Using GFE for Tropical Operations

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National Weather Service
Forecast Decision Training Division
Questions: Shannon.White@noaa.gov
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Virtual Tropical Operations Training (VTOT) Slides and Recordings

Tropical Product Production and Issuance Issues Page

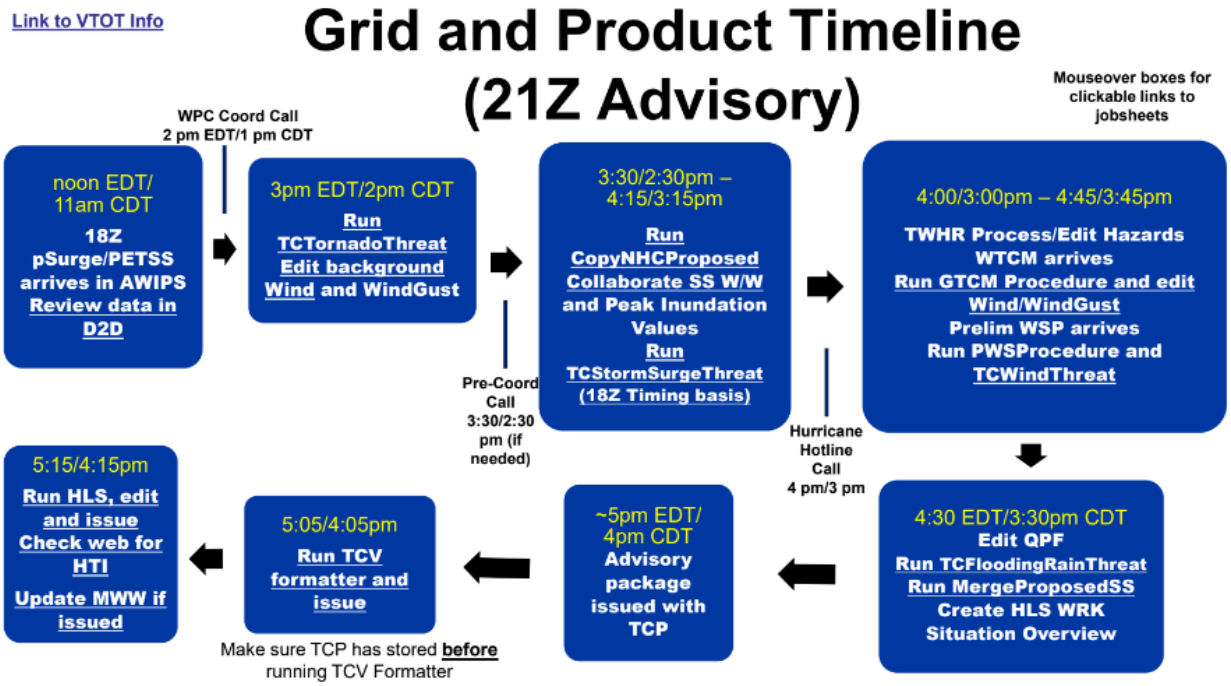
Wind and Storm Surge Fact Sheets

Tropical Operations FAQ

Updating Wind and WindGust Grids
Storm Surge Collaboration
Creating HTI Elements
Wind Hazard Grid Process
Creating the TCV, HLS, and MWW
Troubleshooting the TCV and HLS

There are numerous grids, products, and services generated during a tropical event. From just a WFO perspective, the advisory cycle is incredibly busy, especially the hour prior to the advisory being issued by NHC. The general timeline to complete each of the various steps is below. For a larger image and for the other advisory times, click here or click the timeline image below.

Clickable pdf versions of these coastal WFO timelines, inland WFO timelines, and EPac WFO timelines are also available.



Background Wind and WindGust --> TCTornadoThreat --> Collaborate Surge --> TCStormSurgeThreat --> GTCM Procedure --> TCWindThreat --> Tropical Wind Hazard Recommender --> Edit Hazards --> TCFloodingRainThreat --> Generate Products

Updating Wind and WindGust Grids

Some keys for effectively creating Wind grids with the NHC-forecast cyclone are:

1. Prior to the arrival of the gridded wind data, collaborate on a background Wind and WindGust solution (model or current Fcst grids) which best meets the

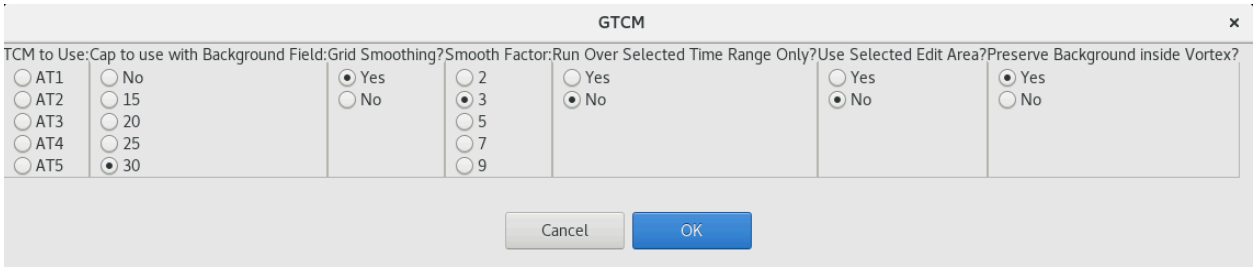
aspects of a good background model. Include all local effects, as needed. *This happens about an hour before the hotline call.*

Once the background Wind and WindGust have been populated, evaluate the background Wind and make any needed edits:

- **How to identify where you need to be concerned with alternate features**
- **How to edit out those bad features**
- **How to bound the edited grids and interpolate so the GTCM can be run**

GTCM Procedure

1. When the gridded TCM arrives, check the data by viewing in D2D to verify it is the latest information. Then run the *GTCM* procedure with capping and smoothing values that match your neighboring WFOs as specified in the collaboration document.



a. If gradient winds of greater than 34 kts need to be maintained, the procedure can be run over just the edit area where the cyclone's 34 kt radii track or over a selected time range.

b. For multiple cyclones, run over the area/time range applicable for storm 1, then repeat over a different area/time for storm 2.

2. Tweaks to the resulting output can be made, but should be very carefully coordinated and should not change the cyclone forecast.

3. All offices should strive to complete Wind and subsequent WindGust editing around the same time so the NDFD is updated uniformly. The NDFD only updates twice an hour.

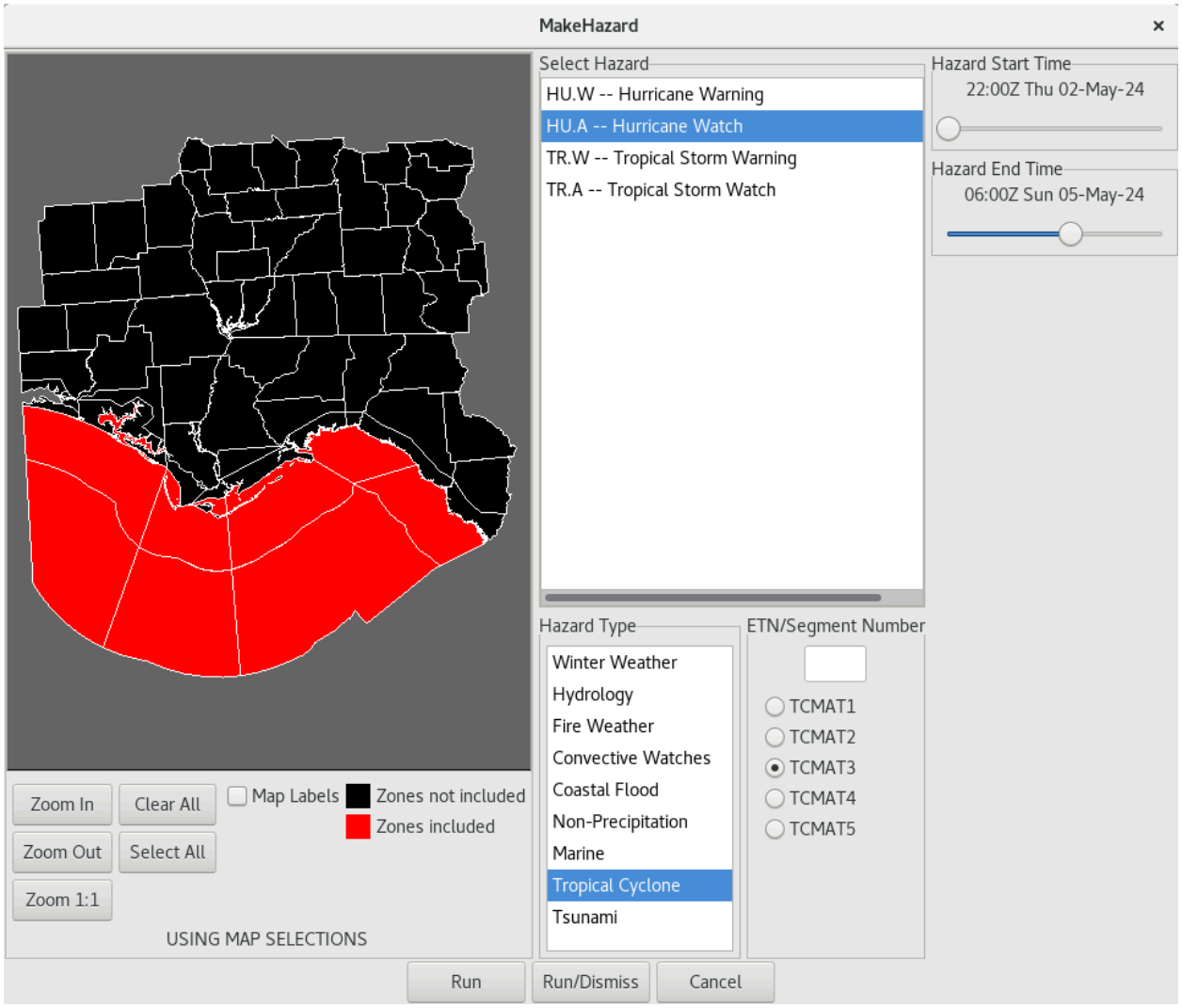
Wind Hazard Grid Process

The Tropical Wind Hazard Recommender (TWHR) is a GFE tool designed to provide consistent, objective, probability-based guidance for the collaboration of inland watches and warnings for tropical cyclone winds. A comprehensive Google site has been developed to outline the lifecycle use of the TWHR.

