An analysis of extrapolation errors of the High latitude eddy covariance measuring networks across space and time, with data driven network optimization

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Woodwell Climate Research Center

This presentation participates in OSPP

EGU

Outstanding Student & PhD candidate Presentation contest

Intro

Q-arctic

- Quantifying disturbance impacts on feedbacks between Arctic permafrost and global climate

- https://q-arctic.net/

Permafrost Pathways

- Permafrost Pathways brings together leading experts in climate science, policy action, and environmental justice to inform and develop adaptation and mitigation strategies to address permafrost thaw.

- https://permafrost.woodwellclimate.org/

How can we best expand the High latitude Eddy covariance network

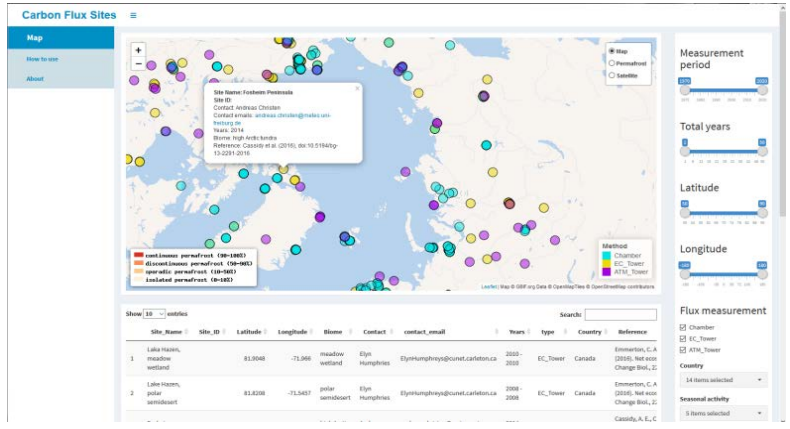
Front page and banner photo by Jaanus Jagomagi

Workflow

What is the extent of the current network?

Where, When, and What is being measured

- Online database
  https://cosima.nceas.ucsb.edu/carbon-flux-sites/
- Survey
  http://capalonga.bgc-jena.mpg.de/mpall/



How does the network scale up to the entire domain?

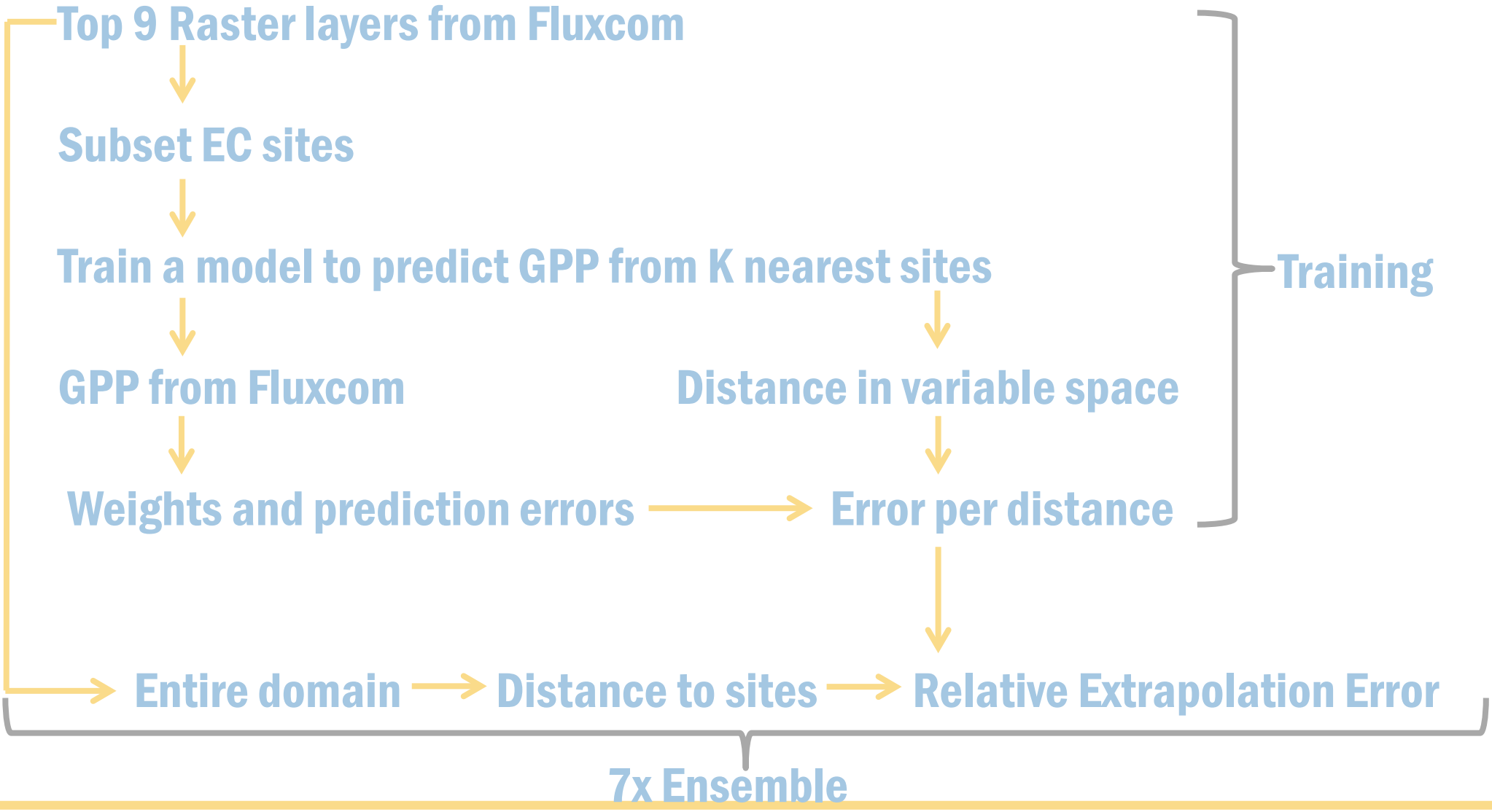
Extrapolation index:

- Scaling carbon fluxes from eddy covariance sites to globe: Synthesis and evaluation of the FLUXCOM approach (Jung et al., 2020)
  - https://doi.org/10.5194/bg-17-1343-2020

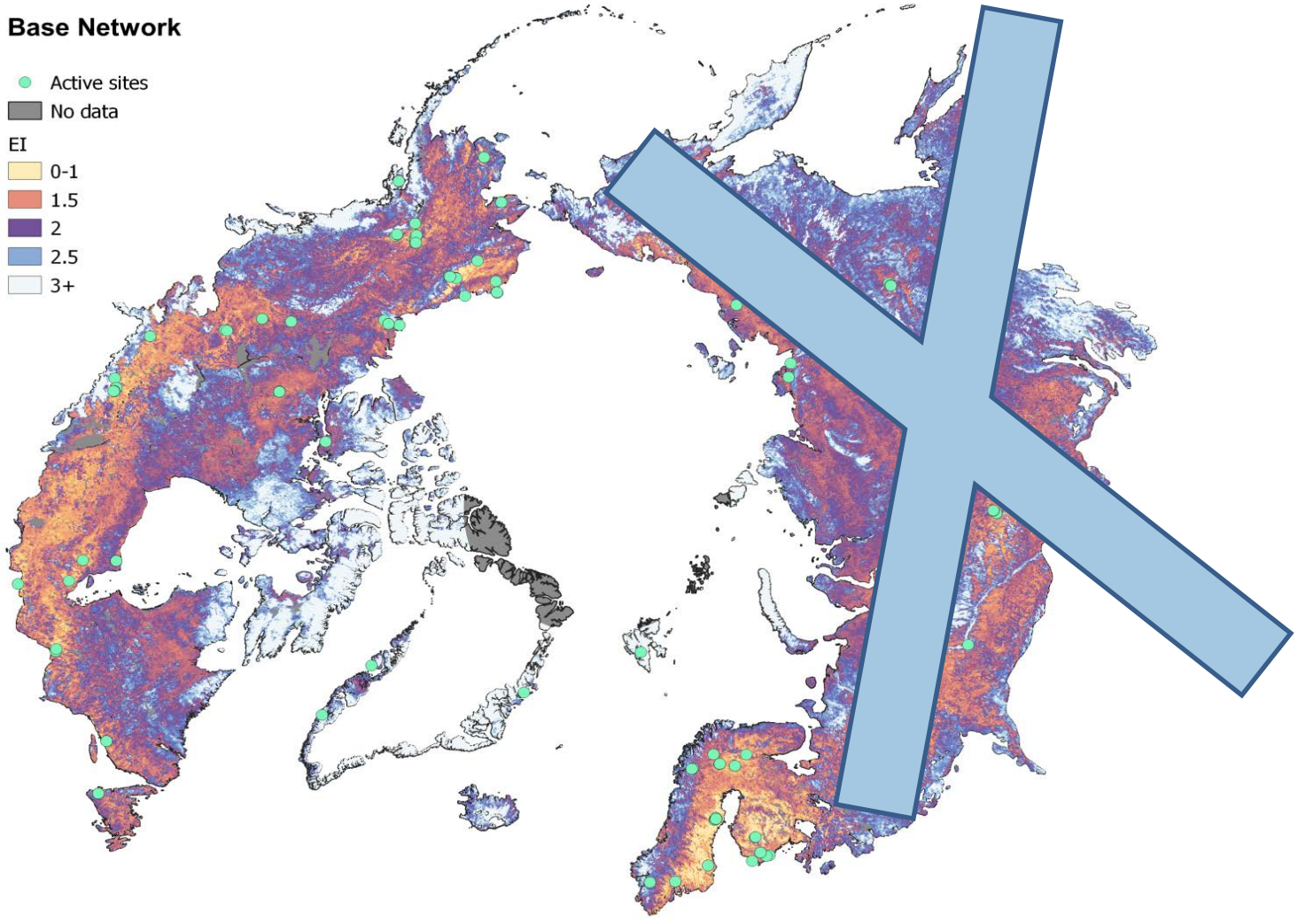
Select optimal site additions for an upgraded network

