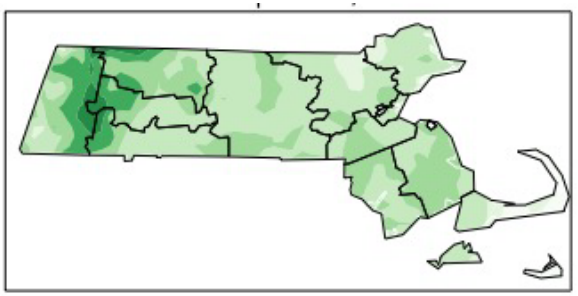
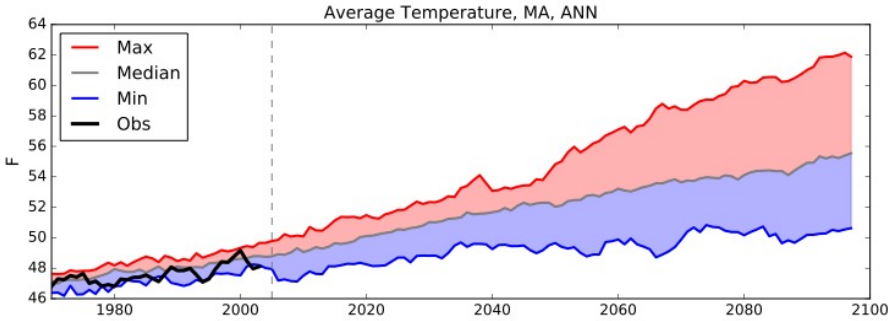
Climate Change Projections for the Commonwealth of Massachusetts

Ambarish Karmalkar and Raymond Bradley

Northeast Climate Science Center (NE CSC), Dept of Geosciences
UMass Amherst





Hazard Mitigation and Climate Adaptation
Stakeholder Initial Workshop

Aug 2, 2017
Westborough, MA

NE CSC Northeast Climate Science Center

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Climate Data

Climate Models:
Current Generation of Climate Models (CMIP5 Archive)

Downscaling Method:
LOCA Statistical Downscaling (Localized Constructed Analogs)

Resolution:
Daily
6 km/3.7 mi (1/16 degree)

Scenarios:
RCP8.5 – High Emissions
RCP4.5 – Medium Emissions

Climate Variables:

Temperature

Average Temperature
Maximum Temperature
Minimum Temperature
Days with Maximum Temperature > 90F
Days with Maximum Temperature > 95F
Days with Maximum Temperature > 100F
Days with Minimum Temperature < 0F
Days with Minimum Temperature < 32F
Growing Degree-Day Accumulation
Heating Degree-Day Accumulation
Cooling Degree-Day Accumulation

Precipitation

Total Precipitation
Days with Precipitation > 1in
Days with Precipitation > 2in
Days with Precipitation > 4in
Consecutive Dry Days

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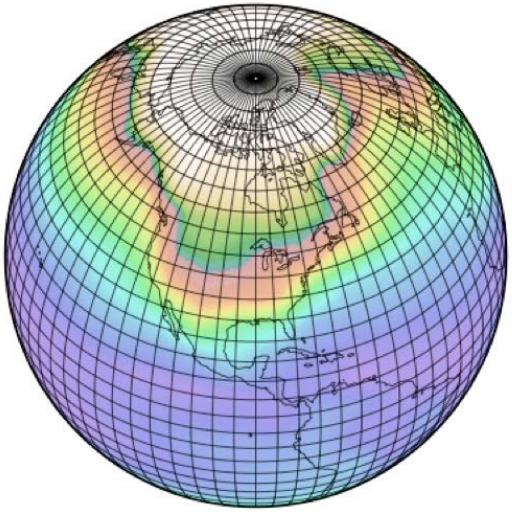
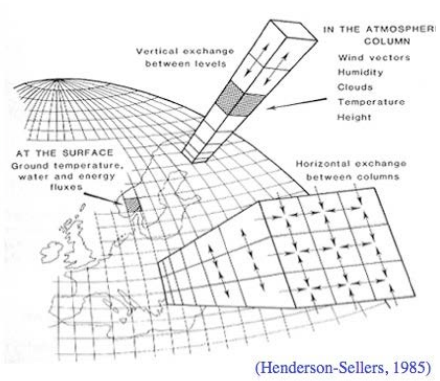
Climate Models

