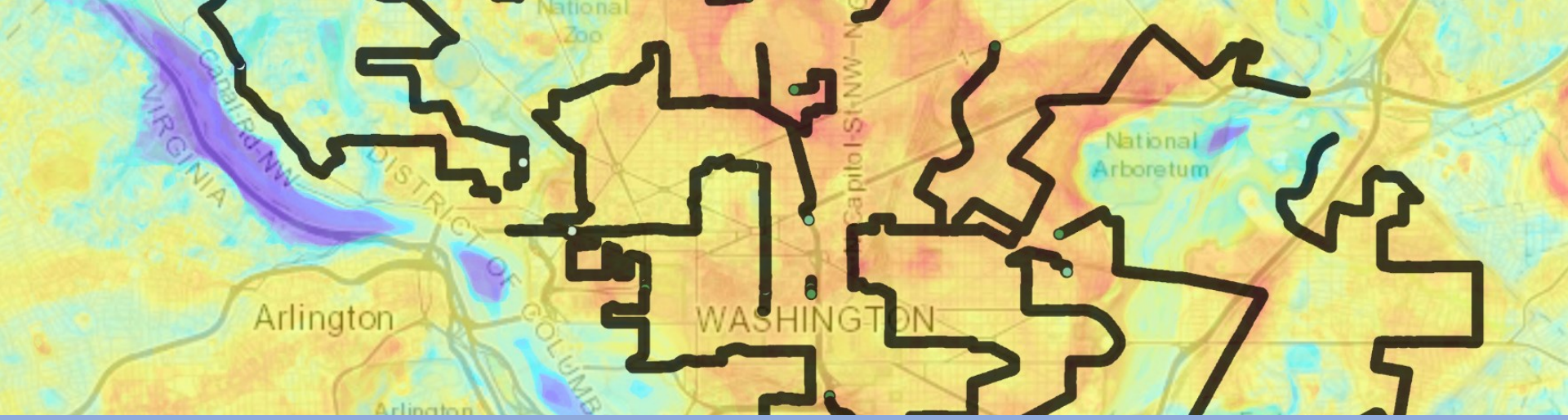


U.S. Heat Health Planning, Preparedness, Response

The National Integrated Heat Health Information System

Hunter Jones

Climate & Health Projects Manager

National Integrated Heat Health Information System (NIHHIS)

NOAA Climate Program Office

http://climate.gov/nihhis

NOAA's Line Offices & Activities

NMFS National Marine Fisheries Service	• Productive and sustainable fisheries, safe sources of seafood, the recovery and conservation of protected resources, and healthy ecosystems.
NOS National Ocean Service	• Provides data, tools, and services for safe & efficient transportation & commerce, preparedness & risk reduction, stewardship, recreation, and tourism.
NESDIS National Env. Satellite Data and Information Service	• Manages NOAA's satellites (GOES, Jason-3, Suomi NPP, DSCOVR, COSMIC-2, etc…) & climate data center – the National Center for Env. Information
OAR Oceanic and Atmospheric Research	• Labs & Cooperative Institutes nationwide, research grant programs, & international research activities
NWS National Weather Service	• Weather and climate prediction, early warning, engagement across US Weather Forecast Offices, partnership with Weather Ready Nation Ambassadors
OMAO Office of Marine and Aviation Operations	• One of 7 US Uniformed Services (*like US Public Health Service Commissioned Corps*)

NOAA's One Health Approach

Human health is intimately tied to environmental conditions, and NOAA provides key stakeholders in the public health sector with the environmental intelligence from NOAA they need to mitigate emerging health threats.

Need for One Health:

- Growing population
- Changing climate
- Predicting and planning increasing disease and extreme weather threats

Goals:

- Interdisciplinary approaches, programs, research
- Information sharing
- Better disease prevention

Extreme Conditions
Heat, Drought, Severe Weather

The Arctic
Dramatic climate-driven changes to regional ecosystems impact local human health

Air Quality
Aero-allergens, pollution
Weather patterns and atmospheric drivers

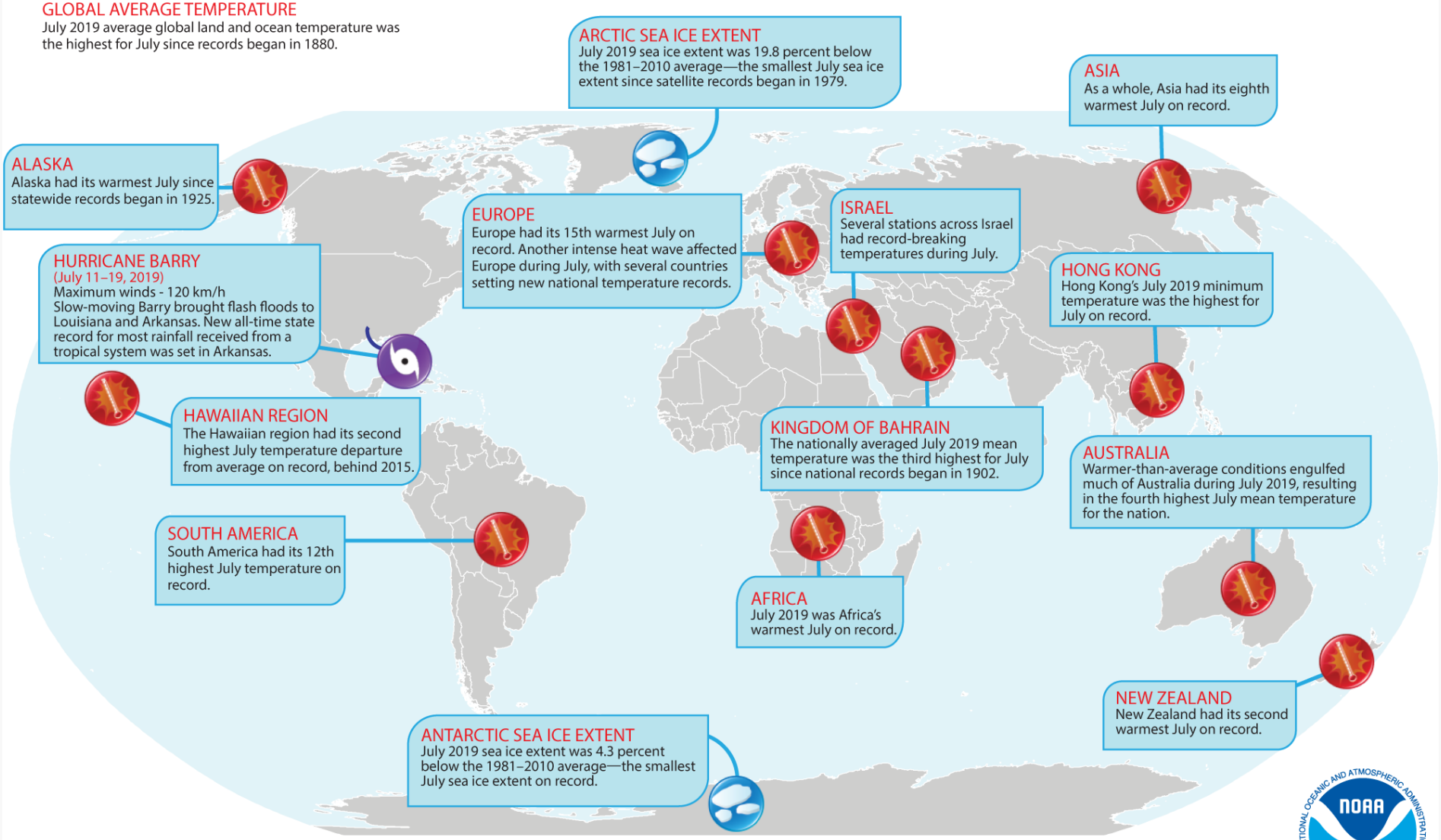
Vector-Borne Disease
Climate impacts on ranges and transmission

Benefits from the Sea
Marine products and nutrition

Water-Borne Disease
Harmful algal bloom and Vibrio forecasts; Water Quality

Marine Mammal Disease
Marine Mammal Health M.A.P.
Unusual Mortality Events

Selected Significant Climate Anomalies and Events July 2019



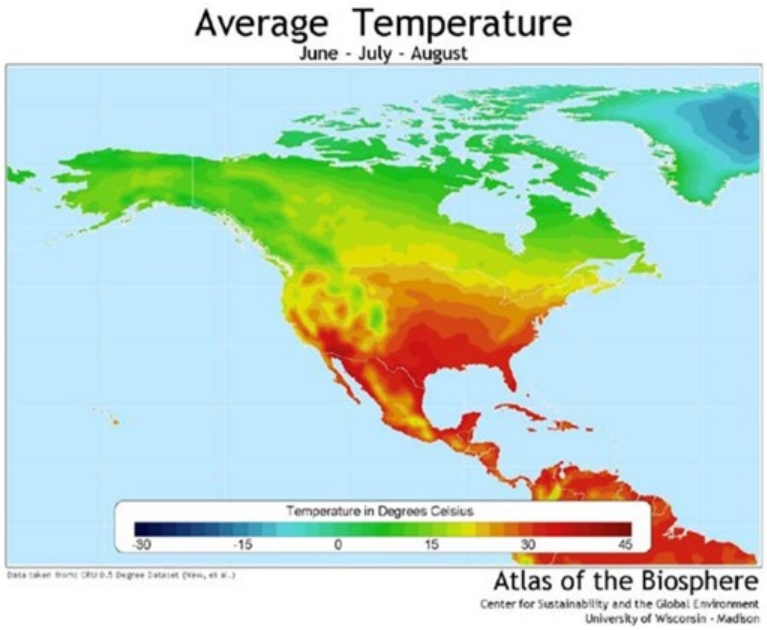
Please Note: Material provided in this map was compiled from NOAA's State of the Climate Reports. For more information please visit: http://www.ncdc.noaa.gov/sotc

Agenda

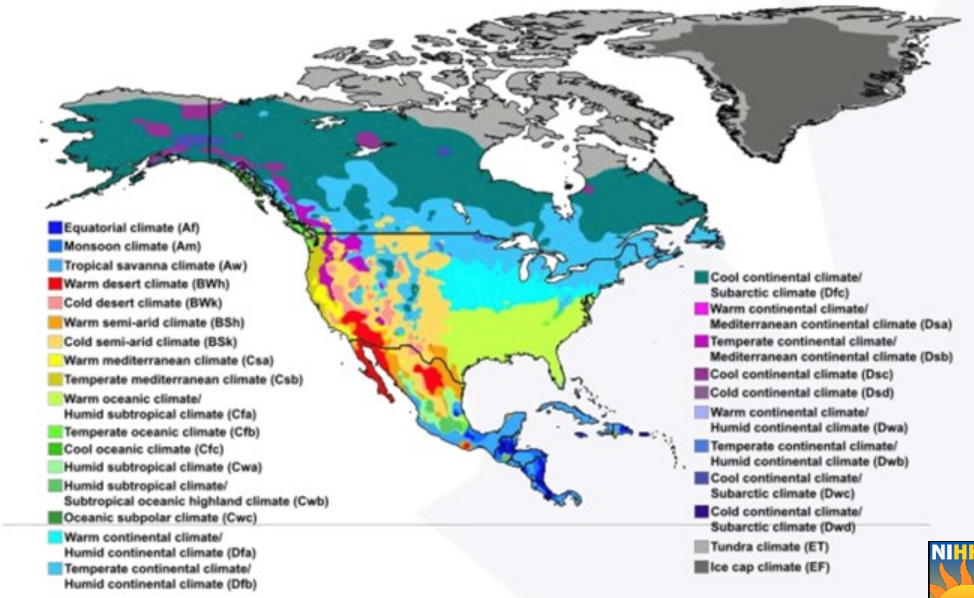
- Extreme Heat in North America & the US – historical context
  - –Impacts and changes
- Timescales – weather to climate S2S & Investment
- Weather Timescale – emergency response
  - HQ, Forecast products used, WFO role, definitions and thresholds
  - New products and approaches,
  - What happens with integration with health: example products
- Seasonal, Sub-seasonal, and Long-Term Climate Timescales
- Integrating Health and Other Disciplines
  - NIHHIS
  - Interagency Working Group
  - Pilots to Understand Local Context
  - Current Experimental & Prototype Products
- Scaling up to GHHIN

North America's Climate

- NA includes every climate zone!
  - North – subarctic and tundra
  - Leeward Mountain side – Semiarid/Desert
  - Mountains - Highlands
  - Continent – Temperate
  - Prairies/Grassland
  - Warmer the farther south you go
  - Drier the farther west you go
  - Mediterranean West Coast
  - Humid to Temperate Continental East
  - Tropical South East



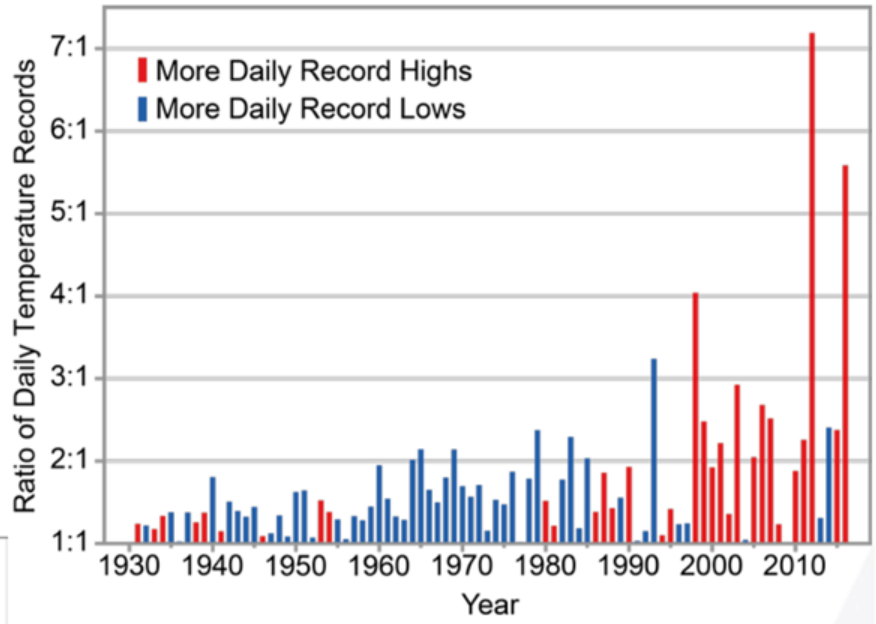
North America map of Köppen climate classification

