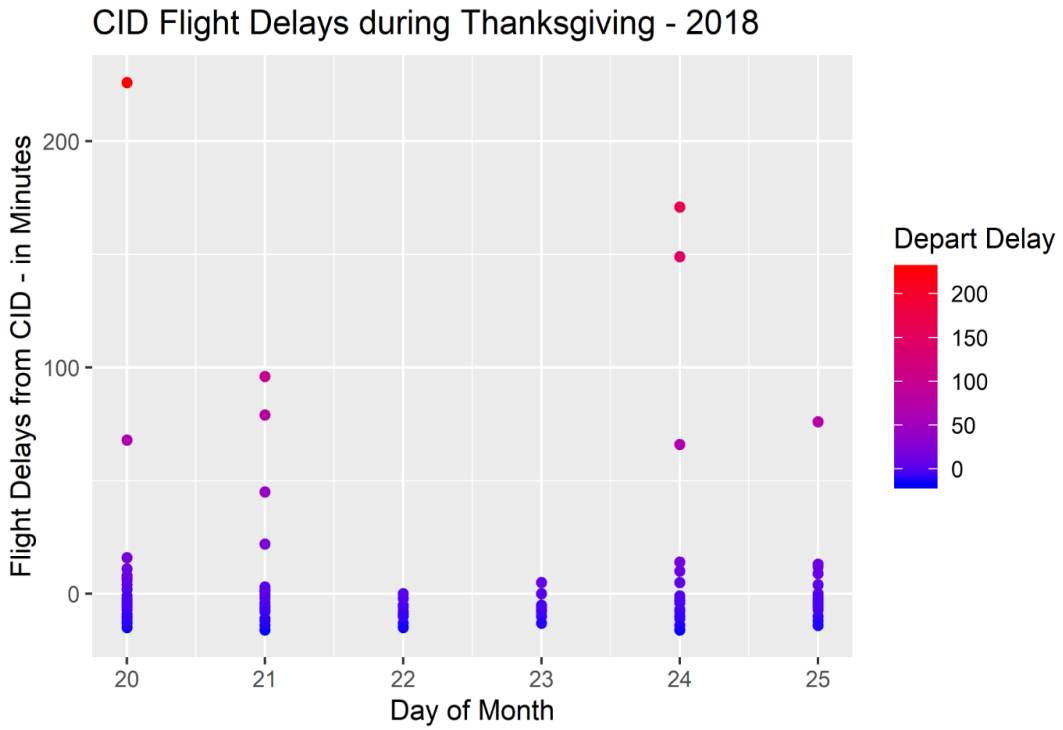
Statistics Summary – By Day of Week in 2018

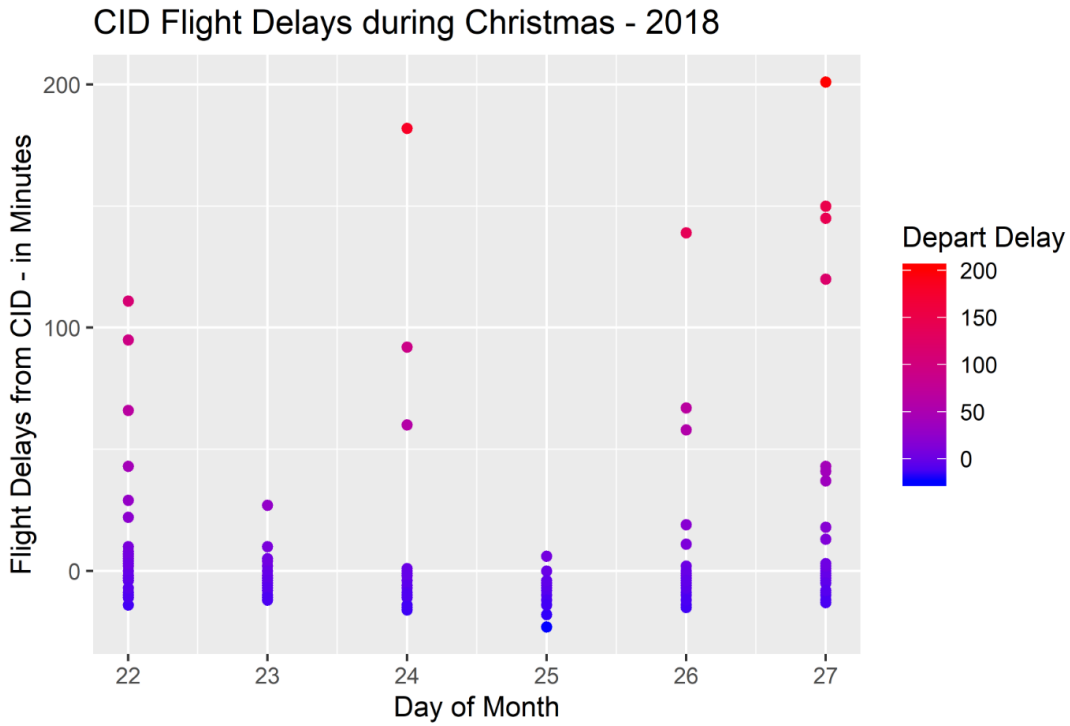
DAY_OF_WEEK	Num_Delays	Mean_delay	Median_delay	Standard_Deviation
Monday	446	59.8632	25	121.9267
Tuesday	417	49.2182	18	77.2697
Wednesday	357	46.5546	19	70.7819
Thursday	477	45.6939	17	78.5912
Friday	434	38.3664	17	56.3670
Saturday	327	46.5933	19	67.7284
Sunday	448	40.0960	16	79.3195

