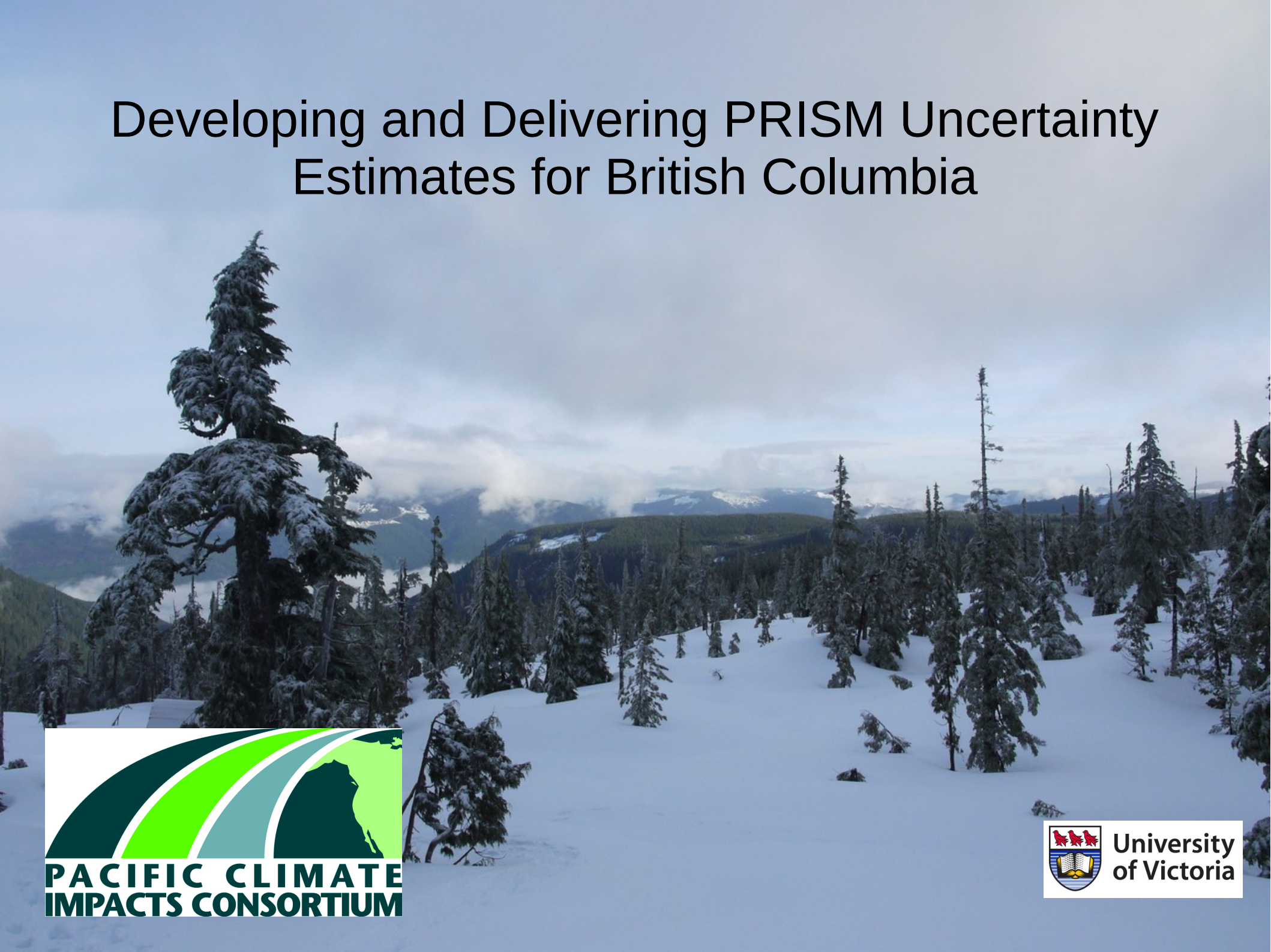
Developing and Delivering PRISM Uncertainty Estimates for British Columbia

