The Front

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Using LAMP Guidance in Flight Planning

By Chris.Leonardi, Forecaster, NWS Charleston, WV

Whether you are a general aviation pilot flying a Piper Cub or a dispatcher for an airline, one thing is always true regarding weather information: The more detail, the better. Pilot weather briefings and Terminal Aerodrome Forecasts (TAF) give you plenty of information about your points of departure and arrival; however, to better plan your flight, you can familiarize yourself with computer-generated forecast information. One of the latest detailed guidance tools available is the Localized Aviation MOS (Model Output Statistics) Program (LAMP) guidance.

LAMP is a statistical forecast system, providing point forecast guidance on sensible weather elements. Forecasts are generated for more than 1500 locations. Below are some of the advantages of using LAMP guidance in flight planning:

- Guidance is updated hourly, incorporating the latest surface conditions and guidance to produce hourly forecasts of weather elements reaching up to 25 hours in the future. The user is always able to access fresh forecast information for the next 24 hours.
- The guidance product provides both categorical and probabilistic forecast guidance on various elements, allowing users to extract the type of information they want.
- Categorical ceiling/visibility forecast information is presented, along with forecasts conditional on the occurrence of precipitation. This data attempts to account for some of the temporary fluctuations that occur in flight conditions and help with contingency planning.
- In addition to the information provided in the text bulletins, there are now graphical guidance products that present additional probabilistic information. These products represent the model "confidence" in their forecasts.

To illustrate the usefulness of the LAMP system, consider the following scenario. It is 4 a.m. (09Z) on December 13, 2009, and a Visual Flight Rules (VFR) pilot is planning a 2 hour flight to Charleston, WV, (KCRW) that morning. Currently, conditions are VFR at KCRW, with light sprinkles. An approaching weather system is expected to worsen flight conditions during the day. Obviously, the pilot would like to arrive at KCRW before Instrument Flight Rules (IFR) conditions develop, so she is looking for a reasonable estimate of when that will occur so that she can plan accordingly. Normally, such planning would require examining many types of forecast information, as well as a briefing from flight service personnel. LAMP text and graphical guidance should be one piece of that process.

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The Front

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Mission Statement

To enhance aviation safety by increasing the pilot's knowledge of weather systems and processes and National Weather Service products and services.

Figure 1 shows the text bulletin for the 0900Z (4 a.m., EST) run of the LAMP guidance for KCRW. There is obviously a lot of information in this product regarding parameters such as temperature, wind and precipitation chances. A full summary of how to read and interpret the various parameters is available on the Meteorological Development Lab website. For now, let's focus on the entries for ceiling and visibility. Notice the four lines toward the bottom of the product: CIG, CCG, VIS and CVS.

```
KCRW     CHARLESTON     ASOS      GFS LAMP GUIDANCE  12/13/2009  0900 UTC
UTC  10 11 12 13 14 15 16 17 18 19 20 21 22 23 00 01 02 03 04 05 06 07 08 09 10
TMP  39 38 39 40 40 42 44 46 47 47 47 46 45 44 44 44 43 43 42 42 41 40 40 39 39
DPT  31 32 33 35 36 38 40 41 42 44 44 43 43 42 42 41 40 39 38 38 37 37 36 37 36
WDR  09 10 10 10 11 15 19 20 22 23 24 25 24 24 23 22 23 22 20 16 15 15 00 17 16
WSP  04 03 03 03 03 03 03 04 05 05 05 05 04 03 03 02 03 03 02 01 02 01 00 01 01
WGS  NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG NG
PPO  63 47 58 79 80 80 54 53 40 32 13  9  3  2  0  0  0  0  0  0  1  0  0  0  0
PCO   Y  Y  Y  Y  Y  Y  Y  Y  Y  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N
P06                        100                    13                    1
TP2          0  1  1  1  1     0     0     0     0     0     0     0     0     0
TC2          N  N  N  N  N     N     N     N     N     N     N     N     N     N
POZ   4  3  1  2  3  2  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0  0  0  0
POS   0  0  0  0  0  2  1  0  0  0  0  0  0  0  2  3  3  1  1  1  1  3  4  7  5
TYP   R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R  R
CLD  OV OV OV OV OV OV OV OV OV OV OV OV OV OV OV OV OV SC SC OV OV OV BK BK OV
CIG   6  6  6  6  6  4  3  3  3  3  3  3  3  3  3  4  4  4  4  4  4  4  4  4  4
CCG   6  6  6  6  5  4  3  3  3  3  3  3  3  3  3  4  4  4  4  4  5  5  5  5  5
VIS   7  7  7  7  6  6  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
CVS   7  7  7  7  5  5  6  7  7  6  7  6  7  7  7  6  6  7  6  7  7  7  7  7  7
OBV   N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N
```

Figure 1: *Text bulletin for the 09Z LAMP forecast run for KCRW on December 13, 2009. Detailed decoding information can be found on the NWS MDL Website.*

CIG and VIS are categorical forecasts for ceiling and visibility, respectively. CCG and CVS are conditional forecasts for ceiling and visibility, contingent on precipitation occurring. Since you usually expect less favorable flight conditions in precipitation, CCG and CVS will always forecast values at or below the corresponding CIG/VIS categorical forecast. The number for each hour represents a range of values corresponding to flight categories. The tables in **Figure 2** will help you decode the values. In particular, notice the ceiling categories. Values from 6-8 represent VFR, 4 and 5 are MVFR (with 4 representing the IFR alternate/extra fuel criteria), and 1-3 are IFR or worse.

