Climate Team Overview and Progress

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BREE
Basin Resilience to Extreme Events
in the Lake Champlain Basin

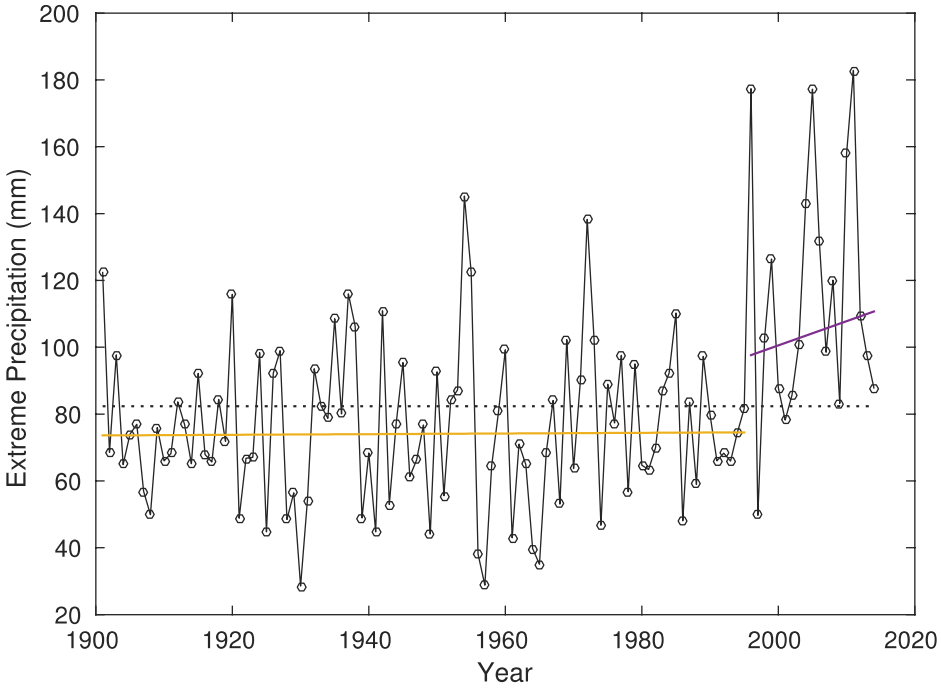
The University of Vermont

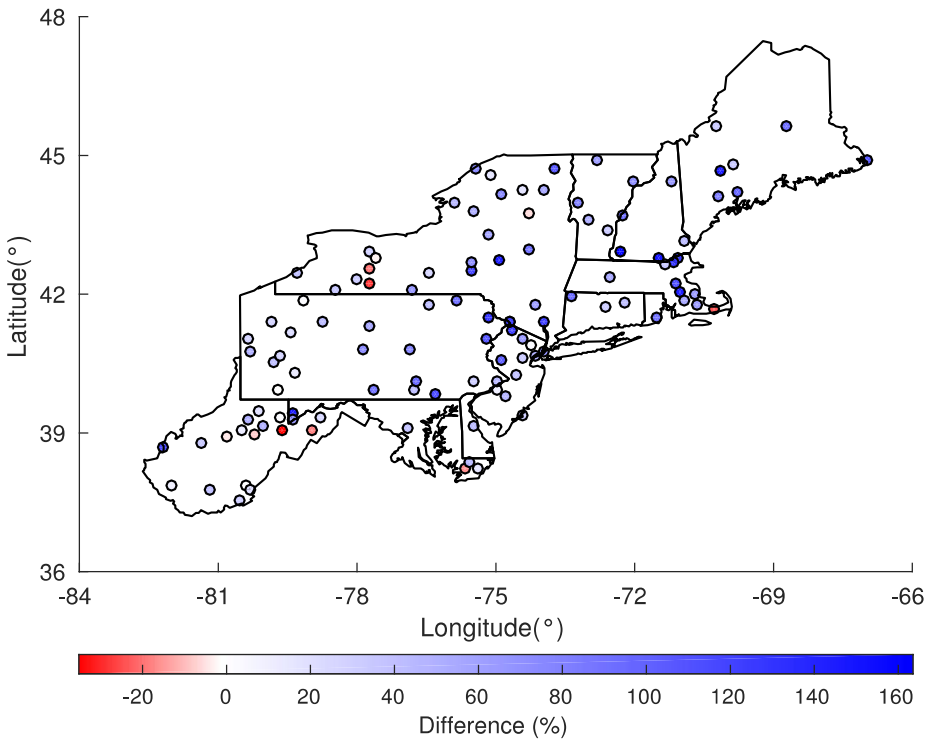