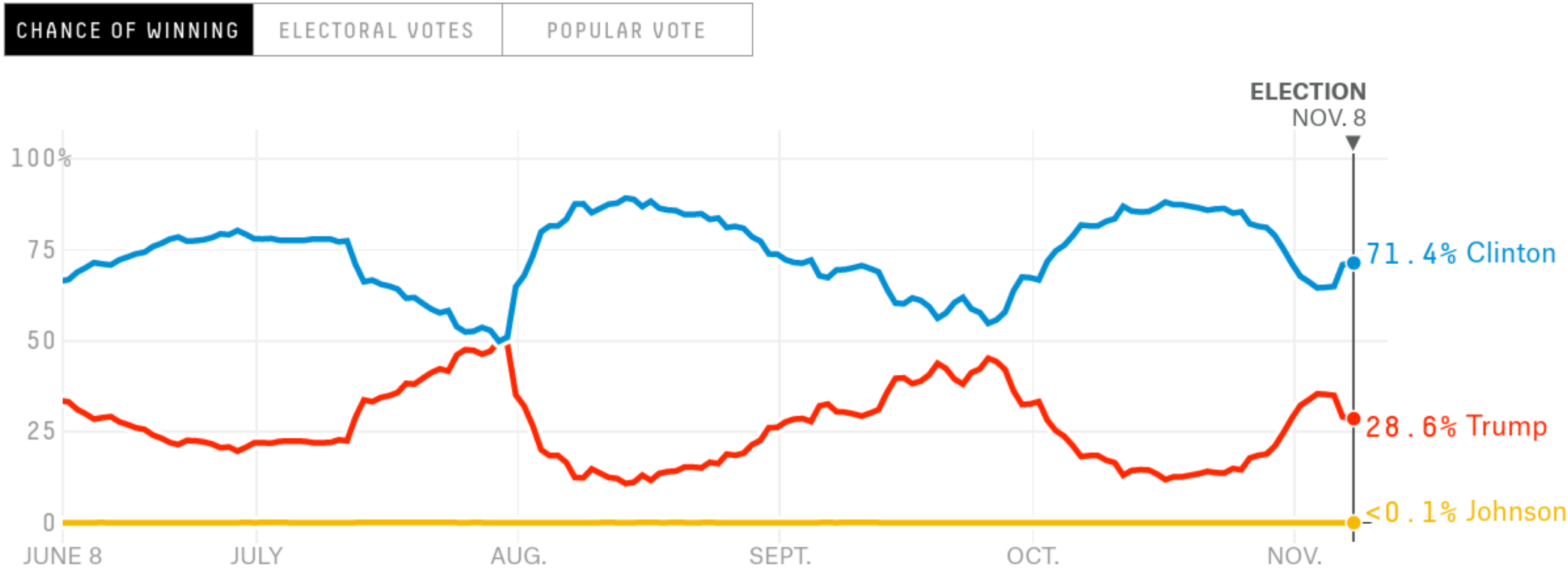


PACIFIC CLIMATE IMPACTS CONSORTIUM

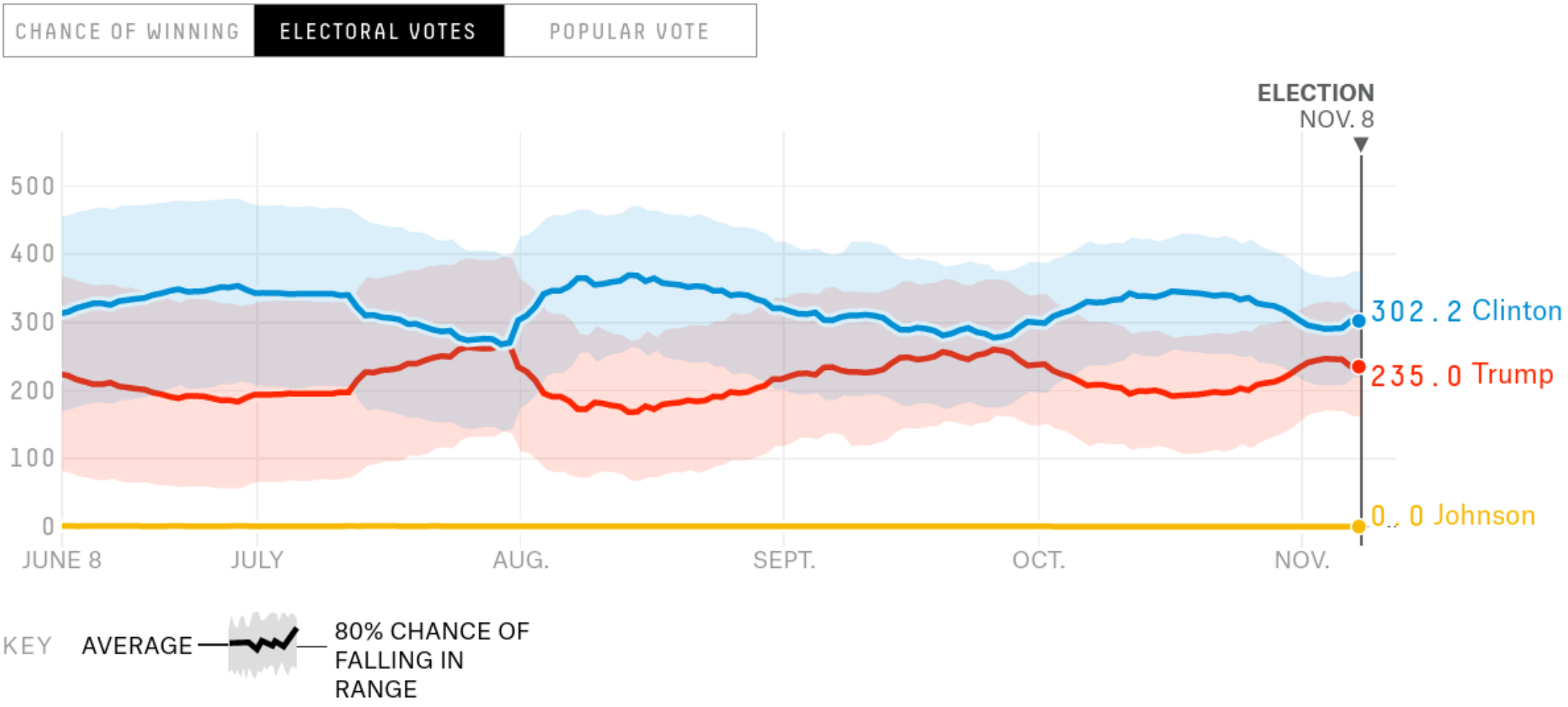
University of Victoria

Why do this?

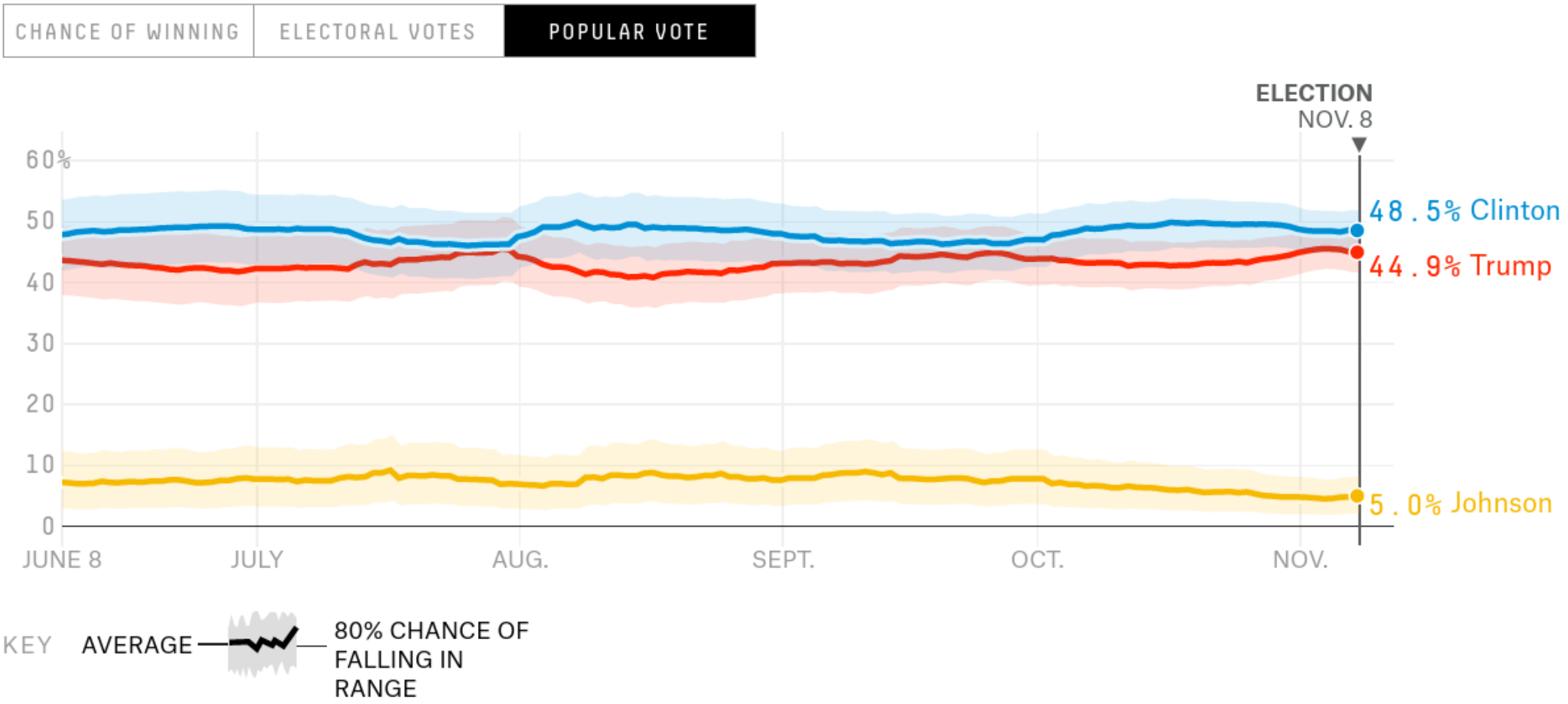
A recent example of model uncertainty...



