

Patterns of Heat Stress Across the Landscape and Its Measurement using Wet Bulb Globe Temperature

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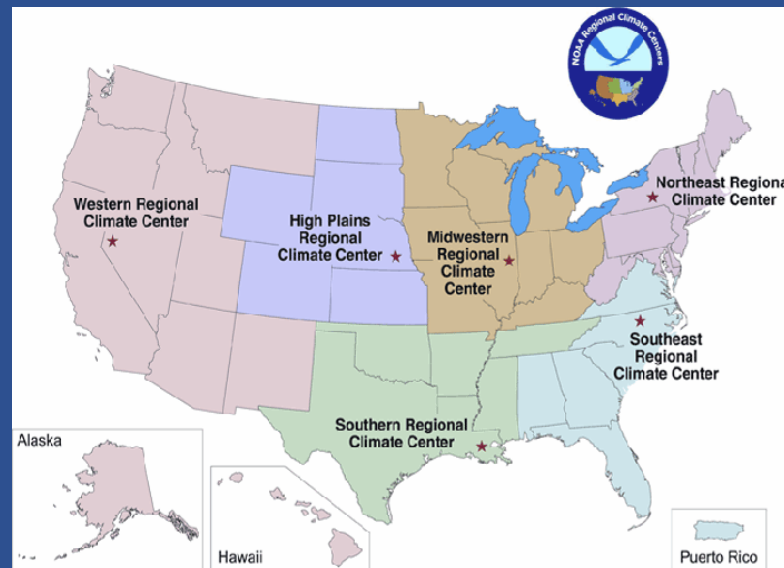
NOAA Southeast Regional Climate Center (SERCC)

<https://sercc.com>

Engage with communities & stakeholders affected by weather and climate & events

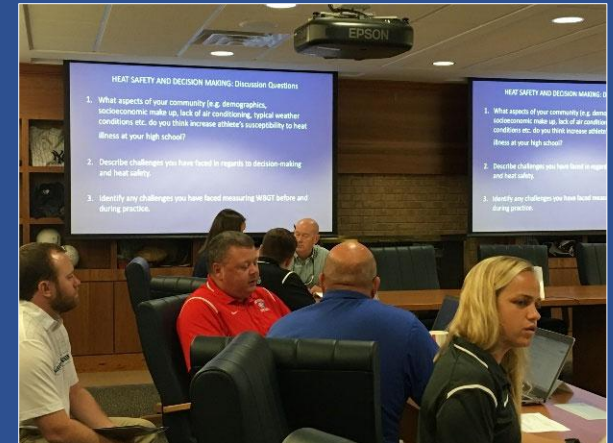
Develop web-based decision support tools