Creating a Tropical Hazard for MWW with No NHC Watches or Warnings

As long as an advisory package is being issued for a storm, you can create tropical wind hazards. These hazards should match the hazards from neighboring WFOs and TAFB/OPC.

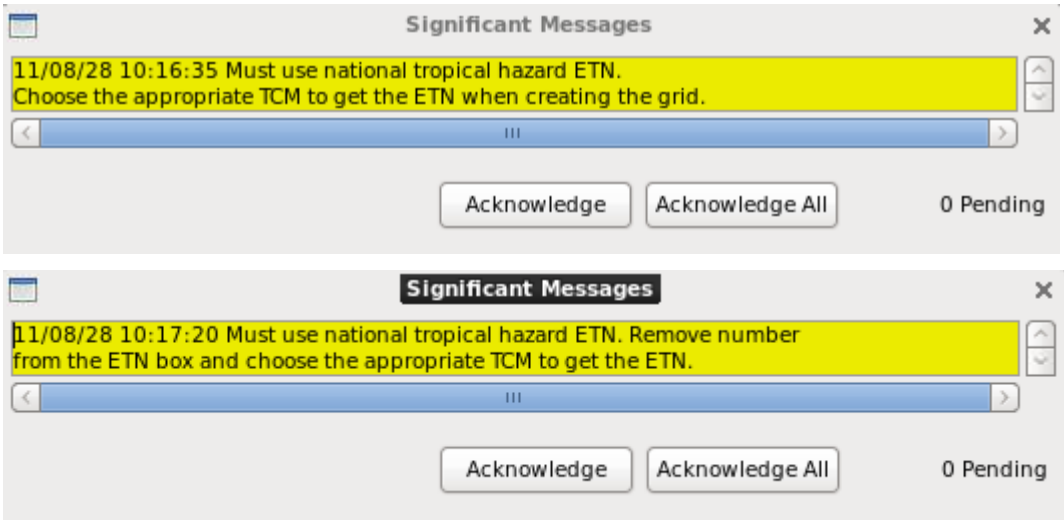
1. **Click on the Hazards grid to display the current hazards on the screen.**
2. **Click *MakeHazard* from the Hazard drop down menu.**
3. **Select Tropical Cyclone from the categories of hazards.**
4. **Choose the type of hazard you wish to create.**
5. **Adjust the bottom slider bar on the right to estimate when the conditions should end, with roughly a 6 hour buffer.**
   a. **Remember that tropical hazards always receive an end time of 000000T0000Z (until further notice).**
6. **Left click and drag any marine zone(s) you wish to add. They will become red when added.**
   Be careful to not add any land zones!
7. **Choose the advisory package from which to pull the ETN.**
8. **Click Run if other hazards need to be created or Run/Dismiss if this is your final hazard to be created.**



a. Failure to choose a TCM will result in one of 2 errors alerting you to a missing ETN. If these are received, click

Acknowledge, follow the message and restore the MakeHazard window (do not open a new one) and fix the ETN

selection.



9. Repeat process for any other hazard you wish to create.

a. If you need to further segment your marine zones for meteorological reasons, see the MWW section.

10. In the Hazards drop down menu, click *MergeHazards*. If you have a Merge Conflict, resolve that before proceeding.

11. Click on the blue disk to Save the Hazards grid. Click Save Weather Elements.

12. After the advisory (TCP) is issued by NHC, publish your grids and then create and transmit the MWW.

Adding Local Zones to Center-Issued Tropical Hazard

Each WFO is responsible for issuing tropical storm and hurricane hazards for marine and inland zones. These hazards should closely match any NHC-issued coastal hazards in both area and threat. If a cyclone is expected to only affect marine zones or for inland sites who do not receive NHC hazards, follow these instructions.

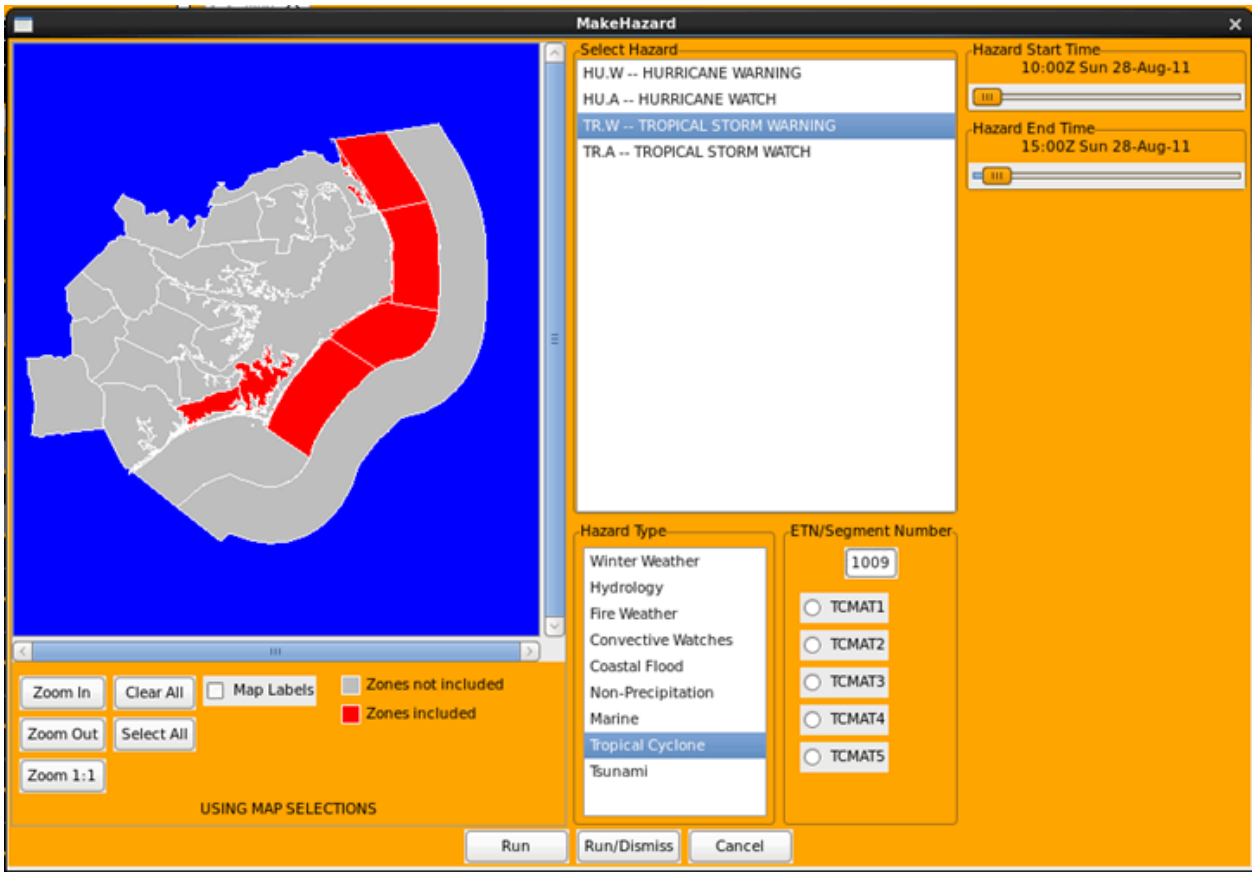
1. Click on the Hazards grid to display the current hazards on the screen.

2. Click *SeparateHazards* from the Hazard drop down menu.

3. Pre-select the desired NHC-issued hazard and Click *MakeHazard* so it will

populate the ETN box with the correct ETN.

4. Add zones as needed to the selected hazard. Be very careful not to remove or change any of the NHC-issued zones.



5. Adjust the end times accordingly. The valid time in GHG should cover from the current time until the expected end time of the hazard. Remember that tropical hazards always receive an end time of 000000T0000Z (until further notice) in the TCV. The grid times are needed for the ZFP and CWF for expressions of uncertainty.

a. If you need to further segment your marine zones for meteorological reasons, see the MWW section.