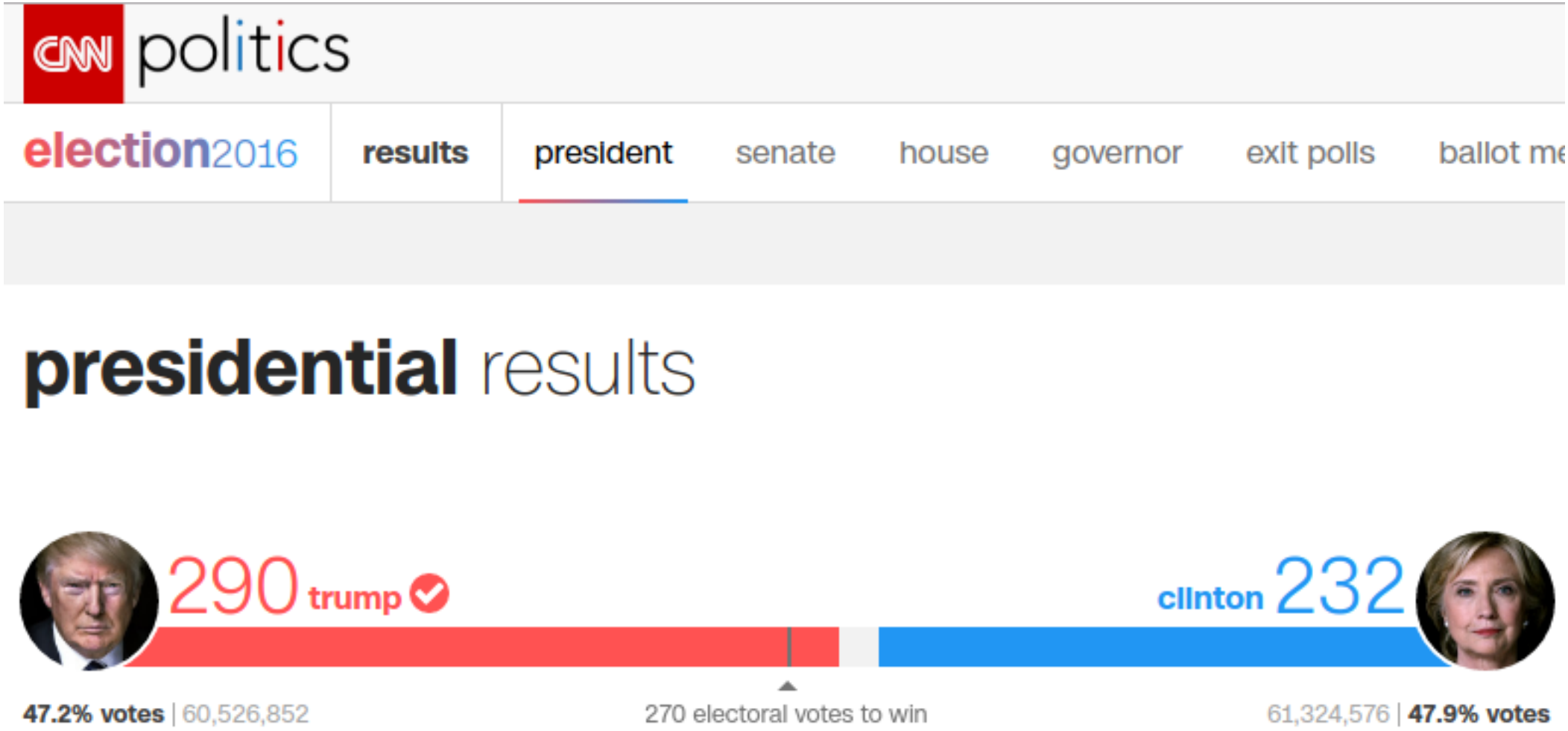
A recent example of model uncertainty...



A recent example of model uncertainty...



A recent example of model uncertainty...



A recent example of model uncertainty...

FOX NEWS Politics

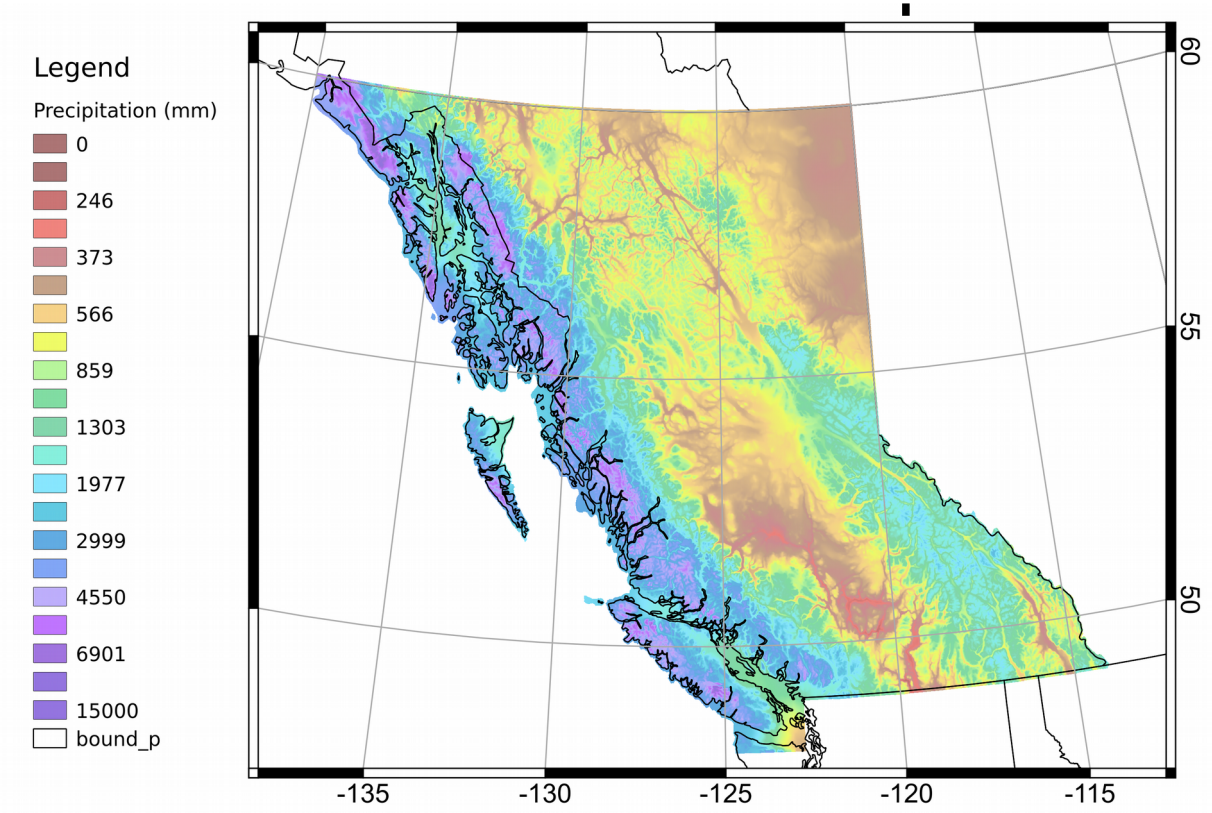
Home | Video | Politics | U.S. | Opinion | Business | Entertainment | Tech | Science | Health | Travel | Lifestyle | World | On Air

