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***Operations and Services  
Public Weather Services, NWSPD 10-5  
WESTERN REGION HEAT SERVICES***

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**SUMMARY:** This supplement establishes a standardized criteria for Western Region WFOs to use for issuing Heat Advisories, Watches, and Warnings.

Signed  
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Director, Western Region

May 24, 2018  
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Date

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1. Introduction: Heat kills more people than any other weather phenomenon across the Nation, and in NWS Western Region (WR), heat kills more people annually than floods, lightning, and tornadoes combined. Historically, the approach toward developing local office heat criteria has been to work with heat partners to determine an appropriate threshold value that captures a subset of high-end impacts and then use that threshold to issue heat products. While this is a logical approach, the realities of heat impacts are that they are broad and vary between individuals, sectors, and locations. It is challenging, if not impossible, to create a single threshold that adequately addresses the diversity of decision points related to heat.

In 2013, the State of California Governor's Office of Emergency Services specifically requested a consistent approach to heat event identification and notification from NWS/WR. To address the issues in our current approach toward heat event identification and to provide the increasing level of Decision Support Services demanded of the NOAA/NWS by its partners and customers, an approach away from single thresholds toward a multi-tiered framework was developed. This framework applies a consistent methodology, incorporating high-resolution local climatology and peer-reviewed heat science, to place forecast heat into a numeric and color-based heat risk system. This makes the system easy to understand, as it's comparable to the Air Quality Index system developed for air quality. HeatRisk is the name of the service first tested in California, then expanded elsewhere in WR. After four years of testing, HeatRisk will now form the criteria basis for which WR issues Heat Watches, Warnings, and Advisories.

2. Defining HeatRisk: At its most basic level, the HeatRisk output at a location is a fractional number that represents the risk of impacts to human health due to excessive heat over a 24 hour period. The higher the value, the greater the potential risk. It is calculated by combining the potential heat stresses from both daytime highs and overnight low temperatures, with the overall heat risk increasing when these temperatures are excessive for that climate and are at levels that have been shown to be dangerous. HeatRisk takes into consideration:

- 1) How significantly above normal the temperatures are at your location
- 2) The time of the year (early season heat versus heart of summer typical heat)
- 3) The duration of unusual heat (do temperatures overnight add to daytime accumulated heat stress or relieve it, is this a multiple day event?)
- 4) If those temperatures are at levels that pose an elevated risk for human health-related heat complications

Significant humidity contributions are acknowledged by both unusually warm overnight low temperatures and by weighting the contribution of heat stress derived from overnight lows more heavily in climatologically humid climates. Science has shown that high levels of daytime and nighttime heat can contribute to higher risk than just the same level of daytime heat alone. The Centers for Disease Control and Prevention heat health data also contributes to the calculations in HeatRisk, leveraging a national dataset of mortality and morbidity statistics. The HeatRisk approach takes all this into consideration when creating the 24 hour HeatRisk output. While HeatRisk can be an important tool to identify approaching episodes of heat that will have significant impacts on human health, it is also expected to be of value to other sectors where heat plays an important part in driving significant impacts (i.e. agriculture, electrical demand, air quality, recreation, water usage, etc).

2.1 Resources: All WR Weather Forecast Offices (WFOs) have a link to the HeatRisk service on their webpages under the "Forecasts" tab, with the title "Experimental HeatRisk."

Customers and partners can view HeatRisk maps daily, out to seven days in advance, to determine where potential heat may occur. This page will also serve as a proxy for Heat Advisories in the Desert Southwest.

A HeatRisk resource center has been developed in the Virtual Lab (Vlab) at: <https://vlab.ncep.noaa.gov/group/heat-risk/home>. Users need to enter their Gmail password to access Vlab. The resource center provides a wealth of resources including: training, information about the science behind the HeatRisk values, outreach resources, Weather Story and social media templates, state level maps, and much more. It also includes historical graphs which provide past legacy product recommendations for the years 2005-2017, and graphs with the annual threshold curves at many National Centers for Environmental Information sites.