As you can see, LAMP is forecasting VFR conditions to continue through 13Z. At 14Z, the categorical forecast is VFR, but there is a risk of marginal VFR (MVFR) in precipitation as noted in the CCG/CVS lines. At 15Z, the categorical forecast for ceiling drops to MVFR, and then to IFR at 16Z, where it stays until evening. Notice that after 15Z, visibility is forecast to remain VFR throughout the entire forecast period.

So after reading this product, our pilot would see that she would be wise to arrive at KCRW prior to 16Z to avoid IFR conditions. A planned arrival at 15Z may require extra fuel. So, the ideal time for arrival would be 14Z or sooner, meaning a departure from her home airport by 12Z. A departure at 13Z is possible, assuming the money for extra fuel is in the pilot's budget!

The text product gives a nice summary of the forecast; however, if you are interested in a more probabilistic or graphic presentation, MDL has you covered. On their Website, you will find probability plots for ceiling and visibility that give you the confidence level of the model (See **Figure 3**, an example of one the uncertainty plots available on the site.) The top half of **Figure 3** is where you select your station, as well as the parameter and flight category for which you want to view probabilities. In this example, I have selected KCRW, and the probabilities of the Ceiling Height falling into the IFR category.

LAV Ceiling Height (CIG) and Conditional Ceiling Height (CCG) Categories	
1	< 200 feet
2	200 - 400 feet
3	500 - 900 feet
4	1000 - 1900 feet
5	2000 - 3000 feet
6	3100 - 6500 feet
7	6600 - 12,000 feet
8	> 12,000 feet or unlimited ceiling

LAV Visibility (VIS) and Conditional Visibility (CVIS) Categories	
1	< 1/2 miles
2	1/2 - < 1 mile
3	1 - < 2 miles
4	2 - < 3 miles
5	3 - 5 miles
6	6 miles

LAV Cloud (CLD) Categories	
CL	clear
FW	few > 0 to 2 octas
SC	scattered > 2 to 4 octas
BK	broken > 4 to < 8 octas
OV	overcast

Figure 2: *Ceiling/visibility categories used in the LAMP text bulletins, from the MDL LAMP Website.*

Recall from **Figure 1** that an IFR ceiling height was the main hindrance to a VFR flight so these probabilities are vital. Notice that there are separate entries for conditional ceiling and visibility in precipitation in the text bulletin.

Each colored vertical bar in the figure represents the probability of an IFR, or worse, ceiling at the indicated hour. The thin black horizontal lines across the figure are threshold values, which vary from hour to hour. The thresholds are dependent on factors such as time of the model run, station and season.

If the probability for a certain hour rises above the threshold value, the categorical forecast in the text bulletin will indicate the flight category in question. The color correspond to how far above or below the probability is relative to the threshold.

In this case, note that the probability of an IFR ceiling rises above the threshold at 16Z. Referring back to **Figure 1**, you see a "3" in the CIG entry at 16Z,