PRESIDENTIAL

Trump wins presidency, defeats Clinton in historic election upset

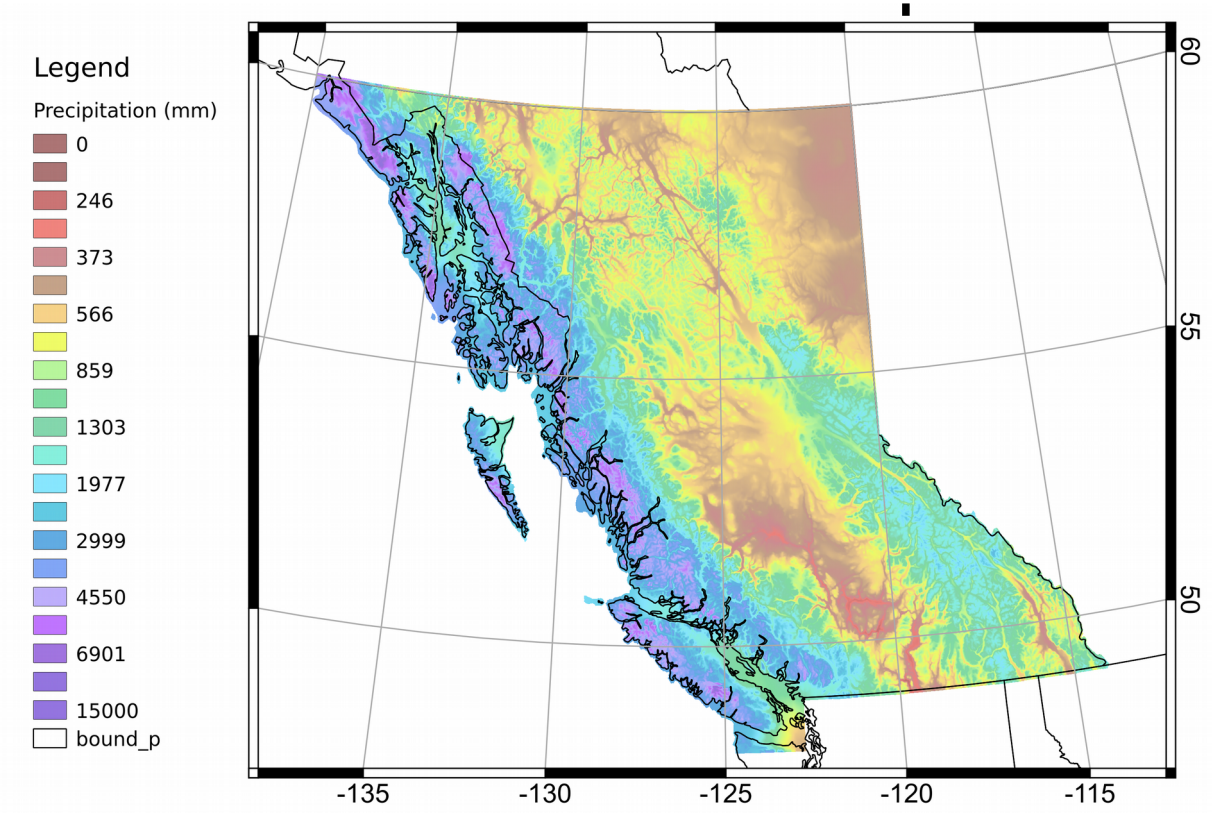
What is PRISM?

- A formerly top-secret surveillance program?



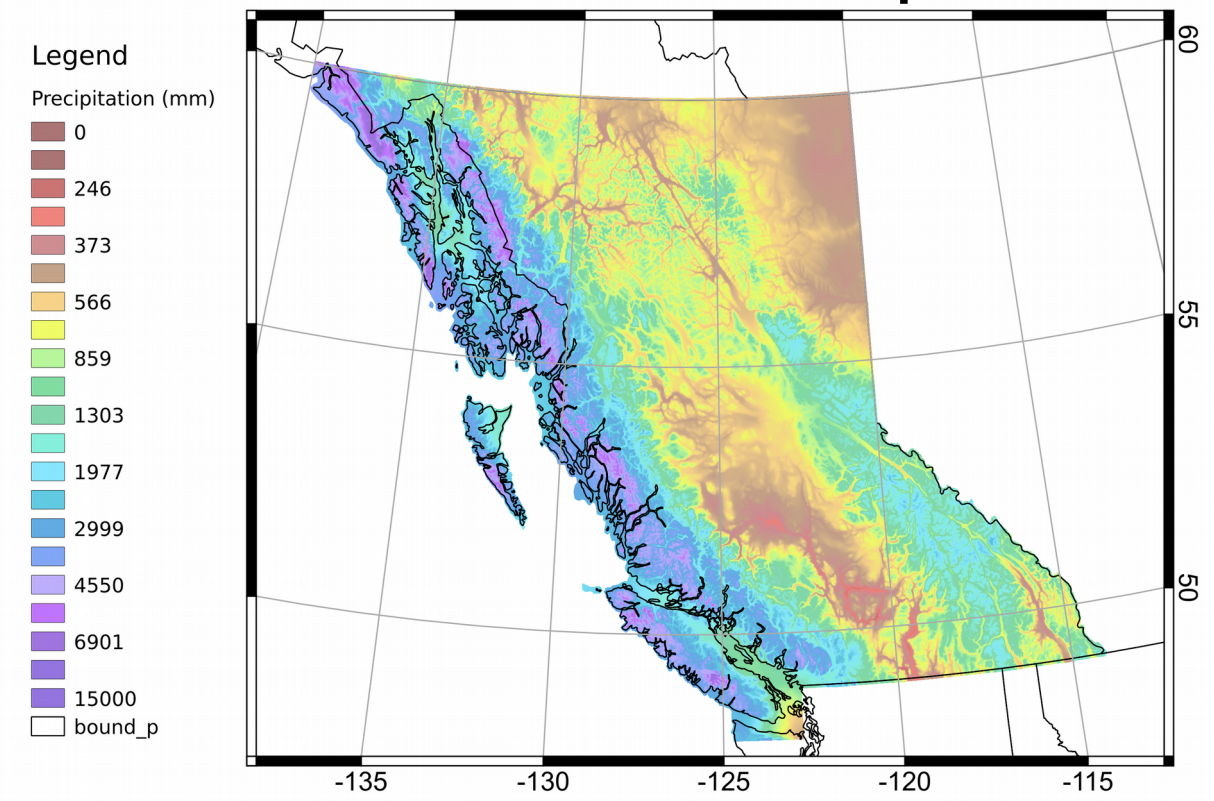
What is PRISM?

- ~~A formerly top-secret surveillance program?~~
- A dynamical climate model?



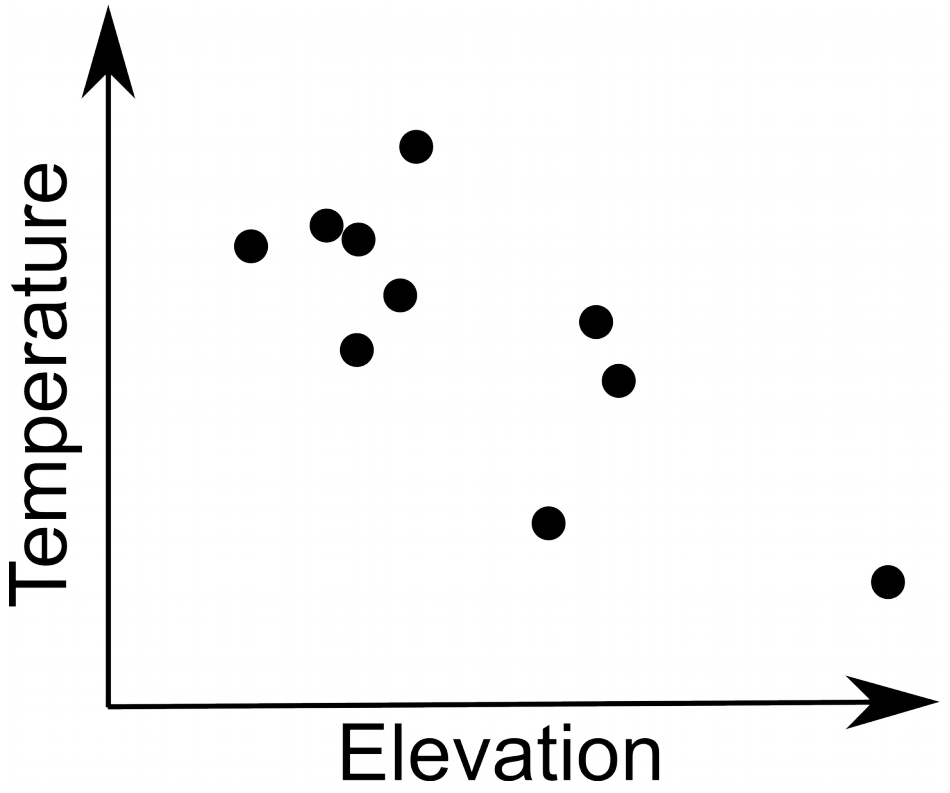
What is PRISM?

