Weather Index Project: Investigating the effect of weather on flight delays

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Agenda

- ➤ Background
  - Industry
  - Flight Delays
  - Goals & Objectives
- ➤ Data Processing
- ➤ Analysis
- ➤ Future Actions

BACKGROUND

U.S. Airline Industry

➢ Carry over 1/3 of the worlds total air traffic

➢ 737.4 million passengers in 2011

➢ Valued at $187b in 2011 with a forecast value of $316b in 2016 (70% increase)

➢ Commercial aviation contributes 8% of US GDP

Huge and economically-significant industry - an integral part of the creation of a global economy

Flight Delays - Impact

➢ An average of 688,000 flights (20% of total flight operations) are delayed per year in the past ten years

Delayed (%)

[1]http://newscenter.berkeley.edu/2010/10/18/flight delays/
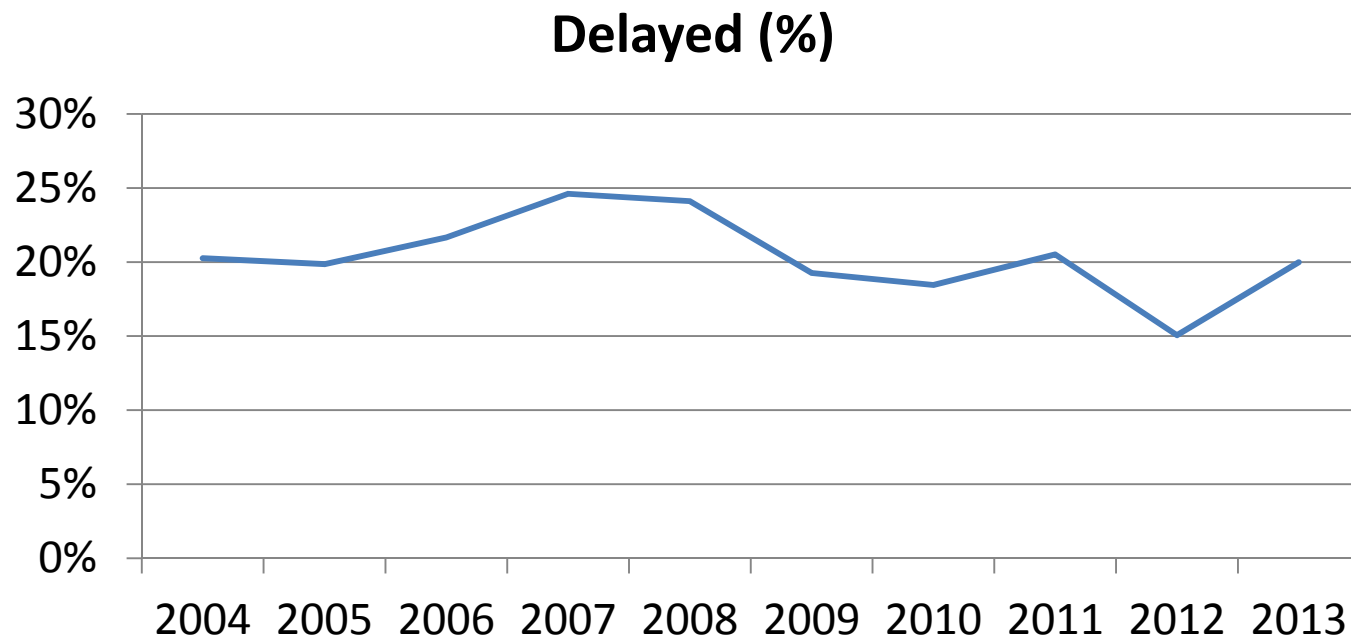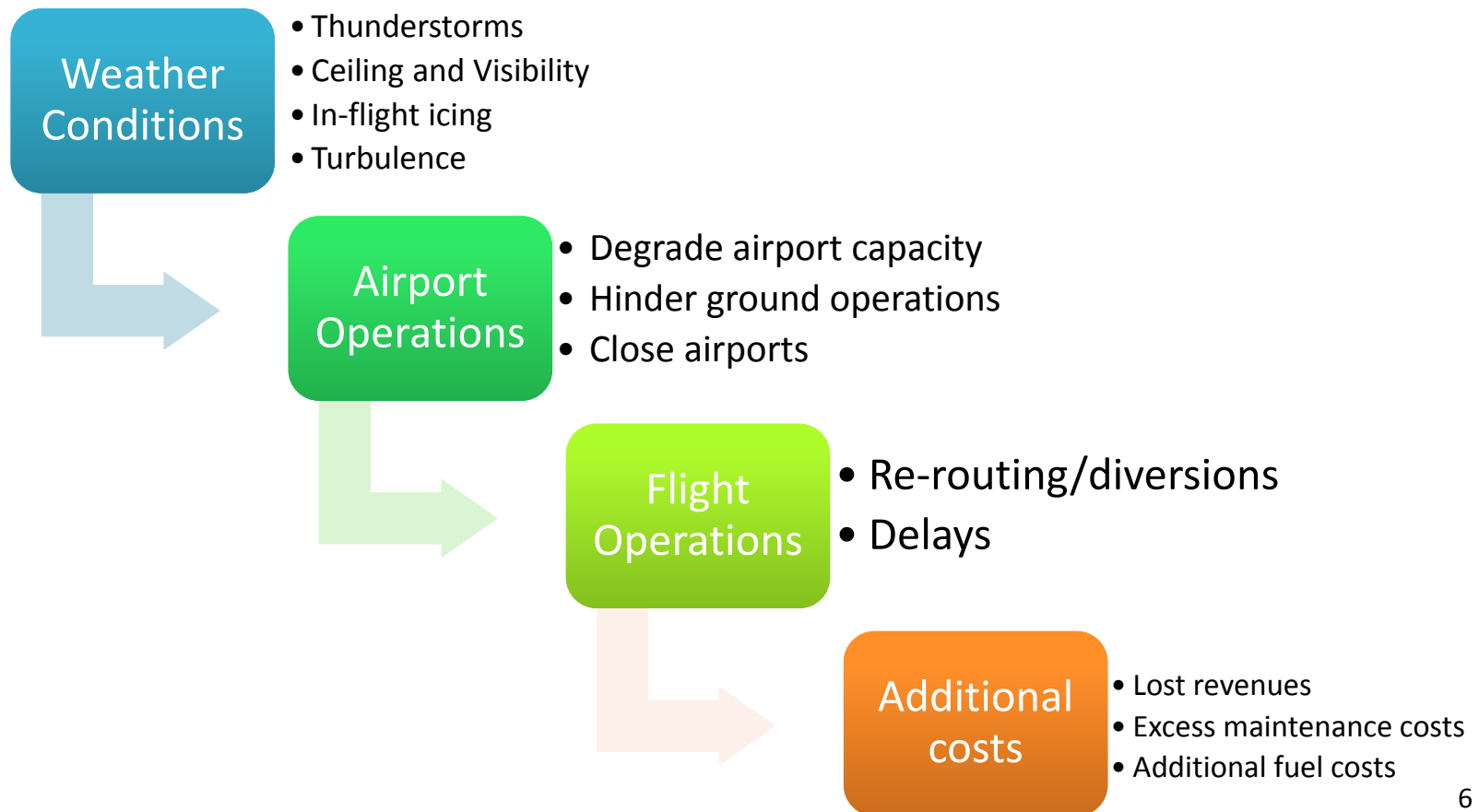
Flight Delays - Impact