Global Climate Models (GCMs)





(Henderson-Sellers, 1985)

Coupled Model Intercomparison Project (CMIP5) archive of climate simulations carried out by modeling centers around the world.

Original set of 36 models → Rigorous assessment of model performance → Selection of 14 models

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Downscaled Data

Global Climate Model information cannot be directly used for impacts studies because

- Their spatial resolution is too coarse to be directly useful.
- The models can have systematic biases.

Downscaling Method:

LOCA Statistical Downscaling (Localized Constructed Analogs)
Pierce et al., 2016

Time Period:

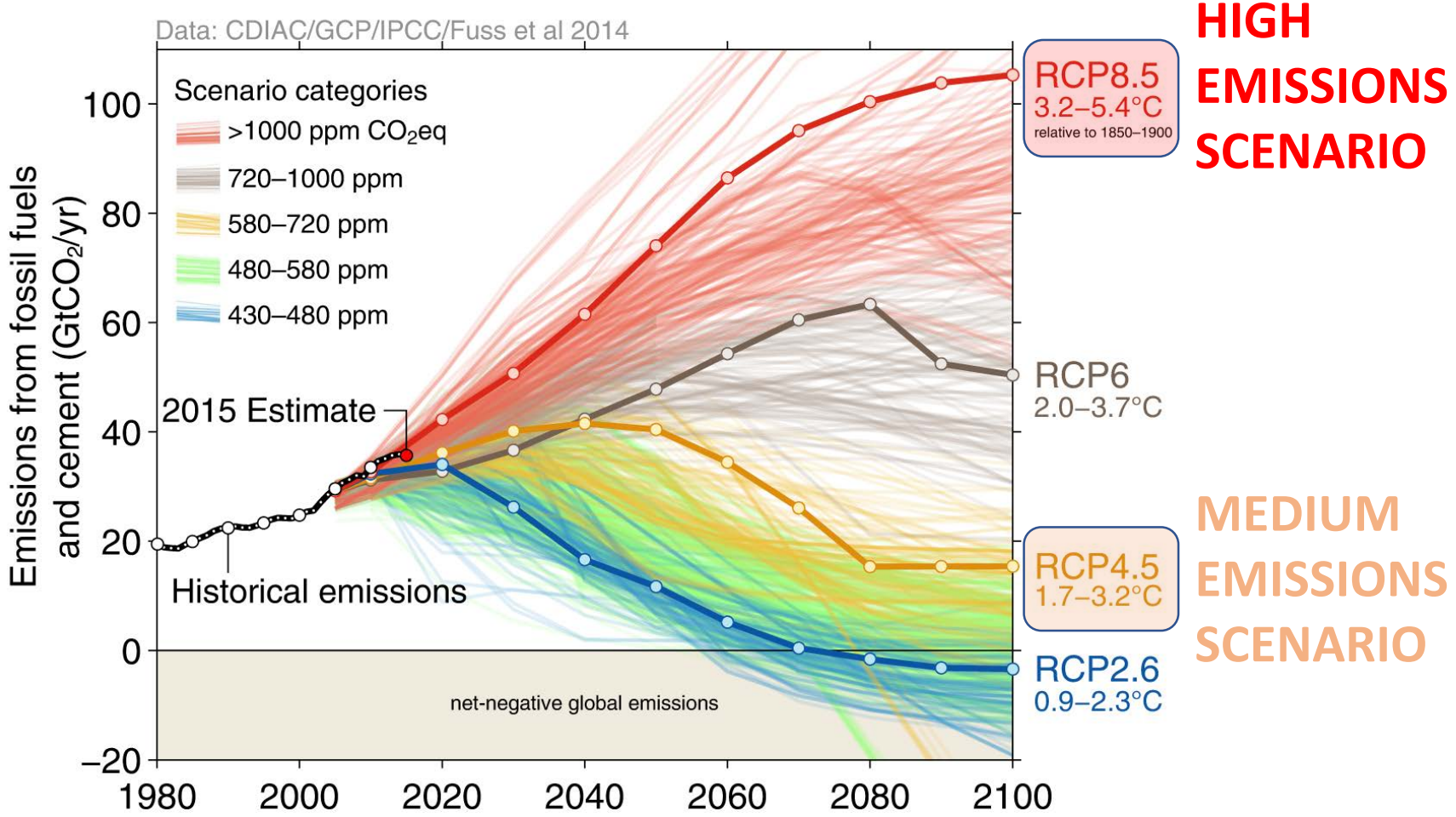
1950-2100

Resolution:

Daily
6 km/3.7 mi (1/16 degree)

Scenarios

Scenarios of how emissions will change in the future



HIGH EMISSIONS SCENARIO

MEDIUM EMISSIONS SCENARIO

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Global Carbon Project

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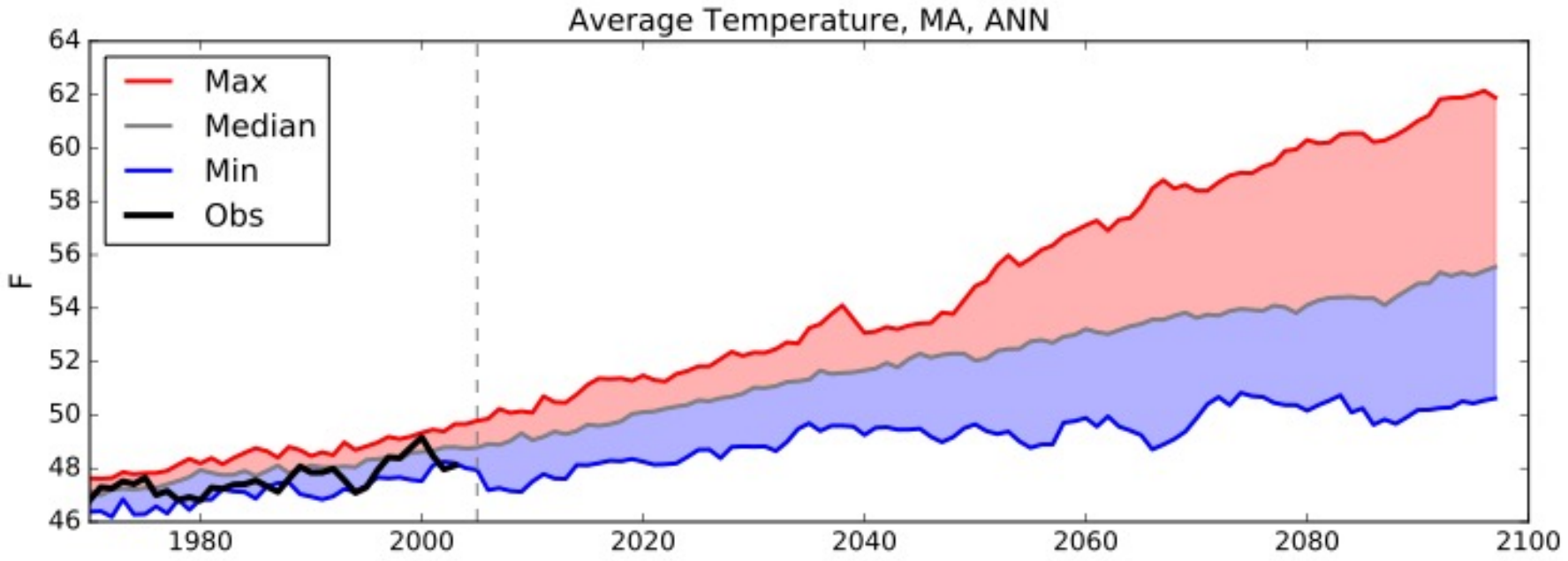
Average Temperature



