ASHRAE Climatic Data Activities

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ASHRAE

- American Society of Heating Refrigerating and Air-Conditioning Engineers
- >50,000 members
- Major products:
  - Handbooks (Fundamentals, Systems and Equipment, Refrigeration, Applications)
  - Standards
- More than 100 Technical Committees and Standards Committees composed of volunteers who write the handbooks, standards, and manage research projects.
- Climatic data required for ASHRAE member's use is created in TC 4.2 and SSPC 169.

ASHRAE Technical Committee 4.2
Climatic Information

Scope:

TC 4.2 is concerned with identification, analysis and tabulation of climatic data for use in analysis and design of heating, refrigeration, ventilation and air-conditioning systems. Promotion of effective use of weather information in these applications is also included.

Committee members includes meteorologists, data suppliers and users (engineers, energy simulation)

TC 4.2 Major Products

- Chapter 14 ASHRAE 2009 Handbook Fundamentals which Climatic Design Conditions for more than 5,500 locations throughout the world.
- Recent research projects (competitive solicitation):
  - New climatic design conditions for 2013 Handbook
  - International Weather data for Energy Calculations (more than 3200 ‘typical’ hourly data files for use in energy simulation – all outside US and Canada)
  - Macroclimatic – regional models
  - Data filling for sparse data sets

Standing Standards Project Committee 169 Weather Data for Building Design Standards

- **PURPOSE:** This standard provides recognized weather data for use in building-design and related equipment standards.

- **SCOPE:**
  - This standard covers weather data used in ASHRAE standards, including dry-bulb, dew-point and wet-bulb temperatures, enthalpy, humidity ratio, wind conditions, solar irradiation, latitude, longitude, and elevation for locations worldwide.
  - This standard also includes statistical data such as mean temperatures, average temperatures, mean/median annual extremes, daily ranges, heating and cooling degree days and degree hours, and hours and seasonal percentages within ranges of temperatures as well as bins.

- **Publications:**
  - **ANSI/ASHRAE Standard 169-2006** - Published standard.
    Weather Data for Building Design Standards
  - Major update under way to incorporate new data from 2009 Handbook and other sources

- Climatic Design Conditions are at the core of TC 4.2 and Standard 169
- These data are calculated for 20-30 years of weather conditions
- Primary data source is the National Climatic Data Center, which houses a WMO data repository for the entire world
  - Integrated Surface Hourly 1986-2010
  - Stations in all countries (including Canada and USA)
- Stations in Canada: GRP118 Data Set 1986-2010

TABLE A1 Design Conditions for Atlanta, GA, USA (SI Units)

Station Information

Station name	WMO#	Lat	Long	Elev	StdP	Hours +/- UTC	Time zone code	Period
1a	1b	1c	1d	1e	1f	1g	1h	1i
ATLANTA	**722190**	**33.65N**	**84.42W**	**315**	**97.60**	**-5.00**	**NAE**	**7201**

Annual Heating and Humidification Design Conditions

Coldest month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB	
			99.6%			99%			0.4%		1%			
	99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD
2	3a	3b	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	6a	6b
1	**-7.3**	**-4.5**	**-16.7**	**0.9**	**-4.0**	**-14.1**	**1.2**	**-1.7**	**11.7**	**2.5**	**10.8**	**3.0**	**5.3**	**320**

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest month	Hottest month DB range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%			
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
7	8	9a	9b	9c	9d	9e	9f	10a	10b	10c	10d	10e	10f	11a	11b
7	**9.7**	**34.4**	**23.8**	**33.1**	**23.5**	**31.8**	**23.1**	**25.2**	**31.4**	**24.6**	**30.4**	**24.0**	**29.5**	**4.0**	**300**

Dehumidification DP/MCDB and HR									Enthalpy/MCDB					
0.4%			1%			2%			0.4%		1%		2%	
DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB
12a	12b	12c	12d	12e	12f	12g	12h	12i	13a	13b	13c	13d	13e	13f
23.5	**19.0**	**27.8**	**22.9**	**18.4**	**26.9**	**22.4**	**17.8**	**26.5**	**78.4**	**31.5**	**75.9**	**30.6**	**73.7**	**29.8**

Extreme Annual Design Conditions

Extreme Annual WS			Extreme Max WB	Extreme Annual DB				n-Year Return Period Values of Extreme DB							
				Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years	
1%	2.5%	5%		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
14a	14b	14c	15	16a	16b	16c	16d	17a	17b	17c	17d	17e	17f	17g	17h
9.8	**8.6**	**7.8**	**28.9**	**35.8**	**-11.8**	**2.0**	**3.9**	**37.2**	**-14.6**	**38.4**	**-16.9**	**39.5**	**-19.1**	**41.0**	**-21.9**

Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperatures

%	Jan		Feb		Mar		Apr		May		Jun	
	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB
	18a	18b	18c	18d	18e	18f	18g	18h	18i	18j	18k	18l
0.4%	**21.2**	**15.2**	**23.5**	**14.9**	**27.1**	**16.9**	**29.8**	**18.7**	**32.0**	**22.2**	**34.8**	**23.3**
1%	**19.8**	**14.8**	**22.2**	**14.6**	**25.9**	**16.4**	**28.9**	**18.0**	**31.0**	**21.4**	**33.9**	**23.0**
2%	**18.5**	**14.5**	**20.9**	**14.7**	**24.8**	**15.6**	**27.9**	**17.5**	**30.2**	**20.9**	**33.2**	**22.8**

%	Jul		Aug		Sep		Oct		Nov		Dec	
	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB
	18m	18n	18o	18p	18q	18r	18s	18t	18u	18v	18w	18x
0.4%	**36.8**	**24.3**	**35.8**	**24.0**	**33.5**	**23.2**	**28.6**	**20.5**	**25.3**	**17.8**	**22.2**	**17.2**
1%	**35.8**	**24.1**	**34.7**	**24.0**	**32.4**	**23.1**	**27.7**	**19.9**	**24.1**	**17.2**	**21.2**	**16.8**
2%	**34.9**	**24.0**	**33.8**	**23.8**	**31.5**	**22.7**	**26.8**	**19.1**	**23.2**	**16.6**	**19.9**	**16.0**

Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperatures

%	Jan		Feb		Mar		Apr		May		Jun	
	WB	MCDB	WB	MCDB	WB	MCDB	WB	MCDB	WB	MCDB	WB	MCDB
	19a	19b	19c	19d	19e	19f	19g	19h	19i	19j	19k	19l
0.4%	**17.6**	**19.1**	**18.4**	**19.7**	**19.1**	**22.9**	**21.4**	**25.8**	**23.8**	**28.8**	**25.1**	**31.4**
1%	**16.8**	**18.5**	**17.6**	**19.8**	**18.4**	**22.2**	**20.5**	**24.9**	**23.2**	**28.6**	**24.6**	**30.8**
2%	**15.9**	**17.7**	**16.8**	**19.2**	**17.9**	**21.9**	**19.9**	**24.2**	**22.6**	**28.0**	**24.1**	**30.1**

%	Jul		Aug		Sep		Oct		Nov		Dec	
	WB	MCDB	WB	MCDB	WB	MCDB	WB	MCDB	WB	MCDB	WB	MCDB
	19m	19n	19o	19p	19q	19r	19s	19t	19u	19v	19w	19x
0.4%	**26.7**	**33.8**	**25.8**	**32.0**	**24.9**	**30.4**	**22.4**	**26.1**	**20.1**	**22.5**	**19.0**	**20.6**
1%	**25.9**	**32.5**	**25.3**	**31.6**	**24.2**	**29.3**	**21.6**	**25.1**	**19.6**	**21.9**	**18.0**	**19.7**
2%	**25.5**	**31.8**	**25.0**	**31.1**	**23.9**	**28.8**	**21.0**	**24.3**	**19.0**	**21.2**	**17.2**	**18.9**

Monthly Mean Daily Temperature Range

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20a	20b	20c	20d	20e	20f	20g	20h	20i	20j	20k	20l
9.6	**10.6**	**11.2**	**11.6**	**10.6**	**10.0**	**9.7**	**9.3**	**9.3**	**10.5**	**10.3**	**9.6**

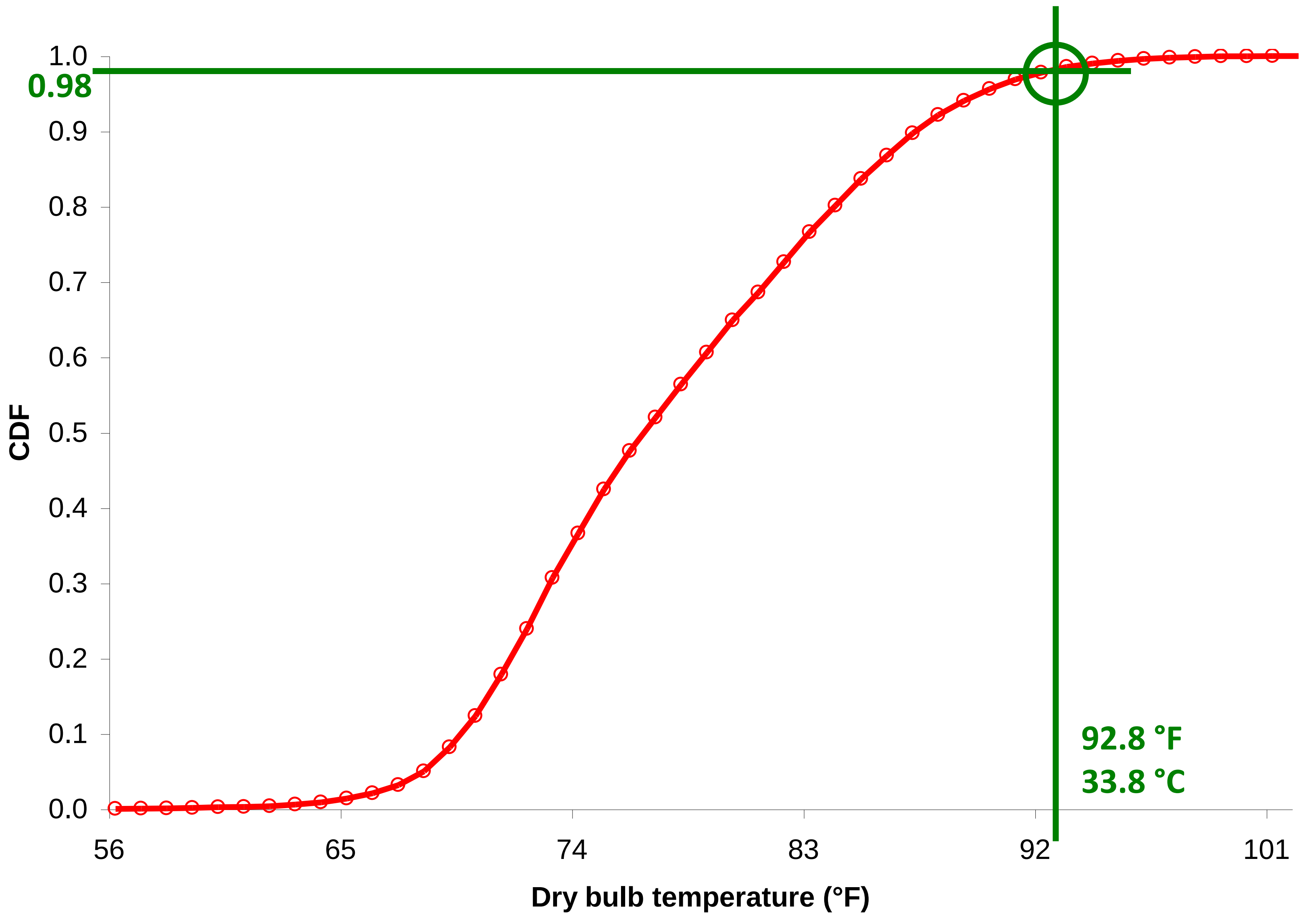
WMO#	World Meteorological Organization number	Lat	Latitude, °	Long	Longitude, °
Elev	Elevation, m	StdP	Standard pressure at station elevation, kPa		
DB	Dry bulb temperature, °C	DP	Dew point temperature, °C	WB	Wet bulb temperature, °C
WS	Wind speed, m/s	Enth	Enthalpy, kJ/kg	HR	Humidity ratio, grams of moisture per kilogram of dry air
MCDB	Mean coincident dry bulb temperature, °C	MCWB	Mean coincident wet bulb temperature, °C	MCWS	Mean coincident wind speed, m/s
PCWD	Prevailing coincident wind direction, °, 0 = North, 90 = East				