- Combinatorial optimization
- Expert and local input

Extrapolation Index



Baseline



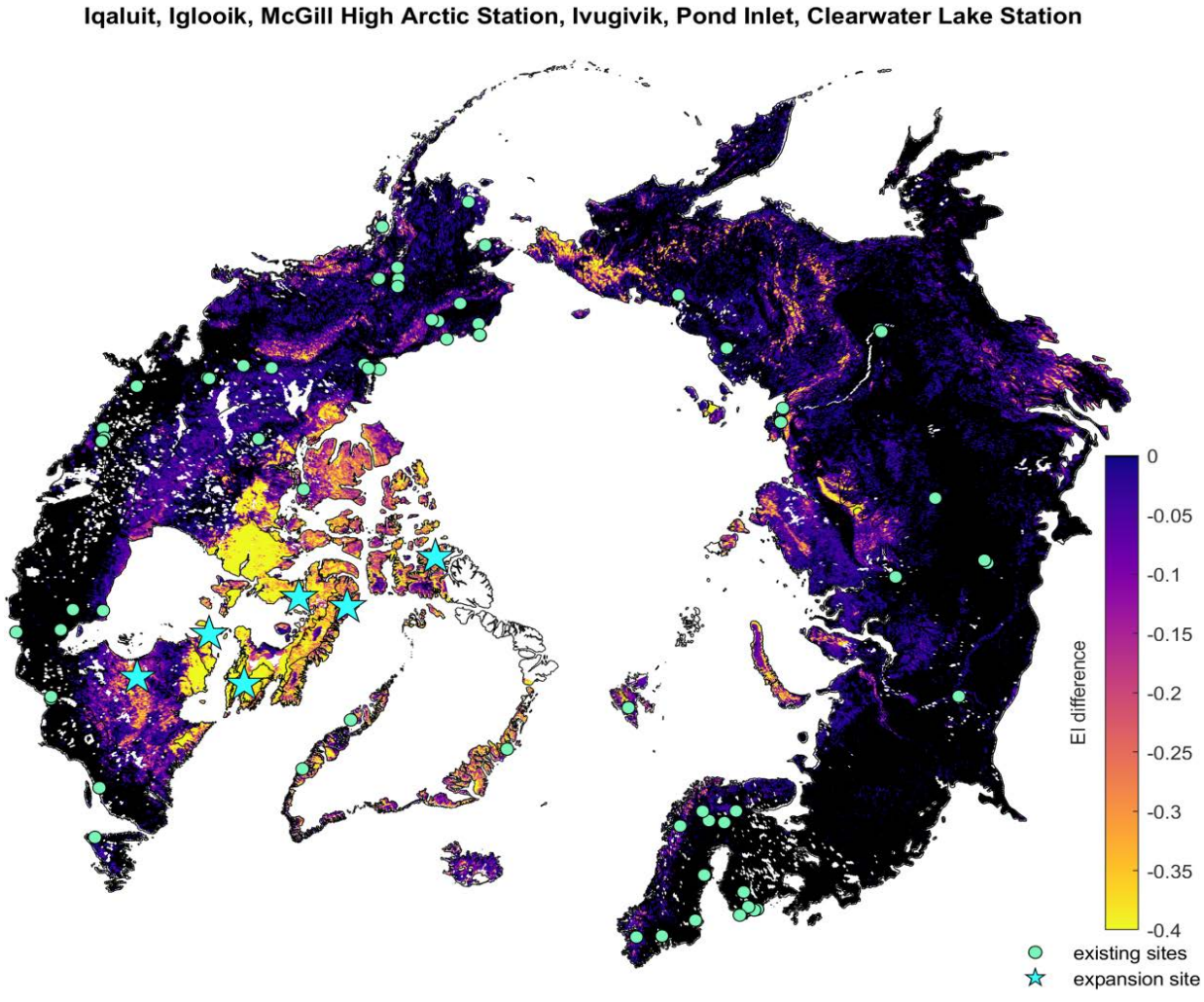
Optimization

3 strategies:

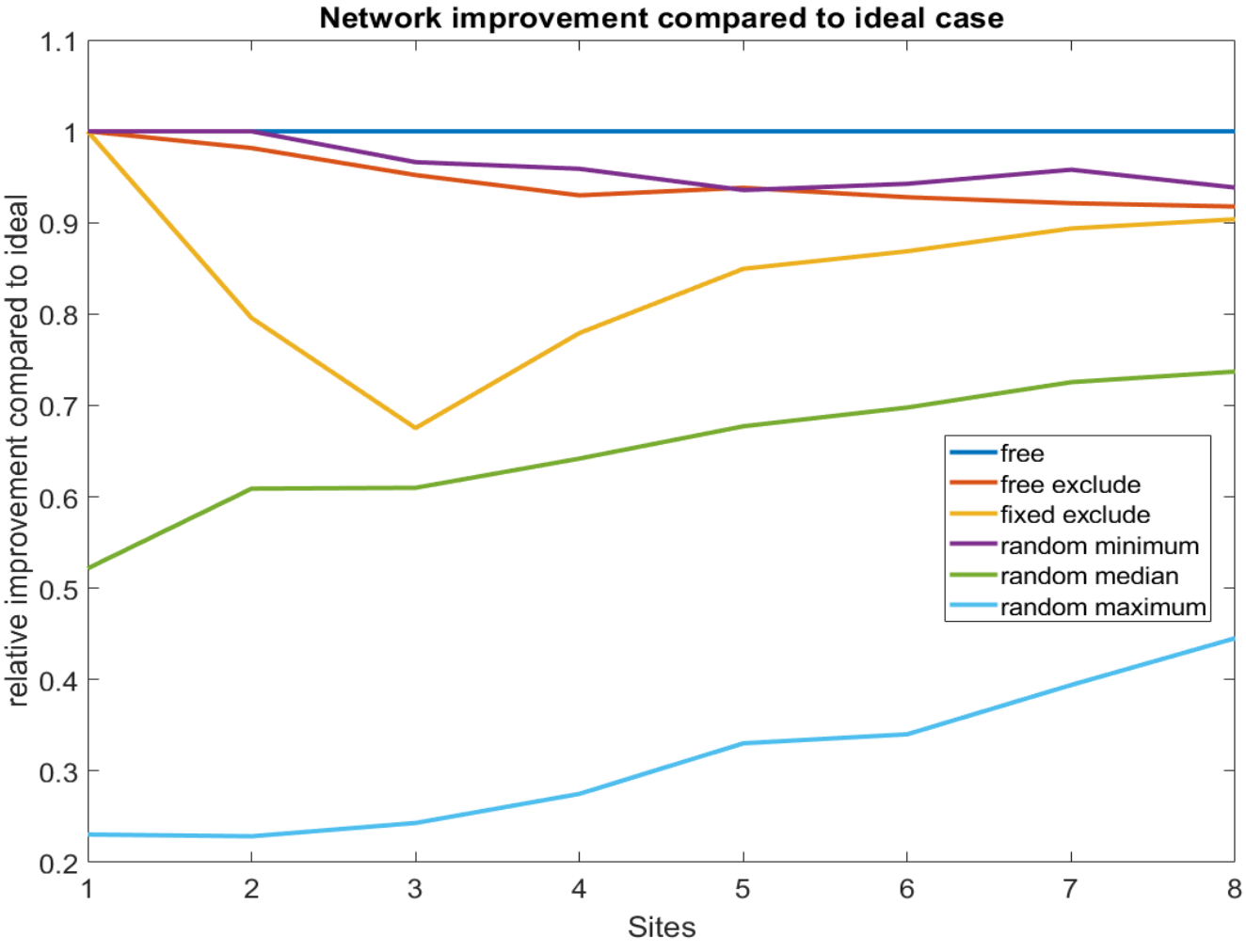
1. **Greedy/stepwise**
   561 combinations

2. **Brute force**
   8.6 billion comb.

3. **Pruning trees**
   Factor 5k reduction



Relative improvements



Thanks for your time

Take home:

- **Large regions in Russia, North Canada and mountainous regions are under represented.**

- **Network optimization techniques can greatly help us to make informed decisions on network extension.**