

1 Contribution of ISU's working group ‘Statistical Graphics’

1.1 Flight Volume & Delays

Flight volumes overall is on the increase (see figure1 for four major airports). Structural shifts in the loads of airports led to minimal average delays in ‘02 and ‘03 (see figure 2). Average delays have been increasing since. Delays build up during the day, with a maximum reached in the early evening hours.



Figure 1: Flight volumes at four major airports shown as daily number of flights over time. Atlanta (ATL) shows the largest structural changes during the time period. Seattle-Tacoma (SEA) exhibits a strong seasonal pattern.

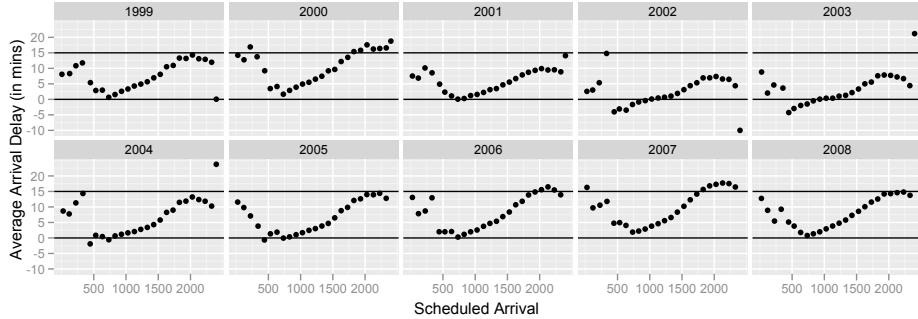


Figure 2: Average arrival delays over the course of a day. Delays build up quite considerably throughout the day. During 2001 – 2003 delays were cut back from previous years, but have crept back up again.

1.2 Ghosts of Flights

Tail numbers uniquely identify a plane and are recorded electronically during take-off and landing making it possible to track each aircraft’s journey over its lifetime. Flight paths re-constructed form the data show interruptions, that is, a plane takes off from a different location than it last landed. We have to assume that the plane covered (at least) this distance in the air – and – with the exception of international flights – was flying empty as a *ghost flight*.

Figure 3 shows all ghost flights for Hawaiian Airline (HA), Jetblue Airways (B6) and Airtran Airways Corporation (FL) in 2008. Neither one of these carriers did fly internationally

during that time.

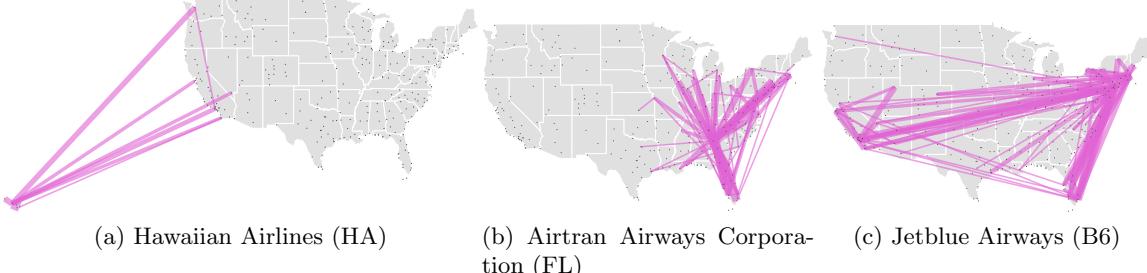


Figure 3: *Ghosts flights of three local carriers in 2008.*

1.3 Windy Situations

Do crosswinds have an impact on on-time performance? - We tried to answer this question at the example of Phoenix International Airport, where all three runways are oriented West-East (see figure 4). Weather data collected at Phoenix Skyharbor (PHX) published by Weather Underground (<http://www.wunderground.com>) is linked to the Expo Data.

Figure 5 shows arrival delays plotted against permutations of wind direction (null plots) as suggested by [?]. One plot is of the real data of the observed wind directions. If we can differentiate this plot from the null plots, we can reject the null hypothesis of crosswinds being unrelated to arrival delays with a p -value of less than $1/10 = 0.10$. The plot of the data is number four. It is left to the reader to decide, whether this plot is different from the others – but evidence gathered informally suggests this to be the case (8 out of 10 group members decided on plot number four – all suggesting the box in SW as the reason, yielding a theoretical p -value of well below 0.0001)



Figure 4: *Phoenix International Airport: all three runways (marked by horizontal lines) are in West-East Direction.*

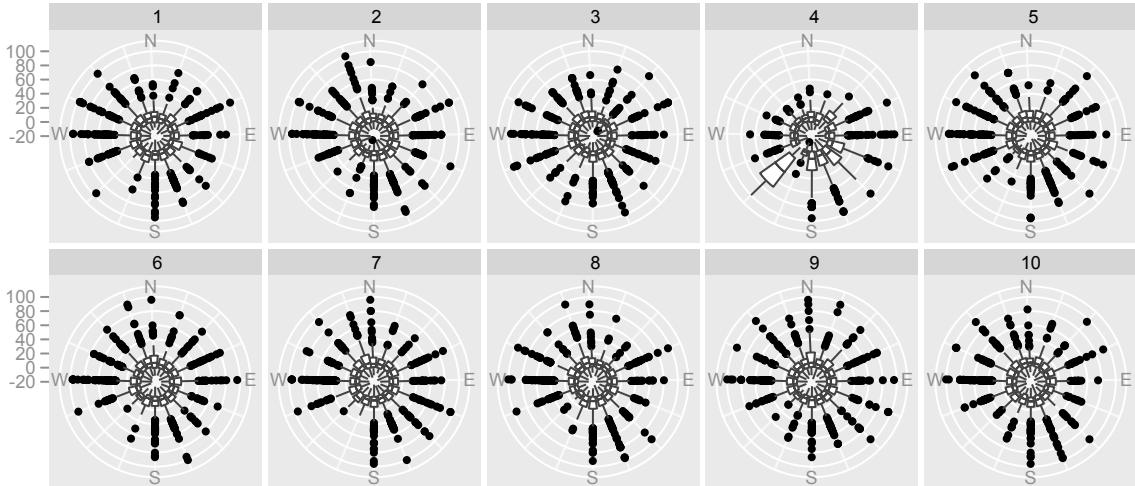


Figure 5: *Delays (in minutes) by wind direction. Only one plot shows the observed data, the others are permutations (null plots).*