Simple design conditions

- *x*% design condition = ‘cond. exceeded x% of time’
- Annual design conditions
  - *99.6% and 99% heating dry bulb temperature,*
  - *0.4%, 1% and 2% cooling dry bulb temperature,*
  - *0.4%, 1% and 2% evaporation wet bulb temperature,*
  - *0.4%, 1% and 2% dehumidification dew point temperature,*
  - **99.6% and *99% humidification dew point temperature,*
  - **0.4%, *1% and *2% enthalpy.*
- Monthly design conditions
  - *0.4% and 1% wind speed for the coldest month,*
  - *0.4%, 1% and 2% dry bulb temperature for all months,*
  - *0.4%, 1% and 2% wet bulb temperature for all months.*

Calculation: simple conditions

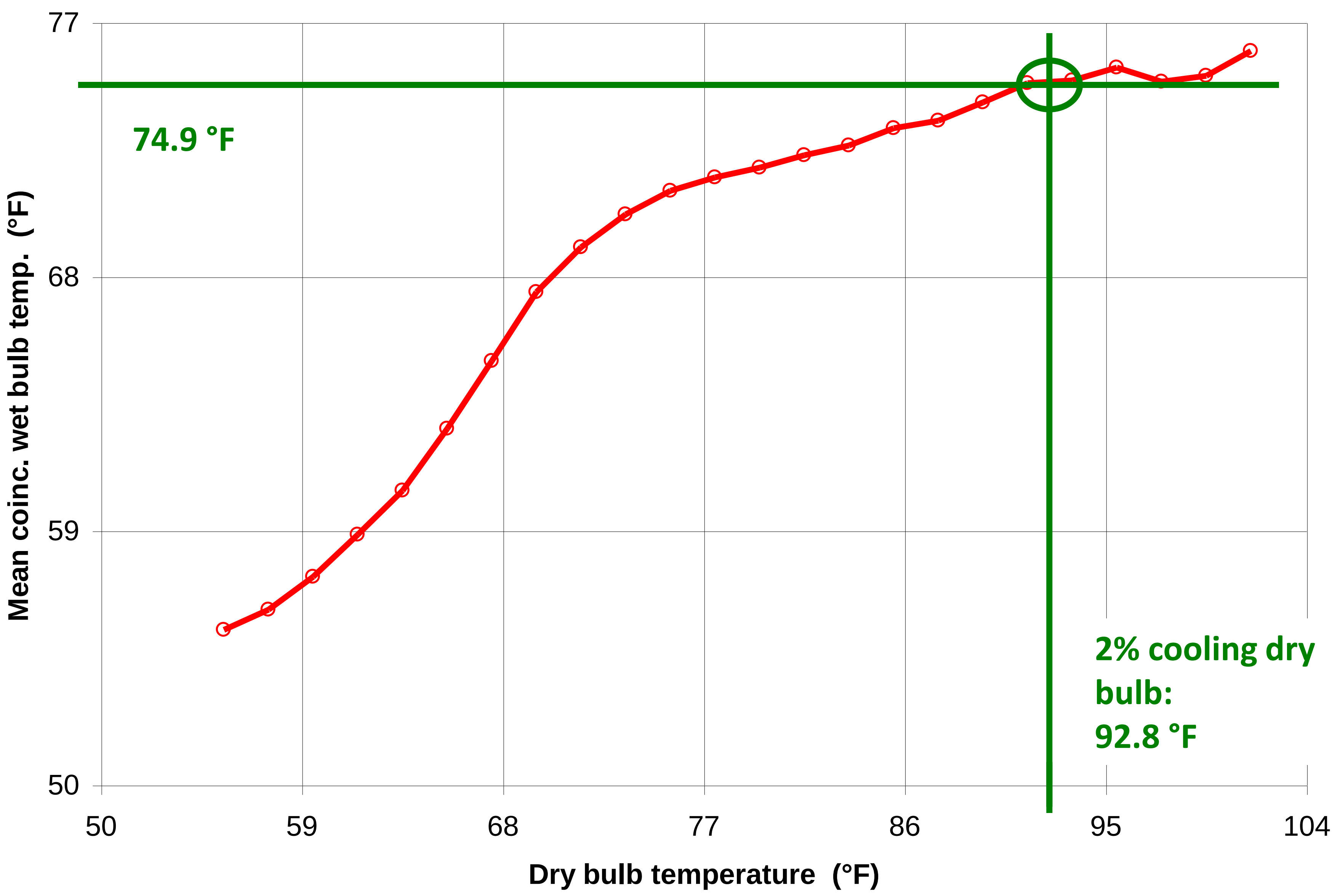
- Data read from original file
- Outliers eliminated
- Time series filled by linear interpolation
  (dry bulb & dew point temperatures only)
- Months included in the analysis only if complete enough
- Data sorted by bins to create ***frequency vector***
- Frequency vector summed to calculate ***cumulative frequency distribution function***
- Example: 2% cooling dry bulb temperature
  Atlanta, GA, for the month of August



1.0
0.98
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
CDF
56
65
74
83
92
101
Dry bulb temperature (°F)
92.8 °F
33.8 °C

