

Understanding the spatial and temporal regional climate patterns of Northeastern US

Emily Landry¹, Alexandra Contosta², Jane R. Foster^{3, 4}, and Scott V. Ollinger^{1,2}

¹Department of Natural Resources and the Environment, University of New Hampshire, Durham, NH, 03824

²Earth Systems Research Center, University of New Hampshire, Durham, NH, 03824

³Rubenstein School of Environment and Natural Resources, University of Vermont, Burlington, VT, 05405

⁴Southern Research Station, US Forest Service, Knoxville, TN, 37919



Introduction

Here in the Northeast, we have a seasonal, temperate, mostly forested ecosystem driven by climate variables like temperature and precipitation. **A regional climate analysis will be completed to investigate the Northeast's climate patterns and how they have changed**, as compared to a study that did the same analysis with older data. The results of this study will help us understand how changing climate patterns might affect ecosystems and can provide environmental models with updated climate input data.

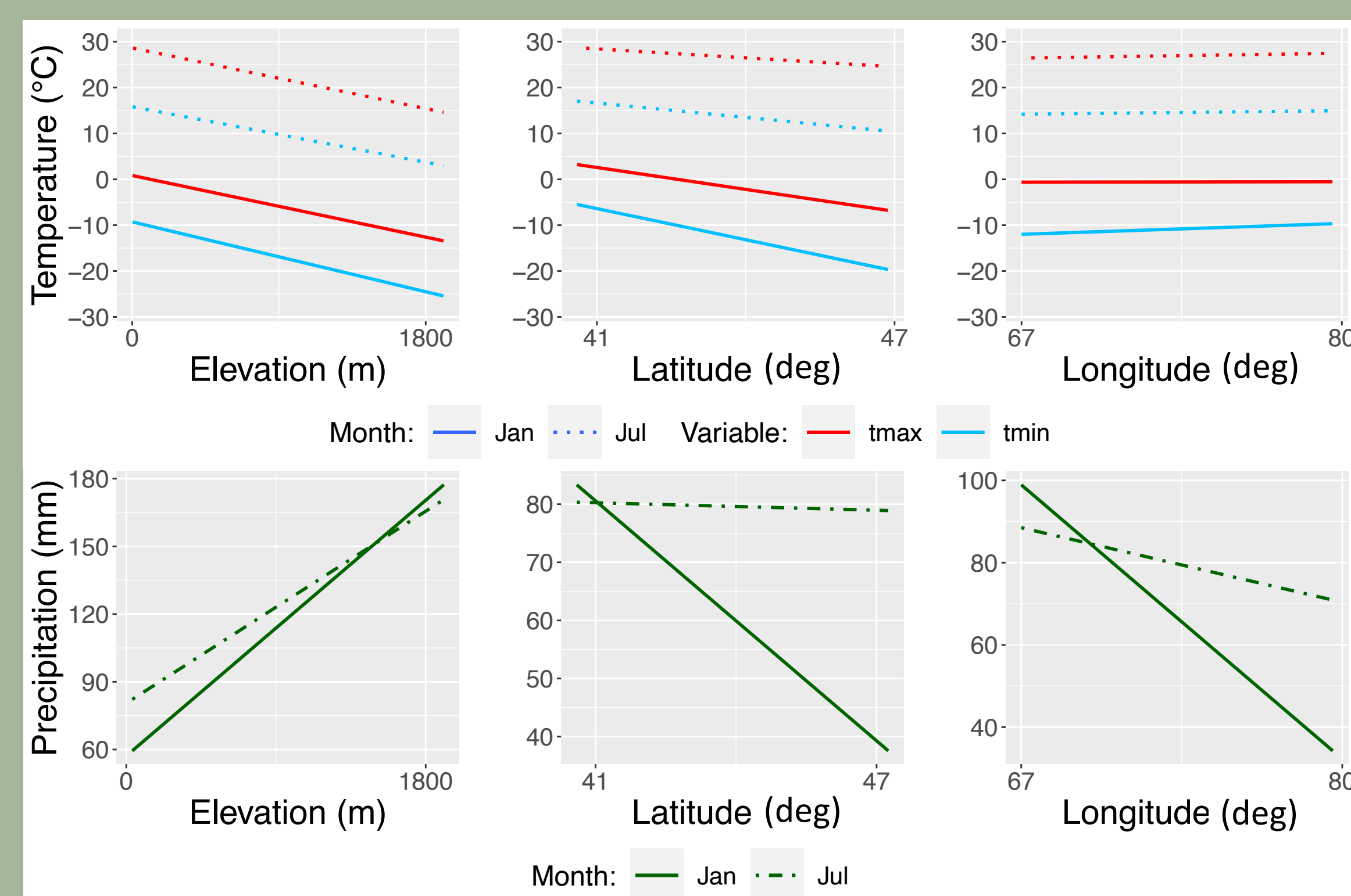
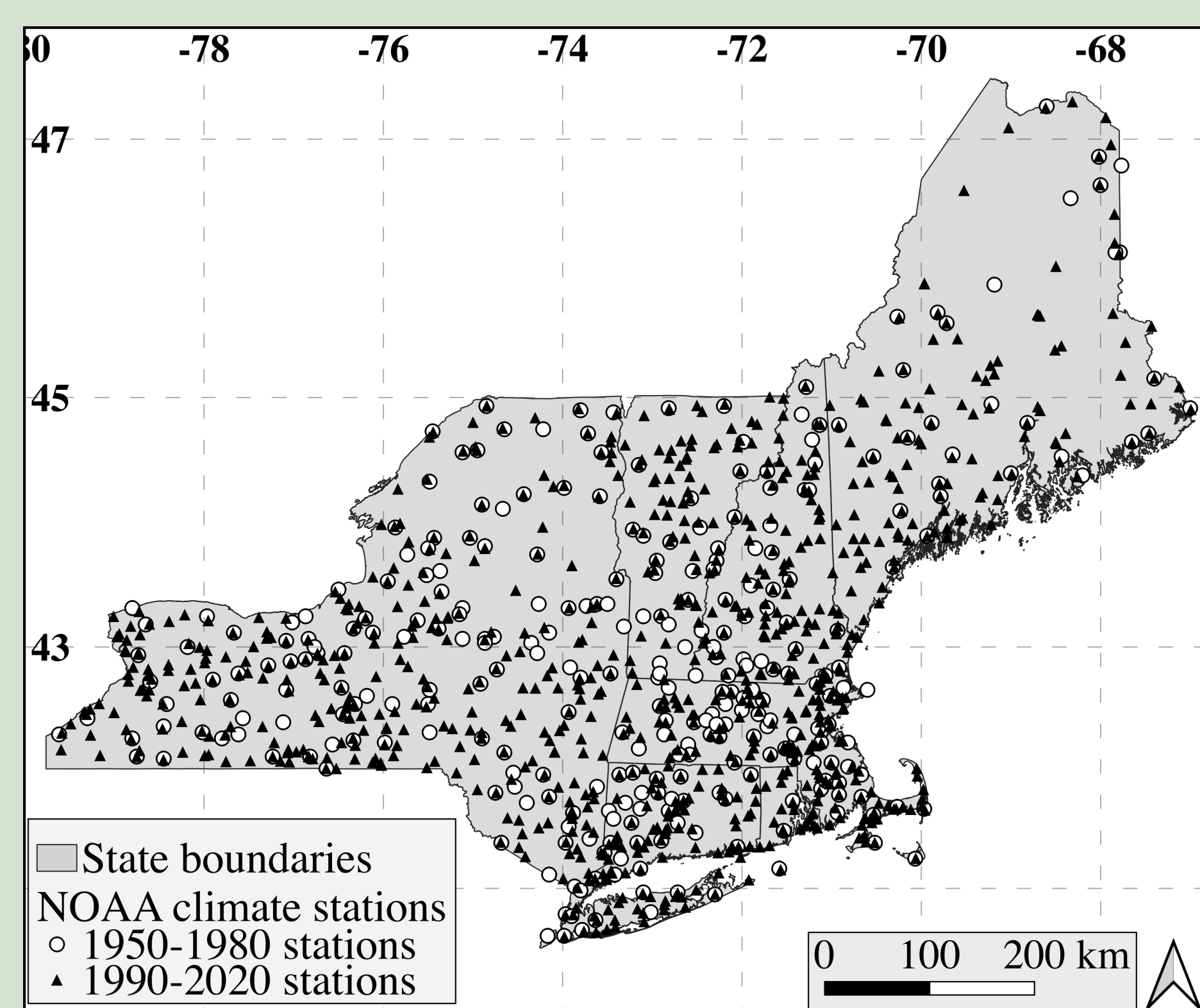


Fig. 1 (left): The general regional climate patterns in the Northeast are influenced by elevation, latitude, and longitude. Typically, temperature decreases as elevation and latitude increase. Precipitation increases as elevation increases but decreases as latitude and longitude increase. Seasons affect the 'steepness' of these patterns.