6. Click Run/Dismiss.

7. Repeat process for any other center-issued hazard to which you need to add zones.

a. If you are upgrading any hazards, make sure to delete the watch grids before proceeding.

8. In the Hazards drop down menu, click *MergeHazards*. If you have a Merge Conflict, resolve that before proceeding.

9. Click on the blue disk to Save the Hazards grid. Click Save Weather Elements.

10. If needed, add the storm surge hazards.

11. After the advisory (TCP) is issued by NHC, publish your grids and then create and transmit the TCV, HLS, and/or MWW.

Finding and Resolving Hazard Conflicts

1. If a merge conflict is detected when running *MergeHazards*, note the grids and time frame involved from the error message, then click Cancel Merge to return to the separated hazards.

2. Click in the time range on one of the temporary hazard grids noted from the error message. Choose the one that you wish to still be in effect once this is resolved.

3. Click within the hazard (red) area, then click the right mouse button and choose *Select Homogeneous Area*. This creates and edit area where that hazard exists.

4. Switch to the other grid in question. The edit area likely overlaps with at least one zone of this hazard. Make sure None is highlighted on the color bar, then click the right mouse button and choose *Assign Value*. This removes the overlapping zone(s) from the conflicting hazard.

5. Proceed with merging your hazards.

Removing Areas from Existing hazards

1. Click on the Hazards grid to display the current hazards on the screen.

2. In the Hazards drop down menu, click *SeparateHazards*. A temporary hazard grid will be created for each hazard in effect.

3. Click on the tropical hazard grid you wish to edit, then click *MakeHazard* from the Hazard drop down menu.

4. Left click once on each red inland or marine zone you wish to remove. They will change to the default black background of the tool. See either Adding Local Zones to a Tropical Watch or Warning. Be careful to not remove any NHC-issued zone.

5. Click Run or Run/Dismiss at the bottom of the tool.

6. Repeat process for any other tropical hazard from which you wish to clear an area.

7. In the Hazards drop down menu, click *MergeHazards*. If you have a Merge Conflict, resolve that before proceeding.

8. Click on the blue disk to Save the Hazards grid. Click Save Weather Elements.

9. After the advisory (TCP) is issued by NHC, publish your grids and then create and transmit the TCV, HLS, and/or MWW.

Canceling/Ending Tropical Hazards

1. If coastal zones are part of the hazard, you MUST wait for the TWHR banner to be received, then run the *CopyTropWindWW* tool. Otherwise, proceed to step 2.

2. In the Hazards drop down menu, click *SeparateHazards*. A temporary hazard grid will be created for each hazard in effect.

3. Click on the hazard you wish to cancel, then right click and hold for menu.

4. Drag down to Delete Grid and release mouse button.

5. Repeat process for any other hazard you wish to end.

6. In the Hazards drop down menu, click *MergeHazards*.

7. Click on the blue disk to Save the Hazards grid. Click Save Weather Elements.

8. After the advisory (TCP) is issued by NHC, publish your grids and then create and transmit the TCV, HLS, and/or MWW.

Creating the HTI Elements

All tropical WFOs, except GUM and PPG, must create the Hurricane Threats and Impacts elements as they are required elements for running the TCV and HLS. The elements are WindThreat, FloodingRainThreat, TornadoThreat, and, if a coastal site, StormSurgeThreat. The elements can be created prior to issuing the TCV/HLS to have a more complete threat mosaic for customers. If your office is creating the HTI elements outside of active tropical hazards and do NOT want the Expressions of Uncertainty to appear in the point-n-click, *do not run the PWS_Procedure*. It is not required for the TCWindThreat.

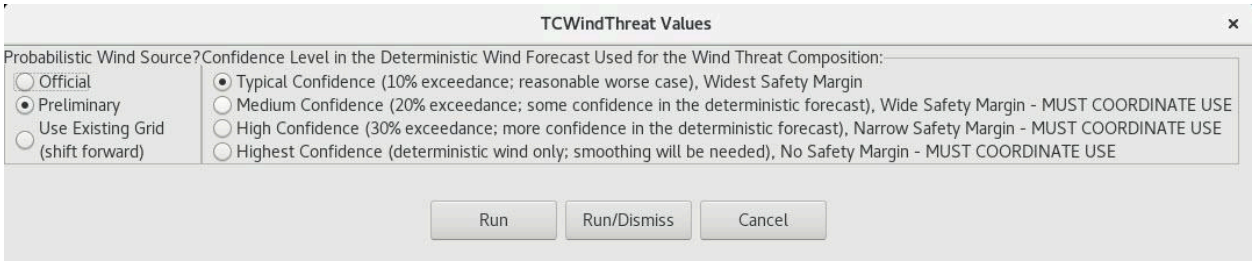
More information can be found via the HTI User Guide.

NOTE: You can create the HTI elements prior to TCVs being issued to allow the HTI mosaics to be more complete, especially when your CWA covers parts of states where there are active W/Ws. After the W/Ws are dropped, HTI elements such as FloodingRainThreat and TornadoThreat can be created to convey the ongoing threat. But the WindThreat should be set to None before manually running make_hti.sh. For StormSurgeThreat, if the Storm Surge Watch/Warning was dropped, the threat grid should be limited to none or “Potential for storm surge flooding > 1 ft above ground” (Elevated).

The Wind and WindGust grids also need to match the NHC forecast and be collaborated with your neighboring offices. This is accomplished through the use of the GTCM Procedure.

WindThreat

The TCWindThreat procedure takes the Wind Speed Probability data along with the Wind grids that result from running the GTCM procedure and generates a WindThreat grid that can be used to guide planning and preparation for the event. The result is not a forecast but what people should reasonably prepare for. Based on the settings chosen, different wind speed probability thresholds are chosen for each of the four possible threat levels. The procedure also takes into account the deterministic wind values in your GFE domain (not just area of responsibility) to account for values that could potentially affect your area.



Most often, you will now run with Preliminary PWS so you can run this procedure before the advisory is issued. The default/typical setting uses the lowest exceedance probability thresholds from the PWS guidance for each threat level. The thresholds move to higher exceedance levels as you move to Medium and High. Highest uses purely the Wind grids to determine the threat.

The resulting threat is outlined as shown.

Wind Threat
Potential for wind > 110 mph (major hurricane)
Potential for wind 74-110 mph (hurricane)
Potential for wind 58-73 mph (strong tropical storm)
Potential for wind 39-57 mph (tropical storm)
Wind < 39 mph

Again, this is to guide planning since it has a safety margin factored in. It is not a forecast, but compliments the forecast. The threat should narrow in on the forecast as the event unfolds.

Run the procedure with values that match your neighbors and make sure to collaborate the output. These grids are mosaicked and used by regional and national customers to assess their risk.

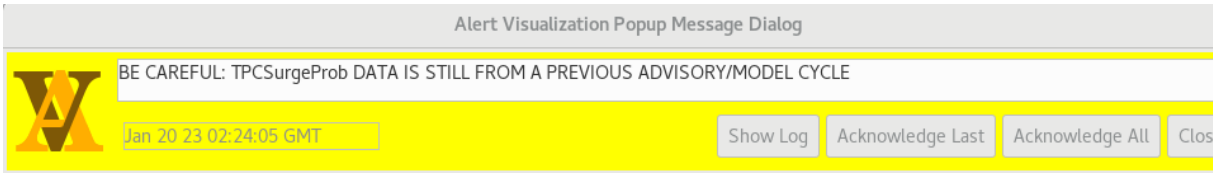
StormSurgeThreat

This procedure must be run every advisory regardless of surge threat.

With the 2023 season, the new TCStormSurgeThreat procedure allows you to view the guidance to determine your time period of concern, highlight that time range in the grid manager, then run using that selected time rather than deal with the timing slider bars. It also allows sites to preconfigure coastal breakpoint segments for forecaster selection rather than relying on hand-drawing edit areas.