- ~~A formerly top-secret surveillance program?~~
- ~~A dynamical climate model?~~
- A statistical, elevation-dependent, regression-based observational data interpolator?



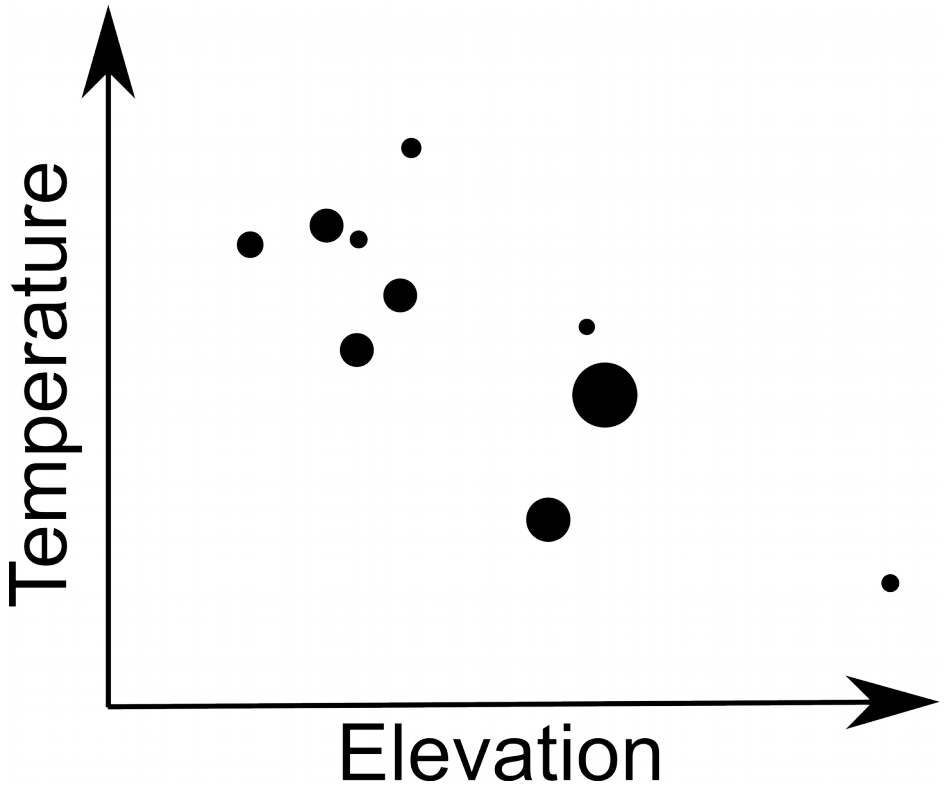
What is PRISM?

- Relationships between a climate parameter and elevation are a first step in empirical interpolation



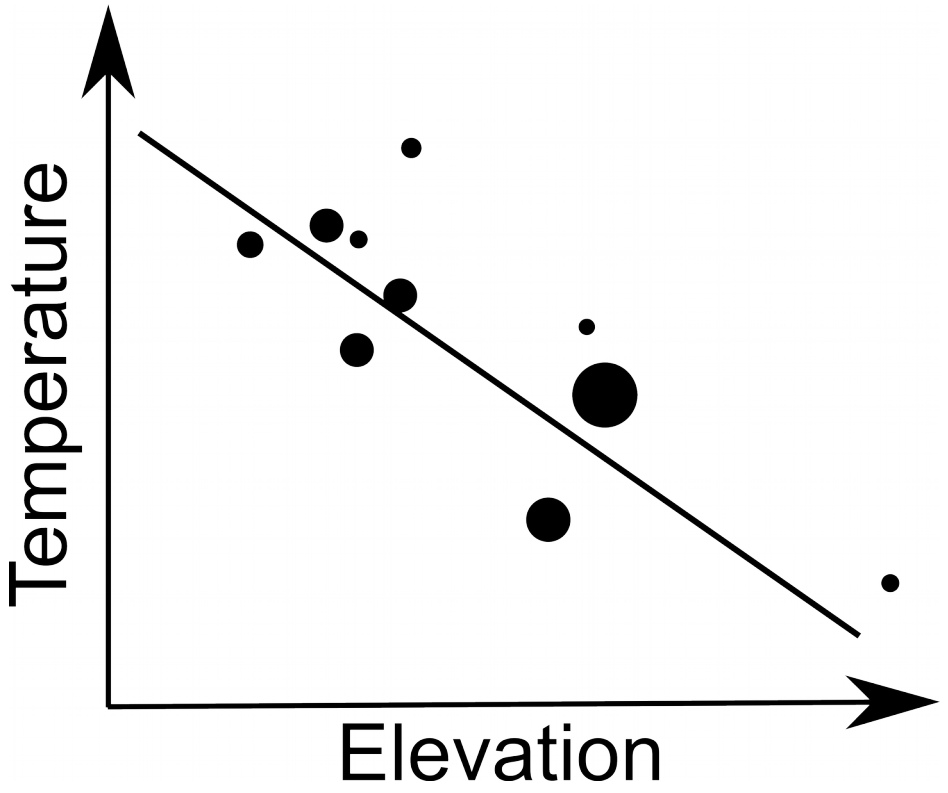
What is PRISM?

- PRISM weights stations for the prediction at a given gridpoint by considering that loction's climatic setting and nearby stations that may be in a similar climate setting.



What is PRISM?

- Linear regression is then used to predict the climatological value at the location in question.
- This also yields a “prediction interval” based on the statistics of the regression.



Types of uncertainty to consider:

- Uncertainty due to model parameterization
  - Can address by performing a detailed assessment of parameter uncertainty.
  - Run suites of models for range of parameters.
- Uncertainty due to observational precision/error.
  - We can explore the influence of varying observationavalues about a small range (i.e. 5% for precipitation or 0.5 C for temperature)
- Uncertainty due to the limited extent of the observational network
  - As the number of observational sites grows, the uncertainty in the gridded product declines.