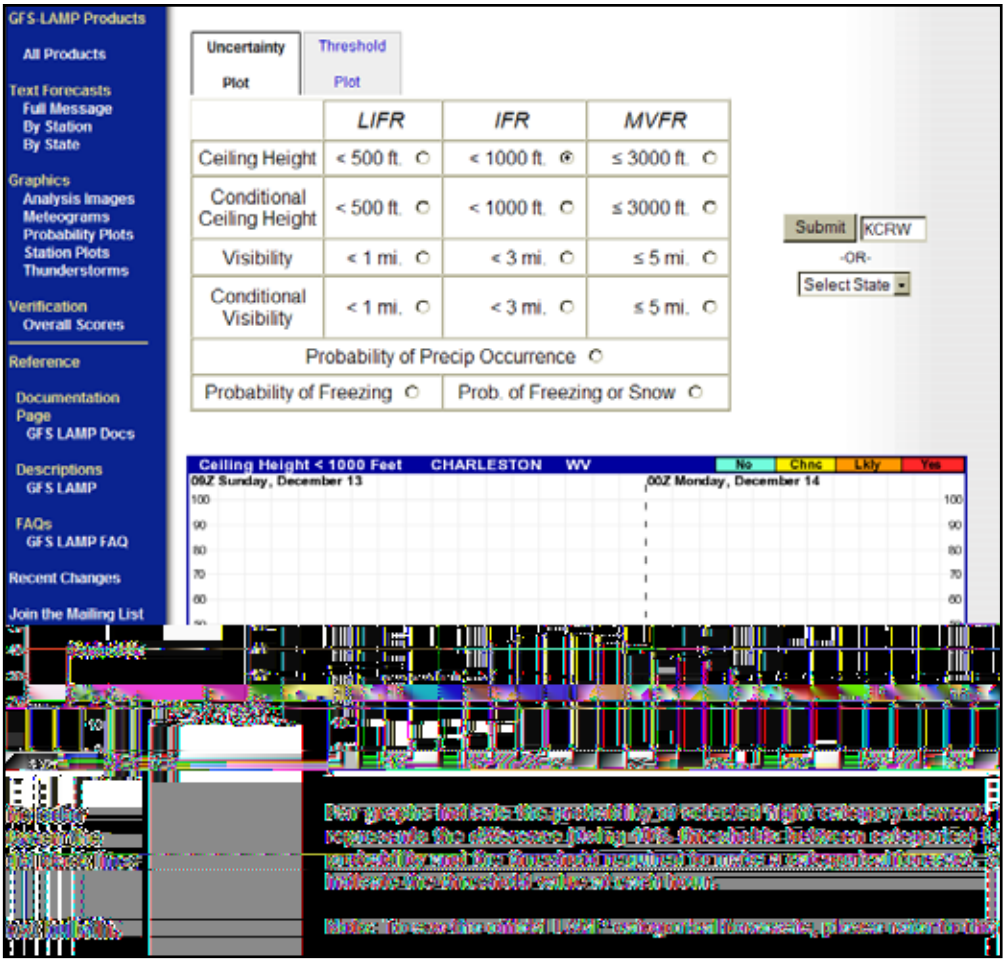


Figure 3: *Uncertainty plot detailing the hourly probability of IFR ceilings, based on the 09Z run of GFS LAMP for KCRW on December 13, 2009. See text for interpretation.*

which represents an IFR ceiling between 500 feet and 900 feet. Note that the probabilities remain above the thresholds by a decent amount for several hours, indicating fairly high confidence in the IFR forecast. Also, notice the probability increases with time in the first 6 hours of the forecast period. You can see there is at least some risk of an IFR ceiling at 14Z and 15Z, although it is not enough for LAMP to make a categorical forecast of IFR. This data can act as an alert to look for an earlier arrival of IFR conditions than depicted in the text bulletin.

How would this affect the KCRW flight? Well, it still appears departing by 12Z for a 14Z arrival would be wise. Even though LAMP is not categorically forecasting IFR until 16Z, there is some risk of IFR conditions between 14Z and 16Z according to the uncertainty plot. So the pilot should depart no later than 12Z. A 13Z departure certainly appears possible, but would be riskier. Certainly, 14Z appears to be too late to leave.

The LAMP text bulletin and uncertainty plot used here are the actual products issued on the morning of December 13, 2009.

What actually happened? **Figure 4** lists the KCRW observations from 09Z on. You can see that VFR conditions remained in effect until about 15Z when the ceiling and visibility dropped to MVFR.

```
METAR KCRW 130854Z 05004KT 10SM -RA OVC049 03/M01 A3010
METAR KCRW 130954Z 12004KT 10SM BKN085 06/02 A3005
METAR KCRW 131054Z 13008KT 10SM CLR 07/03 A3003
METAR KCRW 131154Z 14006KT 10SM -RA BKN075 07/03 A3001
METAR KCRW 131254Z 12003KT 7SM -RA BKN050 OVC080 07/04 A2998
METAR KCRW 131354Z 03003KT 7SM RA OVC055 07/06 A2998
METAR KCRW 131454Z 00000KT 3SM RA BR BKN021 BKN033 OVC042 07/06 A2996
SPECI KCRW 131506Z 00000KT 1SM -RA BR FEW009 BKN019 OVC036 07/06 A2997
METAR KCRW 131554Z 17007KT 1SM -RA BR BKN007 BKN020 OVC034 08/07 A2998
SPECI KCRW 131647Z 18005KT 1SM -DZ BR BKN003 BKN011 OVC022 09/08 A2996
METAR KCRW 131654Z 19004KT 1SM -RA BR BKN003 BKN011 OVC022 09/08 A2996
METAR KCRW 131754Z 24008KT 1/4SM DZ FG BKN003 BKN008 OVC014 10/09 A2996
SPECI KCRW 131803Z 25007KT 1SM -DZ BR BKN005 BKN011 OVC018 10/09 A2996
METAR KCRW 131854Z 25007KT 6SM -DZ BR BKN009 BKN017 OVC023 10/09 A2995
SPECI KCRW 131908Z 25007KT 7SM -DZ SCT009 OVC016 10/09 A2996
METAR KCRW 131954Z 24009KT 7SM -DZ FEW009 BKN015 OVC023 11/09 A2997
METAR KCRW 132054Z 27004KT 2SM -RA BR FEW005 BKN009 OVC015 10/09 A3000
SPECI KCRW 132125Z 25004KT 1/2SM -DZ FG SCT004 BKN008 OVC013 10/09 A3001
  RMK AO2 RAE17DZB18 VIS NE 1 P0001 RVRNO $
SPECI KCRW 132147Z 27004KT 1/2SM -DZ FG OVC004 10/09 A3001
METAR KCRW 132154Z 27003KT 1SM -DZ BR OVC004 10/09 A3001
METAR KCRW 132254Z VRB05KT 5SM -DZ BR SCT004 BKN007 OVC014 09/08 A3004
METAR KCRW 132354Z 00000KT 7SM SCT011 BKN018 OVC040 09/08 A3005
```