The recommended workflow for the first advisory is below:

1. **Choose Show Model Only, with the model of PHISH - Primary (if pSurge is available) or PETSS and 10% exceedance, and click Run.**
    1. **You will receive an AlertViz message letting you know the model is an advisory behind. *This is expected*.**



2. **Select the InundationTimingGuid element and step through the grids to determine the window of concern. You are looking for non-tidal water rises that indicate the event.**
3. **Highlight/select the time range that represents the surge event window. *Make sure to keep this time range highlighted throughout the remainder of this process.***
    1. **If there is no clear end to the event (water levels do not drop below 1 foot in the last grid), make sure to highlight an additional 6 hour time block to account for the fact the guidance is an advisory cycle behind. This will result in no end to the event in the TCV.**
4. **Next, select:**
    1. **Manual under Run Option**
    2. **Start Fresh under Edit Option**
    3. **Selected Time under Time Option (ensure time range from step 3 is properly highlighted)**
    4. **Choose one or more of the breakpoint segments from the choices at the bottom of the interface based on the peak inundation coordinated with SSU**

        1. **If no edit areas have been preconfigured, hand-draw an area that corresponds to the breakpoint segment of concern from SSU (e.g. Cape Lookout to Cape Hatteras)**
    5. **Move the Inundation Height slider bar to correspond to the upper end of the surge range for that coastal segment (if 4-6 feet, choose 6)**
    6. **Click Run**
5. **Change Edit Option to Add/Append and repeat steps 4.4 thru 4.6 until all coastal segments are complete.**
6. **As a final step, choose Set 3 ft. Cap Outside SS.A/SS.W and Run/Dismiss as a QC step to ensure the InundationMax and StormSurgeThreat are in line with the surge watches or warnings.**

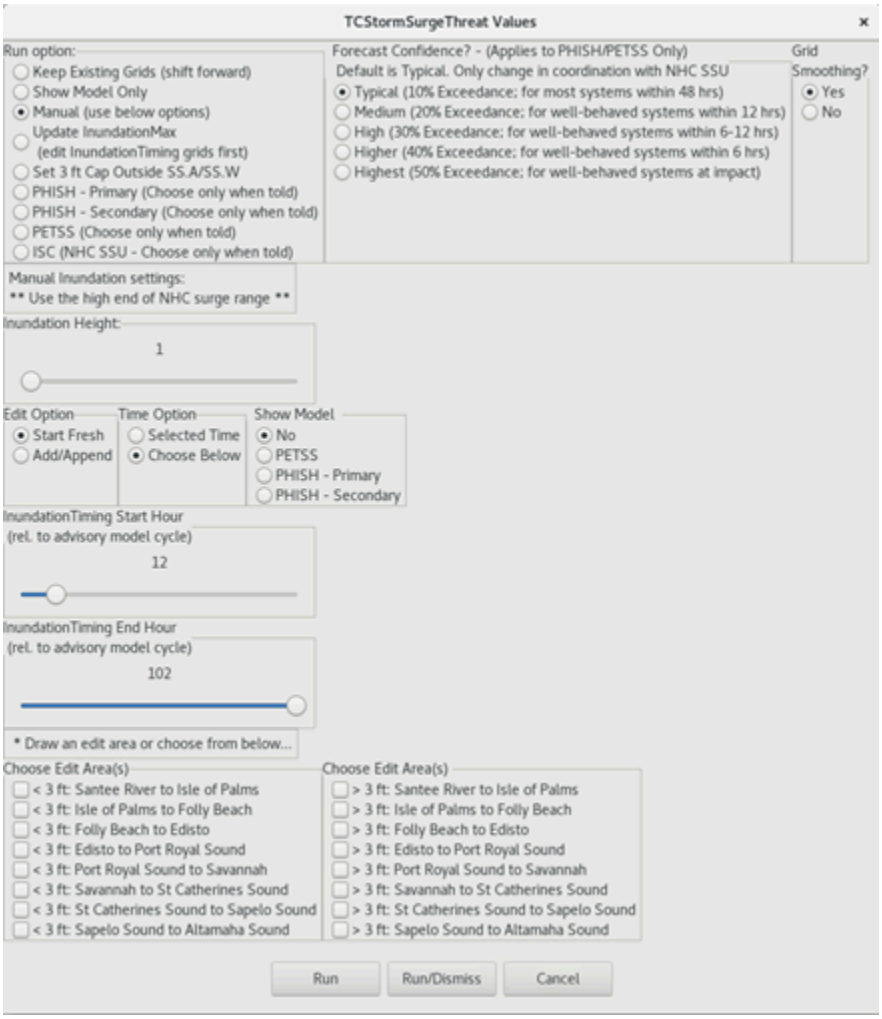
For subsequent advisories after the grids have been created, there are generally 4 scenarios that can occur:

1. No changes: If SSU is not proposing changes to Peak Surge values or areas in a given advisory, use Keep Existing Grids option.

2. Only value change in an existing area or adding new areas: To do this, simply use Manual and Add/Append to add or modify the values in the existing grids. Make sure to highlight the InundationTiming grids that have values and choose Selected Time so the same timing can be included with this update.

3. Small shift in start and/or end time: First run Keep Existing Grids to have the correct InundationTiming grids for the cycle. Then copy the adjacent zero grid to the next grid on the front end to delay the start or conversely copy the value timing grid to the earlier zero to bump up the timing. Same goes for change on the back end. Then run Update InundationMax to make sure all surge grids are in sync.

4. Multiple changes to area, values, and/or timing: It will be far easier to just start over in this case as if it were the first advisory. So follow the steps above for the first advisory.



NOTE: choosing 1 foot now creates a 1.1 value in the Max and Timing grids for TCV purposes and results in "around 1 foot" wording.

The resulting StormSurgeThreat grid is based on the InundationMax value at each grid cell.

Storm Surge Threat
Potential for storm surge flooding greater than 9 ft above ground
Potential for storm surge flooding greater than 6 ft above ground
Potential for storm surge flooding greater than 3 ft above ground
Potential for storm surge flooding greater than 1 ft above ground
Little to no storm surge flooding

The StormSurgeThreat grid should never be post-edited directly as it will result in the various surge elements being inconsistent.

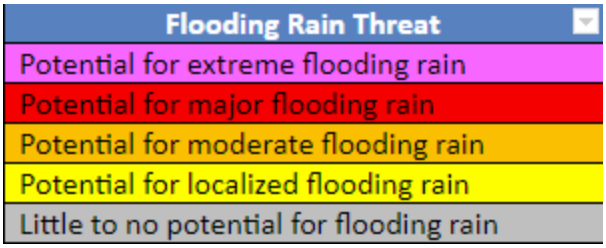
FloodingRainThreat

The *TCFloodingRainThreat* procedure will appear as below, with options to run from guidance or Keep Existing Grid.

The output for any given grid point is the max value of the Day 1, 2, and 3 Excessive Rainfall Outlook (ERO) Excessive Rainfall Probability (ERP) as shown in the table below. This allows the FloodingRainThreat to match the ERO from WPC.

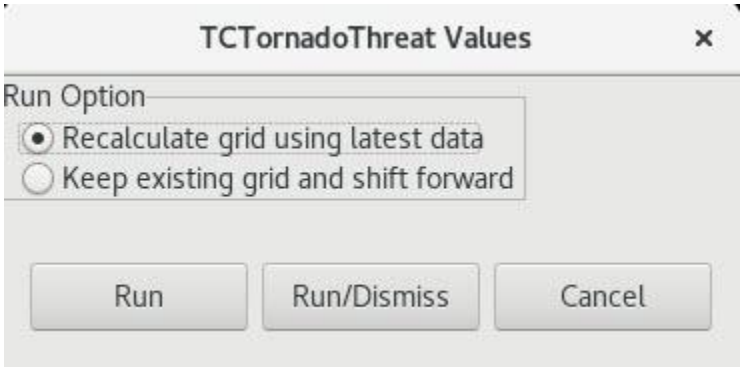
HTI Threat Level	ERO Risk Category	ERO Probabilities
Little to None	No Risk	0% <= x < 5%
Localized	Marginal	5% <= x < 15%
Moderate	Slight	15% <= x < 40%
Major	Moderate	40% <= x < 70%
Extreme	High	70% <= x <= 100%

Collaborate your QPF forecast with WPC and your neighboring WFOs and RFCs and then run the procedure. If needed, collaborate any post-editing that may be needed. These grids are mosaicked and used by regional and national customers to assess their risk. Consider the message you wish to communicate considering the various levels correspond as shown.

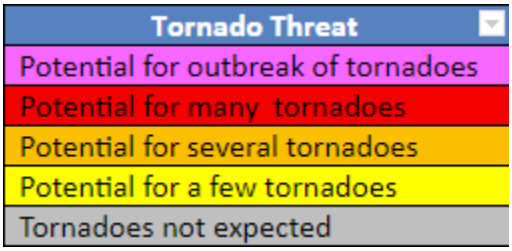


TornadoThreat

The *TornadoThreat* procedure uses various SPC guidance grids to generate a threat grid. The final grid is either the highest threat at each grid point after interrogating the SPC probability grids or the previous grid.



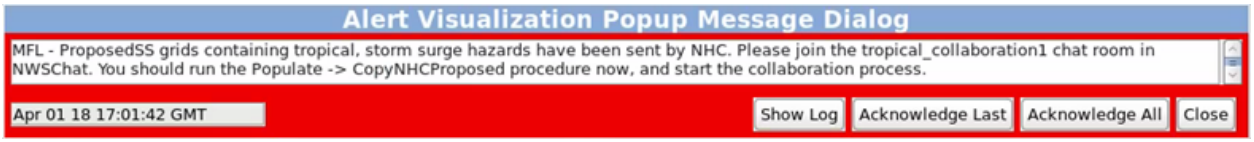
The TornadoThreat grid is one that will likely need post-editing as the SPC probabilities are not well-calibrated for tropical events. Collectively decide what message you wish to convey and adjust the procedure output to match that according to the threat levels, as shown.



