



Aviation Weather Integration Plan

Jimmy Krozel, Ph.D.

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THE SCIENCE OF HARMONIZING AIR TRAFFIC

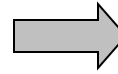
Survey/Assessment of State-of-the-Art:

- **ATM-Weather Translation and Impact Models** – these describe the translation of weather information into ATM constraints the use of weather constraint input in ATM impact models
- **ATM-Weather Integration Techniques** – these describe how ATM-weather impact models may be integrated into Decision Support Tools (DSTs) or in other ways to manage uncertainties in NAS decision making

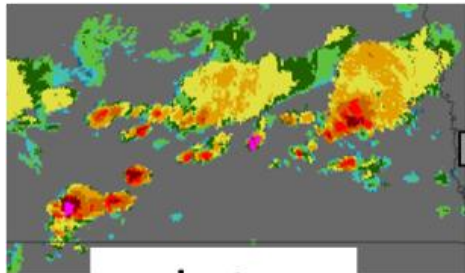
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Subject Matter Experts (SMEs) were asked to summarize the weather translation process and provide a picture depicting the process

Convective Weather Avoidance Model (CWAM)

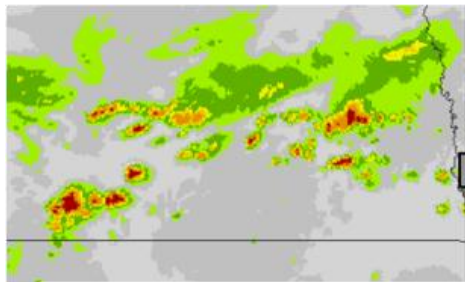
Weather Forecast Data



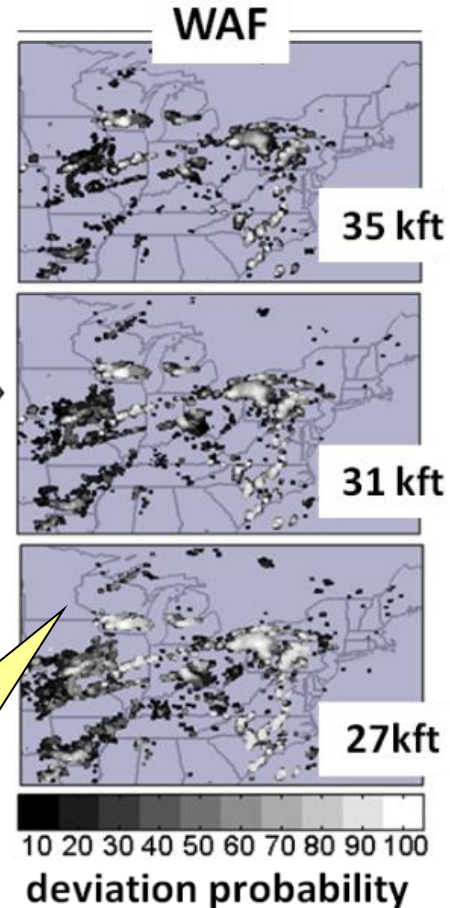
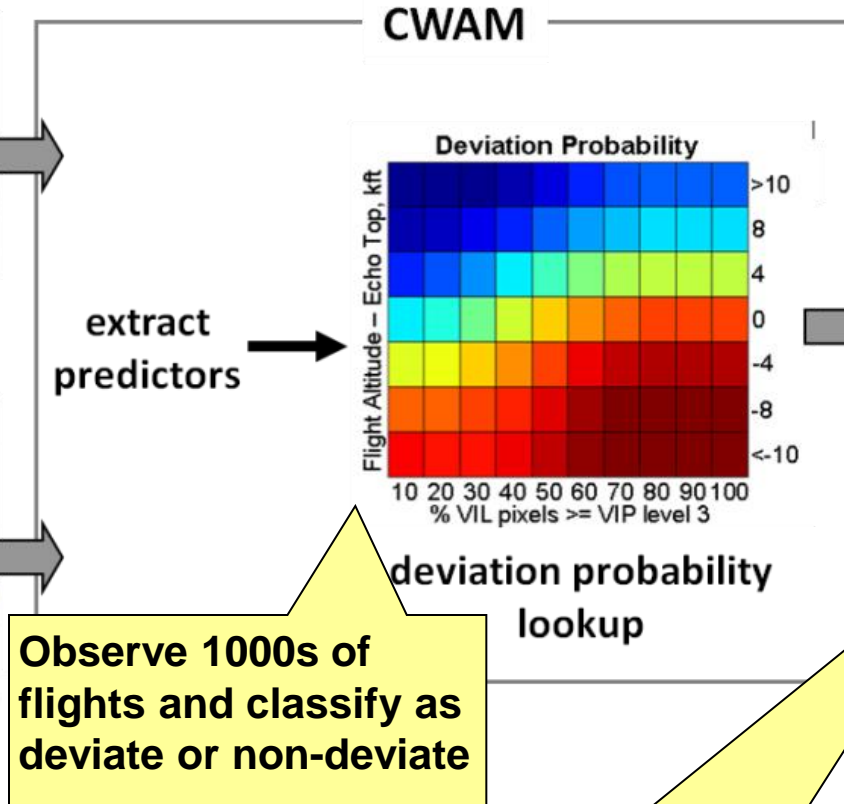
Weather Avoidance Field



