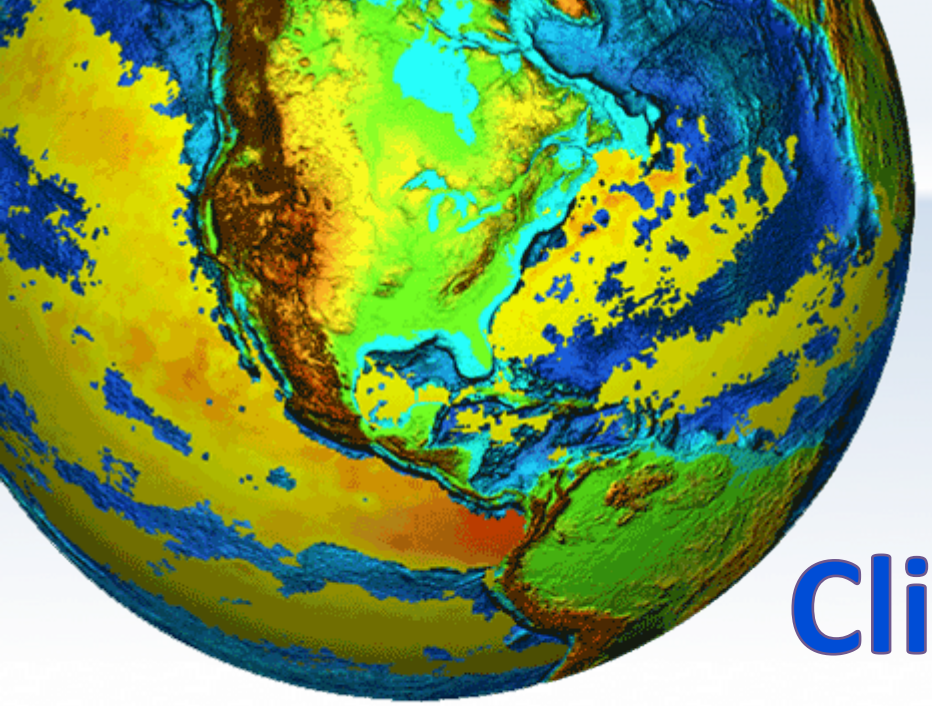


Climate Services: U.S. Perspective

International Conference on Climate Services

Thomas R. Karl

Director, NOAA National Climatic Data Center

Chair, Subcommittee on Global Change Research

October 17, 2011

The Rising Demand for Climate Services

Sustainability of Marine Ecosystems

Coasts and Climate Resilience

Climate Impacts on Water Resources

Changes in Extremes of Weather and Climate

Agriculture

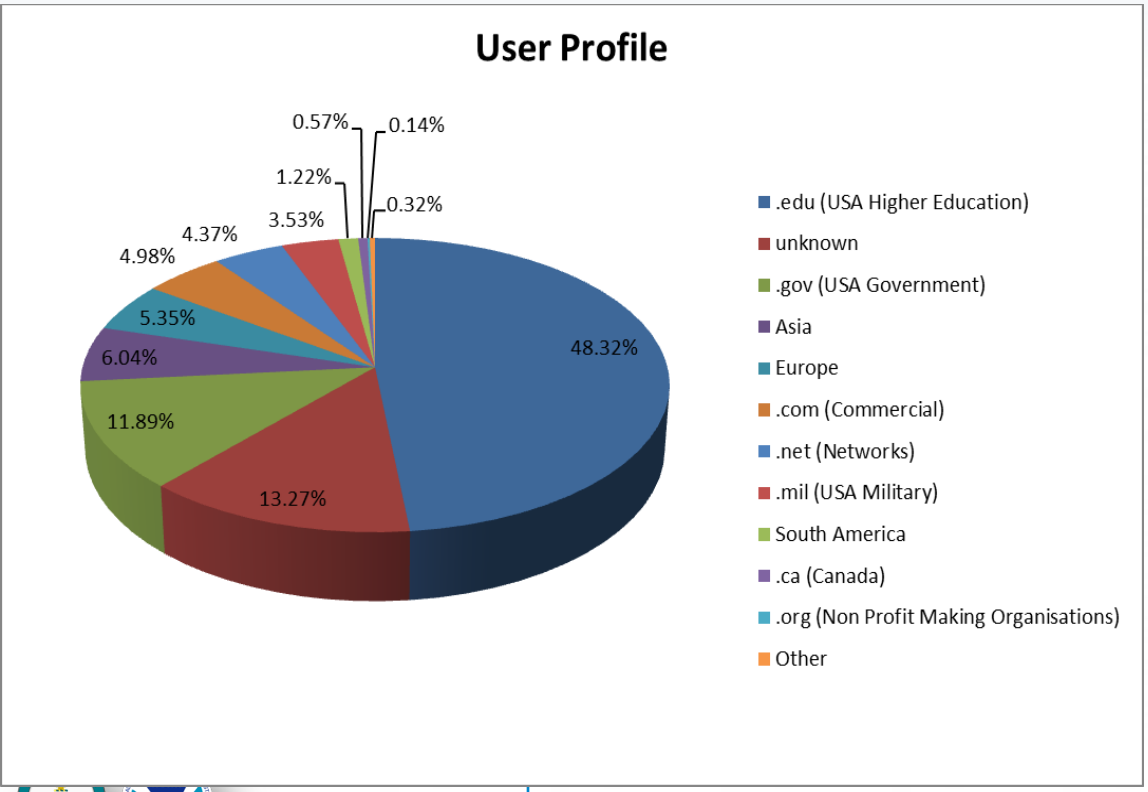
Energy

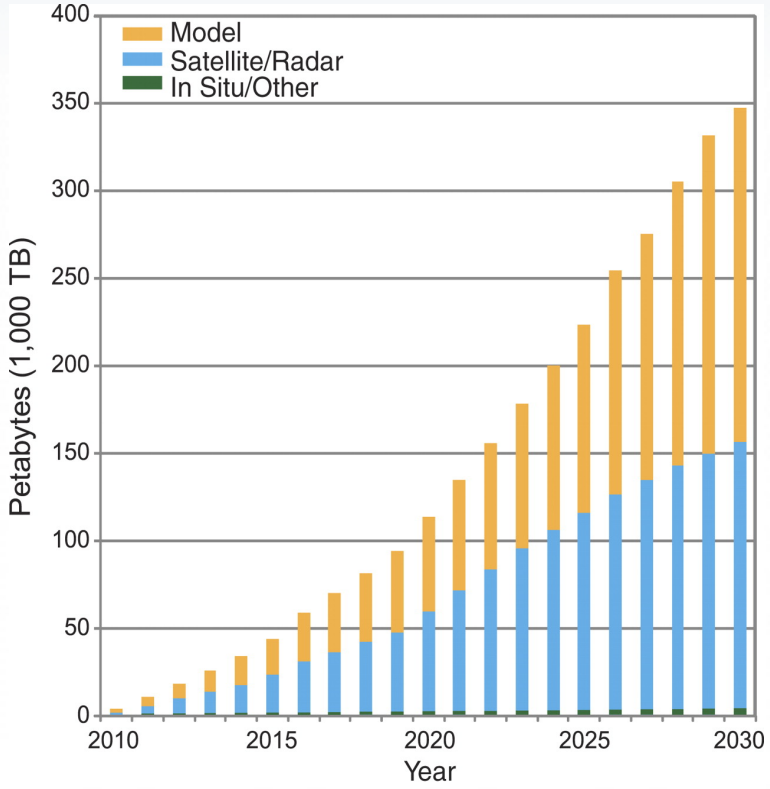
Health

Transportation

The Rising Demand for Climate Services

- In FY 2011, NCDC data deliveries increased from the equivalent of 1.4 billion Kindle books to 1.6 billion
- Unique average monthly visits to the NOAA climate portal grew 13.5% to almost 30,000 per month
- Over 25,000 telephone, e-mail, and facsimile requests

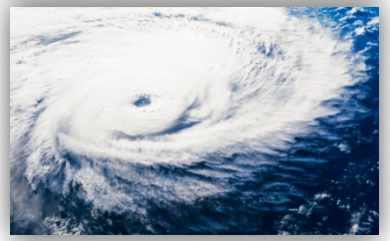




Overview