Best Day of Week to Travel
Worst Day of Week to Travel

Seasonality - Flight Delays by Holidays

Departing Flights





November 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		20	21	22 Thanksgiving	23	24
25						

Best days to travel

December 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						22
23	24	25 Christmas	26	27		

Best days to travel

Delay Type Analysis

Arrivals

Late aircraft is the largest delay type across arrivals to CID.

The delay type that has the lowest volumes impacting arrivals is weather delay, which makes sense as they reflect tornados, blizzards and hurricanes.

Across all 4 delay types we see an increase across summer months.

Number of Flights

Month	Weather	NAS	Carrier	Aircraft
Jan	28	80	72	88
Feb	28	75	52	66
Mar	8	53	68	55
Apr	10	66	54	43
May	23	81	71	86
Jun	24	113	86	96
Jul	22	89	86	94
Aug	35	96	80	103
Sep	18	72	59	71
Oct	12	83	65	59
Nov	8	98	68	73
Dec	15	82	81	82

Departures

Delay Type
by Month

Weather and NAS delay types peak in February.

Carrier and aircraft delays are high during June.

Number of Flights

Month	Weather	NAS	Carrier	Aircraft
Jan	13	76	45	90
Feb	28	123	62	91
Mar	13	103	49	72
Apr	11	83	33	63
May	21	78	57	93
Jun	16	101	68	136
Jul	7	74	60	96
Aug	37	83	48	116
Sep	23	58	47	73
Oct	14	66	41	75
Nov	7	73	43	75
Dec	19	96	44	96

Arrivals

Delay Type by State

High delays comes in from Mid-West and IL is the largest across all delay types.

The least arrival delay states are CA, NV and AZ.

Aircraft and NAS delay types are the highest of all the other delay types.

Number of Flights

Origin State	Weather	NAS	Carrier	Aircraft
AZ	5	15	17	19
CA	0	2	0	0
CO	11	92	110	107
FL	10	32	34	21
GA	18	49	75	57
IL	82	430	322	385
MI	13	84	85	84
MN	24	109	71	91
NC	33	67	60	73
NV	0	4	6	2
TX	35	104	62	77

Departures

Delay Type by State

High departure delays to IL, MN, MI, TX.

The least departure delays is to CA, NV, AZ and FL.

Aircraft delay type is significantly high to IL, MN and MI (Midwest) area.

