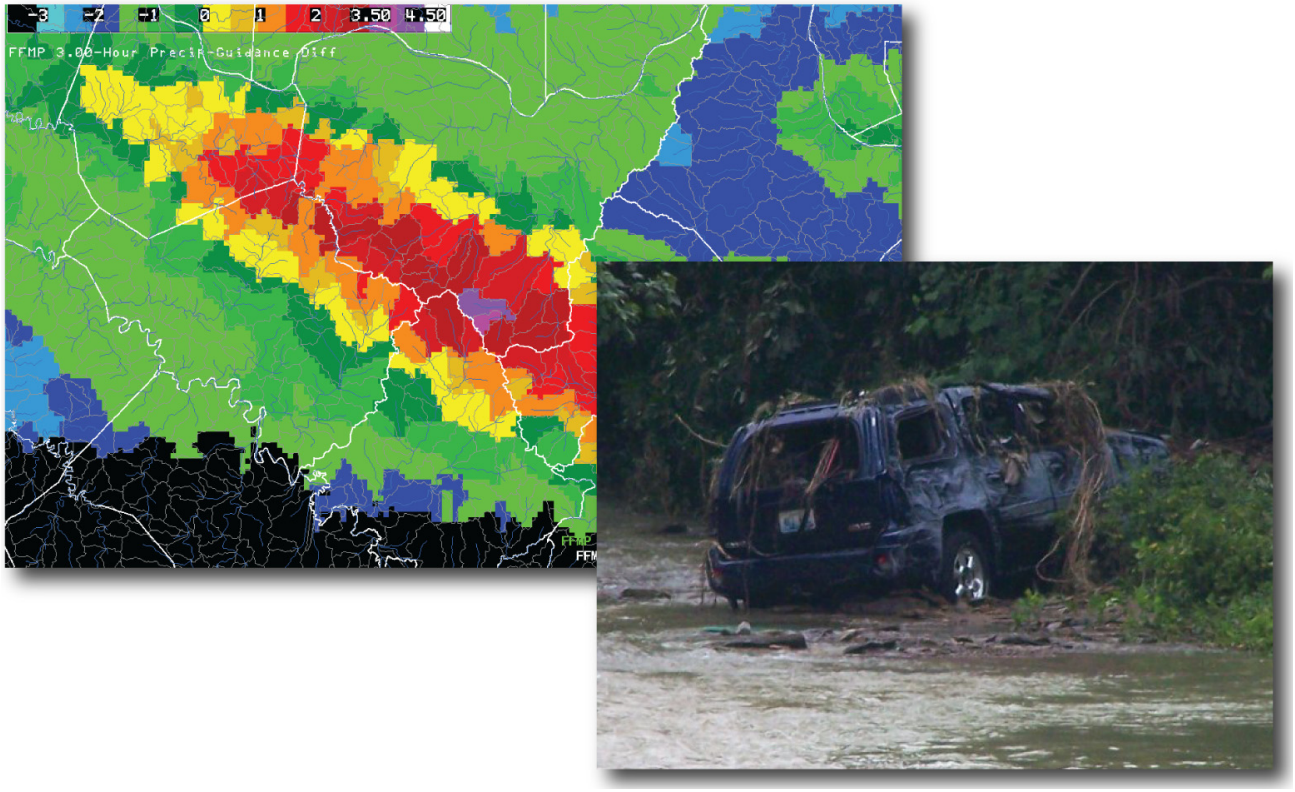
FLASH FLOOD WARNING BEST PRACTICES



SIMULATION GUIDE: JULY 20-21, 2010 EVENT

Presented by:
The Warning Decision Training Branch

Student Version

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Cover image is of the following:

- AWIPS D2D screen capture of rainfall difference compared to the FFMP three-hour flash flood guidance
- A vehicle destroyed by the flash flooding in Lewis County, KY - Courtesy of Joanie Bloomfield, Dennis Brown, and the Lewis County Herald

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Document History

The document history is provided to track any updates or changes to the WES simulation guide. The version number, seen at the bottom of every page, will be updated as each significant change is made to the simulation guide.

Version	Date	Description
1.0	March 31, 2011	Initial Release

To provide feedback, comments, or ideas related to this document, please visit our web site at: http://www.wdtb.noaa.gov

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1: How to Use This Document

Welcome to the ***July 20-21, 2010 Event*** Simulation Guide! The purpose of this guide is to provide you, the trainee, with case-specific materials needed to effectively apply concepts and fundamentals of flash flood forecasting and issuing flash flood warnings in an operations-based simulation. This simulation complements the material provided in the new ***Flash Flood Warning Best Practices*** course regarding the use of a "*Flash Flood Emergency*" in an extreme flash flood event and other previous training detailing basin-based flash flood warnings.

In order to create an effective simulation with this case, you will need to familiarize yourself with the performance objectives and evaluation criteria prior to starting the simulation. The evaluation criteria is outlined in a job-sheet style approach in this guide, which will assist in facilitating your learning experience. See Table 1-1 on Page 1-2 for a description of the layout of this guide. After reviewing the simulation guide and becoming familiar with the details of this event, your training facilitator can begin the simulation for you. This simulation is in a displaced real-time (DRT) mode for the Wilmington, Ohio (ILN) county warning area (CWA).

Your training facilitator will review your performance based on your job-sheet responses, the products you issued, and the your understanding and application of the learning objectives and fundamentals of the new Flash Flood Warning Best Practices course and the Flash Flood Warning Decision Making with FFMP-Advanced course.

Table 1-1: Simulation Guide Layout
Chapter 1: How to Use This Document
This introduction describes the overall content and use of the simulation guide.
Chapter 2: Background Information
The background information provides details regarding the WES simulation, including the WES build and AWIPS data provided with the case.
Chapter 3: Simulation Suggestions
A description of the simulation, including the performance objectives and evaluation criteria, are detailed in this chapter.
Appendix A: SPC Products
This appendix provides the SPC Day One Convective outlook for the event. There were no mesoscale discussions or severe weather watches for this event.
Appendix B: HPC Products
This appendix provides various HPC products regarding heavy rainfall probabilities and quantitative precipitation forecasts (QPFs).
Appendix C: Support Material
This appendix provides supplemental material to assist in the learning experience, including details on built-in procedures and CWA maps.

2: Background Information

The original data set came from the Wilmington, OH (ILN) Weather Forecast Office (WFO), and most data is accessible during the simulations. While there may be some incomplete or missing data due to the archiving process and to reduce the overall size of the case on your WES hard drive, there is enough data present for you to be able to satisfy the learning objectives.

This section will outline some of the datasets available for use during this DRT simulation.

Radar Data:

The radar data provided in Table 2-1 lists the available radars for this case, the location of the radar, the time period of available radar data, and the Volume Coverage Pattern (VCP) used during the time period available. The 0.5° mosaic reflectivity will use all three radars listed here. The Four-Dimensional Storm Cell Investigator (FSI) is also available for KILN and KJKL.

Table 2-1

Radar ID	County and State	CWA	Time Period Available (UTC)	VCP
KILN	Clinton County, OH	ILN	0001 - 0958	12
KJKL	Breathitt County, KY	JKL	0000 - 0959	12
KCLE	Cuyahoga County, OH	CLE	0003 - 0951	212

Upper Air Data:

Table 2-2 lists all of the relevant sounding locations for this case. Only the 0000 UTC 21 July 2010 soundings will be available during the simulation.

Table 2-2

Upper Air ID and Locations	CWA	Location With Respect to ILN
KILN - Cincinnati, OH	ILN	---
KOHX - Nashville, TN	OHX	Southwest
KILX - Lincoln, IL	ILX	West
KGSO - Greensboro, NC	RAH	South-southeast
KDTX - Detroit, MI	DTX	North

Satellite Data:

The majority of the satellite and satellite-derived products are available only for the ***eastConus*** directory for this simulation from 0015 UTC to 0945 UTC 21 July 2010. Since there are numerous satellite base and derived products, this guide will not list them here.

Model Data:

Table 2-3 shows the model data provided for this case. The horizontal resolution of each model is presented for some datasets. Please note the times available for each model. Some files are missing or have been removed in order to reduce the overall size of the case on your WES hard drive.

Table 2-3

Model	Containing Folder	Model Runs Available
LAPS	LAPS	0000 - 0900 UTC (Hourly)
MSAS	MSAS	0000 - 0900 UTC (Hourly)
Eta (40 km)	CONUS212	0000 UTC
GFS (40 km)	CONUS212	0000 UTC and 0600 UTC
MesoEta (40 km)	CONUS212	0000 UTC and 0600 UTC
SREF (40 km)	CONUS212	0300 UTC and 0900 UTC
Eta	GRID218	0000 UTC and 0600 UTC
RUC2	GRID236	0000 - 0900 UTC (Hourly)
ECMWF_HiRes	LATLON	0000 UTC
ENSEMBLE	LATLON	0000 UTC
GFSGuide	LATLON	0000 UTC and 0600 UTC
UKMET	LATLON	0000 UTC and 0600 UTC
LAMP	NDFD	0000 - 0900 UTC (Hourly)
MOSGuide	NDFD	0000 UTC
NamDNG5	NDFD	0000 UTC and 0600 UTC
RTMA	NDFD	0000 - 0900 UTC (Hourly)

Procedures:

We have created a few procedures to help with some basic threat assessment for this event. The procedures can be accessed by selecting *Procedures* in the *File* menu of the D-2D display. A basic list of the provided procedures are shown here in Table 2-4. The details of each procedure are provided in Appendix C: Support Materials. ***Users are encouraged to create their own procedures***.

Table 2-4

Procedure Name	Procedure Bundle	Basic Description	Page
Sfc_Analysis	MesoAnalysis	Surface observations and winds (streamlines) with IR satellite	C-4
PW_MoistTrans	MesoAnalysis	Low-level (925-850 mb) moisture flux divergence and transport vectors with precipitable water	C-5
Corfidi_Vectors	MesoAnalysis	Four panel display featuring Corfidi vectors, CAPE, vorticity, divergence, and frontogenesis	C-6
KILN_Analysis	Radar_FFMP	0.5° reflectivity and one-hour, three-hour, and storm-total precipitation	C-7
FFMP_ILN	Radar_FFMP	Pre-built display for FFMP with various maps displayed	C-8

FFMP Data:

FFMP data were computed from the DHR files available from the three radars provided in this simulation (KILN, KJKL, and KCLE). HPE and Bias-HPE (BHPE) data are also available for this simulation. Table 2-5 provides the details on the flash flood guidance (FFG) being used in this case. Because the 6-HR FFG is not available until after 0600 UTC, the analysis done during the simulation will be focused on the 1-HR and 3-HR FFG.

Table 2-5

FFG Period	Containing Folder	Valid Time
One Hour (1-HR)	OHRFC1	0100 UTC
Three Hour (3-HR)	OHRFC3	0300 UTC
Six Hour (6-HR)	OHRFC6	0600 UTC

When using FFMP, ensure that you have the following settings during the simulation:

- Under the *Config* menu, make sure that the "*Worst Case*" aggregate feature is turned on to show the worst case data instead of basin averages.
- Also under the *Config* menu, make sure that "*Link to Frame*" is also turned on so the table is linked with the scenario time in the D-2D.
- Under the *Layer* menu, make sure that "*All and Only Small Basins*" is selected for the greatest basin detail.
- When doing downstream basin traces, make sure that "*Downstream Only*" is selected from the *Click* menu.