JOHNSON STATE COLLEGE
VERMONT

DARTMOUTH
1769

LYNDON
A vermont STATE COLLEGE

Northeast Extreme Precipitation Events Increased Dramatically 1996-Present

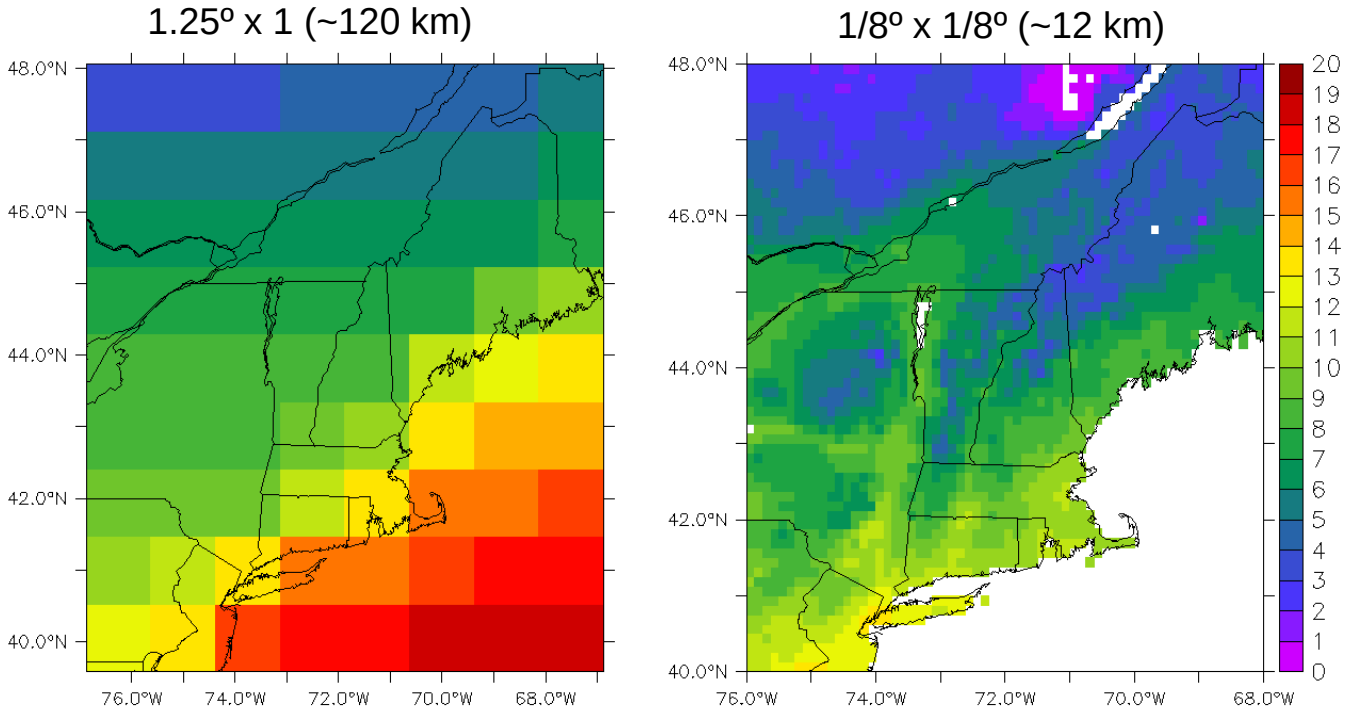




USGCRP, 2014; Huang et al., 2017

Climate Team Objectives