echo tops

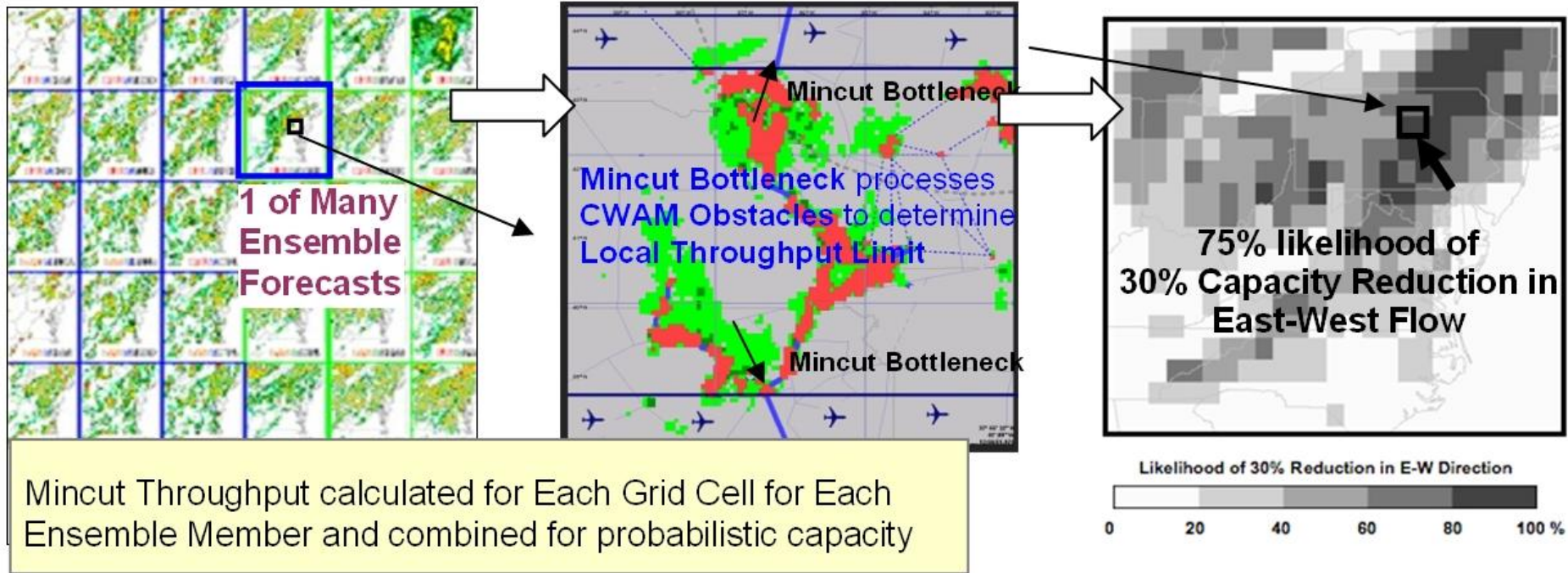


precipitation intensity



En Route models differ from Terminal models

Ensemble Weather Forecast Processing Model



(a) Ensemble of Forecasts

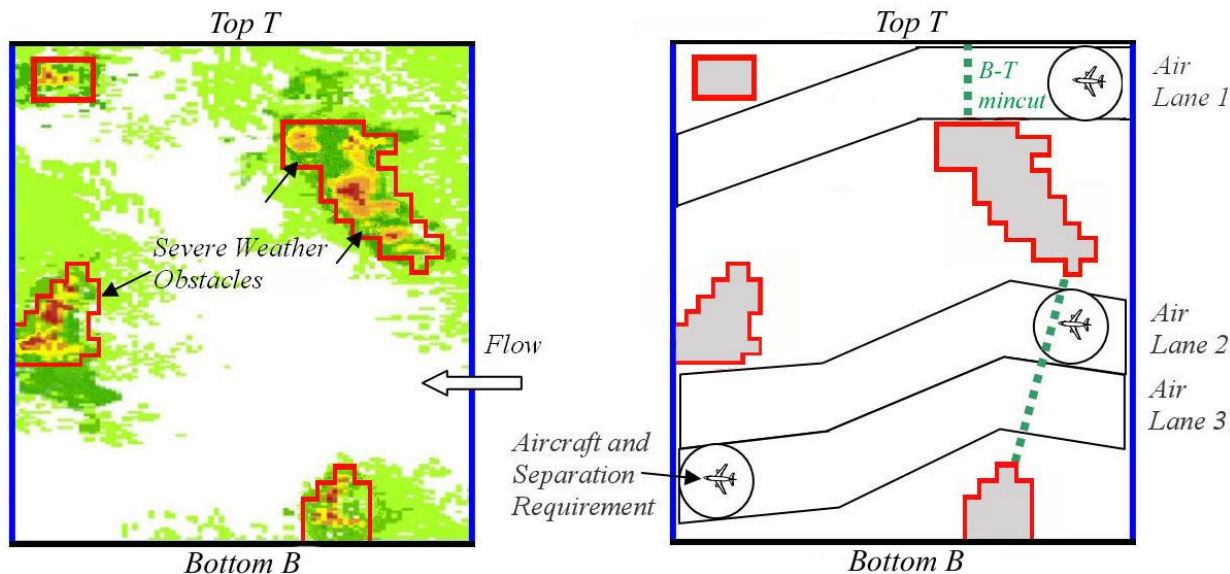
(b) Local ATM impact per Grid Cell

(c) ATM Impact Map

Wx Translation Models Compared for Maturity

Table 4-1. Level of Maturity for ATM-impact Models.

ATM-impact Model	Low	Med	High	Full
En Route CWAMs (Convective Weather Avoidance Models)		x		
Terminal CWAMs		x		
Maximum Airspace Capacity Models (Geometric) - Mincut Algorithms - Mincut Algorithms Given Hard/Soft Constraints		x		