3: Simulation Suggestions

I. Introduction

There is only one displaced real-time (DRT) simulation for this event, which is localized for the Wilmington, OH (ILN) Weather Forecast Office (WFO). The simulation will run from 0415 UTC to 0630 UTC on 21 July 2010. During this simulation, you will analyze the following information:

- Mesoscale environment
- Observed and model-derived Skew-T diagrams
- Radar observations and trends
- FFMP data and trends

The job-sheet style approach will allow you to systematically analyze the event during the simulation. The performance objectives outlined here coincide with the learning objectives from the ***Flash Flood Warning Best Practices*** course. You will be responsible for issuing flash flood warnings for the impacted regions and later issue follow-up statements for their warnings, as described by the simulation schedule outlined on Page 3-4. Make sure that you use appropriate wording and call-to-action statements within your warning products, including the use of a "*Flash Flood Emergency*."

Additional information will be provided during the running of the simulation. An introductory Articulate presentation will appear during the opening minute of the simulation. This presentation will provide you with vital information needed to become familiar with case while gaining local knowledge of the hydrological characteristics of the area, including topography, soil characteristics, and any antecedent precipitation.

A WESSL script will be enabled to help pace the simulation and to provide extra data for you. Local storm reports (LSRs) and information regarding river stage heights will appear during the simulation, which will assist in your analysis and your determining of the magnitude of the event as it unfolds. Another Articulate presentation will appear at the end of the simulation, which will debrief you on the event, including the meteorological and hydrological impacts, and how the reasoning behind the issuance of a "*Flash Flood Emergency*" by the ILN WFO.

At the end of the presentation, you will have access to the following interactive maps, which are linked in the debrief presentation:

- Local Storm Report Map:
    - Extensive details of each LSR
    - Pictures from Lewis County and one video from the town of Olive Hill, KY
- Post-Brief Map:
    - CoCoRaHS rain gauge data
    - Stage hydrographs from USGS river gauge data
    - One-Hour and Three-Hour basin trace flash animations (includes rain rate, QPE, FFG thresholds, KILN 0.5° reflectivity, and difference from FFG)

****** Remember to review the performance objectives and evaluation criteria prior to running the simulation ******

II. Simulation - July 20-21, 2010 Event

Simulation Information:

WFO Localized -- Wilmington, Ohio (ILN)

Simulation Start Date/Time -- 0415 UTC 21 July 2010

Simulation End Date/Time -- 0630 UTC 21 July 2010

WES Macro -- ILN-0415-21July2010

Overview:

This simulation will focus on the flash flood event that occurred in the southern part of the Wilmington, Ohio (ILN) county warning area (CWA). Rainfall started falling in the southern part of the CWA around 2000 UTC 20 July and continued on-and-off into the overnight hours. Some flash flooding has been reported within the CWA where high water is being reported across several roads in the town of Augusta in Bracken County, KY.

The objectives of this simulation are as follows:

1. Complete an environmental analysis and determine the flash flood threat and magnitude.
2. Understand radar and FFMP observations and trends and apply this knowledge to flash flooding situations.
3. Issue appropriate flash flood warnings and follow-up statements, including the use of a "*Flash Flood Emergency*."

You are expected to generally follow the schedule shown on the next page. The simulation is provided in a job-sheet type format to maximize the learning experience from the event while providing an opportunity for you to issue flash flood warnings in a DRT environment.

Schedule for Trainee:

The following schedule is a basic timetable of the simulation. The time spent on each performance objective may vary.

- 0415-0430 UTC (15 mins): **Pre-Brief Presentation**
- 0430-0500 UTC (30 mins): **Performance Objective #1 -** Mesoscale Analysis
- 0500-0520 UTC (20 mins): **Performance Objective #2 -** Radar and FFMP Analysis - Part I
- 0520-0540 UTC (20 mins): **Performance Objective #3 -** Issuing Flash Flood Warnings
- 0540-0610 UTC (30 mins): **Performance Objective #4 -** Radar and FFMP Analysis - Part II
- 0610-0630 UTC (20 mins): **Performance Objective #5 -** Issuing Flash Flood Statements

*The **Post-Brief Presentation** will appear at the end of the simulation and will run for approximately 15 minutes.*

****** Before you begin this simulation...***

1. Make sure that you have a copy of the student guide with you. Review the simulation guide in order to completely understand the objectives prior to starting the simulation.
2. Ensure that you have a readily accessible map of the CWA (see Appendix C for a copy of the CWA map).

Performance Objectives:

Performance Objective #1 -- Mesoscale Analysis

Time Period -- 0430 UTC to 0500 UTC

The mesoscale analysis is important here to characterize the environment and forcing involved in this case since it is not synoptically evident. A short-term (3-4 hour) analysis can help identify the flash flood potential for localized areas.

Evaluation Criteria 1.1 - First perform a basic surface analysis for the region. Load the procedure ***Sfc_Analysis*** from the ***MesoAnalysis*** procedure bundle into a blank D-2D pane. This procedure contains METAR observations, surface winds (as streamlines), and satellite IR imagery. Make sure that you scroll back in time to the RUC40 0400 UTC model output.

**** If you are having problems loading this procedure, refer to **Surface Analysis** on Page C-4 in Appendix C for the procedure details. ****

1. Identify the location of the boundary based on surface streamlines and IR satellite at 0400 UTC. Scroll between the 0000 UTC and 0400 UTC time frame. Describe the movement of this boundary between 0000 UTC and 0400 UTC.

2. Bring the image back to the 0400 UTC analysis. Perform a basic surface analysis using the METAR observations provided in the procedure. You can increase the density of the number of METAR stations to help your analysis.

Evaluation Criteria 1.2 - The next step is to evaluate the moisture content of the atmosphere. In another D-2D pane, load the procedure ***PW_MoistTrans*** from the ***MesoAnalysis*** procedure bundle. This procedure displays the precipitable water, 925-850 mb moisture transport vectors, and 925-850 mb moisture convergence. Again, make sure that you scroll back in time to the RUC40 0400 UTC model output.

**** If you are having problems loading this procedure, refer to **Precipitable Water and Moisture Transport** on Page C-5 in Appendix C for the procedure details. ****

1. What are the general precipitable water values (in inches) across southern Ohio and northern Kentucky? Are these values considered to be above normal for this region (see Figure 3-1)?

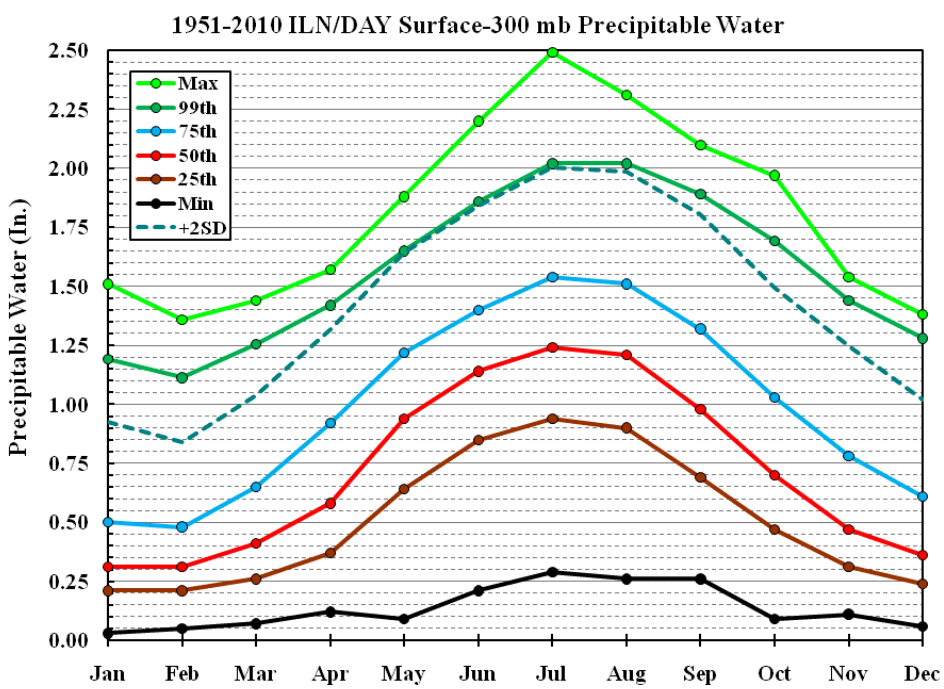


Figure 3-1: Precipitable water climatology from the surface to 300 mb for the ILN sounding from 1951-2010. All the solid lines represent a specific percentile, as seen in the legend, with the red line representing the mean precipitable water for each month. The green dashed line represents +2 standard deviations from normal.

2. Where are the maximum values of 925-850 mb moisture convergence located in this region?

3. Move forward in time to the three-hour RUC40 forecast at 0700 UTC. Are there any significant changes to the location and magnitude of the precipitable water and moisture convergence in this region?

Evaluation Criteria 1.3 - Now evaluate the Corfidi Vectors and the atmospheric flow/instability for this region using the RUC 40 output at 0400 UTC. In another D-2D pane, load the procedure ***Corfidi_Vectors*** from the ***MesoAnalysis*** procedure bundle and set to 0400 UTC.

**** If you are having problems loading this procedure, refer to **Corfidi Vectors and Atmospheric Flow/Instability** on Page C-6 in Appendix C for the procedure details. ****

1. The top left panel contains the 850-300 mb mean wind (which represents the storm-scale steering flow), 850 mb winds, and Corfidi Vectors overlaid onto the 0.5° mosaic reflectivity. What does the wind and Corfidi Vector analysis tell you about the convective movement and duration potential?

2. The top right panel contains 925-850 mb vorticity, winds, and moisture transport. Describe the location of the vorticity maximum and what impact it has on the low-level flow around the southern part of the ILN CWA.

3. The bottom left panel displays the 0-3 km most-unstable convective available potential energy (MUCAPE) for the region. What are the approximate values of MUCAPE in the ILN CWA?

4. The bottom right panel displays 925-850 mb divergence, frontogenesis, and moisture transport. At 0400 UTC, where are the maximum values of convergence and frontogenesis located? Based on the 925-850 mb moisture transport vectors (this panel) and magnitude image (top right panel), where are the convergence and frontogenesis maxima in relation to the maximum moisture transport? And what can you imply from this?

5. Advance the RUC40 analysis to the three-hour forecast at 0700 UTC. Describe the evolution of the environment between 0400 UTC and 0700 UTC based on the parameters shown in this section.

Evaluation Criteria 1.4 - Load into a blank D-2D pane the 0000 UTC 21 July 2010 sounding from Cincinnati, Ohio (ILN). Examine the different parameters shown in Table 3-1 and write your answers in the table.