Figure 4: *Meteorological Actual Report (METAR) and Special Report (SPECI) observations for KCRW between 0854Z 13 December 2009 and 00Z 14 December 2009.*

Shortly after, at 1506Z, the ceiling abruptly dropped to IFR, which persisted for most of the rest of the day, with a few short periods of improvement. So our pilot would have been well-served to leave at 12Z for a 14Z arrival at CRW, per our recommendation. A later departure would have risked flying into riskier conditions. All things considered, the LAMP forecasting system handled this situation well.

Of course, you should never depend on one source of information for planning. You should always review the TAF, which represents the official NWS forecast for an airport. Also, preflight briefings by flight services personnel are essential to help integrate various sources of weather information into flight planning.

The LAMP system is one of the relatively new pieces of the guidance puzzle that can provide the detail and confidence a pilot needs to plan a safe and enjoyable flight, particularly for site without an official TAF. ✈

Eastern Region CWSU Websites Gain Consistent Look and Feel

By Fred McMullen, Regional Aviation Meteorologist, NWS Eastern Region Headquarters

Eastern Region (ER) CWSU Websites were revamped (Figure 1) to provide users a one-stop shopping experience for aviation weather. The intent was to provide the same look and feel at each Center Weather Service Unit (CWSU) Website. Last summer, ER CWSUs started to provide graphical forecasts and other decision support tools for specific Terminal Radar Approach Control (TRACON) in their airspace. This information is accessed from the left-hand menu of the four ER CWSU Websites by selecting the name of the TRACON (e.g., CLE TRACON forecast).

On the right-hand side, are graphical products that automatically loop when the page loads. Examples of products include Airmets, Sigmets, Icing and Turbulence information, Collaborative Convective Forecast Product (CCFP), from the NWS Aviation Weather Center (AWC) as well as the Storm Prediction Center's Day 1 and Day 2 Convective Outlooks

In the past, specific convective forecast products were not available at aeronautical arrival and departure fixes (Figure 2, the black dots). Thunderstorm Tactical Decision Aids (TDA) were developed (Figure 2) to address a gap in the NWS convective product suite and the TAF. Thunderstorm impact at or near these gates has significant repercussions on the flow of aircraft