3. Legacy Heat Products: WR is adopting a policy of issuing three Heat products: Watches, Warnings, and Advisories, with a few exceptions to this spelled out in section 3.3. This allows WR offices to be consistent across state boundaries and in line with already established approaches across much of the rest of the country. It also allows us to distinguish between potential life threatening heat impacts versus mostly heat illness impacts. The frequency of issuing products is based on both climatology and the seven-day potential for heat impacts, which will be based on the fractional HeatRisk values. This means that for areas that experience heat events infrequently, Warnings may rarely be issued, while in the warmest climates, Warnings may be issued multiple times during a heat season. However, the HeatRisk framework is such that even in cooler climates - if daytime and nighttime temperatures are high enough (generally in the 95<sup>th</sup> percentile or greater), red level HeatRisk values are possible.

3.1 Gridded Product Recommender: A gridded legacy product recommender (HeatRiskWWA) has been developed for the Graphical Forecast Editor (GFE) in the Advanced Weather Interactive Processing System, to aid forecasters in determining appropriate legacy heat products. While values of HeatRisk remain integers in the 24 hour HeatRisk grid (for purposes of external use/graphics), the "HeatRiskWWA" grid will utilize the actual fractional HeatRisk values to highlight the recommended legacy heat product. **Table 1** shows the ranges of fractional HeatRisk values, and the corresponding legacy heat product that is recommended.

It is strongly encouraged that neighboring offices coordinate/collaborate on their heat products, including those in other regions. WFOs in other regions may not have this same policy in place for issuing their heat products, but collaboration is still strongly encouraged to agree on similar messaging.

HeatRisk Value	Recommended Legacy Heat Product
<b>2.66-4.00 (Magenta/Mid Red+)</b>	<b>Excessive Heat Warning</b>
<b>2.40-2.65 (High Orange/Low Red)</b>	<b>Heat Advisory</b>
<b>2.00-2.39 (Orange)</b>	<b>Consider Heat Advisory*</b>
<b>&lt;2.00 (Low Orange and lower)</b>	<b>No legacy heat product</b>

\*forecaster discretion

**Table 1:** HeatRisk values and the corresponding suggested legacy heat product that will be recommended in the GFE.

3.2 Excessive Heat Warning: Will be issued for Magenta and the mid/high range of the Red level HeatRisk thresholds. An exception would be in the case of a mixture of periods of recommended Warnings and Advisories, where forecaster discretion and coordination with surrounding offices should determine the appropriate Legacy Product and messaging strategy. In the HeatRiskWWA grids, Magenta and mid/high Red areas will be represented as “Warning”. These values represent temperatures well above climatological normals, both for high and low temperatures, and are at levels that have been shown to significantly impact human health. Because of the increased duration of unrelenting heat, impacts tend to become magnified at these levels with spikes in both mortality and heat illness. These levels will be uncommon at locations that see climatological overnight low temperatures frequently drop below 65 degrees, as heat health science indicates that heat mortality is significantly reduced with as little as two hours of cooling (which can be provided by relatively cooler nights), limiting the contribution of duration toward widespread heat impacts.

3.3 Heat Advisory: Should be issued for values of HeatRisk in the low end of the Red level and high end of the Orange level, except in the case of a mixture of periods of recommended Warnings and Advisories, where forecaster discretion and coordination with surrounding offices should determine the appropriate Legacy Product and messaging strategy. Regarding the “should” wording above: While we anticipate most situations would warrant issuing an Advisory with these thresholds, it is recognized that after a long heat season, it may no longer be necessary to issue advisories. In these situations, forecaster discretion could be used to decide to message the upcoming heat through social media and other means, without issuing an advisory. In the HeatRiskWWA grids low Red and high Orange areas will be represented as “Advisory”. These values represent temperatures above or well above climatological normals, generally for either high temperatures (daytime heat) or low temperatures (typically due to unusual higher humidity), but generally not both. Heat at this level can still significantly impact human health, primarily through increases in heat illness and less so in terms of spikes in heat mortality. Taking specific actions such as movement of outdoor activities away from the heat of the day, opening windows at night, seeking

a place of cooling for a few hours during the afternoon/evening, and using fans to circulate air should be sufficient to mitigate the dangers of significant spikes of heat mortality and illness.

