National Future Extreme Heat Scenarios for Assessment of Climate Impacts on Public Health

Development of National Future Extreme Heat Scenario to Enable the Assessment of Climate Impacts on Public Health

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<u>Project Objective:</u> To provide historical and future measures of climate-driven heat events to enable assessments of heat impacts on public health over the coterminous U.S.

- The project's emphasis will be on providing assessments of the magnitude, frequency and geographic distribution of EHEs to facilitate public health studies.
- We will focus on the daily to weekly time scales on which EHEs occur, not on decadal-scale climate changes.
- There is, however, a very strong connection between air temperature patterns at the two time scales and long-term climatic changes will certainly alter the frequency of EHEs.

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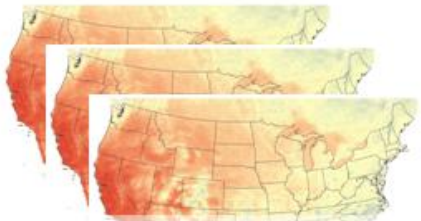
GCM monthly mean T_{max}, T_{min}, q grids (1990 climate)

Compute monthly differences, averaged over 20-year periods

GCM monthly mean T_{max}, T_{min}, q grids (2040, 2090 scenarios)

Future – current monthly difference grids (Δ climate): ΔT_{max}, ΔT_{min}, Δq

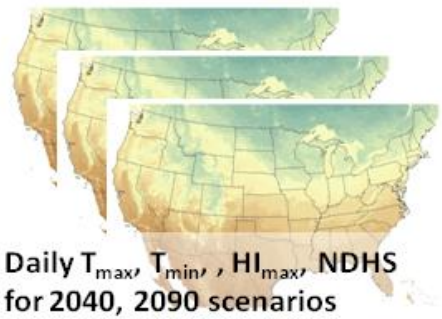
Add Δ climate to NLDAS-2



Hourly climate realizations: T, RH for 2040, 2090 scenarios

Hourly NLDAS-2 historical (1981-2000) data : T, RH

Temporally aggregate; derive HI, NDHS



Daily T_{max}, T_{min}, , HI_{max}, NDHS for 2040, 2090 scenarios

Gridded Statistics of Heat Stress:

- mean annual #of days when T > threshold
- mean annual #of days when HI > threshold
- mean annual #of days when NDHS > 0
- mean annual total NDHS

