April Webinar: *Spring* into Climate Data

Al Mitchell

Phius Alliance April 2026 Webinar

April Webinars Bring May Flowers

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Phius Alliance April 2026 Webinar

Outline

- 101 - Introduction to Climate Data
- 102 - The Future
- 201 - Phius and Climate Data

phius

Event Approved for Phius CEUs

April Webinar: Climate and Weather Data

Earn 1.0 CEU

XXXXX

Self Report Code Coming Later

Self Report @

www.phius.org/certifications/professionals/maintain-credentials

101 - Introduction to Climate Data

Climate or Weather?

Weather

Weather is what you experience when you step outside on any given day. In other words, it is the state of the atmosphere at a particular location over the short-term.

Climate

Climate is the average of the weather patterns in a location over a longer period of time, usually 30 years or more.

https://www.noaa.gov/explainers/what-s-difference-between-climate-and-weather

Paleoclimatology

Ice

Study the contents:

- Air
- Layering
- Pollen
- Volcanic ash
- Chemistry

Dendroclimatology (Trees)

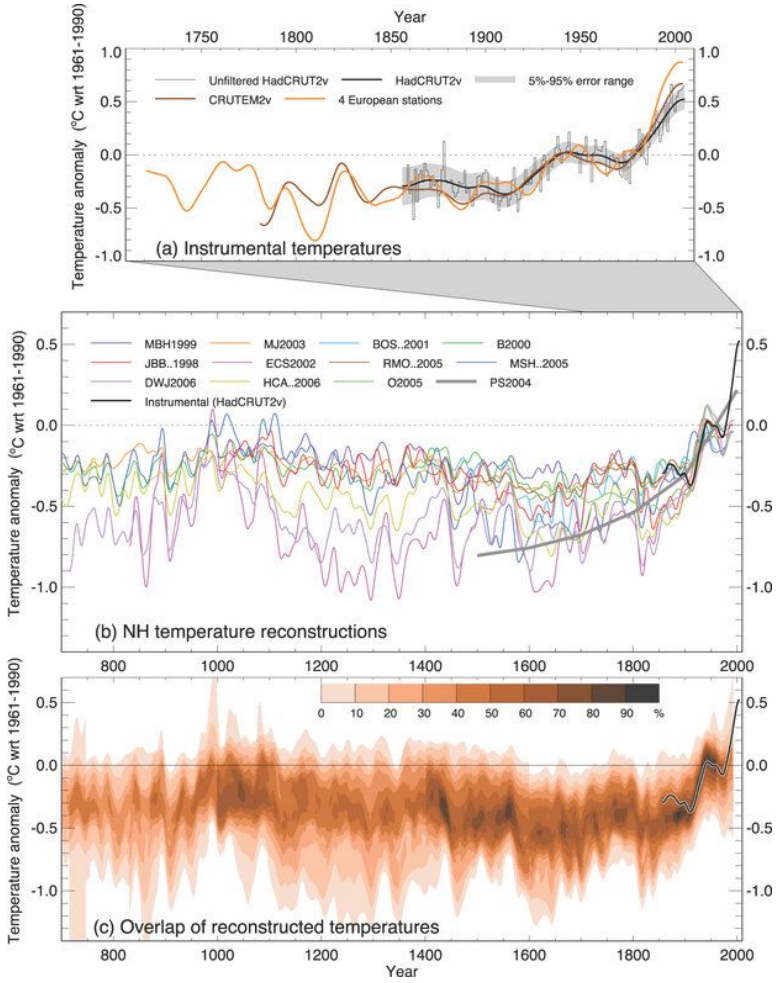
- Depth of rings

Corals and Sediment

- Layering of sediment
- Placement of rocks (glaciers)
- Chemistry

Paleoclimatology

Climate or Weather?



Climate

- Certain models can reproduce past event, synthesize data from paleoclimatology
- Measured data begins in limited area in 1600's - Medici Network
- Modern data, since 1970s, vast, accurate and global

IPCC AR4 WG 1 figure 6.10.

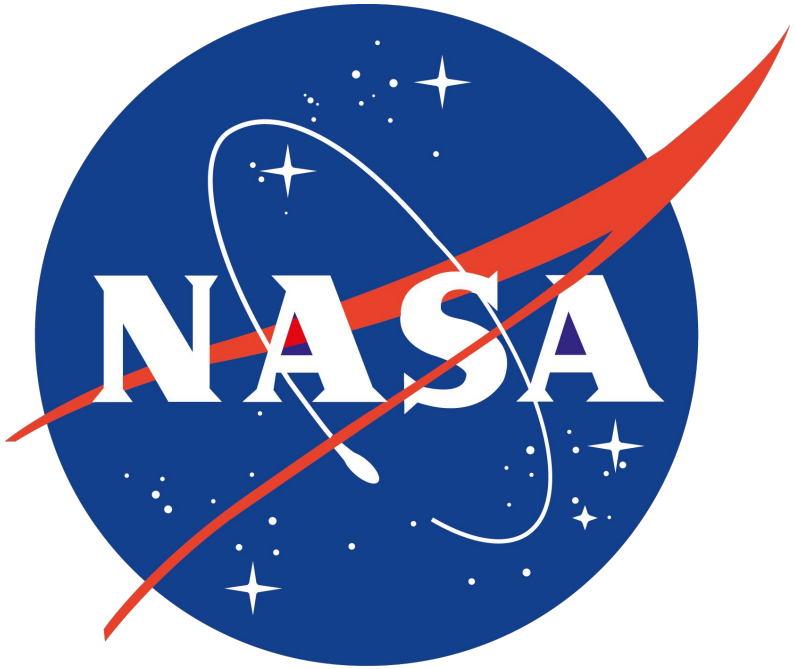
Compiled Source

Global Hourly - Integrated Surface Database (ISD)

- Hourly, sequential weather data
- 100 original data sources
  - Manually entered from 1950-1970
- Temperature, wind, humidity, cloud cover, pressure, visibility

https://www.ncei.noaa.gov/products/land-based-station/integrated-surface-database

Compiled Source

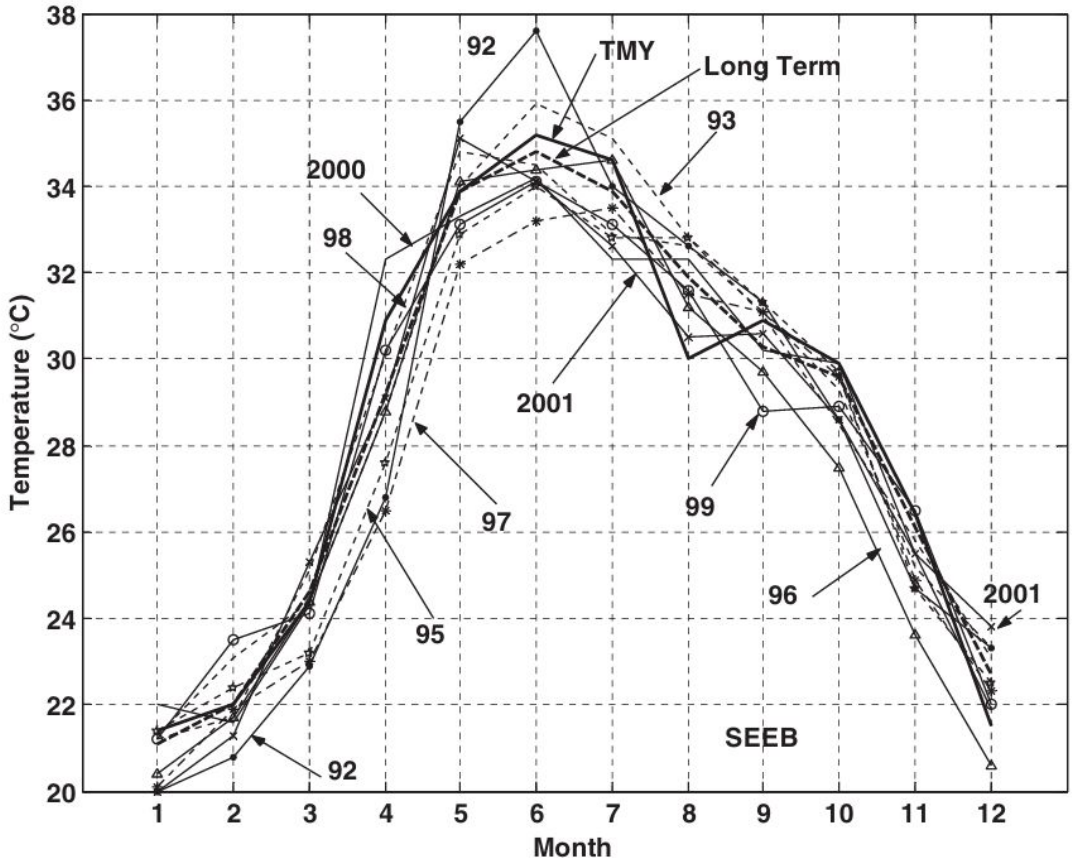


Global Hourly - NASA POWER DAV

- Easy access to different formats of historic climate data
- Satellite data and assimilation models
- Good for remote locations

https://power.larc.nasa.gov/data-access-viewer/

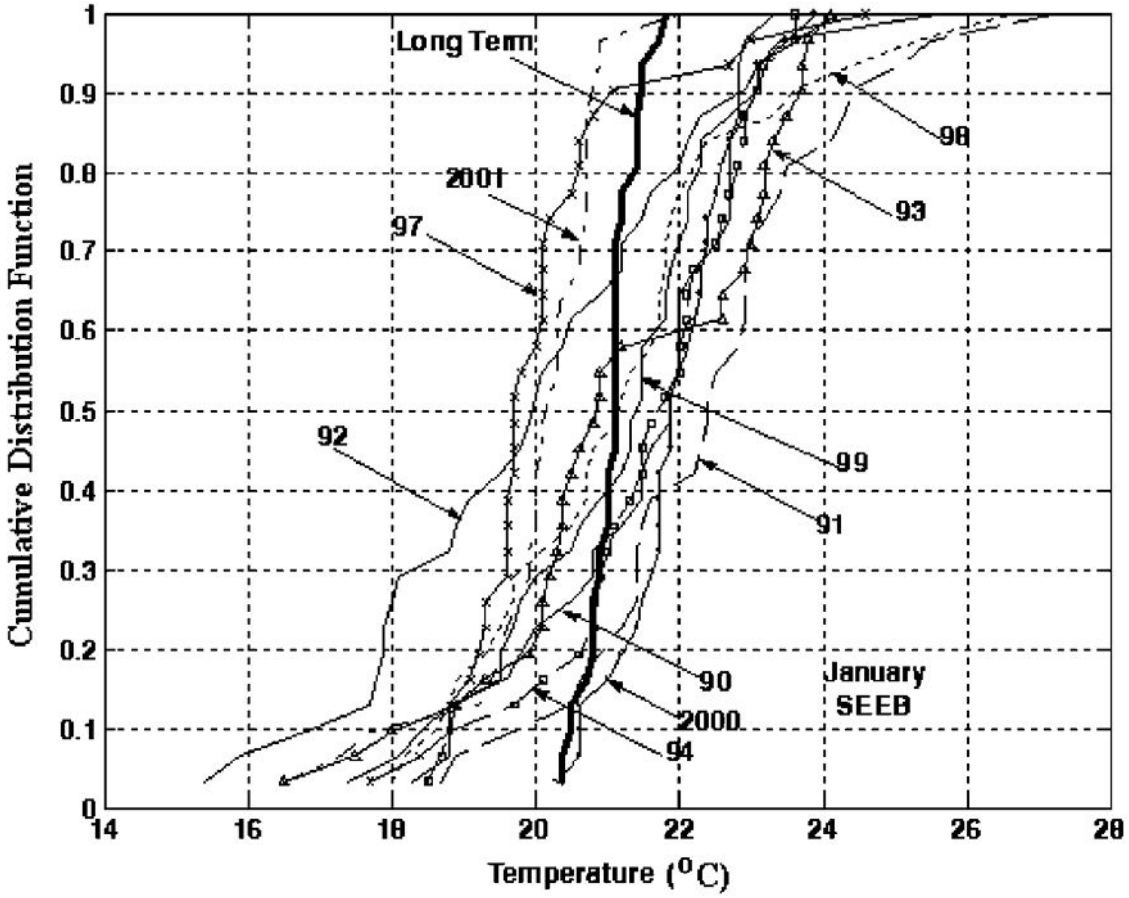
Sandia Method



Generation of a typical meteorological year

- 1978 - Sandia National Laboratory
- Statistical method for building “typical” weather year
- Month by month
- Typically ~15 years of data
  - Reccomended 12 or 24 years due to sun cycle