Table 3-1

Skew-T Parameter	Answer
Moisture Depth: Determine how deep the moisture profile is for this sounding. In the answer column, write the approximate height (in mb and feet) of the top of the moist layer.	
Precipitable Water: Find the parameter *Precip Water* in the text shown below the sounding and write down the value (in inches).	
LCL: Write down the LCL height (in mb and feet) as it is described in the parameters below the sounding.	
Sub-Cloud Layer: Determine the depth of the sub-cloud layer by subtracting the elevation of the sounding location (1,063 feet) from the LCL height.	
Height of the Freezing Level: Write down the height of the freezing level (in feet) as described in the parameters provided with the Skew-T.	
Warm Cloud Layer: Determine the depth of the warm cloud layer (in feet). To do this, subtract the height of the LCL from the height of the freezing level.	
Mean Layer Flow: Write down the direction and magnitude (in kts) of the 0-6 km winds as shown in the parameters below the sounding.	
CAPE Profile: Describe the CAPE profile of this sounding. Write down the CAPE value (*Positive Energy Abv LFC)* in J/kg. Then describe the CAPE profile of this sounding (i.e., tall and skinny CAPE, short and fat CAPE, etc.)	

Evaluation Criteria 1.5 - In another D-2D pane, set the zoom to *WFO* scale and load *Points* from the *Tools* menu. Place one of the points over Lewis County, KY at approximately 38.6°N, 83.4°W. Open a *Volume Browser* and change the product type to *Sounding*. Load a RUC40 sounding for the point over Lewis County. Conduct an analysis on the RUC40 sounding at 0400 UTC 21 July 2010 using Table 3-2.

Table 3-2

Skew-T Parameter	Answer
Moisture Depth: Determine how deep the moisture profile is for this sounding. In the answer column, write the approximate height (in mb and feet) of the top of the moist layer.	
Precipitable Water: Find the parameter *Precip Water* in the text shown below the sounding and write down the value (in inches).	
LCL: Write down the LCL height (in mb and feet) as it is described in the parameters below the sounding.	
Sub-Cloud Layer: Determine the depth of the sub-cloud layer by subtracting the elevation of the sounding location (873 feet) from the LCL height.	
Height of the Freezing Level: Write down the height of the freezing level (in feet) as described in the parameters provided with the Skew-T.	
Warm Cloud Layer: Determine the depth of the warm cloud layer (in feet). To do this, subtract the height of the LCL from the height of the freezing level.	
Mean Layer Flow: Write down the direction and magnitude (in kts) of the 0-6 km winds as shown in the parameters below the sounding.	
CAPE Profile: Describe the CAPE profile of this sounding. Write down the CAPE value (*Positive Energy Abv LFC)* in J/kg. Then describe the CAPE profile of this sounding (i.e., tall and skinny CAPE, short and fat CAPE, etc.)	

Evaluation Criteria 1.6 - After examining the mesoscale environment and soundings, complete the checklist in Table 3-3 for the southern Ohio and northern Kentucky region. After answering all of the questions in the checklist, write a brief summary on the atmospheric conditions in place over the southern part of the ILN CWA and how conducive it is for flash flooding. The summary should include a short-term forecast for the next three to four hours for the southern part of your CWA.

Table 3-3

Checklist	Yes	No
Is there a quasi-stationary forcing mechanism (i.e., boundary)? A slow moving line segment or numerous storms moving along a boundary can lead to increased rain duration over areas.		
Does an abnormally high amount of precipitable water exist over the region?		
Is there a considerable amount of moisture transport and convergence over the area? High amounts can lead to strong moisture flux into storms and better rainfall efficiency and rates.		
Are there low LCL heights over the area?		
Does a deep warm cloud layer (i.e., > 10,000 ft) exist in this area based on the soundings? This can imply that warm rain processes will be dominant and better precipitation efficiency.		
Is there weak mean cloud layer flow (i.e., layer winds generally less than 10 kts) over the region? Weak flow can lead to very slow moving or nearly stationary storms.		
Are the Corfidi vectors weak (i.e., approximately 10 kts or less) over the region, which could signify slow system movement?		
Are the CAPE values relatively small over the area? Note that moderate CAPE is not required for flash flooding events since they can potentially lead to significant DCAPE, which could lead to cold-pooling and forward propagation.		
Was there a significant amount of antecedent precipitation that fell over the region prior to the start of the simulation? Recall this information from the pre-brief presentation.		

Use this blank page to write your discussion for Evaluation Criteria 1.6.

Performance Objective #2 -- Radar and FFMP Analysis - Part I

Time Period -- 0500 UTC to 0520 UTC

Evaluation Criteria 2 - During this part of the simulation, you will take a look at real-time radar observations and FFMP data. Document any areas that have received a significant amount of rainfall within the ILN CWA. Use FFMP to determine what basins have exceeded the 1-HR and 3-HR flash flood guidance (FFG) and by how much. Observe any radar and basin trends to determine what areas will exceed FFG in the near future.

Do not issue any warnings during this time period! A WESSL pop-up window will appear at 0520 UTC to inform you when you can start issuing warnings. This message will also signify the end of Performance Objective #2 and the beginning of Performance Objective #3. The evaluation criteria for the flash flood warnings are defined in Evaluation Criteria 3 beginning on Page 3-16.

Recommendations and Notes for Your Analysis:

- This event is occurring along the southern part of your CWA border and it is about equidistant between the Wilmington, OH WSR-88D (KILN) and the Jackson, KY WSR-88D (KJKL). You can use both radars to help with your analysis on precipitation accumulation; however, this simulation focuses on the KILN WSR-88D data.
- Be aware that as you start your analysis, there are a lack of reports for your area. Therefore, you will have to rely on reports from other areas and create comparisons to determine the severity of the flash flooding.
- Remember to go to the Layers menu in FFMP and set it to "*All and Only Small Basins*" for the greatest basin detail.
- Make sure that FFMP has been set to "*Link to Frame*" and that the frame count is set to a low number. FFMP is a memory-intensive program and could become sluggish.
- When using FFMP, focus on the 1-HR and 3-HR difference product to assist in determining the magnitude of the flash flooding. Please note that 6-HR FFMP data is currently not available.
- Be cognizant of the downstream flow of runoff from the basins receiving the heavy precipitation. You can make FFMP editable in D-2D and then right click the basin in the display to see downstream traces.

We have provided two procedures to assist you during your analysis:

- ***KILN_Analysis***
- ***FFMP_ILN***

Both of these procedures are located in the ***Radar_FFMP*** procedure bundle. The ***KILN_Analysis*** procedure is a four-panel display containing 0.5° base reflectivity along with one-hour precipitation, storm-total precipitation, and an image combination of one-hour and three-hour FFG. The ***FFMP_ILN*** procedure is a pre-built display for FFMP with various maps overlaid onto FFMP (e.g., cities, CWA borders, etc.).

**** If you are having problems loading these procedure, refer to* ***KILN WSR-88D Radar Analysis*** *on Page C-7 and* ***ILN FFMP Analysis*** *on Page C-8 within Appendix C for the procedure details. ****

Performance Objective #3 -- Issuing Flash Flood Warnings

Time Period -- 0520 UTC to 0540 UTC

Evaluation Criteria 3 - Demonstrate the ability to issue effective *Flash Flood Warnings* for the impacted regions. Ensure that the flash flood warnings cover the threat area and also accounts for the immediate downstream basins. Also, make sure that the warnings clearly describe the magnitude of the threat and use appropriate call-to-action statements. Remember not to issue one large warning because of the differences in flash flood magnitude and anticipated and/or continued flash flooding based on radar and FFMP trends.

Once you have finished issuing your flash flood warnings, you can move on to Performance Objective #4 to continue your radar and FFMP analysis.

Performance Objective #4 -- Radar and FFMP Analysis - Part II

Time Period -- 0540 UTC to 0610 UTC

Evaluation Criteria 4 - This is a continuation of the radar and FFMP data analysis that you completed in Performance Objective #2. Again, identify any areas that have received a significant amount of rainfall within the ILN CWA. Use FFMP to determine what basins have exceeded FFG and by how much. Continue observing any radar and basin trends to determine what areas will continue to exceed FFG in the near future.

Do not issue any flash flood statements for your warnings during this time period! A WESSL pop-up window will appear at 0610 UTC to inform you when you can start issuing follow-up statements for your warnings. This message will also signify the end of Performance Objective #4 and the beginning of Performance Objective #5. The evaluation criteria for the flash flood statements are defined in Evaluation Criteria 5 beginning on Page 3-19.

Recommendations and Notes for Your Analysis:

- Focus on the ratio and difference from 1-HR and 3-HR FFG and their rate of increase over the analysis period. You can use basin trend graphs to assist in your analysis of the situation. Take note of areas that have significantly exceeded FFG (e.g., basins that have exceeded 3-HR FFG by over three inches and/or 300%). The FFMP products based on the 6-HR FFG will be available after 0600 UTC.
- Take note of any incoming storm reports, including those outside of your area of responsibility. Compare these reports with the rainfall totals and FFG in their respective areas. This can help provide an understanding of what might be happening in areas where you are lacking storm reports.
- Be cognizant of the downstream flow of runoff from the basins receiving the heavy precipitation. The combination of the antecedent precipitation and the rainfall totals already received to this point guarantees that the top layers of soil are completely saturated and rainfall is being converted directly into runoff.
- After 0600 UTC, you will receive some river gauge data from the USGS. Although the stage heights are unremarkable at this time, please note their rates of increase. Note that it takes time for rivers and creeks to respond to heavy rains based on flood-routing and time-of-travel.

We have provided two procedures to assist you during your analysis:

- ***KILN_Analysis***
- ***FFMP_ILN***

Both of these procedures are located in the ***Radar_FFMP*** procedure bundle. The ***KILN_Analysis*** procedure is a four-panel display containing 0.5° base reflectivity along with one-hour precipitation, storm-total precipitation, and an image combination of one-hour and three-hour FFG. The ***FFMP_ILN*** procedure is a pre-built display for FFMP with various maps overlaid onto FFMP (e.g., cities, CWA borders, etc.).

**** If you are having problems loading these procedure, refer to **KILN WSR-88D Radar Analysis** on Page C-7 and **ILN FFMP Analysis** on Page C-8 within Appendix C for the procedure details. ****

Performance Objective #5 -- Issuing Flash Flood Statements

Time Period -- 0610 UTC to 0630 UTC

Evaluation Criteria 5 - In the final part of the simulation, you will now issue *Flash Flood Statements* for the *Flash Flood Warnings* issued earlier in the simulation. Determine what region of your CWA is currently experiencing extreme flooding based on your FFMP analysis and the flooding reports you have received over the past hour and issue a "Flash Flood Emergency" for the appropriate area. Make sure that your follow-up statements clearly describe the magnitude of the threats for each warning polygon and use appropriate call-to-action statements. A copy of the template for a flash flood statement containing the "Flash Flood Emergency" wording is available on Page 3-20.

Try to compare the rainfall totals and flooding to previous events in order to evaluate the magnitude of the event. Due to a lack of river and stream gauges in the area, you do not have much to work with regarding the hydrologic response to the rainfall. However, an update on some of the river gauge data in the region was provided in the WESSL just after 0600 UTC. Also, here are a couple of significant events that have impacted the region near the Ohio River that are either within or near the ILN CWA:

- ***May 1-2, 2010*** -- Areas south of the Ohio River, notably Mason and Lewis Counties in Kentucky, received over five inches of rain. Numerous roads were closed due to flooding in both counties, and the Kinniconick Creek was flowing over its banks near Petersville. Outside of the ILN CWA, Tygarts Creek near Greenup, KY (RLX CWA) recorded a record crest of 24.40 ft. on May 3rd. The town of Olive Hill in Carter, Co. (RLX CWA) had five feet of water in the downtown area.
- ***May 18, 2001*** -- Counties along the Ohio River received five to eight inches of rainfall over a six day period (14-19 May 2001) with the majority of the rain falling on 18 May 2001. Some of the most notable flash flooding occurred in Scioto County, OH, where numerous roads were closed with a number of houses and a fire department evacuated.