Storm Surge Collaboration

If the threat for life-threatening inundation exists, the NHC SSU will initiate the collaborative process that results in the storm surge watch/warning. The

upcoming collaboration will be discussed on the hotline call so offices affected can expect the banner below to join the tropical_collaboration1 chatroom in NWSChat and to run *CopyNHCProposed* to generate an editable grid. If there are multiple storms requiring collaboration, tropical_collaboration2 may be the room for your storm. NHC will announce that on the Hotline call for each storm.



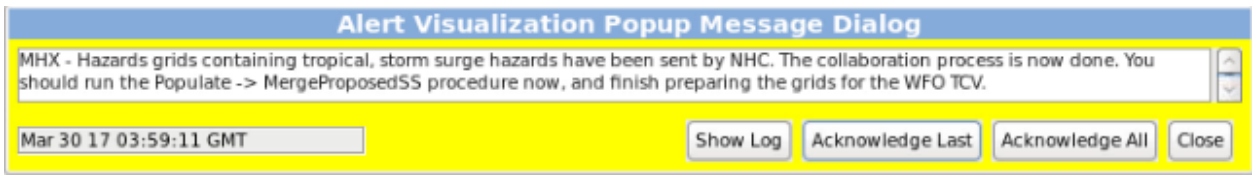
This procedure also creates a difference grid that shows where areas are recommended to be added or removed when compared to the last advisory. Recall that the guidance being used is from the previous advisory. If this is your first advisory with a SS W/W, the procedure will let you know no difference grid could be created.

Decide which areas to leave in the W/W and which areas may need to be removed. Ensure the W/W ends or begins on a zone boundary. Zones which have at least 3% coverage in the SS W/W will automatically be included in your WFO TCV. Also collaborate with your neighboring WFOs on areas being modified. This can be accomplished both via chat and ISC.

Once your edits are complete, save your ProposedSS grid which shares your grid with both SSU and your neighboring WFOs. If SSU has any issues with your edits, that will be noted via chat or possibly a phone call.

Once SSU has approved of all edits, they will finalize the process and notify all WFOs collaboration is complete. This should occur about 30 minutes before advisory. You may receive another banner at this point prompting you to run *MergeProposedSS* to add the finalized SS W/W to your Hazards grid. If you do not receive the banner, go ahead and run MergeProposedSS so you can finalize your Hazard grids if you are certain the collaborative process is complete.

If you attempt to run MergeProposedSS with unsaved, separated, or locked Hazards, you will be forced to rectify that before running again. You may receive the banner to run MergeProposedSS around advisory time. If you have already run the procedure, ignore that late banner.



Creating the Products

When tropical wind or storm surge hazards are in effect for land and/or marine zones, WFOs must issue the TCV and HLS, when land zones are affected, and MWW when marine zones are under threat.

NOTE: If your office does NOT want the Expressions of Uncertainty to appear in the point-and-click, *do not run the PWS_Procedure* if you are not issuing the TCV/HLS.

TCV

1. Once NHC issues the TCP/Advisory and the TCP is in your database, you can start working on the TCV text product. If hazards are currently separated into temporary hazard grids, finish your edits then click *MergeHazards* from the Hazards drop down menu. If you have a Merge Conflict, resolve that before proceeding.

2. Ensure you have the following grids complete:

3. Click on the blue disk to Save your grids. Click Save Weather Elements.

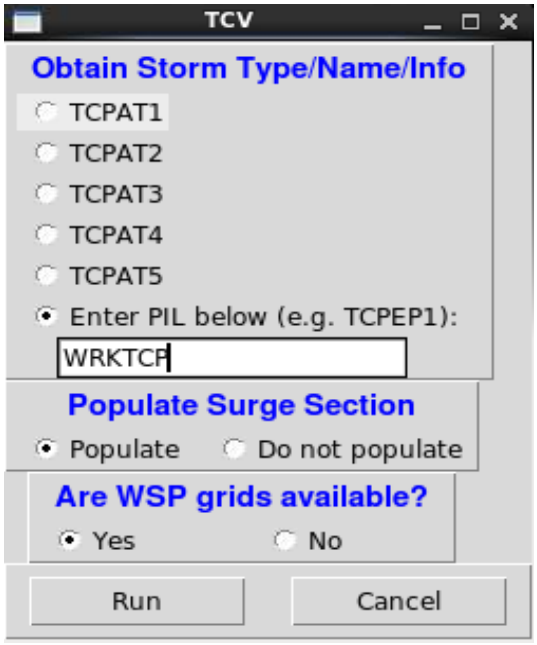
4. On the Products drop down menu, click Publish to Official. Make sure to publish *all* grids and *all* times!

5. Under the Products drop down menu, click Formatter Launcher.

6. In the Formatter Launcher window, click Products, then choose Hazard --> Hazard_TCV.

7. Choose the appropriate TCP for your storm. It is critical to choose the correct TCP as it affects the MND header and the ability to run the HLS. As such, you must wait for the current advisory cycle's TCP to store to your text database before running the TCV.

a. With early WSP and NHC SSU providing surge grid creation guidance, there should no longer be a reason to change the default options for Populate Surge Section and Are WSP grids available?.



8. Click Run.

9. Make sure the output looks correct. If anything looks out of order, *correct the necessary grids and re-run the TCV*. Do not edit the output.

a. The hazards will have a hazard end time of 000000T0000Z for UFN. This is correct.

10. When you are ready, click Transmit to send the product. Click Transmit again on the transmit window which comes up to actually issue the product.

11. Check NWSChat and the WWA map to ensure your hazards transmitted successfully. This transmit also saves off information which is required to run HLS and will push the HTI graphics to the web.

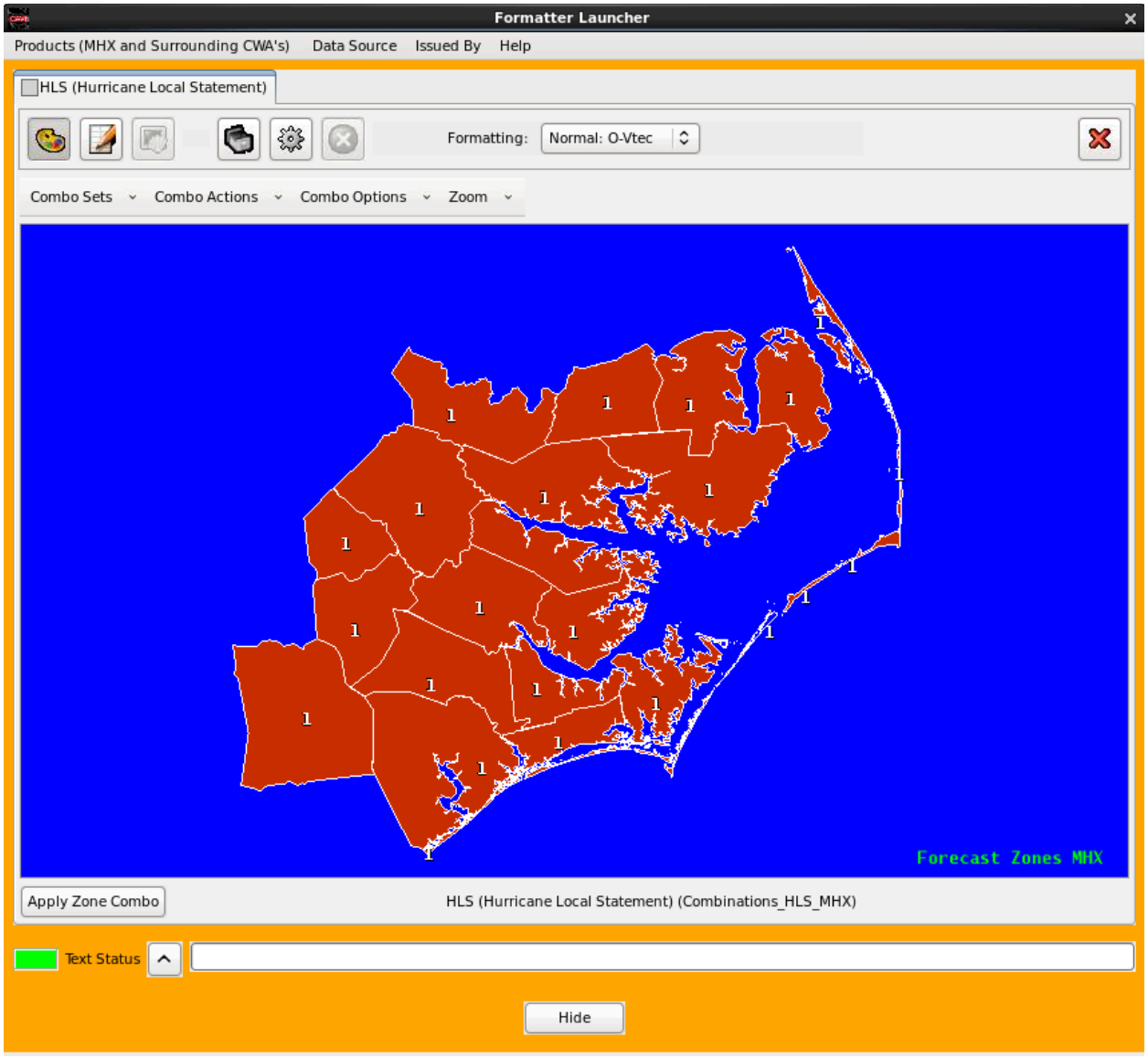
HLS

1. Before running the HLS, ensure the Situation Overview has already been created by entering WRKHLS in the AFOS Cmd window (the one with Text 1, Text 2, Text 3 and Text 4) and including the overview of the event for this advisory. Save that file so it will be imported when the HLS is run. Do not use any other editor than the text workstation as invisible characters can be introduced which cause the HLS to fail.