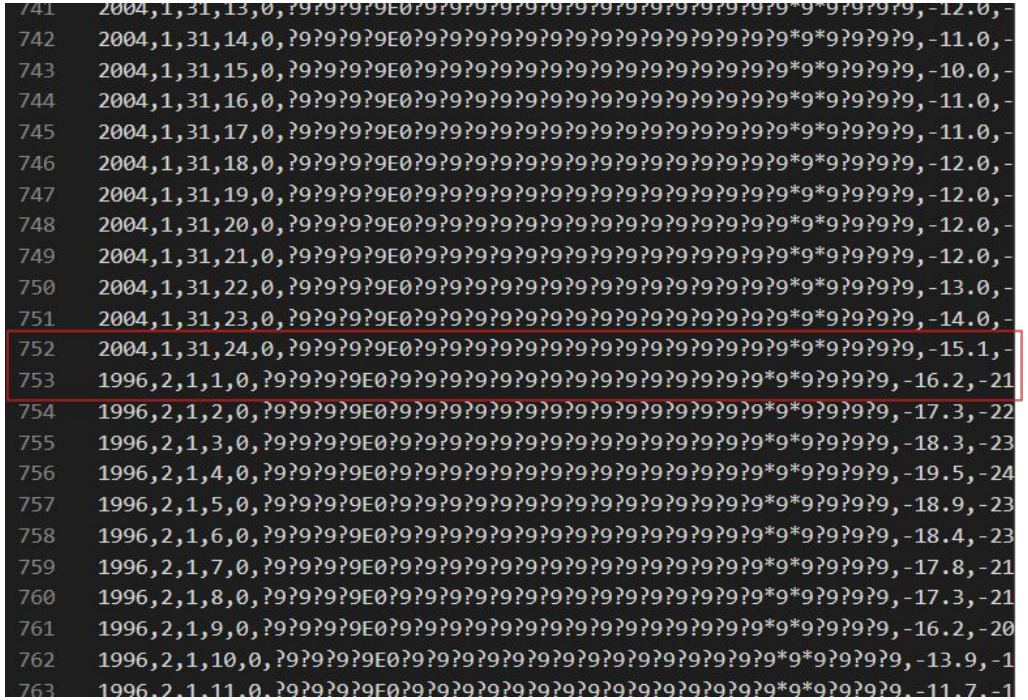
Sandia Method



Generation of a typical meteorological year

- Find the “most average” month
  - Calculate cumulative distribution functions (CDF) for daily average conditions for each year and *long term* (full dataset)
  - Find month with closest days to long term average

Sandia Method



Generation of a typical meteorological year

- Weight temp, humidity, radiation, etc
- Stitch most average months into a cohesive year
- Frequent switching between years

Typical Meteorological Year

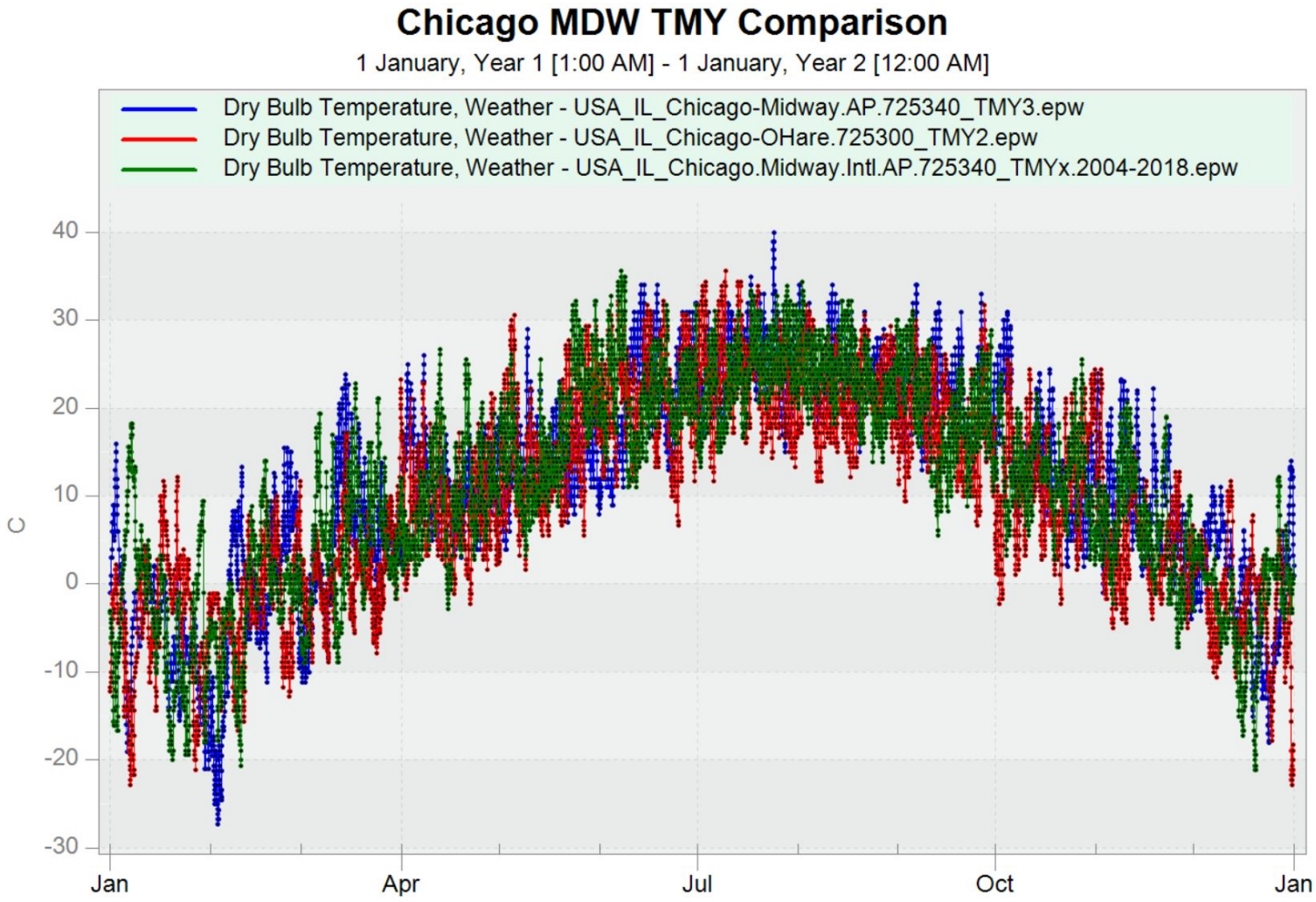
TMY

- Ubiquitous, most common weather data type
- Temperature, humidity, wind, radiation, pressure
- Hourly format
- Used in statistical analysis for design temperatures, etc

Modifiers

- TMY - 248 locations for 1952-1975
- TMY2 - 1961-1990
- TMY3 - 1976-2005
- TMYx - rolling 2011-2025 current
- fTMY - Future, next chapter

Chicago TMY Comparison



Climate Zones

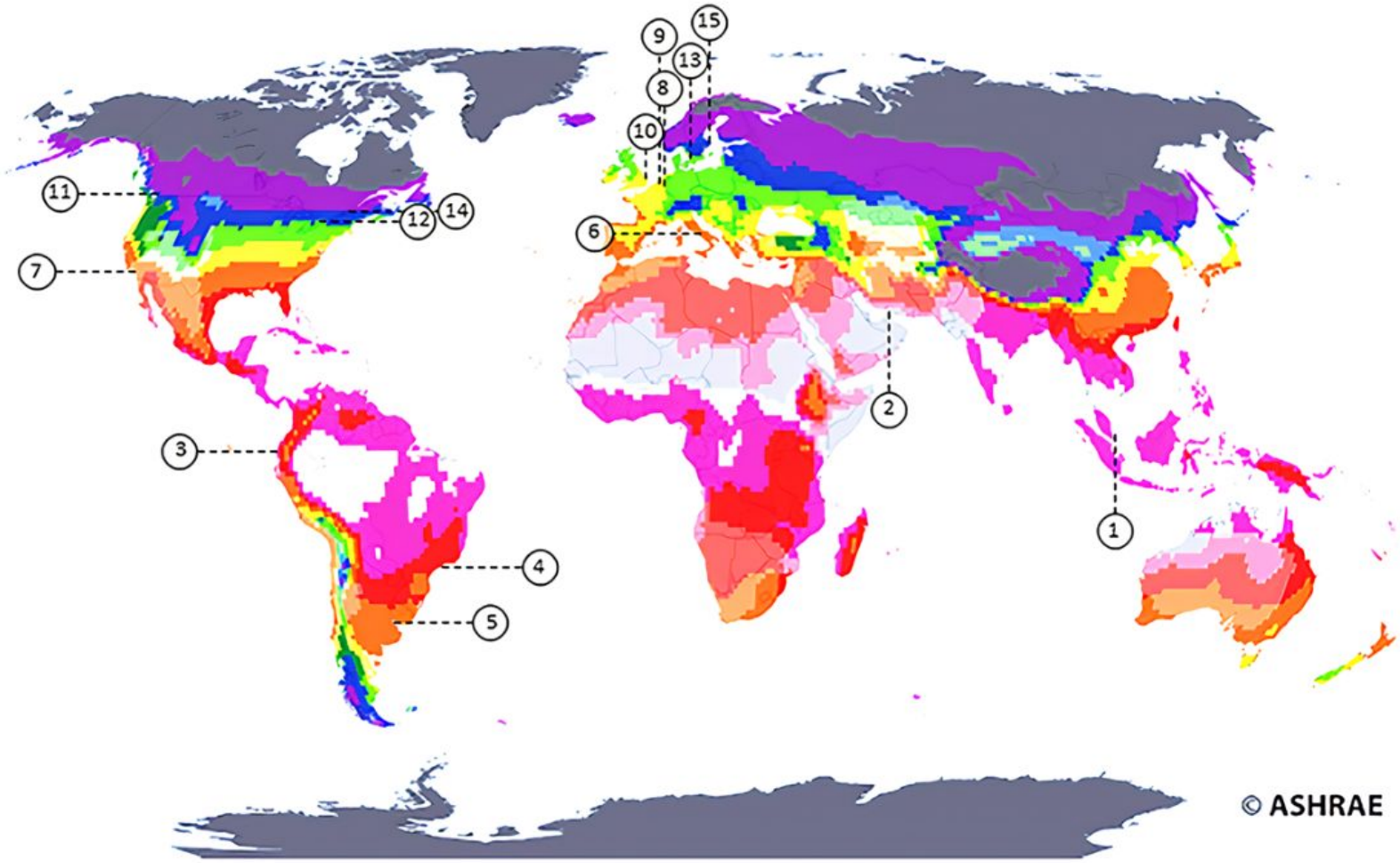
TABLE C301.3THERMAL CLIMATE ZONE DEFINITIONS