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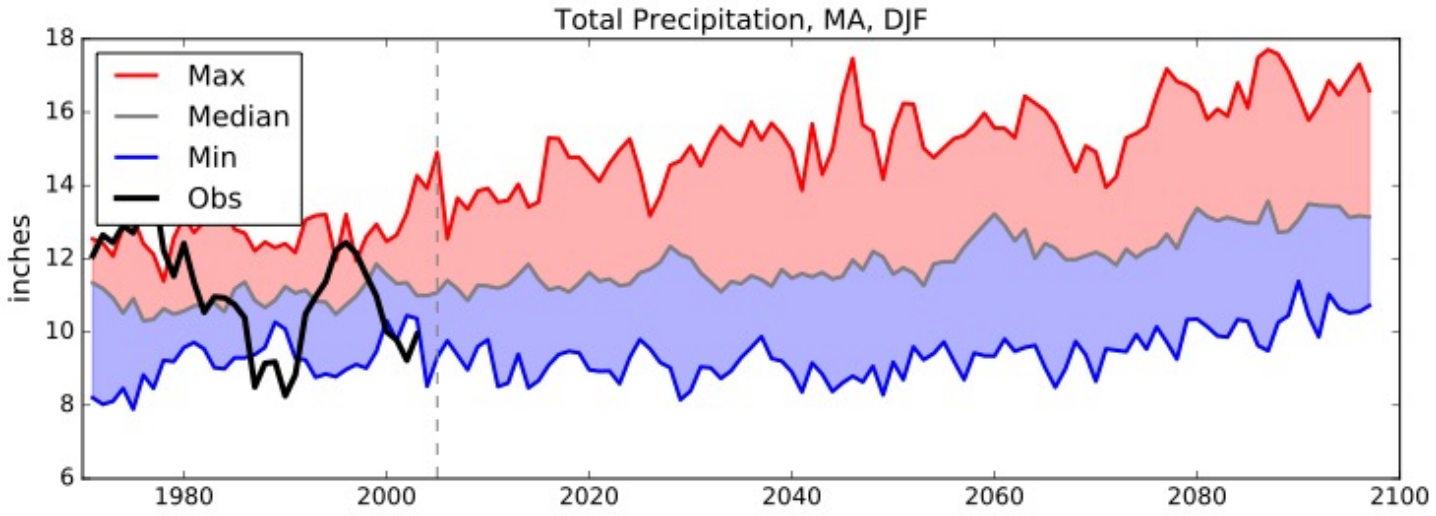
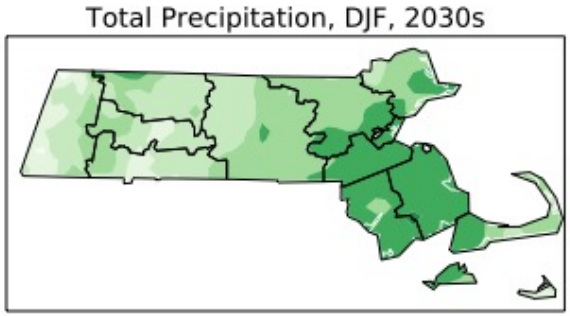
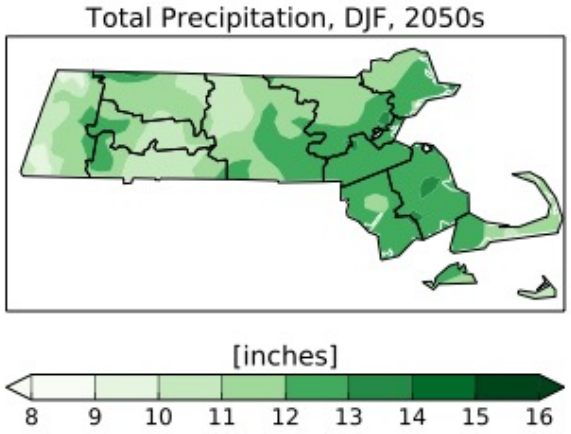
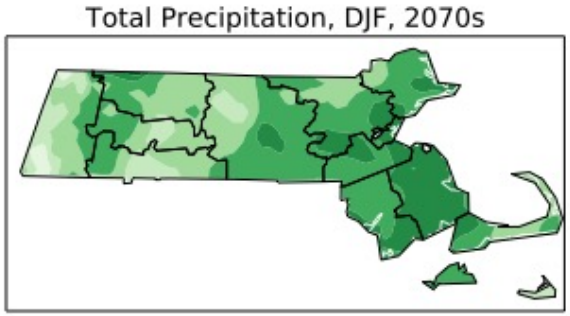
Winter (DJF) Precipitation









