Technical Support Unit for the National Climate Assessment

Sarah Champion and Liqiang Sun
NOAA Cooperative Institute for Climate and Satellites
Asheville, NC

November 29, 2016

Overview

- Hosted by the National Centers for Environmental Information (NCEI)
- Multi-disciplinary team
- Initially established to support 3rd National Climate Assessment (NCA3) and the sustained assessment process
- Comprised almost entirely of CICS-NC staff

TSU Science Team

- **Kenneth Kunkel - Lead Scientist**
- Liqiang Sun - Research Scientist/Modeling Support
- Laura Stevens - Research Scientist
- Andrew Buddenberg - Scientific Programmer
- Jim Biard – Scientific Programmer

  - ➢ Climate Scenarios
  - ➢ Technical Reports
  - ➢ State Climate Summaries

Data and Metadata

- **Sarah Champion - Data Architect and Team Lead**
- Kristy Thomas - Metadata Support
- Mara Sprain – references, copyrights

  - Ensure IQA standards implemented
  - Collect figure metadata
  - Coordinate dissemination of TSU-generated datasets

Editorial and Project Management

- **Brooke Stewart – Science and Technical Editor/Project Management**
- Tom Maycock – Science and Technical Editor
- Jen Runkle – Science and Technical Editor
- Anne Waple – Science and Technical Editor
- Tyler Felgenhauer – Science and Technical Editor

  - Editing
    - Style Guide
    - Basic Copyediting
    - Grammar, punctuation, spelling
    - Conform to style sheet
    - Help craft text for readability, clarity

Graphics – The NCEI Graphics Team

- **Sara Veasey - Creative Director**
- Jessicca Griffin - Graphic Designer
- Debbi Riddle - Graphic Designer
- Deb Misch - Graphic Designer
- Liz Love-Brotak - Graphic Designer

  - ➢ Produce high quality graphics
  - ➢ Document layout

Finding 10: ECOSYSTEMS

SPECIES RESPONSES TO CLIMATE CHANGE

Mussel and barnacle beds have declined or disappeared along parts of the Northwest coast due to higher temperatures and drier conditions.[21]

Conifers in many western forests have died, experiencing mortality rates up to 87%, from warming-induced changes in the prevalence of pests and pathogens and drought stress.[12]

Warming-induced interbreeding was detected between southern and northern **flying squirrels** in the Great Lakes region of Ontario, Canada, and Pennsylvania after a series of warm winters created more overlap in their habitat ranges.[27]

In the Northwest Atlantic, 24 out of 36 **commercial fish stocks** showed significant range shifts, both in latitude and depth, between 1968 and 2007 in response to increased sea surface and bottom temperatures.[29]

Decreases in the weight and **survival of polar bear offspring** along the north Alaska coast have been linked to changes in mother's body size and/or condition following years with lower availability of optimal sea ice habitat.[22]

In response to climate-related habitat change, many **small mammal species** have altered their ranges, with lower-elevation species expanding their ranges and higher-elevation species contracting their ranges.[23]

Quaking aspen tree dominated systems are experiencing declines in the western U.S. due to drought stress during the last decade.[24]

First flowering dates in 178 plant species in North Dakota have shifted significantly in more than 40% of all species examined, with the greatest changes observed during the two warmest years of the study.[28]

Studies of black ratsnake populations in Illinois and Texas suggest that snake populations, particularly in the northern parts of their ranges, could benefit from rising temperatures if there are no negative impacts on their habitat and prey.[30]

Widespread declines in body size of resident and migrant birds in western Pennsylvania were documented over a 40-year period. The higher the average regional temperatures in the preceding year, the smaller the birds.[31]