ZONE NUMBER	THERMAL CRITERIA	
	IP Units	SI Units
0	10,800 < CDD50°F	6000 < CDD10°C
1	9,000 < CDD50°F < 10,800	5000 < CDD10°C < 6000
2	6,300 < CDD50°F ≤ 9,000	3500 < CDD10°C ≤ 5000
3	CDD50°F ≤ 6,300 and HDD65°F ≤ 3,600	CDD10°C < 3500 and HDD18°C ≤ 2000
4	CDD50°F ≤ 6,300 and 3600 < HDD65°F ≤ 5,400	CDD10°C < 3500 and 2000 < HDD18°C ≤ 3000
5	CDD50°F < 6,300 and 5,400 < HDD65°F ≤ 7,200	CDD10°C < 3500 and 3000 < HDD18°C ≤ 4000
6	7,200 < HDD65°F ≤ 9,000	4000 < HDD18°C ≤ 5000
7	9,000 < HDD65°F ≤ 12,600	5000 < HDD18°C ≤ 7000
8	12,600 < HDD65°F	7000 < HDD18°C

For SI: °C = [(°F) − 32]/1.8.

Climate Zones

CZ	Description
0A	Extremely Hot Humid
0B	Extremely Hot Dry
1A	Very Hot Humid
1B	Very Hot Dry
2A	Hot Humid
2B	Hot Dry
3A	Warm Humid
3B	Warm Dry
3C	Warm Marine
4A	Mixed Humid
4B	Mixed Dry
4C	Mixed Marine
5A	Cool Humid
5B	Cool Dry
5C	Cool Marine
6A	Cold Humid
6B	Cold Dry
7	Very Cold
8	Subarctic / Arctic



1 Singapore
2 Abu Dhabi
3 Guayaquil
4 São Paulo
5 Buenos Aires
6 Rome
7 Los Angeles
8 Brussels
9 Ghent
10 London
11 Vancouver
12 Toronto
13 Copenhagen
14 Montreal
15 Stockholm

Climate Zones are Not Equal

Chicago MDW

- 99.6%: 1.0°F
- 99.0%: 6.3°F
- 1.0%: 89.5°F
- 0.4%: 91.8°F
- HDD65: 5694
- CDD50: 3585

Boston Logan

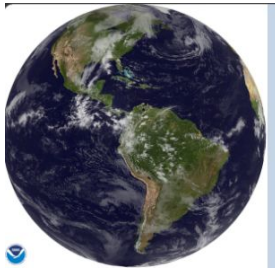
- 99.6%: 8.4°F
- 99.0%: 13.6°F
- 1.0%: 87.9°F
- 0.4%: 91.1°F
- HDD65: 5398
- CDD50: 3142

Climate Zones are Not Equal

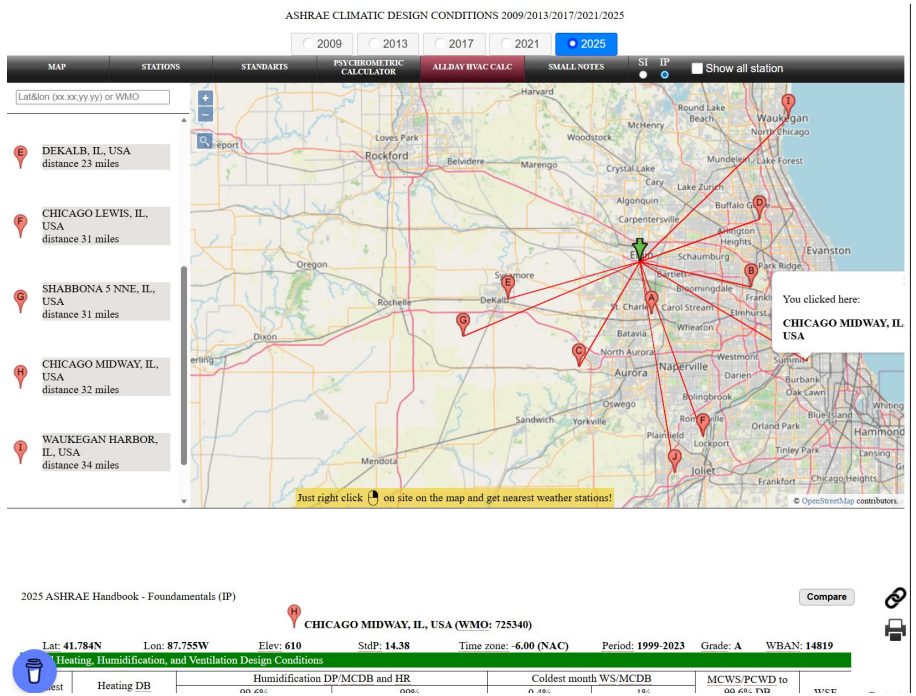
Chicago MDW

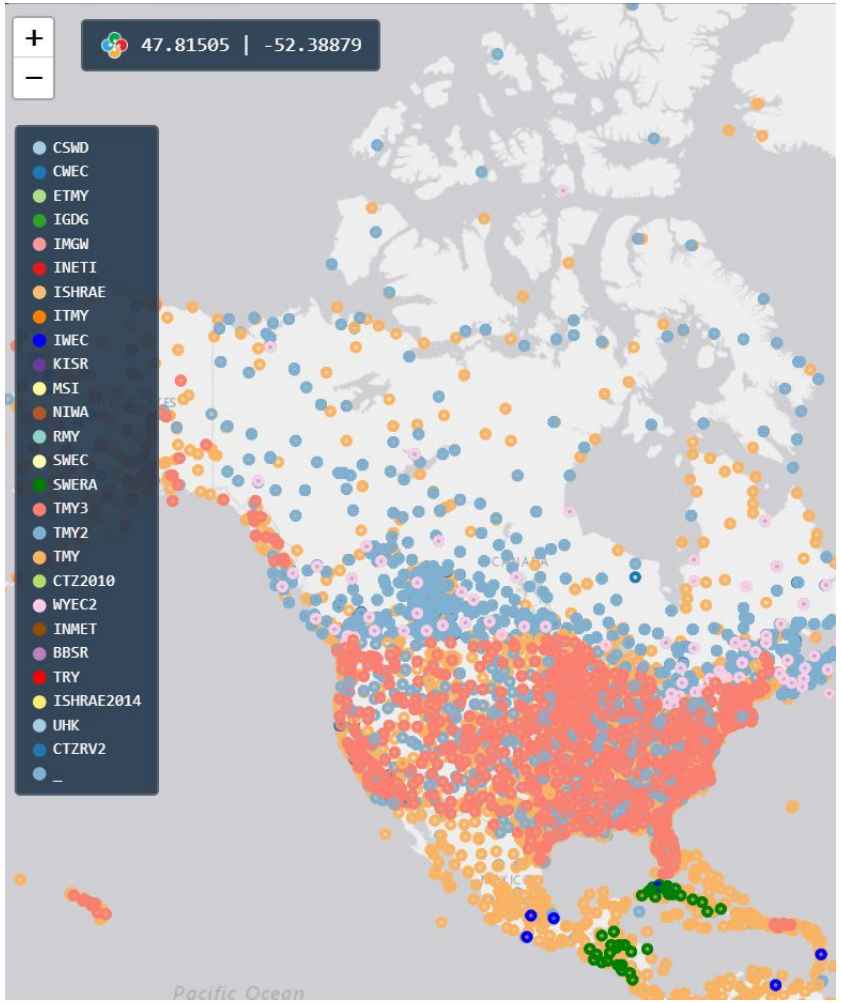
- 99.6%: 1.0°F
- 99.0%: 6.3°F
- 1.0%: 89.5°F
- 0.4%: 91.8°F
- HDD65: 5694
- CDD50: 3585