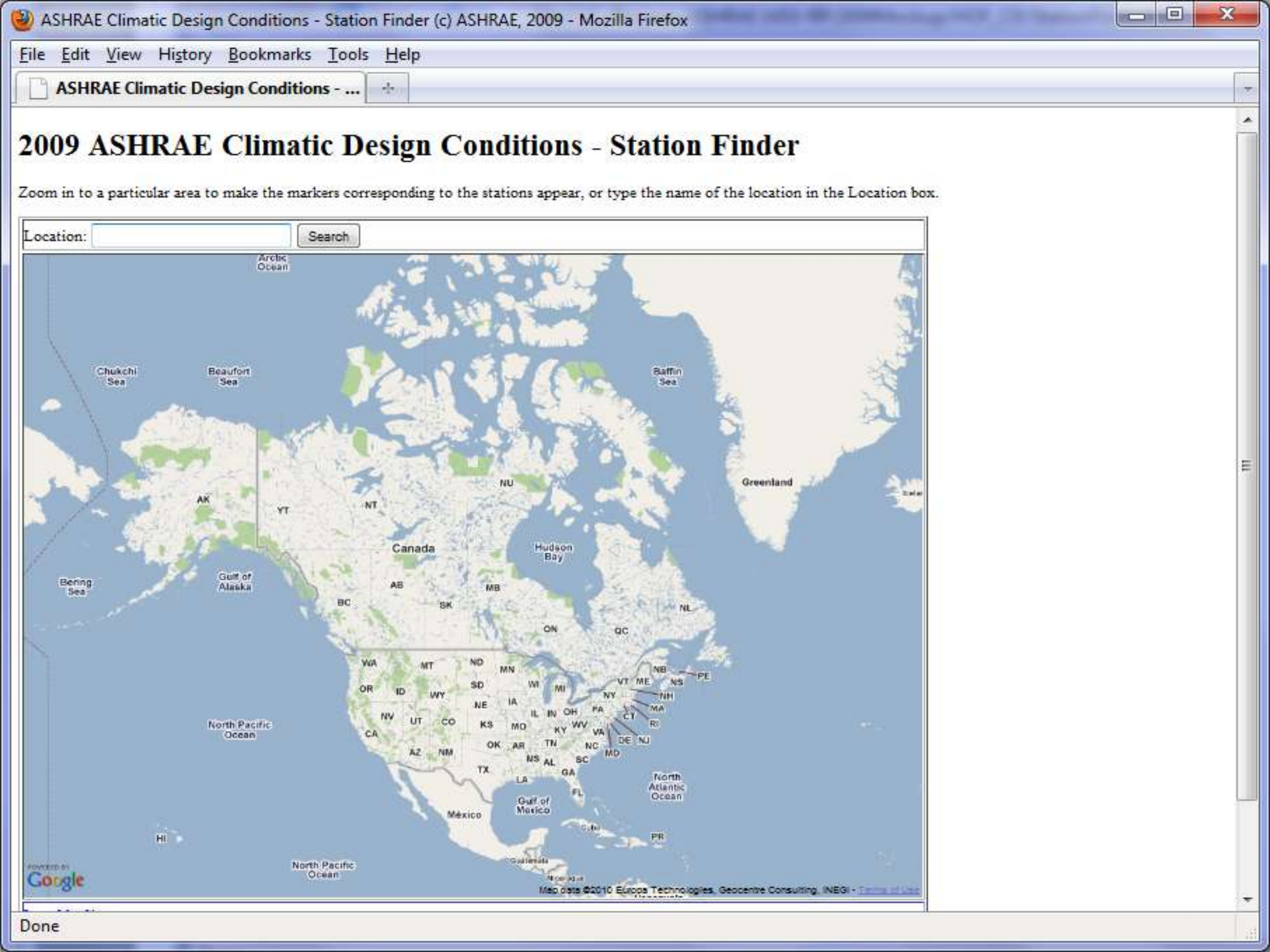
Coincident design conditions

- Annual design conditions
  - *mean wet bulb temperature coincident with the 0.4%, 1% and 2% yearly cooling dry bulb temperatures;*
  - *mean wind speed coincident with the 99.6% and 0.4% yearly dry bulb temperatures;*
  - *etc…*
- Monthly design conditions
  - *mean wet bulb temperature coincident with the 0.4%, 1% and 2% dry bulb temperatures, for all months;*
  - *etc…*


77
68
59
50
50
59
68
77
86
95
104
Mean coinc. wet bulb temp. (°F)
Dry bulb temperature (°F)
74.9 °F
2% cooling dry bulb:
92.8 °F

Other elements calculated

- Coldest and Hottest Months
- Mean and Standard Deviation of Extreme Annual Dry Bulb Temperature
- Monthly Mean Daily Dry Bulb Temperature Range
- Extreme Maximum Wet Bulb Temperature
- Degree days to any base
- Clear sky irradiance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2009 ASHRAE Climatic Design Conditions - Station Finder
Zoom in to a particular area to make the markers corresponding to the stations appear, or type the name of the location in the Location box.
Location:
Search
Arctic Ocean
Chukchi Sea
Beaufort Sea
Baffin Sea
Greenland
Canada
Hudson Bay
Bering Sea
Gulf of Alaska
North Pacific Ocean
North Atlantic Ocean
Gulf of Mexico
México
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Done