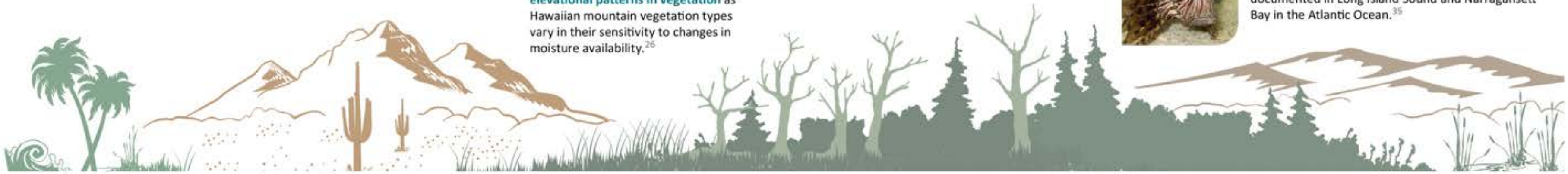
Seedling survival for nearly 20 species of trees decreased during years of lower rainfall in the Southern Appalachians and the Piedmont areas, indicating reductions in native species.[33]

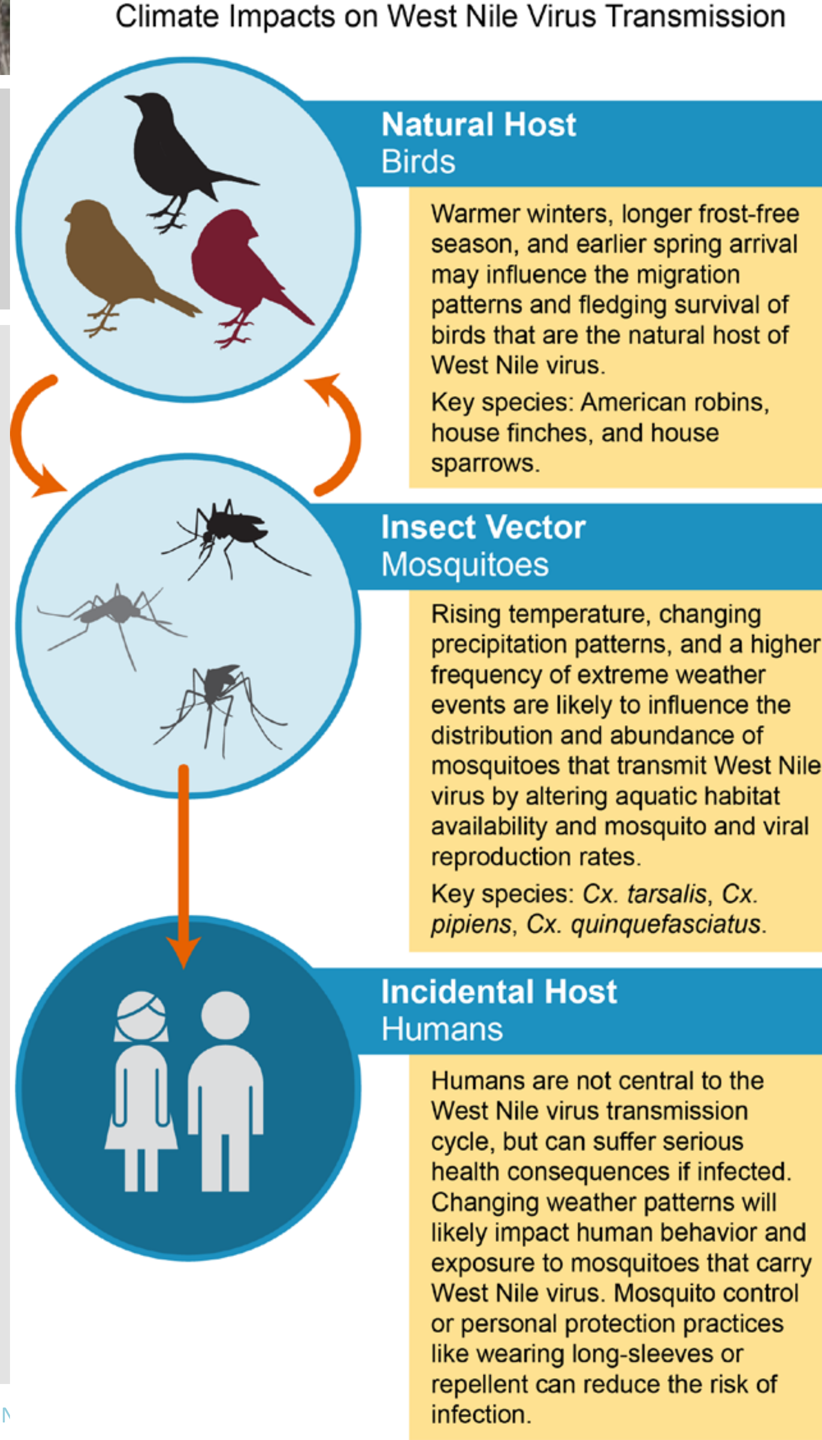
Climatic fluctuations increase the probability of **infidelity in birds** that are normally monogamous. This increases gene exchange and the likelihood of offspring survival.[32]