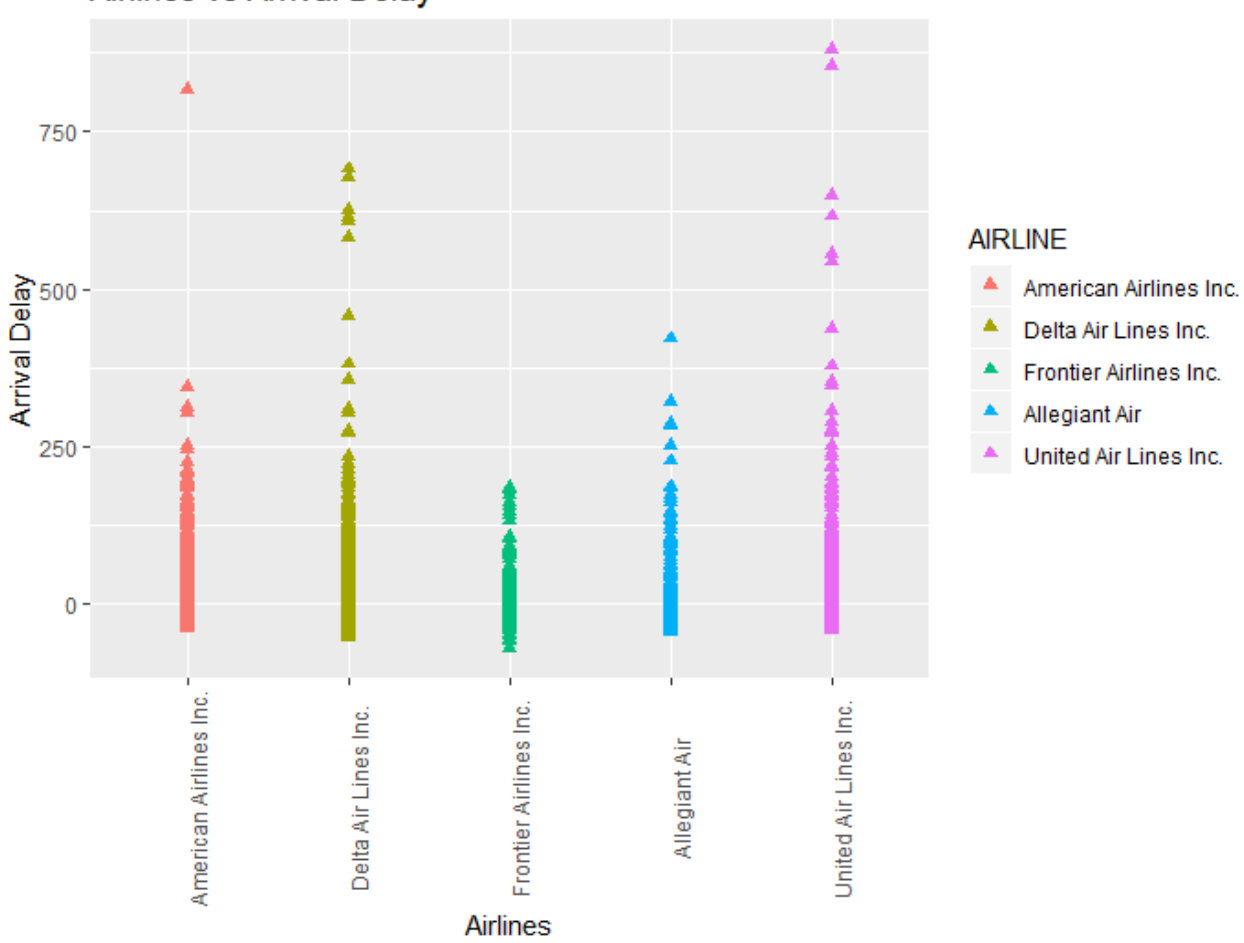
Number of Flights

Origin State	Weather	NAS	Carrier	Aircraft
AZ	3	29	30	34
CA	0	1	2	0
CO	12	96	61	84
FL	4	42	39	55
GA	10	105	59	71
IL	70	399	182	465
MI	26	75	32	109
MN	22	82	46	120
NC	19	51	50	39
NV	2	14	11	6
TX	41	120	85	93