Educate stakeholders on emerging regional climate issues

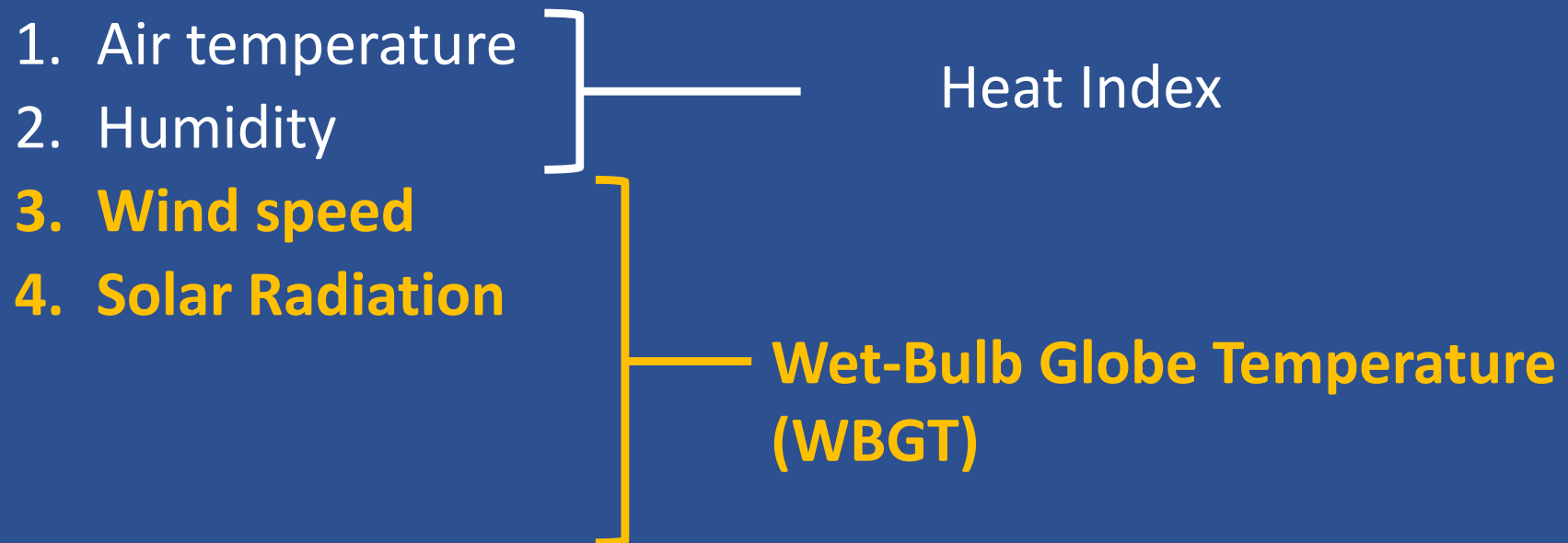


SERCC/CISA Heat Research and Outreach Program

- Field work measuring variables that affect heat over different landcover types– e.g. different athletic surfaces
- Web-based tool that predicts WBGT over next 5 days across the SE US.
- Engagements & site visits with trainers & athletic directors at various high schools across the region



Measures of Heat Stress



Many states have developed requirements for high school sports practice

Wet bulb temperature (WBGT) football practice guidelines

WBGT Index (F)	Athletic Activity Guidelines
Less than 80	Unlimited activity with primary cautions for new or unconditioned athletes or extreme exertion; schedule mandatory rest / water breaks (5 min water / rest break every 30 min)
80 - 84.9	Normal practice for athletes; closely monitor new or unconditioned athletes and all athletes during extreme exertion. Schedule mandatory rest / water breaks. (5 min water / rest break every 25 min)
85 - 87.9	New or unconditioned athletes should not practice. Well conditioned athletes should have more frequent rest breaks and hydration as well as cautious monitoring for symptoms of heat illness. Schedule frequent mandatory rest / water breaks. (5 min water / rest break every 20 min) Have immersion pool on site for practice.
88 - 89.9	All athletes must be under constant observation and supervision. Remove pads and equipment. Schedule frequent mandatory rest / water breaks. (5 min water / rest break every 15 min) Have immersion pool on site for practice.
90 or Above	SUSPEND PRACTICE

- Guidelines for North Carolina

OCEA has strict guidelines for worker exposure to heat stress

Work/Rest and Water Consumption Table <i>Applies to average sized, heat-acclimated soldier wearing BDU, hot weather. (See TB MED 507 for further guidance.)</i>							
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	78° - 81.9°	NL	½	NL	¼	40/20 min	¼
2 (GREEN)	82° - 84.9°	NL	½	50/10 min	¼	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 min	1

For additional copies, contact: U.S. Army Center for Health Promotion and Preventive Medicine Health Information Operations Division at (800) 222-9698 or CHPPM - Health Information Operations@apg.amedd.army.mil.

For electronic versions, see <http://chppm-www.apgea.army.mil/heat>. Local reproduction is authorized.

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• The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hrs of work in the specified heat category. Fluid needs can vary based on individual differences (± ¼ qt/hr) and exposure to full sun or full shade (± ¼ qt/hr).

• **NL** = no limit to work time per hr.

• **Rest** = minimal physical activity (sitting or standing) accomplished in shade if possible.

• **CAUTION: Hourly fluid intake should not exceed 1½ qts.**

Daily fluid intake should not exceed 12 qts.

• If wearing body armor, add 5°F to WBGT index in humid climates.

• If doing Easy Work and wearing NBC (MOPP 4) clothing, add 10°F to WBGT index.

