



Weather-Aware Post Event Analysis

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AvMet Applications, Inc.

**Friends and Partners in Aviation
Weather (FPAW) Summer Meeting
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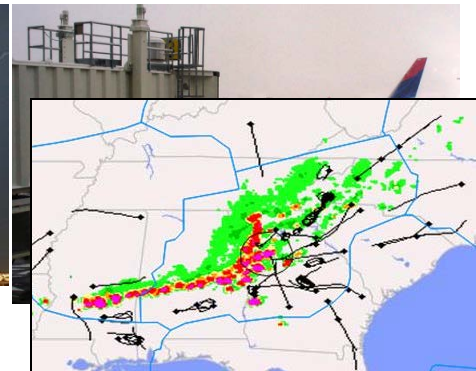
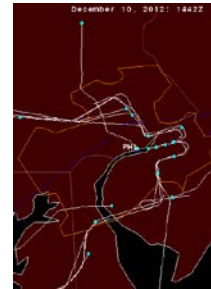
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Consider This....

- In the absence of irregular operations, the **NAS performs pretty well**
- It is **during irregular operations** when NAS goes “nonlinear”....impacts soar and both inefficiencies and opportunities abound....
- By far, most significant cause of irregular operations is **adverse aviation weather**
- Despite continued and heightened use and development of NAS post-event metrics, **dedicated, weather-aware post event analysis of weather-induced irregular operations continues to be challenging and relatively elusive**



NAS Operation – Weather Post Event Analysis

Some Key Challenges and Needs

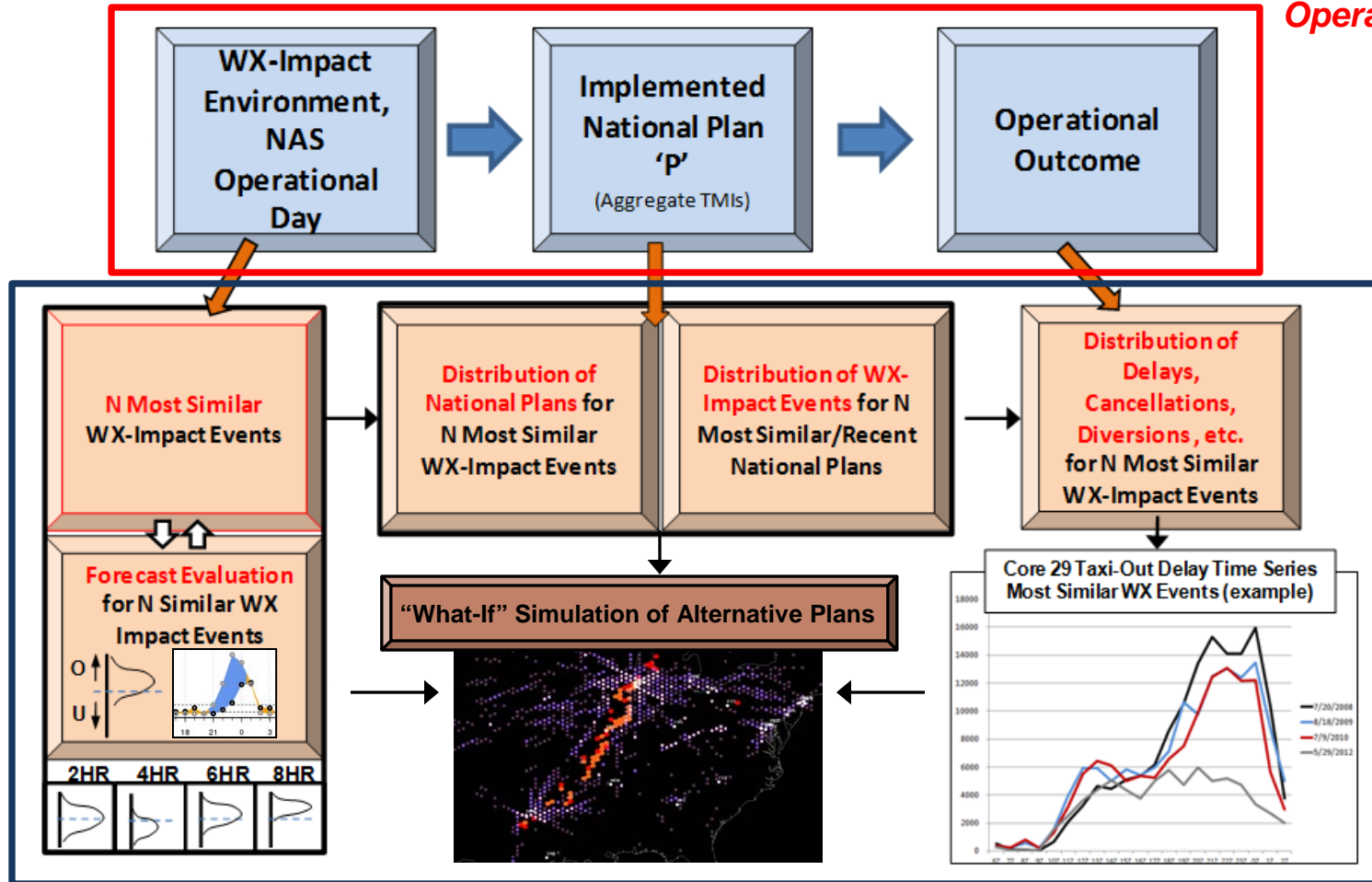
- Post-analysis of NAS operation given adverse weather constraints and impacts has historically included little to no explicit weather-aware data / analysis
- Standard, objective measures of impact / performance used for post weather-event NAS analysis have not been readily available (*subjective, anecdotal, non-repeatable.....all bad*)
- Convective WX Impact events (and associated impacts, plans, and outcomes) can come in 100's of varieties.....
 - It's misleading and incomplete to analyze NAS weather impact events (TMI usage, delays, airborne holding) when comparing against all NAS days or all NAS weather events
 - Most informative post-event analysis must be conducted for similar weather events
- Post-analysis of weather impact events focuses on “what happened” but often stops short of analyzing “how would alternative approach change things”
 - Lack of robust weather, forecast, and TMI-aware “what-if” simulator tools that support these types of analyses