Note that the simulation is ending at 0630 UTC. A post-brief presentation will open up during the final minute of the simulation. Make sure that you have all of your flash flood statements issued before the simulation concludes.

Flash Flood Statement Containing the "Flash Flood Emergency" Format from NWS Directive 10-922:

```
WGAAii cccc ddhhmm (BBB)
FFSxxx

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE <city, state>
hhmm am/pm time_zone day mon dd yyyy

stCNNN-NNN-NNN-ddhhmm-
/k.CON.cccc.FF.W.####.yymmddThhnnZB-yymmddThhnnZE
/0000.s.ic.000000T0000Z.000000T0000Z.000000T0000Z.OO/
<county #1>-<county #2>-<county #n>-
INCLUDING <THE CITIES OF> location...location
hhmm am/pm time_zone day mon dd yyyy

...THE FLASH FLOOD WARNING REMAINS IN EFFECT UNTIL <hhmm am/pm time_zone>
FOR <geographic area>...

...A FLASH FLOOD EMERGENCY FOR <geographic area>...

<current hydrometeorological situation and expected impacts>.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

<call-to-action statement> (optional)

&&

LAT...LON nnnn nnnn

$$

<Name/Initials/Forecaster ID> (optional)
```

Appendix A: SPC Products

Provided here is the valid SPC Day One convective outlook for the nation. There were no severe weather watches or mesoscale discussion in effect for the ILN area during the simulation.

Convective Day 1 Outlook
Valid 210100 UTC - 211200 UTC

SPC AC 210102

DAY 1 CONVECTIVE OUTLOOK
NWS STORM PREDICTION CENTER NORMAN OK
0802 PM CDT TUE JUL 20 2010

VALID 210100Z - 211200Z

...THERE IS A SLGT RISK OF SVR TSTMS ACROSS PARTS OF THE CNTRL PLAINS...MID-MO VALLEY...MID-MS VALLEY...AND OH VALLEY...

...THERE IS A SLGT RISK OF SVR TSTMS ACROSS PARTS OF THE NRN PLAINS...

...THERE IS A SLGT RISK OF SVR TSTMS ACROSS PARTS OF THE UPPER GREAT LAKES...

...THERE IS A SLGT RISK OF SVR TSTMS ACROSS PARTS OF THE CNTRL AND NRN HIGH PLAINS...

...THERE IS A SLGT RISK OF SVR TSTMS ACROSS PARTS OF SE VA AND ERN NC...

...CNTRL PLAINS/MID-MO VALLEY/MID-MS VALLEY...
AN MCS IS ONGOING IN NE KS AND CNTRL MO LOCATED ALONG THE NRN EDGE OF STRONG INSTABILITY WITH OBJECTIVE ANALYSIS SHOWING MLCAPE VALUES JUST SOUTH OF THE BOWING LINE-SEGMENT IN THE 2500 TO 4000 J/KG RANGE. THIS COULD FUEL THE LINE ESEWD ACROSS THE REMAINDER OF MO INTO SRN IL THIS EVENING. THE ST LOUIS WSR-88D VWP SHOWS UNIDIRECTIONAL WINDS WITH 20 TO 30 KT OF FLOW AT 1 TO 2 KM. THIS ALONG WITH SFC DEWPOINTS IN THE UPPER 70S F AND STEEP LOW-LEVEL LAPSE RATES SHOULD RESULT IN A WIND DAMAGE THREAT WITH THE MCS EARLY THIS EVENING. HAVE MAINTAINED A SMALL 30 PERCENT WIND PROBABILITY IN ERN MO AND SRN IL ALONG THE EXPECTED TRACK OF THE MCS.

FURTHER WEST...ACROSS THE CNTRL HIGH PLAINS...A PRONOUNCED LOW-LEVEL JET WILL STRENGTHEN THIS EVENING WITH SCATTERED THUNDERSTORMS POSSIBLY DEVELOPING ALONG THE NOSE OF THE LOW-LEVEL JET IN NRN KS AND SERN NEB. STEEP MID-LEVEL LAPSE RATES AND MODERATE DEEP LAYER SHEAR SHOULD BE SUFFICIENT FOR A SEVERE THREAT TONIGHT WITH THE STRONGER CELLS SO HAVE MAINTAINED THE SLIGHT RISK IN THIS AREA. A FEW SEVERE STORMS WILL ALSO BE POSSIBLE THIS EVENING ACROSS SE CO WHERE OBJECTIVE ANALYSIS SHOWS 2500 TO 3500 J/KG OF MLCAPE AND 40 KT OF DEEP LAYER SHEAR.

...NRN PLAINS...
SCATTERED THUNDERSTORMS ARE ONGOING IN NRN ND JUST AHEAD OF A SHORTWAVE TROUGH EVIDENT ON WATER VAPOR IMAGERY. THIS ACTIVITY IS LOCATED IN A POCKET OF MODERATE INSTABILITY WITH OBJECTIVE ANALYSIS SHOWING MLCAPE VALUES IN THE 1500 TO 2000 J/KG RANGE ACROSS NRN AND ERN ND. THIS COMBINED WITH 40 TO 50 KT OF DEEP LAYER SHEAR AND STEEP MID-LEVEL LAPSE RATES SHOULD SUPPORT A THREAT FOR HAIL WITH THE MORE INTENSE CORES FOR A FEW MORE HOURS.

...UPPER GREAT LAKES...
A LINE OF THUNDERSTORMS IS CURRENT ONGOING FROM THE NRN END OF LAKE MICHIGAN SSWWD ACROSS FAR ERN WI AND IS JUST AHEAD OF A SHORTWAVE TROUGH EVIDENT ON WATER VAPOR IMAGERY OVER THE FAR WRN PART OF THE GREAT LAKES. OBJECTIVE ANALYSIS SUGGESTS THAT MODERATE INSTABILITY IS IN PLACE ACROSS NRN LOWER MI AND THIS MAY HELP CONVECTION TO REINTENSIFY AFTER CROSSING LAKE MICHIGAN. HAIL AND STRONG GUSTY WINDS WILL BE POSSIBLE ESPECIALLY WITH THE MORE INTENSE SHORT BOWING LINE-SEGMENTS. HAVE MAINTAINED A SMALL SLIGHT RISK ACROSS NRN LAKE MI AND PARTS OF WRN LOWER MI.

...SE VA AND ERN NC...
SCATTERED THUNDERSTORMS ARE ONGOING IN SERN VA AND ERN NC ALONG A SF TROUGH AND AXIS OF MODERATE TO STRONG INSTABILITY. OBJECTIVE ANALYSIS CURRENTLY SHOWS ABOUT 20 KT OF FLOW AT 850 MB WITH STEEP LOW-LEVEL LAPSE RATES. THIS ENVIRONMENT ALONG WITH UNIDIRECTIONAL WIND PROFILES SHOULD BE SUFFICIENT FOR A FEW DAMAGING WIND GUSTS WITH THE MORE INTENSE CELLS FOR A FEW MORE HOURS.

...UPPER OH VALLEY...
A CLUSTER OF STORMS CURRENTLY OVER NERN KY...SWRN OH AND SERN IND IS ONGOING ON THE NERN EDGE OF STRONG INSTABILITY AHEAD OF A SUBTLE SHORTWAVE TROUGH EVIDENT ON WATER VAPOR IMAGERY. THIS CONVECTION SHOULD CONTINUE TO MOVE EWD INTO THE CNTRL APPALACHIAN MTNS THIS EVENING WHERE REGIONAL WSR-88D VWPS SHOW 25 TO 30 KT OF 0-3 KM SHEAR. THIS ALONG WITH THE INSTABILITY SHOULD BE SUFFICIENT FOR STORM ROTATION AND A MARGINAL TORNADO THREAT MAY CONTINUE FOR

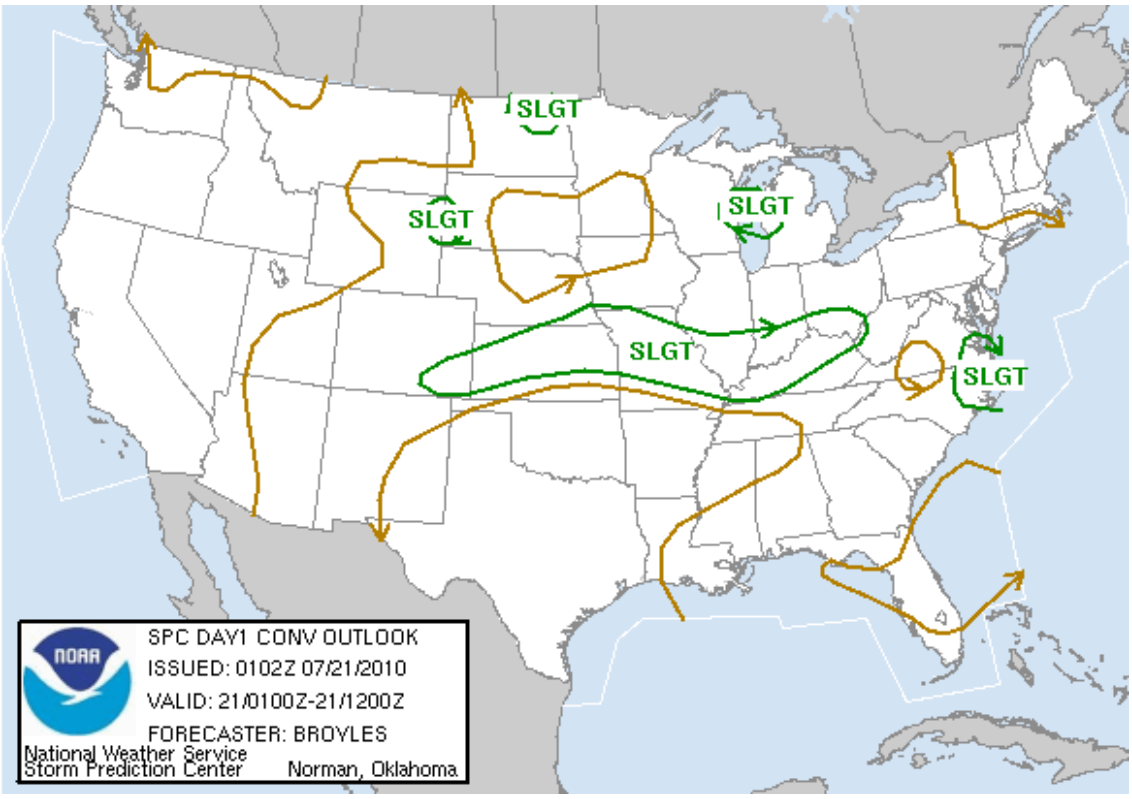
ANOTHER HOUR OR SO. STRONG GUSTY WINDS MAY ALSO ACCOMPANY THE MORE INTENSE CELLS.