Sector Capacity Models		x		

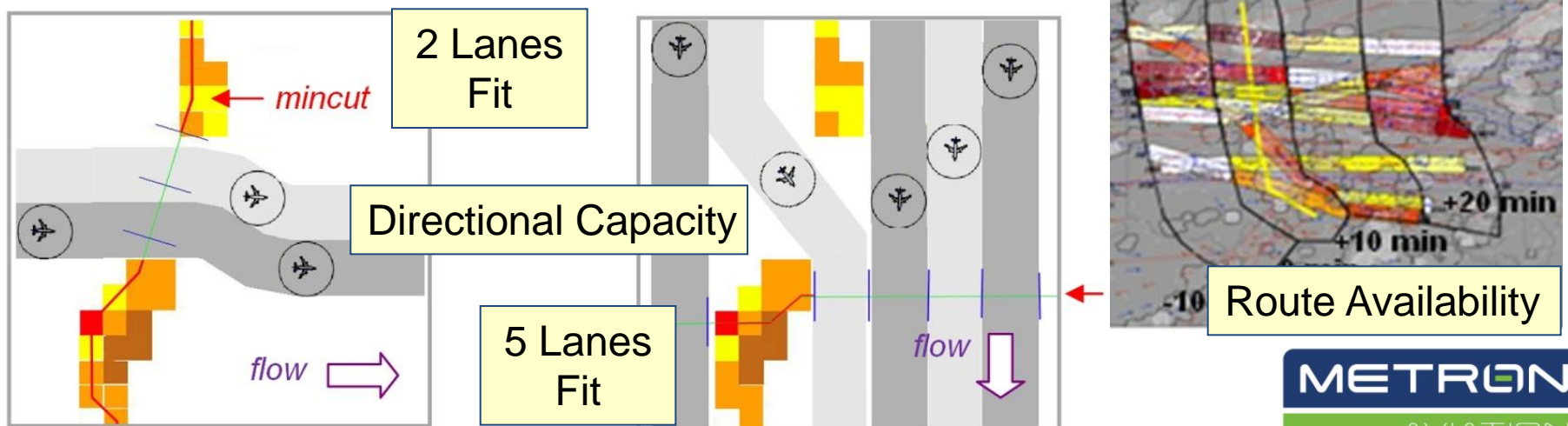


Mincut of Convective Weather Constraint

Wx Translation Models Compared for Maturity

Table 4-1. Level of Maturity for ATM-impact Models.

ATM-impact Model	Low	Med	High	Full
Route Availability Methods			x	
Directional Capacity / Directional Demand Models		x		
NAS Traffic (WITI) Models		x		*
Sector Demand via Periodic Auto Regression		x		
NAS Traffic Flow Distribution Models <ul style="list-style-type: none"> - Congestion Models - Network Flow Models 		x		



Wx Translation Models Compared for Maturity

Table 4-1. Level of Maturity for ATM-impact Models.