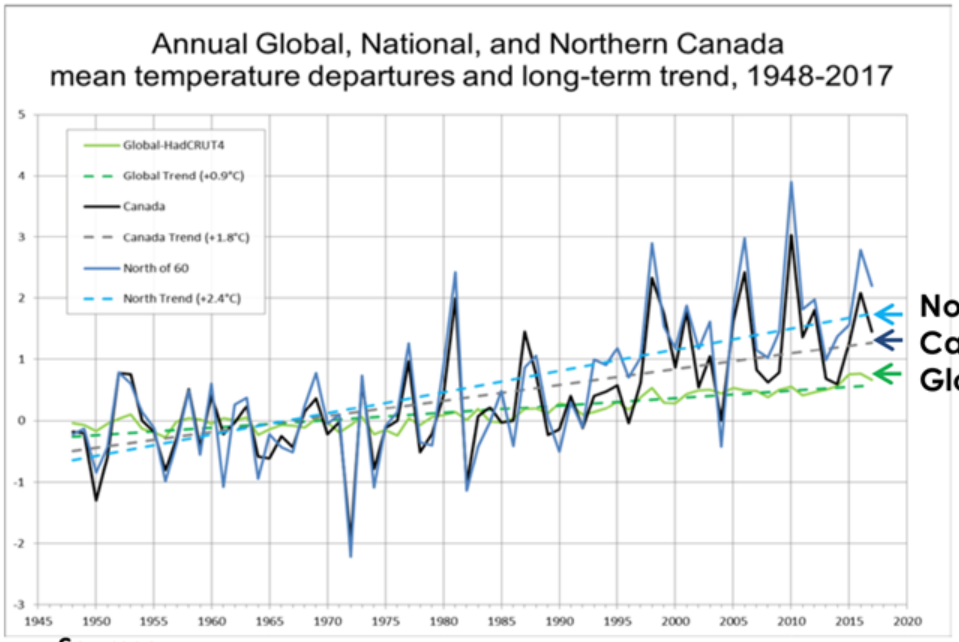


Warming Trends

The continental United States has warmed by 0.7C from 1986-2016 and by 1C since 1895, increases largest in Alaska and smallest in coastal SE (U.S. Global Change 2017).

Source: NOAA/NCEI





Canada warmed 1.7C from 1950 to 2016, twice the global average with northern Canada warming more quickly than the south (ECCC 2018).

Sources:

Environment and Climate Change Canada (ECCC). 2018. *Changes in temperature*. https://www.canada.ca/en/environment-climate-change/services/climate-change/canadian-centre-climate-services/basics/trends-projections/changes-temperature.html

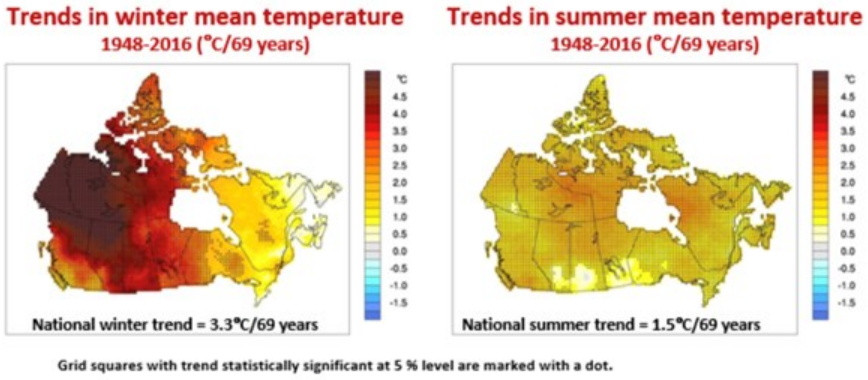
U.S. Global Change Research Program. 2017. Temperature Changes in the United States - Climate Science Special Report https://science2017.globalchange.gov/chapter/6/

Increased Heat Waves and Heat Events

Source: Globalchange.gov

- Canada's modernized Heat Warning project pulled by need of better alerting capabilities due to increased events.
- 3 significant Canadian events that had heat-related mortality in the past 10 years.
- Winter warming most significant in Canada, extreme cold events still evident.

- Increased Heat Wave frequency
- Longer duration heat events
- Increased early season events
- Larger temperature variations
- Missing Seasons (Spring/Fall)



Sources:

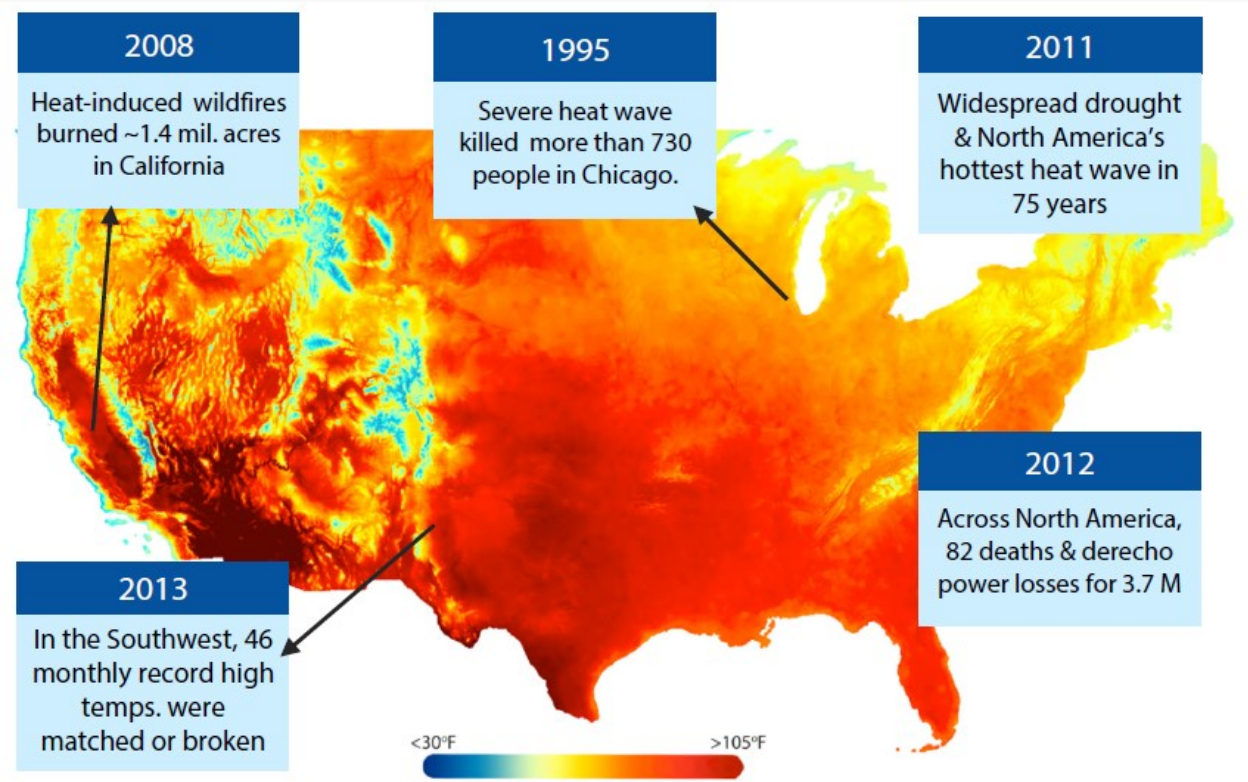
Heat Waves, U.S. Global Change Research Program. 2017. https://www.globalchange.gov/browse/indicators/us-heat-waves.

Extreme Heat is a Multidisciplinary Problem

Decisions must be made in many disciplines to protect humans from extreme heat's health consequences.

- Local health departments
- Utilities / Energy
- Emergency Management
- Resilience/Sustainability Offices
- Weather Forecast Offices
- Hospitals
- School districts

They all need information at different timescales, and have different risk tolerances and capacity to respond.

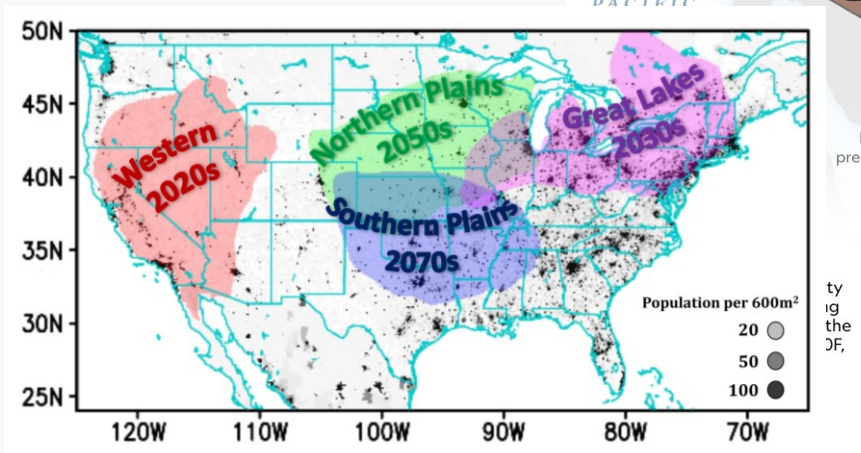


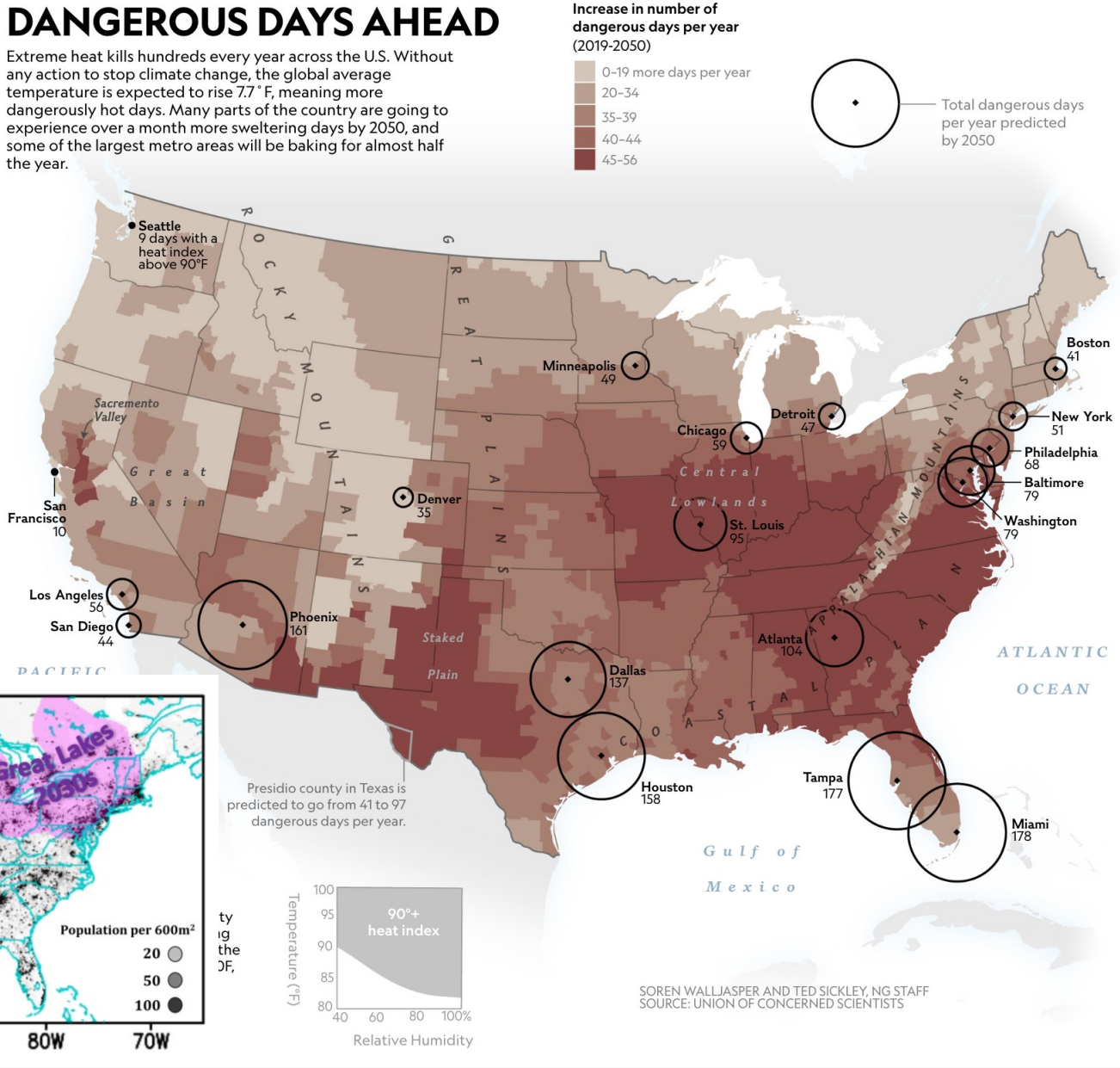
The base map shows projected average maximum temperatures for July 2030 in degrees Fahrenheit under a low emissions scenario (best case scenario). Call out boxes detail devastating effects of past heat waves across the country.