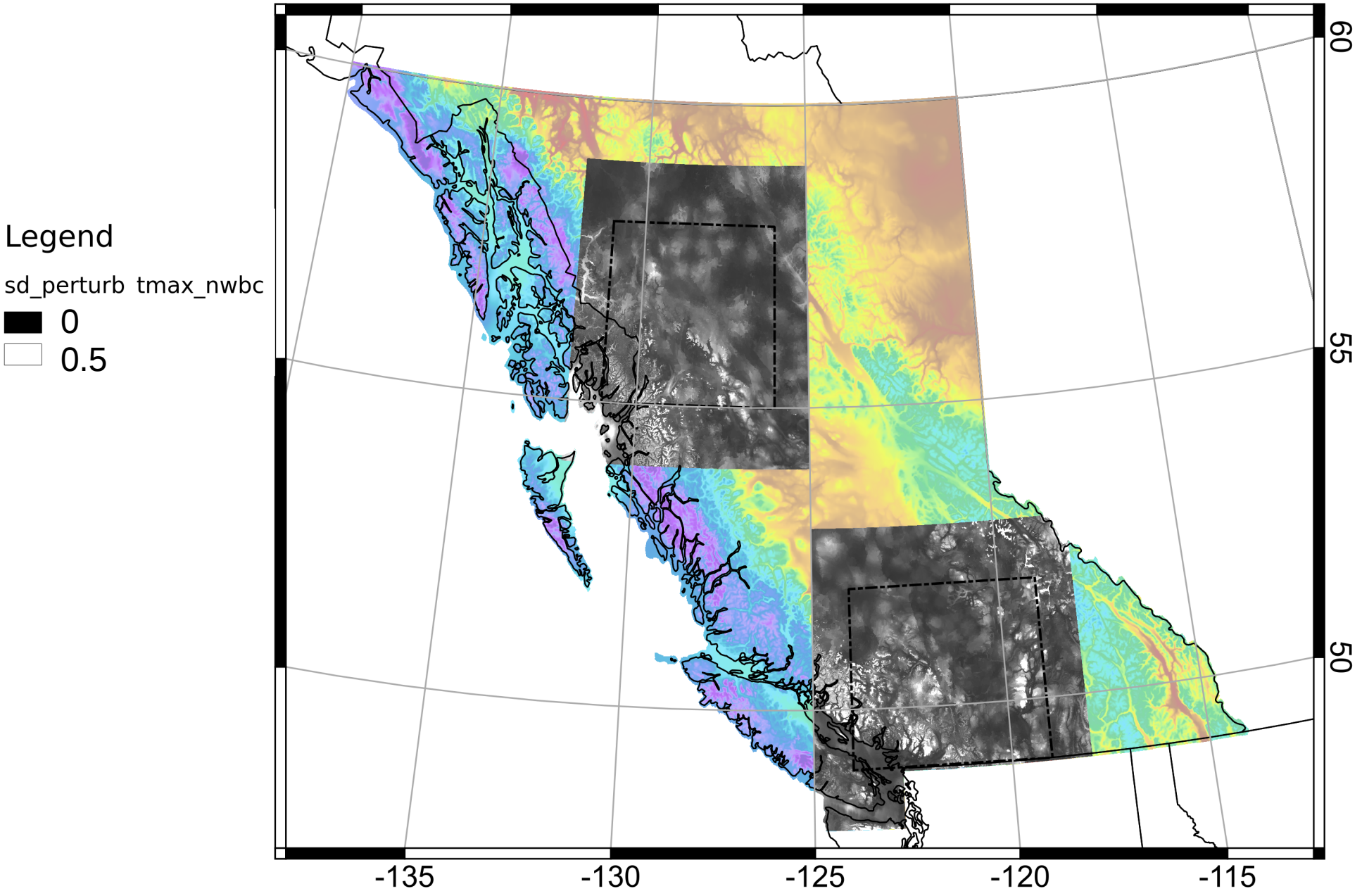
$$\epsilon \rightarrow 0 \qquad \text{as} \qquad N \rightarrow \infty$$

- Uncertainty arising from model insufficiencies/limitations
  - Unavoidable!
  - PRISM's default 70% prediction interval gives some estimate of this, but this falls in the realm of model development/improvement.
    - Incorporate remote sensing data.
    - Incorporate dynamic model results.

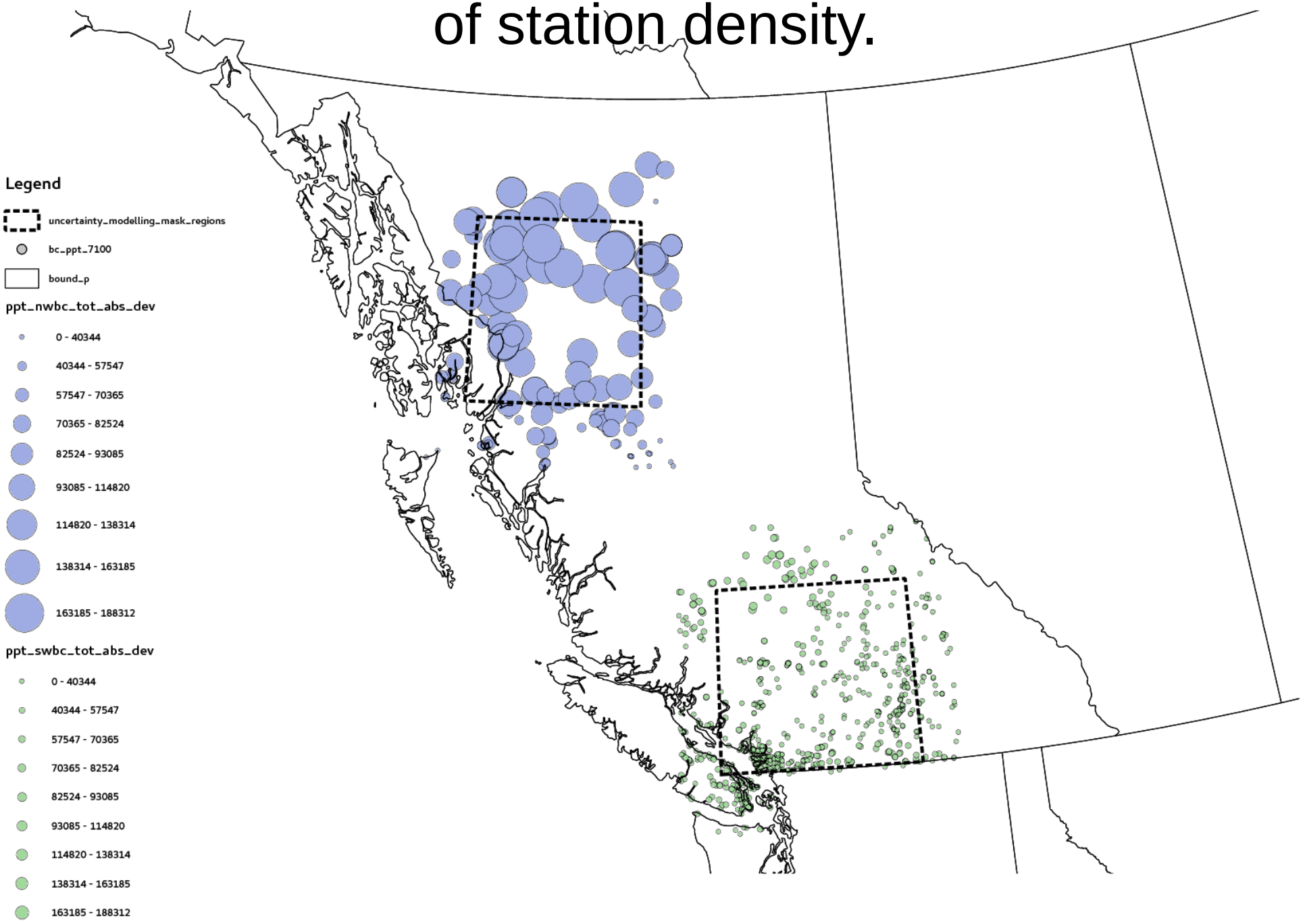
My experiments = brute force!

- Jackknife cross validation
  - Multiple model runs, leaving out a new station each time to evaluate the performance of the model at the station.
- Station data perturbation
  - Multiple model runs in which the climate data are perturbed by some small amount.
  - See if the perturbation range is amplified or suppressed away from station locations.
- Cross validation using blocks of stations
  - Multiple model runs in which the given network is sub-sampled randomly.
- Synthetic network generation
  - Multiple (detect a pattern?) model runs in which synthetic networks are generated by sampling the “full” model with random error based on the regression statistics from the full model.