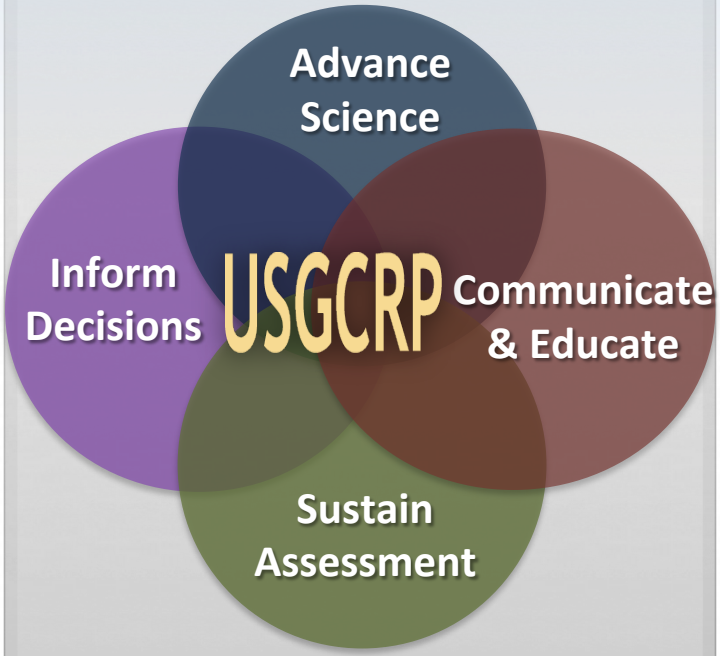
- U.S. Global Change Research Program (USGCRP)
  - New Strategic Plan
- Example: NOAA's Climate Services
  - Societal Challenges
  - Sector Examples





USGCRP Strategic Plan

Goals	Objectives
Advance Science	1.1 Earth System Understanding 1.2 Science for Adaptation and Mitigation 1.3 Integrated Observations 1.4 Integrated Modeling 1.5 Information Management and Sharing
Inform Decisions	2.1 Inform Adaptation Decisions 2.2 Inform Mitigation Decisions **2.3 Enhancing Climate Services** 2.4 Enhancing International Partnerships
Sustain Assessment	3.1 Scientific Integration 3.2 Ongoing Capacity 3.3 Inform Responses 3.4 Evaluate Progress
Communicate & Educate	4.1 Strengthen Communication and Education Research 4.2 Reach Diverse Audiences 4.3 Increase Engagement 4.4 Cultivate Workforce



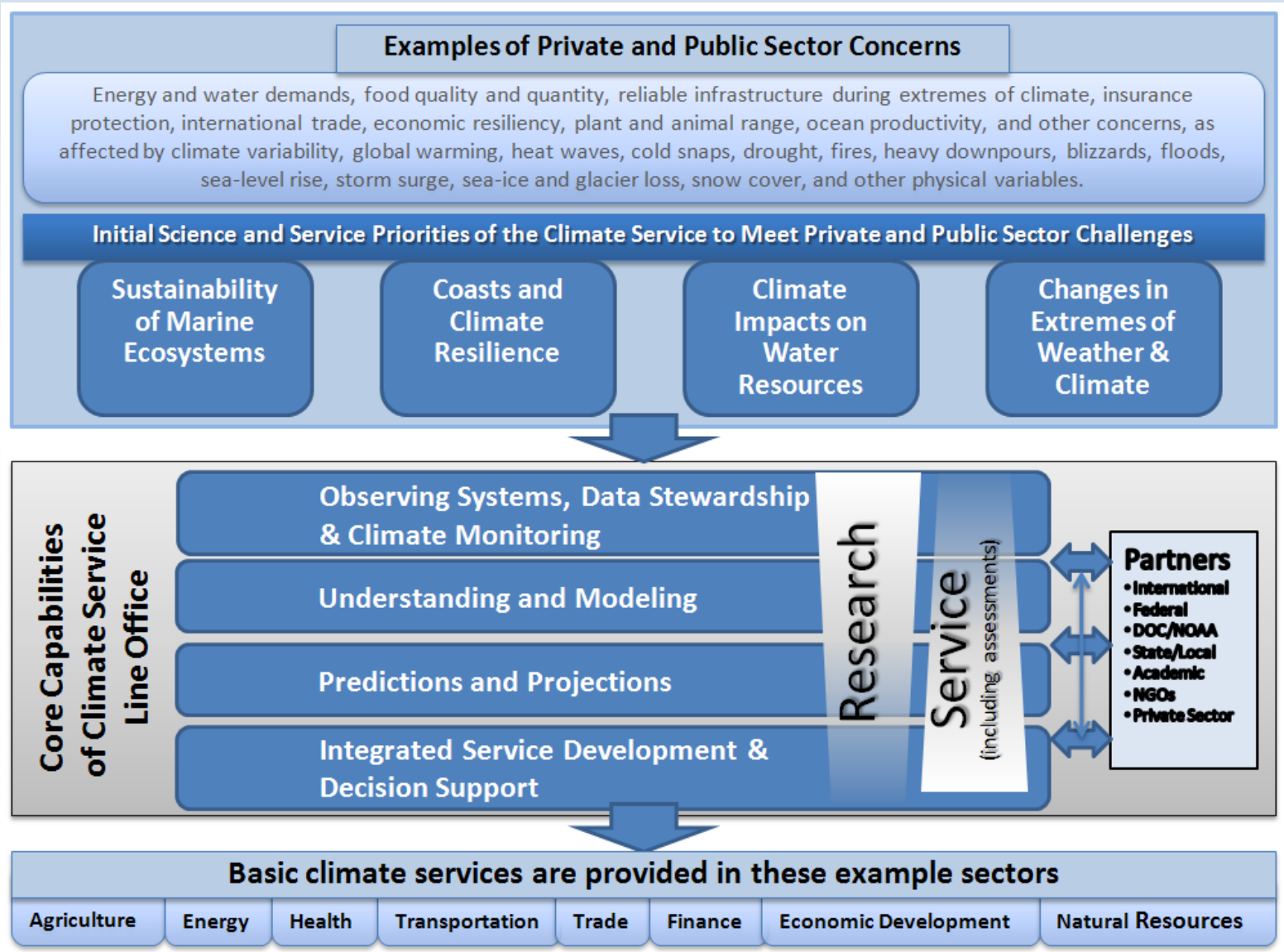
U.S. Federal Climate Services Enterprise