Weather-Aware Post Event Analysis

A Way Forward....

This Was My Operational Day



Targeted, Well-focused Assessment of Performance, Needs, Challenges, and Best Practices

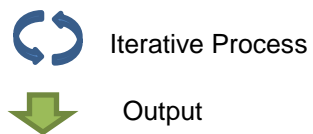
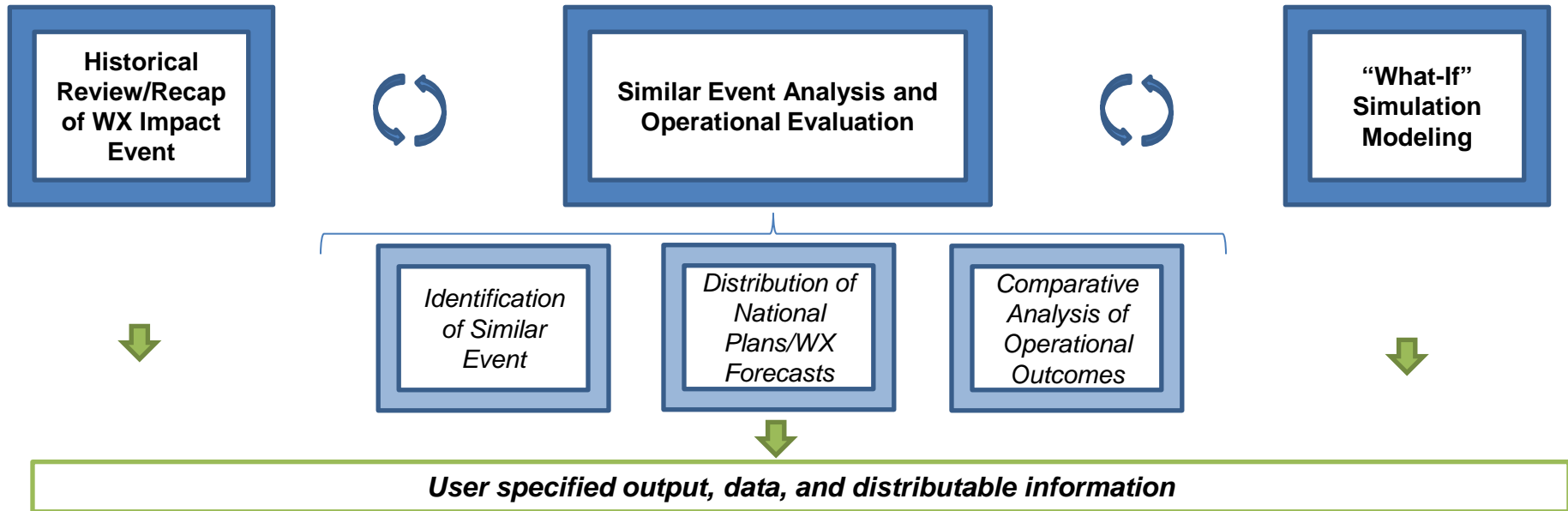
Weather-Aware Post Event Analysis Summary Concept

