P1.4

An Enhanced Convective Forecast (ECF) for the New York TRACON Area

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1. INTRODUCTION

In an effort to relieve summer-time congestion in the NY Terminal Radar Approach Control (TRACON) area, the FAA tested an enhanced convective forecast (ECF) product this past summer. The test ran from June through early September.

The ECF was updated every two hours, right before the Air Traffic Control System Command Center (ATCSCC) national planning telcon. It was intended to be used by traffic managers throughout the National Airspace System (NAS) and airlines dispatchers to supplement information from the Collaborative Convective Forecast Product (CCFP) and the Corridor Integrated Weather System (CIWS). The ECF began where the current CIWS forecast ended at 2 hours and extended out to 12 hours. Unlike the CCFP it was a detailed deterministic forecast with no aerial coverage limits. It was created by an ENSCO forecaster using a variety of guidance products including, the Weather Research and Forecast (WRF) model. This is the same version of the WRF that ENSCO runs over the Florida peninsula in support of launch operations at the Kennedy Space Center. For this project, the WRF model domain was shifted to the Northeastern US. Several products from the NASA SPoRT group were also used by the ENSCO forecaster.

2. ECF WEB SITE

Fig 1 shows the ECF home page. From here the user can navigate to the ECF and other related products. It also contains introductory material to help the user get the most out of the WEB site.

The ECF itself is viewed by clicking on "ECF PRODUCT" in the upper left corner of the ECF home page. Fig 2 is a sample ECF product. These hand-drawn polygons are the forecaster's best estimate of what the NEXRAD composite reflectivity will look like at the valid time show in the lower right corner. The ECF home page also contains a short product description.

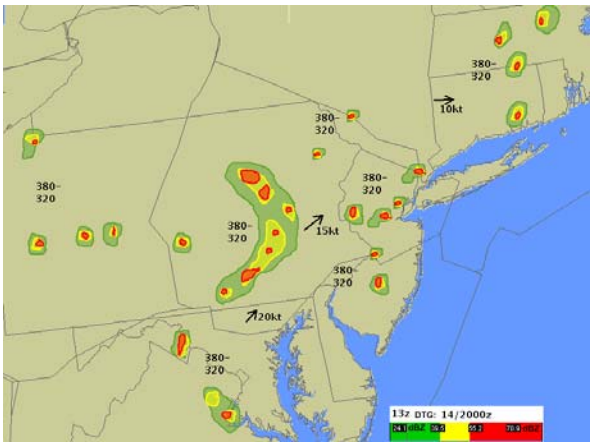

Fig 2 Sample ECF product.

Figs 3 & 4 show the raw WRF model output which can be found by clicking on the "WRF MODEL" box in the upper left of the ECF home page.

For more information on the ENSCO WRF see:

http://www.wrf-model.org/index.php

http://www.srh.noaa.gov/mlb/ARPS.html

For this project the WRF model configuration was as follows:

- 271 x 224 points (X x Y)
- center points: 40.5N, -75.4W
- 31 vertical levels
- Lambert conformal map projection
- standard lats: 25.0N, 25.0N
- standard lons: -95.0W