Changes in predicted data due to small deviations in station data

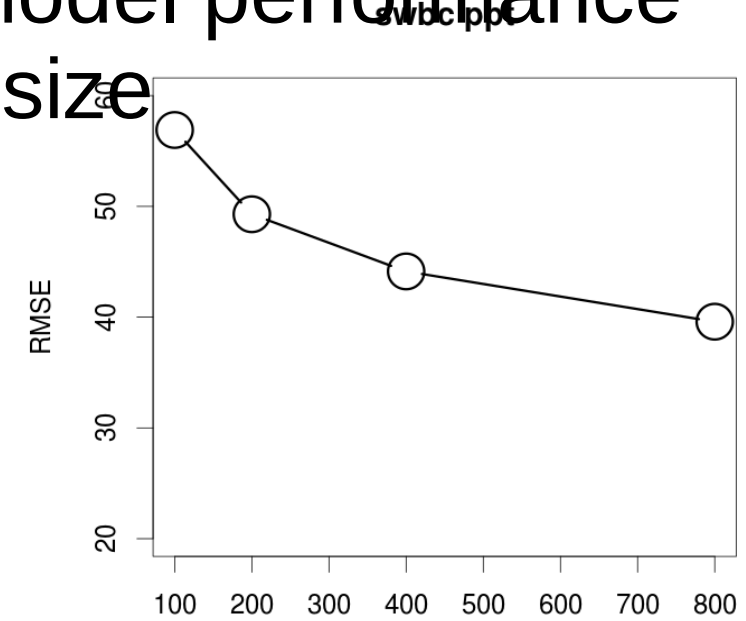


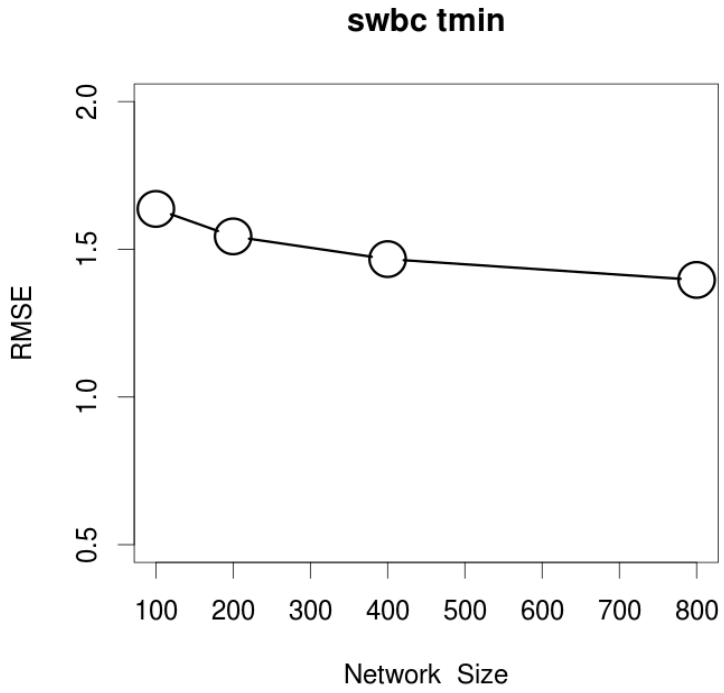
Radius of influence of a given station is a function of station density.

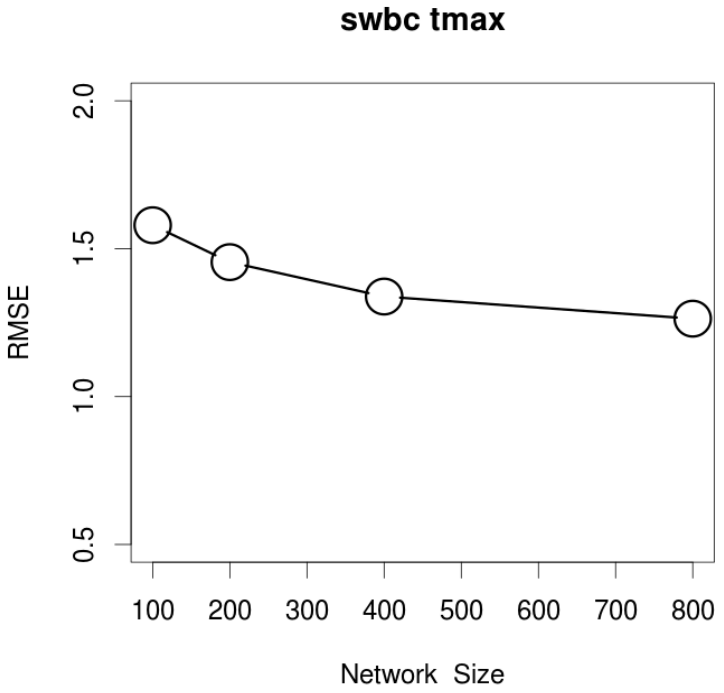


Synthetic networks indicate model performance as a fxn. of net size

- Functional relationship between network size and RMSE.
- Apparent asymptote where increasing network density would result in no further improvement in error, or gains are slow.

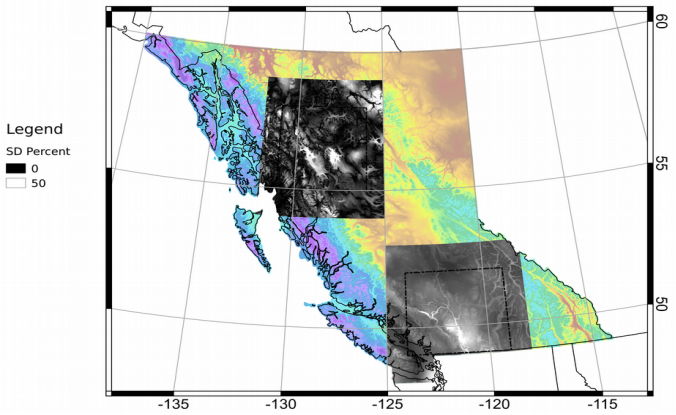


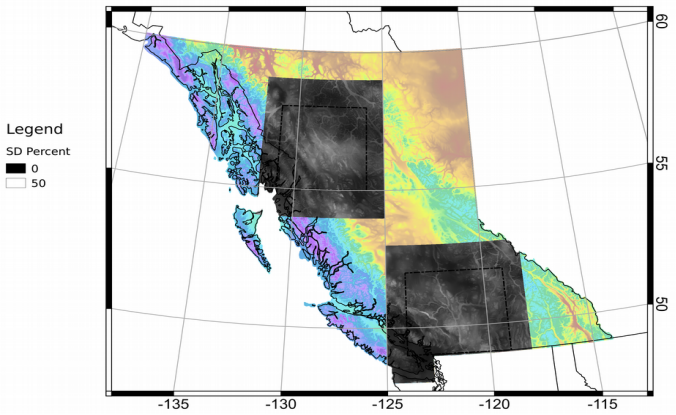




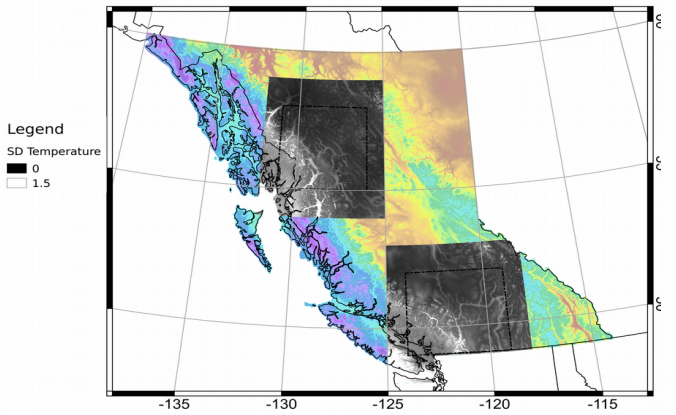
Driving PRISM with synthetic networks of data yields information on the sensitivity of regions to input data.