Core Components

Build context around weather day of interest
(More than just the Weather)

“Control” Analysis for Similar Historical Events

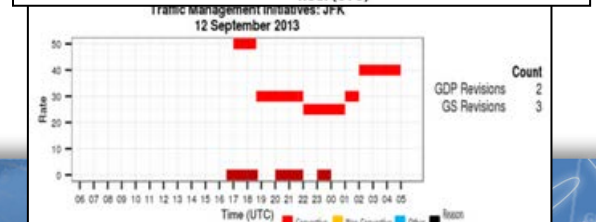
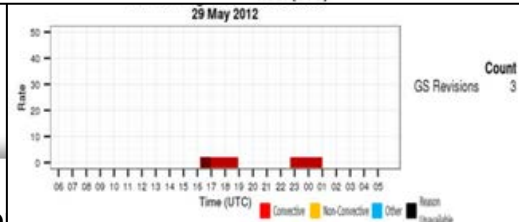
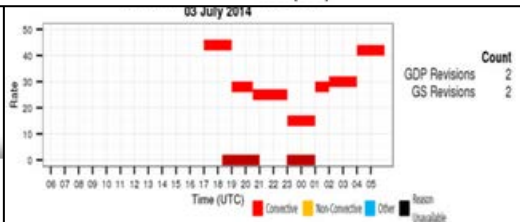
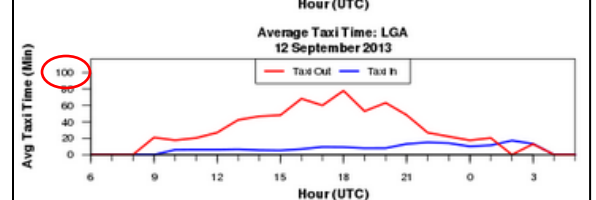
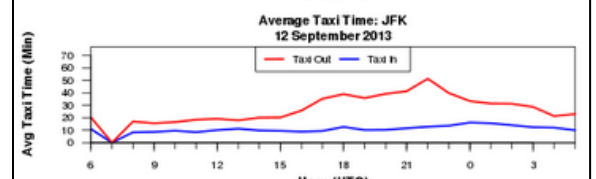
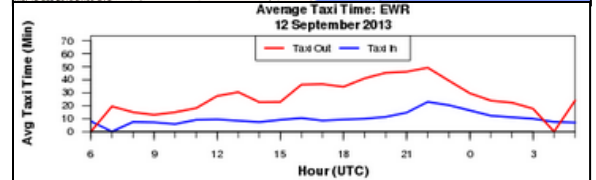