Warmer springs in Alaska have **reduced calving success in caribou** populations as a result of earlier onset of plant emergence and decreased spatial variation in growth and availability of forage to breeding caribou.[25]

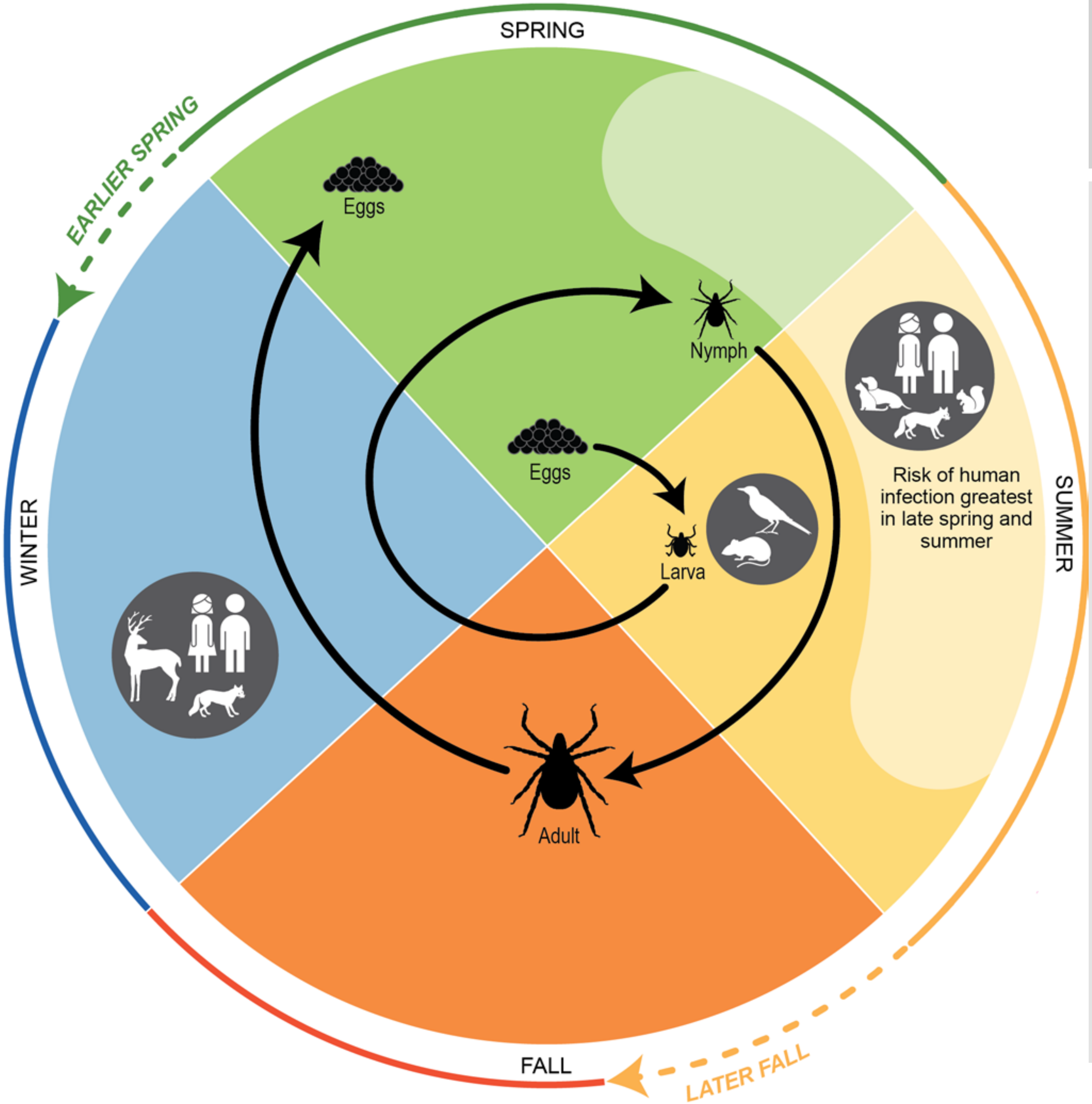
Climate change is likely to influence **elevational patterns in vegetation** as Hawaiian mountain vegetation types vary in their sensitivity to changes in moisture availability.[26]