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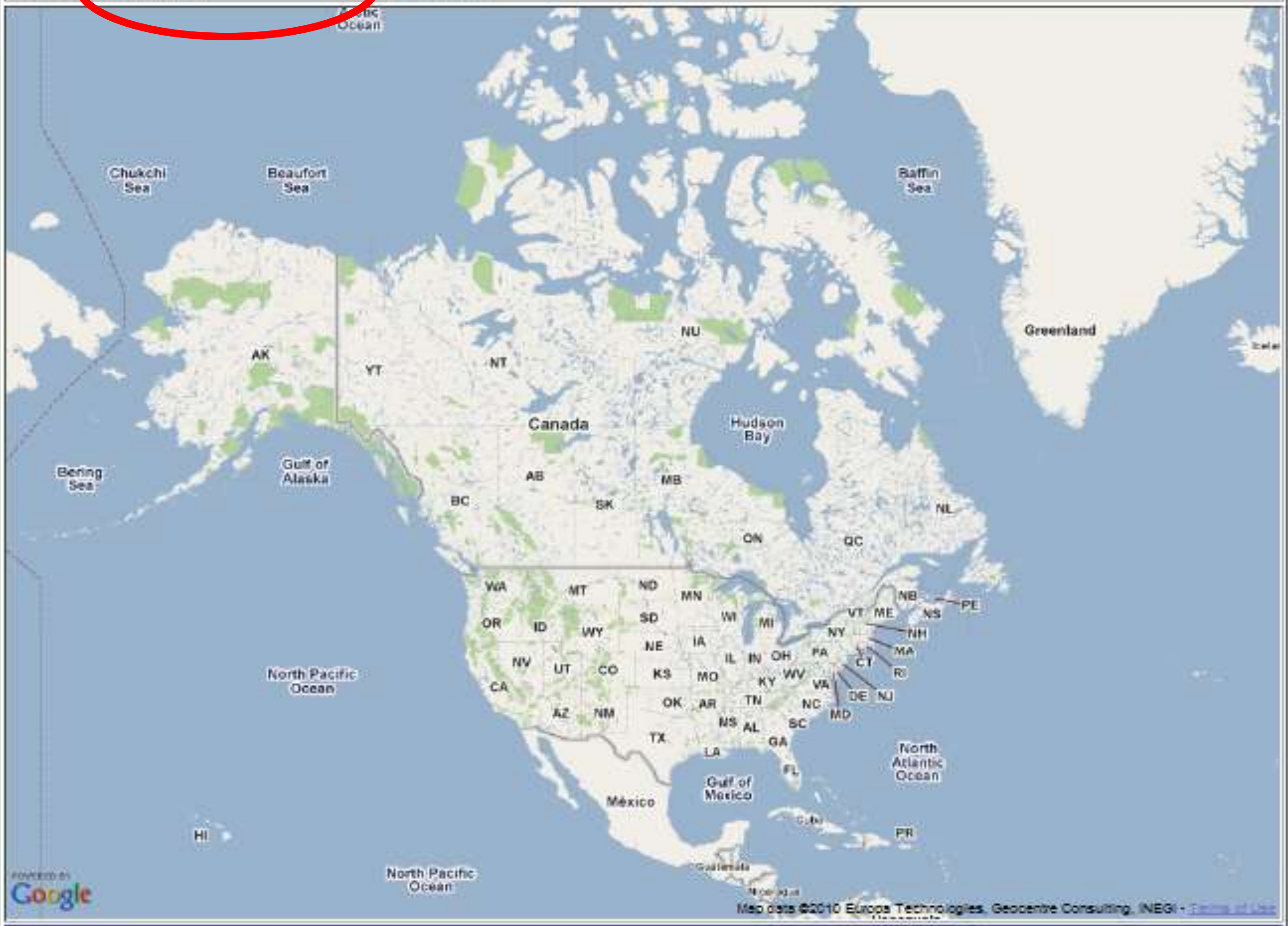
ASHRAE Climatic Design Conditions - ...

2009 ASHRAE Climatic Design Conditions - Station Finder

Zoom in to a particular area to make the markers corresponding to the stations appear, or type the name of the location in the Location box.

Location: Atlanta, GA Search



Done

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ASHRAE Climatic Design Conditions - ...

2009 ASHRAE Climatic Design Conditions - Station Finder

Zoom in to a particular area to make the markers corresponding to the stations appear, or type the name of the location in the Location box.

Location: Atlanta, GA [Search]

Done

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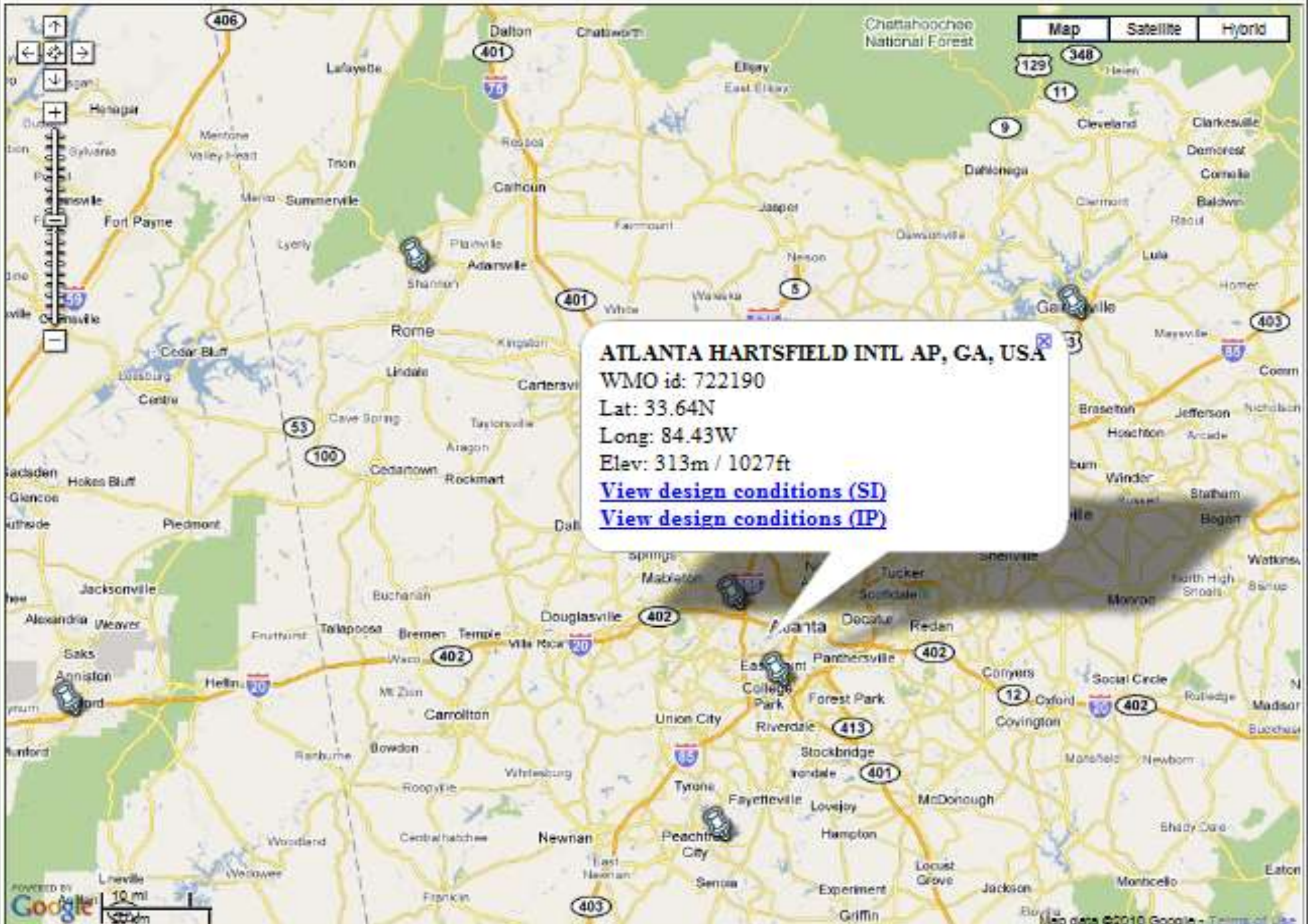
ASHRAE Climatic Design Conditions - ...