➢ Domestic flight delays imposed a $32.9 billion cost on US economy in 2007[1]

    ➢ Half the cost was borne by passengers

Cost Component	Cost (in billions)
Costs to Airlines	$8.3
Cost to Passengers	$16.7
Costs from Lost Demand	$3.9
Total Direct Cost	$28.9
Impact on GDP	$4.0
Total Cost	**$32.9**

[1]http://newscenter.berkeley.edu/2010/10/18/flight_delays/

BACKGROUND

Weather Delays

Weather Conditions
- Thunderstorms
- Ceiling and Visibility
- In-flight icing
- Turbulence

Airport Operations
- Degrade airport capacity
- Hinder ground operations
- Close airports

Flight Operations
- Re-routing/diversions
- Delays

Additional costs
- Lost revenues
- Excess maintenance costs
- Additional fuel costs

BACKGROUND

Goals & Objectives

To develop a sophisticated database tool that

➢ contains ten years' worth of weather data and the matching ten years' worth of flight data

➢ spans all major US airports and all major carriers

➢ enables a wide range of detailed analysis of link between weather and flight delays

BACKGROUND

Potential Questions

➢ Which weather factor impacts on-time performance the most?

➢ How long do weather delays typically last?

➢ Which airport's weather has the biggest impact on the system as a whole?

➢ Under which weather conditions is WN performance better than other carriers? Under which weather conditions is it worse?

DATA PROCESSING

Flight Data

- Extracted from [Bureau of Transportation Statistics (BTS)](#)

- 10 years of complete domestic flight records from 2003 to 2012

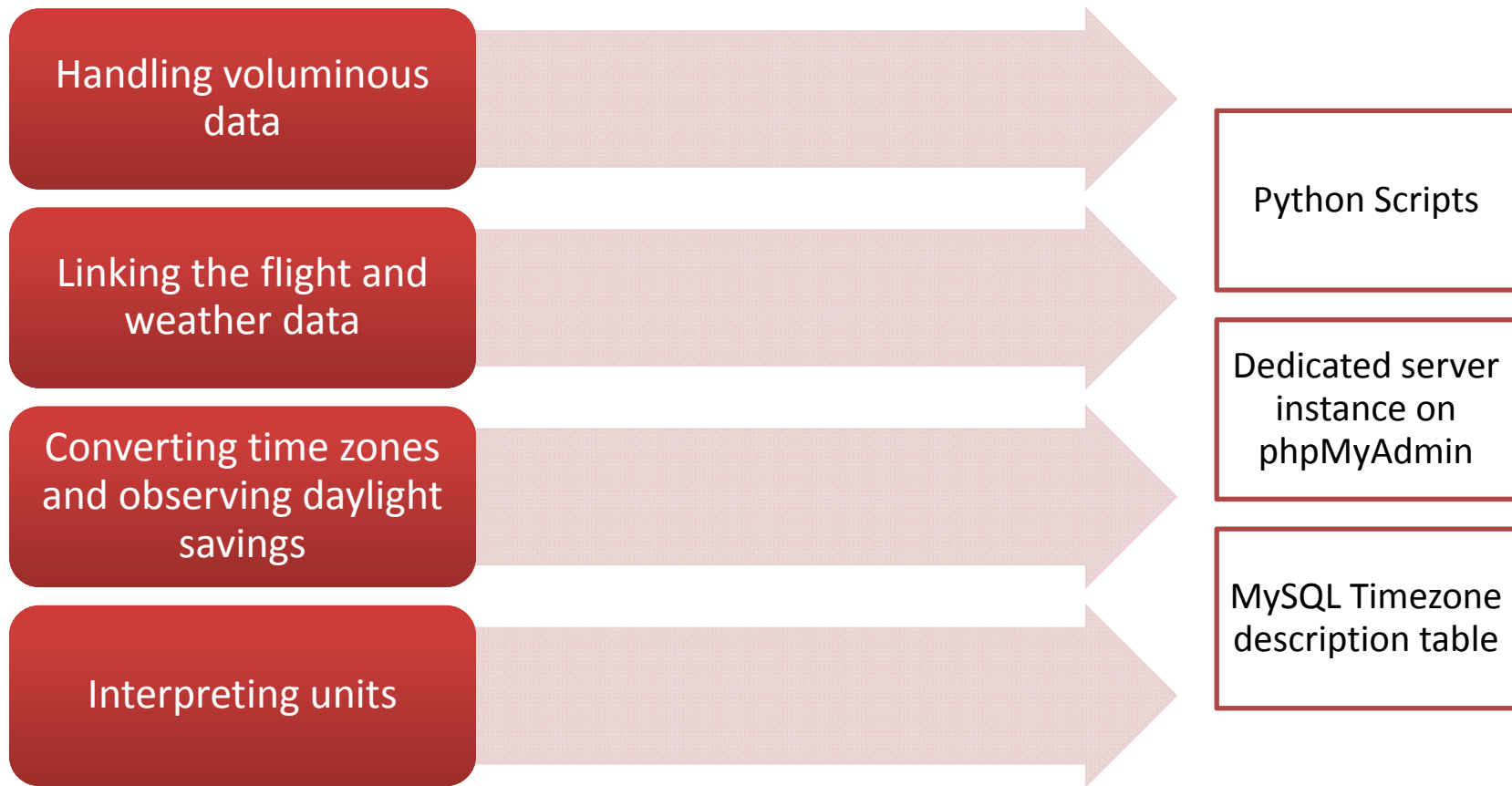- Total 120 files with >67,000,000 records