Future Heat

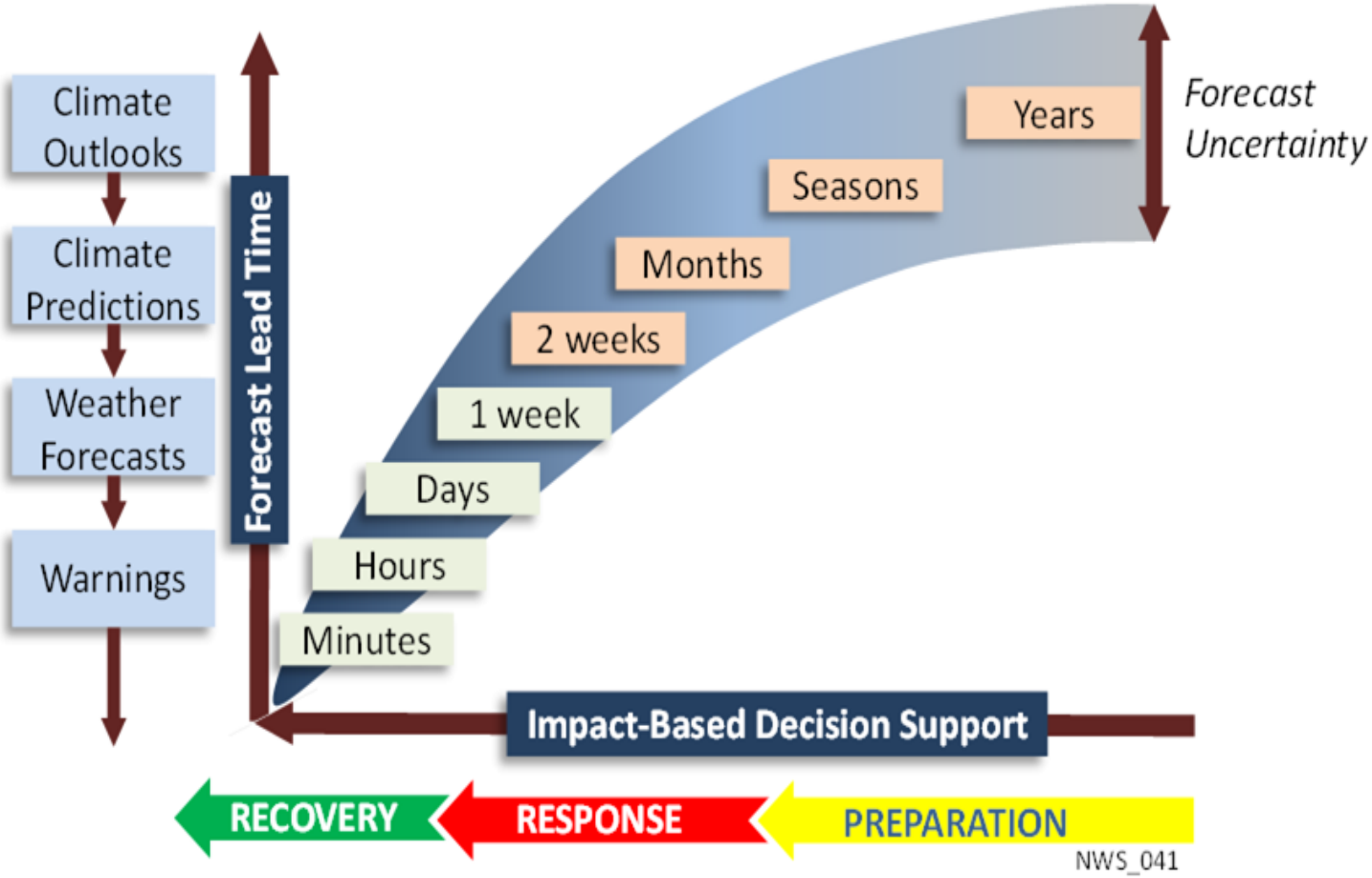
Image at right from National Geographic from Union of Concerned Scientists Report (2019): "Killer Heat in the United States"

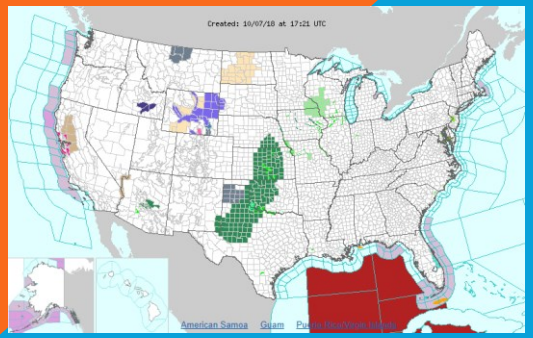
Below from Lopez et al., 2018, of AOML shows the four dominant historical heat wave clusters in the US. The labels indicate when in the 21st century anthropogenically forced heat waves will occur.

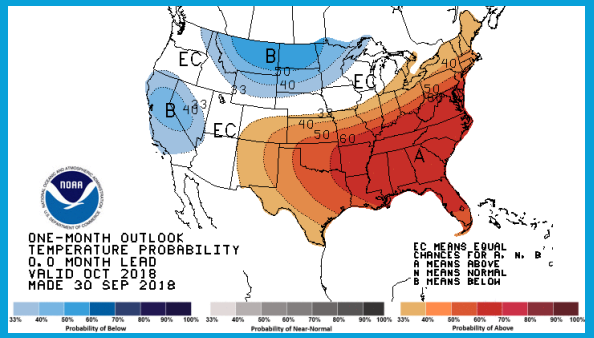


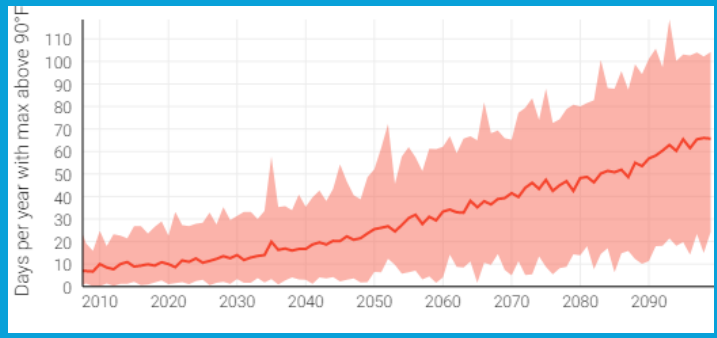


UNDERSTANDING DECISION TIMESCALES

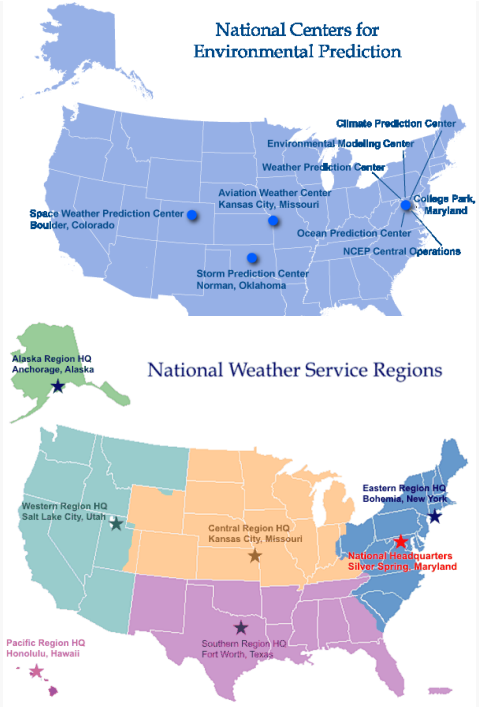








Near-term – How NOAA Handles Heat



NOAA HQ

HQ: Creates policies, provides standard products for use in WFOs

Regional Offices

6 Regional Offices: perform administrative and operational support for the WFOs

WFO

122 Weather Forecast Offices: Understands local context & needs, interprets HQ products, and issues advisories, watches, and warnings.

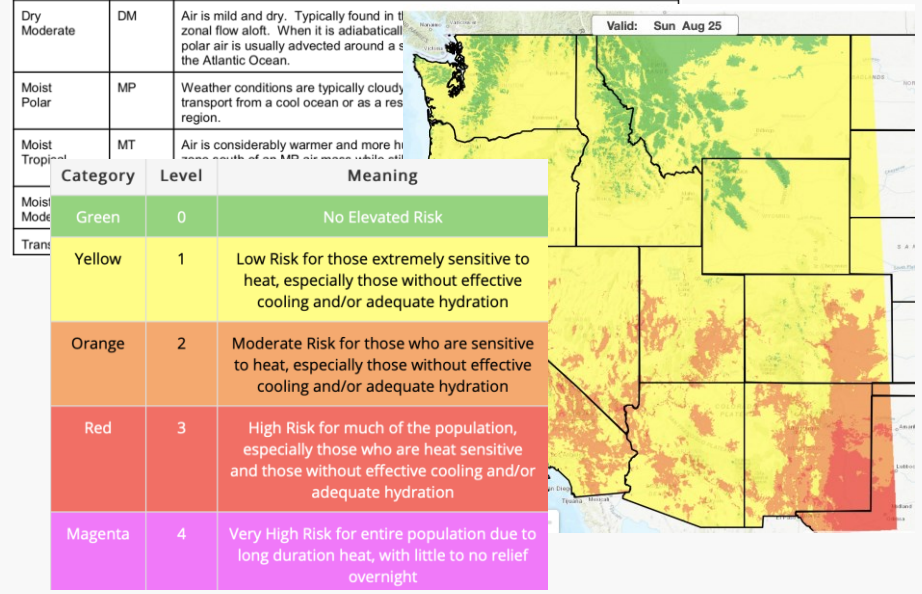
Current Heat Wave Products

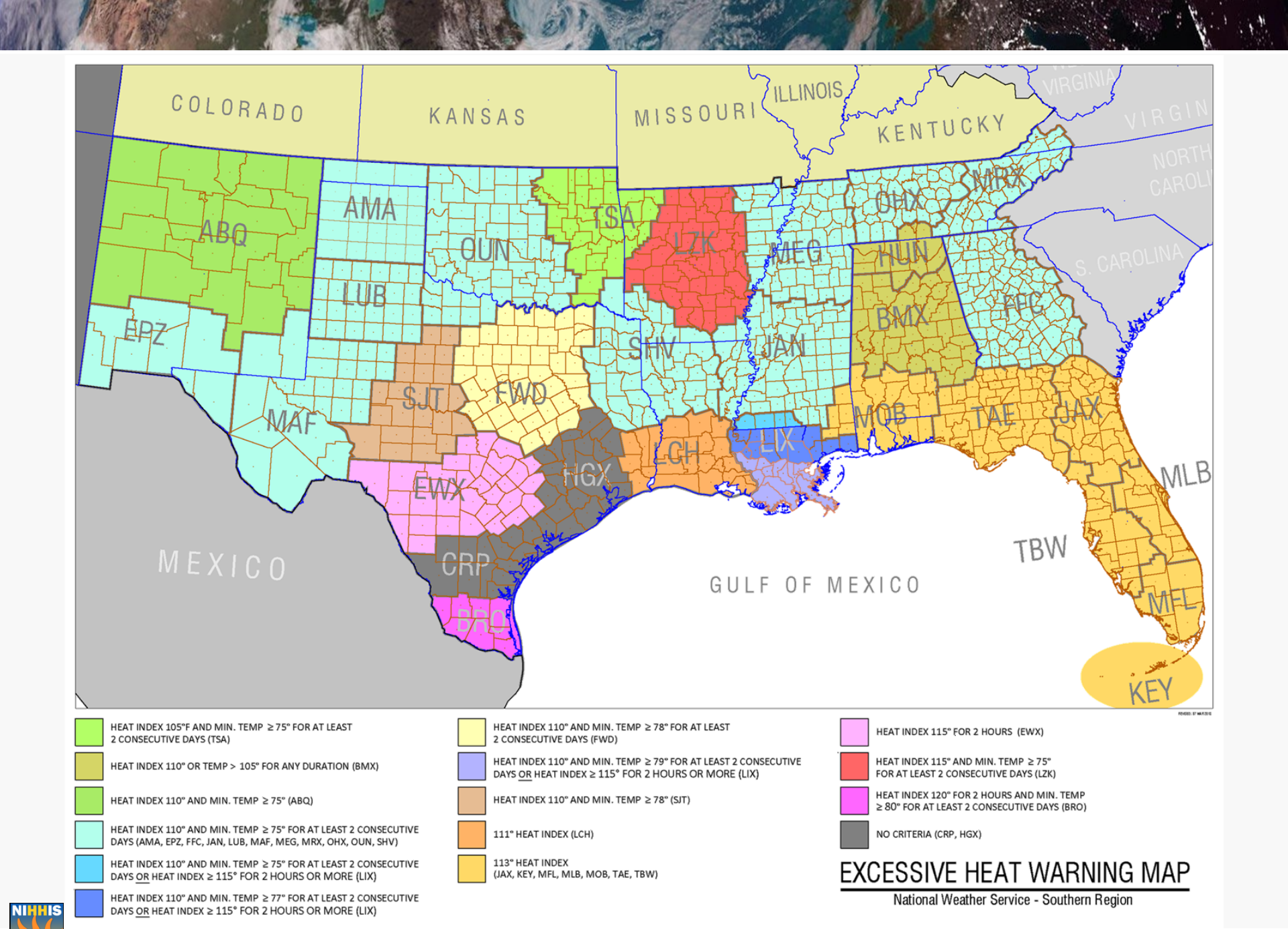
- NOAA issues Heat Advisories, Watches, and Warnings.
  - –Advisory: Take action, excessive heat is expected.
  - –Watch: Be prepared for a prolonged period of extreme heat within 48 hours.
  - –Warning: Take action, a prolonged period of extreme heat is expected in < 24 hours.