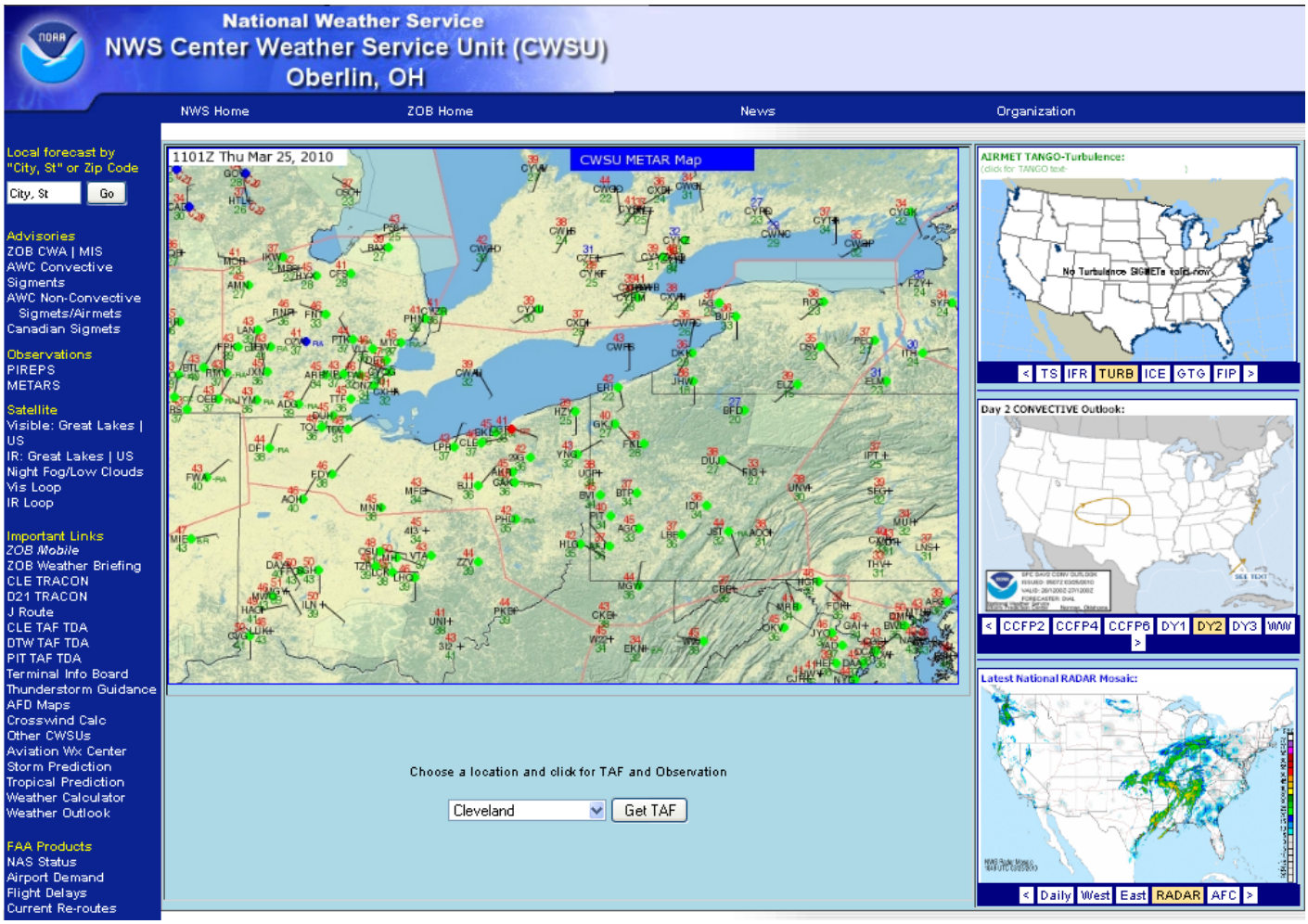


***Figure 1**: Example of CWSU Cleveland's Website*

Thunderstorm	Icing
Cleveland	Boston (A90)
Detroit	N90
New York (N90)	Philadelphia
Philadelphia	
Import points through ZOB's Airspace	
Compression / Wind Speed Outlook	
N90	
Philadelphia	

List of current TDAs produced by ER CWSU meteorologists.

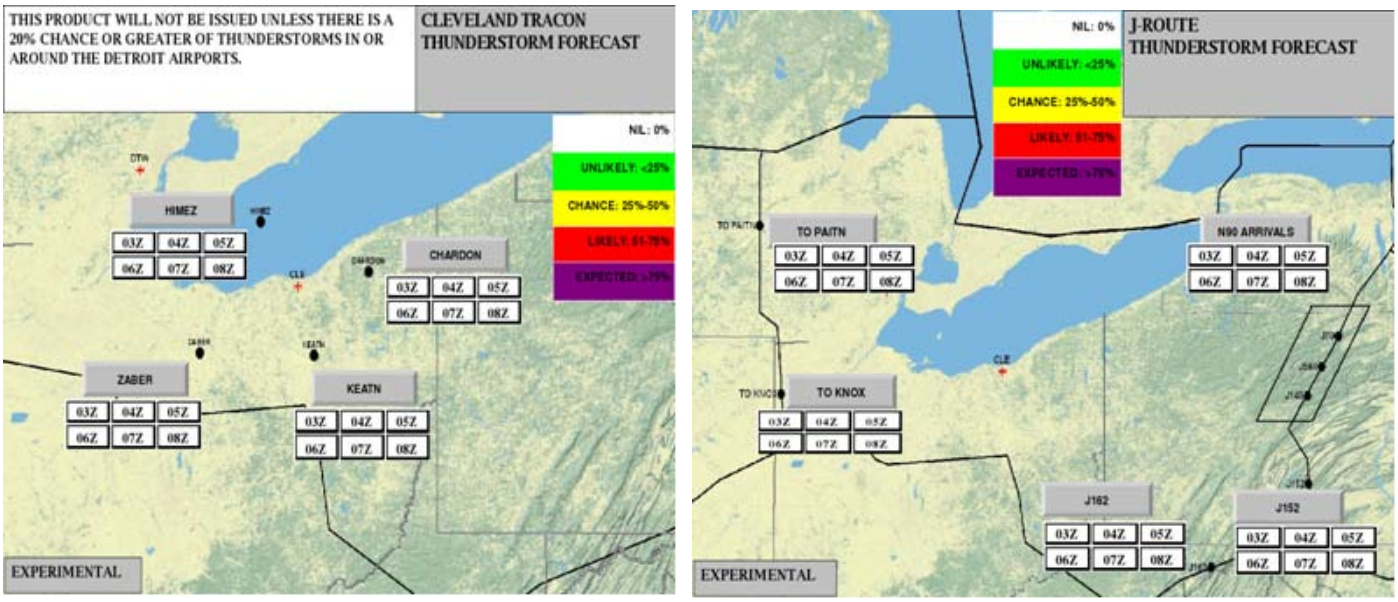


Figure 2: *Example of thunderstorm TDAs issued by CWSU Cleveland. Both the left and right image also can be found online.*