Arrivals

Delay by Airline Carrier

Total Number of Flights



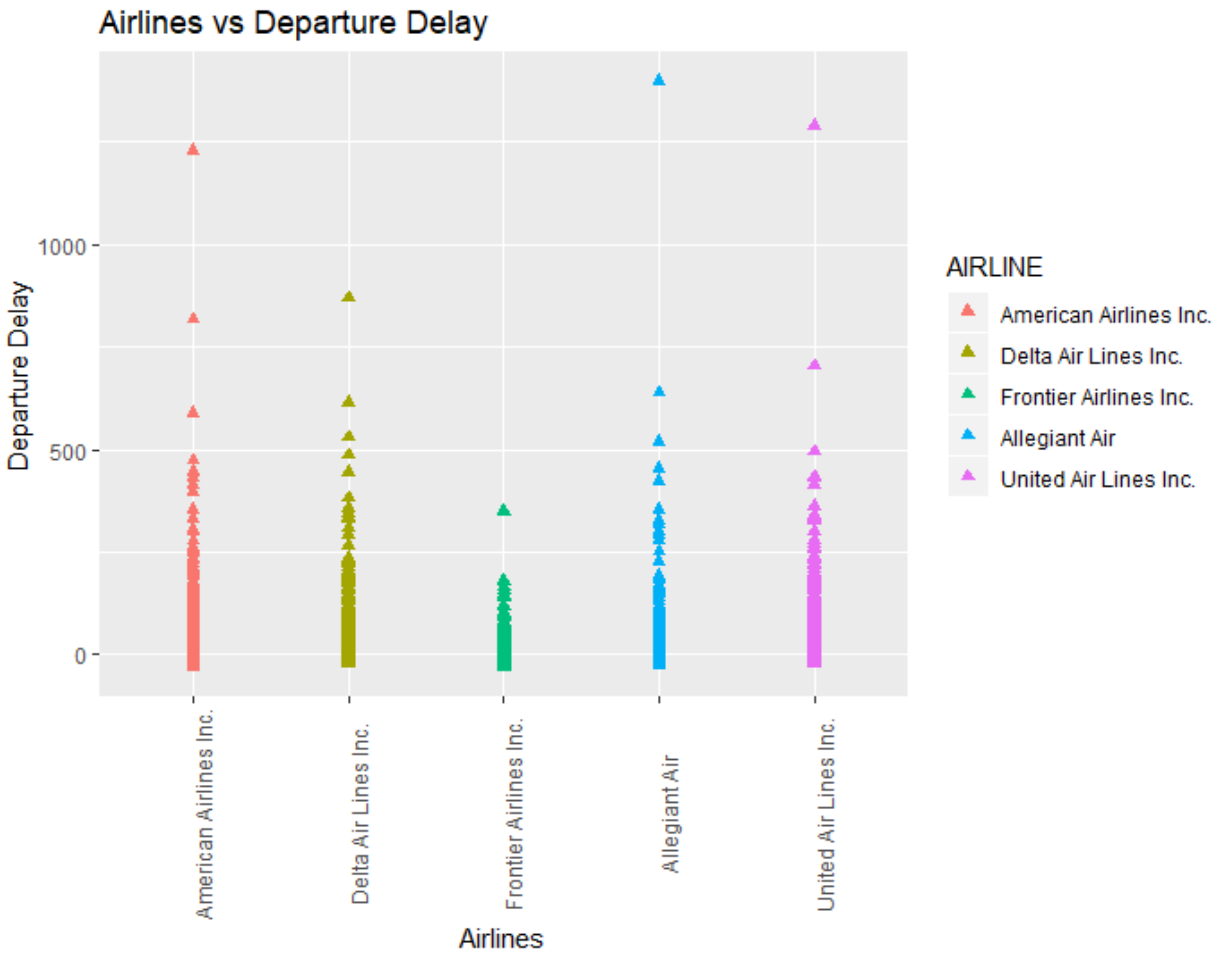
Number of Flights

Airline	Weather	NAS	Carrier	Aircraft
American Air-line Inc.	124	432	256	345
Delta Air Lines Inc.	55	242	231	232
Frontier Air Lines Inc	2	24	36	37
Allegiant Air	14	52	56	37
United Air Lines Inc.	36	238	263	265

