Operational Scoring of Forecasts of Convective Weather Impacts in the Route Availability Planning Tool (RAPT)*

RAPT Departure Management for NYC Airspace



RAPT Display with Route Status Timelines

The RAPT route status algorithm discretizes departure route status into **GREEN (clear), YELLOW (impacted), or RED (blocked)**

Forecast Scoring Algorithm

- Operational concern of assessing forecast accuracy helps traffic managers judge quality of RAPT route status forecasts
- Significant time lag (80 minutes) required to collect observations to calculate a forecast verification using true weather
- Experimental algorithm generates a Modified Critical Success Index (mod-CSI) score. Score provides a heuristic forecast verification with smaller time lag (40 minutes)

	Forecast Blockage						
True Weather Blockage	Score < 40 > :		> = 40 & < 80	> = 80			
	< 40	Hit	False	False			
	> = 40 & < 80	Miss	Hit	Partial			
	> = 80	Miss	Partial	Hit			







Table of Enumerated Verification Types

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ZNY Departure Gates

Convective Weather Study Domain

Questions of Study

- **1. How robust is the RAPT route alogrithm** when forecast and true weather inputs are compared?
- 2. During periods of high convective weather volatility, can the mod-CSI scoring algorithm provide a reasonable approximation of forecast accuracy?



Biggy J75 Route Timeline Comparison Sample

Forecast vs. True Weather Route Status Timeline Comparisons

		Forecast						
	Status	G		Υ		R		
Truth	G	56.04%		3.69%		0.19%		
		56.49%	54.56%	3.53%	4.33%	0.11%	0.33%	
	Y	3.51%		17.30%		3.24%		
		3.42%	4.00%	17.85%	16.10%	2.69%	4.25%	
	R	0.14%		2.15%		13.74%		
		0.08%	0.24%	2.12%	2.26%	13.70%	13.83%	

Route Status Confusion Matrix with Overall Rates (N = 43008) and 15/30 Minute Tuple Rates (N = 6144)





Forecast Yellow Distribution

Gate-Oriented Segmented Blockage Grids of Forecast vs. Truth Weather

Hits + 1/2 Partials Hits + Partials + Misses + Falses

modCSI Equation



Time to Coordinate Deviation (55 km)

- Route status timelines on ZNY were generated from 08:00 to 23:59 for each test day from the summer 2009 convective weather season
- Forecast and true status tuples, representing departure times (t + 5) to (t + 35), were compared



ı = 71.46% μ = 26.48% μ = 12.69% μ = 2.06% True Red True Green True Yellow True Red

Forecast Red Distribution





- Incidents of high status misclassification (> 1 level) were rare and predominately involved RED forecast status
- The mod-CSI algorithm performed poorly as a predictor of forecast accuracy. Scores exhibited high volatility and poor cross-correlation to true-CSI
- Despite longer time-lag, the true-CSI algorithm exhibited superior performance features. Scores exhibited lower volatility and strong autocorrelation within time series

Mod-CSI as Predictor of Truth

30 Minute Lag mod/true-CSI Deltas



Large deltas existed between mod-CSI and true-CSI scores on varying time lags. Concluded that mod-CSI is poor predictor of forecast reliability.

Time-Lagged True-CSI Score

South Gate Time-Lagged true-CSI

30 Minute Lag true-CSI Deltas



Small deltas existed between timelagged true-CSI scores on varying intervals. Concluded that true-CSI is superior predictor of forecast reliability.

Conclusions

RAPT status algorithm generally showed high level of accuracy using forecast weather