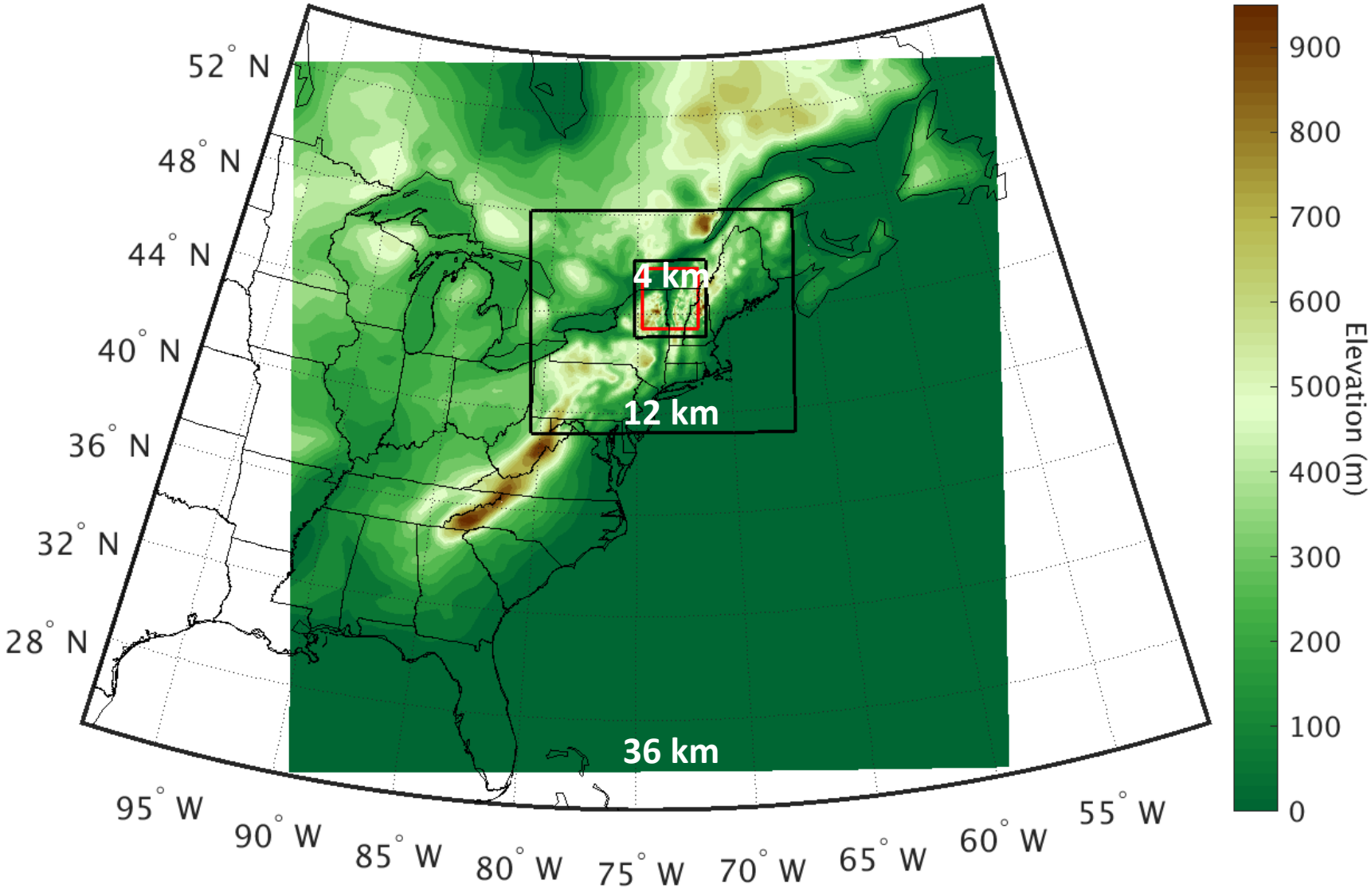
1. Deploy, calibrate, and evaluate a regional climate model (Weather Research and Forecasting Model; WRF)
2. Refine WRF to better capture extreme events (e.g., flooding, heatwaves, drought, cold snaps)
3. Include WRF climate scenarios in the IAM