Weather and Climate Data Sources



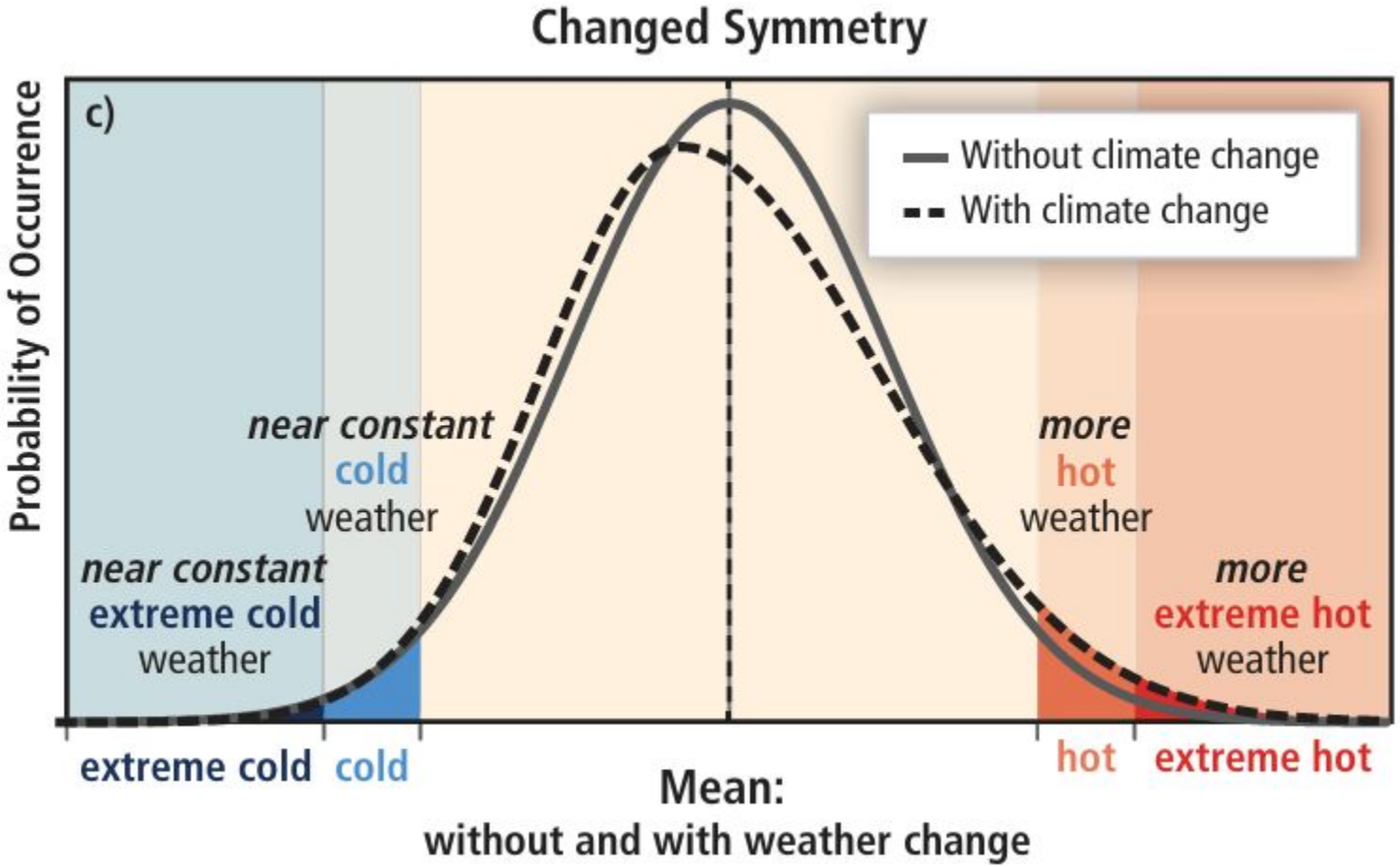
Climate.OneBuilding.Org



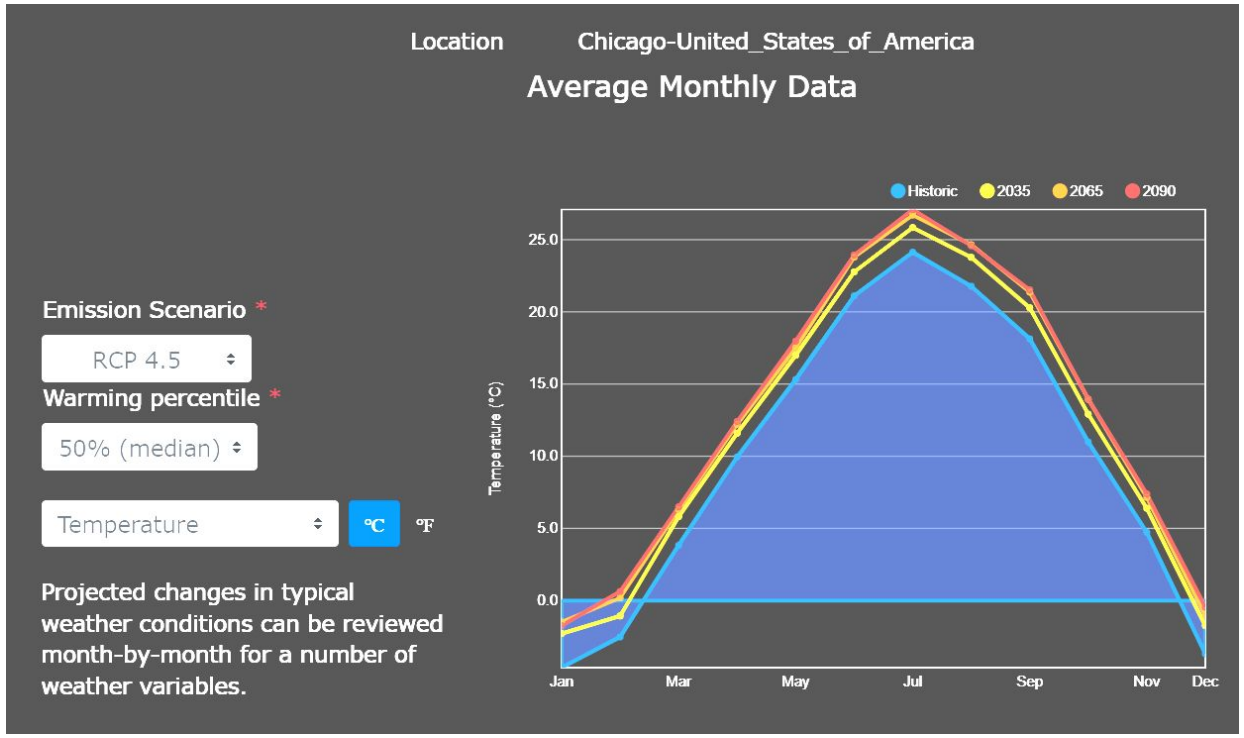


102 - The Future

Future Climate is Changing



History of Future Weather



So far…

- Ignore future climate
- Oversize systems based to reduce risk
- Use a different climate file: different city or climate zone
- Morph climate data based on IPCC projections

History of Future Weather

Emission Scena

RCP 4.5

Warming percer

50% (median)

Temperature

Projected chang
weather conditi
month-by-mont
weather variabl

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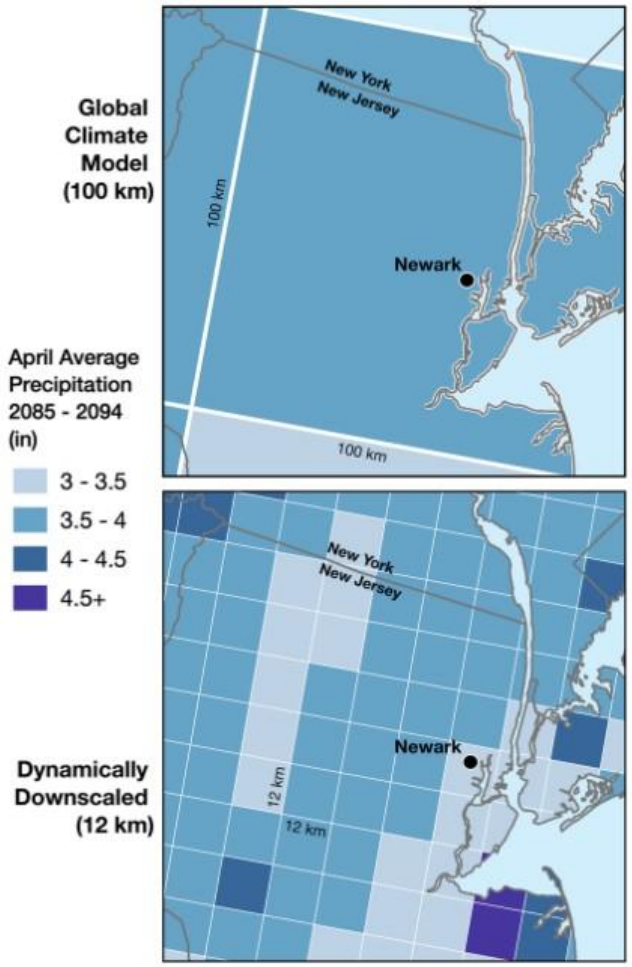
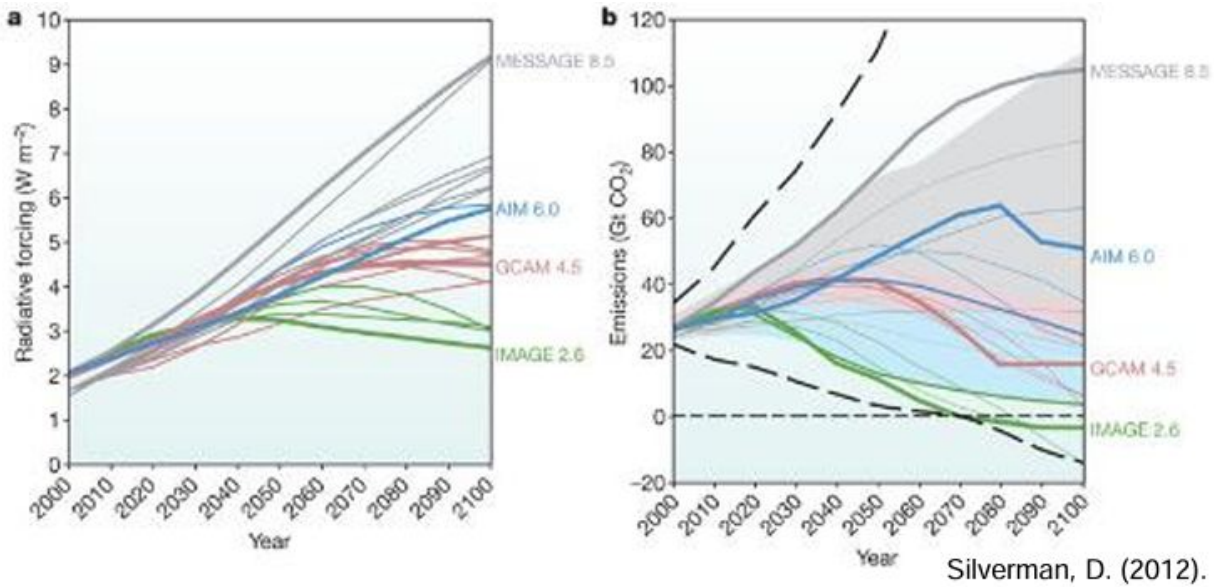
Argonne National Lab



Dynamically Downscaled Future Data

- Physics based climate model of North America
- RCP 4.5 & 8.5
- Time synchronized
- 20 years 2045-2055 & 2085-2095
- Downscaled to a 12 km grid

Oak Ridge National Laboratory

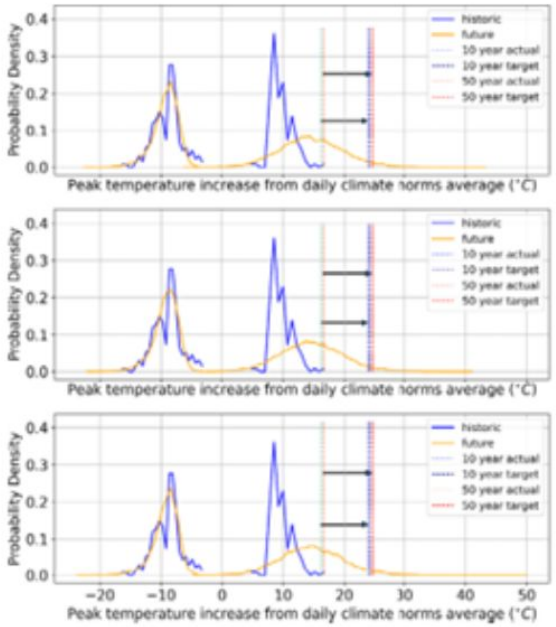


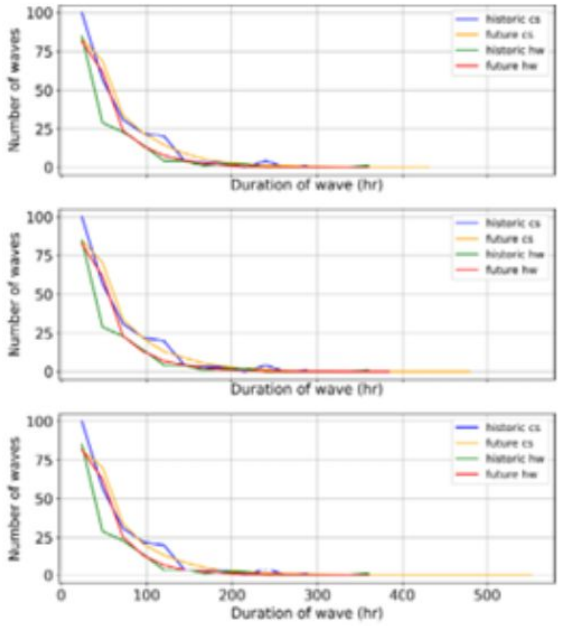
Silverman, D. (2012).