through the National Airspace System (NAS) causing delays. This will allow critical partners and customers to make more informed decisions regarding the air traffic flow through the NAS. For example the forecast outlined in Figure 2 illustrates a zero probability of thunderstorms for those time periods.

Icing TDAs (Figure 3) are also available to provide situational awareness on icing intensity at key points throughout select TRACONs airspace. For A90, the forecasted height of the freezing level is given on the graphic as well.

On days when wind speeds are strong in the lowest levels of the atmosphere, this could lead to compression of airplanes. As a result, CWSU New York provides a wind speed outlook to enhance situational awareness. A traffic light color scheme has been adopted based on customer feedback (Figure 4).

On the left-hand menu, links are provided for information such as "Vertical Wind Profiles," which outline the forecast wind speed aloft based on the Rapid Update Cycle (RUC) model. For further information, please see the June 2009 edition of The Front.

The Terminal Information Board on the Aviation Weather Center's Testbed Website provides a Tactical Decision Aid for TAFs (Figure 5). These TDAs can be filtered by the FAA Air Route Traffic Control Center by typing the center ID (e.g., ZNY). Individual airports can be added using the four-letter ID (e.g., KJFK). You can also select multiple airports by separating them with a

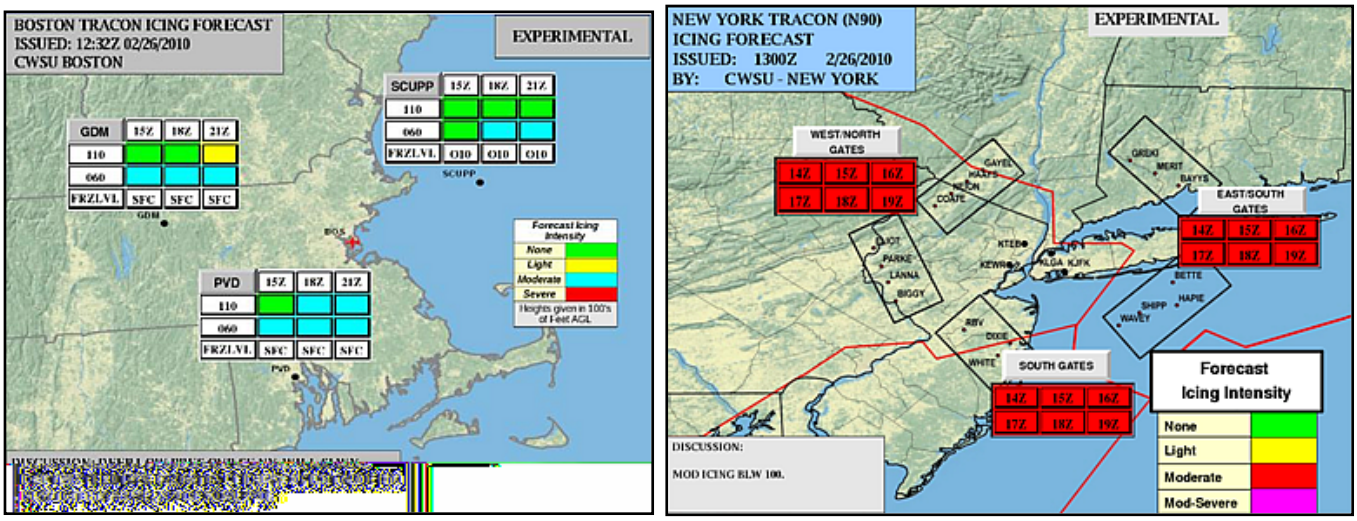


Figure 3: Two examples of Icing TDAs found on the website of CWSU New York and one at CWSU Boston.