Some warm-water fishes have moved northwards, and some tropical and subtropical fishes in the northern Gulf of Mexico have increased in temperate ocean habitat.[34] Similar shifts and invasions have been documented in Long Island Sound and Narragansett Bay in the Atlantic Ocean.[35]




Climate Impacts on West Nile Virus Transmission
Natural Host
Birds
Warmer winters, longer frost-free season, and earlier spring arrival may influence the migration patterns and fledging survival of birds that are the natural host of West Nile virus.
Key species: American robins, house finches, and house sparrows.
Insect Vector
Mosquitoes
Rising temperature, changing precipitation patterns, and a higher frequency of extreme weather events are likely to influence the distribution and abundance of mosquitoes that transmit West Nile virus by altering aquatic habitat availability and mosquito and viral reproduction rates.
Key species: *Cx. tarsalis*, *Cx. pipiens*, *Cx. quinquefasciatus*.
Incidental Host
Humans
Humans are not central to the West Nile virus transmission cycle, but can suffer serious health consequences if infected. Changing weather patterns will likely impact human behavior and exposure to mosquitoes that carry West Nile virus. Mosquito control or personal protection practices like wearing long-sleeves or repellent can reduce the risk of infection.

Life Cycle of Blacklegged Ticks, Ixodes scapularis



Web/Technology

- Angel Li - Web Developer
- Kate Johnson - Web Developer
- Andrew Buddenberg - Software Engineer

    - ➢ Develop report websites (e.g. nca2014.globalchange.gov)
    - ➢ Develop support websites (e.g. author resources, review and comment system).
    - ➢ Other software engineering (e.g. metadata flow to GCIS).

Web/Technology Products

- Resources web site for NCA report authors
- Review and comment system for organization of external review comments and responses
- Web sites for NCA products

- NCA3 – highly regarded presentation of NCA3 report
- Climate and Health report – followed the NCA3 example with another highly regarded web site

TSU Science Products

- Scientific Reports

➢ NOAA NESDIS Technical Report 142, Parts 1-9

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, J. Rennells, A. DeGaetano, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 1. Climate of the Northeast U.S.* NOAA Technical Report NESDIS 142-1, 80 pp.

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, C.E. Konrad II, C.M. Fuhrman, B.D. Keim, M.C. Kruk, A. Billet, H. Needham, M. Schafer, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 2. Climate of the Southeast U.S.* NOAA Technical Report NESDIS 142-2, 95 pp.

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, S.D. Hilberg, M.S. Timlin, L. Stoecker, N.E. Westcott, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 3. Climate of the Midwest U.S*. NOAA Technical Report NESDIS 142-3, 96 pp.

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, M.C. Kruk, D.P. Thomas, M. Shulski, N. Umphlett, K. Hubbard, K. Robbins, L. Romolo, A. Akyuz, T. Pathak, T. Bergantino, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 4. Climate of the U.S. Great Plains*. NOAA Technical Report NESDIS 142-4, 83 pp.

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K.T. Redmond, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 5. Climate of the Southwest U.S*. NOAA Technical Report NESDIS 142-5, 79 pp.

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K.T. Redmond, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 6. Climate of the Northwest U.S.* NOAA Technical Report NESDIS 142-6, 76 pp.

Stewart, B.C., K.E. Kunkel, L.E. Stevens, L. Sun, and J.E. Walsh, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 7. Climate of Alaska*. NOAA Technical Report NESDIS 142-7, 61 pp.

Keener, V.W., K. Hamilton, S.K. Izuka, K.E. Kunkel, L.E. Stevens, and L. Sun, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 8. Climate of the Pacific Islands.* NOAA Technical Report NESDIS 142-8, 45 pp.