ATM-impact Model	Low	Med	High	Full
Ensemble Forecast Processing Models		x		
Deterministic Pseudo-Ensemble Models		x		
Pilot Deviation Models given Probabilistic Forecasts		x		
ATM Impact Forecast Quality Assessment Models		x		
Ground Delay Fog Impact Models			x	
Airport Winter Weather Impact Models		x		
Airport Capacity Models		x		
In-flight Icing Impact Models		x		



(a) Original Convective Forecast (b) ATM Impact Uncalibrated (c) Calibrated

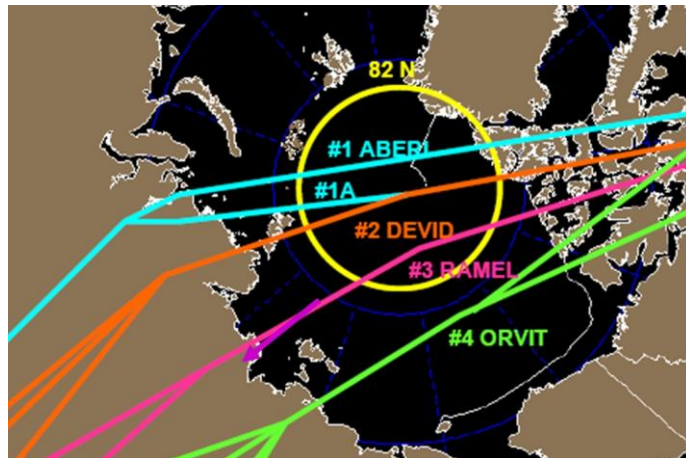
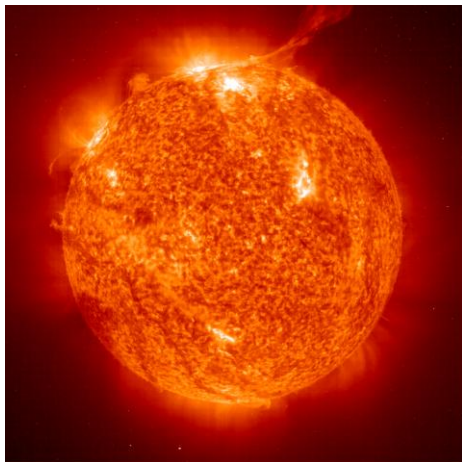
ATM Impact
Forecast
Quality
Assessment



Wx Translation Models Compared for Maturity

Table 4-1. Level of Maturity for ATM-impact Models.

ATM-impact Model	Low	Med	High	Full
Airport Configuration Impact Models	X			
Wake Vortex Impact Models			X	
Traffic Flow Compression Models		X		
Volcanic Ash Impact Models	X			
Environmental Impact Models	X			
Space Weather Impact Models	X			
General Aviation Impact Models	X			



ATM Impact of Space Weather Affects choice of Polar Routes over North Pole

Literature Review for Wx Translation Models

Oceanic/Remote		△△△△▲	Winds Aloft – Jet Stream △▲	Turbulence	Space Weather △△ △△ △ ▲▲
En Route	△△△△△△△△△△△△ △△△△△△△△△△△△ △△△△△△△△△△△△ △△△△△△△△△△△△ △△△△△△△△△△△△ △△△△△△△△△△△△ ▲▲▲▲▲▲▲▲▲▲▲▲	Volcanic Ash		Turbulence △ △ △ ▲	
Terminal / Transition	Convection △△△△△ △△△△△ △△▲	Volcanic Ash	Terminal Winds △		In-Flight Icing △ △ ▲
Surface	Convection △△△△△ △△△△△	△	Surface Winds △△ △△ △△	Fog △△ △△ △ ▲	C&V △△ △△
					Snow / Ice ▲

Symbol Key: △ = Conference Publication; ▲ = Journal Publication

Color Key: Red = Low Maturity; Blue = High Maturity

ATM-Wx Integration Techniques Compared

Table 4-2. Level of Maturity for ATM-Weather Integration Technologies

ATM-Weather Integration Technology	Low	Med	High	Full
Sequential Congestion Management		X		
Sequential Traffic Flow Optimization		X		
Airspace Flow Programs	X			
Ground Delay Program Optimization		X		
Contingency Flow Planning		X		
ATM Turbulence Impact		X		
Automated Turbulence e- Pilot Reports		X		
Probabilistic Traffic Flow Management		X		
Adaptive Search for Resolution Actions		X		
Integrated Departure Route Planning		X		
Tactical Flow-Based Rerouting		X		
Tactical On-Demand Coded Departure Routes		X		



Questions?



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