DATA PROCESSING

Weather Data

- Extracted from [National Oceanic and Atmospheric Administration (NOAA)](#)

- 10 years of data: 2003-2012

- >41,000,000 records

- 7 weather factors:
  - ❖ Wind direction
  - ❖ Wind speed
  - ❖ Ceiling height
  - ❖ Visibility
  - ❖ Air temperature
  - ❖ Dew point
  - ❖ Sea level pressure
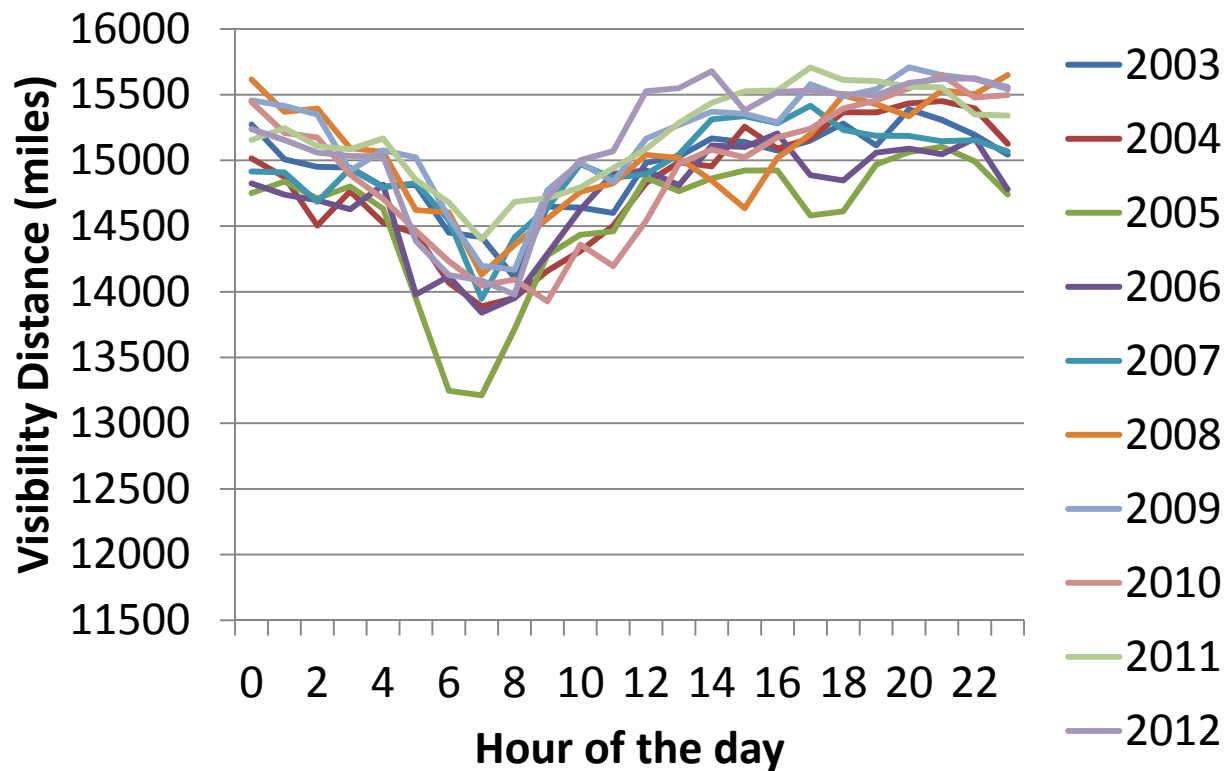
DATA PROCESSING