These communications are issued by WFOs and derived from:

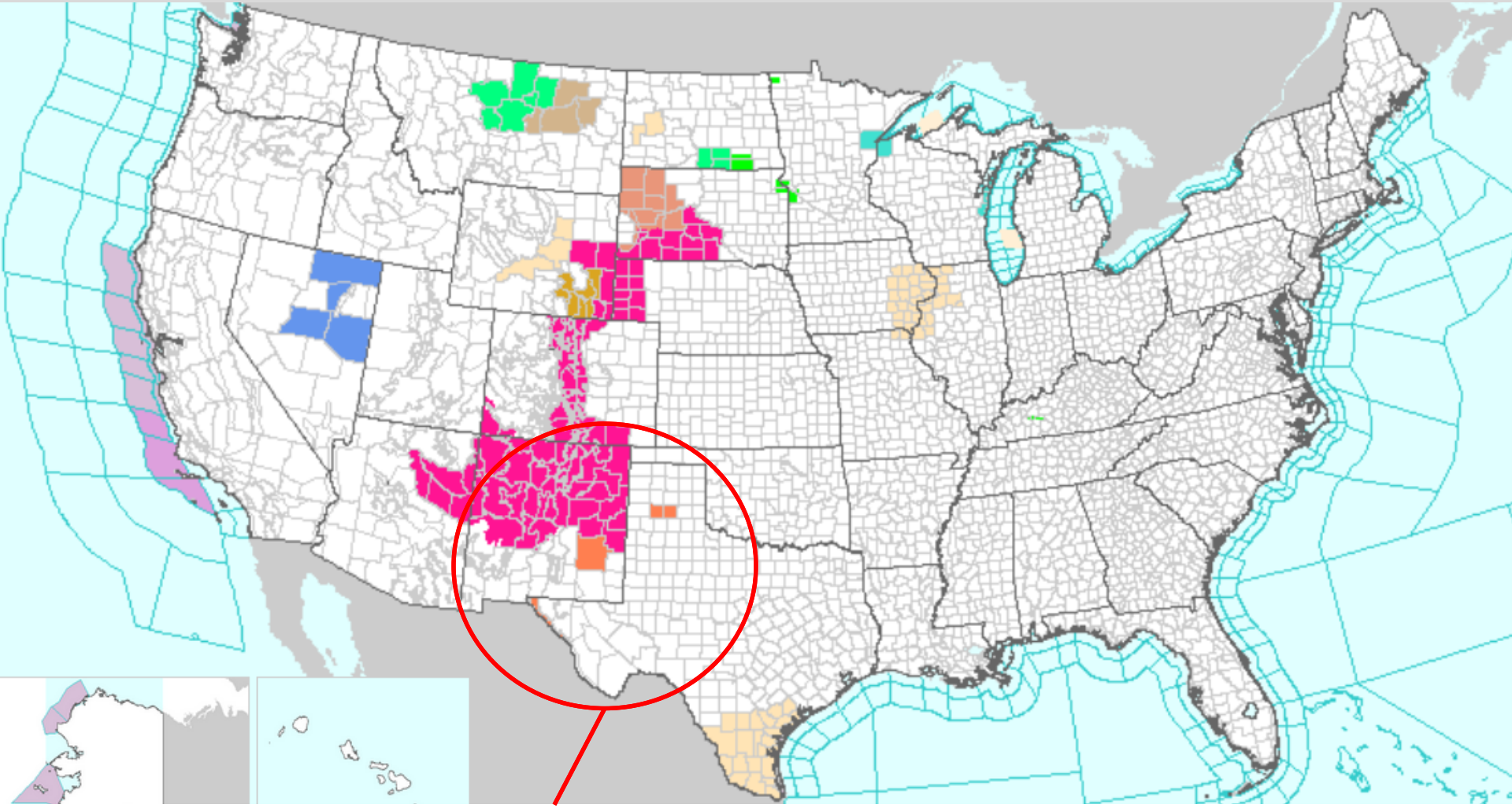
- Temperature & Wet Bulb Globe Temperature
- Kalkstein Procedures
  Classify air as “oppressive” based on temperature and humidity.
- HeatRisk
  Developed and used primarily in the western region, but has been codified as a requirement and will be available as a national option soon. Level 3 or 4 of the NWS Heat Risk scale is the threshold for issuing an Excessive Heat Warning.

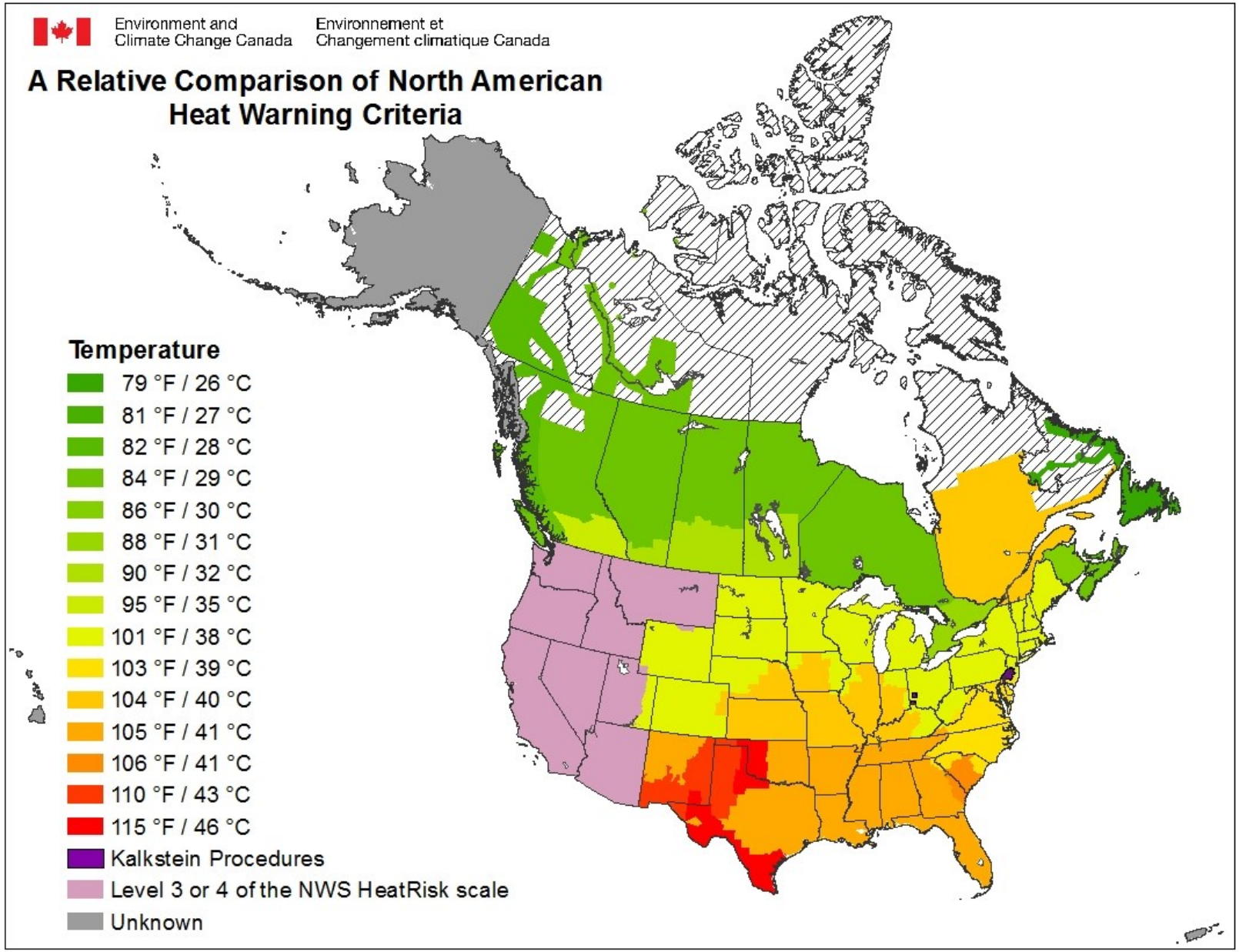
Type	Abbrev.	Description
Dry Polar	DP	Generally advected from Canada through circulation around a cold-core anticyclone and is usually associated with the lowest temperatures observed in a region for a particular time of year, as well as, clear and dry conditions.
Dry Tropical	DT	Represents the hottest and driest conditions found at any location. There are two modes of development for this air mass. It is either advected from the Southwest U.S. or Sonoran Desert of Mexico or it is produced by rapidly descending air.
Dry Moderate	DM	Air is mild and dry. Typically found in t zonal flow aloft. When it is adiabaticall polar air is usually advected around a s the Atlantic Ocean.
Moist Polar	MP	Weather conditions are typically cloudy transport from a cool ocean or as a res region.
Moist Tropical	MT	Air is considerably warmer and more h
Moist Mode		
Trans		

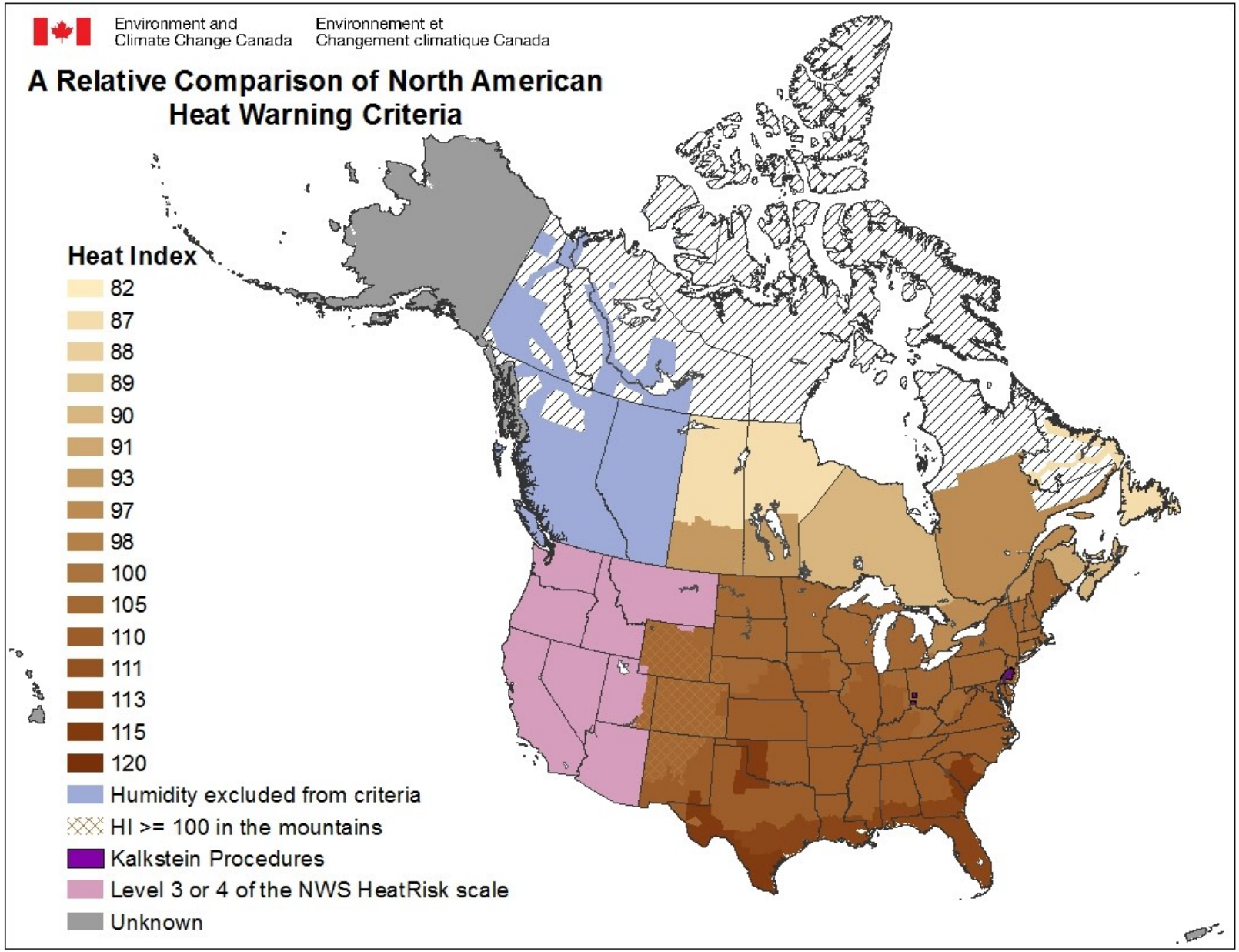



COLORADO
KANSAS
MISSOURI
ILLINOIS
KENTUCKY
VIRGINIA
NORTH CAROLINA
S. CAROLINA
ABQ
AMA
LUB
EPZ
OUN
TSA
LZK
MEG
OHX
MRX
HUN
BMX
FFC
SHV
JAN
SJT
FWD
MAF
MOB
TAE
JAX
LIX
LCH
HGX
EWX
MLB
TBW
MFL
CRP
BRO
KEY
MEXICO
GULF OF MEXICO
HEAT INDEX 105°F AND MIN. TEMP ≥ 75° FOR AT LEAST 2 CONSECUTIVE DAYS (TSA)
HEAT INDEX 110° OR TEMP > 105° FOR ANY DURATION (BMX)
HEAT INDEX 110° AND MIN. TEMP ≥ 75° (ABQ)
HEAT INDEX 110° AND MIN. TEMP ≥ 75° FOR AT LEAST 2 CONSECUTIVE DAYS (AMA, EPZ, FFC, JAN, LUB, MAF, MEG, MRX, OHX, OUN, SHV)
HEAT INDEX 110° AND MIN. TEMP ≥ 75° FOR AT LEAST 2 CONSECUTIVE DAYS OR HEAT INDEX ≥ 115° FOR 2 HOURS OR MORE (LIX)
HEAT INDEX 110° AND MIN. TEMP ≥ 77° FOR AT LEAST 2 CONSECUTIVE DAYS OR HEAT INDEX ≥ 115° FOR 2 HOURS OR MORE (LIX)
HEAT INDEX 110° AND MIN. TEMP ≥ 78° FOR AT LEAST 2 CONSECUTIVE DAYS (FWD)
HEAT INDEX 110° AND MIN. TEMP ≥ 79° FOR AT LEAST 2 CONSECUTIVE DAYS OR HEAT INDEX ≥ 115° FOR 2 HOURS OR MORE (LIX)
HEAT INDEX 110° AND MIN. TEMP ≥ 78° (SJT)
111° HEAT INDEX (LCH)
113° HEAT INDEX (JAX, KEY, MFL, MLB, MOB, TAE, TBW)
HEAT INDEX 115° FOR 2 HOURS (EWX)
HEAT INDEX 115° AND MIN. TEMP ≥ 75° FOR AT LEAST 2 CONSECUTIVE DAYS (LZK)
HEAT INDEX 120° FOR 2 HOURS AND MIN. TEMP ≥ 80° FOR AT LEAST 2 CONSECUTIVE DAYS (BRO)
NO CRITERIA (CRP, HGX)
EXCESSIVE HEAT WARNING MAP
National Weather Service - Southern Region