A key strategy to improving the efficiency and effectiveness of Federal climate services is to partner with and support the broader Climate Services Enterprise

- Partners from across the broader climate community both contribute to and benefit from the core capabilities
  - ✓ Includes Federal, state, tribal and local agencies, other academic partners, the private sector, and the international community

Example: NOAA's Climate Services

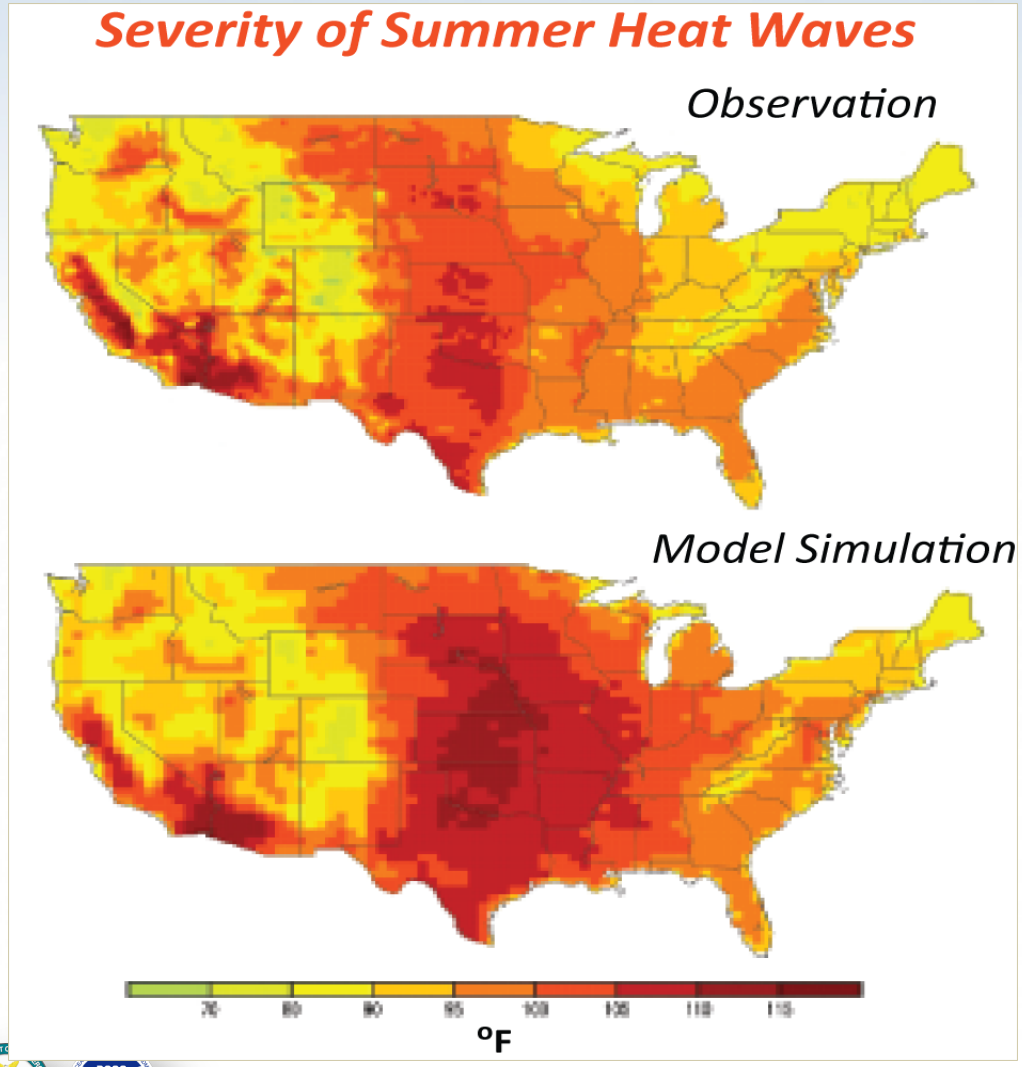
Meeting the Demand



Example of Federal Climate Services

Societal Challenge:
Changes in Extremes of Weather and Climate

Extremes:
High-resolution Modeling to Project Heat Waves



A new high-resolution global model (~50 km) developed by NOAA has produced promising results in simulating the severity and duration of summer heat waves.

This model was used to produce the bottom figure, from a 30-year simulation of present-day climate.

Top figure is based on observational data for a 24-year period.