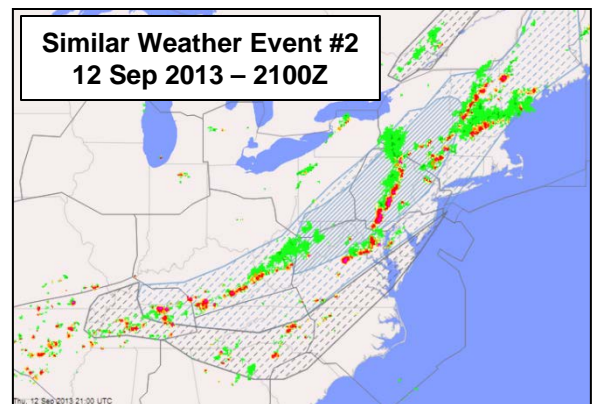
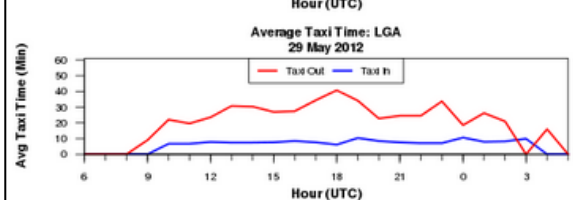
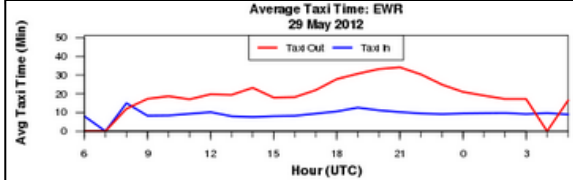
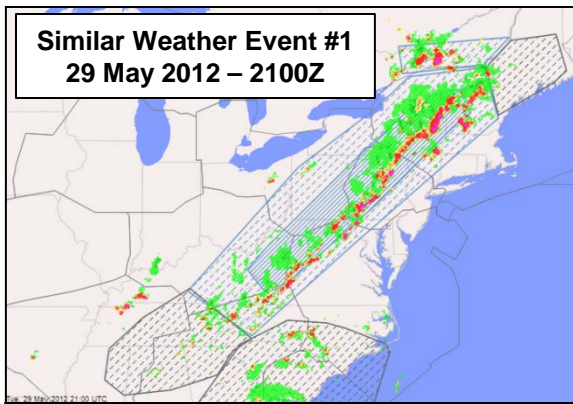
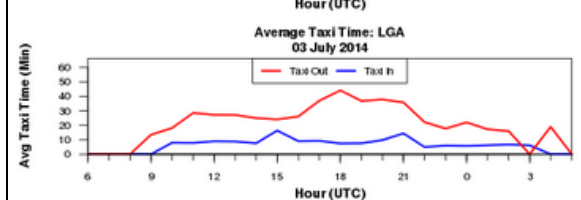
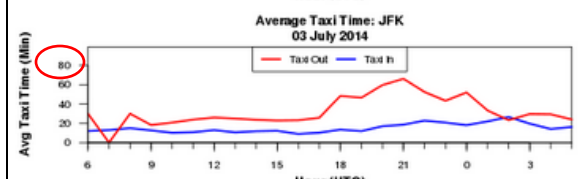
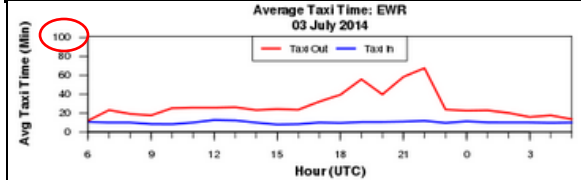
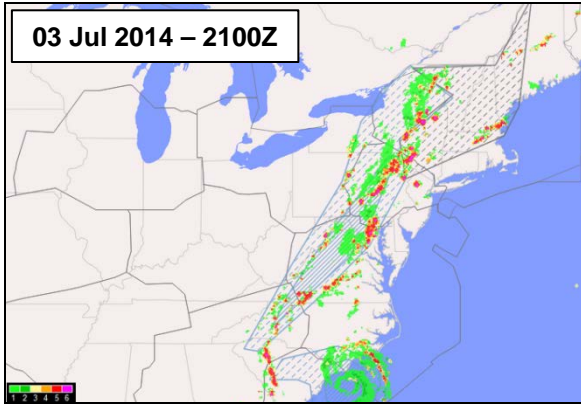
Assess / Demonstrate Value of Alternative ATM Strategies & Outcomes