Seeking a **consistent approach** to extreme heat

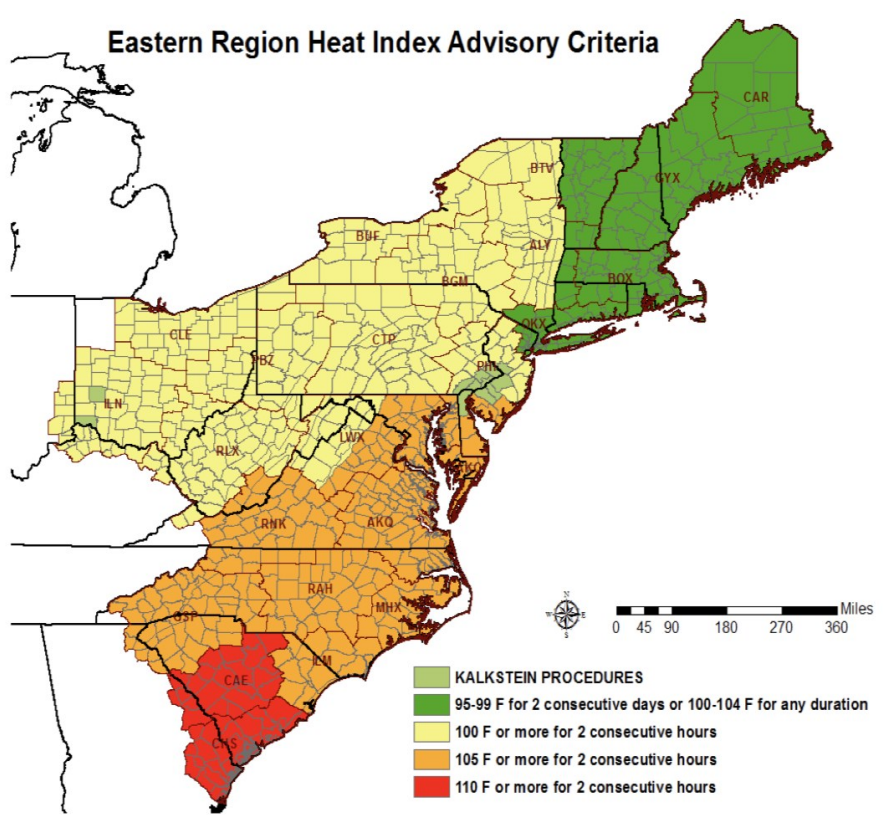


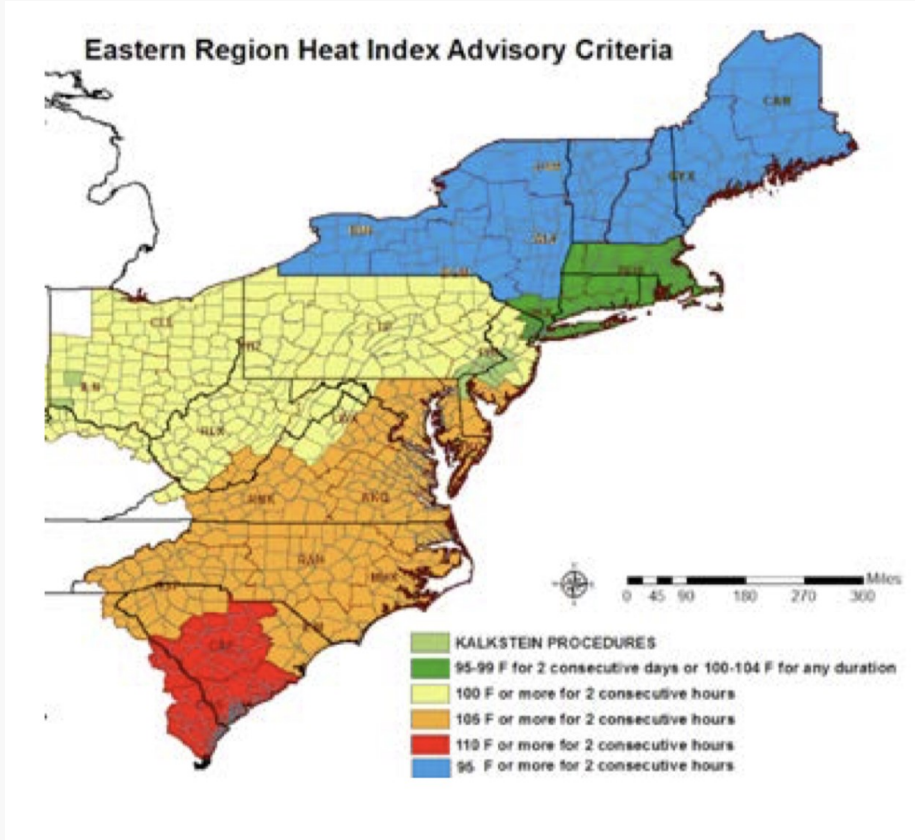

Environment and Climate Change Canada
Environnement et Changement climatique Canada
A Relative Comparison of North American Heat Warning Criteria
Temperature
79 °F / 26 °C
81 °F / 27 °C
82 °F / 28 °C
84 °F / 29 °C
86 °F / 30 °C
88 °F / 31 °C
90 °F / 32 °C
95 °F / 35 °C
101 °F / 38 °C
103 °F / 39 °C
104 °F / 40 °C
105 °F / 41 °C
106 °F / 41 °C
110 °F / 43 °C
115 °F / 46 °C
Kalkstein Procedures
Level 3 or 4 of the NWS HeatRisk scale
Unknown

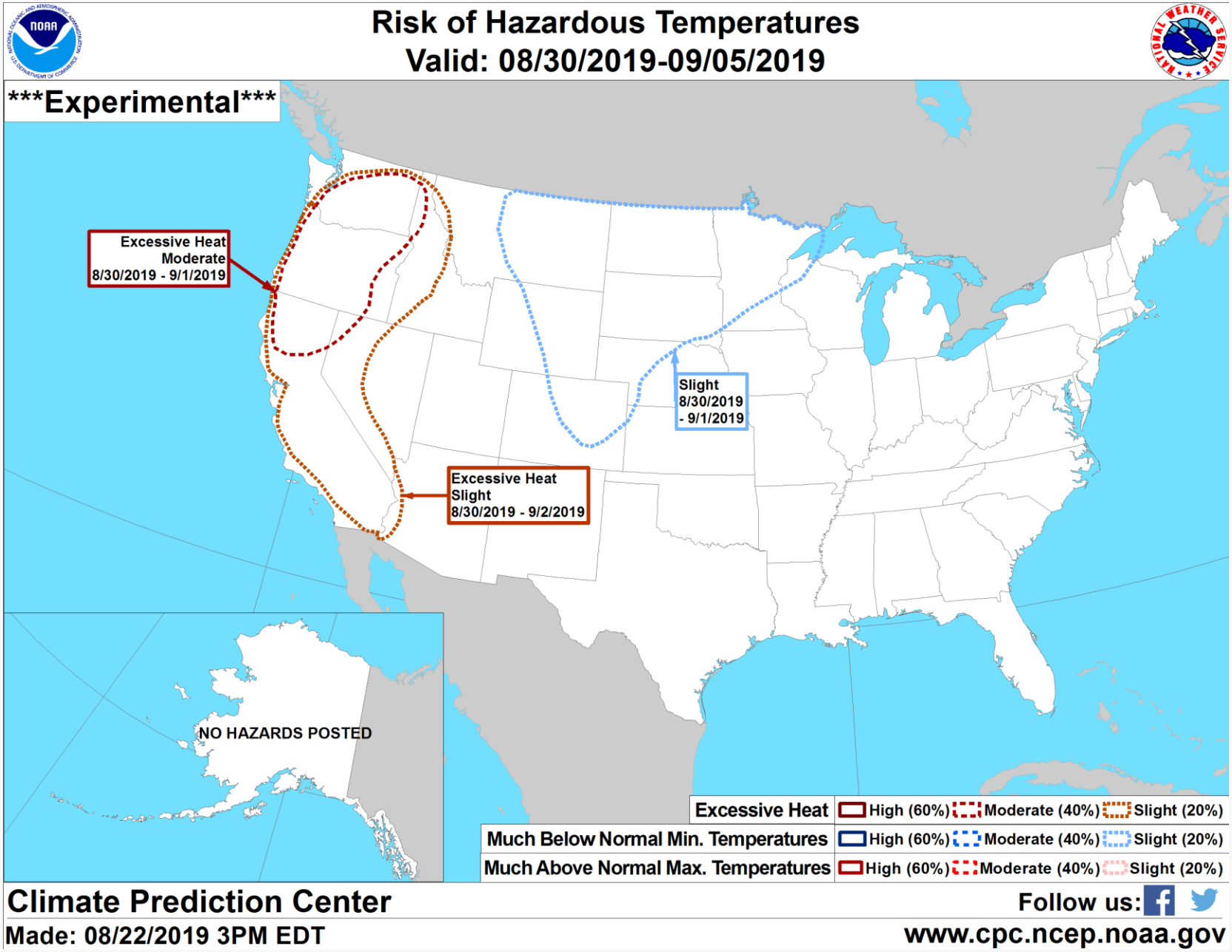

Environment and Climate Change Canada
Environnement et Changement climatique Canada
A Relative Comparison of North American Heat Warning Criteria
Heat Index
82
87
88
89
90
91
93
97
98
100
105
110
111
113
115
120
Humidity excluded from criteria
HI >= 100 in the mountains
Kalkstein Procedures
Level 3 or 4 of the NWS HeatRisk scale
Unknown

Recently, NWS WFOs in New England worked with state Health Departments to lower heat advisory thresholds based on mortality and ED visits.

- Formerly, the criteria were 95-99 F for 2 days.
- Now the criteria are 95 F for more than 2 consecutive hours.