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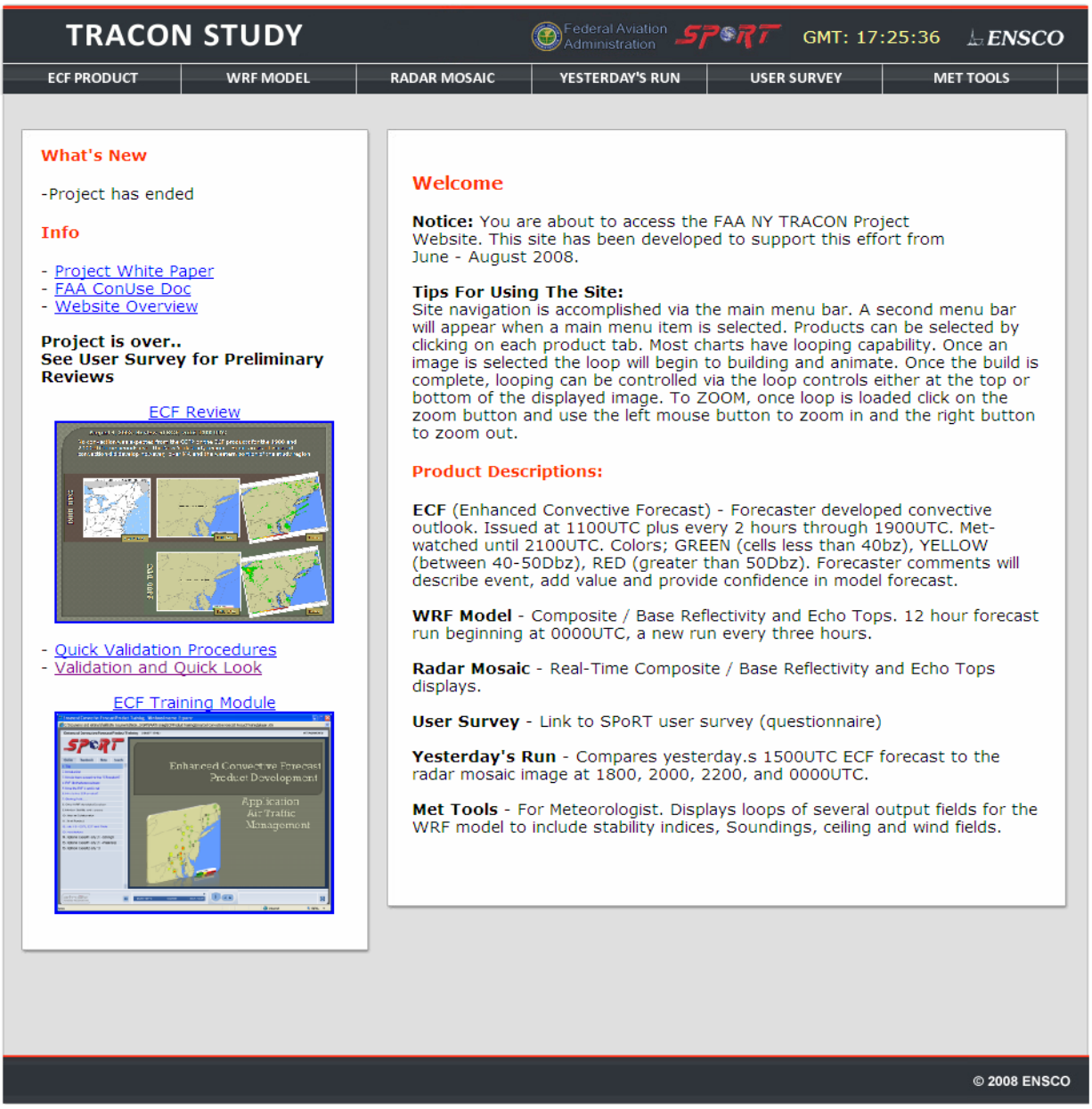


Fig 1 ECF home page.

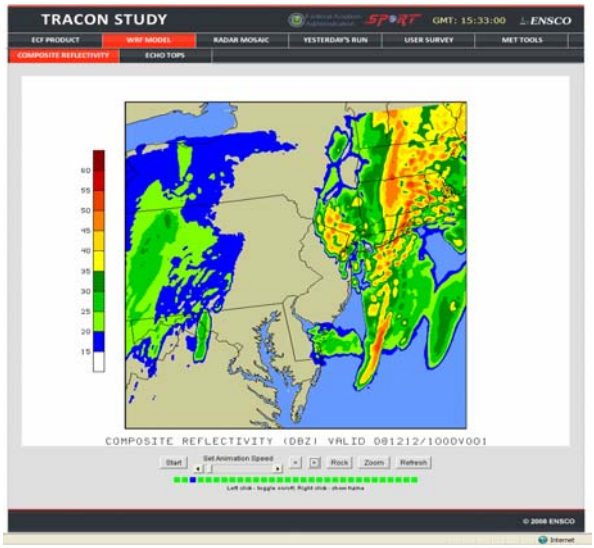


Fig 3 Sample WRF-generated CR product.