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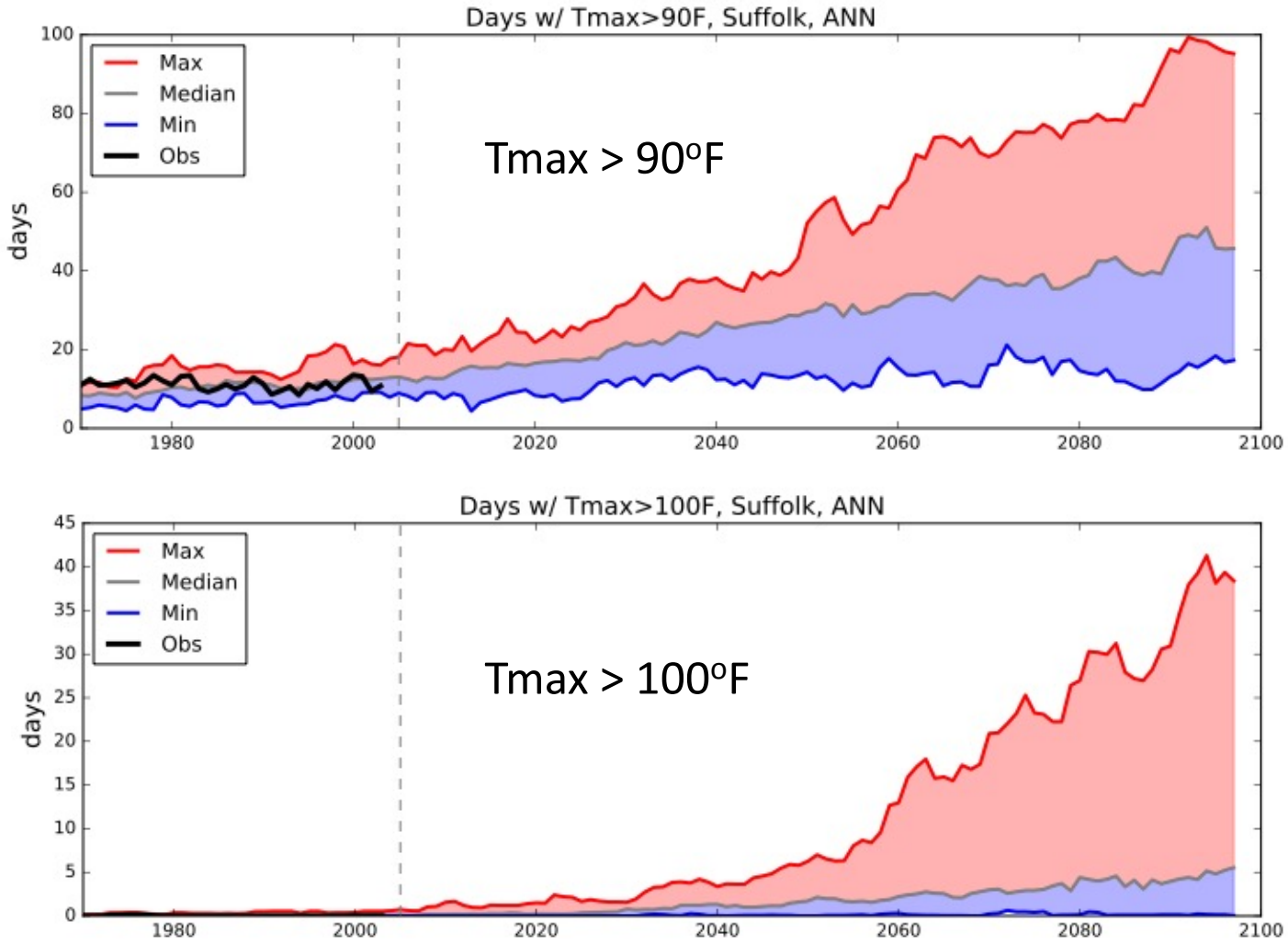
Hot extremes



