Observations on 25 January 2010 in the New York City Metropolitan Area
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**ATC Problem and Motivation**
- Exceptionally strong, vertical shear of horizontal wind from surface to cruise flight levels in northeast United States
- Severe turbulence and arrival compression into major New York City metro-area airports
- Extreme air traffic delays, flight cancellations, diversions, and alternate holding
- Seven weather event was underforecast for FAA controllers and managers and led to a severe delay of aircraft into regions of unexpected turbulence
- Future work: automated incorporation of improved turbulence information to improve air traffic safety, efficiency, and decision making

**Weather Synopsis and Gravity Wave**
- Complex low-pressure system moved through the Northeast on 25 January 2010
- Pennsylvania, New Jersey, New York, and Connecticut were impacted by severe and strong shear of southerly wind flow
- Intense but narrow prefrontal squall line formed suddenly ahead of main cold front
- Gradient of pressure was calculated with squall line; echo was detected in Doppler velocity field. Impacted airports at 1711 UTC and US Airways at 1715 UTC; southern JFK airport at 1718 UTC
- Sudden shift in wind direction and increase in speed resulted in numerous wind shear and turbulence reports
- Move propagated from west through east across most of New York TRACON airspace, impacting airport and departure traffic for many hours

**Numerical Model Forecasts and ATM Decision Support**
- NOAA SBDL High-Resolution Rapid Refresh (HRRR) model accurately forecast prefrontal squall line 6 hours in advance
- FAA Consolidated Storm Prediction for Aviation (CoSPA) verified accurate 3–9-hr forecast location of north-south line, but intensity and speed of squall line were underestimated
- 24-hr resolution interpolated to 16Z; 2–8-hr forecast updated every 15 min
- FAA Consolidated Integrated Weather System (CIWS) verified, although VIL intensity was underestimated
- 1-km resolution; 0–2-hr forecast updated every 5 min
- Extensive set of supplemental HRRR forecast output fields extremely valuable for real-time decision making and post-event analysis
- Not currently incorporated into any operational forecast

**Translation of Wind Forecast into Path-based Shear Forecast**
- Computation of shear forecasts and wind forecast validation with hazardous turbulence significantly impact airport capacity
- Compute horizontal acceleration along path of various corridor into airports
- Negative shear, strong path, significant gains or losses will be experienced
- Path-based Shear: Display plan location of the arrival path and highlights path segments where excessive gains and losses have been calculated
- Excessive gains lead to compensation from air traffic control and air traffic
- Excessive losses lead to wider than desirable spacing between aircraft

**Future Work**
- Identify other terminal synoptic-scale events at New York airports and other major airports, such as CDL, JFK, and ANC, and make a first-order assessment of "drivable" delay
- Assess capability of HRRR to forecast other significant terminal capacity impacts due to wind