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, and J.G. Dobson, 2013: *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 9. Climate of the Contiguous United States*. NOAA Technical Report NESDIS 142-9, 78 pp.

TSU Science Products

- Scientific Reports

➢ NOAA NESDIS Technical Report 144

Sun, L., K.E. Kunkel, L.E. Stevens, A. Buddenberg, J.G. Dobson, and D.R. Easterling, 2015: Regional Surface Climate Conditions in CMIP3 and CMIP5 for the United States: Differences, Similarities, and Implications for the U.S. National Climate Assessment, *NOAA Technical Report NESDIS 144,* 111 pp.

➢ NOAA State Summaries

- To be published in late 2016 or early 2017

TSU Science Products

- Scientific Analysis
- ➢ Third National Climate Assessment
- ➢ Observations (e.g. COOP)

Global climate model (CMIP3) products

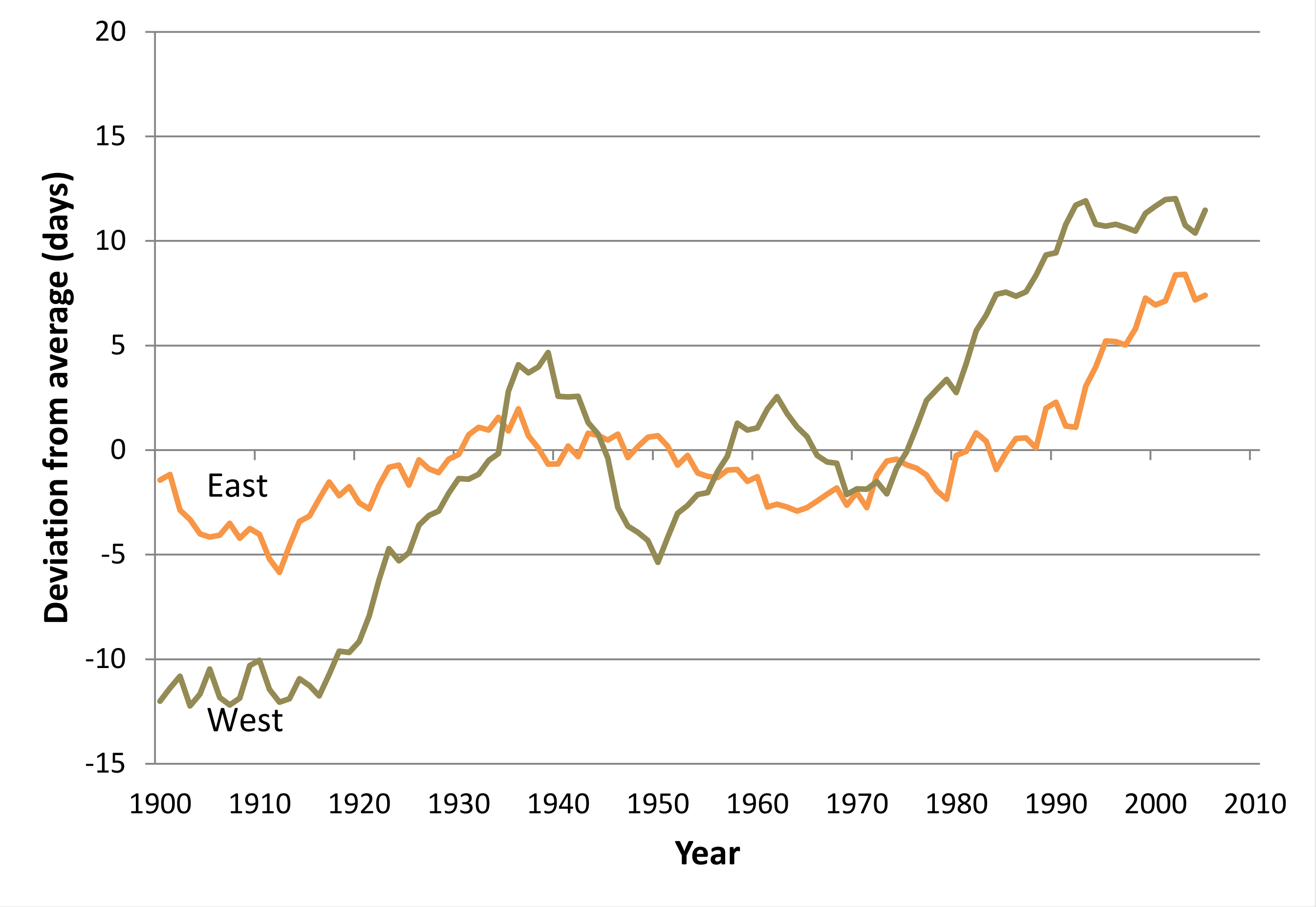
Regional Climate Model (NARCCAP) model products