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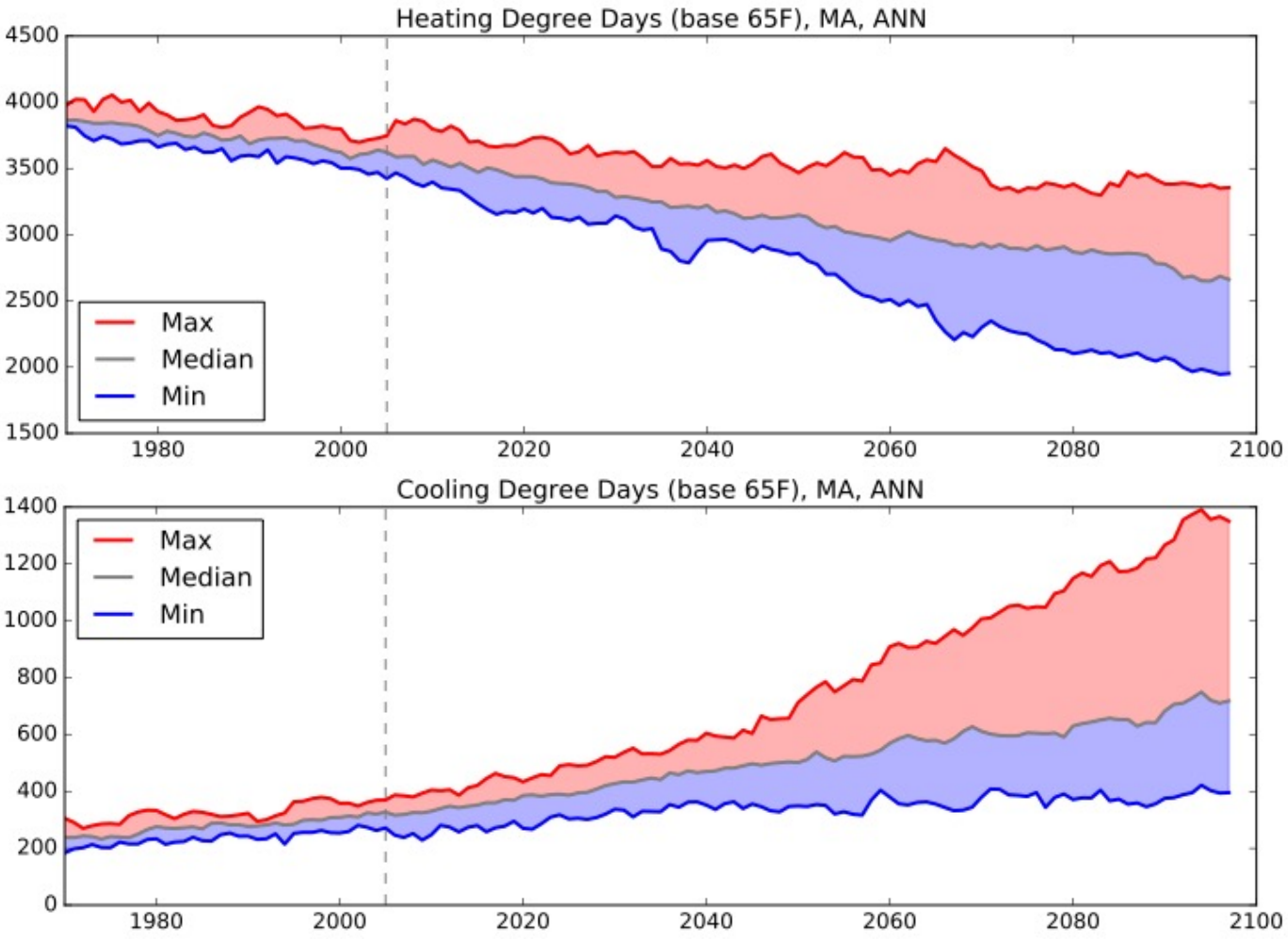
Heating and Cooling Degree-Days

