Weather Impact on Air Traffic
Models of Weather Impact on Air Traffic

Deepak Kulkarni
Yao Wang
Weather is the largest cause of delays

- Estimated annual cost of delays is about 30 billion per year.
- Two thirds of weather delays are avoidable.
Avoidable weather delay challenge

• Most weather support to ATM is manual, with weather displays that must be interpreted by the user

• Weather products do not have the maturity nor are they translated into impact information required for direct insertion without interpretation

• Rules for interpretation and use of weather data are generally based on the experience of the user

• It is hard for decision makers to handle uncertainty in prediction of weather and air traffic demand

• ATM decisions based upon today’s weather products are inconsistent from user to user
Weather ATM integration challenge

- Given predicted weather, manage air traffic so as to minimize delays, cancellations and safety incidents
- Current state of operations: Sub-optimal operations, high level of controller workload
- Challenges: Complexity with the large number of aircraft involved, Weather impact assessment, Weather unpredictability
The Operational Actors

Pilot
Dispatcher
Ramp Controller

GA Operators / Flight Plan Service Providers
AOC

ATC
Ground Controller
Local Controller
Clearance Delivery
En-route Controller
FLM
TMC’s
Data => Optimal ATM Control Decisions and Support for What-if reasoning
Levels of ATM-Weather Integration

- Separate Visualization
- Integrated Visualization
- Weather Constraints on ATM
- ATM Impacts
- Decision Support Tools
Decision Support Tools
- CTOP DST
- FOQA ADIS
- Gate Turnaround

ATM Impact Models
- Operational Characteristics: Flows, capacity
- Control Actions: Ground Delay Programs, Ground Stops
- Performance Metrics: Delays, Throughput

Decision Trees, Neural Networks, SVM, Random Forests, Linear Regression, Quantile Regression

Wx Constraint Models
- Percent Coverage Models
- Wx Impacted Traffic Indices
- Directional Flow Impact

Data Integration and Warehouse
- Weather
- Traffic
- Safety