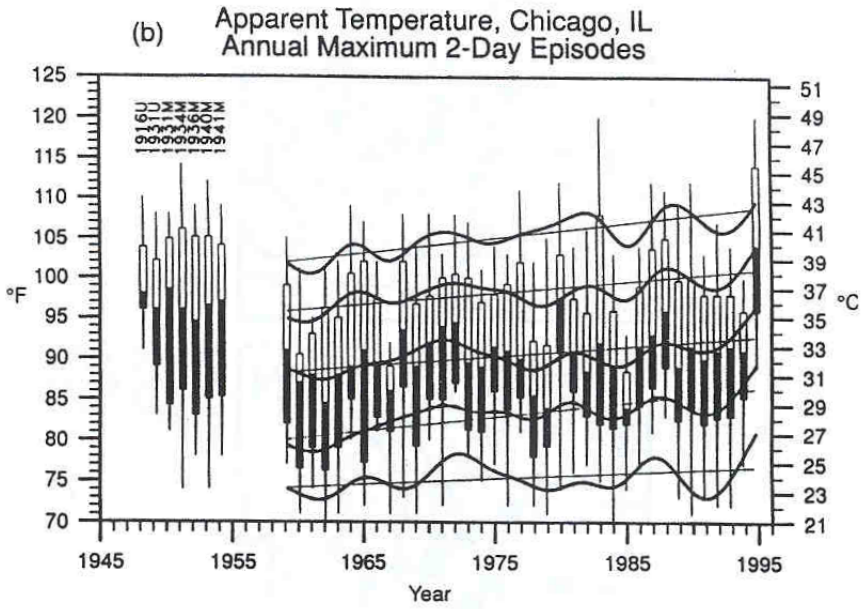
Extremes: Heat Waves

Example Applications and Impacts

- Urban areas impacted severely
  - Peak Power Loads affected
  - Heat wave event fatalities

Event	Deaths
2000 SE U.S.	140
1999 E U.S	502
1998 TX to NC	200
1995 Chicago	> 500
1988 central to east U.	5-10,000
1980 central to east U.S.	10,000

NOAA Information Used



Analysis of the max. temperature at Chicago, IL

Used in:

- anticipating future heat waves

- monitoring long-term changes

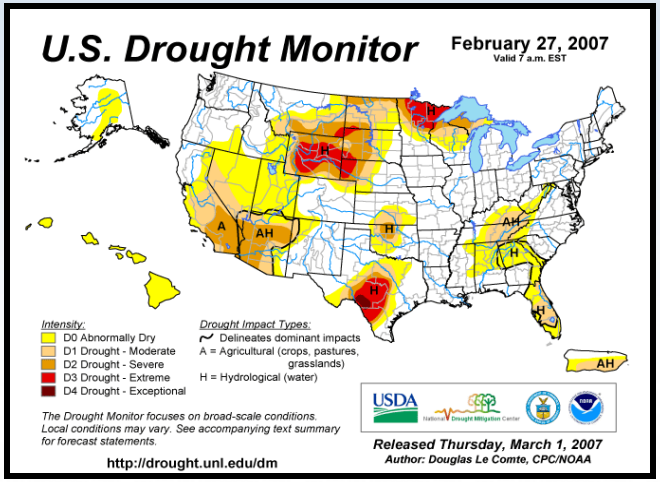
Societal Challenge:
Climate Impacts on Water Resources

Water Resources:
Drought Impacts

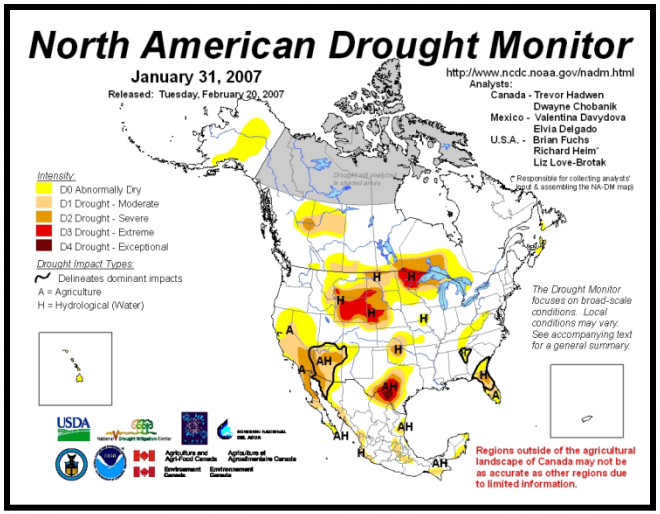
Applications & Impacts

- Drought results in annual losses of $6-8 billion to all sectors of the economy
- Energy sector impacts
  - Hydropower generation curtailed
  - Duration of Drought important factor – irrigation is powered by Natural Gas
  - Many times drought occurs in conjunction with Heat Waves

U.S. Monitor *(produced weekly)*



North American Monitor *(produced monthly)*



Societal Challenge:
Coasts and Climate Resilience

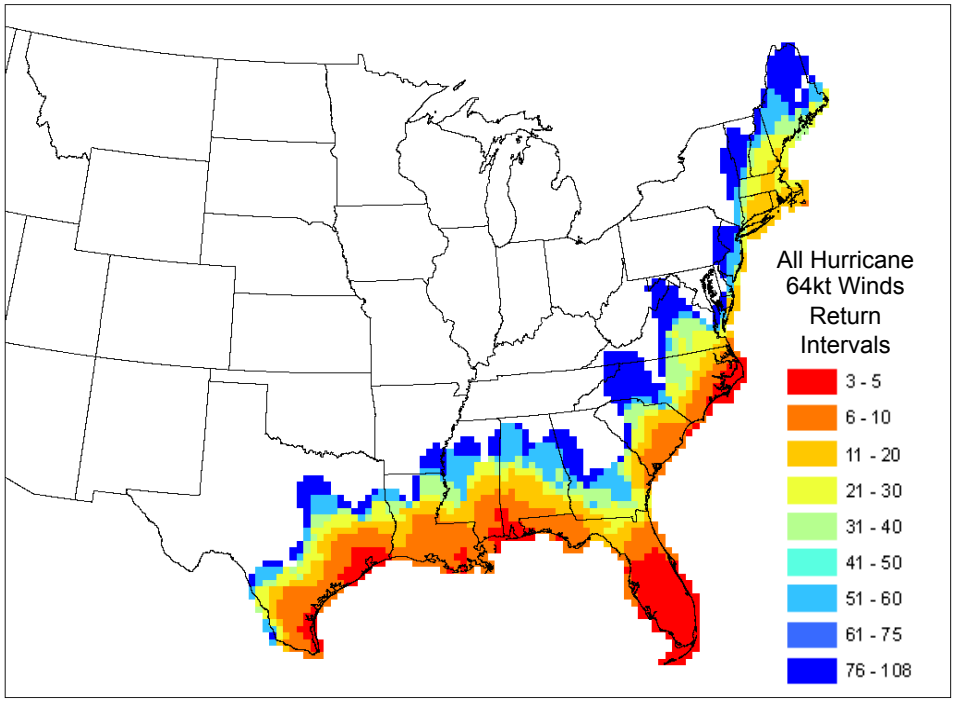
Coasts and Climate Resilience:

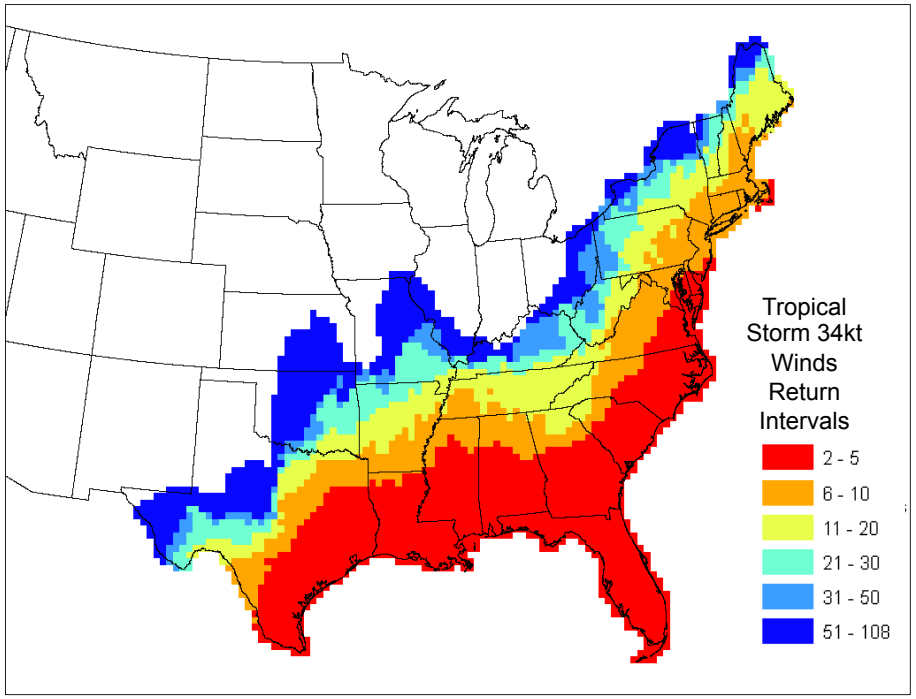
Sea Level Rise and Coastal Flooding Impacts Viewer

Features
Displays potential future sea levels
Provides simulations of sea level rise at local landmarks
Communicates the spatial uncertainty of mapped sea levels
Models potential marsh migration due to sea level rise
Overlays social and economic data onto potential sea level rise
Examines how tidal flooding will become more frequent with sea level rise

http://www.csc.noaa.gov/digitalcoast/tools/slrviewer

Coasts and Climate Resilience:
Hurricane Climatology





- **Climatology of the Inland Frequency of Hurricanes and Tropical Storms: 1900-2008**

Example: Energy

- Ice Storms
- US Climate Normals

Ice Storms

Applications & Impacts

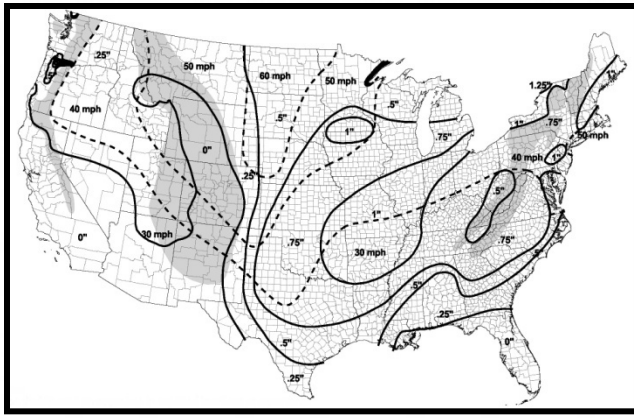
- **Energy Sector Impacts**
  - Power supply interrupted due to downed:
    - Transmission towers
    - Power poles and lines
    - Transformers
  - Transportation to make repairs impeded
  - Loss of revenue from unsold power & cost to make repairs

- **Costliest U.S ice storms**
  - Northeast U.S.
    - Jan 1998; > $1.4 billion damages
  - Southeast U.S.
    - Feb 1994; > $3 billion damages

NOAA Information Used

Freezing Rain/Ice Storm Statistics
-# days/hours with freezing rain
-ice storm losses
-Part of a National Engineering Design Standard

50-year recurrence interval for ice thickness from freezing rain and concurrent wind gusts.



Energy:
U.S. Climate Normals

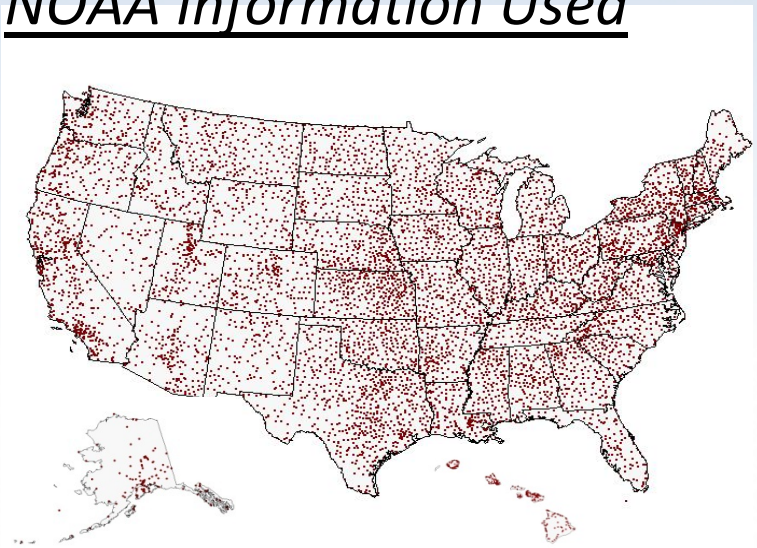
Climate Applications for Energy Sector

- Heating and cooling degree days normals - used for rate adjustments and energy demand forecasts
- Renewable Energy – Siting, energy potential - wind turbines, solar, hydro
- Weather Derivatives market - To protect industries from extreme climate conditions
- Climate projections IPCC CCSP

Improved Climate Normals

- Account for Changing Climates
- Forecast what Normals will be in the future
- Make Normals more representative of 2010, not the midpoint (1995/1996) of 30-year range
- More useful statistics for energy consumption variables (e.g., heating degree days)
- Define and provide normals product delivery schedule