Departures

Delay by
Airline Carrier

Total Number of Flights



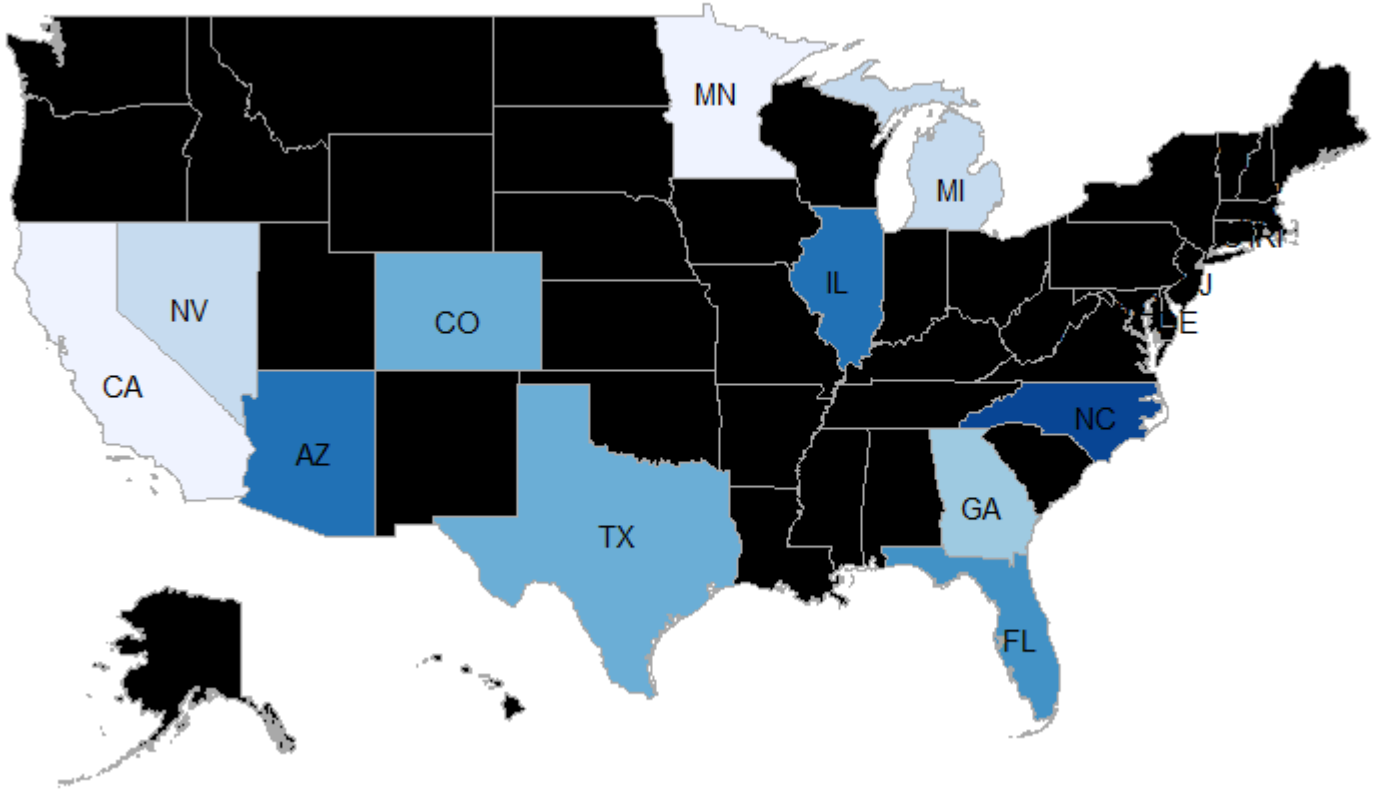
Number of Flights

Air-Line	Weather	NAS	Carrier	Aircraft
American Air-line Inc.	113	355	254	383
Delta Air Lines Inc.	58	262	137	300
Frontier Air Lines Inc	0	28	18	44
Allegiant Air	9	85	80	92
United Air Lines Inc.	29	284	108	257