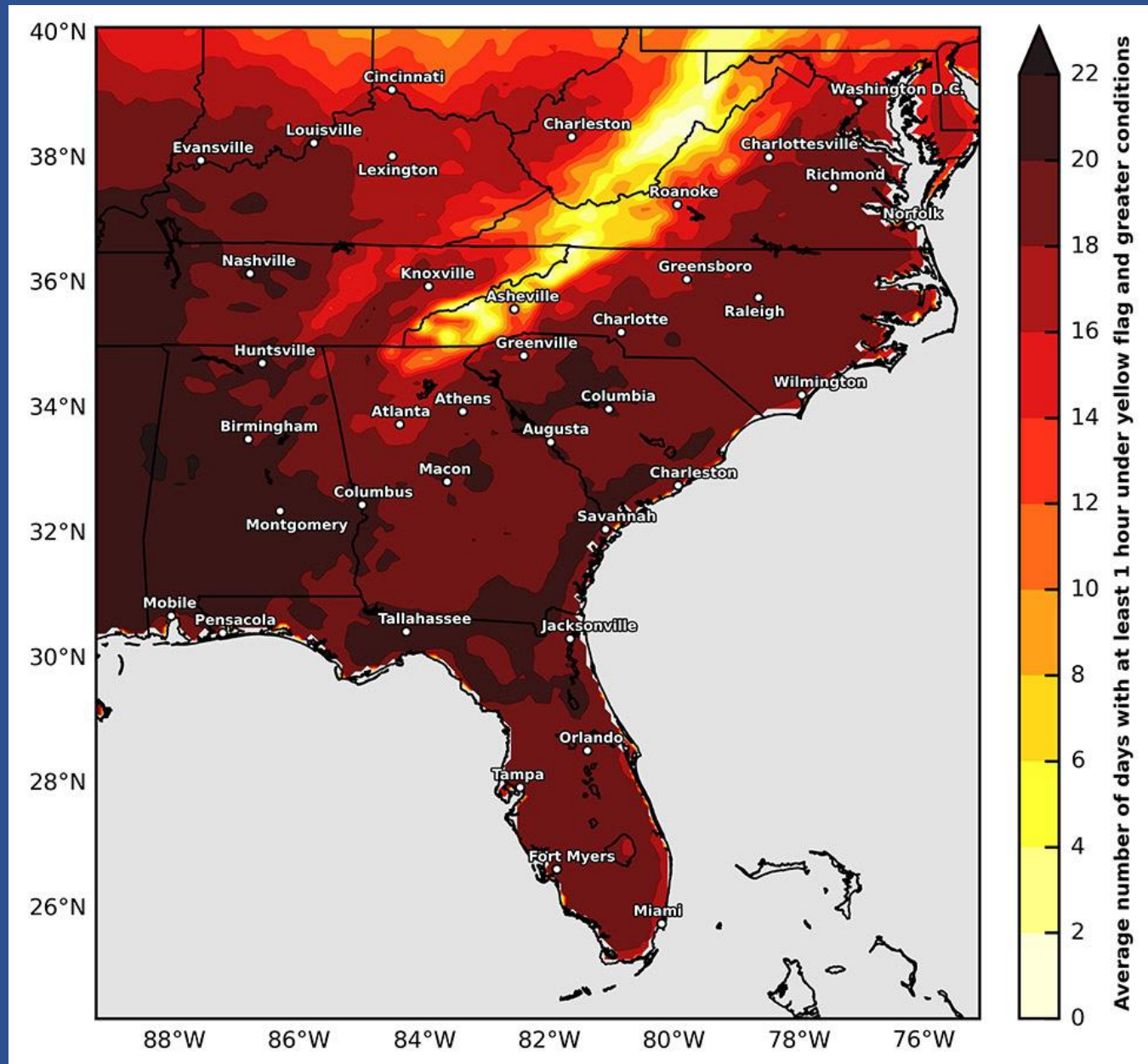
• If doing Moderate or Hard Work and wearing NBC (MOPP 4) clothing, add 20°F to WBGT index.