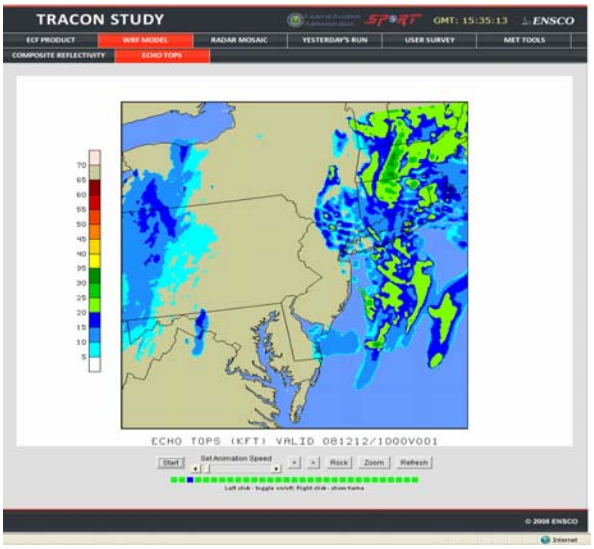


Fig 4 Sample WRF-generated ET product.

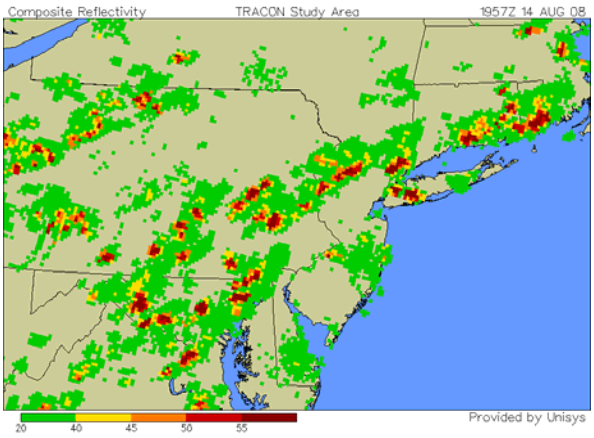


Fig 5 Sample NEXRAD CR mosaic from Unisys.

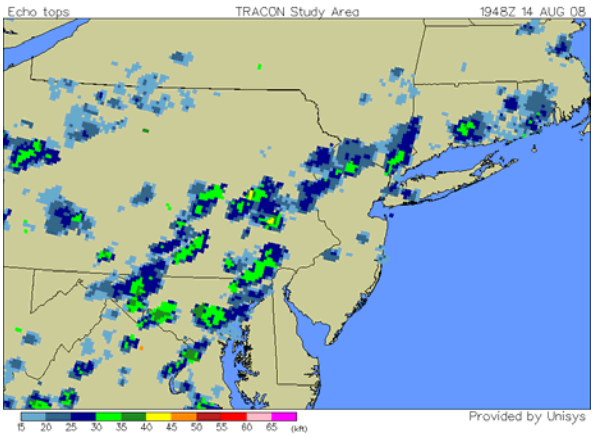


Fig 6 Sample NEXRAD ET mosaic from Unisys.