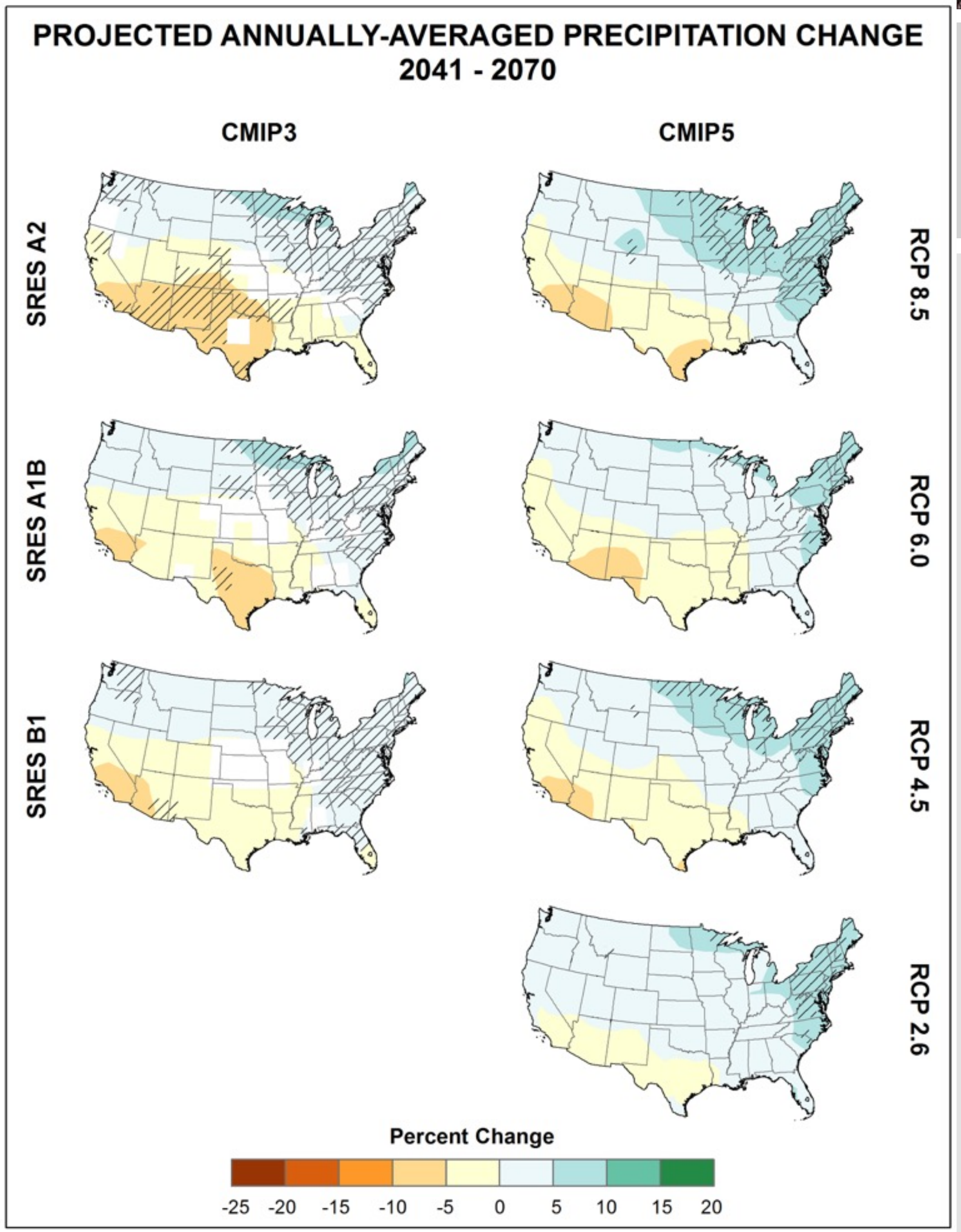
Statistically-downscaled (Asynchronous Regional Regression Model) model products