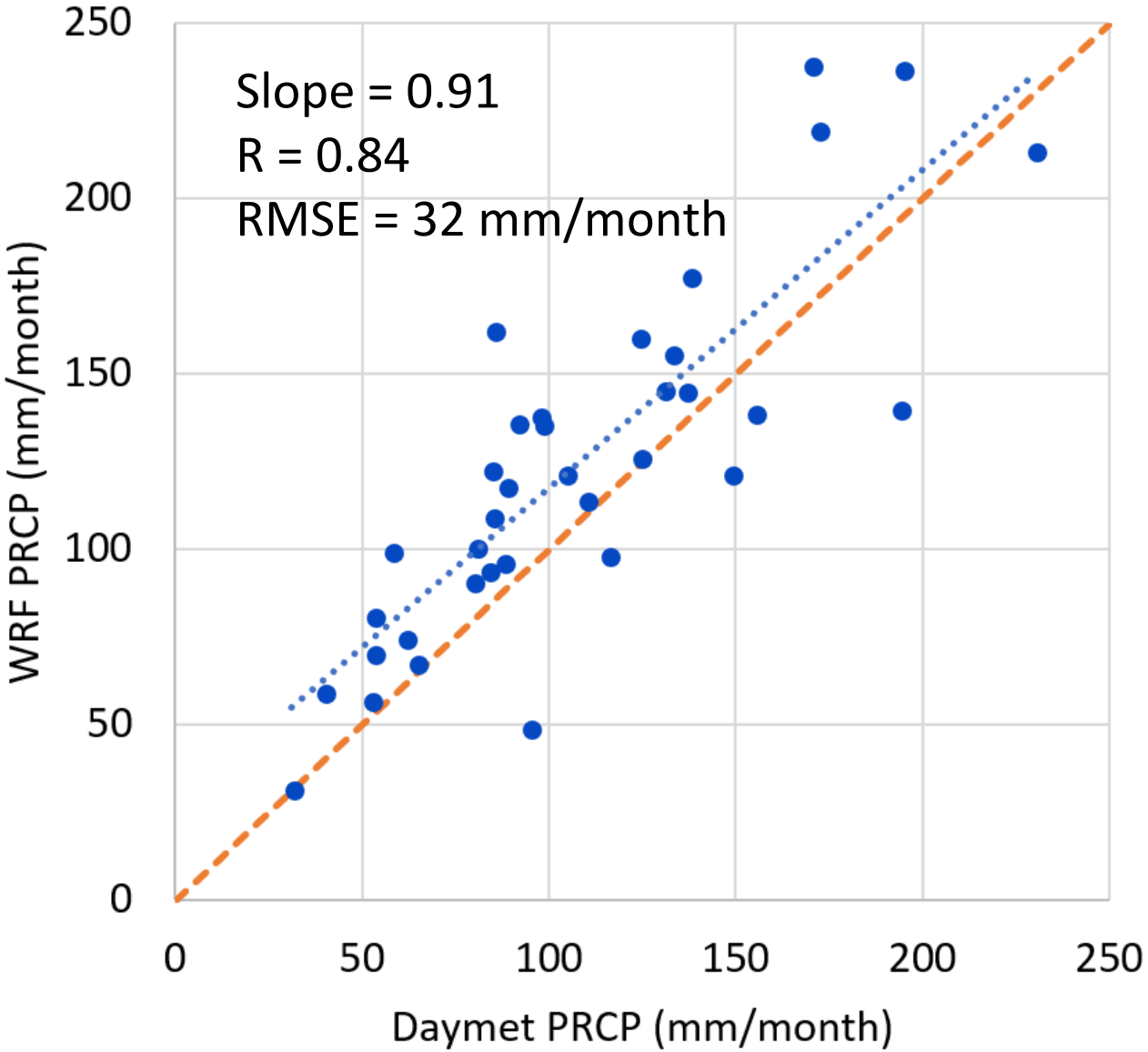
Deploy, Calibrate, and Evaluate a Regional Climate Model (WRF)

- Team
  - PI Leads: Jonathan Winter, Brian Beckage, Janel Hanrahan
  - Students: Huanping Huang (Dartmouth), Maike Holthuijzen (UVM)
- Key Activities
  - Deploy, calibrate, and evaluate WRF forced with reanalysis (WRF-REA)
  - Setup and evaluate WRF forced with historical GCM data (WRF-HIS)
  - Create downscaled climate projections using WRF with future GCM data (WRF-FUT)
- Facilities
  - Discovery (Dartmouth)
  - Cheyenne (NCAR)