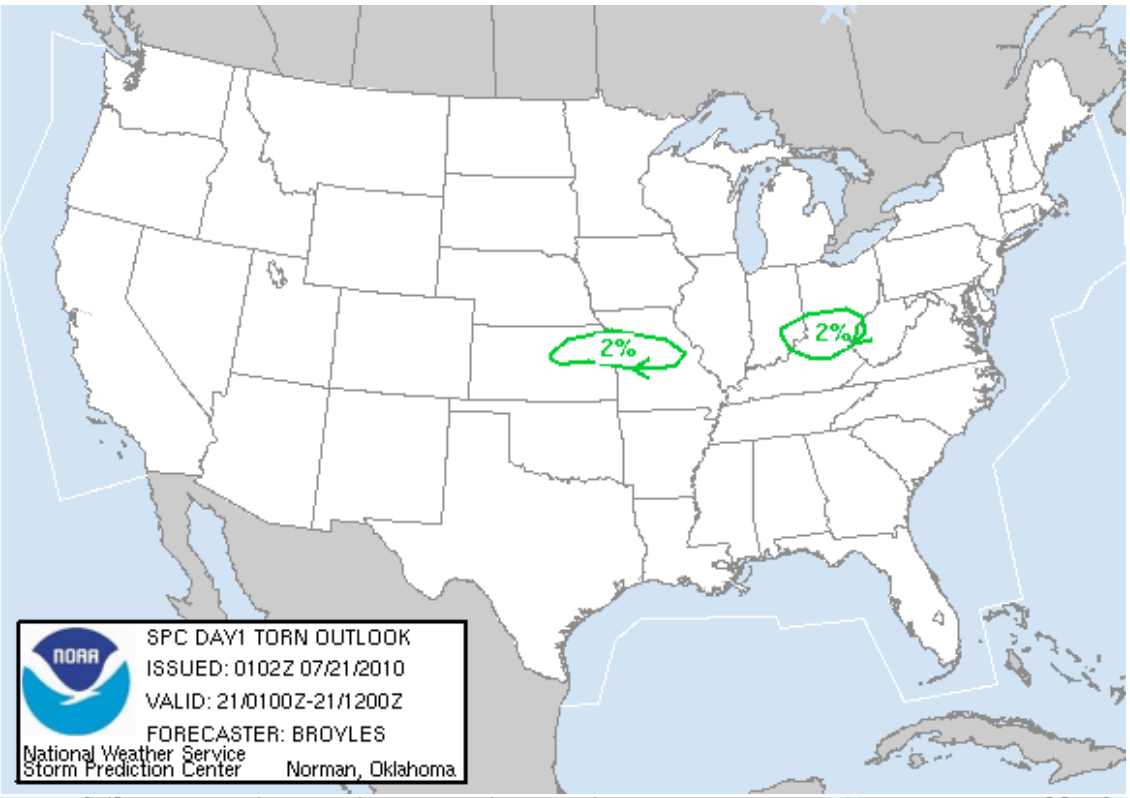
...CNTRL AND NRN HIGH PLAINS...
THUNDERSTORMS ARE BEGINNING TO DEVELOP ACROSS NE WY ALONG AN AXIS OF INSTABILITY. THIS CONVECTION SHOULD MOVE SEWD INTO THE BLACK HILLS AREA WHERE WSR-88D VWPS SHOW 50 TO 60 KT OF DEEP LAYER SHEAR. THIS ALONG WITH STEEP MID-LEVEL LAPSE RATES SHOULD BE SUFFICIENT FOR SUPERCELLS WITH LARGE HAIL. A WIND DAMAGE THREAT COULD ALSO ACCOMPANY THE MORE INTENSE CELLS ESPECIALLY IF A SHORT-LINE SEGMENT CAN ORGANIZE.

..BROYLES.. 07/21/2010

CLICK TO GET WUUS01 PTSDY1 PRODUCT

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 0600Z




2%
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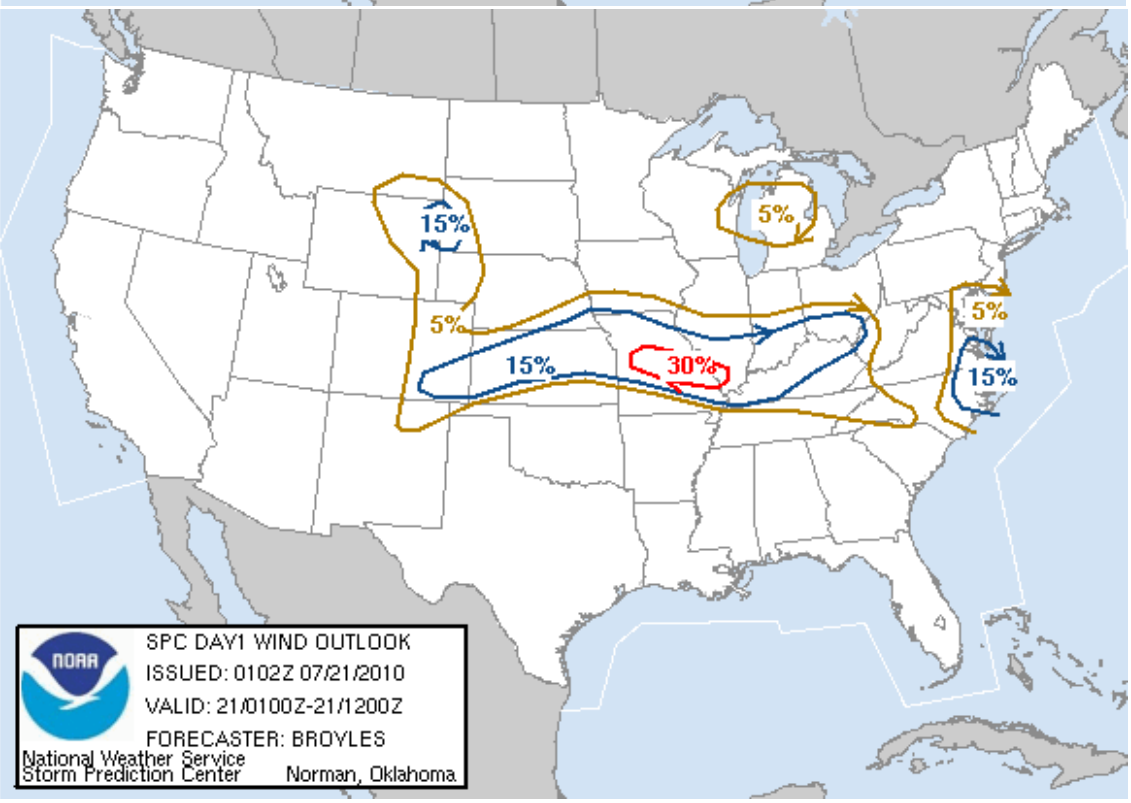
SPC DAY1 TORN OUTLOOK
ISSUED: 0102Z 07/21/2010
VALID: 21/0100Z-21/1200Z
FORECASTER: BROYLES
National Weather Service
Storm Prediction Center
Norman, Oklahoma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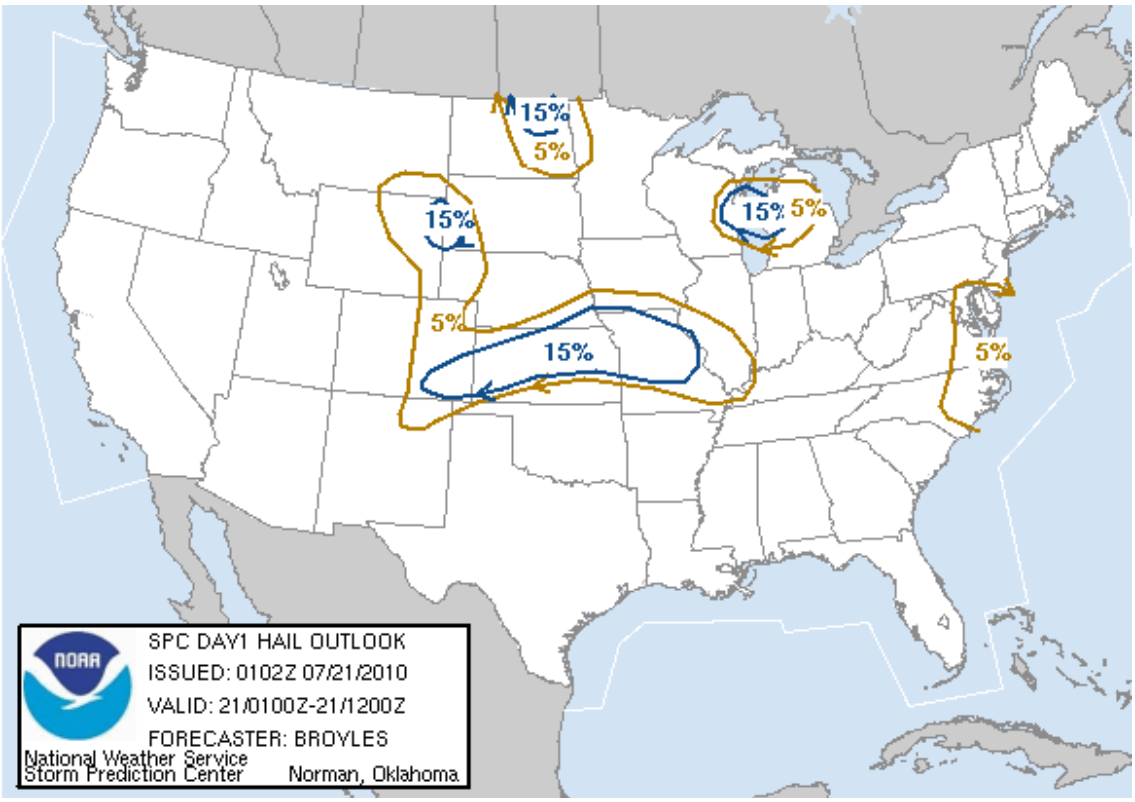
SPC DAY1 WIND OUTLOOK
ISSUED: 0102Z 07/21/2010
VALID: 21/0100Z-21/1200Z
FORECASTER: BROYLES
National Weather Service
Storm Prediction Center
Norman, Oklahoma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SPC DAY1 HAIL OUTLOOK
ISSUED: 0102Z 07/21/2010
VALID: 21/0100Z-21/1200Z
FORECASTER: BROYLES
National Weather Service
Storm Prediction Center
Norman, Oklahoma

Appendix B: HPC Products

I. Introduction

This section contains all of the relevant Hydrometeorological Prediction Center (HPC) precipitation products. These products are valid at the beginning of the simulation. The products will be displayed by type in the following order in this Appendix:

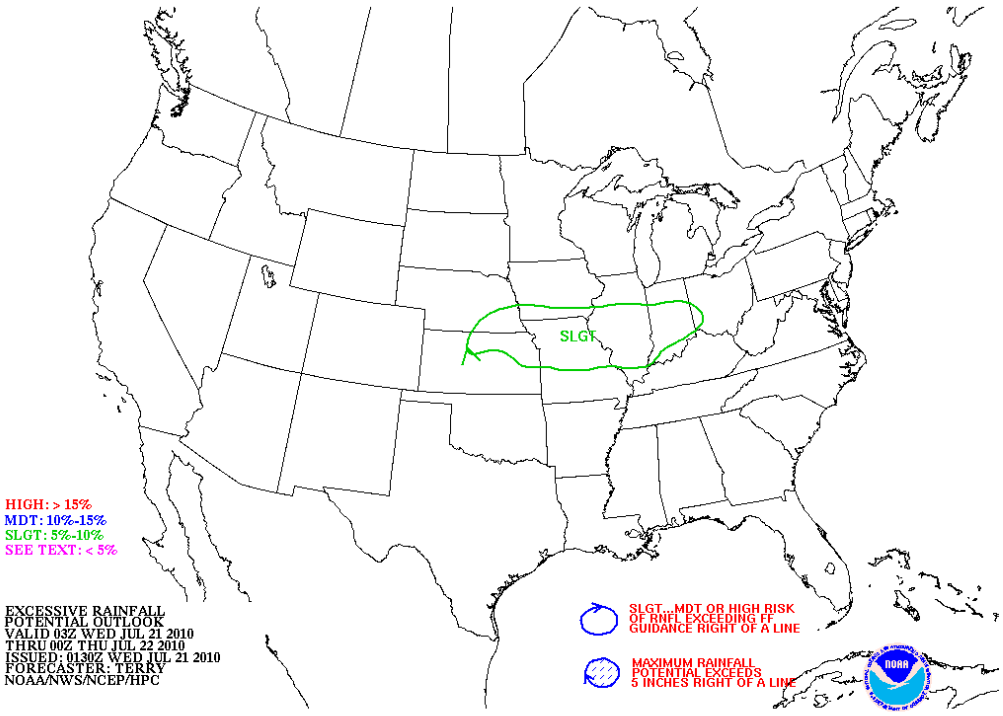
- **Excessive Rainfall Potential Outlook**
  - Graphic and Discussion -- Valid 0300 UTC 21 July to 0000 UTC 22 July
- **Quantitative Precipitation Forecast**
  - Issued Around 2200 UTC 20 July -- 6 HR QPF, 12 HR QPF, 24 HR QPF, and Discussion

For the Excessive Rainfall Potential Outlook images, the colored contours and text represent the following probabilities:

- **SEE TEXT: LESS THAN 5% PROBABILITY**
- **SLGT: 5% - 10% PROBABILITY**
- **MDT: 10% - 15% PROBABILITY**
- **HIGH: GREATER THAN 15% PROBABILITY**

II. Excessive Rainfall Potential Outlook

Day 1 Outlook -- Valid 0300 UTC 21 July to 0000 UTC 22 July



EXCESSIVE RAINFALL DISCUSSION
NWS HYDROMETEOROLOGICAL PREDICTION CENTER CAMP SPRINGS MD
957 PM EDT TUE JUL 20 2010

...VALID 03Z WED JUL 21 2010 - 00Z THU JUL 22 2010...
...REFERENCE AWIPS GRAPHIC UNDER...DAY 1 EXCESSIVE RAINFALL...

SLIGHT RISK OF RAINFALL EXCEEDING FFG TO THE RIGHT OF A LINE FROM
30 N HYS 40 SSE HDE 10 ENE HSI 25 SW FET AIO 20 SE OXV
15 WNW GBG 10 W C75 20 SW IKK 30 SE IKK 15 WNW GUS 25 NNE MIE
35 NNW DAY DAY 10 S MGY 10 WNW CVG 35 S BAK 15 N HNB 15 WNW EHR
MDH 20 WSW SAR 35 E VIH 10 SSW VIH 30 W AIZ 40 SW SZL 40 S IXD
20 E UKL 15 NE EMP 25 SSE MHK 30 W MHK 25 NNW SLN 25 ENE RSL RSL
30 N HYS.

THIS IS A LOW CONFIDENCE FCST..GIVEN QUITE VARYING MDL QPF
SOLNS..SO DIDN'T CHG THE PREVIOUS FCST MUCH AT ALL AND KEPT A LRG
AREA OUT GIVEN LOW FF GUIDANCE VALUES ALREADY IN PLACE. 00Z RAOBS

SHOWED AMS IS VRY MOIST AND UNSTABLE FM THE CNTRL PLAINS EWD INTO THE OH VLY..WITH PWS NR OR ABV 2 INCHES..AND AS HI AS 2.55 INCHES AT TOP..AND LIS AS LOW AS -8. THIS VRY MOIST AND UNSTABLE AMS..ALG WITH S/WVS MOVG ALG THE SRN EDGE OF THW WLYS..SUPPORTS THE CONTD THREAT OF CLUSTERS OF CNVCTN MOVG OUT OF THE CNTRL PLAINS EWD INTO PTNS OF THE MID/LWR OH VLY. PROB IS THAT MDLS ARE NOT IN AGREEMENT IN TIMING OF THE S/WVS..WITH THE GFS AGAIN CONTAMINATED BY FEEDBACK ISSUES..THUS THE MDL QPF SOLNS ARE ALL OVR THE PLACE. THINKING ATTM IS THAT CNVCTN WL CONT TO DVLP TUE NGT FM ERN KS/SERN NE INTO CNTRL/NRN MO AND SRN IA VCNTY OF SFC FNTL BNDRY AND IN AXES OF STGR LLJ/HIER PWS..WITH SOME WKR ACTIVITY TRYING TO MOV INTO PARTS OF THE LWR AND MID OH VLY. SOME LCL 1-2 INCH RNFL AMTS IN A COUPLE OF HRS AND 3+ INCH TOTALS THIS ENTIRE PD PSBL ESP ERN KS/ERN NE INTO MO AND SRN IA..WITH MORE ISOLD HVIER RAINS PSBL EWD INTO THE LWR AND MID OH VLY.

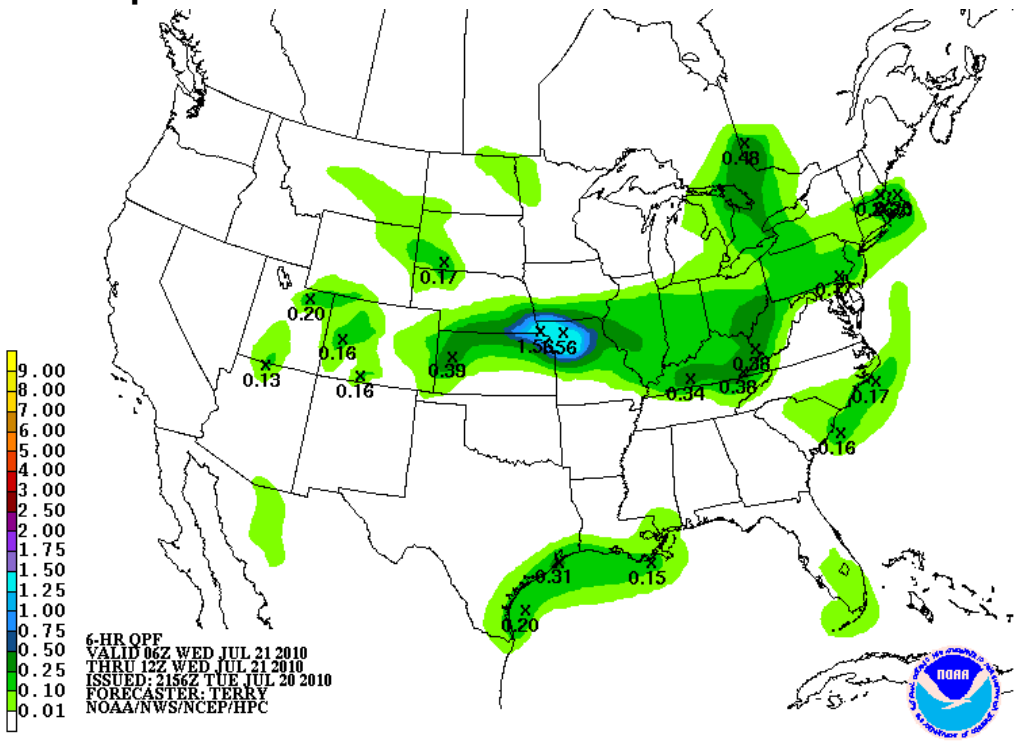
TERRY
$$

III. Quantitative Precipitation Forecasts

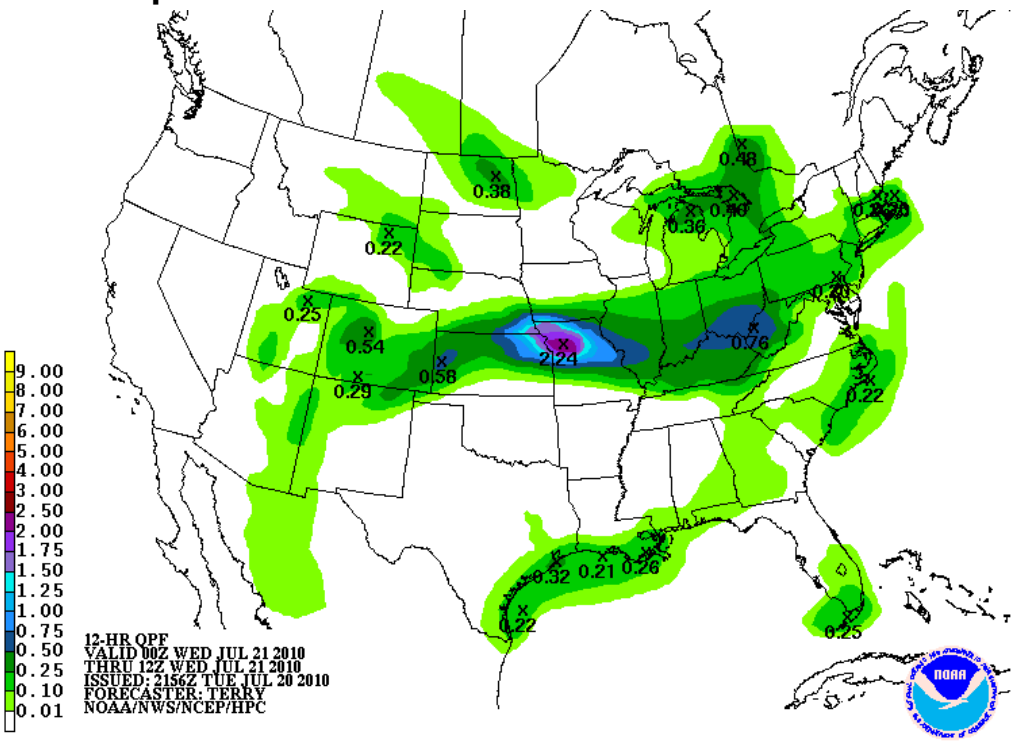
Products Issued Around 2200 UTC 20 July *(In Order Displayed)*

6 Hour QPF Graphic -- Valid 0600 UTC 21 July to 1200 UTC 21 July
12 Hour QPF Graphic -- Valid 0000 UTC 21 July to 1200 UTC 21 July
24 Hour QPF Graphic -- Valid 0000 UTC 21 July to 0000 UTC 22 July
Discussion