Choropleth Map Analysis

Average Arrival Time Variance

Flights Departing from Cedar Rapids



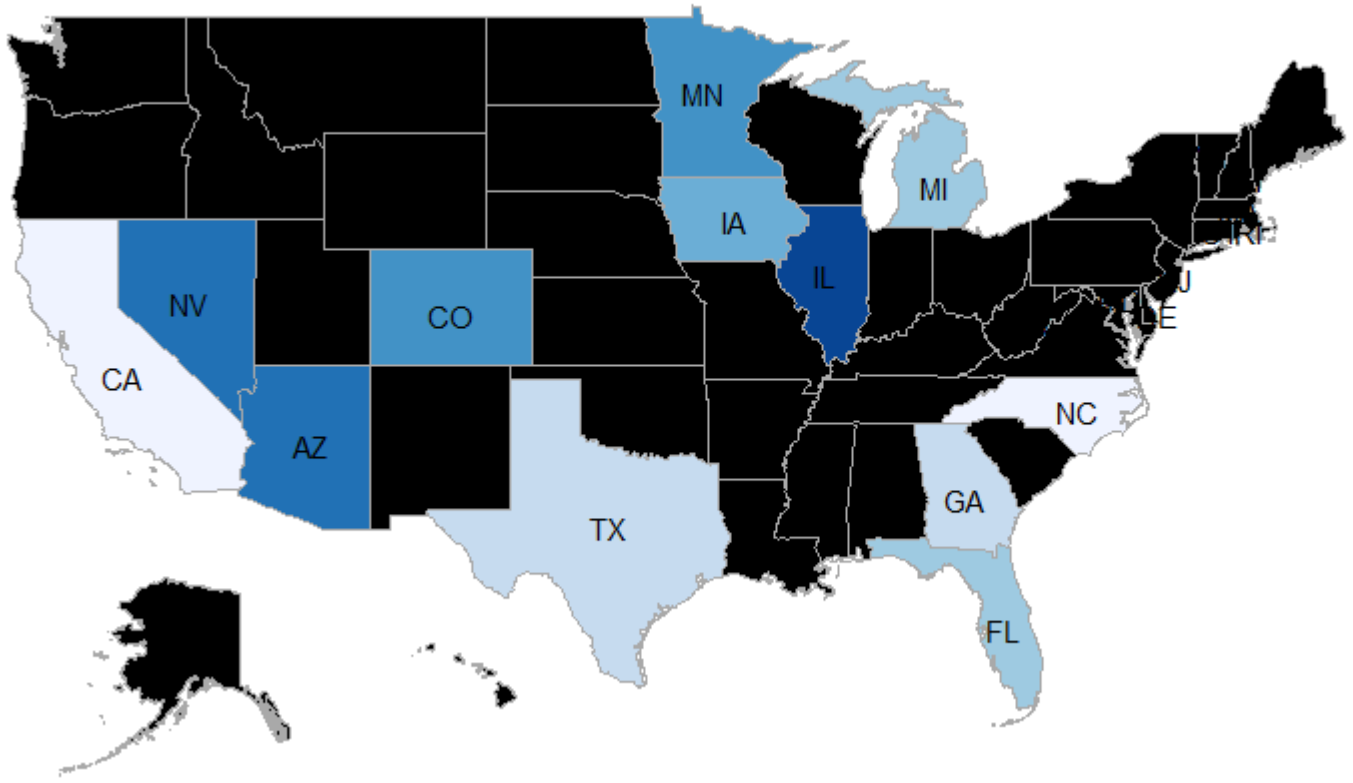
Minutes

- [-6.15 to 1.63)
- [1.63 to 2.50)
- 2.5
- [3.21 to 7.04)
- 7.04
- [9.32 to 21.97)
- 21.97
- NA

region	value
arizona	14.0894737
california	-6.1500000
colorado	6.3479769
florida	7.0423940
georgia	2.5005727
illinois	9.3154947
michigan	1.6315789
minnesota	0.1793042
nevada	2.3357771
north carolina	21.9741379
texas	3.2137862