- a. Special Case for Forecaster Discretion: Heat Advisories may also be issued when the HeatRiskWWA grids show areas labeled as “Consider.” These areas are still in the orange range, which is still dangerous to “at risk” groups (See Appendix B for more on “at risk” groups). Local knowledge is necessary to know if issuing an Advisory in this Orange level range is warranted. In general, only offices with cooler climates and/or very infrequent heat episodes are likely to do this. Two examples of when a forecaster might choose to issue a Heat Advisory on a “Consider” day are:
    - a. Early season heat in zones when heat is uncommon. While marginal at most other County Warning Areas (CWAs), for those who don’t experience heat often or where widespread air conditioning use is uncommon, this level of heat may still be impactful and lead to a spike in primarily heat illness across a broad population.
    - b. A multiple day event is occurring in your area and one of the days is expected to only be at the “Consider” level. Rather than having a break in products and confuse the public, a forecaster could decide to include this “consider” day along with the rest of the legacy product suite and message appropriately.
  - b. Exception to issuing Advisories in the Desert Southwest Areas: In the Desert Southwest, where excessive heat is common throughout the summer, Advisories would be issued too frequently to be effective. Because of this, a large portion of southeast California, southern Nevada, and southern Arizona will not be required to issue Advisories, even if recommended by HeatRisk. Orange and lower end Red level days are still dangerous; therefore offices should educate heat partners in those areas to utilize the HeatRisk website directly and to take appropriate actions for their “at-risk” communities even when the office doesn’t issue a legacy product. These offices should use the “Advisory” level recommendations as their version of “Consider” days as discussed above. See map and specific zones in **Appendix A**.
- 3.4 Excessive Heat Watch: Will be issued in anticipation of a warning event.
- a. Excessive Heat Watches will be handled similarly to other long-duration phenomena (snow, wind, etc.), as specified in NWSI 10-515.
  - b. Forecaster Discretion: If there is potential for both Advisory and Excessive Heat Warning products to be issued in adjacent areas of a CWA, an Excessive Heat Watch can be used to cover both for more consistent messaging (e.g. even if you are fairly confident you will issue a coastal Heat Advisory and an inland Excessive Heat Warning, a Watch for the entire area could be issued for message consistency, with specific details and appropriate calls to action spelled out in the Watch).
4. Non-Legacy Heat Products: HeatRisk maps are ideal for portraying when and where the greatest impacts from heat are expected, and should be used to spread the message about heat via social media, partner emails/briefings, and Weather Stories, in addition to our legacy products. Templates have been developed, which detail the meaning of the various levels of HeatRisk, and can be used to save time when posting to social media. These templates are

available in Vlab, as specified above in section 2.1 Resources.

5. Heat Decision Support Services: It will be important for those involved in outreach at the WFOs to train and educate partners on the HeatRisk approach. This is also important since all WR offices will now be issuing Heat Advisories, Watches, and Warnings, which may be new in some CWAs in WR. There are outreach resources available to offices for use in working with their partners on the Vlab HeatRisk Resource Center specified in section 2.1.

County and state health and emergency management partners are common partners to provide heat related Decision Support Services to, but there are numerous other sectors who could benefit from having the information provided by the HeatRisk. Other sectors could include: education/schools, transportation, agriculture, livestock/dairy, energy, recreation (such as the National Parks), etc. It is ideal to reach out to key partners before, during, and after heat events, as time permits.