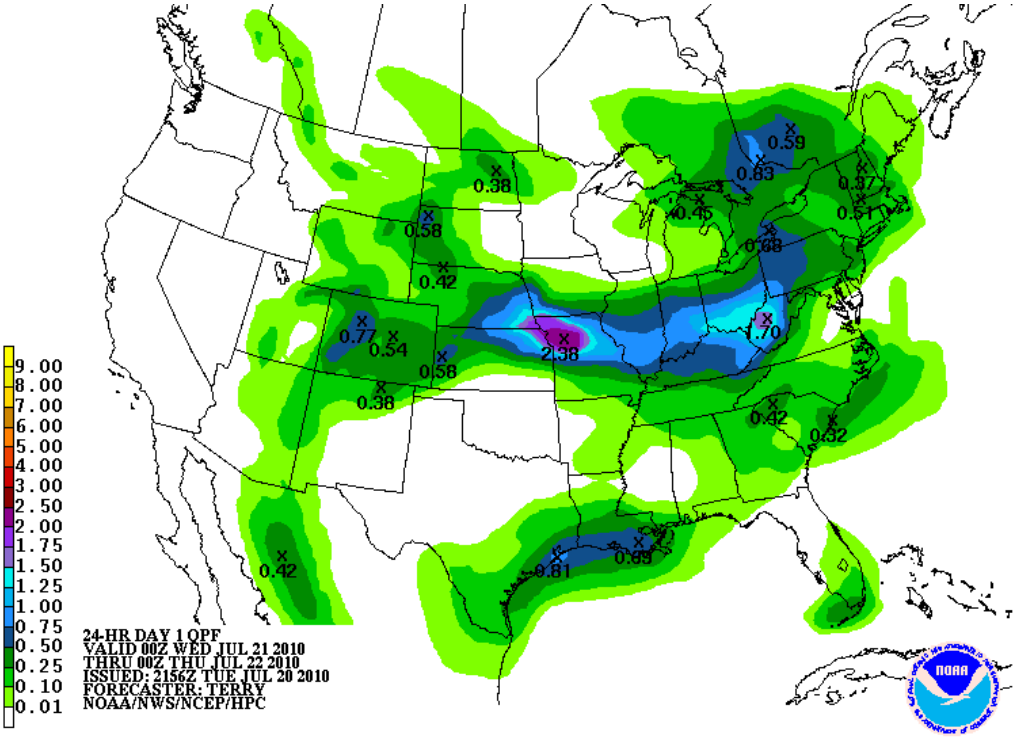
6 Hour QPF Graphic



12 Hour QPF Graphic



24 Hour QPF Graphic



QUANTITATIVE PRECIPITATION FORECAST DISCUSSION
NWS HYDROMETEOROLOGICAL PREDICTION CENTER CAMP SPRINGS MD
559 PM EDT TUE JUL 20 2010

FINAL DAY 1...DAY 2 AND DAY 3 QPF DISCUSSION
VALID JUL 21/0000 UTC THRU JUL 24/0000 UTC
REFERENCE AWIPS GRAPHICS UNDER...PRECIP ACCUM - 24HR

THE 18Z MDL RUNS WERE IN VRY GOOD AGREEMENT WITH THE 12Z RUNS..AT LEAST MASS FIELD-WISE..SO MADE ONLY
MINOR CHGS TO THE PRELIM DAY 1 QPF..MSTLY ERY IN THE PD BASED ON RECENT RADAR IMAGERY/SATL PIX TRENDS.

DAY 1...

...CENTRAL PLAINS TO THE MID ATLANTIC...
ANOTHER SUMMER TIME DIURNAL CONVECTIVE CYCLE CHALLENGE ON DAY 1. PRE-EXISTING OUTFLOW BOUNDARIES AND A STALLED MOISTURE DISCONTINUITY/FRONT DRAPED FROM WEST TO EAST ACROSS THE PLAINS...TENNESSEE/OHIO VALLEYS AND THE CAROLINAS WILL BE THE FOCAL POINT FOR MERGING CLUSTERS OF SHOWERS AND THUNDERSTORMS FROM THE KS/NE BORDER EWD INTO CENTRAL/SOUTHERN ILLINOIS EARLY IN THE PERIOD. ONE OR MORE OF THE CLUSTERS WILL DEVELOP INTO A LONG-DURATION MCS LATE TONIGHT...THEN MOVE ALONG THE NRN FLANKS OF THE UPPER RIDGE ACROSS THE OHIO/TENNESSEE VALLEYS-CENTRAL APPALACHIA TO THE MID-ATLANTIC SHORELINE. LATE IN THE PERIOD...THE CONVECTIVE CYCLE RE-FIRES OVER THE CENTRAL PLAINS...AND FOLLOWING THE CONTINUITY OF THE PREVIOUS SHIFT...THE 18Z PACKAGE FOCUSED THE HEAVIEST RAINFALL OVER SERN NE/NW MO...THEN DOWNWIND/EASTWARD AS ELEVATED CONVECTION DEVELOPS ALONG AND NORTH OF THE SHARP MOISTURE/H85 WIND BOUNDARY/FRONT. SEVERAL AREAS OF ELEVATED CONVECTION DEVELOP IN THE LATTER HALF OF THE PERIOD...IE IN WESTERN/CENTRAL KS AND SRN OH/IN/NRN KY. HAD TO COMPROMISE BETWEEN THE GFS/NAM HERE...USING A GOOD DEAL OF THE LATEST HI-RES SOLUTION...ARW/HWRF GUIDANCE...TO SMOOTH OUT THE TIMING/STRENGTH DIFFERENCES BETWEEN MODELED MCS DEVELOPMENT CYCLES...AND DOWNWIND PROPAGATION ALONG THE MOISTURE DISCONTINUITY.

..UPPER MISSISSIPPI VALLEY EASTWARD TO THE GREAT LAKES...
MULTIPLE SHORTWAVES ORIGINATING IN TRICKY ZONAL FLOW WILL MOVE EASTWARD ALONG THE US/CANADIAN BORDER FROM SRN ALBERTA TO THE UPPER GREAT LAKES AND WRN ONTARIO BY THE END OF DAY 1. EARLY IN THE PERIOD...DIURNAL CONVECTION FIRES ALONG THE MT/ND BORDER THEN ATTEMPTS TO HOLD TOGETHER AS THE MID-LEVEL FORCING AND SPEED SHEAR ALOFT SUSTAINS ISOLATED TO SCATTERED SHOWERS THROUGH TONIGHT. THIS

AREA OF MID-LEVEL FORCING MIGRATES THROUGH THE UPPER GREAT LAKES ON WEDNESDAY...AND COMBINED WITH THE DIURNAL HEATING CYCLE...GENERATES A SECOND ROUND OF CONVECTION ACROSS WI/MI EWD INTO SRN ONTARIO. THE PRIMARY DIFFERENCE IN THE QPF SEEMS TO BE TIED TO THE DEPTH OF THE SHORTWAVE...IE HOW WELL IT CAN REMAIN ORGANIZED IN THE SFC-H85 LAYER...GIVEN THE ENVIRONMENT THIS WAVE IS APPROACHING IS FAIRLY STABLE. THE SECOND STRONGER SHORTWAVE COMBINED WITH LOCAL LOW-LEVEL WIND CONVERGENCE AND A SLIGHTLY COOLER AIRMASS ALOFT...GENERATES SOME MID-LEVEL WARM ADVECTION ACROSS THE NORTHERN HIGH PLAINS ON WEDNESDAY AFTERNOON WITH CONVECTION DEVELOPING ALONG THE SOUTHERN MTN RANGES OF SRN MT/NRN WY EWD INTO THE DAKOTAS. SOME QPF VARIANCE IN THE TIMING OF THE LEAD SHORTWAVE WEDNESDAY AFTERNOON ACROSS UPSTATE NEW YORK. MANUAL GRAPHICS BLENDING THE 12Z/NAM AND GFS-P HERE AND OVER THE NRN HIGH PLAINS IN ASSOCIATION WITH THE SECOND SHORTWAVE DURING THE LATTER HALF OF THE DAY 1 FORECAST PERIOD.

...DESERT SOUTHWEST...FOUR CORNERS TO THE CENTRAL ROCKIES...
GOOD AGREEMENT FOR A SLIGHT WWD RETROGRESSION OF THE MID/UPPER-LEVEL RIDGE ALONG 30-35N LAT INTO WEST TEXAS AND THE SRN PLAINS STATES...SHOULD BE ABLE TO GENERATE SOME MID-LEVEL MONSOONAL MOISTURE AND WEAK DYNAMICS AROUND THE WRN PERIPHERY OF THE RIDGE AXIS. THIS ALLOWS FOR DECENT OUTFLOW OFF THE HIGHER TERRAIN AND DOWNWIND INTO THE ADJACENT VALLEYS. HERE AGAIN...THE 12Z/NAM AND GFS-P HAVE A DECENT HANDLE ON THE HIGHER QPFS DURING THE HEATING CYCLE...WITH THE NAM PROBABLY A BIT OVERDONE...IE ITS SLOWER SOLUTION ALLOWING MORE MOISTURE FROM THE 4 CORNERS TO DRIFT NWD ALONG THE WYO/CO/UT BORDER. IN EITHER CASE/SOLUTION...CONFLUENCE IS CENTERED ALONG THE WEST AND SOUTHWEST FACING SLOPES OF THE DIVIDE...THEN CHANNELED EASTWARD INTO THE FRONT RANGE...WHERE LOCAL SFC FLOW AND UNSTABLE AIRMASS WILL BE IN PLACE TO PROMOTE ADDITIONAL CONVERGENCE...LIFT AND CONVECTION ACROSS THE CENTRAL HIGH PLAINS.