Data

Fig. 2 (right): The data used here are 1990-2020, 30-year climate normals of monthly average daily maximum temperature (tmax) and minimum temperature (tmin), and monthly average precipitation (precip) from 830 stations (black triangles) in the Northeast published by NOAA. The previous study used 1950-1980, 30-year normals from 310 stations (white dots).



Changes in Climate Patterns

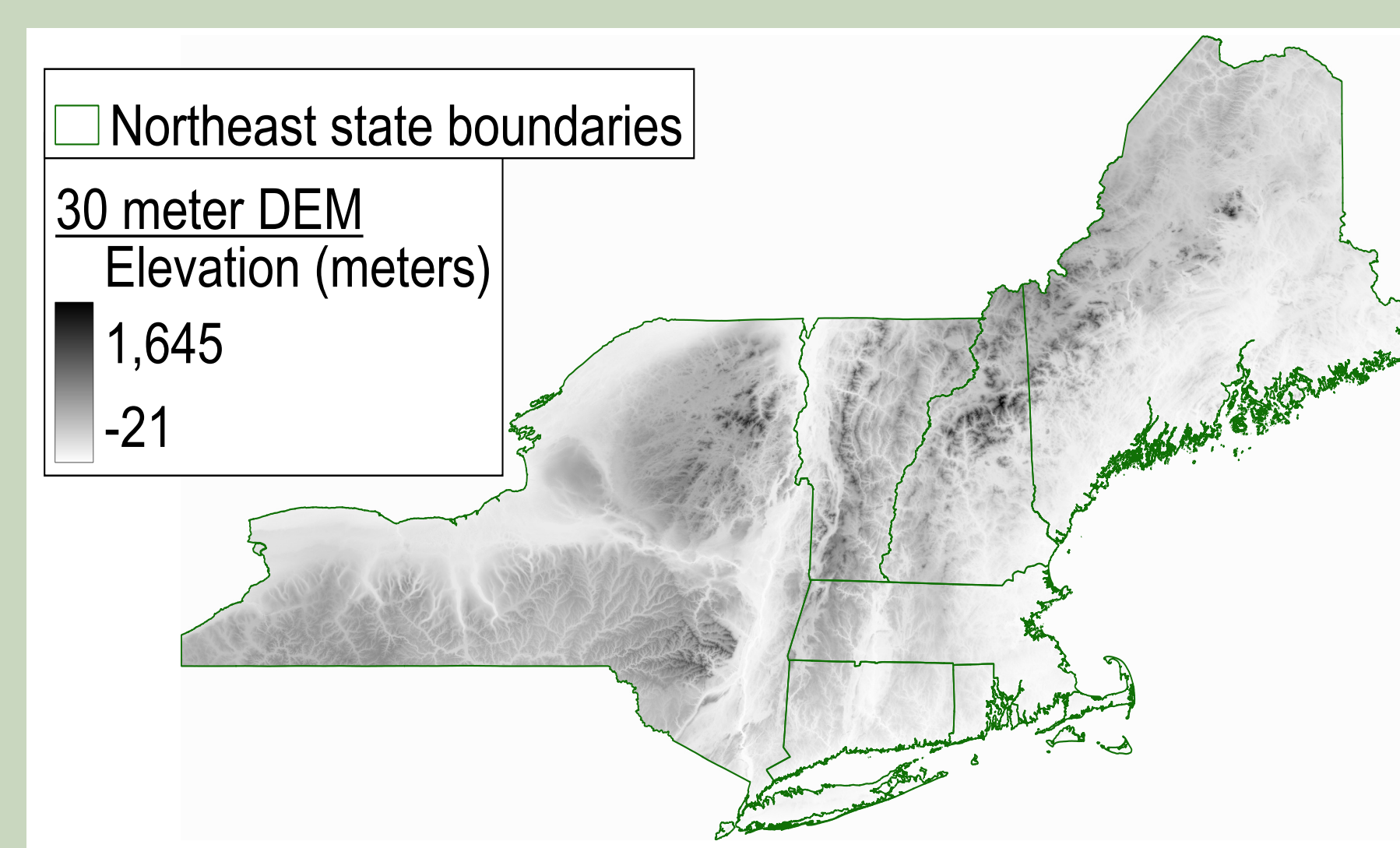
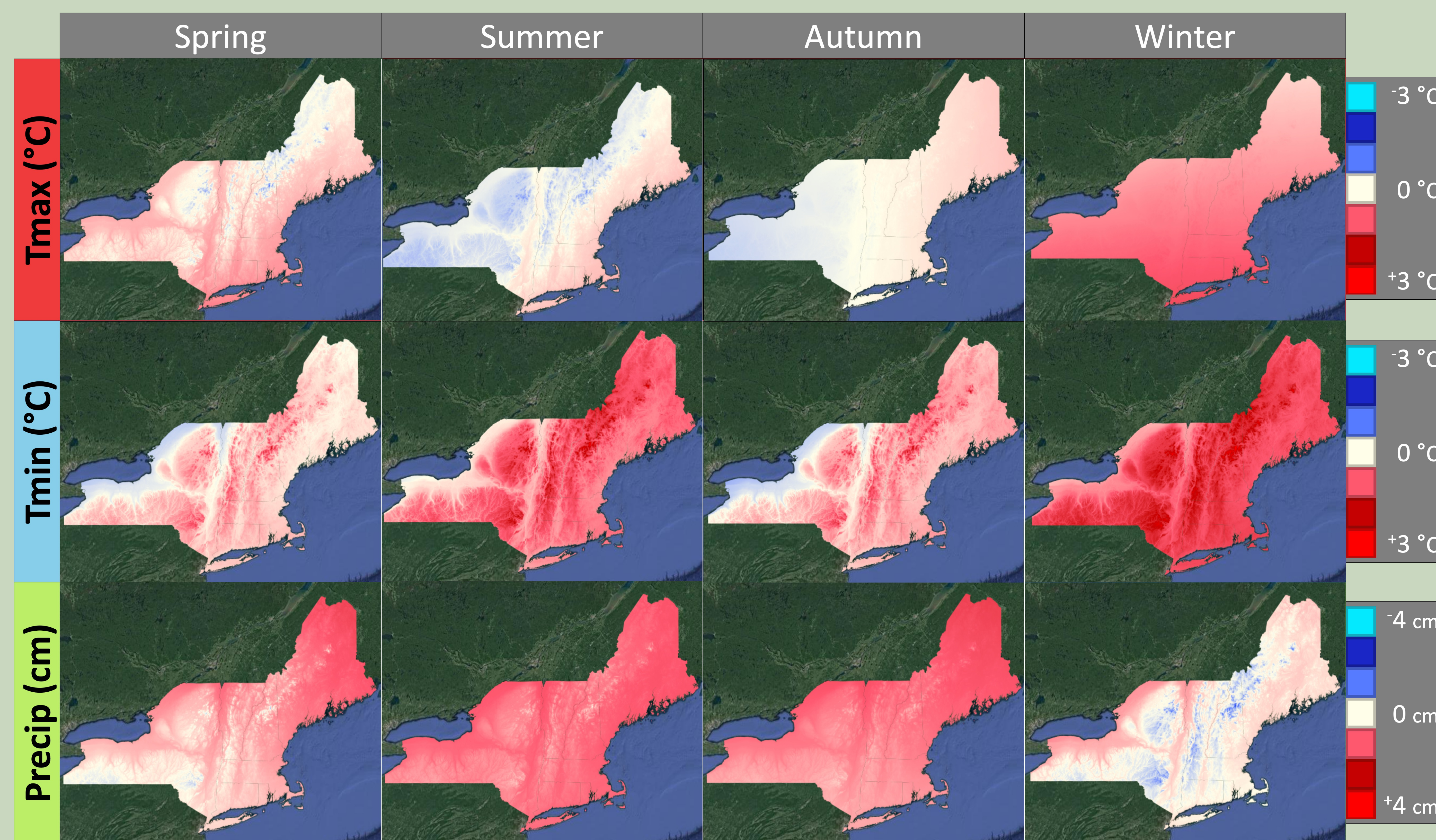


