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TAMEST NATURAL HAZARDS SUMMIT

Responding to and Mitigating the Impacts

PART I: VIRTUAL SUMMIT 10.19.2021

#NATURALHAZARDSSUMMIT

TAMEST NATURAL HAZARDS Responding to and Mitigating the Impacts



Theme One: PREDICTION, WARNING AND RESPONSE TO ALERTS AND WARNINGS

Moderated by: KISHOR MEHTA, PH.D., P.E. (NAE) P.W. Horn Professor of Civil, Environmental and Construction Engineering Texas Tech University





Panel:

Preparing for Future Disasters



ED HIRS, M.B.A.

UH Energy Fellow University of Houston



CHIEF TONYA L. HOOVER Acting Fire Administrator United States Fire Administration





DAVID ROBERT MAIDMENT, PH.D. (NAE)

Professor Emeritus The University of Texas at Austin OLGA WILHELMI, PH.D. Research Scientist

National Center for Atmospheric Research



EXTREME HEAT

OLGA WILHELMI, PhD

RESEARCH APPLICATIONS LABORATORY NATIONAL CENTER FOR ATMOSPHERIC RESEARCH BOULDER, COLORADO What has been accomplished in terms of understanding and preparing for extreme heat? What is the state of the art and where are the gaps?



Human health & economy

- Increasing health risks
 - Leading cause of weather-related human mortality in the US
 - Associated with increases in the number of hospital admissions and emergency visits
 - Increasing risk of acute and chronic health effects
- Growing economic impacts
 - Premature mortality
 - Healthcare costs to healthcare provider, patient and family
 - Lost or decreased productivity
- Risks vary across regions, among sociodemographic groups, and throughout summer season

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During 2004–2018, an average of 702 heat-related deaths occurred in the US annually (a total of 10,527 deaths) with 37% of the total death in Arizona, California and Texas (Vaidyanathan et al. 2020; MMWR)

During summer of 2020, 28% of US adult population experienced heat-related symptoms. 13% had reduced productivity due to heat (Wilhelmi et al, 2021; ERL)



Probability of 911 heat-related calls in Houston, TX (May-September, 2007-2011); Heaton et al. 2015

May 26



Built environment

- Urban population is growing
- Cities are warming
- Urban heat island effect increases heat exposure
- People spend ~90% of time indoors
 - Interactions between outdoor and indoor environments
 - Building design & management
 - Indoor exposure & health risks
- Heat wave-power outages are an increasing concern
 - Energy demand
 - Reliance on air conditioning



2020 Urban Heat Mapping Campaign in Houston, Texas WWW.H3AT.ORG



Green roofs in Austin, Texas



The response of archetypical buildings to a three-day heat event with power outage *Sailor et al.* 2019, ERL



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Equity & vulnerability

- Systemic vulnerabilities to heat in under-resourced communities
 - Low income
 - Housing instability
 - Energy insecurity
 - Health inequity
- Growing number of heatvulnerable populations
 - Age and health conditions
- Increasing occupational health risks

20% of Americans have AC but cannot use it effectively (Wilhelmi et al, 2021; *ERL*); 20% of Houston seniors feel too hot at home (Wilhelmi et al. in preparation)



Extreme heat vulnerability framework (Wilhelmi and Hayden 2010)



Innovative tools to explore current and future vulnerability to heat in the US (Esri, 2021)



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Heat and climate change

- It is virtually certain that hot extremes (including heatwaves) have become more frequent and more intense across most land regions since the 1950s" (IPCC AR6)
- 37% of heat-related deaths from 1991-2018 are attributable to human-caused climate change (study of placed in 43 countries)
- Climate change is projected to increase average temperatures, summertime temperature variability, and frequency of hot days and warm nights
- Heat risk is compounded by other climate extremes and weather hazards (e.g., wildfires, air pollution, drought, severe weather and tropical storms)



Burden of heat-related mortality attributed to human-induced climate change (1991-2018) Vicedo-Cabrera et al. 2021 Nature Climate Change



43 cities had increase in heat wave frequency; and 45 experienced increases in heat season length, NCA4, 2018





Future population exposure to extreme heat; *Jones et al. 2015, Nature Climate Change*



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Preparing, responding & adapting

- Preparedness and response measures aim to reduce heat health effects
 - Risk and vulnerability assessments
 - Urban heat island mitigation
 - Early warning systems
 - Community-based programs adaptations

- Heat governance & institutions
- Equity-focused heat response and adaptation
- Innovation in construction and building design approaches



Mitigation

(n=1198)

n=741)

Impacts

(n=9172)

Research landscape on climate and health; *Berrang-Ford et al. 2021*



"NIHHIS is an integrated system that builds understanding of the problem of extreme heat, defines demand for climate services that enhance societal resilience, develops science-based products and services from a sustained climate science research program, and improves capacity, communication, and societal understanding of the problem in order to reduce morbidity and mortality due to extreme heat" NOAA & CDC



Houston stakeholders; Wilhelmi and Hayden 2016



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