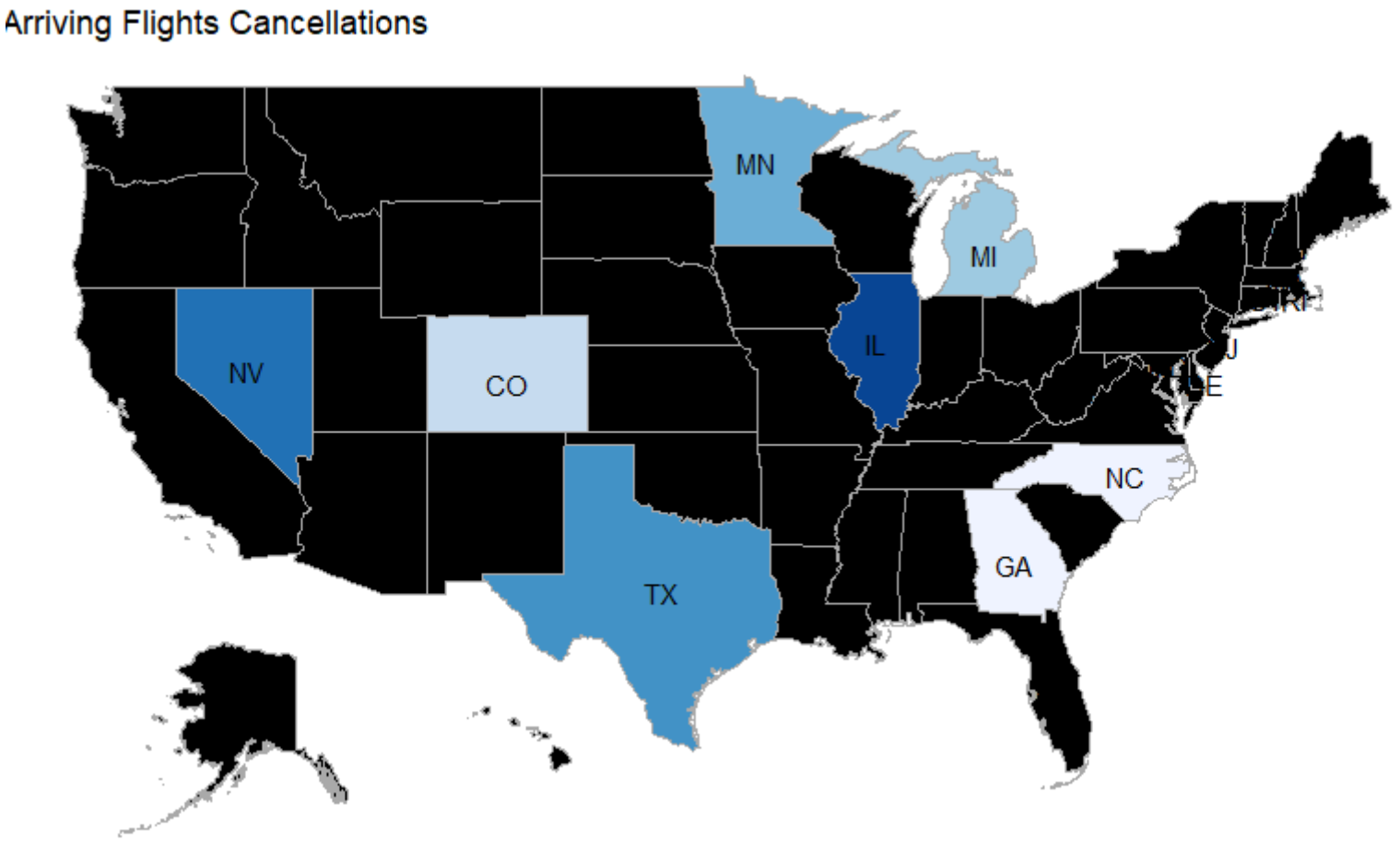
Average Arrival Time Variance

Flights Arriving in Cedar Rapids



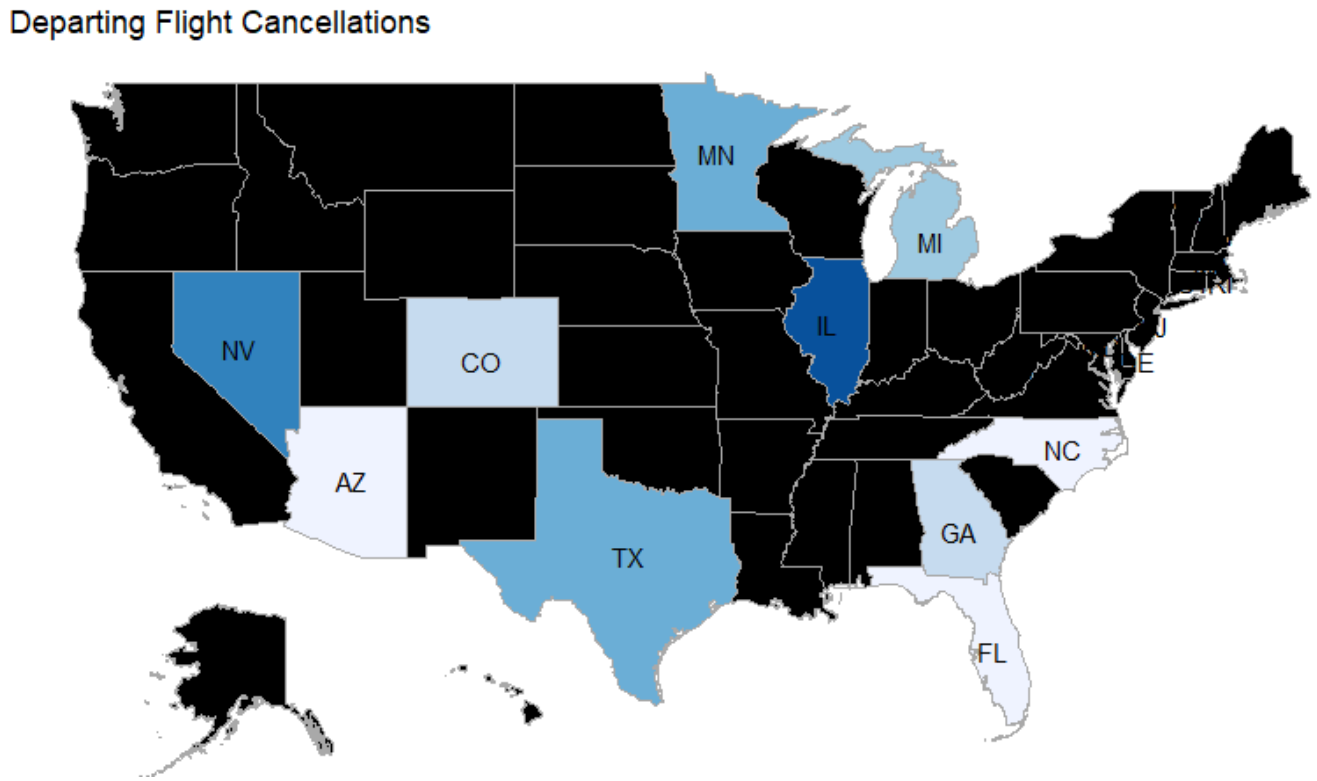
	region	value
1	arizona	13.439024
2	california	-5.950000
3	colorado	11.808535
4	florida	9.172043
5	georgia	7.016204
6	illinois	295.000000
7	iowa	10.478247
8	michigan	9.013011
9	minnesota	10.665461
10	nevada	11.818591
11	north carolina	-2.517857
12	texas	4.469388