- WRF Environmental Modeling System (EMS) software
- Used Advanced Regional Prediction System (ARPS) Data Analysis System (ADAS) for hot-start initialization
- Data ingested within ADAS:
  - North American Model (NAM) 12km data as background data
  - Level II Weather Surveillance Radar-1988 Doppler (WSR-88D) data from 9 sites
  - GOES VIS and IR satellite imagery
  - Surface observations
- 3-km grid spacing over NY TRACON and surrounding areas
  - WRF model run over the 2008 convective season
  - 15-h integration, 8 runs per day, run every 3 hours

By running at 3-km horizontal resolution and 31 levels, the ENSCO WRF can explicitly model small scale convective processes. These small scale convective processes can be expressed in terms of the radar reflectivity they would be expected to produce. For this project, the ENSCO WRF provided images and grids of radar composite reflectivity (CR) and echo tops (ET). The ET for each polygon were defined as the highest altitude at which the model depicts a reflectivity of at least 18 dBZ. This is the same ET criterion used by NEXRAD. Additional WRF model output plots were also generated such as convective indices, surface features and soundings for New York and Washington DC areas.

The ECF WEB site also provided current NEXRAD mosaics. These could be viewed by clicking on the "RADAR MOSAICS" box on the ECF home page.

These products included CR and ET mosaics provided by Unisys (Figs 5 & 6)

Users could also access information about previous forecasts. A brief summary of the previous day's performance could be obtained by clicking on the "YESTERDAY'S RUN" box. More detailed analyses of selected cases could be obtained by clicking on the "ECF Review" link (Fig 7).

A "USER SURVEY" link provided easy access to user survey forms (Fig 8).

Finally, the "MET TOOLS" link provided a series of forecasting tools based on the ENSCO WRF model the NSSL/SPoRT WRF model. These tools were provided for meteorologists using the WEB site and would not typically be used by traffic management personnel.

3. EVALUATION

Three organizations evaluated the Enhanced Convective Forecast (ECF), the NASA Short-term Prediction Research and Transition Center (SPoRT), AvMet Applications, Inc., and the NOAA Earth System Research Laboratory/Global Systems Division (ESRL/GSD). These organizations evaluated the product in terms of both its meteorological validity and its usefulness to the users. SPoRT and ESRL/GSD evaluated the meteorological performance by comparing the forecasts to weather radar depictions at the forecast valid times. AvMet used the Weather Impact Traffic Index (WITI) approach to measure how well the ECF predicted air traffic flow impacts. AvMet and SPoRT also used user surveys and site visits for subjective evaluations.

The meteorological and WITI evaluations compared the ECF forecast accuracy to the National Convective Weather Diagnostic (NCWD) and used the Collaborative Convective Forecast Product (CCFP) as baseline. Although the ECF and CCFP forecasts have different characters, (i.e. the ECF pinpoints where the storms will be while the CCFP gives a large area of general coverage), each evaluation group devised techniques for comparing the two forecasts side-by-side. The consensus among the evaluation groups was that the ECF did not score as well as the CCFP. Its most apparent problem was its tendency to under forecast storm coverage. Interestingly, the Weather Research and Forecast (WRF) model used by the ENSCO forecasters had much broader storm coverage and consequently exhibited better skill scores. While the head-to-head scores of the ECF verses the CCFP are disappointing, the users generally found the more specific ECF forecast to be a beneficial supplement to the broader-brush CCFP.

The majority of the user survey responses came from the airlines (19 responses) and the FAA Air Traffic Control System Command Center (ATCSCC) (21 responses). . The airline respondents had generally positive comments about ECF. They also suggested that planning of routes and delays at other airports such as in Chicago and Washington, D.C. would benefit from this same product. Approximately half the responses from ATCSCC users were favorable and indicated that the ECF had some influence on air traffic management decisions. They indicated that the ECF had slightly higher value than the CCFP when indicating storm structure. The negative comments from ATCSCC respondents complained about the under forecasting described above and that the forecast seldom pinpointed exactly where the storms would be 4-6 hours out. To overcome the under forecasting problem, one of the ATCSCC weather specialists decided to just use the raw WRF model output later in the summer.