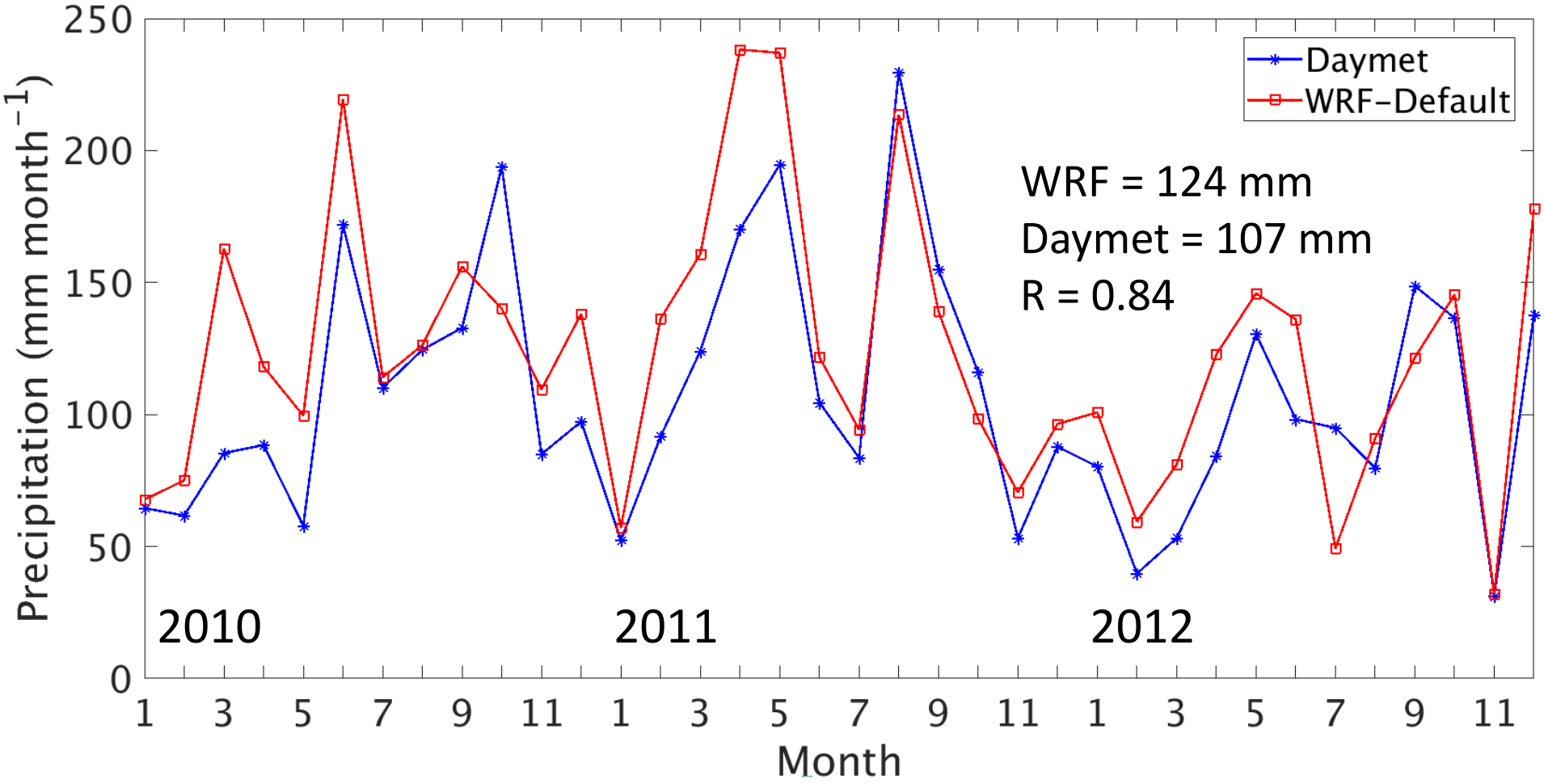
WRF Domains


52° N
48° N
44° N
40° N
36° N
32° N
28° N
95° W
90° W
85° W
80° W
75° W
70° W
65° W
60° W
55° W
4 km
12 km
36 km
900
800
700
600
500
400
300
200
100
0
Elevation (m)