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Regional patterns of heat stress (WBGT) across SE U.S

Hours of
Yellow Flag and
greater
May-Sept



Local patterns of heat stress (WBGT) across a landscape

1. Surface type

Asphalt/concrete is hottest, especially if it is dark colored

Artificial turf is hotter

Natural grass is hot.

2. Degree of shade.

Surfaces that have been shaded most of day are the coolest (e.g. cross country trails in a forest)

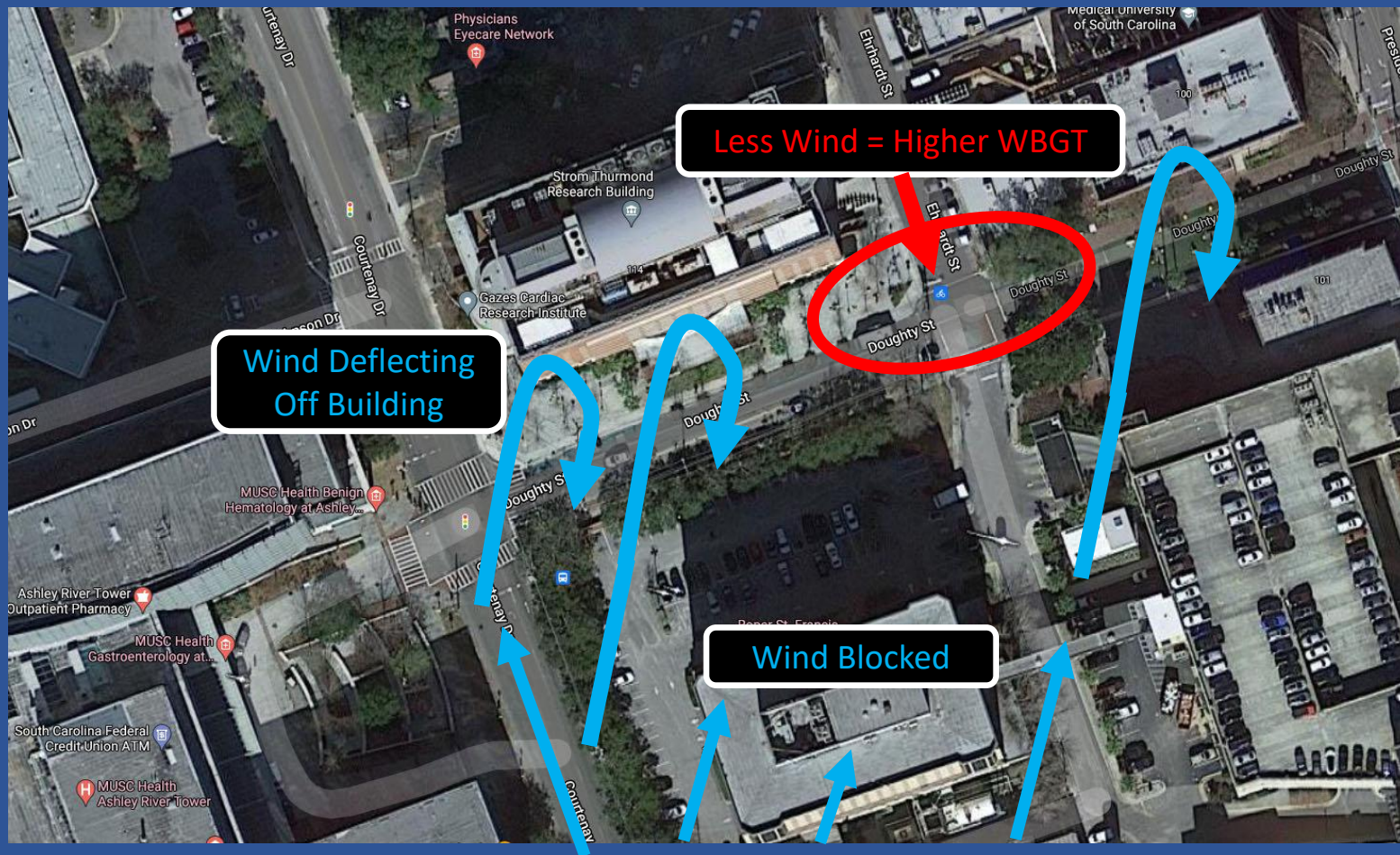
3. Openness of landscape

Closed (lots of trees/buildings nearby) -Hottest (lowest wind speeds)