APPENDIX A

EXCLUSIONS FOR DESERT SOUTHWEST AREAS

**Zones shown in dark gray:** Only Excessive Heat Warnings required

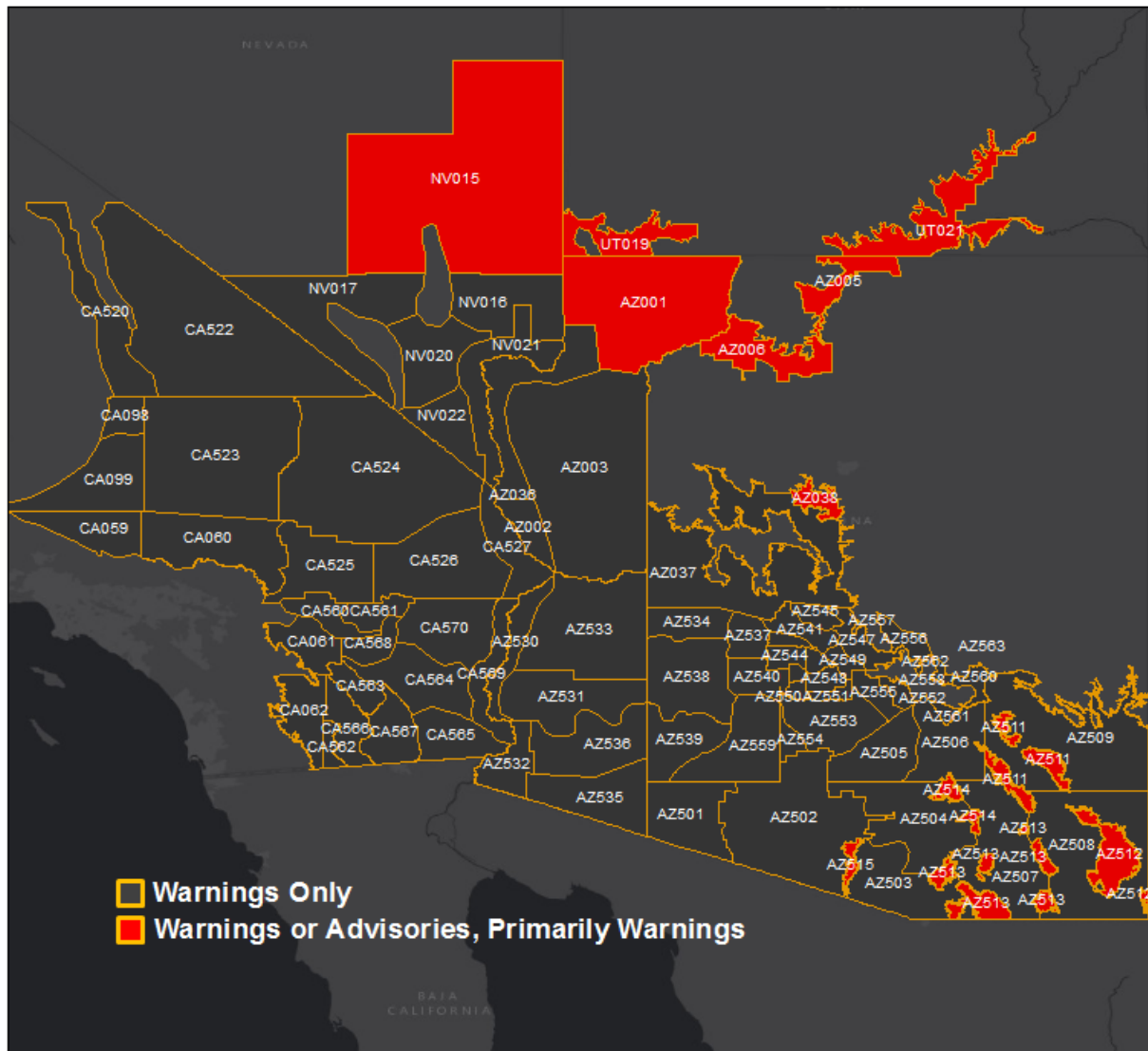
**Zones shown in red:** These zones near the Desert Southwest area have a generally large percentage of high terrain, with population centers and/or recreation areas at lower elevations. These population areas are used to significant summer heat and may not benefit from the issuance of routine advisories as recommended by HeatRisk.

- If a mix of Excessive Heat Warnings and Advisories are recommended, and the main population areas are recommended as Warning – issue an Excessive Heat Warning.
- If the zone is primarily highlighted as recommending just an Advisory – you are not required to issue an Advisory.
  - Western Region Headquarters is leaving it up to the office to determine the best product to issue based on population impacted by heat and to best blend with legacy heat products in neighboring zones. There might be situations when the right product is an Excessive Heat Warning to blend with neighboring zones and other times issuing a Heat Advisory makes more sense to blend with northern neighbors.

**Non-specified zones (Areas in gray):** Heat Advisories and Warnings as recommended by HeatRiskWWA grid



# HeatRisk Advisory Exclusion Zones



**Example:** If Advisory is recommended for much of southern NV, zones in black would not need to issue a Heat Advisory, and if the HeatRiskWWA showed Lincoln County (NV015 - a transition zone) with only lower elevations in the high end orange, a Heat Advisory would also not be required.

**Example:** If high end orange (Advisory level) is predicted for almost all of northern and central NV including much of Lincoln County (a transition zone), then forecasters could consider including Lincoln County in the Heat Advisory, if that led to a more effective message.

## Appendix B

### HeatRisk Color Level Definitions

The NWS has assigned a specific color and number to each HeatRisk category to make it easier for people to understand quickly whether heat is reaching a high enough level to create heat concerns for their unique situation. The five levels of heat concern and what they mean are shown in the table below.