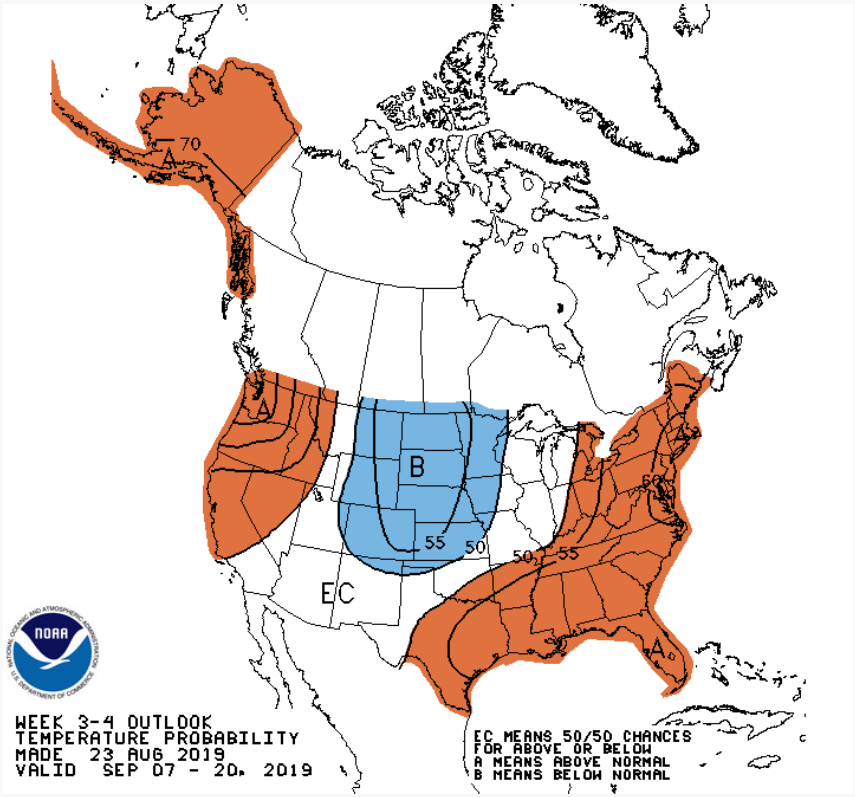




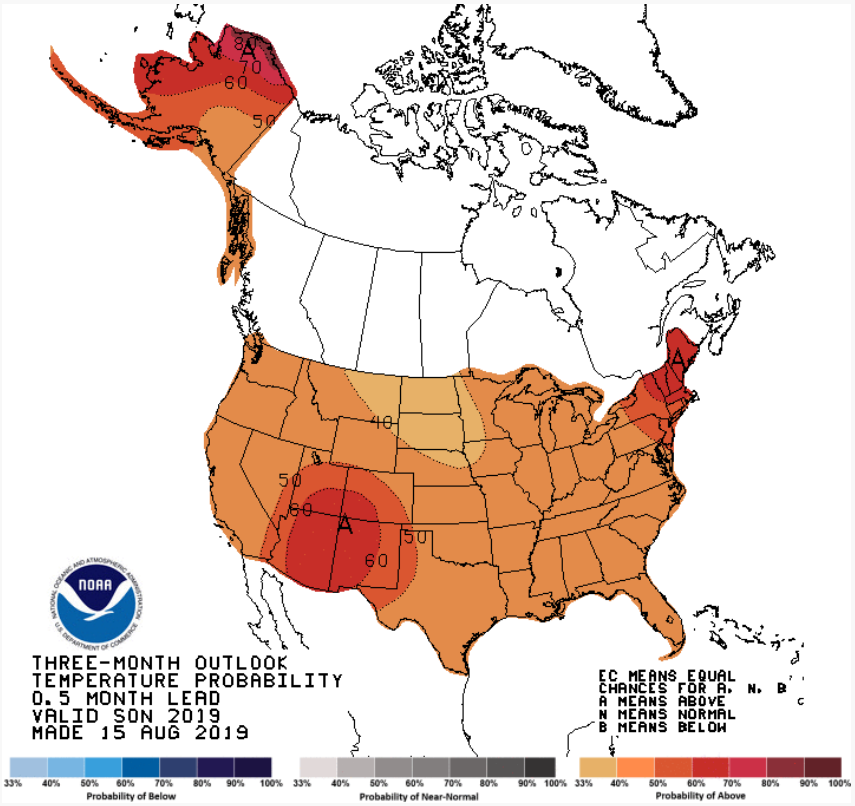

Risk of Hazardous Temperatures
Valid: 08/30/2019-09/05/2019
Experimental
Excessive Heat
Moderate
8/30/2019 - 9/1/2019
Slight
8/30/2019
- 9/1/2019
Excessive Heat
Slight
8/30/2019 - 9/2/2019
NO HAZARDS POSTED
Excessive Heat
High (60%)
Moderate (40%)
Slight (20%)
Much Below Normal Min. Temperatures
High (60%)
Moderate (40%)
Slight (20%)
Much Above Normal Max. Temperatures
High (60%)
Moderate (40%)
Slight (20%)
Climate Prediction Center
Made: 08/22/2019 3PM EDT
Follow us:
www.cpc.ncep.noaa.gov

NOAA Heat Predictions at Seasonal and Sub-seasonal Scales

NOAA 3-4 Week Outlook



NOAA 3-Month Seasonal Outlook



National Integrated Heat Health Information System

- NOAA and CDC launched the National Integrated Heat Health Information System (NIHHIS) in June of 2015 to address heat across timescales
- NIHHIS quickly grew to include representation from several agencies (right) in an interagency working group. The group launched the NIHHIS portal and began harmonizing information and guidance.
- NIHHIS has also launched regional, trans-boundary pilots to understand local decision-making contexts and needs, and to improve the information.

Ongoing activities include:

- Expanding border health network in the south,
- ★ 'Decision calendar' exercises to understand multi-disciplinary needs in the Northeast,
- ★ National projects to improve the utility of information such as Urban Heat Island campaigns.

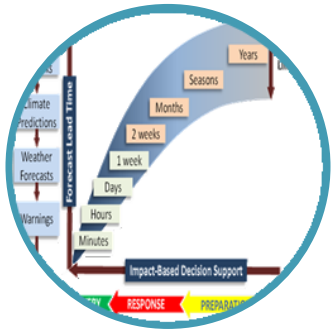
The National Integrated Heat Health Information System weaves together existing pieces, identifies information needs and helps to develop needed climate services.

NIHHIS will facilitate an integrated approach to providing a suite of decision support services to reduce heat related illness and death

NIHHIS: an Integrated Information System

Define demand by building relationships to understand local context

Co-develop inter-disciplinary decision calendars, prototypes, requiremnts



Integrate information across timescales and disciplines

Foster inter-agency, NGO, and private sector involvement

Co-learning, sharing best practices, and sharing information

Build Capacity, Inform Decisions, Encourage Risk-Reducing Actions

NIHHIS Core Questions

All NIHHIS engagements are used to understand the answers to these core questions – as well as how and why those answers change given local context.

Institutional Capacity & Partnerships	Heat Parameters & Health Outcomes	Data and Forecast Products	Engagement and Communication Strategies	Interventions and Effectiveness
• What institutional partners have you engaged to help define the needs (esp. bridging disciplines: health, env. science, emergency management); is that sustainable and if so, how and why?	• What heat parameters (tmax, tmin, heat index, etc) are most important for which specific population and in what geographic conditions?	• What data and forecast products, indicators, surveillance, and monitoring is needed (at what spatial and temporal resolution & lead time) and what is currently being used by practitioners to make decisions?	• What communication strategies are most effective both during an event and for long lead time planning (seasonal outlooks)?	• What health interventions are currently being employed in managing heat risk and at what timescales? • Are these interventions successful, and to what extent to they depend on local context & capacity?

NIHHIS Interagency Working Group

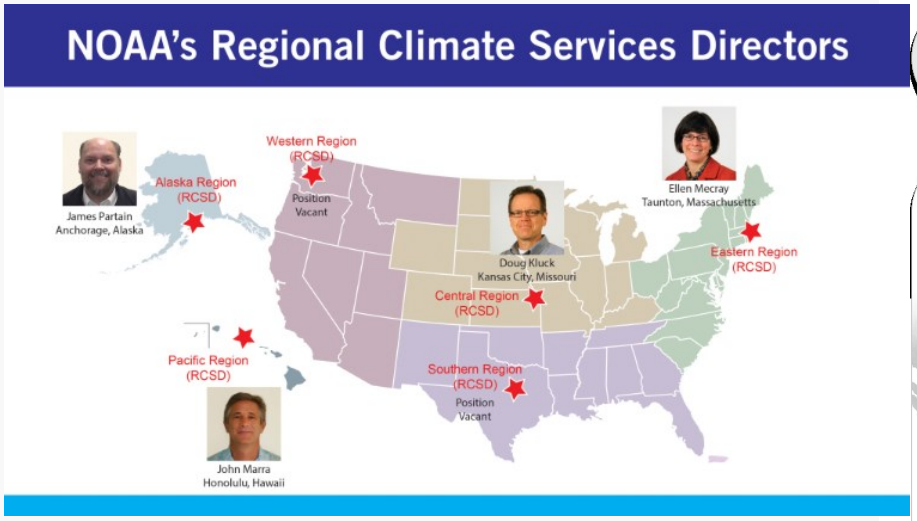
The NIHHIS Interagency Working Group was initially formed as an Extreme Heat and Critical Infrastructure Task Force under the National Security Council. The group includes representation from:

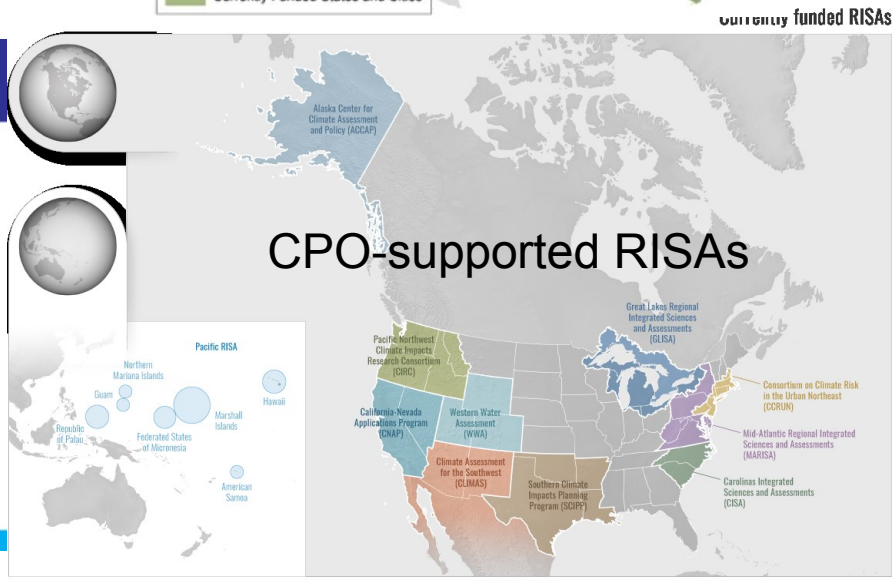
ASPR – Assistant Secretary for Preparedness and Response
CDC – Centers for Disease Control and Prevention
EPA – United States Environmental Protection Agency
FEMA – U.S. Department of Homeland Security
NIOSH – National Institute for Occupational Safety and Health
NOAA – National Oceanic and Atmospheric Administration
OSHA
SAMHSA

Recent accomplishments and ongoing projects:

- A major social media campaign to expand awareness of the issue in 2017 heat season.
- Activity modification thresholds and WBGT – workshops and review paper.
- Development of version 2 of the NIHHIS Portal with harmonized inter-agency information and resources as well as heat predictions.
- A White House webinar on protecting vulnerable populations from Extreme Heat (2016).

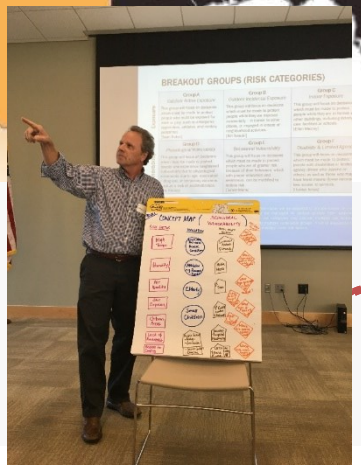
Building user engagement via other networks





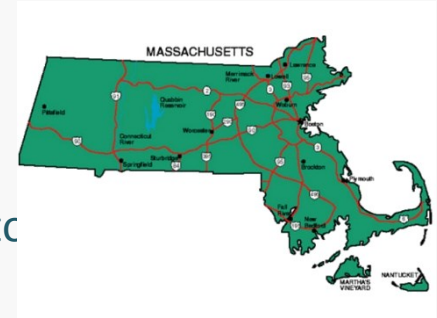
Defining Local Context and Understanding Sector-based Decisions

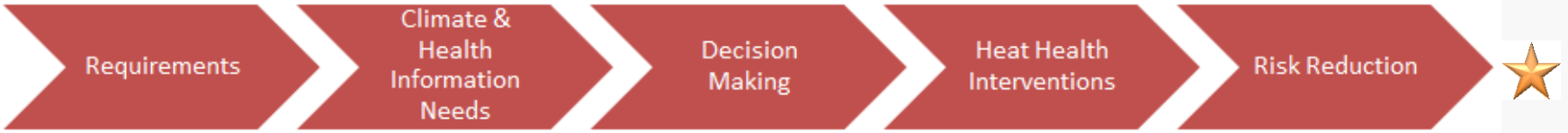
- Engagement with other agencies
  - –Activity Modification Guidelines
- Engagement through Pilots & Decision Calendars
  - –Interviews with experts in many disciplines
  - –Documentation and refinement
  - –Compare across pilots
- Attend Trade Meetings
  - –American Institute of Architects NYC
  - –National Association of County and City Health Officials
  - –Army Public Health Center
  - –Harris County Public Health One Health Conference
- Invite other disciplines to climate meetings
  - –AMS 2020 in Boston
  - –AGU GeoHealth



NIHHIS NE Decision Calendar Workshop

- Build and strengthen the **network** between a multidisciplinary set of heat-health decision-makers.
- Identify and document locally-contextualized **interventions** at the planning and preparedness timescales.
- Discipline-specific decision makers will use **planning scenarios** to explore decision contexts behind the identified interventions, and specific **information needs** will be documented to support decisions in the form of **decision calendars**.

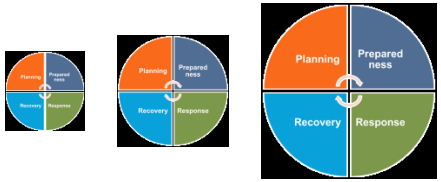




Decision Calendars support **Decision Making** about **Heat Health Interventions** by documenting essential **Climate and Health Information Needs** in a temporally and spatially explicit way that facilitates the elicitation and elaboration of **Requirements**

HEAT HEALTH RISK MANAGEMENT ANNUAL CYCLE

Analysis of historical impacts & climate observations



Previous Years

What can we learn from past experiences to improve heat health planning and preparedness?