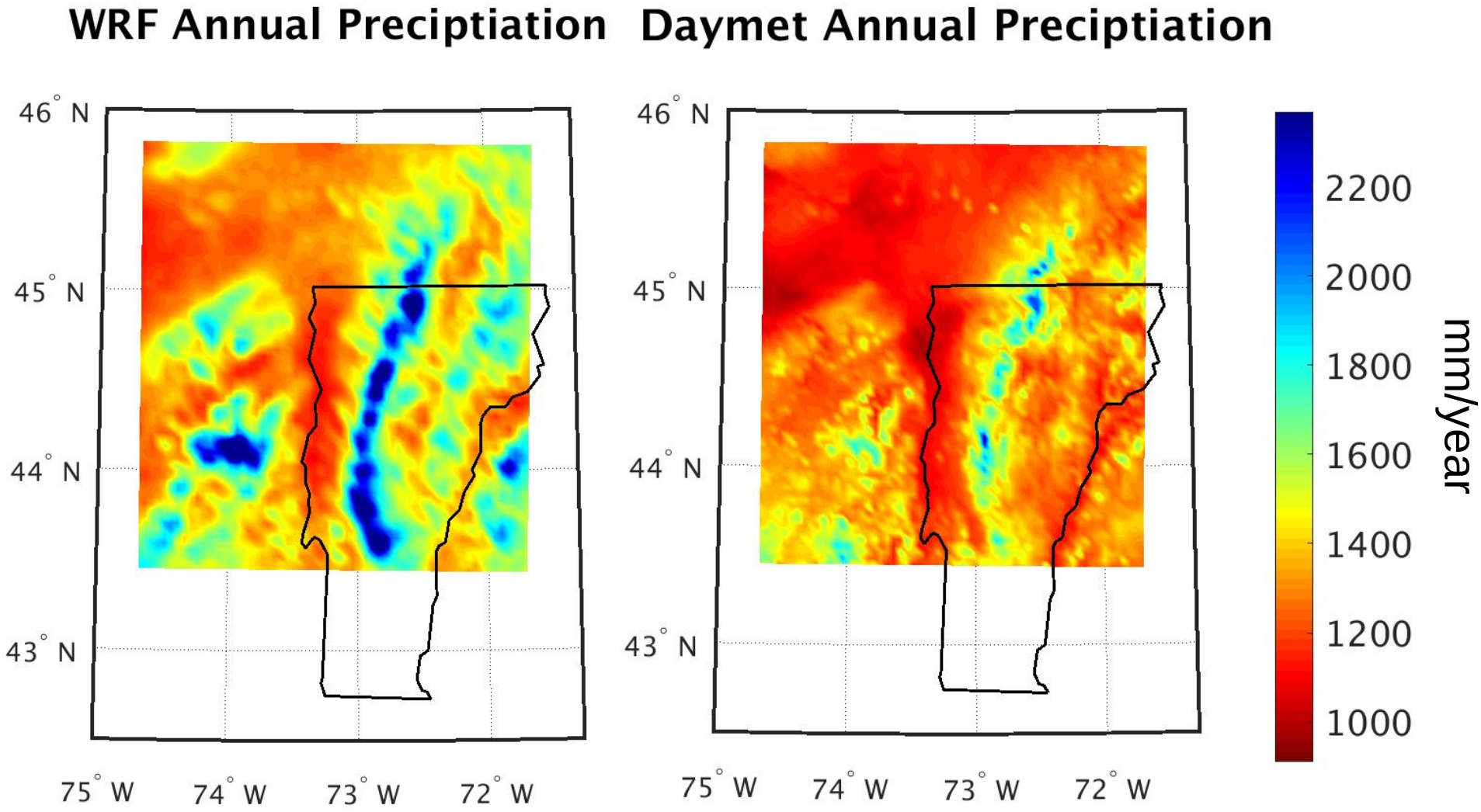
WRF Reasonably Simulates Monthly Precipitation