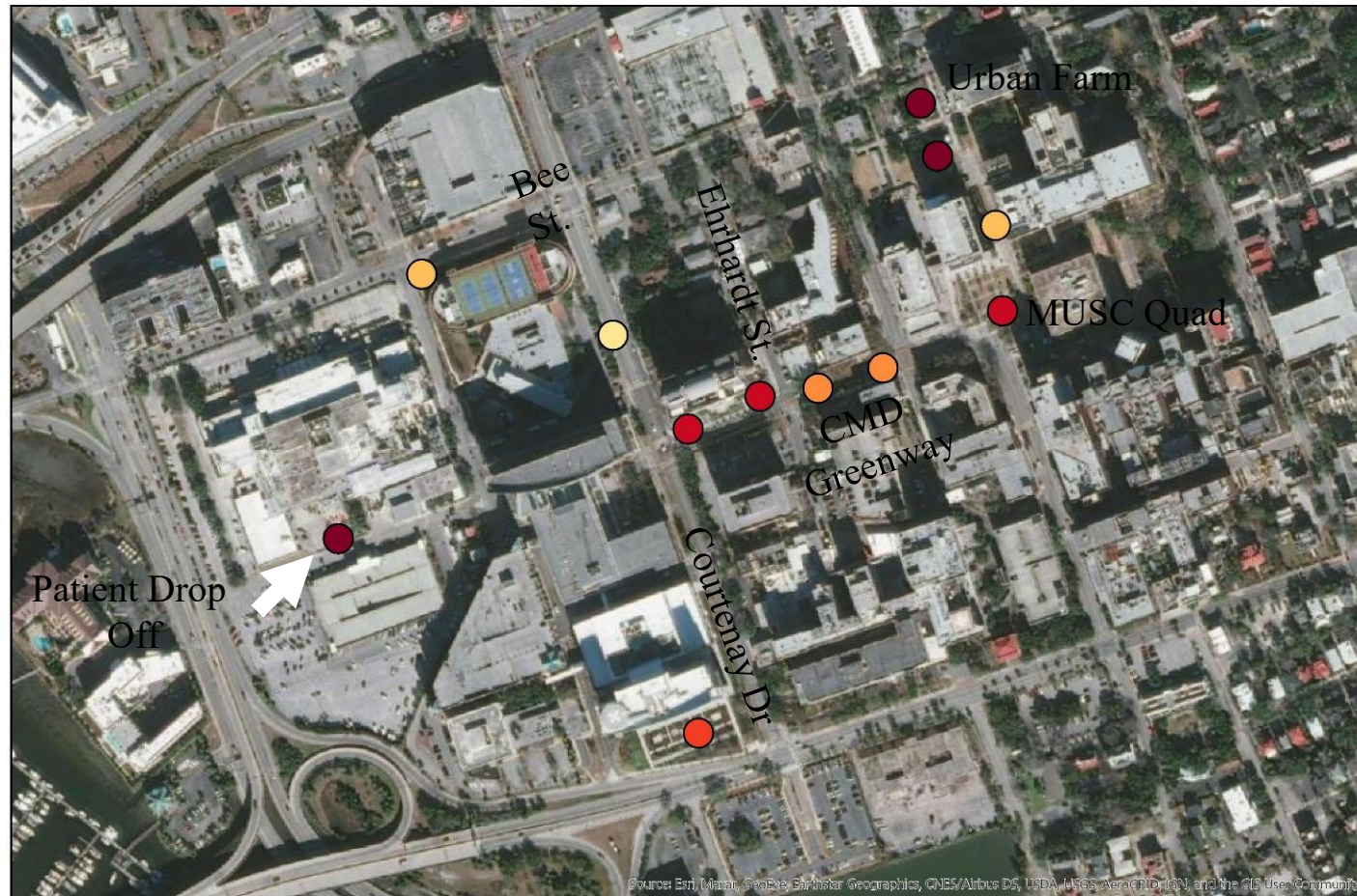
Open (few trees/buildings) – Coolest (highest wind speeds)