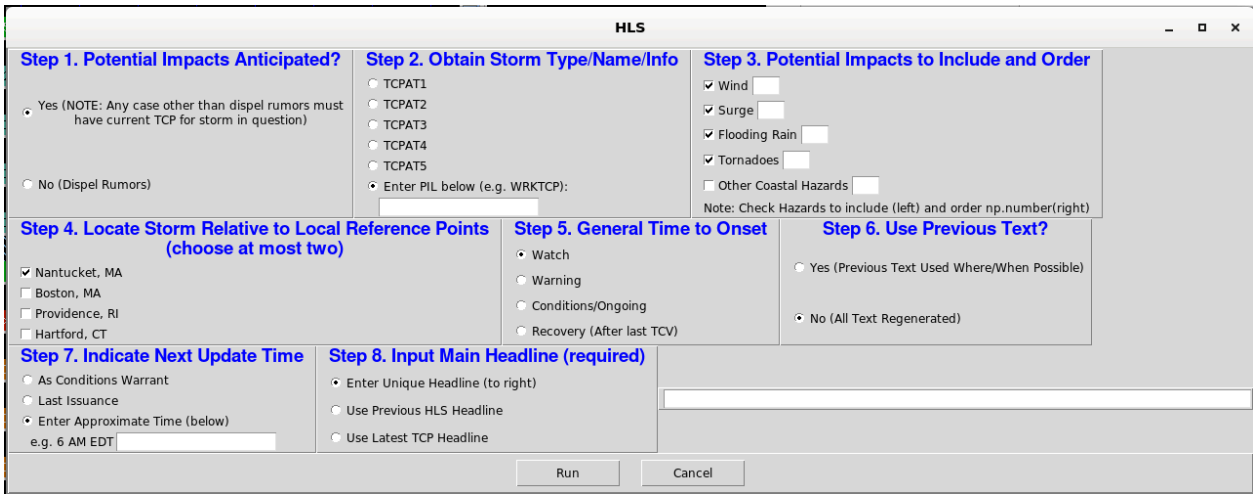
2. In the Formatter Launcher window, click Products, then choose HLS (Hurricane Local Statement).

3. Select the zones you would like to be included in the UGC list for this advisory. *This only affects the UGC list.* The product will still contain information for the entire CWA.

> **a. If a subset of zones is selected after having all zones in the CWA in the previous HLS, the WWA map will continue to show the other zones and will link to the previous HLS until it "expires" roughly 8 hours from when it was issued.**



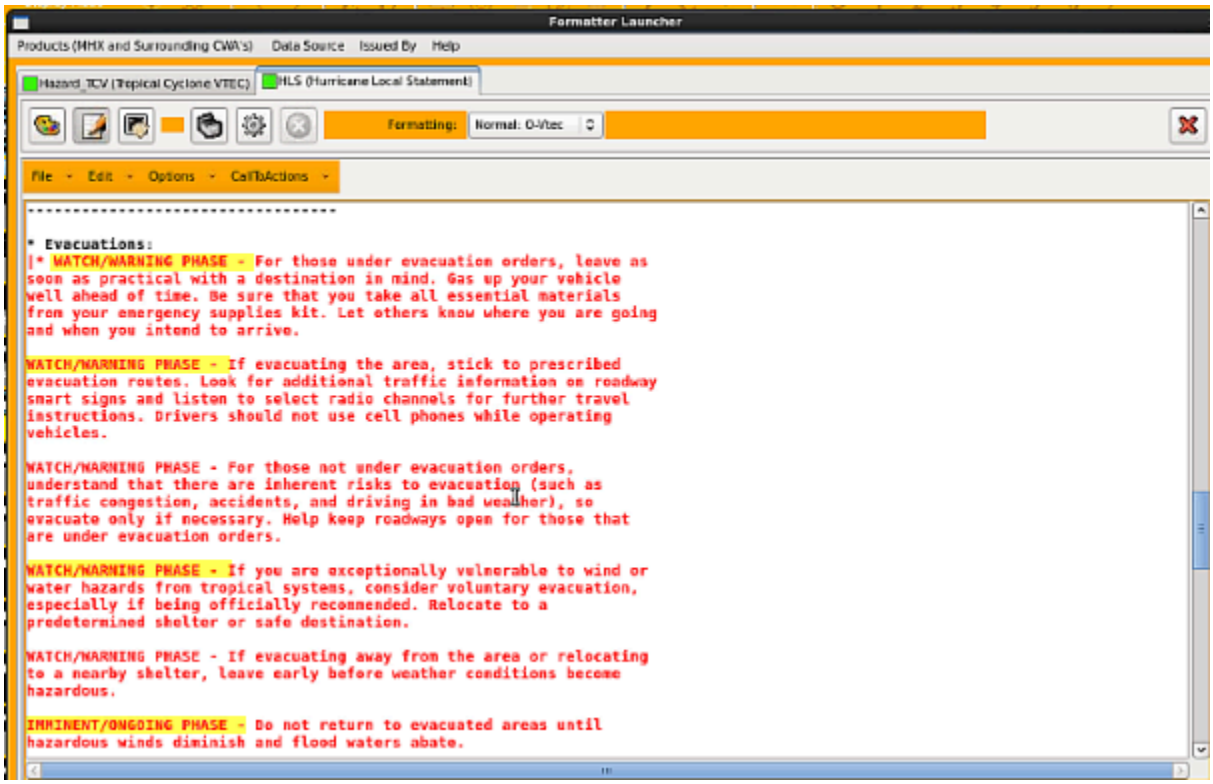
4. Make the appropriate selections on the interface. For Step 3, select only the hazards which present a real threat to the CWA and order them according to the impact they will have. *You do not have to choose all of the hazards*, but at least one needs to be chosen. For Step 5, Conditions/Ongoing is to be chosen when the CWA is about 6 hours either side of 34 kt winds affecting your CWA.



5. Click Run.

6. Edit all framing code as appropriate and ensure WRKHLS was properly imported as the Situation Overview. In the Precautionary/Preparedness Actions section, *make sure to not only trim down the list but to remove the phase wording* intended to help you decide which information to keep.

As edits are made, make sure to leave the general format (e.g. ** around Main Headline, bullet format) *as the formatter produced it*.



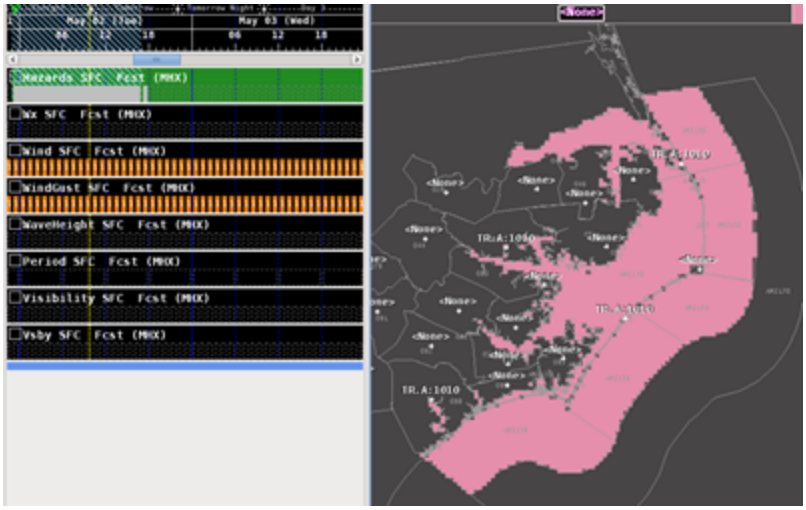
7. Run Spell Check, correct any valid issues discovered, and click Transmit. Click Transmit again on the transmit window which comes up to actually issue the product.

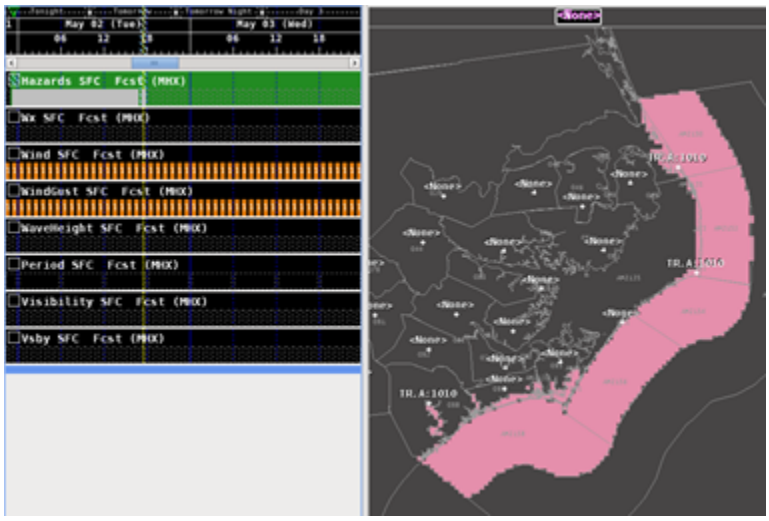
MWW

1. If marine zones are involved, create and issue the Hazard_MWW as usual.

a. If you need to segment the MWW for meteorological reasons (e.g. some zones in TR.A will have 10 ft. seas while others will have 3-5 ft.), you can use the end time to force that separation since the ETN replaces the segmentation ability. When creating Hazards, make one set of zones end one hour before the rest, as shown.

b. Only make this change to the end time of the hazard. The end time is always UFN in the VTEC for tropical hazards and one hour difference should not negatively impact the Expressions of Uncertainty in the CWF.