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Weather Post-Analysis Enabling Capabilities

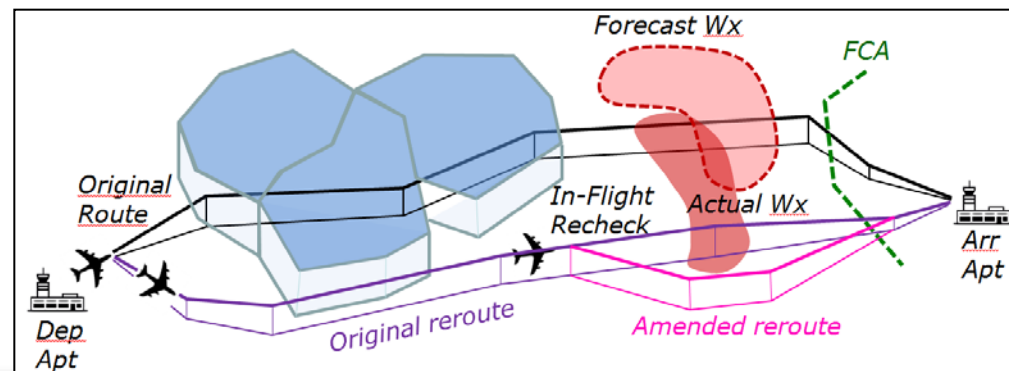
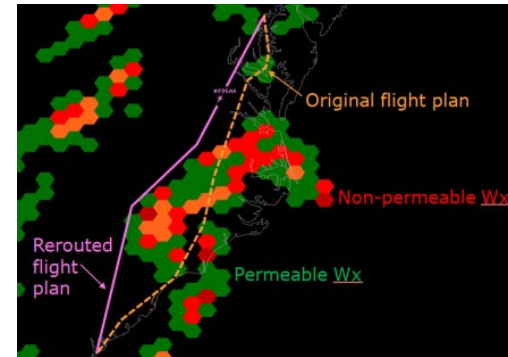
Similar Weather Toolkit [©] TM



Weather Post-Analysis Enabling Capabilities

Dynamic Airspace Routing Tool (DART) ©

- **Weather-Aware Superfast-time NAS Simulator**
 - Model 50,000 flights for day-in-the-NAS in 2 min
- Ingests detailed air traffic, weather data:
 - Full ETMS flight plans
 - Terminal (METAR), en route convective weather (NCWD, CIWS VIL, Echo Tops)
 - Convective weather forecasts (LAMP 2-6 hour, CIWS, CoSPA)
- Model or enforce key Traffic Management Initiatives (TMI); “hybrid” modeling
- Computes weather-degraded airport and en route (sector) capacity (using NASA-based airspace permeability model)
- “Step-out-and-scan” rerouting rechecks for developing reroutes
- Flight, airway, airport, airspace resource-specific outputs for flight distance, delay, cancellations, diversions, etc.



Weather Event Post-Analysis and Benefits Quantification

- “Weather” Benefits Quantification is incredibly challenging
 - Improved forecast performance → Advanced operational ATM utility / innovation?
 - Leave “weather” in a hurry and move towards resource constraint management, ATM / ATC / AOC actions, and ops-specific outcome measures
- Benefits analyses start with proper scoping of shortfall / opportunity space
 - Informed by operational scenarios if properly controlled for pertinent constraint events
- Requires objective, repeatable, data-driven analysis for defensible benefits assessment

Routine, repeatable, objective, well-scoped (but agile) weather post-event analysis capability can be leveraged for significant WX-ATM benefits quantification advancements