Frequency of Arriving Cancellations



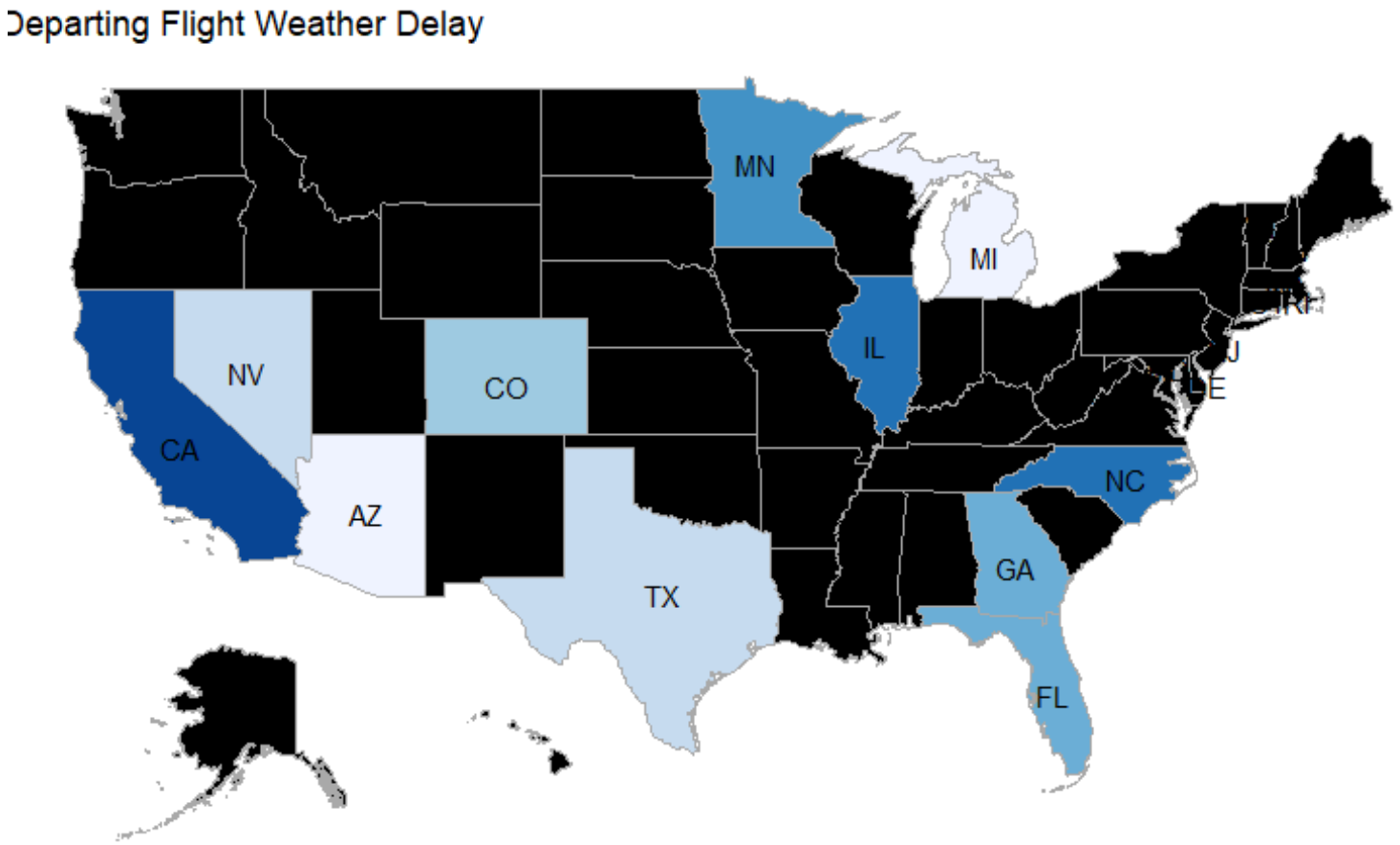
	region	value
1	colorado	5
2	georgia	3
3	illinois	130
4	michigan	6
5	minnesota	12
6	nevada	20
7	north carolina	1
8	texas	15

Frequency of Departing Cancellations



	region	value
1	arizona	1
2	colorado	6
3	florida	1
4	georgia	3
5	illinois	148
6	michigan	8
7	minnesota	10
8	nevada	26
9	north carolina	1
10	texas	16

Average Departing Weather Delay



	region	value
1	arizona	14.48276
2	california	65.00000
3	colorado	24.29167
4	florida	25.19048
5	georgia	24.69811
6	illinois	30.97243
7	michigan	21.34667
8	minnesota	29.60976
9	nevada	21.43137
10	north carolina	37.50000
11	texas	23.65000

Conclusion

Conclusion

- Delays have a seasonal pattern by month, by day of the week, and by holidays. Best months to travel is March, April, and October and the best day of the week is Friday.
- Overall National Air System delay is significantly higher than all the other delay types.
- Flying in or out of CID, the highest number of delays as well as the longest average delay is flying to Illinois, and the lowest is California. While the cause behind this is unknown, it can be helpful in planning a trip.
- Thank you


Thank You