Users:
Public health professionals
General public

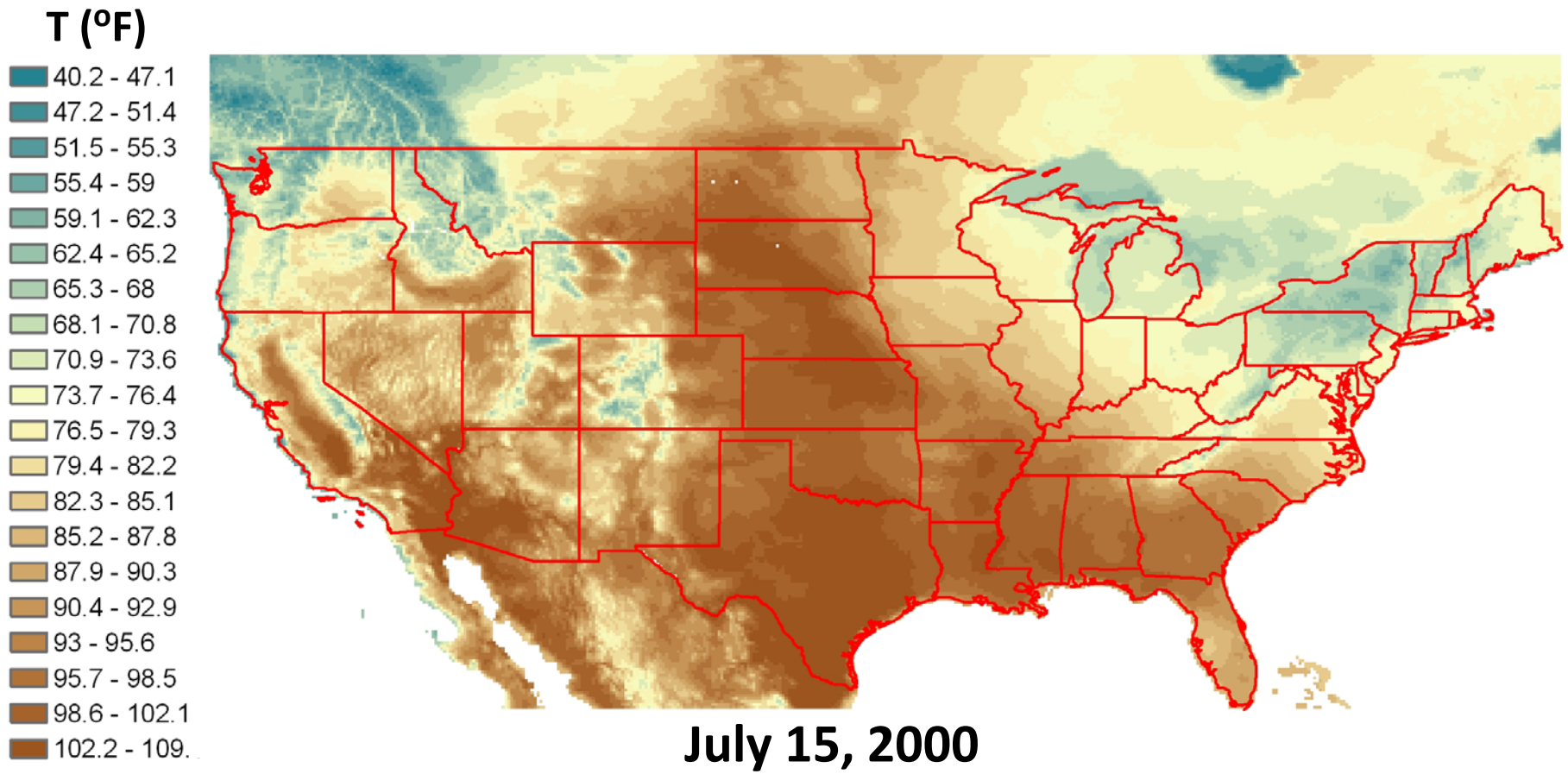
CDC WONDER and EHTB:

- archive & host county-level heat stress data and statistics

Metrics of Excessive Heat

1. Daily Maximum Air Temperature

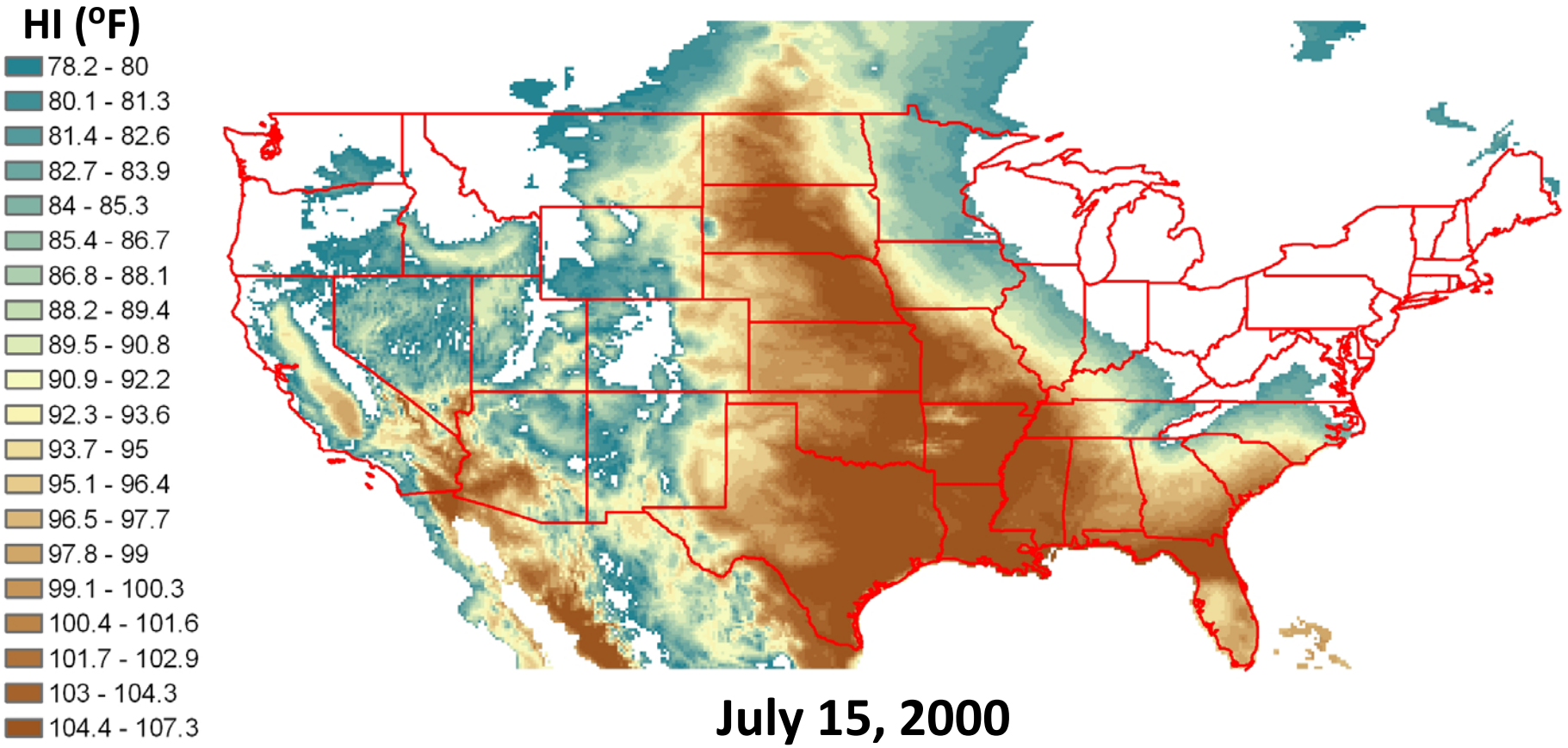
➢ **Daily maximum air temperature, the highest temperature recorded at an observation site between midnight and midnight local standard time, is a traditional measure of heat, and one with which everyone is familiar.**
We used NLDAS data to calculate daily maximum air temperature.



Metrics of Excessive Heat

2. Heat Index (HI)

We used NLDAS data to calculate daily maximum HI.



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Metrics of Excessive Heat

3. Net Daily Heat Stress (NDHS)

Net Daily Heat Stress is a new heat variable that gives an integrated measure of heat stress (and relief) over the course of a day, defined as:

$$NDHS = \Sigma(HI_i - HI_{hot}) - \Sigma(T_{cool} - T_i)$$

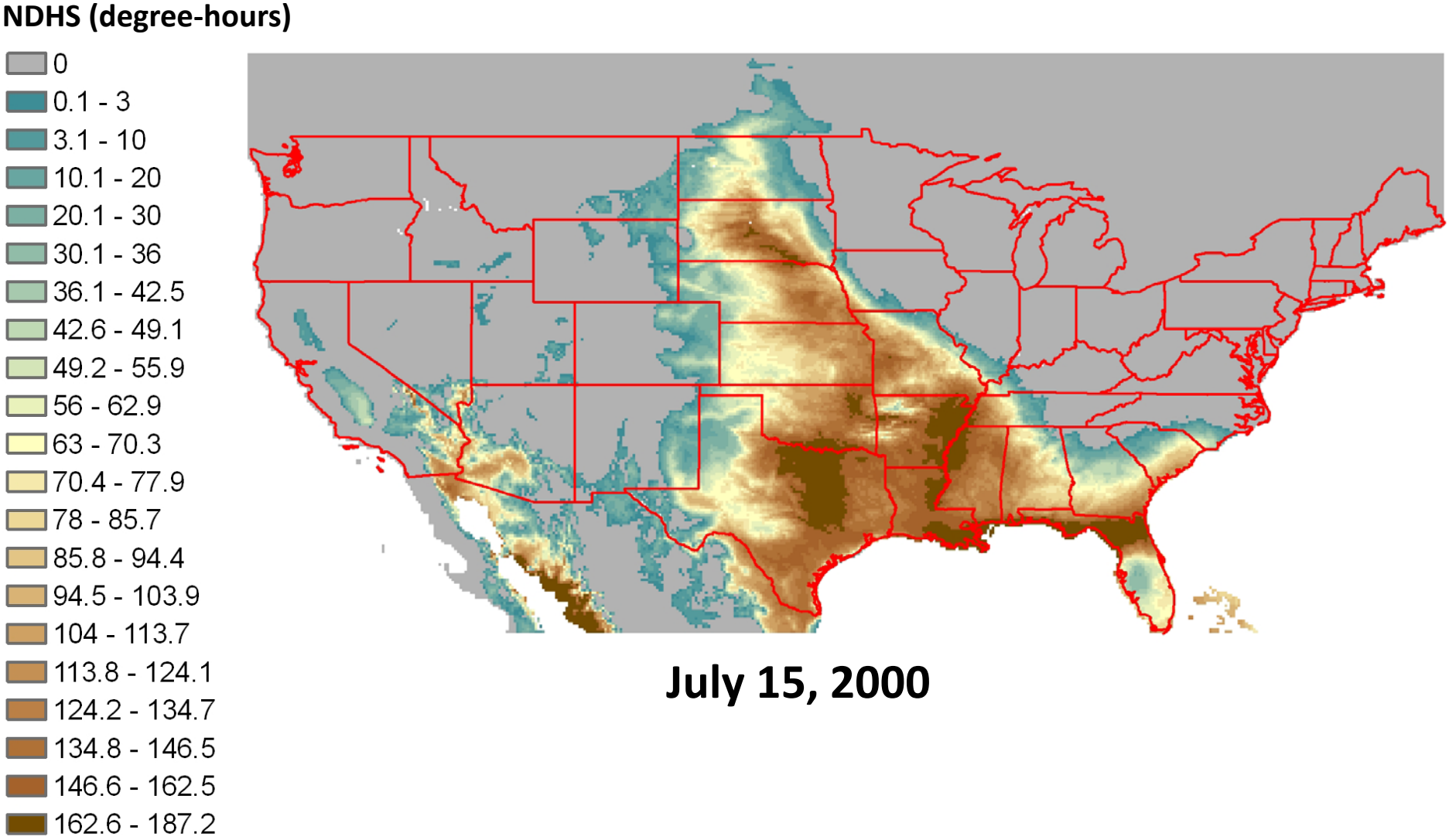
where the summations are over the hours in a day, but only positive terms are included. In other words, the first sum, the 'heat stress', is only calculated when $HI_i > HI_{hot}$, where HI_{hot} is a threshold above which HI is considered a stressor, set to 90° F.

The second term, 'heat relief', is only computed when $T_i < T_{cool}$, a temperature below which relief from heat occurs, set to 75° F. This term is based on air temperature since HI is only defined when T > 80° F.

If heat relief is greater than heat stress, NDHS is set to 0.

Metrics of Excessive Heat

3. Net Daily Heat Stress (NDHS)



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CDC WONDER Climate Change portal.mht

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Key Results Expected

- GCM-scale monthly climatologies of air temperature and specific humidity for the historical period 1981-2000, and future changes relative to this period.
- NLDAS-scale (12km) hourly realizations of temperature and relative humidity.
- NLDAS-scale daily T_{max}, T_{min}, Hi_{max} and NDHS.
- NLDAS-scale statistics over 20-year past and future periods of heat stress measures.
- County-level heat stress measures along with 2040 and 2090 population projections, hosted on CDC WONDER, to enable assessments of heat impacts on public health.

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Task Schedule

1. Year 1/Qtr 1 & 2: Obtain GCM monthly mean inputs for 1981-2000 (‘current’), 2031-2050 (‘2040’), and 2081-2100 (‘2090’).
2. Year 1/Qtr. 1: Obtain NLDAS data for 1981-2000.
3. Year 1/Qtr 3: Compute monthly differences, averaged over 20-year periods, between future and current climate.
4. Year 2/Qtr. 1: Create hourly climate realizations for 2040 and 2090
5. Year 2/Qtr. 2: Derive HI, NDHS, Tmax, Tmin on daily basis for future climates.
6. Year 2/Qtr. 3: Compute gridded heat stress statistics for future climates.
7. Year 2/Qtr. 3-4: Provide data to CDC WONDER at a county-level scale.
8. Year 2/Qtr 4: End user demonstration.
9. Year 3/Qtr 1: Manuscripts/reports.