fTMY

- Scaled down IPCC models
- Sandia Method!
- 144 climate locations, 18 in US
- SSP 5, RCP 8.5
- 4 files for 20 year periods
- 2020-2040
- 2040-2060
- 2060-2080
- 2080-2100

Sandia National Laboratory





MEWS

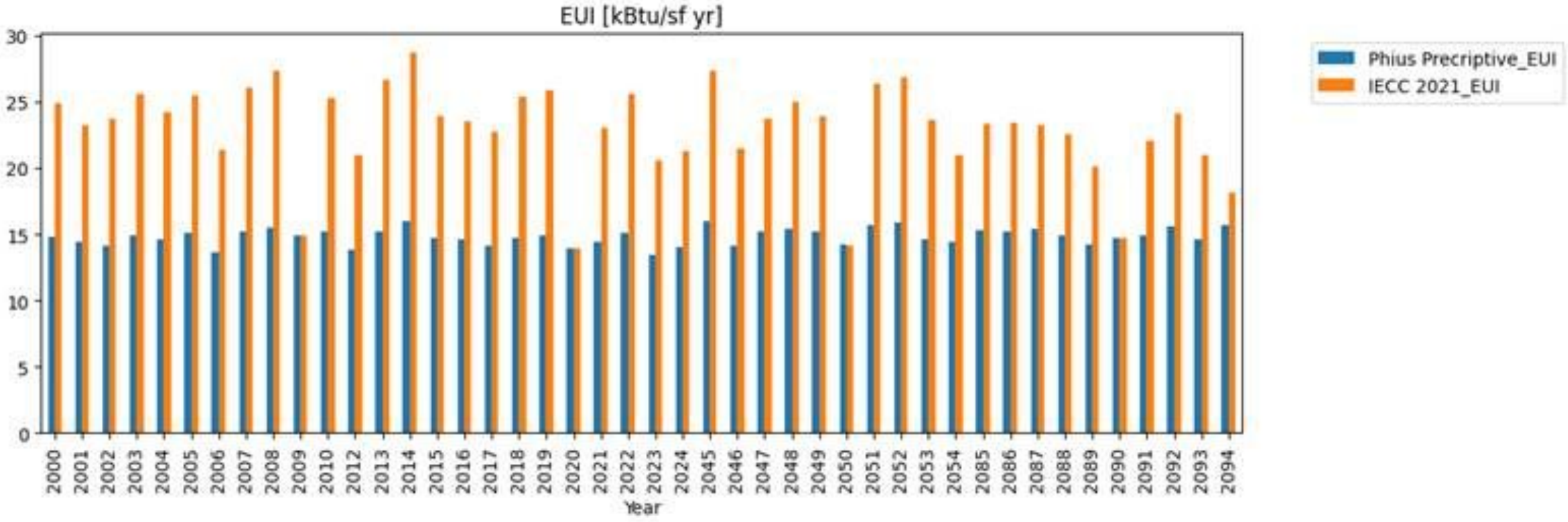
- Stochastic heat wave and cold snap generator
- Maintains extremes
- Can be used to modify existing weather files
- Uses IPCC data about projected extreme events

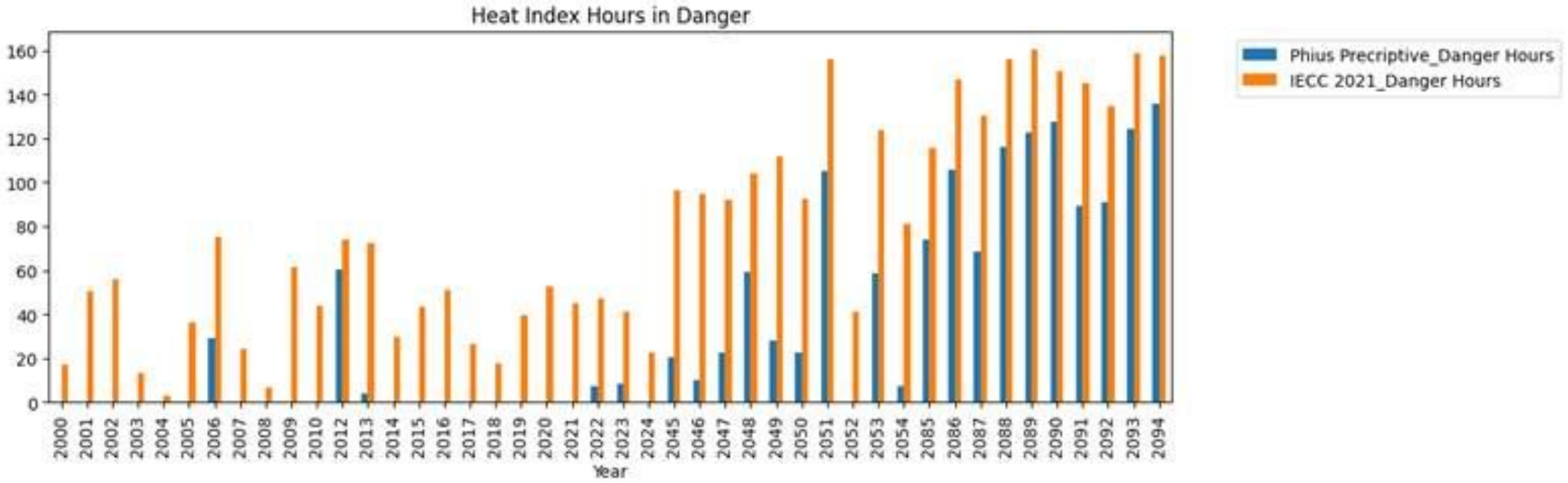
Future Applications to Passive Building

Passive Buildings Decouple Environments

- Building envelope lasts longer than systems
- Well air sealed and insulated envelopes decouple buildings from the exterior environment
- EUI 35.3% lower than IECC 2021
  - SD 0.627 vs 3.46

Impact on Energy




Heat Index Hours in Danger
160
140
120
100
80
60
40
20
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2012
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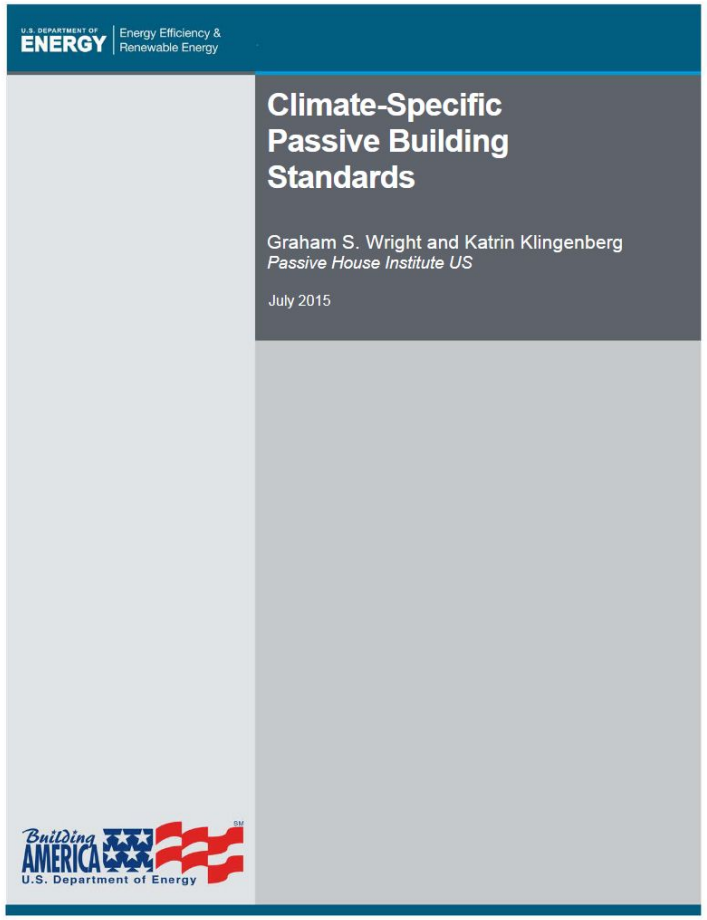
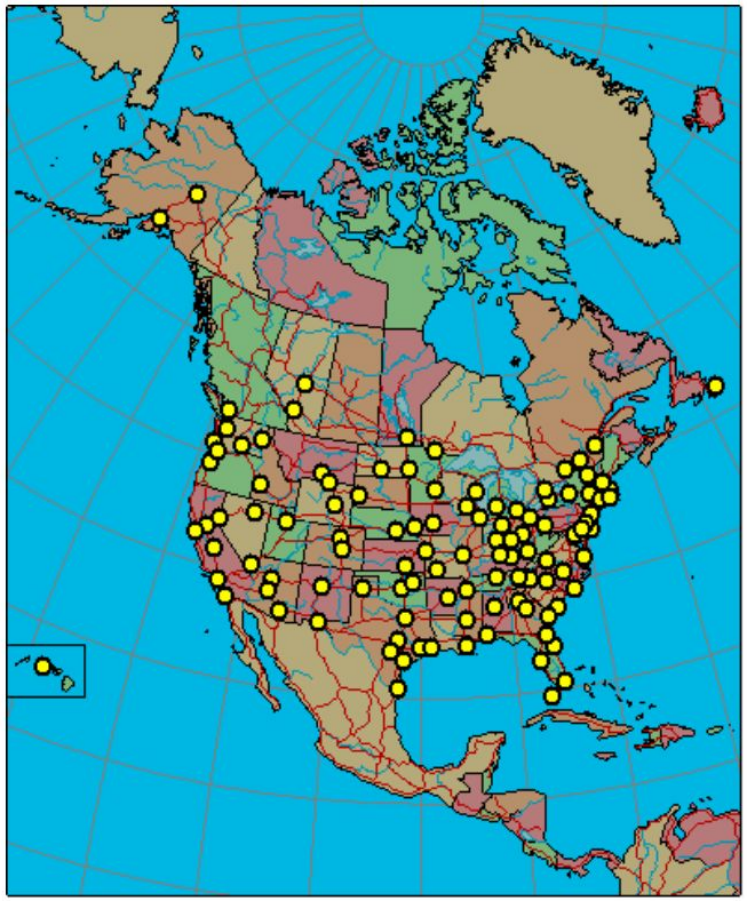
2092
2093
2094
Year
Phius Precriptive_Danger Hours
IECC 2021_Danger Hours

201 - Phius and Climate Data

Does Climate Influence Work at Phius?