Fig. 4 (left): The best fit climate models for each month were then applied to the region using the latitude, longitude, and elevation from a 30-meter digital elevation model to map climate variables for each month.

Fig. 5 (below): 'Old' maps were subtracted from the 'new' maps to produce a map showing how climate has changed across the region. Monthly changes were averaged into seasons; spring (Mar, Apr, May), summer (Jun, Jul, Aug), autumn (Sep, Oct, Nov), and winter (Dec, Jan, Feb).



Changes in Model Coefficients

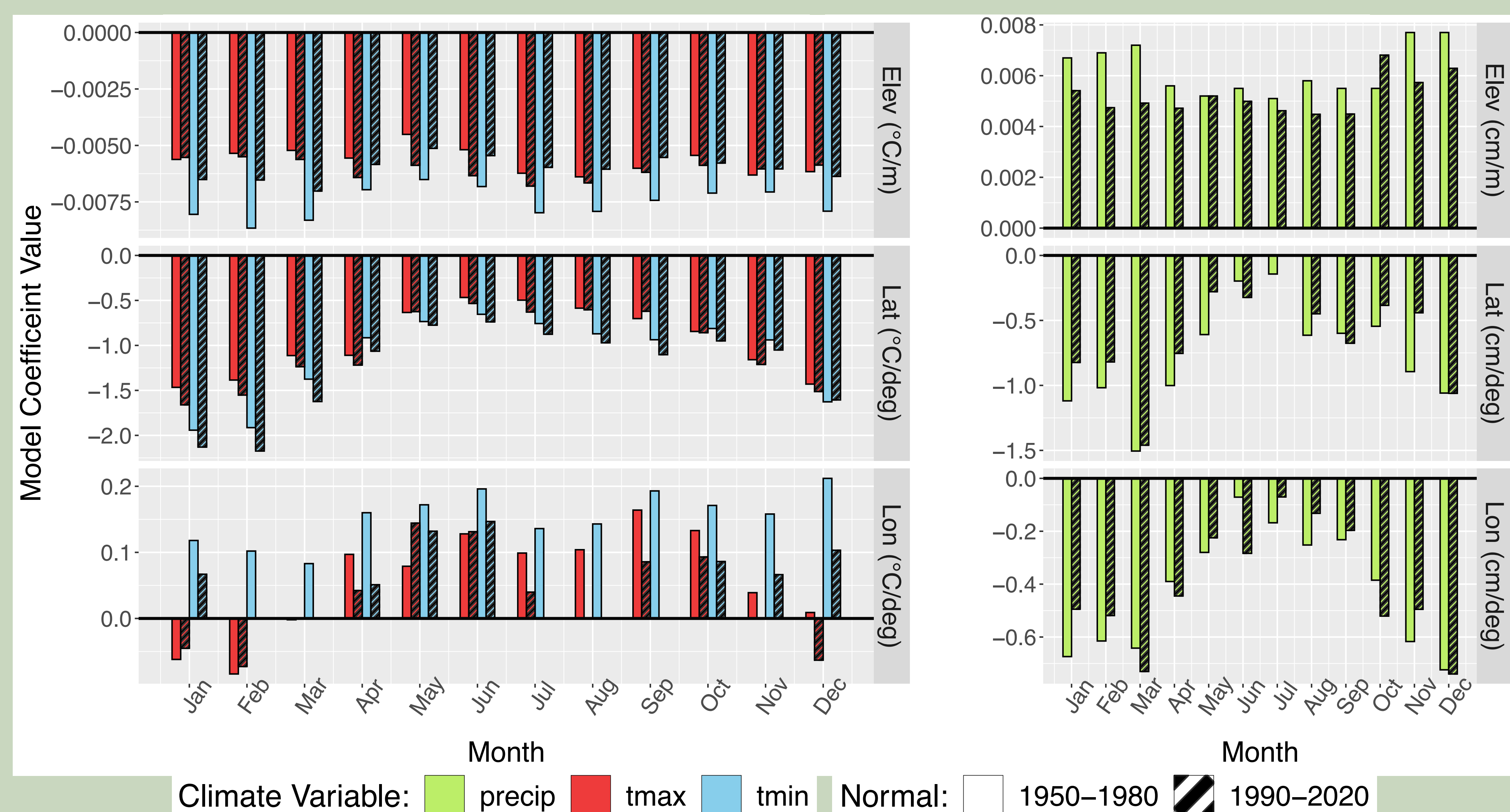


Fig. 3 (left): A series of multiple linear regressions were run to find the best fit models for each monthly climate variable using latitude, longitude, and elevation as predictor variables when significant. Changes in coefficients between the 'old' 1950-1980 analysis and 'new' 1990-2020 analysis are shown here. Average R² values for new monthly best fit models are 0.86 for tmax, 0.75 for tmin, and 0.41 for precip.

Note: Absolute value of longitude was used in this analysis.

Conclusions

There has been an overall increase in tmax, tmin, and precip, with variations in seasonal and regional changes. Dewpoint may be responsible for increases in tmin and decreases in tmax. In future work, dewpoint normals will be calculated and used for an additional regional analysis for that variable. The previous study used the climate data in a model (PnET) to predict forest productivity, and this could be repeated with the new climate data to investigate changes in forest productivity.

Questions/Comments?

Email me at: emily.landry@unh.edu

References & Acknowledgements

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Ollinger, S. V., Aber, J. D., Federer, A. C., Lovett, G. M., & Ellis, J. M. (1995). Modeling physical and chemical climate of the northeastern United States for a geographic information system (NE-GTR-191; p. NE-GTR-191). U.S. Department of Agriculture, Forest Service, Northeastern Forest Experimental Station. <https://doi.org/10.2737/NE-GTR-191>