2009 ASHRAE Climatic Design Conditions - Station Finder

Zoom in to a particular area to make the markers corresponding to the stations appear, or type the name of the location in the Location box.

Location: Atlanta, GA Search



Done

ATLANTA HARTSFIELD INTL AP, GA, USA

WMO#: 722190

Lat: 33.64N Long: 84.43W Elev: 313 StdP: 97.62 Time Zone: -5.00 (NAE) Period: 82-06 WBAN: 13874

Annual Heating and Humidification Design Conditions

Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB	
			99.6%			99%			0.4%		1%			
	99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD
1	-6.3	-3.5	-15.8	1.0	-2.6	-12.9	1.3	0.1	11.4	3.0	10.7	3.4	5.3	320

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%			
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
7	9.5	34.4	23.5	33.0	23.3	31.9	23.0	25.1	31.2	24.5	30.3	24.0	29.4	4.0	300

Dehumidification DP/MCDB and HR									Enthalpy/MCDB						Hours 8 to 4 & 12.8/20.6
0.4%			1%			2%			0.4%		1%		2%		
DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB	
23.4	19.0	27.3	22.9	18.3	26.7	22.5	17.8	26.3	77.9	31.3	75.6	30.4	73.5	29.7	813

Extreme Annual Design Conditions

Extreme Annual WS			Extreme Max WB	Extreme Annual DB				n-Year Return Period Values of Extreme DB							
				Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years	
1%	2.5%	5%		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
9.8	8.6	7.7	28.0	-11.2	35.9	4.2	1.8	-14.2	37.2	-16.7	38.2	-19.0	39.2	-22.1	40.6

Monthly Climatic Design Conditions

		Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperatures, Degree-Days and Degree-Hours	Tavg	17.0	6.6	8.8	12.6	16.6	21.2	24.8	26.7	26.2	22.9	17.5	12.4	7.7
	Sd		5.34	5.05	5.00	4.35	3.34	2.52	1.98	2.06	3.24	3.93	4.66	5.20
	HDD10.0	381	132	76	32	4	0	0	0	0	0	2	29	107
	HDD18.3	1497	365	268	185	81	13	1	0	0	6	63	184	331
	CDD10.0	2949	26	41	112	203	348	444	519	501	386	234	101	34
	CDD18.3	1023	0	1	7	29	102	195	261	243	142	37	6	1
	CDH23.3	8753	0	3	53	251	796	1712	2498	2196	1030	196	18	1

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ATLANTA HARTSFIELD INTL AP, GA, USA

WMO#: 722190

Lat: 33.64N Long: 84.43W Elev: 313 StdP: 97.62 Time Zone: -5.00 (NAE) Period: 82-06 WBAN: 13874

Annual Heating and Humidification Design Conditions

Coldest Month	Heating DB 99.6%	Heating DB 99%	Humidification 99.6% DP	99.6% HR	99.6% MCDB	99% DP	99% HR	99% MCDB	Coldest month 0.4% WS	0.4% MCDB	1% WS	1% MCDB	MCWS/PCWD to 99.6% DB MCWS	PCWD
1	-6.3	-3.5	-15.9	1.0	-2.6	-12.9	1.3	0.1	11.4	3.0	10.7	3.4	5.3	320

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest Month	Hottest Month DB Range	Cooling 0.4% DB	0.4% MCWB	1% DB	1% MCWB	2% DB	2% MCWB	Evaporation 0.4% WB	0.4% MCDB	1% WB	1% MCDB	2% WB	2% MCDB	MCWS/PCWD to 0.4% DB MCWS	PCWD
7	9.5	34.4	23.5	33.0	23.3	31.9	23.0	25.1	31.2	24.5	30.3	24.0	29.4	4.0	300

Dehumidification 0.4% DP	0.4% HR	0.4% MCDB	1% DP	1% HR	1% MCDB	2% DP	2% HR	2% MCDB	Enthalpy 0.4% Enth	0.4% MCDB	1% Enth	1% MCDB	2% Enth	2% MCDB	Hours 8 to 4 & 12.8/20.6
23.4	19.0	27.3	22.9	18.3	26.7	22.5	17.9	26.3	77.9	31.3	75.6	30.4	73.6	29.7	813