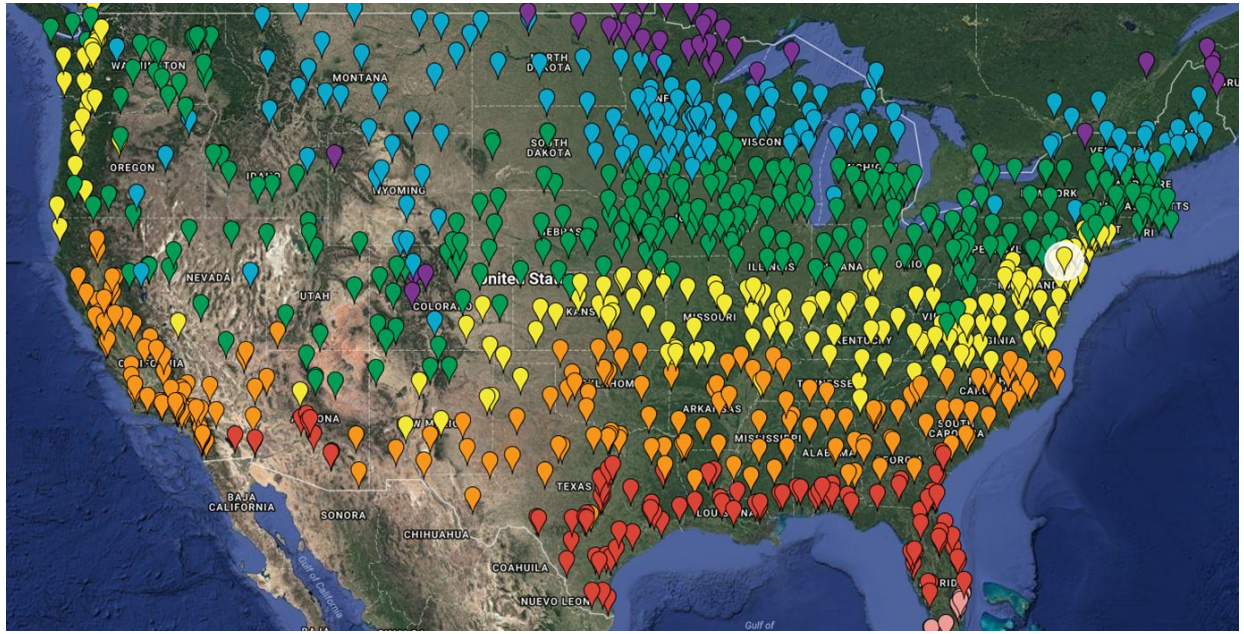




YES!

- Phius has been a climate specific standard since PHIUS+2015
- Targets were “just beyond the knee of efficiency” for cost for 111 climate locations

Beyond PHIUS+2015



Phius Prescriptive Climate Map

- Phius prescriptive climate map shows all locations with existing weather data ~1200
- Underlying study is ~340 optimization models
- Database includes US and Canada

Meteonorm

Phius uses Meteonorm for all climate data

- Generates custom climate data
- Interpolate between weather station
- Produce extreme and future weather data
- Convert from TMY formatted to WUFI Passive

Climate Impact on Targets

A-1.1 Annual Heating Demand [kBtu/ft^2.yr]

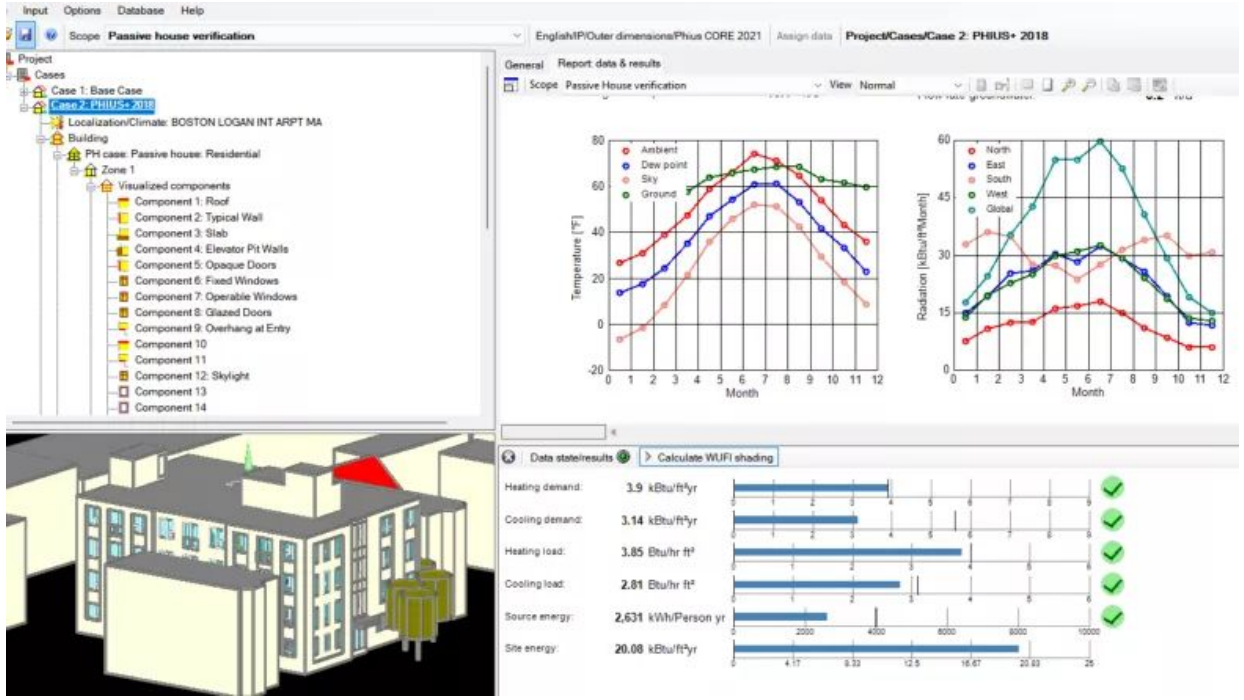
A-1.1.1 Buildings (>1,000 sf iCFA)

2.5457921063
+ 0.0006964273 • HDD65
+ -0.001754101 • IGA
+ -12.84284075 • $elec
+ 2.0656632454 • EnvFlr
+ 1566.1974476 • UnitDens
+ (HDD65 - 5674.3866667) • (HDD65 - 5674.3866667) • -8.222261e-8)
+ (HDD65 - 5674.3866667) • (IGA - 1451.0633333) • -3.521982e-7)
+ (HDD65 - 5674.3866667) • (($elec - 0.2029193333) • -0.002089994)
+ (HDD65 - 5674.3866667) • ((EnvFlr - 1.7740848024) • 0.0003487784)
+ ($elec - 0.2029193333) • ((EnvFlr - 1.7740848024) • -3.472274709)

Guidebook Appendix A

- Detailed equations behind Phius targets are published in App A
- Climate data from database is used in calculations

Climate Data and WUFI Passive



WUFI Passive

- Steady state monthly climate data
  - All data is average for the month
- Import or manually enter into WUFI
- Data is plotted in Localization/Climate tab

Phius Excel Climate Format

Passive House Planning

OFFICIAL CLIMATE DATA SET

METRIC:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (m):	186.0	0	Daily temperature variation summer (K)		8.7	Radiation Data:	kWh/(m²*month)	Radiation: W/m²		W/m²
Ambient Temp (°C)	-5.7	-1.8	4.9	11.2	13.9	21.4	25.2	24.2	21.2	13.5	8.6	-0.8	-20.5	-7.6	28.7
North	24.0	27.0	33.0	38.0	55.0	60.0	64.0	48.0	35.0	26.0	20.0	19.0	47.0	29.0	76.0
East	53.0	61.0	80.0	93.0	109.0	115.0	135.0	118.0	101.0	75.0	67.0	52.0	128.0	52.0	152.0
South	89.0	90.0	89.0	75.0	82.0	75.0	85.0	95.0	109.0	98.0	117.0	101.0	232.0	62.0	99.0
West	35.0	41.0	48.0	61.0	86.0	88.0	89.0	82.0	69.0	45.0	35.0	31.0	85.0	34.0	101.0
Global	51.0	62.0	91.0	120.0	169.0	179.0	190.0	165.0	133.0	87.0	69.0	50.0	120.0	51.0	210.0
Dewpoint	-10.8	-6.8	-1.2	5.9	6.9	13.9	16.0	17.0	14.8	6.6	0.9	-6.0			
Sky temperature	-28.9	-18.8	-13.1	-5.4	-2.3	3.9	8.3	9.3	4.9	-3.9	-9.9	-23.3			

US CUSTOMARY:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (ft):	610.2	0	Daily temperature variation summer (F)		15.7	Radiation Data:	kBTU/(ft².month)	Radiation: BTU/hr.ft²		BTU/hr.ft²
Ambient Temp (°F)	21.7	28.8	40.8	52.2	57.0	70.5	77.4	75.6	70.2	56.3	47.5	30.6	-4.9	18.3	83.7
North	7.6	8.6	10.5	12.0	17.4	19.0	20.3	15.2	11.1	8.2	6.3	6.0	14.9	9.2	24.1
East	16.8	19.3	25.4	29.5	34.6	36.5	42.8	37.4	32.0	23.8	21.2	16.5	40.6	16.5	48.2
South	28.2	28.5	28.2	23.8	26.0	23.8	26.9	30.1	34.6	31.1	37.1	32.0	73.5	19.7	31.4
West	11.1	13.0	15.2	19.3	27.3	27.9	28.2	26.0	21.9	14.3	11.1	9.8	26.9	10.8	32.0
Global	16.2	19.7	28.8	38.0	53.6	56.7	60.2	52.3	42.2	27.6	21.9	15.8	38.0	16.2	66.6
Dewpoint	12.6	19.8	29.8	42.6	44.4	57.0	60.8	62.6	58.6	43.9	33.6	21.2			
Sky temperature	-20.0	-1.8	8.4	22.3	27.9	39.0	46.9	48.7	40.8	25.0	14.2	-9.9			

Phius Excel Climate Format

Location Information

Passive House Planning

OFFICIAL CLIMATE DATA SET

METRIC:

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Ambient Temp (°C)	-5.7	-1.8	4.9	11.2	13.9	21.4	25.2	24.2	21.2	13.5	8.6	-0.8	-20.5	-7.6	28.7
North	24.0	27.0	33.0	38.0	55.0	60.0	64.0	48.0	35.0	26.0	20.0	19.0	47.0	29.0	76.0
East	53.0	61.0	80.0	93.0	109.0	115.0	135.0	118.0	101.0	75.0	67.0	52.0	128.0	52.0	152.0
South	89.0	90.0	89.0	75.0	82.0	75.0	85.0	95.0	109.0	98.0	117.0	101.0	232.0	62.0	99.0
West	35.0	41.0	48.0	61.0	86.0	88.0	89.0	82.0	69.0	45.0	35.0	31.0	85.0	34.0	101.0
Global	51.0	62.0	91.0	120.0	169.0	179.0	190.0	165.0	133.0	87.0	69.0	50.0	120.0	51.0	210.0
Dewpoint	-10.8	-6.8	-1.2	5.9	6.9	13.9	16.0	17.0	14.8	6.6	0.9	-6.0			
Sky temperature	-28.9	-18.8	-13.1	-5.4	-2.3	3.9	8.3	9.3	4.9	-3.9	-9.9	-23.3			