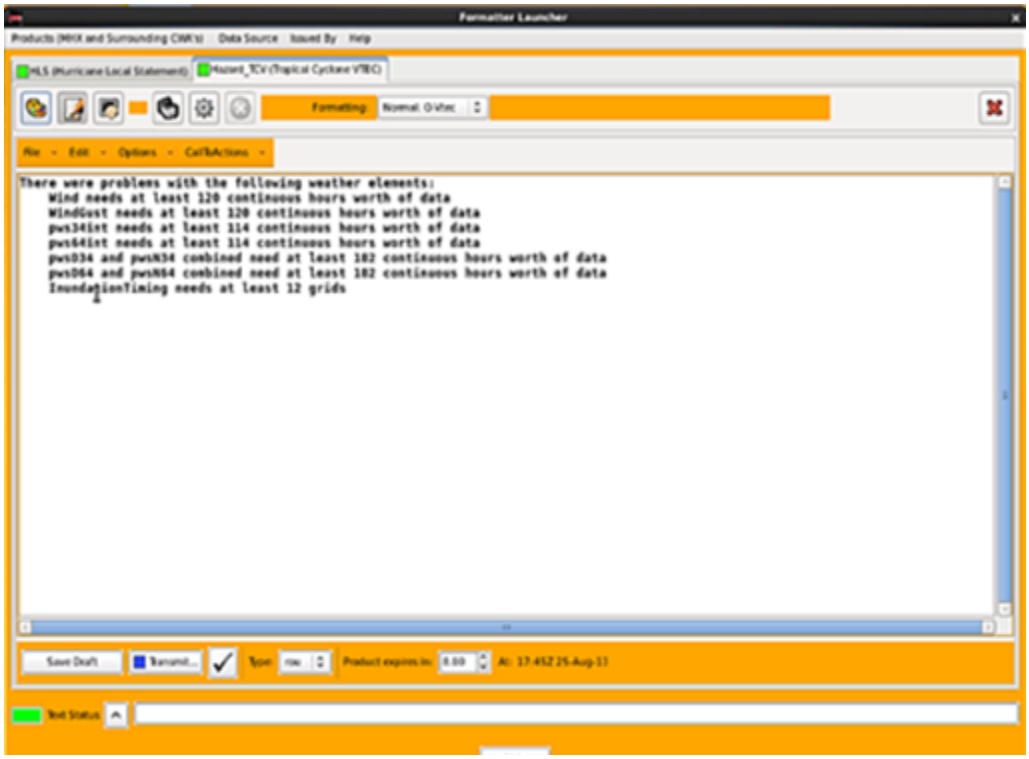


Troubleshooting

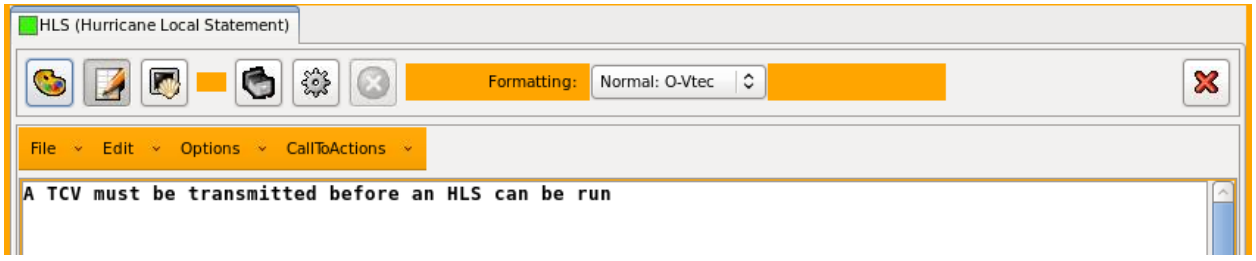
The TCV and HLS are very complex formatters which rely on a variety of grids, guidance, and other internal files. Feedback messages are provided to help guide you in case of issues.

1. The most common reason for a TCV formatter failure is one or more of the required grids was not generated. If this is the case, a list of missing weather elements, as shown.

If you have the listed element in your grid manager, then make sure to go back and publish ALL grids and ALL times. It is best to use a weather element group that contains all of the required grids such as the baseline HTI weather element group.



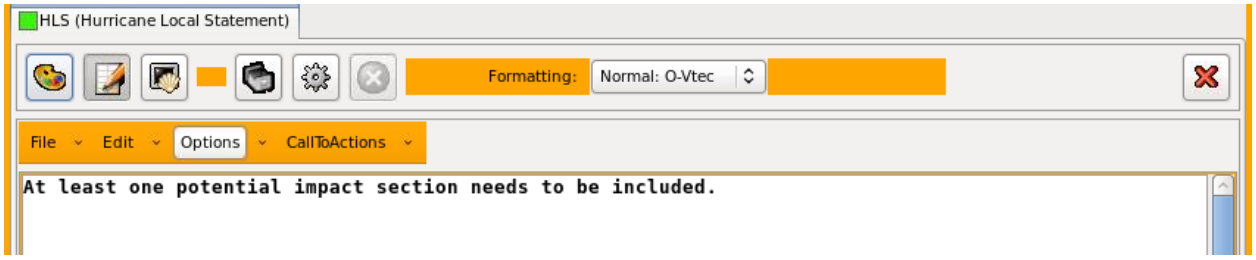
2. A storm-based HLS cannot be generated unless a TCV has first been issued *for that advisory*. Only a Dispel Rumors HLS can be created without first issuing a TCV. If you attempt to create an HLS without first issuing a TCV for the given advisory, including intermediate advisories, you will receive the message below in your formatter launcher window:



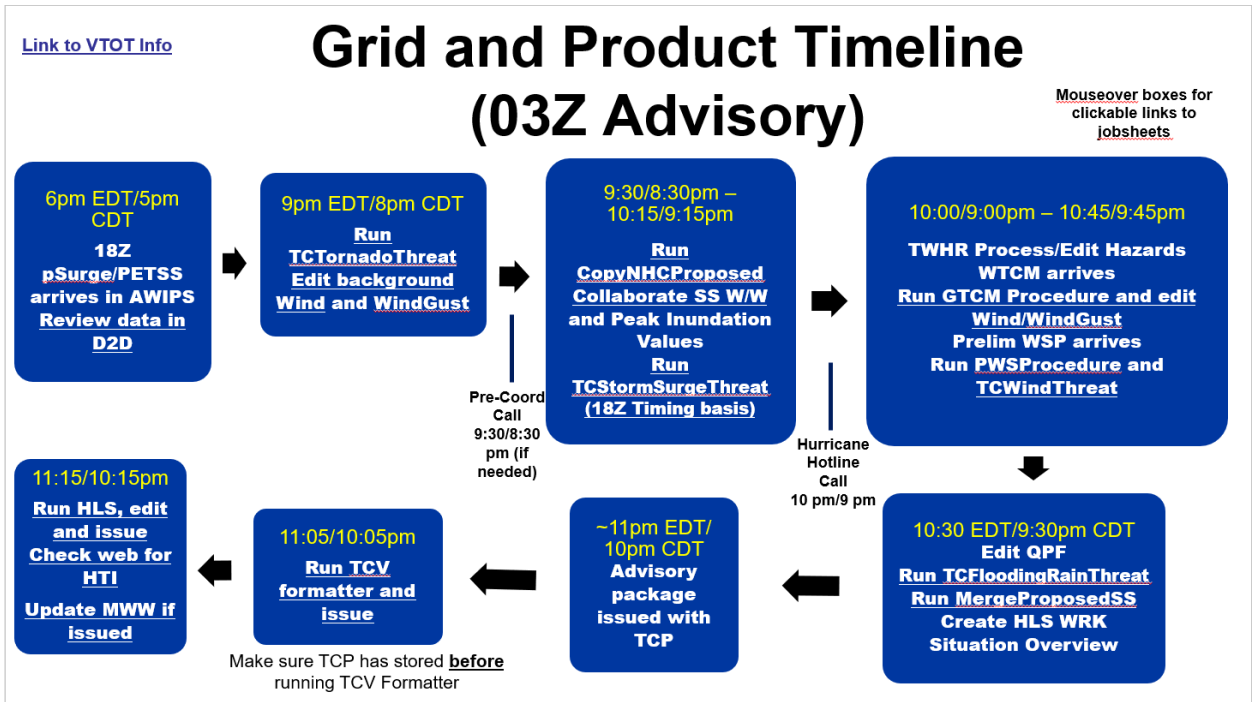
a. If a TCV was issued and a different forecaster is running the HLS and receives this message, then there are likely permission issues with the

tcvAdvisories directory. This will need to be addressed by your ITO or the NCF. Open a CRITICAL trouble ticket!