Extreme Annual Design Conditions

Extreme Annual WS 1%	2.5%	5%	Extreme Max WB	Extreme Annual DB Mean Min	Mean Max	Std. dev. Min	Std. dev. Max	n=5 years Min	Max	n=10 years Min	Max	n=20 years Min	Max	n=50 years Min	Max
9.8	8.6	7.7	28.0	-11.2	35.9	4.2	1.8	-14.2	37.2	-16.7	38.2	-19.0	39.2	-22.1	40.6

Monthly Climatic Design Conditions

			Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperatures, Degree-Days and Degree-Hours	Tavg		17.0	6.0	8.0	12.6	16.6	21.2	24.8	26.7	26.2	22.9	17.5	12.4	7.7
	Sd			5.34	5.06	5.00	4.36	3.34	2.52	1.90	2.06	3.24	3.93	4.90	5.20
	HDD10.0		391	132	76	32	4	0	0	0	0	0	2	29	107
	HDD18.3		1497	365	290	185	81	13	1	0	0	6	63	194	331
	CDD10.0		2949	26	41	112	203	348	444	518	501	386	234	101	34
	CDD18.3		1023	0	1	7	29	102	195	261	243	142	37	6	1
	CDH23.3		8753	0	3	63	251	796	1712	2496	2196	1030	196	18	1
	CDH26.7		3296	0	0	4	46	215	668	1104	894	321	22	1	0
Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperatures	0.4%	DB		21.4	23.2	27.0	29.9	32.3	34.9	36.6	35.7	33.4	28.7	25.6	22.2
		MCWB		15.3	16.1	17.2	18.9	22.1	23.2	23.8	23.8	22.9	21.0	17.9	16.9
	2%	DB		18.8	20.7	24.8	28.0	30.5	33.2	34.8	33.8	31.3	27.1	23.3	20.0
		MCWB		14.8	15.0	15.7	17.9	21.0	22.6	23.8	23.8	22.2	18.8	17.2	16.1
	5%	DB		16.3	18.8	22.9	26.4	29.1	31.8	33.3	32.4	30.0	25.7	21.7	17.9
		MCWB		13.2	14.0	14.8	17.1	20.5	22.3	23.5	23.5	21.8	18.5	16.6	14.8
	10%	DB		14.9	17.0	20.8	24.4	27.6	30.5	31.9	31.1	28.8	24.0	20.0	16.0
		MCWB		11.5	12.8	14.3	16.4	19.8	21.9	23.5	23.1	21.5	18.0	15.8	12.8
Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperatures	0.4%	WB		17.3	18.6	19.3	21.6	23.9	25.0	26.1	25.7	24.8	22.6	20.7	19.0
		MCDB		19.7	19.8	23.2	26.1	28.8	31.0	32.3	32.0	30.0	26.7	22.4	20.6
	2%	WB		16.2	17.0	17.9	20.1	22.9	24.1	25.2	25.0	23.7	21.3	19.3	17.5
		MCDB		17.8	19.2	22.0	24.5	28.1	30.0	31.4	31.1	28.5	24.6	21.6	18.9
	5%	WB		14.2	15.5	16.8	19.0	21.9	23.6	24.7	24.4	23.1	20.4	18.1	15.5
		MCDB		16.0	17.8	20.8	23.4	27.0	29.1	30.6	29.9	27.5	23.4	20.3	17.7
	10%	WB		12.1	13.6	15.5	17.9	21.1	23.0	24.1	23.9	22.6	19.5	16.8	13.2
		MCDB		14.1	15.8	19.2	22.2	25.6	28.0	29.6	29.0	26.8	22.5	19.2	15.2
Mean Daily Temperature Range		MDBR		9.7	9.9	10.8	11.1	10.4	9.6	9.5	9.1	9.2	9.9	10.1	9.5
	5% DB	MCDBR		11.8	11.9	12.9	12.8	11.3	11.4	11.5	10.8	10.5	11.0	11.2	10.9
		MCWBR		8.0	7.2	6.6	5.5	4.4	3.7	3.5	3.4	3.7	4.9	6.4	7.4
	5% WB	MCDBR		9.4	9.8	10.3	10.0	8.7	9.8	10.0	9.5	8.7	8.3	8.7	9.3
		MCWBR		7.9	7.3	6.8	5.5	4.4	3.8	3.6	3.4	3.8	4.7	6.3	7.5
Clear Sky Solar Irradiance	taub			0.326	0.349	0.383	0.395	0.448	0.505	0.559	0.593	0.431	0.373	0.339	0.320
	taud			2.401	2.316	2.176	2.175	2.028	1.892	1.779	1.679	2.151	2.317	2.422	2.514
	Ebn,noon			888	896	890	893	845	784	751	714	832	859	862	874
	Edh,noon			95	117	143	148	173	186	220	239	144	115	97	87