US CUSTOMARY:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (ft):	610.2	0	Daily temperature variation summer (F)		15.7	Radiation Data:	kBTU/(ft².month)	Radiation: BTU/hr.ft²		BTU/hr.ft²
Ambient Temp (°F)	21.7	28.8	40.8	52.2	57.0	70.5	77.4	75.6	70.2	56.3	47.5	30.6	-4.9	18.3	83.7
North	7.6	8.6	10.5	12.0	17.4	19.0	20.3	15.2	11.1	8.2	6.3	6.0	14.9	9.2	24.1
East	16.8	19.3	25.4	29.5	34.6	36.5	42.8	37.4	32.0	23.8	21.2	16.5	40.6	16.5	48.2
South	28.2	28.5	28.2	23.8	26.0	23.8	26.9	30.1	34.6	31.1	37.1	32.0	73.5	19.7	31.4
West	11.1	13.0	15.2	19.3	27.3	27.9	28.2	26.0	21.9	14.3	11.1	9.8	26.9	10.8	32.0
Global	16.2	19.7	28.8	38.0	53.6	56.7	60.2	52.3	42.2	27.6	21.9	15.8	38.0	16.2	66.6
Dewpoint	12.6	19.8	29.8	42.6	44.4	57.0	60.8	62.6	58.6	43.9	33.6	21.2			
Sky temperature	-20.0	-1.8	8.4	22.3	27.9	39.0	46.9	48.7	40.8	25.0	14.2	-9.9			

Phius Excel Climate Format

Temperature and Dewpoint

Passive House Planning

OFFICIAL CLIMATE DATA SET

METRIC:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (m):	186.0	0	Daily temperature variation summer (K)		8.7	Radiation Data:	kWh/(m²*month)	Radiation: W/m²		W/m²
Ambient Temp (°C)	-5.7	-1.8	4.9	11.2	13.9	21.4	25.2	24.2	21.2	13.5	8.6	-0.8	-20.5	-7.6	28.7
North	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47.0	29.0	76.0
East	53.0	61.0	80.0	93.0	109.0	115.0	135.0	118.0	101.0	75.0	67.0	52.0	128.0	52.0	152.0
South	89.0	90.0	89.0	75.0	82.0	75.0	85.0	95.0	109.0	98.0	117.0	101.0	232.0	62.0	99.0
West	35.0	41.0	48.0	61.0	86.0	88.0	89.0	82.0	69.0	45.0	35.0	31.0	85.0	34.0	101.0
Global	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120.0	51.0	210.0
Dewpoint	-10.8	-6.8	-1.2	5.9	6.9	13.9	16.0	17.0	14.8	6.6	0.9	-6.0			
Sky temperature	-28.9	-18.8	-13.1	-5.4	-2.3	3.9	8.3	9.3	4.9	-3.9	-9.9	-23.3			

US CUSTOMARY:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (ft):	610.2	0	Daily temperature variation summer (F)		15.7	Radiation Data:	kBTU/(ft² month)	Radiation: BTU/hr.ft²		BTU/hr.ft²
Ambient Temp (°F)	21.7	28.8	40.8	52.2	57.0	70.5	77.4	75.6	70.2	56.3	47.5	30.6	-4.9	18.3	83.7
North	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.9	9.2	24.1
East	16.8	19.3	25.4	29.5	34.6	36.5	42.8	37.4	32.0	23.8	21.2	16.5	40.6	16.5	48.2
South	28.2	28.5	28.2	23.8	26.0	23.8	26.9	30.1	34.6	31.1	37.1	32.0	73.5	19.7	31.4
West	11.1	13.0	15.2	19.3	27.3	27.9	28.2	26.0	21.9	14.3	11.1	9.8	26.9	10.8	32.0
Global	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	38.0	16.2	66.6
Dewpoint	12.6	19.8	29.8	42.6	44.4	57.0	60.8	62.6	58.6	43.9	33.6	21.2			
Sky temperature	-20.0	-1.8	8.4	22.3	27.9	39.0	46.9	48.7	40.8	25.0	14.2	-9.9			

Phius Excel Climate Format

Radiation

Passive House Planning

OFFICIAL CLIMATE DATA SET

METRIC:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (m):	186.0	0	Daily temperature variation summer (K)		8.7	Radiation Data:	kWh/(m²*month)	Radiation: W/m²		W/m²
Ambient Temp (°C)	-5.7	-1.8	4.9	11.2	13.9	21.4	25.2	24.2	21.2	13.5	8.6	-0.8	-20.5	-7.6	28.7
North	24.0	27.0	33.0	38.0	55.0	60.0	64.0	48.0	35.0	26.0	20.0	19.0	47.0	29.0	76.0
East	53.0	61.0	80.0	93.0	109.0	115.0	135.0	118.0	101.0	75.0	67.0	52.0	128.0	52.0	152.0
South	89.0	90.0	89.0	75.0	82.0	75.0	85.0	95.0	109.0	98.0	117.0	101.0	232.0	62.0	99.0
West	35.0	41.0	48.0	61.0	86.0	88.0	89.0	82.0	69.0	45.0	35.0	31.0	85.0	34.0	101.0
Global	51.0	62.0	91.0	120.0	169.0	179.0	190.0	165.0	133.0	87.0	69.0	50.0	120.0	51.0	210.0
Dewpoint	-10.8	-6.8	-1.2	5.9	6.9	13.9	16.0	17.0	14.8	6.6	0.9	-6.0			
Sky temperature	-28.9	-18.8	-13.1	-5.4	-2.3	3.9	8.3	9.3	4.9	-3.9	-9.9	-23.3			

US CUSTOMARY:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (ft):	610.2	0	Daily temperature variation summer (F)		15.7	Radiation Data:	kBTU/(ft².month)	Radiation: BTU/hr.ft²		BTU/hr.ft²
Ambient Temp (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-4.9	18.3	83.7
North	7.6	8.6	10.5	12.0	17.4	19.0	20.3	15.2	11.1	8.2	6.3	6.0	14.9	9.2	24.1
East	16.8	19.3	25.4	29.5	34.6	36.5	42.8	37.4	32.0	23.8	21.2	16.5	40.6	16.5	48.2
South	28.2	28.5	28.2	23.8	26.0	23.8	26.9	30.1	34.6	31.1	37.1	32.0	73.5	19.7	31.4
West	11.1	13.0	15.2	19.3	27.3	27.9	28.2	26.0	21.9	14.3	11.1	9.8	26.9	10.8	32.0
Global	16.2	19.7	28.8	38.0	53.6	56.7	60.2	52.3	42.2	27.6	21.9	15.8	38.0	16.2	66.6
Dewpoint	12.6	19.8	29.8	42.6	44.4	57.0	60.8	62.6	58.6	43.9	33.6	21.2			
Sky temperature	-20.0	-1.8	8.4	22.3	27.9	39.0	46.9	48.7	40.8	25.0	14.2	-9.9			

Phius Excel Climate Format

Sizing Data

Passive House Planning

OFFICIAL CLIMATE DATA SET

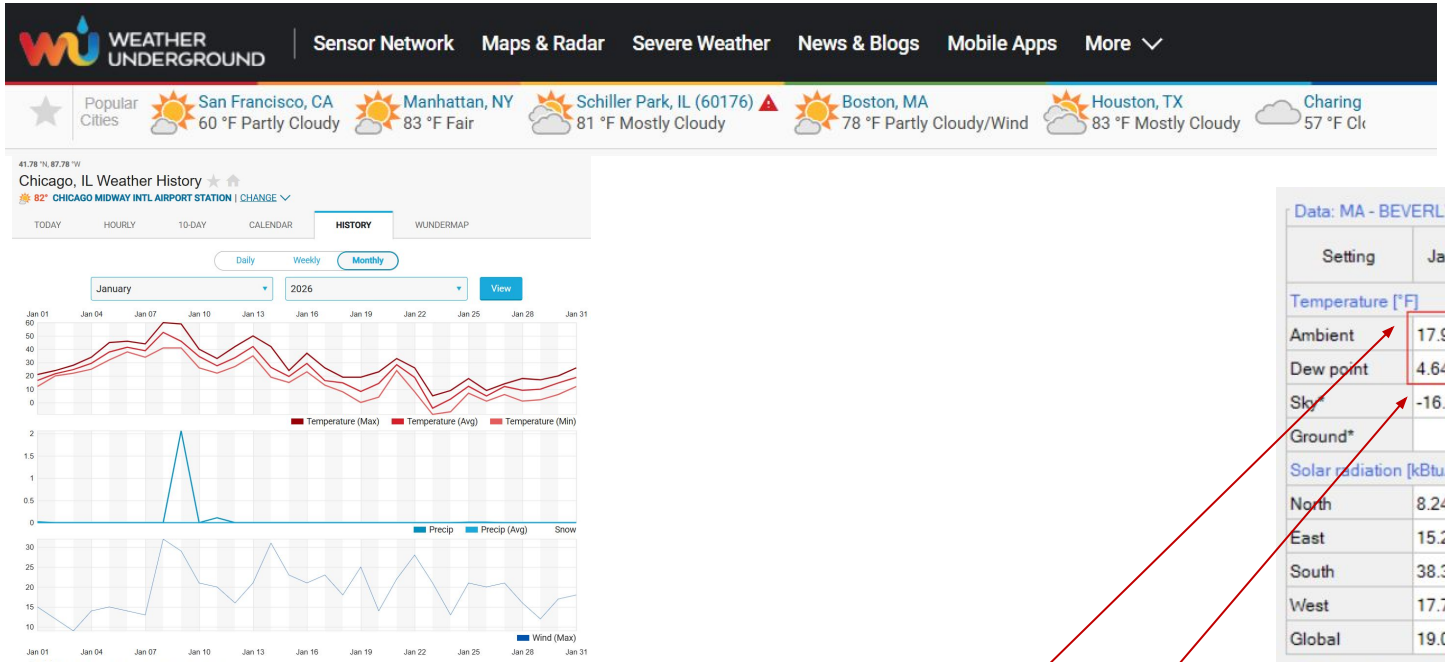
METRIC:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (m):	186.0	0	Daily temperature variation summer (K)		8.7	Radiation Data:	kWh/(m²*month)	Radiation: W/m²		W/m²
Ambient Temp (°C)	-5.7	-1.8	4.9	11.2	13.9	21.4	25.2	24.2	21.2	13.5	8.6	-0.8	-20.5	-7.6	28.7
North	24.0	27.0	33.0	38.0	55.0	60.0	64.0	48.0	35.0	26.0	20.0	19.0	47.0	29.0	76.0
East	53.0	61.0	80.0	93.0	109.0	115.0	135.0	118.0	101.0	75.0	67.0	52.0	128.0	52.0	152.0
South	89.0	90.0	89.0	75.0	82.0	75.0	85.0	95.0	109.0	98.0	117.0	101.0	232.0	62.0	99.0
West	35.0	41.0	48.0	61.0	86.0	88.0	89.0	82.0	69.0	45.0	35.0	31.0	85.0	34.0	101.0
Global	51.0	62.0	91.0	120.0	169.0	179.0	190.0	165.0	133.0	87.0	69.0	50.0	120.0	51.0	210.0
Dewpoint	-10.8	-6.8	-1.2	5.9	6.9	13.9	16.0	17.0	14.8	6.6	0.9	-6.0			
Sky temperature	-28.9	-18.8	-13.1	-5.4	-2.3	3.9	8.3	9.3	4.9	-3.9	-9.9	-23.3			

US CUSTOMARY:

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
CHICAGO MIDWAY AP IL	Latitude:	41.8	Longitude ° East:	-87.8	Altitude (ft):	610.2	0	Daily temperature variation summer (F)		15.7	Radiation Data:	kBTU/(ft².month)	Radiation: BTU/hr.ft²		BTU/hr.ft²
Ambient Temp (°F)	21.7	28.8	40.8	52.2	57.0	70.5	77.4	75.6	70.2	56.3	47.5	30.6	-4.9	18.3	83.7
North	7.6	8.6	10.5	12.0	17.4	19.0	20.3	15.2	11.1	8.2	6.3	6.0	14.9	9.2	24.1
East	16.8	19.3	25.4	29.5	34.6	36.5	42.8	37.4	32.0	23.8	21.2	16.5	40.6	16.5	48.2
South	28.2	28.5	28.2	23.8	26.0	23.8	26.9	30.1	34.6	31.1	37.1	32.0	73.5	19.7	31.4
West	11.1	13.0	15.2	19.3	27.3	27.9	28.2	26.0	21.9	14.3	11.1	9.8	26.9	10.8	32.0
Global	16.2	19.7	28.8	38.0	53.6	56.7	60.2	52.3	42.2	27.6	21.9	15.8	38.0	16.2	66.6
Dewpoint	12.6	19.8	29.8	42.6	44.4	57.0	60.8	62.6	58.6	43.9	33.6	21.2			
Sky temperature	-20.0	-1.8	8.4	22.3	27.9	39.0	46.9	48.7	40.8	25.0	14.2	-9.9			

Actual Data For Calibration



Summary

Temperature (°F)	Max	Average	Min
Max Temperature	60	29.39	5
Avg Temperature	52.67	22.68	-4.3
Min Temperature	41	16.39	-9
Dew Point (°F)	**Max**	**Average**	**Min**
Dew Point	57	12.23	-27

Data: MA - BEVERLY MUNI (Monthly)

Setting	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Heating W. 1	Heating W. 2	Cooling W. 1	Cooling W. 2
Temperature [°F]																
Ambient	17.96	24.08	41	45.86	54.86	63.68	68.54	72.32	62.78	48.92	45.5	32.54	5.54	15.44	80.06	
Dew point	4.64	5.54	29.12	35.78	45.5	55.22	58.28	62.24	50.36	39.56	33.62	24.26				
Sky*	-16.6	-15.7	14.72	23.72	34.34	46.76	49.46	53.78	40.28	27.5	21.2	8.78				
Ground*																
Solar radiation [kBtu/ft²Month]													Solar radiation [Btu/hr ft²]			
North	8.24196	9.82695	15.2159	13.3139	15.5329	16.1669	16.8009	14.5819	10.4609	7.60796	5.70597	5.70597	12.67993	10.14395	20.28789	
East	15.2159	18.0689	29.1638	24.4088	27.5788	24.4088	28.8468	29.7978	23.4578	15.5329	12.3629	10.1439	25.35986	15.21592	46.59875	
South	38.3567	33.6018	40.5757	26.9448	23.4578	21.2388	23.4578	32.9678	32.9678	27.2618	25.6768	24.0918	71.32462	33.28482	51.03673	
West	17.7519	18.7029	27.5788	23.4578	25.9938	26.9448	28.2128	32.9678	23.7748	15.8499	10.4609	9.82695	29.48084	16.48391	51.98772	
Global	19.0199	21.8728	36.7718	38.6737	46.5987	47.2327	50.7197	56.1087	39.3077	24.4088	16.1669	12.6799	31.38283	19.97089	86.85754	

* Optional input, Sky/Ground: if not defined, temperatures will be estimated)

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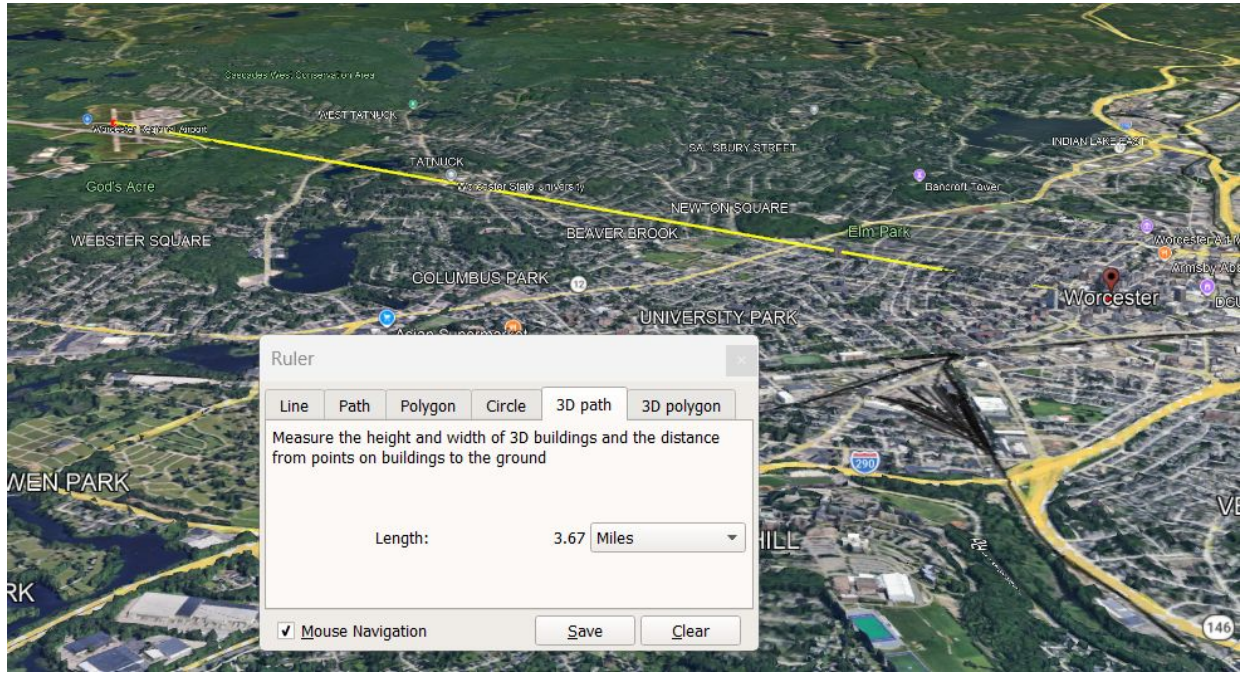
Sizing Data Comparison

	Heating				Cooling		
	ASHRAE		Phius		ASHRAE		Phius
Parameter	99.6%	99.0%	Weather 1	Weather 2	0.4%	1.0%	Cooling Load
Drybulb Temperature °F	1.04	6.26	-4.9	18.3	91.76	89.6	83.7
Wetbulb Temperature °F	1.04	6.26	?	?	73.94	72.68	?
Global Radiation Btu/hr ft2	0?	0?	38	16.2	?	?	66.6
Wind Speed MPH	10.5	10.5	9?	9?	23.5	12.3	9?

Custom Climate Data



When is it required

- > 50 linear miles away
  - and / or
- > 400 ft of elevation difference

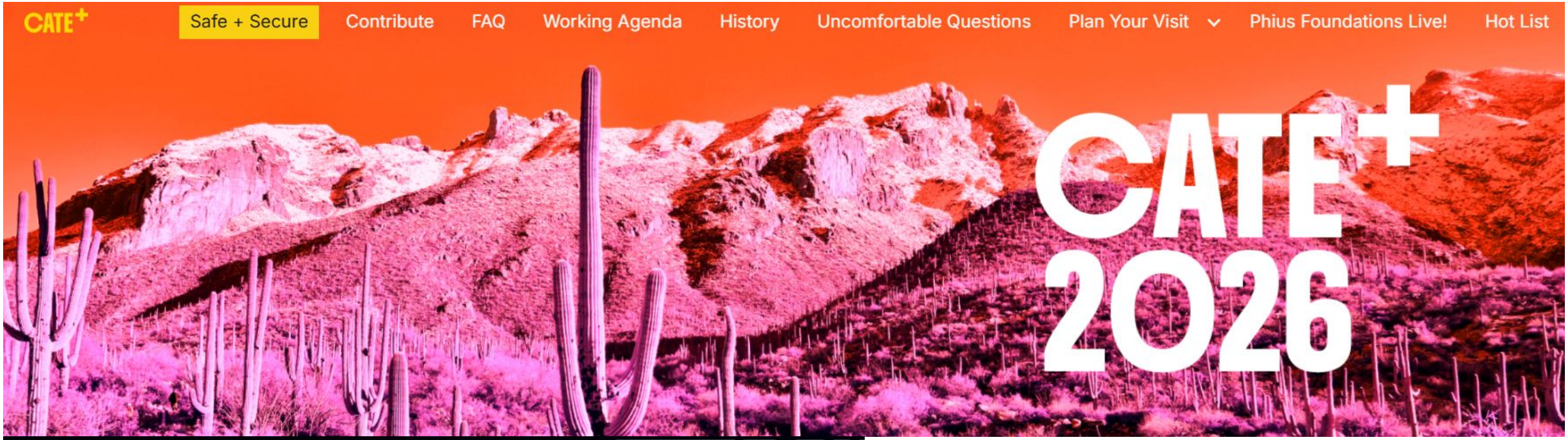
Lapse Rate:

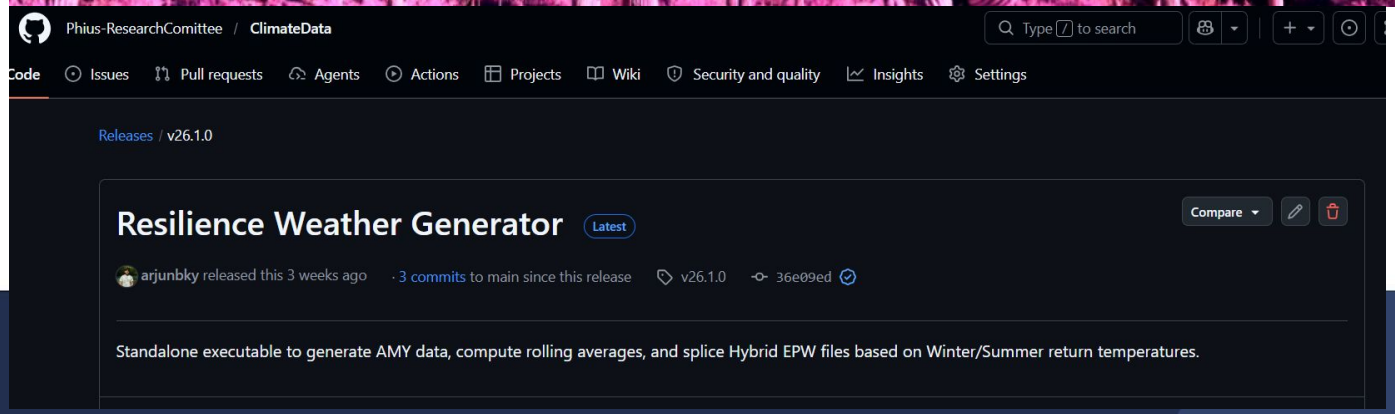
3.56°F / 1000 ft

Summary

- Designers have the biggest impact on how the building interacts with climate
  - Opaque Envelope
  - Glazing
  - Heat exchange with outside (heat pumps, ventilation)
- Many sources for historic, contemporary, and future data
  - What research question are you considering?
  - What format do you need it in?
  - Is this source produced by the best scientific knowledge available?
  - Consider running multiple sources and years
- Phius monthly data is good for hand calculations
- Use actual data for model calibration

CATE 2026 & Phius Foundations Live
May 27-29





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Questions?

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Event Approved for Phius CEUs

April Webinar: Climate and Weather Data

Earn 1.0 CEU

26109

5-Digit Self Report Code

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