NOAA Information Used



Traditional Climate Normals

- Official 30 year averages for 8,000 sites
- Updated each decade
- Data
- Max, Min, Mean Temperature
- Precipitation
- Heating & Cooling Degree Days

Example: Construction

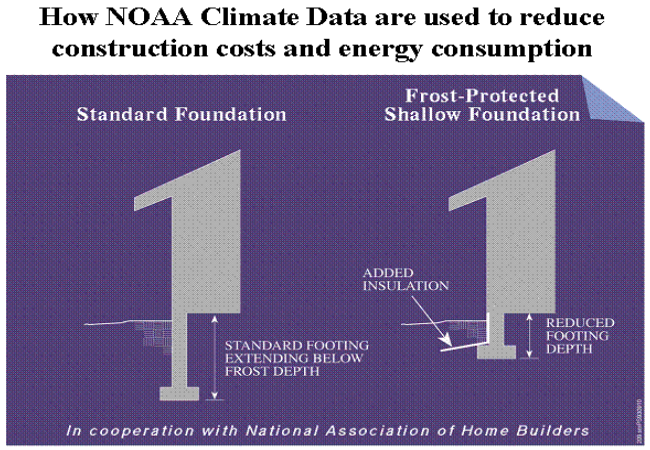
- Air Freezing Index

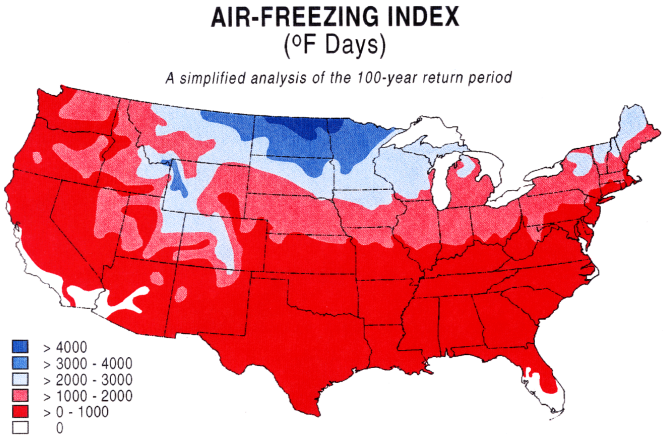
Construction and Climate:
Frost-Protected Shallow Foundation

Applications & Benefits

- **Construction Benefits Cost Savings**
  - Foundation depths now 16 inches vs. several feet
  - Green building: limited site disturbance
  - Building cost saving: 1.1 to 3.8% of total home price
  - **Projected annual savings: $330 million**
- **Energy Cost Savings**
  - Added insulation protects foundation from frost heave
  - Amount of insulation determined by NOAA's Air Freezing Index
  - **Projected annual energy savings: 586,000 megawatt-hours**

NOAA Information Used





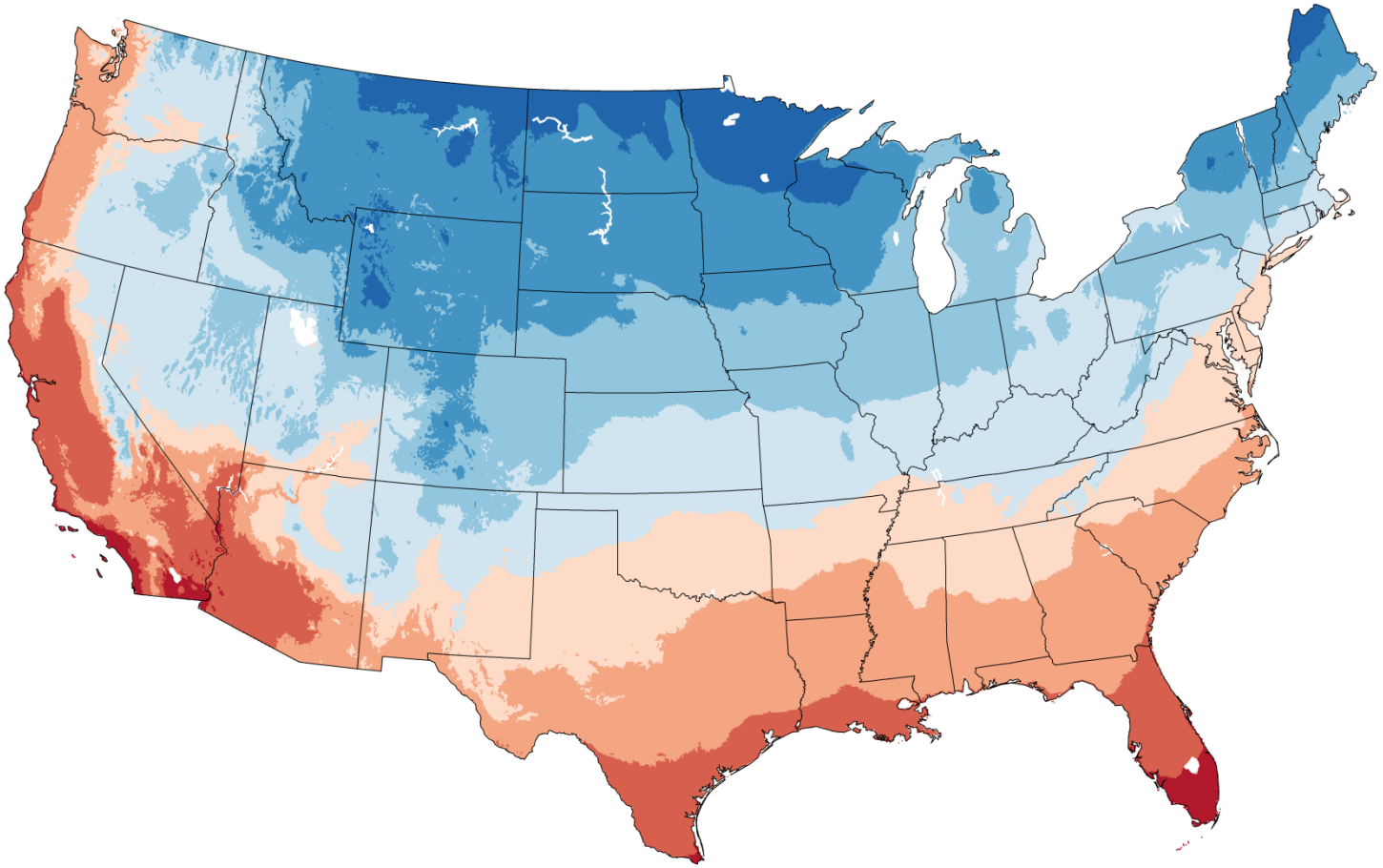
The amount of insulation needed to protect a building foundation is determined by the Air-Freezing Index.