- ➢ Climate Science Special Report
- ➢ CMIP5

Localized Constructed Analogs (LOCA) statistically downscaled data set

Climatic Trends: Freeze-free Season





PROJECTED ANNUALLY-AVERAGED PRECIPITATION CHANGE
2041 - 2070
CMIP3
CMIP5
SRES A2
SRES A1B
SRES B1
RCP 8.5
RCP 6.0
RCP 4.5
RCP 2.6
Percent Change
-25 -20 -15 -10 -5 0 5 10 15 20

Weighting Method

Weighting

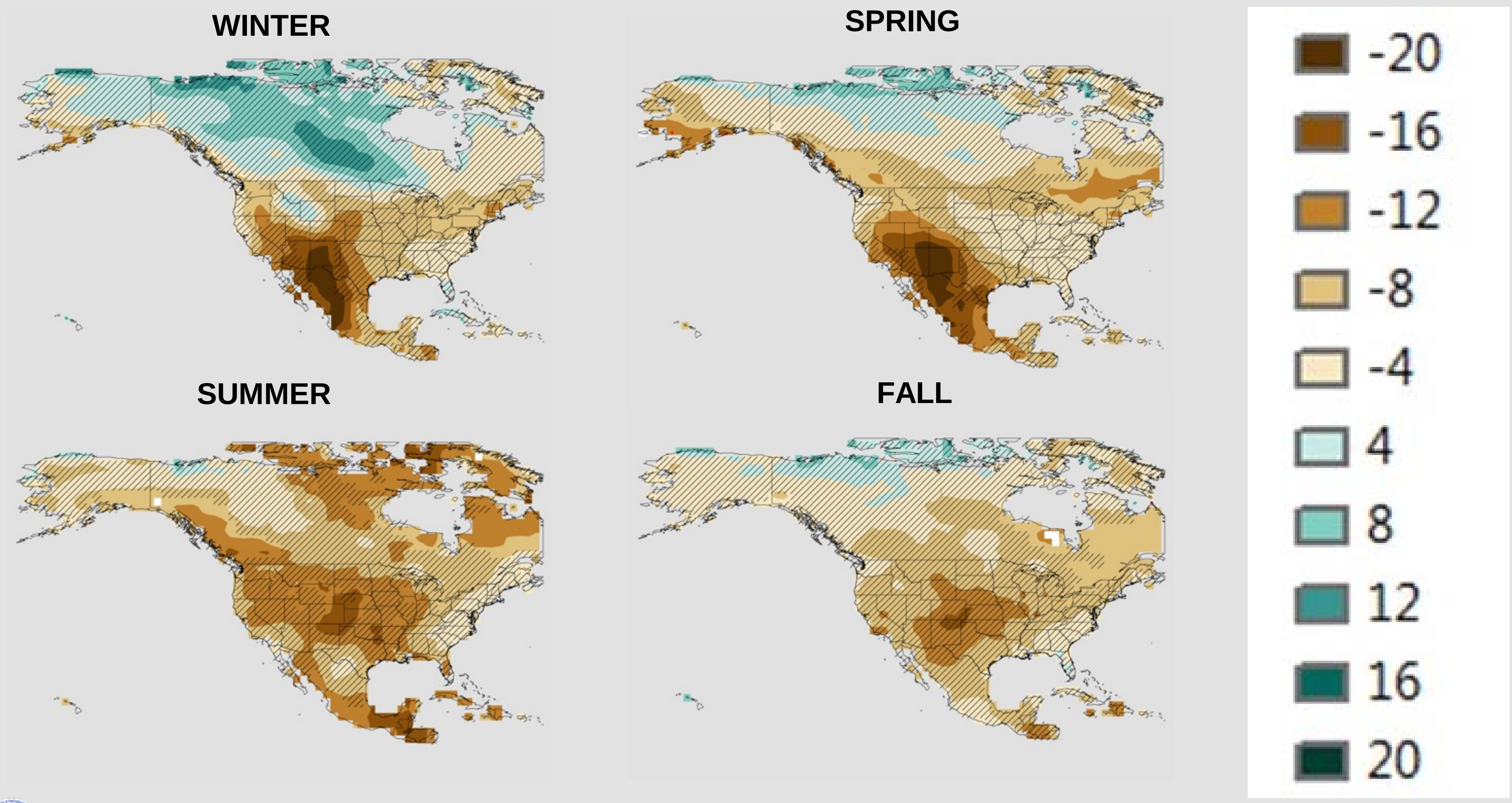
- Independence Weights - Inter-model distances computed as simple root mean square differences are used to calculate independence weights
- Skill Weights - The RMSE distances between each model and the observations are used to calculate skill weights
- An overall weight is then computed as the product of the skill weight and the independence weight.