3. At least one impact section must be chosen when running the HLS, even for the final HLS. If no impact sections are chosen, you will receive the following error in the formatter launcher window:



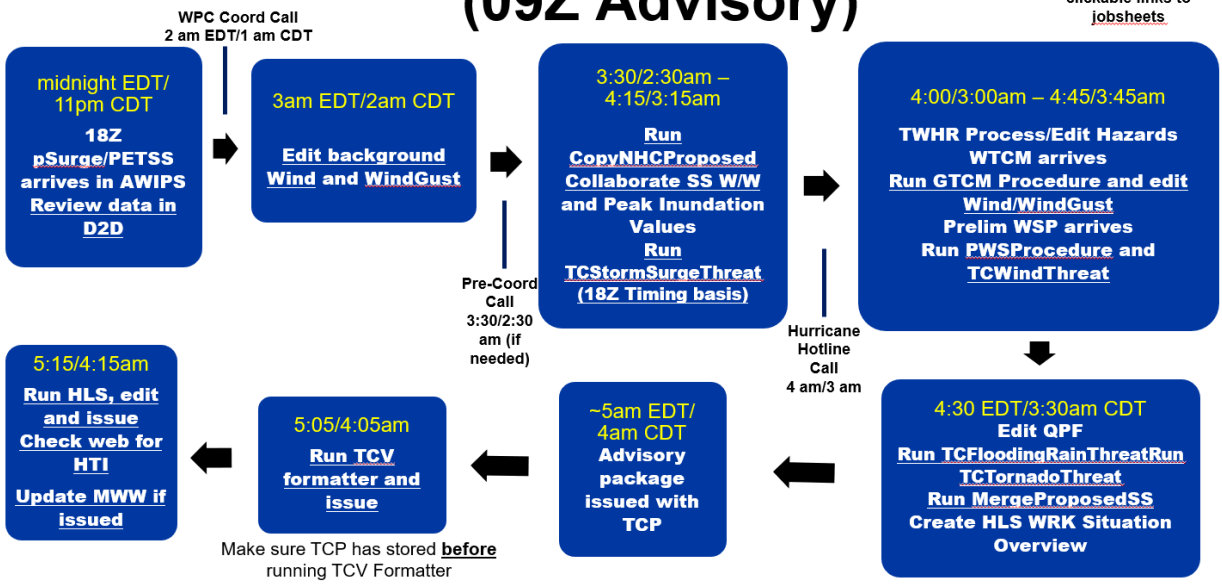
4. For any other TCV or HLS failure, call the NCF and open a CRITICAL trouble ticket.



Link to VTOT Info

Grid and Product Timeline (09Z Advisory)

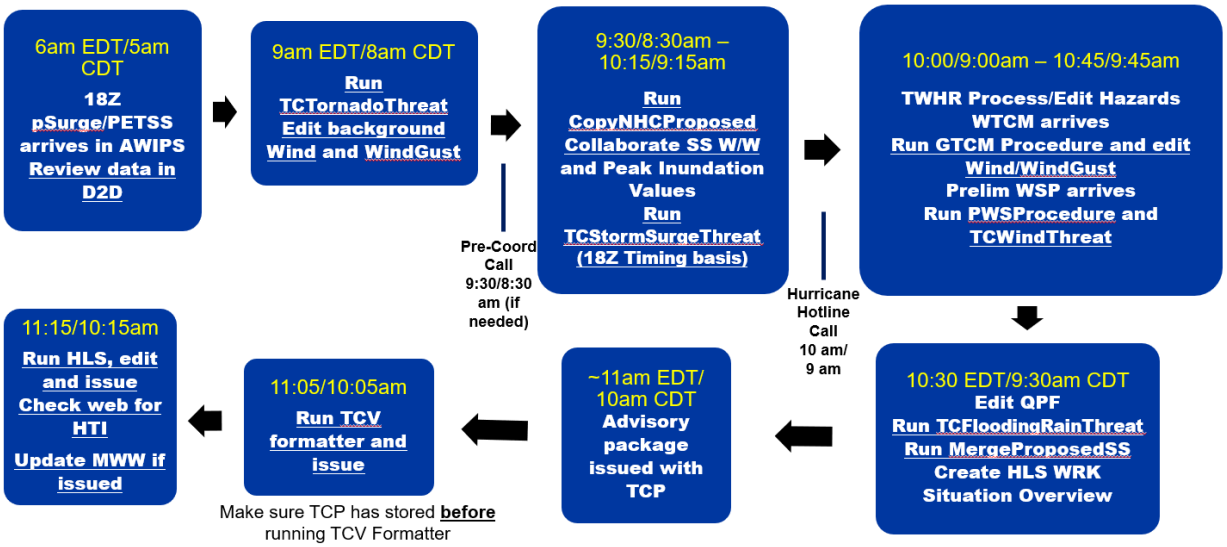
Mouseover boxes for clickable links to jobsheets



Link to VTOT Info

Grid and Product Timeline (15Z Advisory)

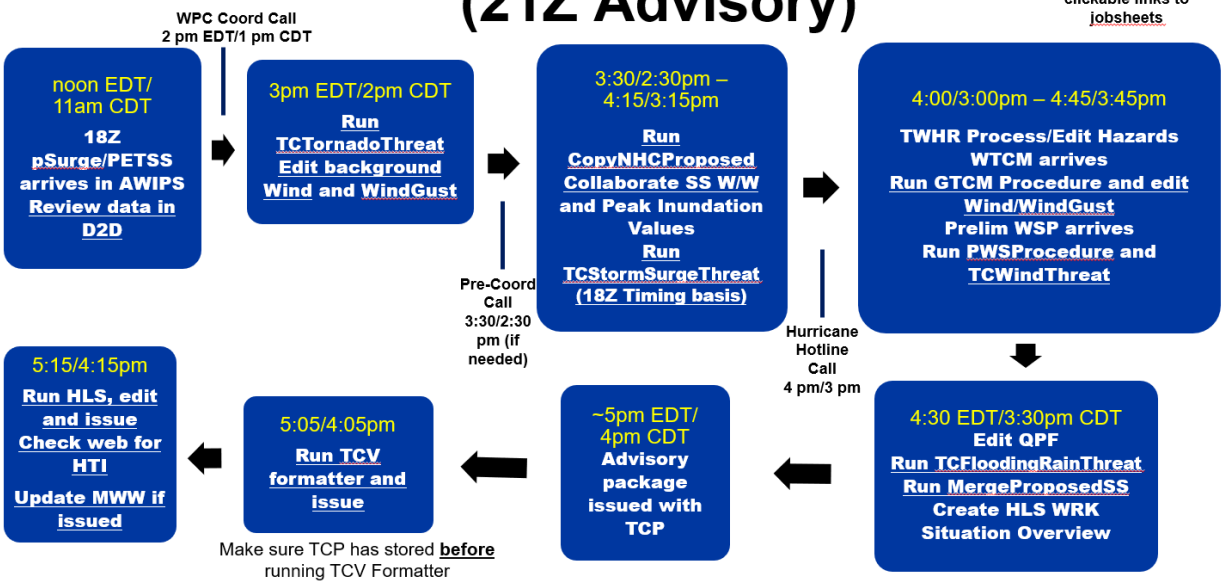
Mouseover boxes for clickable links to jobsheets



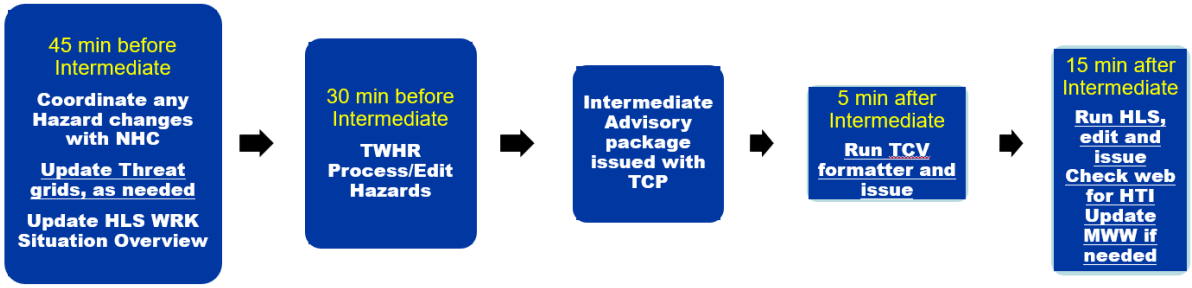
Link to VTOT Info

Grid and Product Timeline (21Z Advisory)

Mouseover boxes for clickable links to jobsheets



Link to VTOT Info

Generic Intermediate Timeline (not required unless changing Hazards)

Mouseover boxes for clickable links to jobsheets