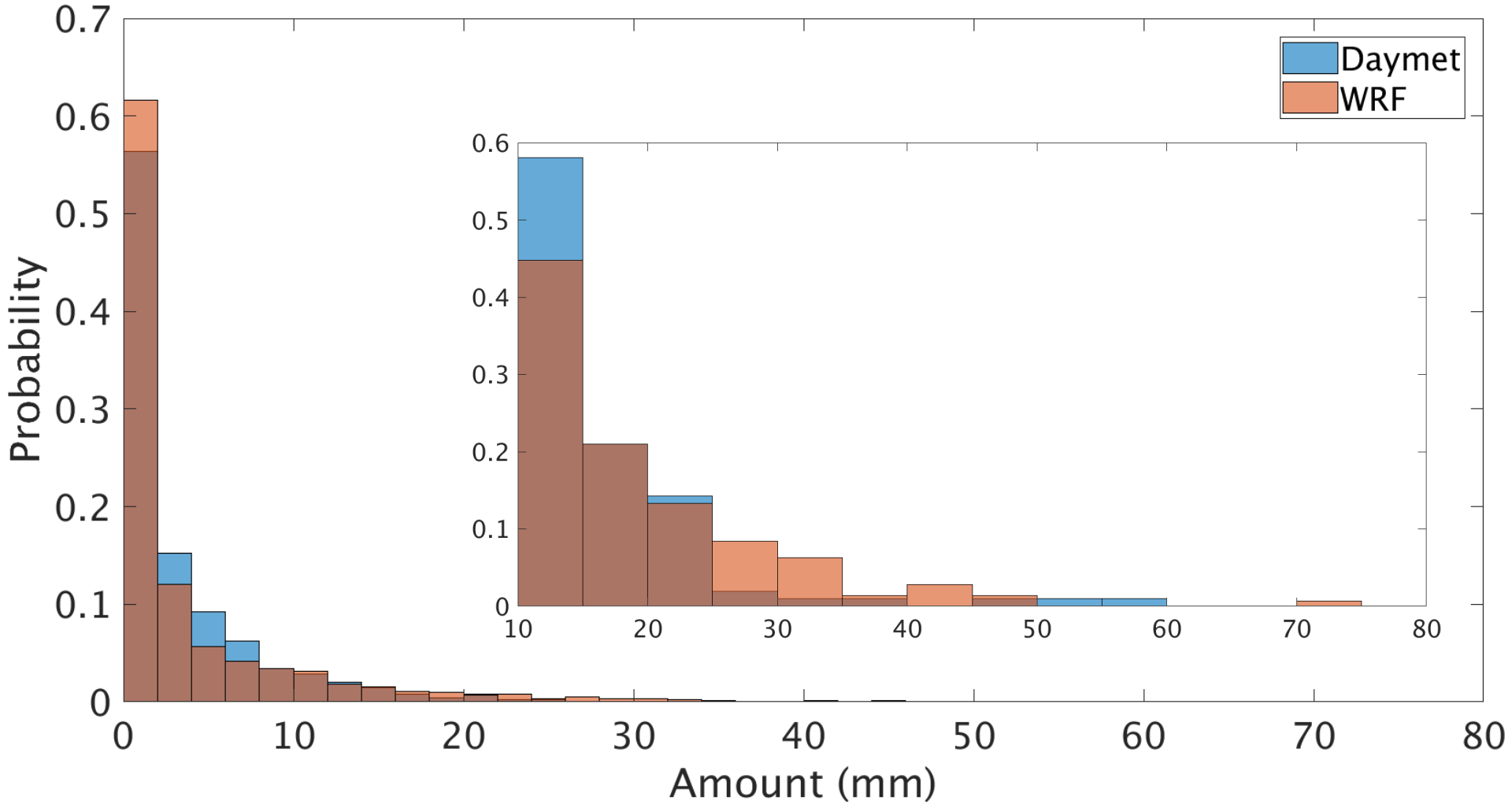
WRF Overestimation of Precipitation Largest in Winter