The consensus of the three evaluating organizations was that while the ECF represents an improvement in terms of satisfying user requirements for a more detailed convective forecast in the 2-8 hour time window, its skill did not measure up to the current CCFP. The simplest improvement that could be made would be for the forecaster to re-calibrate his/her forecasts such that they generally enlarge the individual storm coverage instead of just focusing on storm cores. It should be noted that the WRF simulated reflectivity product alone added more structural information to CCFP than the ECF. Also, a more comprehensive user training program would enable the users to get more out of the product. They should not take the pinpoint locations literally but should use them as general guidance on where to expect traffic impacts. Overall, there is ample room for improvement next summer. These validation results provide a valuable roadmap of where to focus those improvements.

3. REFERENCES

Jedlovec, G. J. and K. Fuell, 2008: Terminal Radar Control (TRACON) Study for the New York Region Enhanced Convective Forecast (ECF) Product Quick Validation. Internal document prepared for the FAA TRACON Study Project.

Jedlovec, G. J. 2008: Convective Impact Index (C I I). Internal document prepared for the FAA TRACON Study Project.

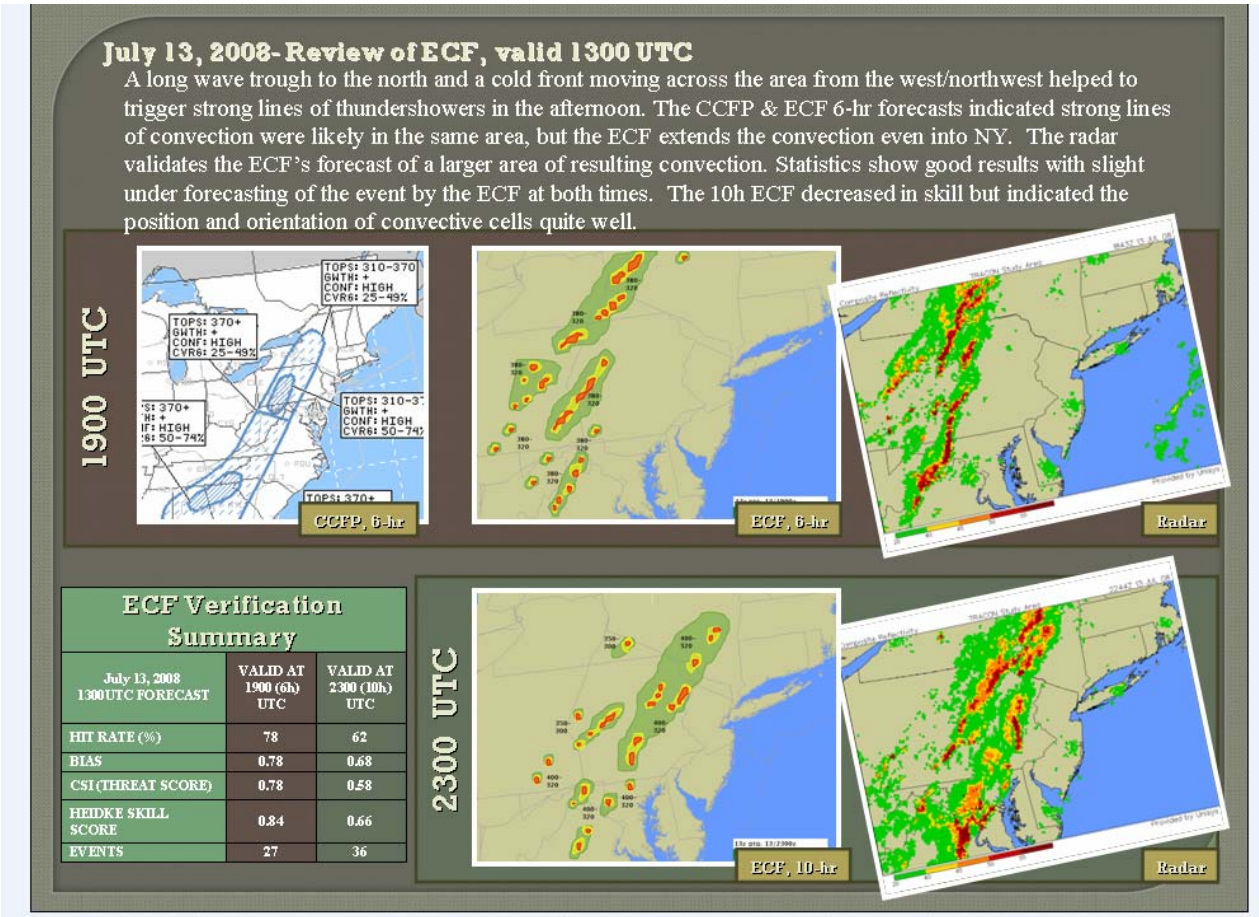


Fig 7 Sample ECF Review WEB Page.

Enhanced Convective Forecast User Feedback/Survey

The purpose of these surveys is to assess the use and impact of the Enhanced Convective Forecast (ECF) product on FAA planning operations at the ATCSCC, ARTCC, and New York TRACON. The web-based assessments are designed to be used by the planners, traffic managers, and other users of the ECF product in their daily operations. The goal of assessments is NOT to validate performance of the ECF product (that will be done elsewhere), but to **document and assess the use and impact of the product on operations** at these FAA facilities.

ATCSCC - User Survey/Feedback Form