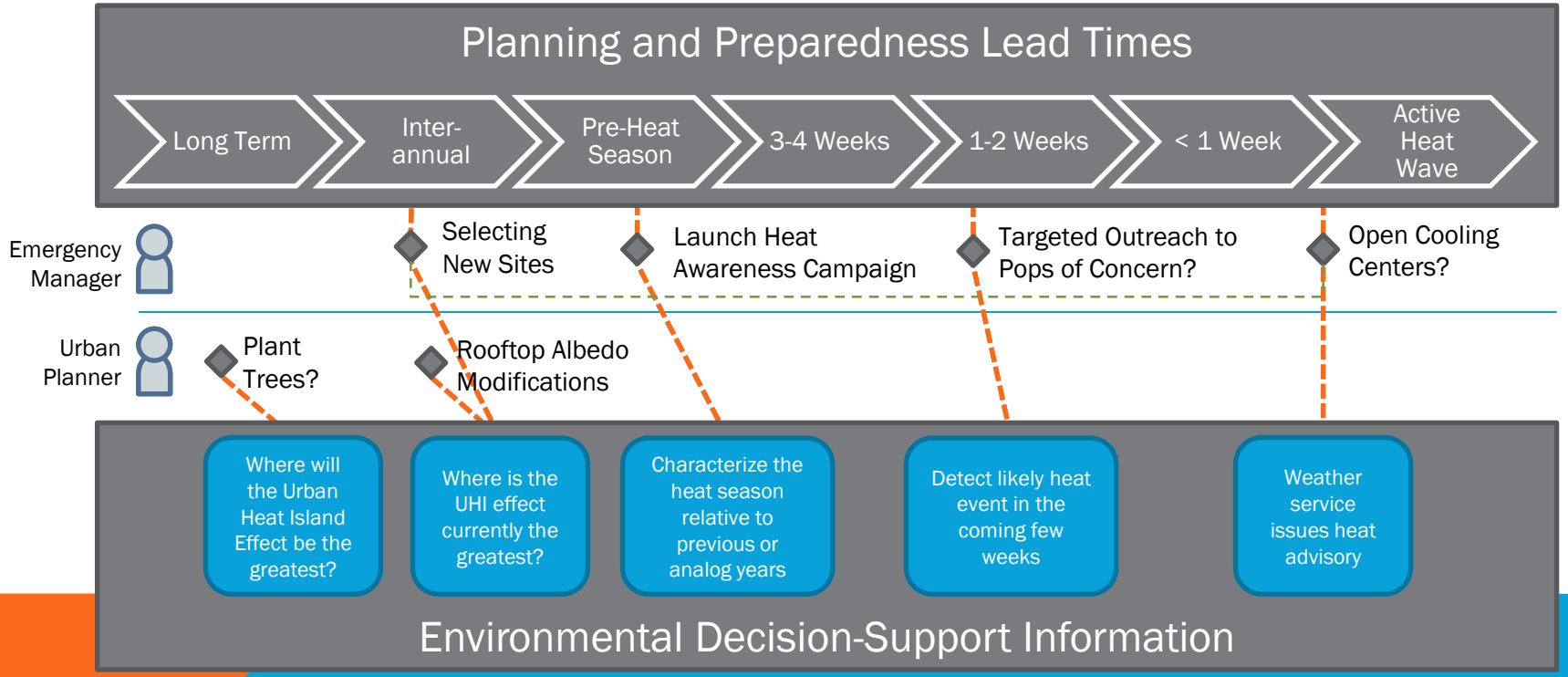
Scenario-based planning & climate predictions

Future Years

How might our current approach fail under future climate stressors, and how can we prevent such failure?

DECISION CALENDARS

Decision calendars are a framework to organize information about user context in decision-making. They document what needs to be known when, by whom, and with what certainty in order to take actions to reduce heat health risk.



For more information see:

Ray, A. J., & Webb, R. S. (2016). Understanding the user context: decision calendars as frameworks for linking climate to policy, planning, and decision-making. Climate in Context, 27–50. doi:10.1002/9781118474785.ch2

NIHHIS Rio Grande/Bravo Pilot Engagement for Launch Workshop

The University of Arizona
NM State University
Texas Tech University
UTEP
University of California San Diego
Texas Department of Family and Protective Services
Paso del Norte Health Foundation
Universidad Autónoma de Ciudad Juárez
The City of El Paso Texas
United States-Mexico Border Health Commission
Office of Emergency Management El Paso County 1861
United States Environmental Protection Agency
CLIMAS Climate Assessment for the Southwest A NOAA RISA TEAM
City of El Paso Office of Resilience + Sustainability
New Mexico Department of Health
Protección Civil Chihuahua
el paso Water
The University of Oklahoma School of Meteorology
NOAA
Sustainability program
TCEQ
Cofepris Comisión Federal para la Protección contra Riesgos Sanitarios
The Electric Company El Paso Electric
LSU Louisiana State University
El Colegio de la Frontera Norte
Environment and Climate Change Canada
NIHHIS

Rio Grande/Bravo NIHHIS Pilot Local Approaches

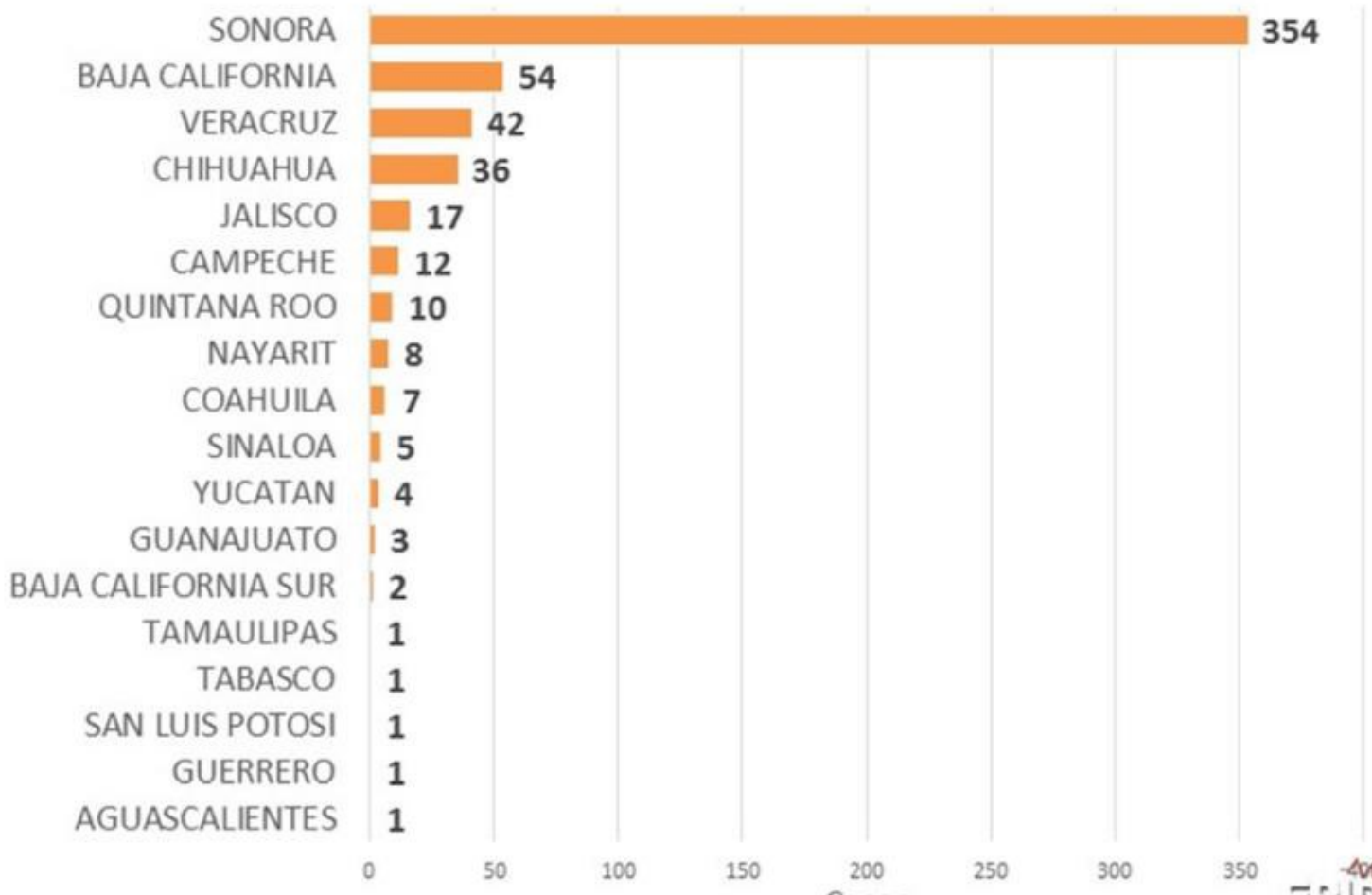
Promotoras: Incorporating Local Knowledge

- Members of the community who already have trust and are able to speak English and Spanish.
- They often receive some specialized training, but do not have advanced degrees in health.
- They not only educate, but also investigate, and can return with valuable information on vulnerability that is hard to capture in surveys.

Extreme Weather Task Force

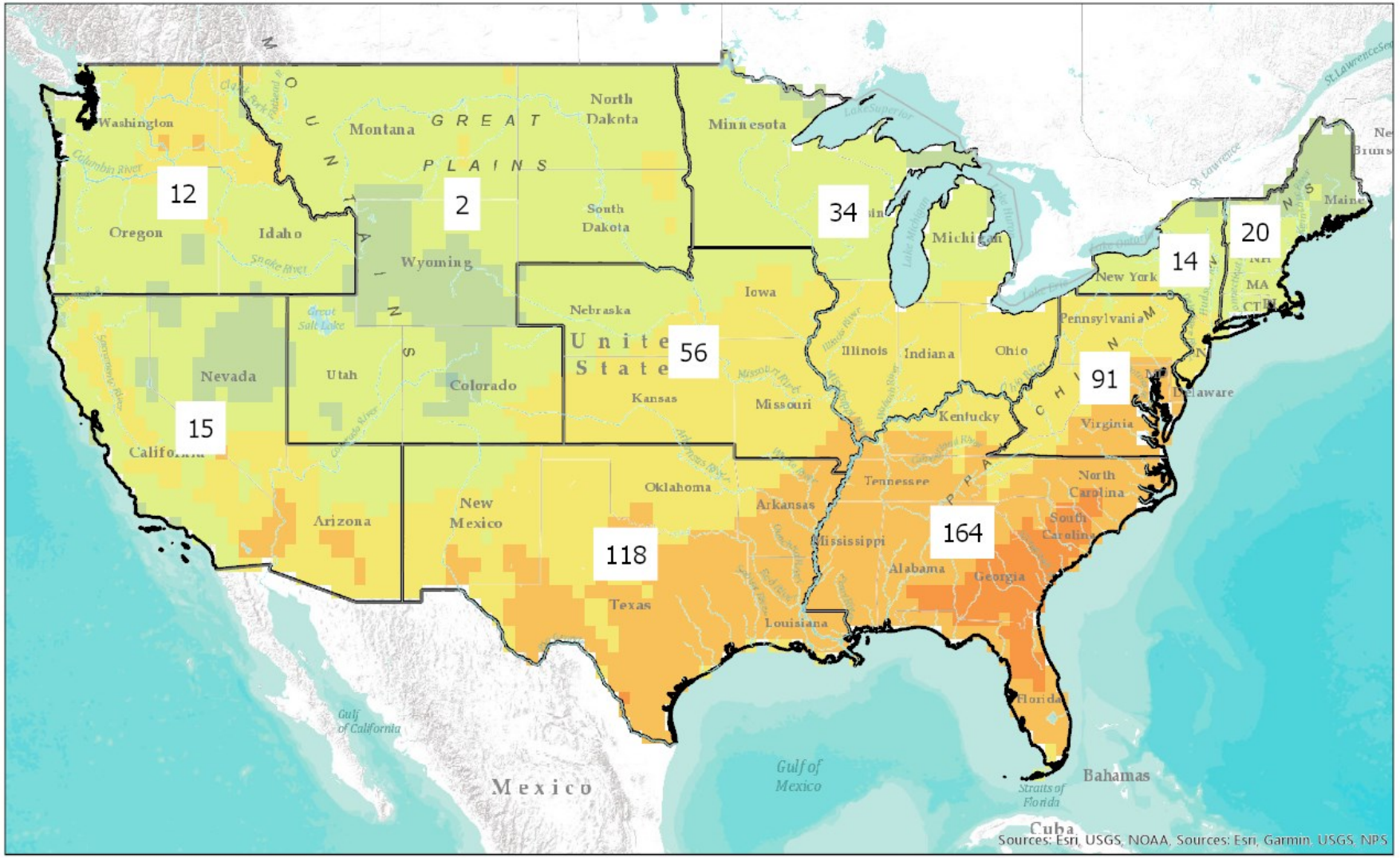
- Multi-organization and agency task force that provides assistance upon request to those most in need.

Casos de lesiones por temperaturas naturales extremas en temporada de calor, por entidad federativa. México 2015.



Fuente: SSA/DGE/DVEENT/Sistema de Vigilancia Epidemiológica de Daños a la Salud por Temperaturas

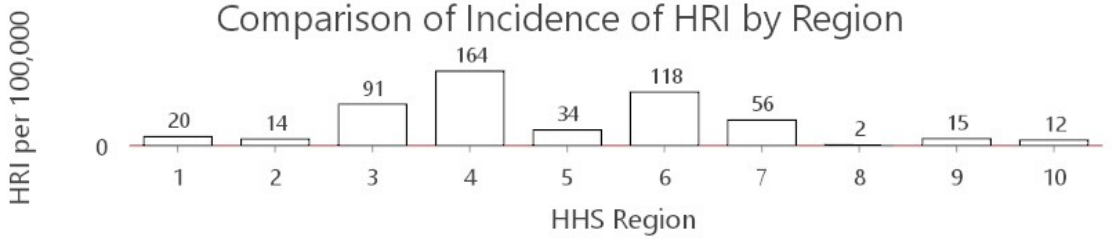
Early Summer 2019 NIHHIS Monitor Showing The Southeastern Heat Wave's Impacts