Variables

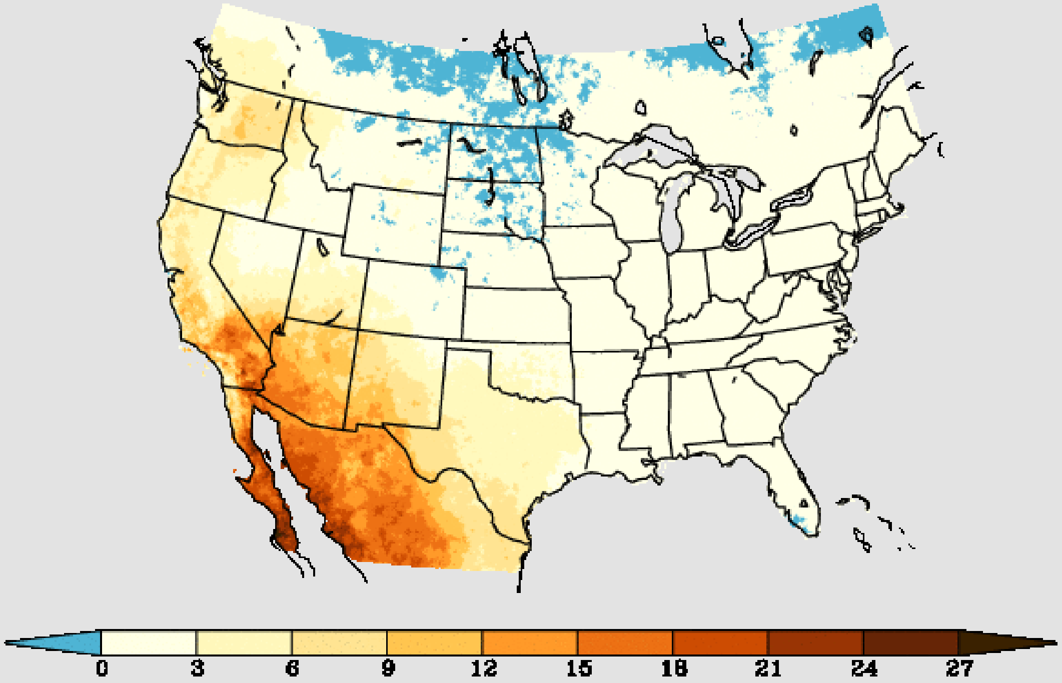
1. Surface Temperature (seasonal)
2. Mean Precipitation (seasonal)
3. TOA Shortwave Flux (seasonal)
4. TOA Longwave Flux (seasonal)
5. Vertical Temperature Profile (seasonal)
6. Vertical Humidity Profile (seasonal)
7. Surface Pressure (seasonal)
8. Coldest Night
9. Coldest Day
10. Warmest Night
11. Warmest day
12. Seasonal max. 5-day total precip.

Sanderson *et al.* 2016

Projected Seasonal Moisture Change (upper layer) RCP8.5 2070-2099



LOCA - Annual Maximum Number of Consecutive Dry Days: RCP8.5 2070-2099



Any questions?