Example: Agriculture

- Changes in Normals and Plant Heartiness Zones

Climate-Related Planting Zones: 1971-2000

Based on Current 30-Year Normals



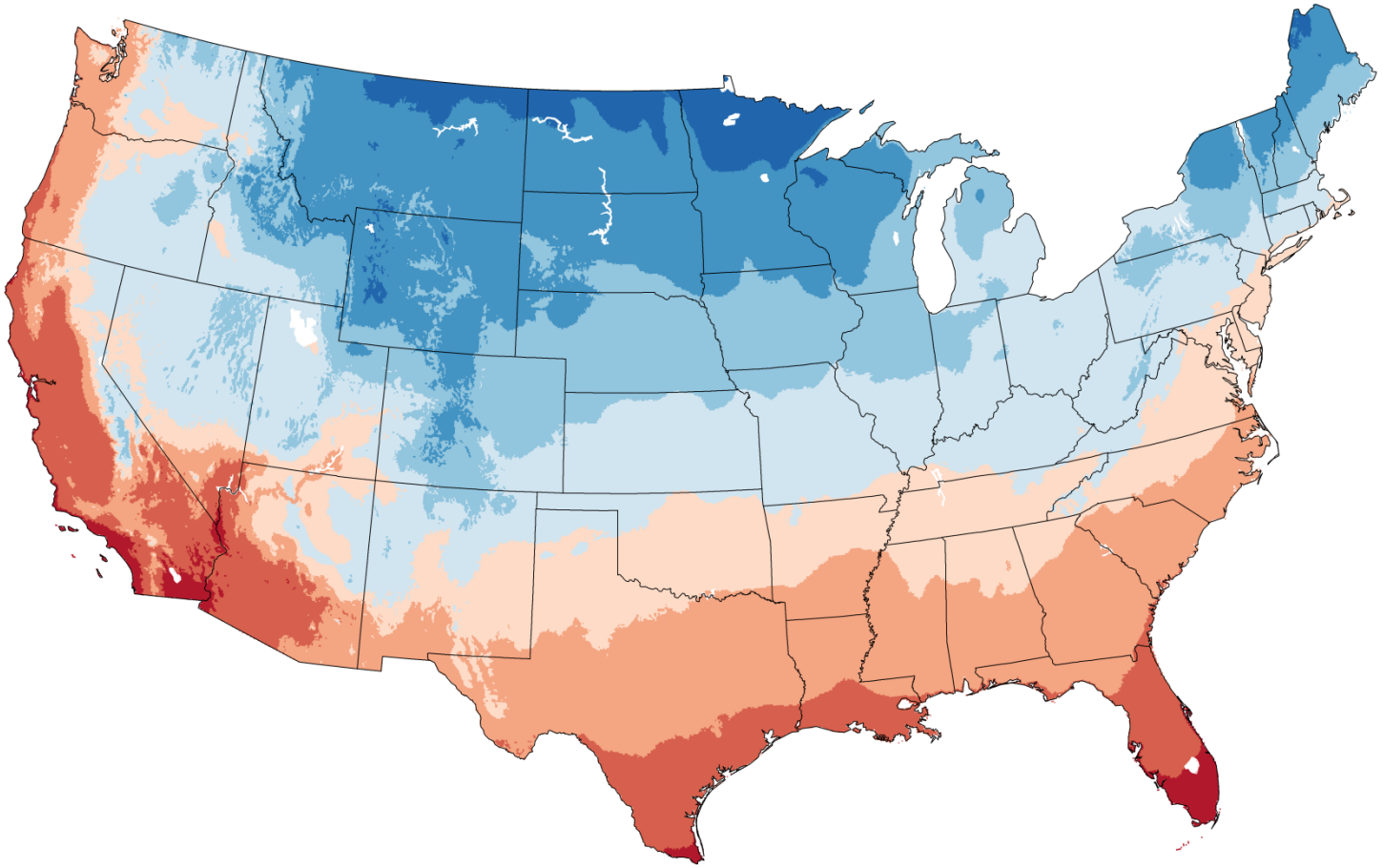
Average Annual Minimum Temperature by Climate-Related Planting Zone

Zone 3 (-39 to -30 F)	Zone 5 (-19 to -10 F)	Zone 7 (1 to 10 F)	Zone 9 (21 to 30 F)
Zone 4 (-29 to -20 F)	Zone 6 (-9 to 0 F)	Zone 8 (11 to 20 F)	Zone 10 (31 to 40 F)

Disclaimer: This illustration of nationwide patterns and changes in climate-related planting zones for gardeners was created as a special service to the American Public Gardens Association by the National Oceanic and Atmospheric Administration (NOAA). The official Plant Hardiness Zone map was prepared by the U.S. Department of Agriculture (USDA) in 1990 using data collected and distributed by NOAA. USDA is currently updating its official map, which will soon be available via the Internet.

Climate-Related Planting Zones: 1981-2010

Based on New 30-Year Normals (Available July 1, 2011)