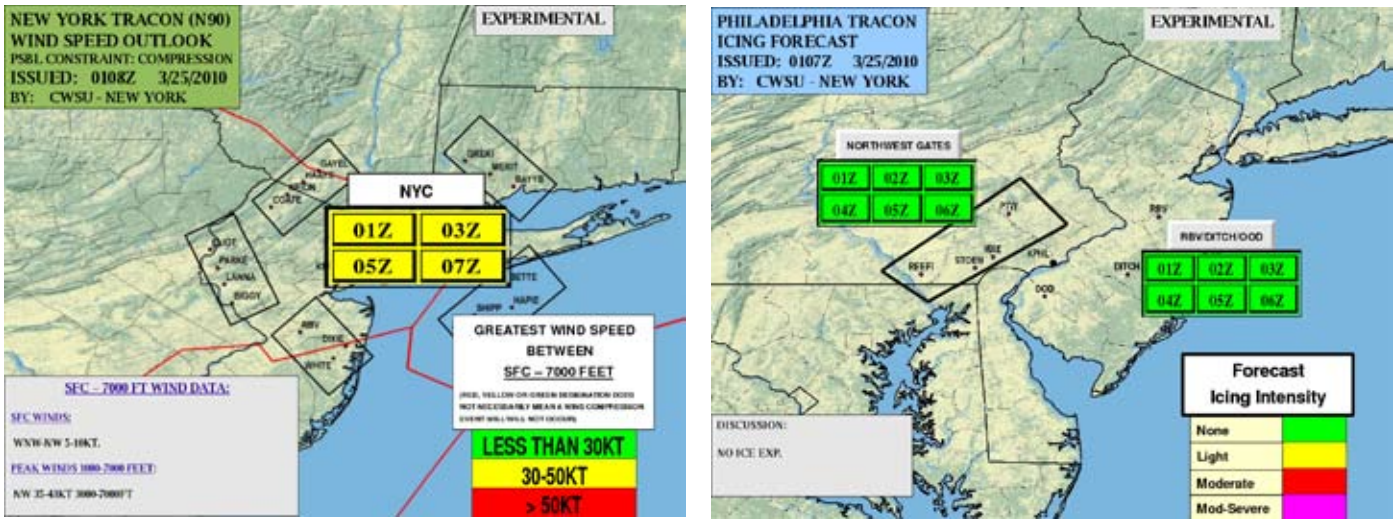


***Figure 4:** Examples of Wind Speed/Compression Outlook products created by forecasters at CWSU New York for New York. and Philadelphia.*

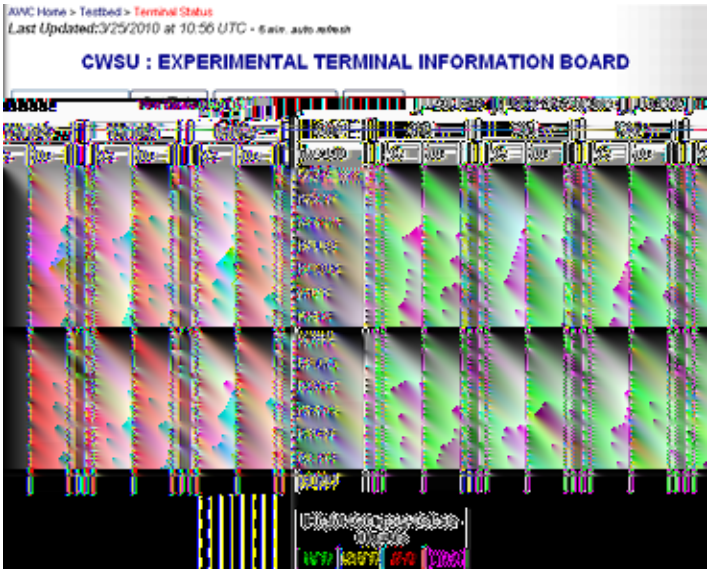
comma. To call up the TAF forecast for the D.C. metro airports, perform the following steps: Enter KDCA, KIAD, KBWI. For future reference, you can bookmark the site after the airport(s) of interest are entered, eliminating the chore of entering the airports again.

CWSU Websites have bundled up several pieces of weather information for key airports to provide a weather bulletin page. These pages are available for New York City, Philadelphia, Cleveland, Detroit, Pittsburgh and the Washington D.C. metro airports. Weather information on the pages include TAFs, aviation discussion, surface analysis, and graphical TRACON products.

Below are the links to each Eastern Region CWSU Website:

- Boston Center
- Cleveland Center
- New York Center
- Washington Center

If you have questions or feedback, please email Fred Mcmullen. ✈



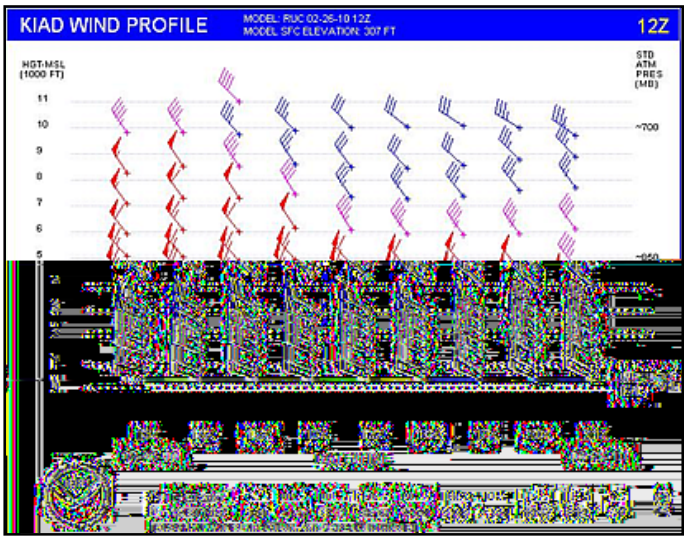


Figure 5: *Left: Terminal Information Board from the [Aviation Weather Center's Testbed Website](#) which provides a list of airports by FAA Air Route Traffic Control Center or user selected airports. Above: Example of a vertical wind profile for Washington Dulles International Airport (KIAD).*

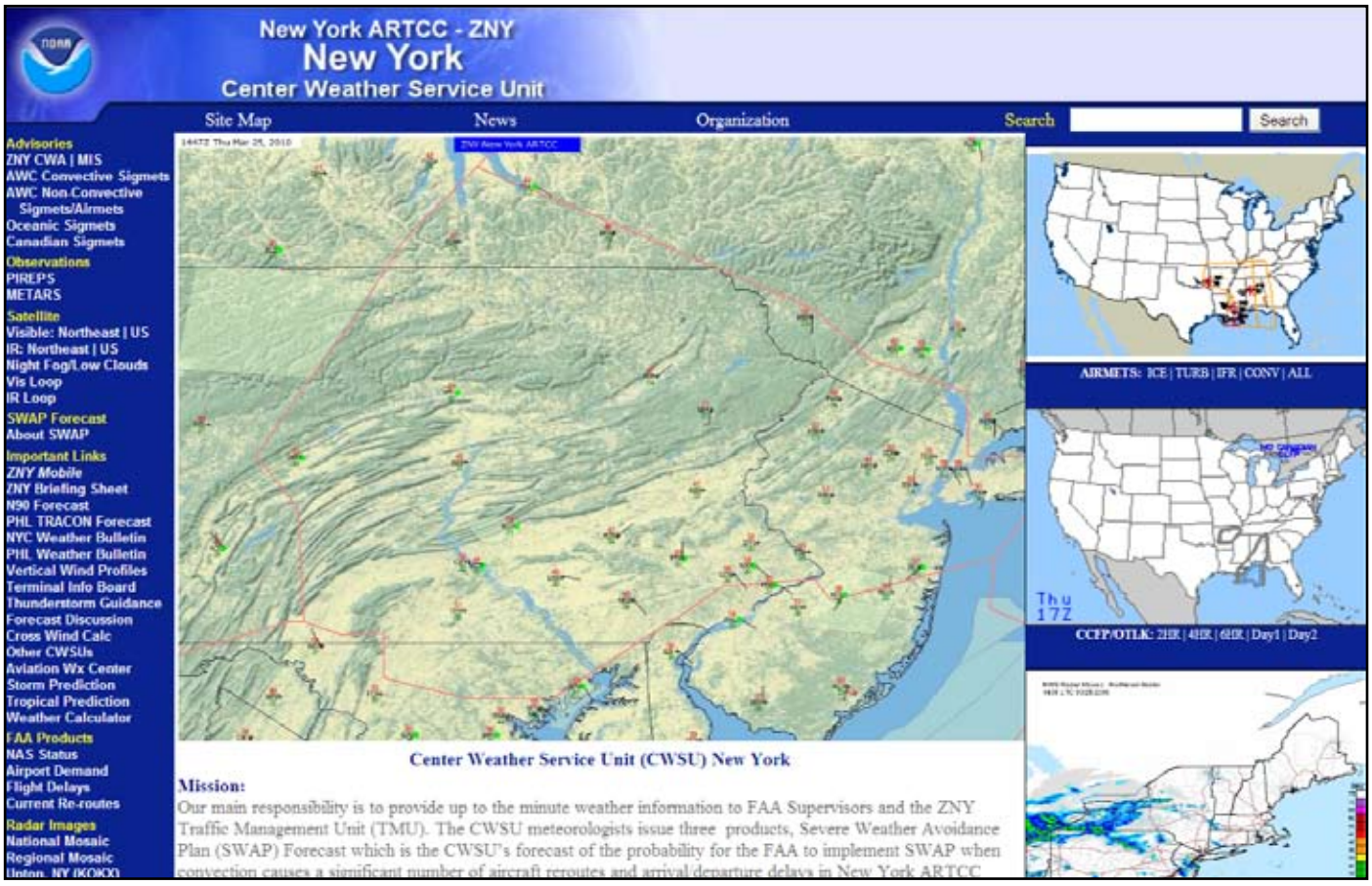


Figure 6: *CWSU New York's main page, with links to the New York City and Philadelphia weather bulletin highlighted within the red box.*