Challenges & Solutions

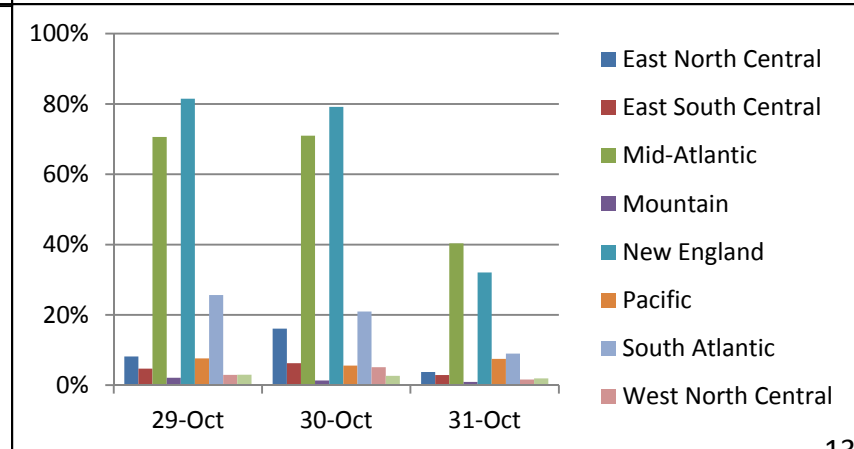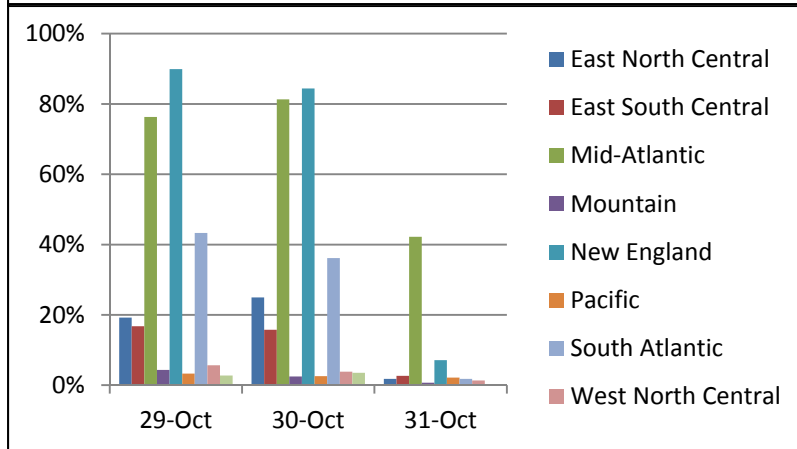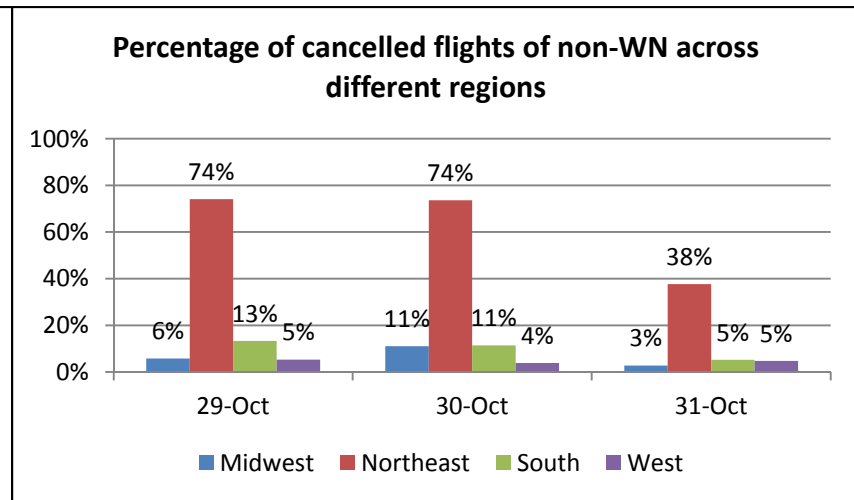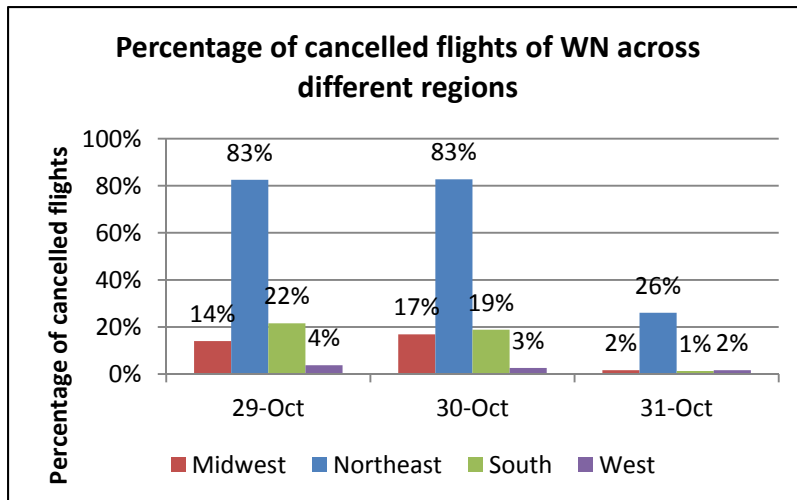| Challenge	Solution
Handling voluminous data	Python Scripts
Linking the flight and weather data	Dedicated server instance on phpMyAdmin
Converting time zones and observing daylight savings	MySQL Timezone description table
Interpreting units	