Numerical Value	Meaning	Who/What is at Risk?	How Common is this Heat?	For those at risk, what actions can be taken?
0	<ul style="list-style-type: none"> <li>Level of heat poses <b>little to no risk</b></li> </ul>	<ul style="list-style-type: none"> <li>No elevated risk</li> </ul>	Very Common	<ul style="list-style-type: none"> <li>No additional preventative actions should be necessary.</li> </ul>
1	<ul style="list-style-type: none"> <li>Heat of this type is <b>tolerated by most</b>; however there is a <b>low risk for sensitive groups</b> to experience health effects</li> </ul>	<ul style="list-style-type: none"> <li>Primarily those who are extremely sensitive to heat</li> </ul>	Very Common	<ul style="list-style-type: none"> <li>Increase hydration</li> <li>Reduce time spent outdoors or stay in the shade when the sun is strongest</li> <li>Open windows at night and use fans to bring cooler air inside buildings</li> </ul>
2	<ul style="list-style-type: none"> <li><b>Moderate risk for members of heat sensitive groups</b> to experience health effects</li> <li><b>Some risk for the general population who are exposed to the sun and are active</b></li> <li>For those without air conditioning, <b>living spaces can become uncomfortable during the day</b>, but should cool below dangerous levels at night</li> </ul>	<ul style="list-style-type: none"> <li>Primarily heat sensitive groups, especially those without effective cooling or hydration</li> <li>Some transportation and utilities sectors</li> </ul>	<ul style="list-style-type: none"> <li>Fairly common most locations</li> <li>Very common in southern regions of country</li> </ul>	<ul style="list-style-type: none"> <li>Reduce time in the sun between 10 a.m. and 4 p.m.</li> <li>Stay hydrated</li> <li>Stay in a cool place during the heat of the day</li> <li>Move outdoor activities to cooler times of the day</li> <li>Open windows at night and use fans to bring cooler air inside buildings and circulate air</li> </ul>
3	<ul style="list-style-type: none"> <li><b>High Risk for much of the population who are 1) exposed to the sun and active or 2) are in a heat sensitive group</b></li> <li><b>Dangerous to anyone without proper hydration or adequate cooling</b></li> <li><b>Poor air quality</b> is possible</li> <li><b>Power interruptions may occur</b> as electrical demands increase</li> </ul>	<ul style="list-style-type: none"> <li>Much of the population, especially those who are heat sensitive and anyone without effective cooling or hydration</li> <li>Most transportation and utilities sectors</li> </ul>	<ul style="list-style-type: none"> <li>Uncommon most northern locations</li> <li>Fairly common in southern regions of country</li> </ul>	<ul style="list-style-type: none"> <li>Try to avoid being outdoors in the sun between 10 a.m. and 4 p.m.</li> <li>Stay hydrated</li> <li>Stay in a cool place especially during the heat of the day</li> <li>If you have access to air conditioning, use it. Fans may not be adequate</li> <li>Cancel outdoor activities during the heat of the day</li> </ul>

<p>4</p>	<ul style="list-style-type: none"> <li>• <b>Very High Risk for entire population</b></li> <li>• <b>Very dangerous to anyone without proper hydration or adequate cooling.</b></li> <li>• <b>This is a multi-day excessive heat event.</b> Prolonged heat is dangerous to anyone not prepared.</li> <li>• <b>Poor air quality</b> is likely.</li> <li>• <b>Power outages are increasingly likely</b> as electrical demands may reach critical levels.</li> </ul>	<ul style="list-style-type: none"> <li>• Entire population is at risk.</li> <li>• For heat sensitive groups, especially people without effective cooling, <b>this level of heat can be deadly.</b></li> <li>• Most transportation and utilities sectors</li> </ul>	<ul style="list-style-type: none"> <li>• Rare most locations</li> <li>• Occurs up to a few times a year in southern regions of country, especially the Desert Southwest</li> </ul>	<ul style="list-style-type: none"> <li>• Avoid being outdoors in the sun between 10 a.m. and 4 p.m.</li> <li>• Stay hydrated</li> <li>• Stay in a cool place, including overnight</li> <li>• If you have access to air conditioning, use it. Fans will not be adequate</li> <li>• Cancel outdoor activities during the heat of the day</li> </ul>
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