Charleston Medical District:
Urban Heat Island Pilot Study



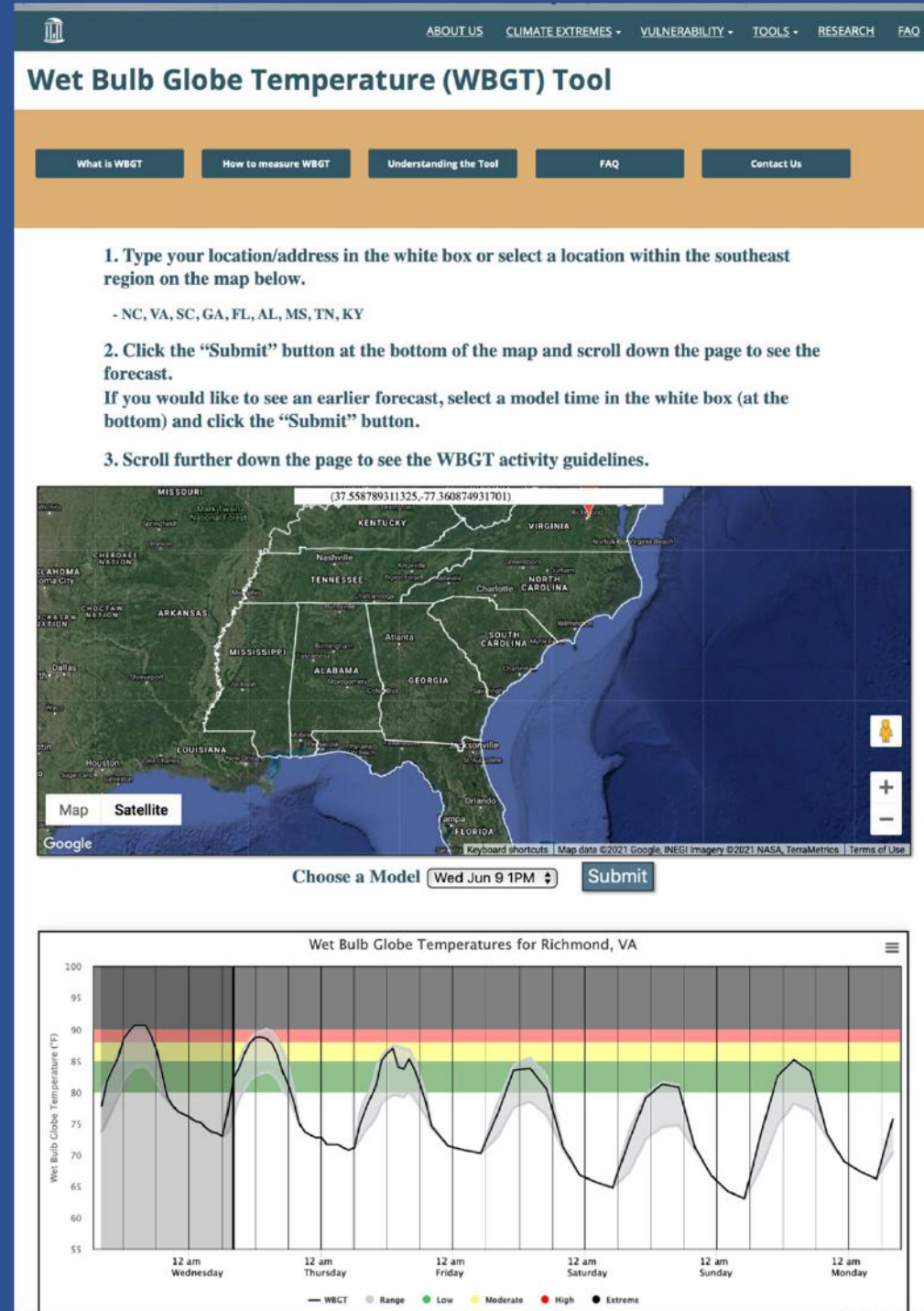
Maximum WBGT at each location



Wet Bulb Globe Temperature Tool

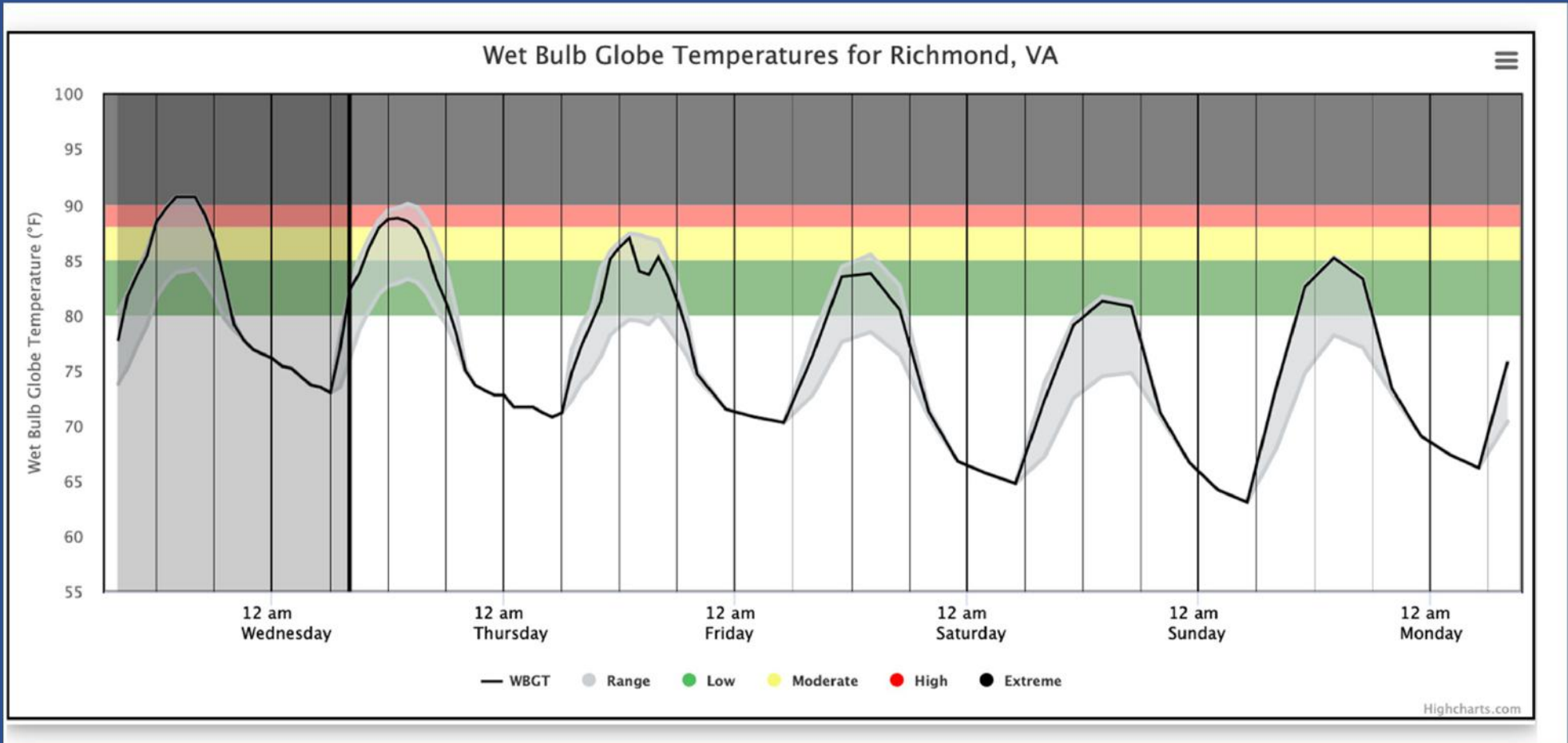
<https://convergence.unc.edu/tools/wbgt/>

- Calculates WBGT from forecasts of meteorological variables from the National Weather Service (NWS) forecast grids
- Provides background information on WBGT and use of the tool



Wet Bulb Globe Temperature Tool

Expanded view of output



Thank You

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