ANALYSIS

Weather-Related: Visibility

Average visibility across the day at SFO

ANALYSIS

Flight Performances Related: Cancellations

Percentage of cancelled flights of WN across different regions
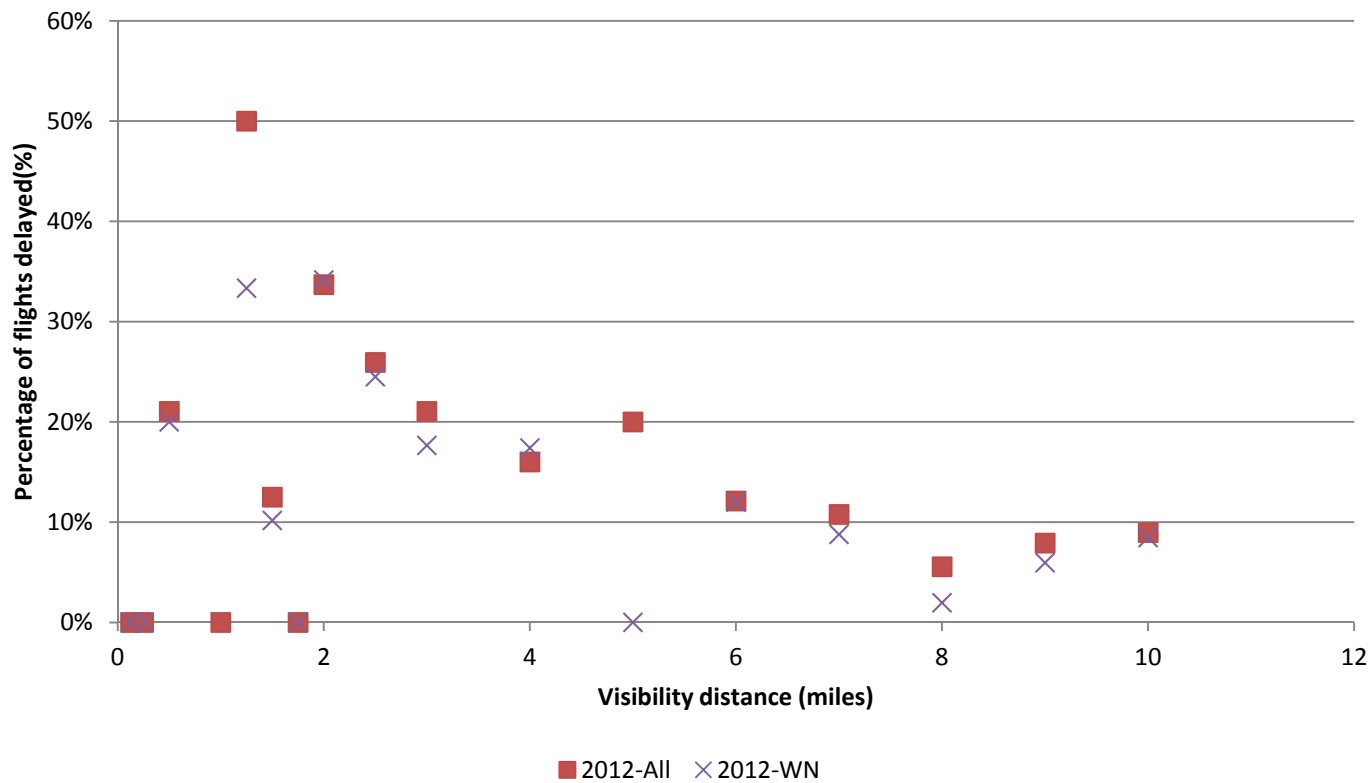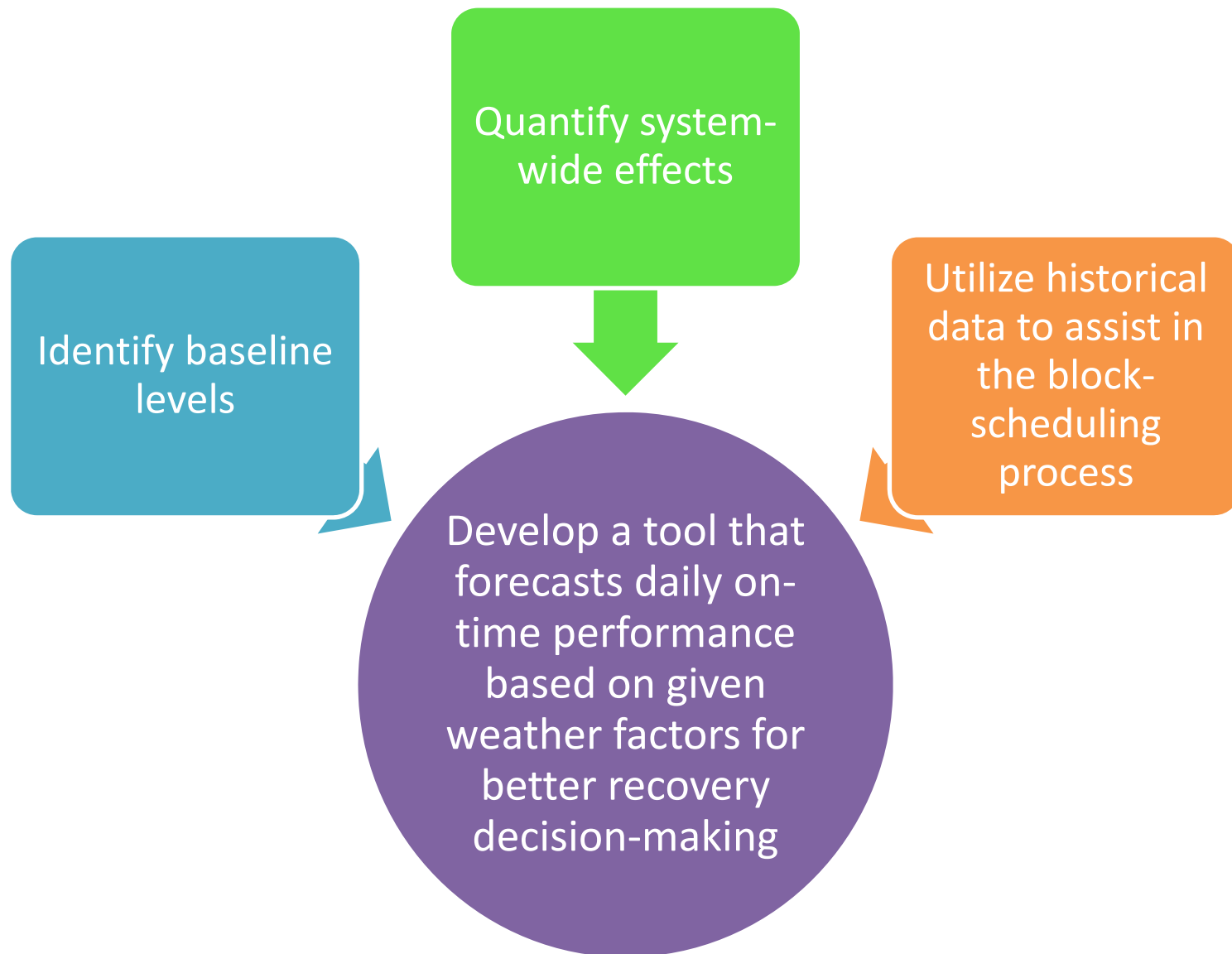
Percentage of cancelled flights of non-WN across different regions

ANALYSIS

Merging weather and flight data

Arrival on-time performance against visibility distance in 2012 at HOU

Future Actions

Quantify system-wide effects

Identify baseline levels

Utilize historical data to assist in the block-scheduling process

Develop a tool that forecasts daily on-time performance based on given weather factors for better recovery decision-making

Thank You

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