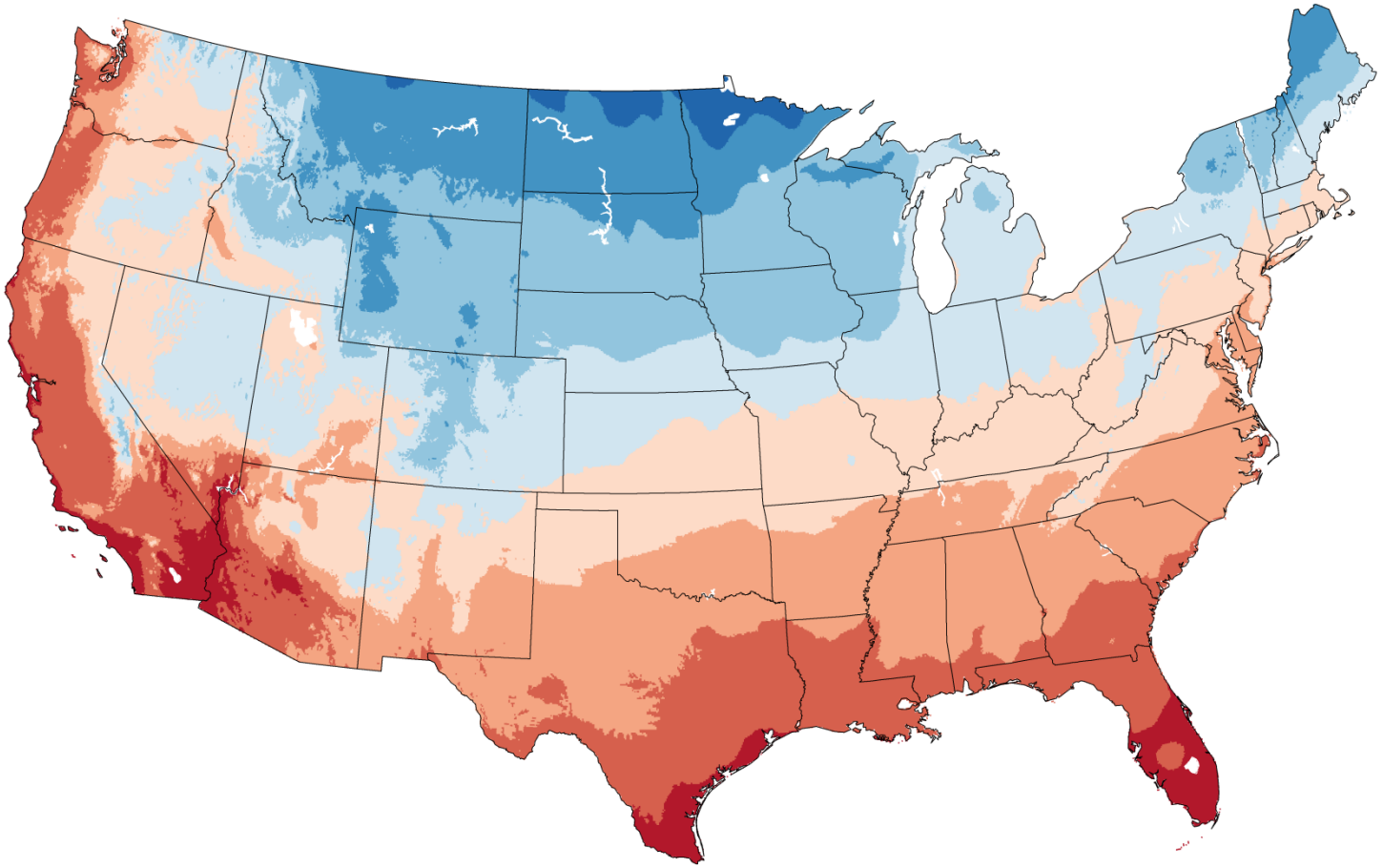
Average Annual Minimum Temperature by Climate-Related Planting Zone

Zone 3 (-39 to -30 F)	Zone 5 (-19 to -10 F)	Zone 7 (1 to 10 F)	Zone 9 (21 to 30 F)
Zone 4 (-29 to -20 F)	Zone 6 (-9 to 0 F)	Zone 8 (11 to 20 F)	Zone 10 (31 to 40 F)

Disclaimer: This illustration of nationwide patterns and changes in climate-related planting zones for gardeners was created as a special service to the American Public Gardens Association by the National Oceanic and Atmospheric Administration (NOAA). The official Plant Hardiness Zone map was prepared by the U.S. Department of Agriculture (USDA) in 1990 using data collected and distributed by NOAA. USDA is currently updating its official map, which will soon be available via the Internet.

Projected Planting Zones: 2011-2040

Derived from Historical Data for 1971-2010



Average Annual Minimum Temperature by Climate-Related Planting Zone

- Zone 3 (-39 to -30 F)
- Zone 4 (-29 to -20 F)
- Zone 5 (-19 to -10 F)
- Zone 6 (-9 to 0 F)
- Zone 7 (1 to 10 F)
- Zone 8 (11 to 20 F)
- Zone 9 (21 to 30 F)
- Zone 10 (31 to 40 F)

Disclaimer: This illustration of nationwide patterns and changes in climate-related planting zones for gardeners was created as a special service to the American Public Gardens Association by the National Oceanic and Atmospheric Administration (NOAA). The official Plant Hardiness Zone map was prepared by the U.S. Department of Agriculture (USDA) in 1990 using data collected and distributed by NOAA. USDA is currently updating its official map, which will soon be available via the Internet.

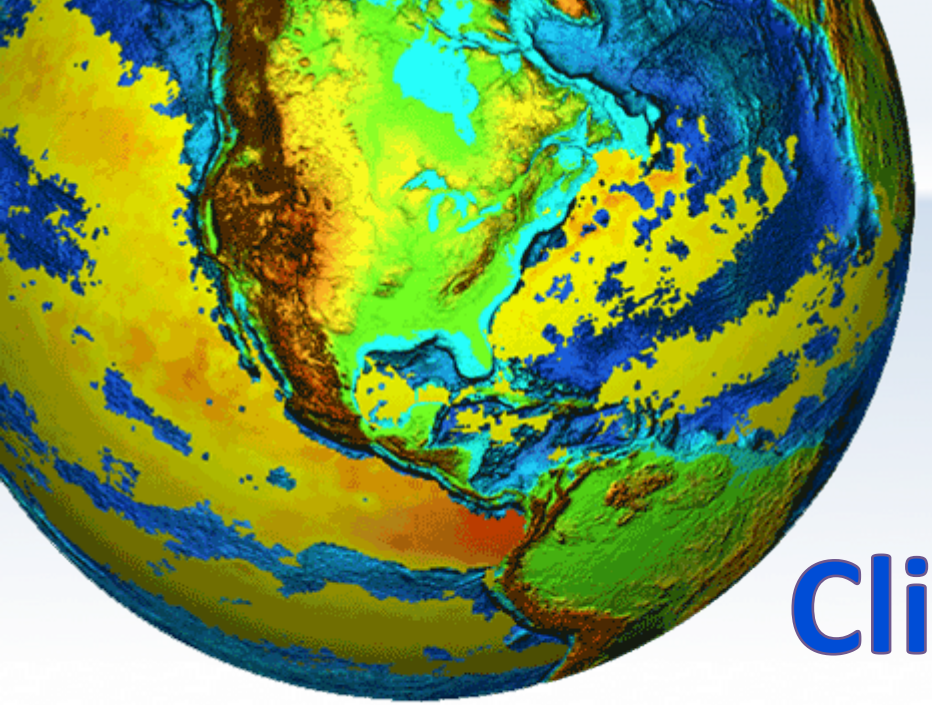
For More Information…

www.globalchange.gov

– U.S. Global Change Research Program

www.climate.gov

– NOAA's Climate Portal



Climate Services: U.S. Perspective

Thank you…

Questions?