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Appendix C: Support Materials

This Appendix includes:

A map of the Wilmington, OH CWA --- Page C-2

A map of the Area of Interest --- Page C-3

Procedure Details:

Surface Analysis --- Page C-4
Precipitable Water and Moisture Transport --- Page C-5
Corfidi Vectors and Atmospheric Flow/Instability --- Page C-6
KILN WSR-88D Radar Analysis --- Page C-7
ILN FFMP Analysis --- Page C-8

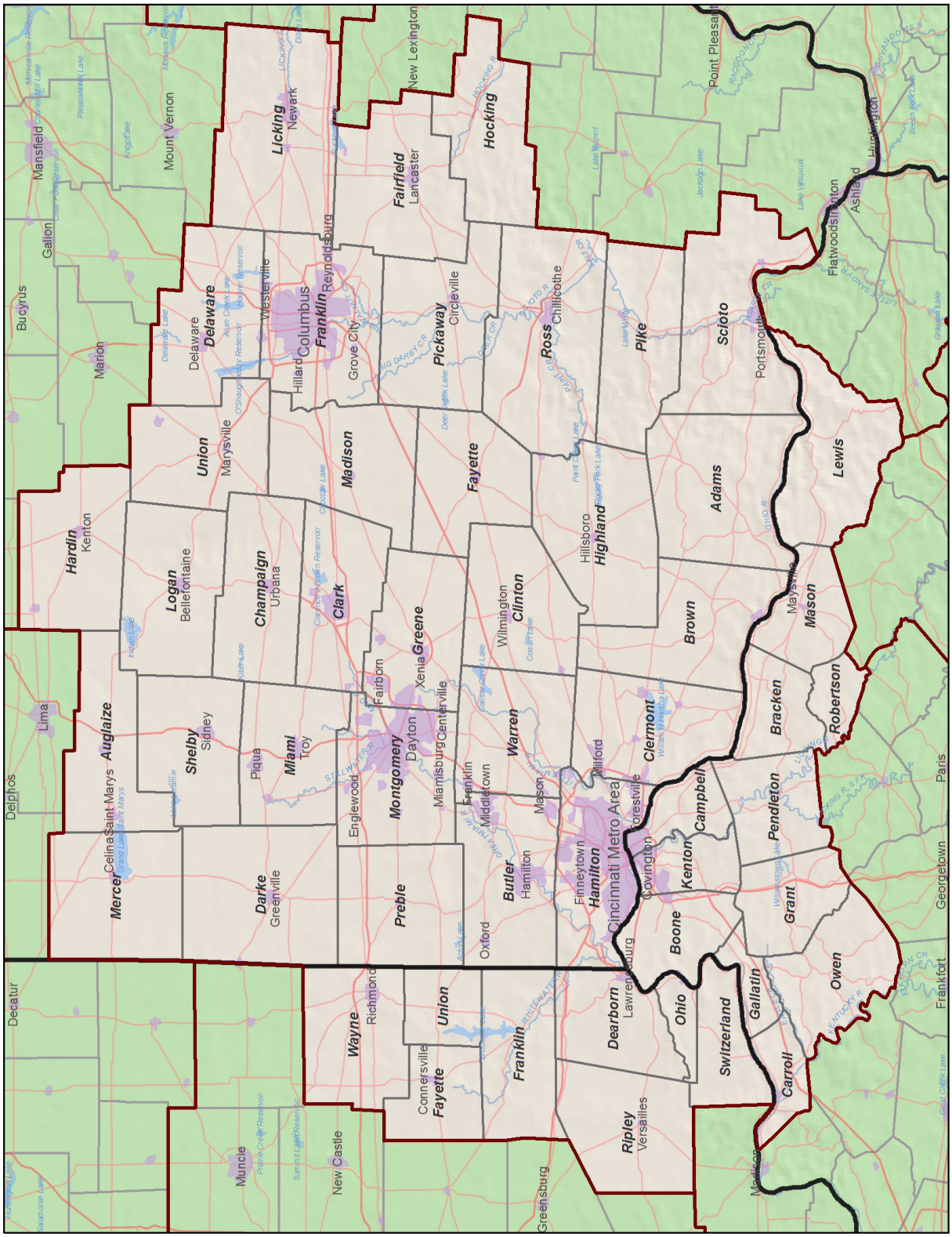

Figure C-1: A map of the Wilmington, OH (ILN) CWA.

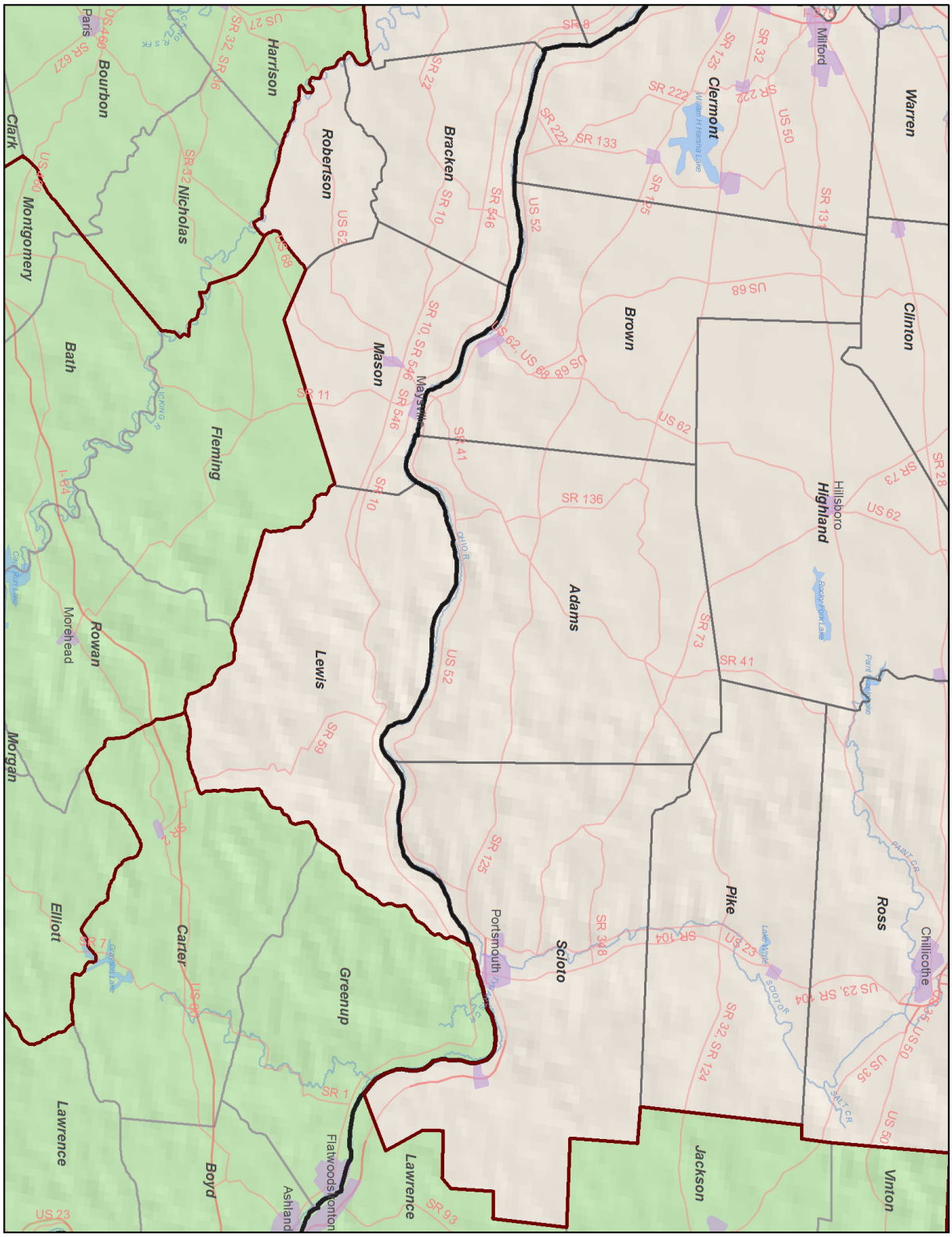

Figure C-2: A map of the Area of Interest for this case.

Procedure Details

Surface Analysis

Contents: This procedure will provide a basic surface analysis overlaid with GOES IR satellite images. Surface winds shown in streamlines will help in the identification of any boundary in the analysis, especially any quasi-stationary boundaries that are important to flash flooding.

Procedure Bundle: MesoAnalysis

Procedure Name: Sfc_Analysis

Model: RUC40

Procedure: Set a D-2D pane to a single-panel display and to the State scale. Load the following products into the D-2D display (in order):

-- GOES IR Satellite
-- METAR Observations
-- RUC40 Surface Winds (right-click on product and select “Load as Streamlines”)

Load the following from the *Maps* menu:

-- CWAs

Precipitable Water and Moisture Transport

Contents: This procedure will focus on the amount of precipitable water in the atmosphere and the low-level moisture transport for the region. In combination with the surface analysis, areas of enhanced and focused moisture flux and convergence at a quasi-stationary boundary can lead to repeated convective growth along the boundary.

Procedure Bundle: MesoAnalysis

Procedure Name: PW_MoistTrans

Model: RUC40

Procedure: Set a D-2D pane to a single-panel display and to the State scale. Load the following products into the D-2D display (in order):

-- 925-850 mb Moisture Transport Vectors (aka, Moisture Flux)
-- 925-850 mb Moisture Flux Divergence (contours and image)
-- Layer Precipitable Water

Load the following from the *Maps* menu:

-- CWAs

Corfidi Vectors and Atmospheric Flow/Instability

Contents: This procedure allows the user to analyze different ingredients that contribute to the flash flood potential. The four-panel display will assist in the analysis of Corfidi vectors, vorticity, moisture transport, convergence, CAPE, and frontogenesis.

Procedure Bundle: MesoAnalysis

Procedure Name: Corfidi_Vectors

Model: RUC40

Procedure: Set a D-2D pane to a four-panel display and to the State scale. Load the following products into the D-2D display (in order):

Top Left Pane:
- -- 850-300 mb Winds
- -- 850 mb Winds
- -- Corfidi Vectors
- -- Mosaic 0.5° Reflectivity

Top Right Pane:
- -- 925-850 mb Vorticity (load as image)
- -- 925-850 mb Winds
- -- 925-850 mb Moisture Transport Magnitude (aka, Moisture Flux Magnitude)

Bottom Left Pane:
- -- 0-3 km MUCAPE (contours and load as image)

Bottom Right Pane:
- -- 925-850 mb Divergence
- -- 925-850 mb Pettersen Frontogenesis (load as image)
- -- 925-850 mb Moisture Transport Vectors (aka, Moisture Flux)

KILN WSR-88D Radar Analysis

Contents: This four-panel display allows the student to view various base and derived precipitation products and compare it against an image toggle of one-hour and three-hour flash flood guidance. Here, the 0.5° reflectivity can be viewed along with the radar estimated one-hour and storm-total precipitation from the KILN WSR-88D.

Procedure Bundle: Radar_FFMP

Procedure Name: KILN_Analysis

Procedure: Set a D-2D pane to a four-panel display and to the WFO scale. Load the following products into the D-2D display (in order):

Top Left Pane:
-- KILN 0.5° Reflectivity

Top Right Pane:
-- KILN One-Hour Precipitation

Bottom Right Pane:
-- KILN Storm Total Precipitation

Bottom Left Pane:
-- One-Hour HPE Flash Flood Guidance (select Image Toggle)
-- Three-Hour HPE Flash Flood Guidance

Hold down the right mouse button and select “Load to All Panels.” Then load the following from the *Maps* menu:

-- CWAs
-- States
-- County Names
-- Cities
-- Urban Boundaries

ILN FFMP Analysis

Contents: This is a basic display created for the use of FFMP analysis during the simulation. Along with the small stream basins and basin links, this map will also display such things as county warning area boundaries and county names to help with the situational awareness. Remember to configure your FFMP once loaded for optimal use during the simulation.

Procedure Bundle: Radar_FFMP

Procedure Name: FFMP_ILN

Procedure: Set a D-2D pane to a single-panel display and to the WFO scale. Also set the number of frames for D-2D to a low number (preferably “1”). Load the following products into the D-2D display (in order):

-- FFMP ILN Table (select Image Toggle)
-- KILN 0.5° Reflectivity

Hold down the right mouse button and select “Load to All Panels.” Then load the following from the *Maps* menu:

-- FFMP Small Stream Basins
-- FFMP Small Stream Basin Links
-- CWAs
-- States
-- County Names

To configure your FFMP Table, select “*All & Only Small Basins*” from the Layer menu and “*Link to Frame*” from the Config menu.