Used in the calculation of energy consumption



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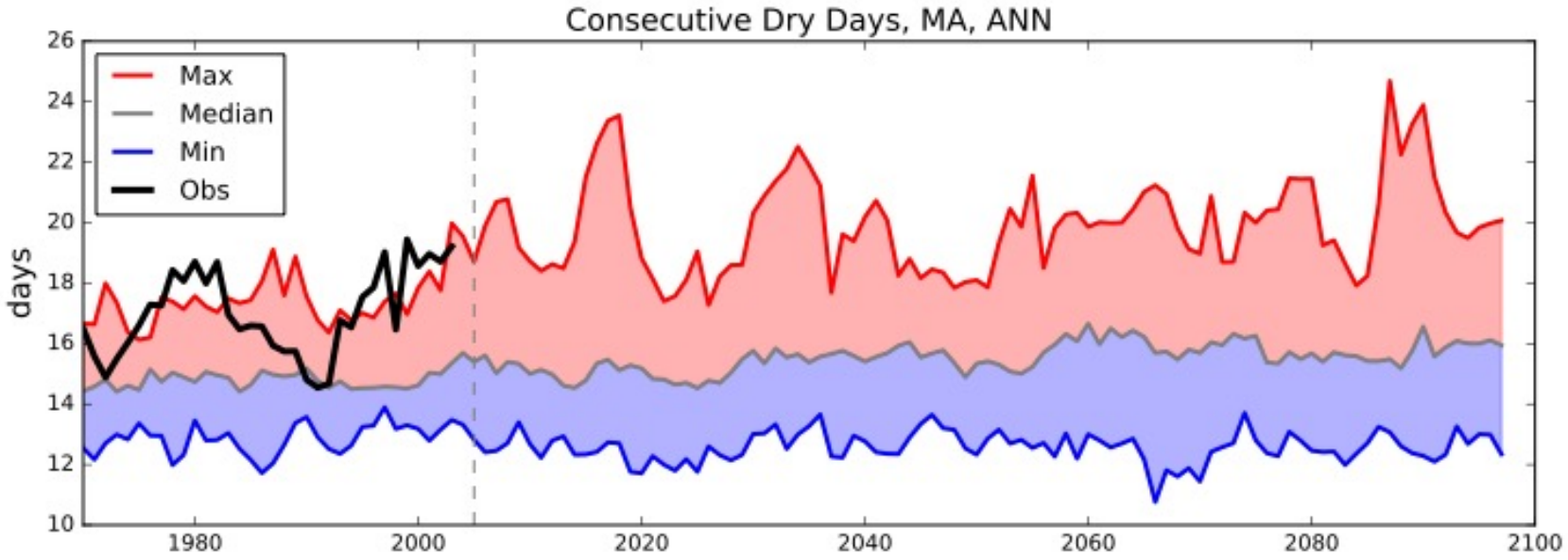
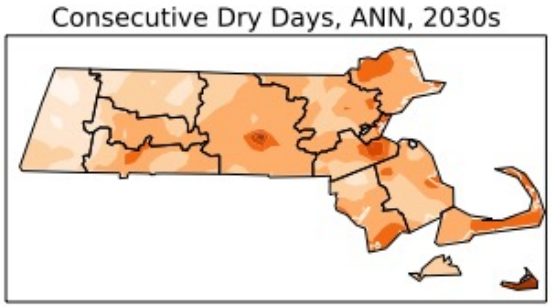
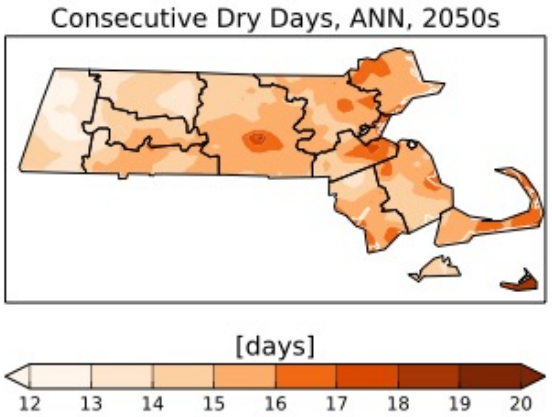
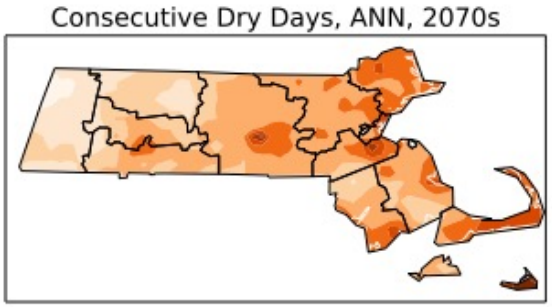
Consecutive Dry Days