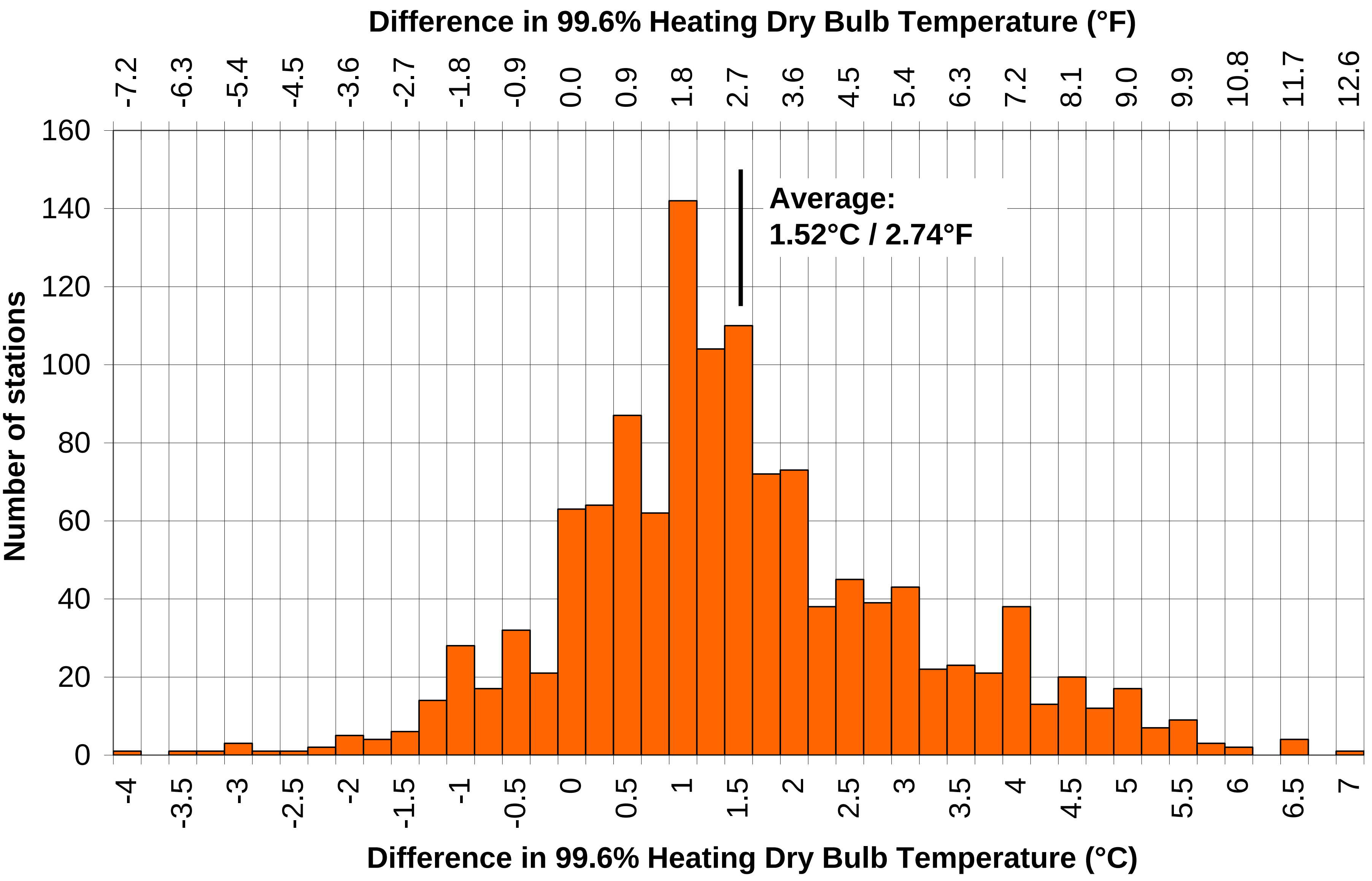
CDDn	Cooling degree-days base n°C, °C-day	Lat	Latitude, °	Period	Years used to calculate the design conditions
CDHn	Cooling degree-hours base n°C, °C-hour	Long	Longitude, °	Sd	Standard deviation of daily average temperature, °C
DB	Dry bulb temperature, °C	MCDB	Mean coincident dry bulb temperature, °C	StdP	Standard pressure at station elevation, kPa
DP	Dew point temperature, °C	MCDBR	Mean coincident dry bulb temp. range, °C	taub	Clear sky optical depth for beam irradiance
Ebn,noon	Clear sky beam normal and diffuse horizontal irradiances at solar noon, W/m2	MCDP	Mean coincident dew point temperature, °C	taud	Clear sky optical depth for diffuse irradiance
Edh,noon		MCWB	Mean coincident wet bulb temperature, °C	Tavg	Average temperature, °C
Elev	Elevation, m	MCWBR	Mean coincident wet bulb temp. range, °C	Time Zone	Hours ahead or behind UTC, and time zone code
Enth	Enthalpy, kJ/kg	MCWS	Mean coincident wind speed, m/s	WB	Wet bulb temperature, °C
HDDn	Heating degree-days base n°C, °C-day	MDBR	Mean dry bulb temp. range, °C	WBAN	Weather Bureau Army Navy number
Hours 8/4 & 12.8/20.6	Number of hours between 8 a.m. and 4 p.m. with DB between 12.8 and 20.6 °C	PCWD	Prevailing coincident wind direction, °, 0 = North, 90 = East	WMO#	World Meteorological Organization number
HR	Humidity ratio, g of moisture per kg of dry air			WS	Wind speed, m/s

Done

The changing climate

- Climatic design conditions have changed significantly over the last few decades; this reflects a warming of the climate
- Cooling DB increases at same rate as average temperature, heating DB increases faster
- Cause may be combination of global warming and Urban Heat Island Effect
- Be cautious when using of a shorter, more recent period of record to capture climatic trends, as it may introduce uncertainties bigger than the trends themselves

$$\Delta DB^{99.6} = DB^{99.6}_{1997\text{–}2006} - DB^{99.6}_{1977\text{–}1986}$$



Average changes per decade, last ‘30 years’

99.6% heating dry bulb temperature	+ 0.76 °C	+ 1.37 °F
0.4% cooling dry bulb temperature	+ 0.38 °C	+ 0.68 °F
0.4% dehum. dew point temperature	+ 0.28 °C	+ 0.50 °F
Dry bulb temperature range	~ 0 °C	~ 0 °F
Average temperature	+ 0.41 °C	+ 0.73 °F
Heating degree-days base 18.3°C / 65°F	- 118 °C-day	- 212 °F-day
Cooling degree-days base 10°C / 50°F	+ 68 °C-day	+ 122 °F-day

TC 4.2 and SSPC 169 Resources

- TC 4.2:
  - Chapter 14 Climatic Design Conditions, ASHRAE 2009 Handbook Fundamentals
  - TC 4.2 Chair: Didier Thevenard, DThevenard@numlog.com
- Standard 169:
  - ANSI/ASHRAE Standard 169-2006 Weather Data for Building Design Standards
  - SSPC 169 Chair: Dru Crawley, Dru.Crawley@bentley.com