Planners are responsible for the development of the NAS Operations Plan, leading discussions with ATCSCC and field traffic managers and external customers (airlines, air taxi, and general aviation). ATCSCC help develop and manage the operations plan for a single Center.

NAV Canada - User Survey/Feedback Form

Planners and managers use forecast and TELCON information for NAS planning and reroute requests through Canadian air space.

ARTCC & TRACON - User Survey/Feedback Form

Field facility planners and managers plan Center operations looking at internal operations around the NAS operations plan. Field users include Center and TRACON managers.

Airline - User Survey/Feedback Form

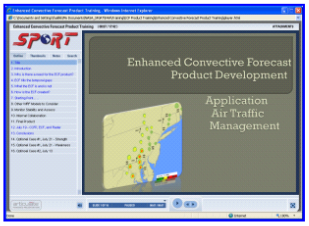
ATC representatives will use ECF and NAS Operations Plans to better understand how convective weather will affect their airline operations at the airports they operate from and the associated routes to and from them.

ENSCO - User Survey/Feedback Form

Forecasters from ENSCO have an inside perspective on the creation of the Enhanced Convective Forecast (ECF) Product. They will use unique mesoscale modeling and remote sensing products in the development of an ECF every two hours from 11Z to 19Z.

View Survey Results

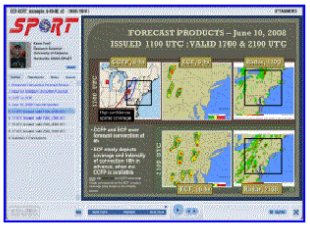
Password -- Submit



ECF Training Module

- Download *(recommended for NWS users)*
- Launch in browser

(user guide)



ECF Overview Module

- Download *(recommended for NWS users)*
- Launch in browser

(user guide)

Validation of ECF

A simple validation of the ECF is performed using a 50x50 km grid over the study region based on standard statistical parameters. The ECF issued at 1300 UTC is compared to the CCFP 6-hour forecast as well as the radar image for 1900 and 2300 UTC. Click on a calendar day for a 1-chart validation image with daily stats or the links to weekly plots of statistics.

Quick Validation Procedures (PDF)
Weekly Stats
Case Dates for ECF

June 2008

Click a day for validation image

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
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July 2008

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August 2008

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Fig 8 User Survey WEB page.