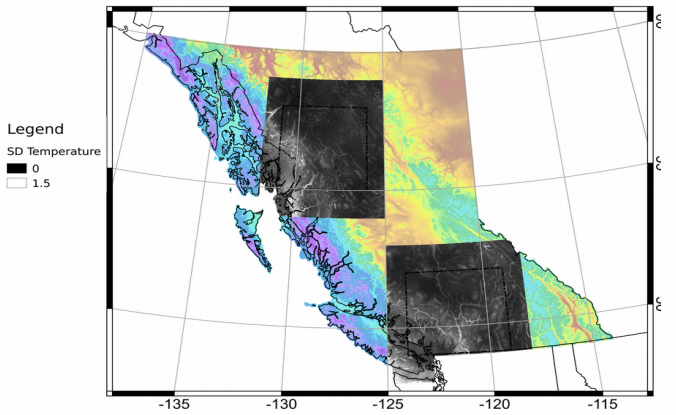
Precipitation



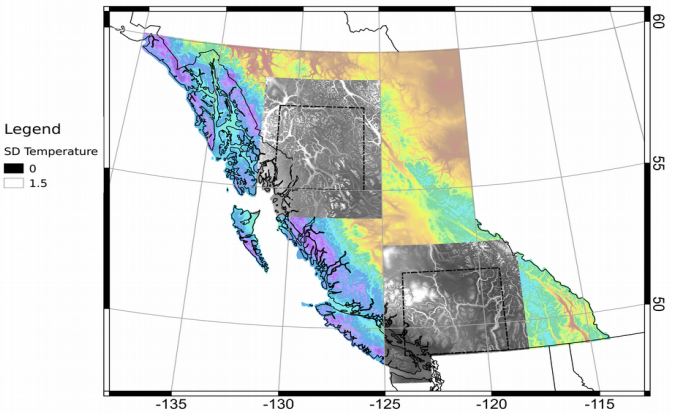


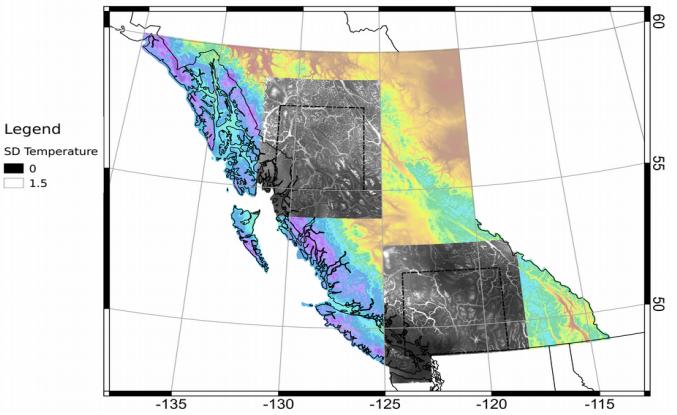
Tmax



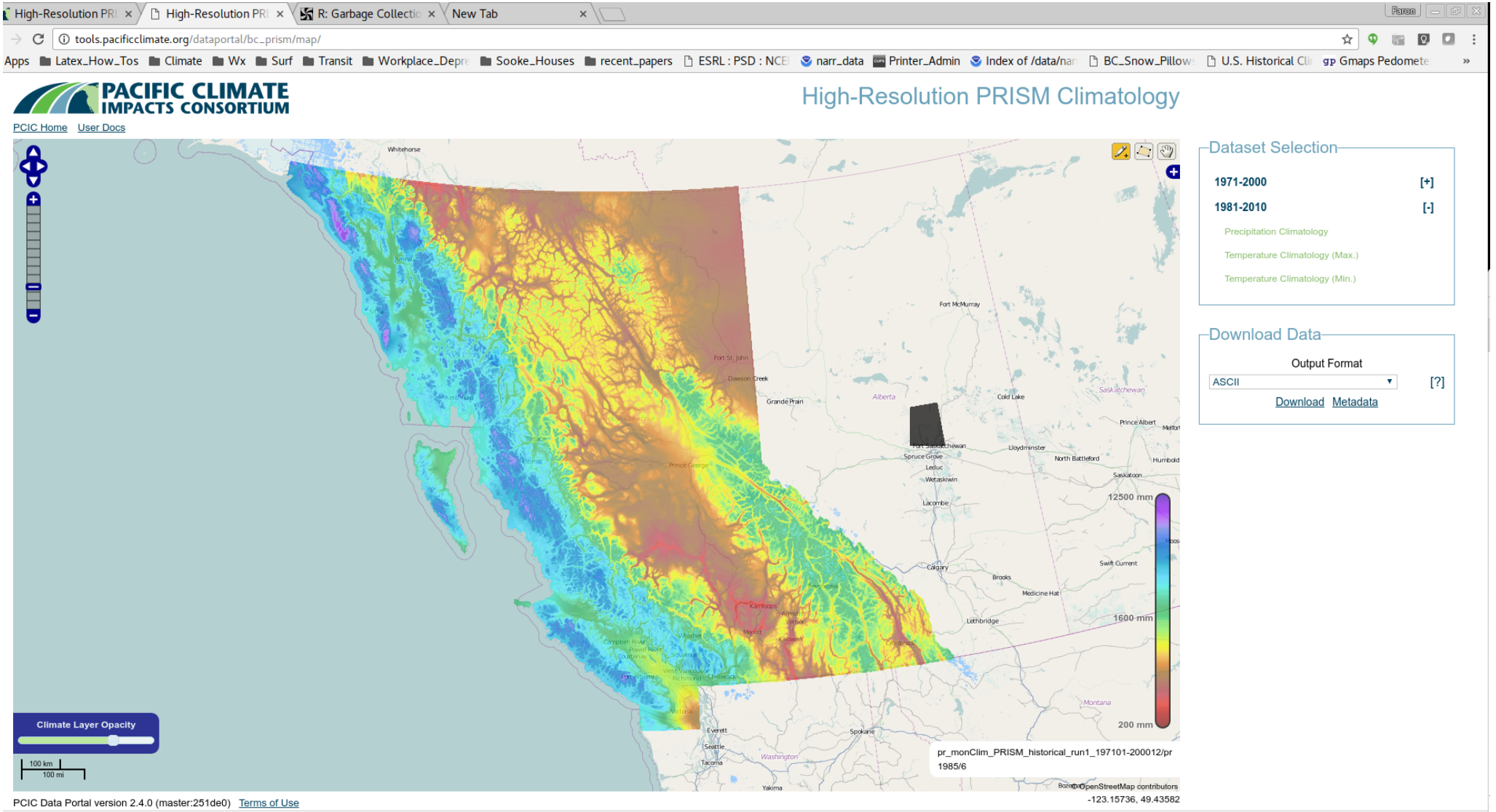


Tmin





Delivery of data through raster data portal



Conclusions

- We find that PRISM is stable to perturbations in its input data.
- However, perturbations do have a remote impact and this should be quantified
- Generation of synthetic networks show where PRISM is sensitive to having data available.
-