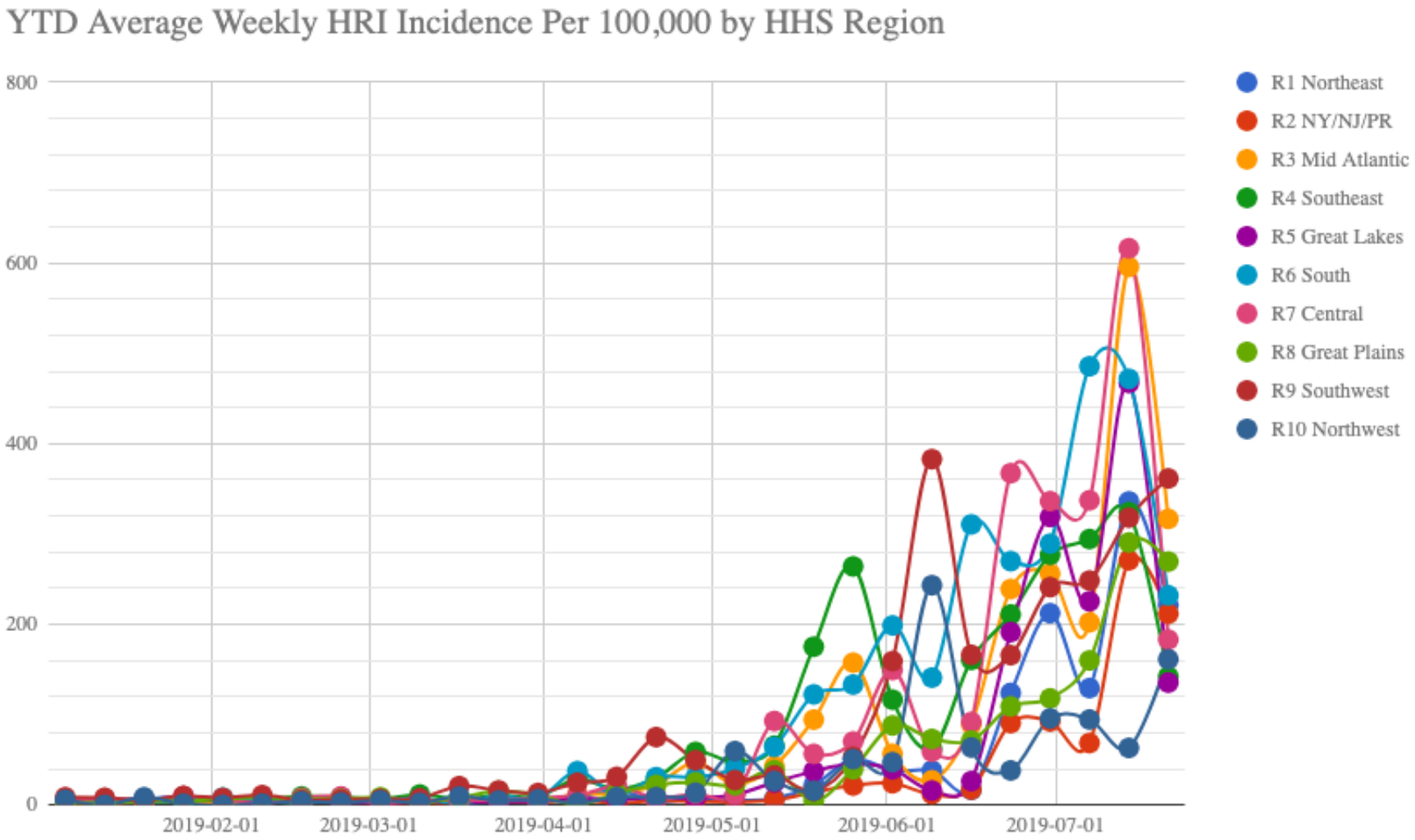


Week Starting
2019-05-26

Weekly Avg Max Temp in F

- ≤ 35
- ≤ 45
- ≤ 55
- ≤ 65
- ≤ 75
- ≤ 85
- ≤ 95
- ≤ 105
- ≤ 115
- ≤ 125





Data from CDC Essence Syndromic Surveillance

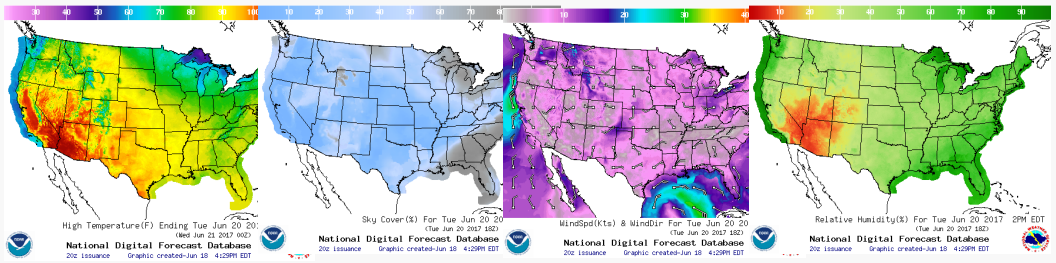
Heat's Impact on Outdoor Workers

Activity Modification Guidelines, often based on wet-bulb globe temperature (WBGT) are used for occupational, athletic, and the military heat exposure to advise on work/rest ratios and hydration.

Work/Rest and Water Consumption

Easy Work	Moderate Work	Hard Work
• Weapon Maintenance • Walking Hard Surface at 2.5 mph, < 30 lb Load • Marksmanship Training • Drill and Ceremony • Manual of Arms	• Walking Loose Sand at 2.5 mph, No Load • Walking Hard Surface at 3.5 mph, < 40 lb Load • Calisthenics • Patrolling • Individual Movement Techniques, i.e., Low Crawl or High Crawl • Defensive Position Construction	• Walking Hard Surface at 3.5 mph, ≥ 40 lb Load • Walking Loose Sand at 2.5 mph with Load • Field Assaults

Heat Category	WBGT Index, F°	Easy Work		Moderate Work		Hard Work	
		Work/Rest (min)	*Water Intake (qt/hr)*	*Work/Rest (min)*	*Water Intake (qt/hr)*	*Work/Rest (min)*	*Water Intake (qt/hr)*
1	[illegible]	NL	½	NL	½	[illegible]	½
2 (GREEN)	82° - 84.9°	NL	½	50/10 min	¾	30/30 min	1
3 (YELLOW)	85° - 87.9°	NL	¾	40/20 min	¾	30/30 min	1
4 (RED)	88° - 89.9°	NL	¾	30/30 min	¾	20/40 min	1
5 (BLACK)	> 90°	50/10 min	1	20/40 min	1	10/50 [illegible]	1



WBGT can be approximated from temp., insolation, humidity, and wind.

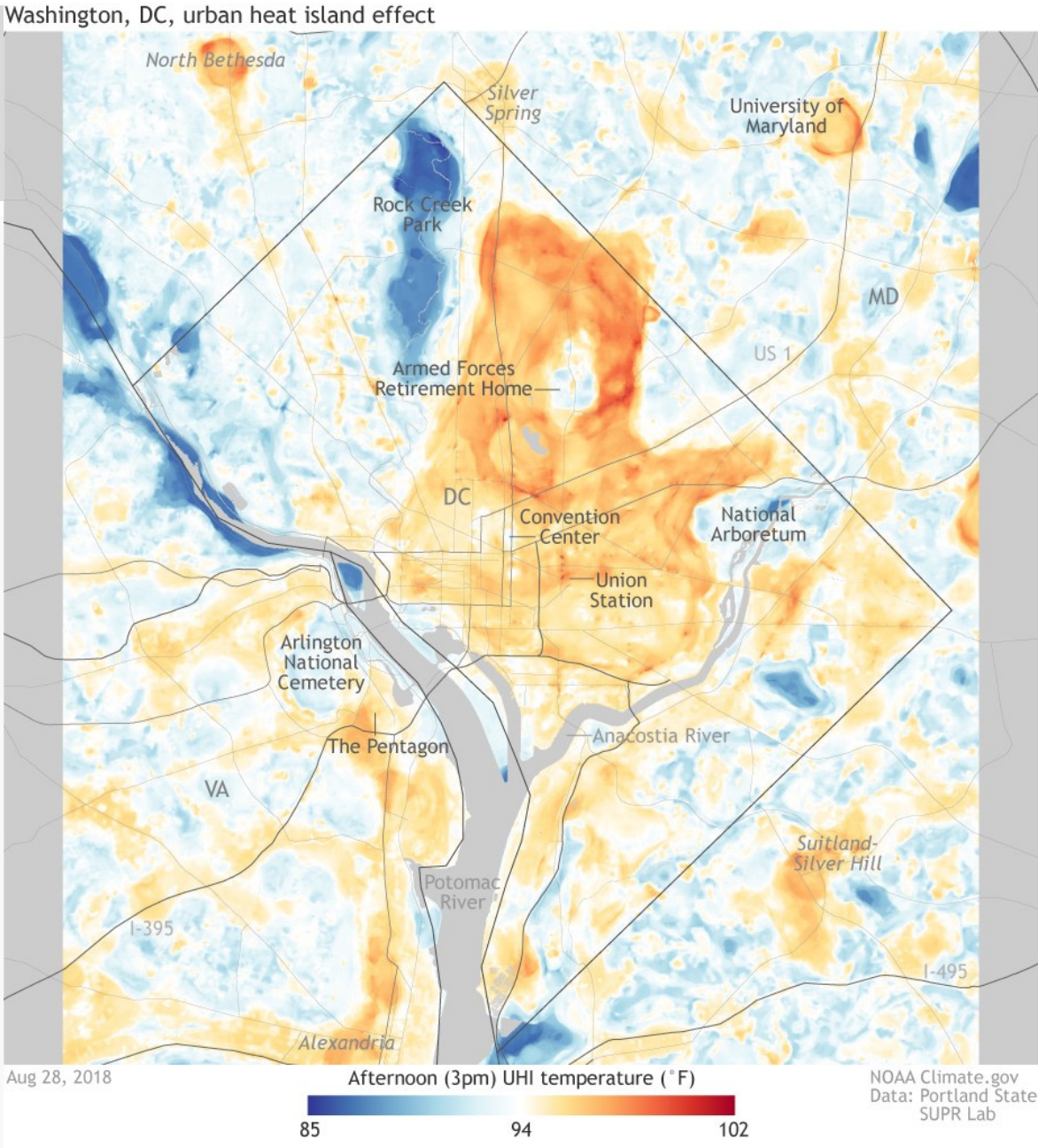
UHI Map of DC

Produced in summer 2018. Also created maps of Baltimore. Richmond was mapped by the same PIs previously.

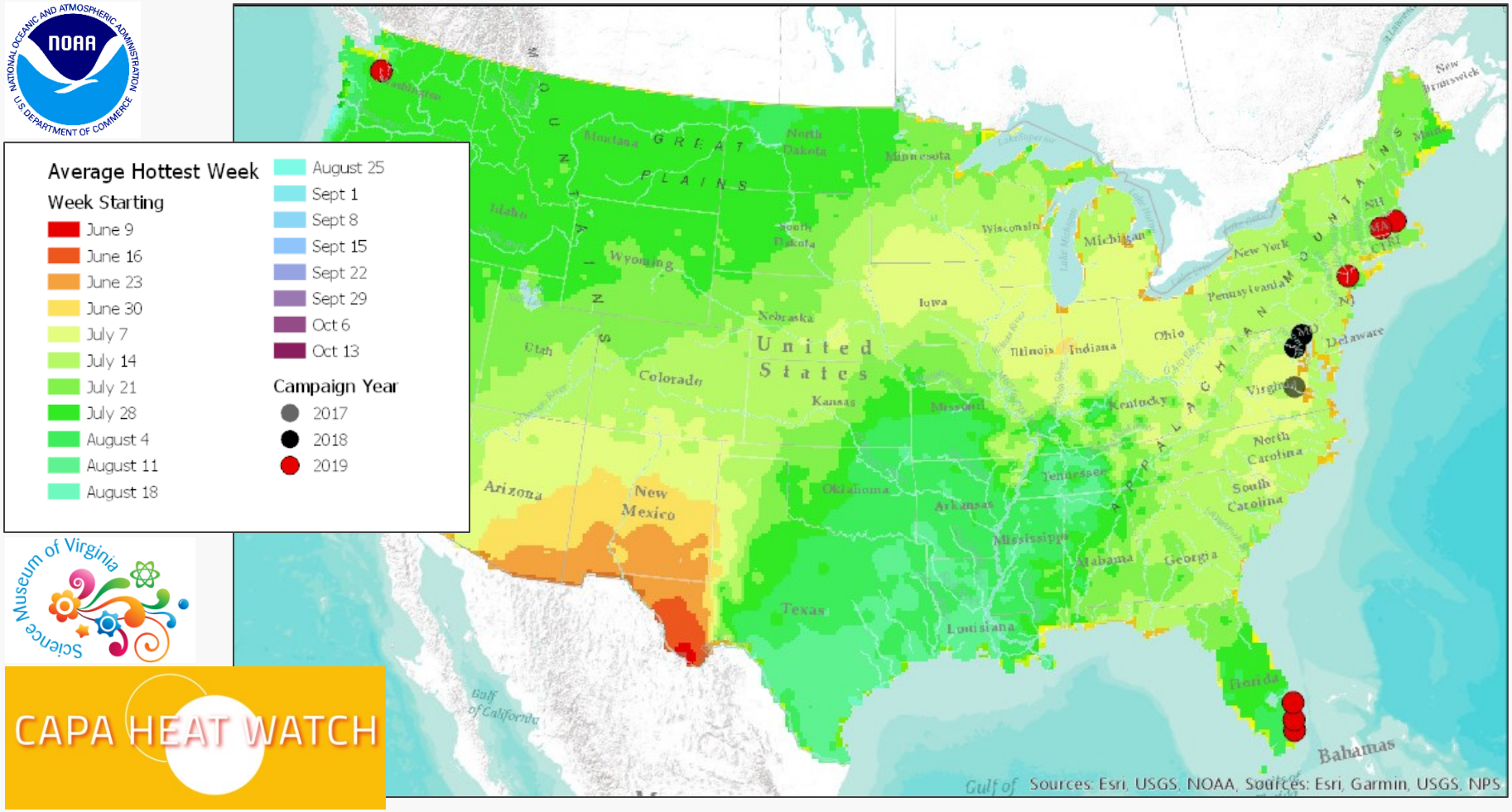
Temperature readings collected in-situ via vehicle transects using mounted thermometers every second.

Satellite imagery and other data fed into machine learning process with transect data to create maps.

https://doi.org/10.3390/cli7010005



Urban Heat Island 2019
Citizen Science Campaigns



https://www.climate.gov/news-features/featured-images/if-things-go-%E2%80%9Cnormal%E2%80%9D-most-us-locations-will-have-their-hottest-day

THANK YOU FOR LISTENING

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301-734-1215

BAMS
MEETING SUMMARY

dx.doi.org/10.1175/BAMS-D-19-0042.1

LEARN MORE

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cpo.noaa.gov/nihhis

climate.gov/nihhis

NIHHIS NE Materials

https://github.com/hunterjonesm/NIHHIS-Northeast

GHHIN

https://ghhin.org

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