WRF Spatial Precipitation Distribution Consistent with Daymet

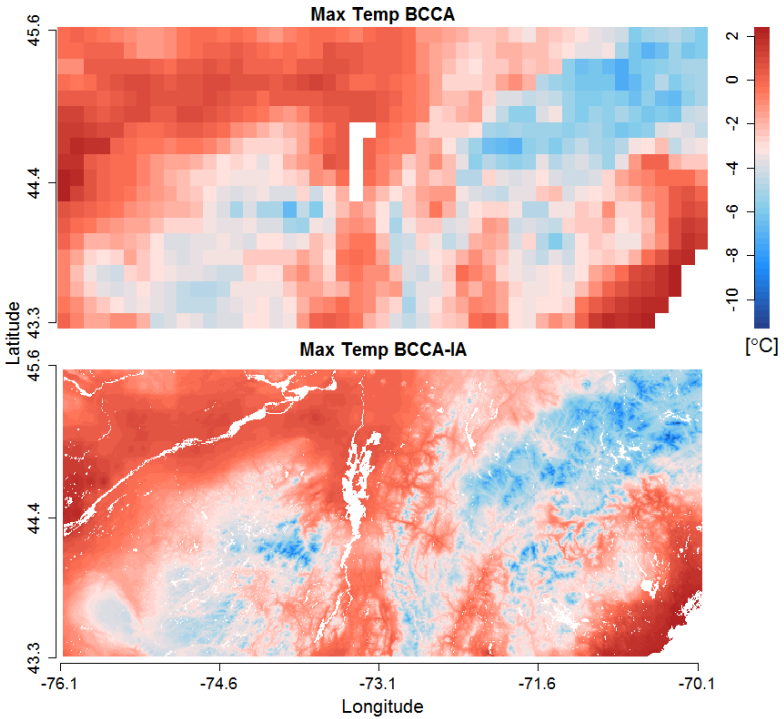


Daily Precipitation Distributions of WRF and Daymet Statistically Similar



Refine WRF to Better Capture Extreme Events

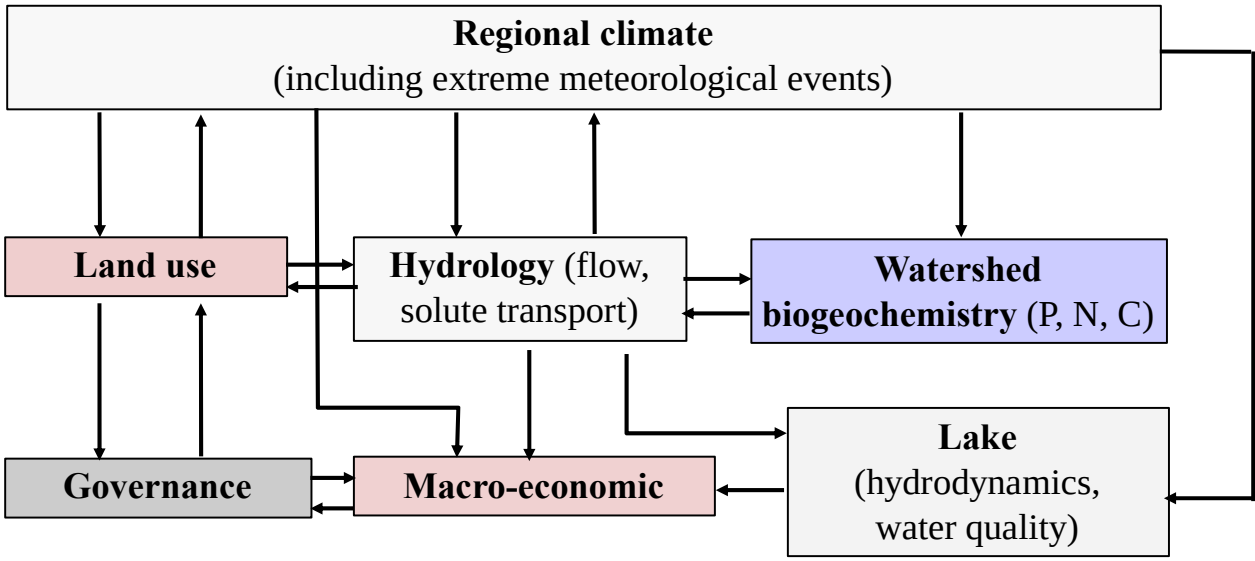
- Team
  - PI Leads: Brian Beckage, Jonathan Winter, Janel Hanrahan
  - Students: Maike Holthuijzen, Huanping Huang
- Key Activities
  - Apply bias correction to WRF simulations
  - Employ Extreme Value Theory (EVT)
- Facilities
  - Babbage (UVM)
  - Cheyenne (NCAR)
  - Workstations



Winter et al., 2016

Include WRF Climate Scenarios in the IAM

- Team
  - PI Leads: Patrick Clemins, Asim Zia, Brian Beckage, Jonathan Winter
  - Postdoc: Jory Hecht
  - Students: Huanping Huang, Maike Holthuijzen
- Key Activities
  - Climate scenario integration with IAM component models
  - Support climate projections for downstream applications
- Facilities
  - Babbage (UVM)
  - Pascal (UVM)
  - Cheyenne (NCAR)
  - Leibnitz (UVM)



ERA5 Regional Precipitation Analysis

- Team
  - PI Leads: Arne Bomblies, Lesley-Ann Dupigny-Giroux, Alan Betts
  - Students: Caitlin Crossett
- Key Activities
  - Analyze synoptic mechanisms of precipitation and precipitation trends across the Lake Champlain Basin
  - Explore the impacts of antecedent conditions on flooding
- Facilities
  - Leibnitz (UVM)
  - Workstations