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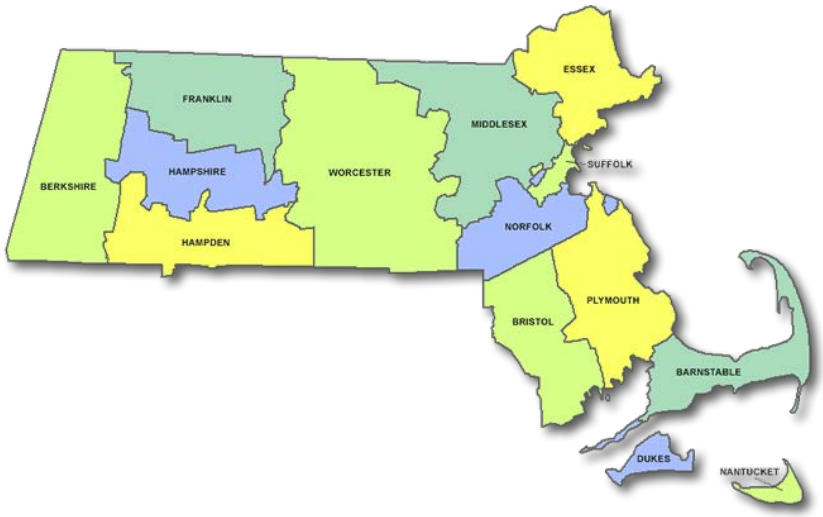
Climate Variables



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Questions

Critical variables related to temperature and precipitation changes in the future for decision making.

After viewing the list of data that will be considered during the development of a MA climate adaptation plan, are there other Mass-specific sources that you know of that should be included?

How do you feel about the sources being used to discuss climate change/variables? (i.e. comfortable, data is insufficient, data is not realistic, etc.)

Have you been a participant in any significant climate change discussions to date? If so, what are these? Have these events produced reports or data that should be included?

What types of management decisions do you make that are affected by climate variables such as heating degree days, cooling degree days, extreme precipitation, etc?