



**EARTH &  
ENVIRONMENTAL  
SCIENCES**



# Uncertainty reduction in CMIP model projections

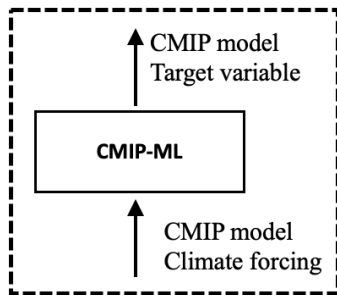
Qing Zhu, William J. Riley

<sup>1</sup> Climate Sciences Department, Climate & Ecosystem Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA  
94720

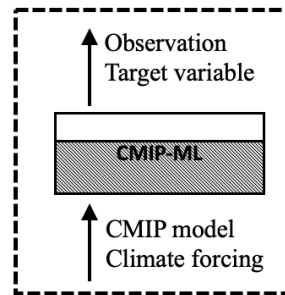
# Science motivation and summary

CMIP model simulations of historical and future state/flux are subject to high uncertainties:

- **Parametric uncertainty**
- **Structure uncertainty**
- **Scenario uncertainty**



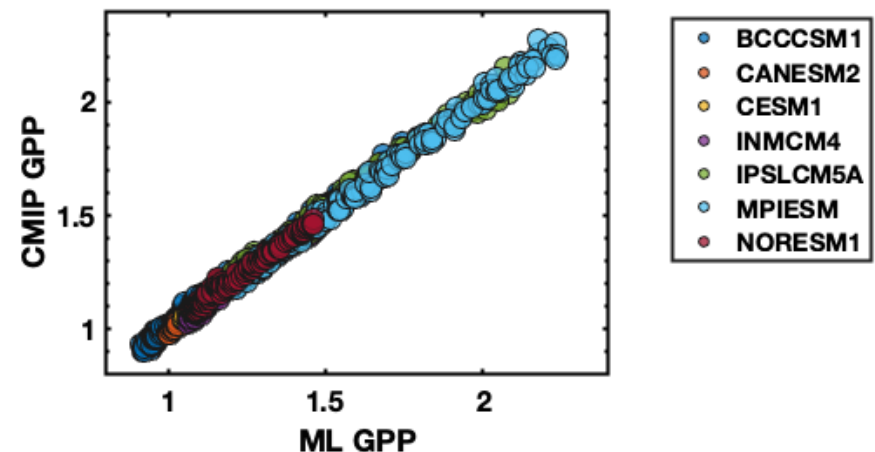
Step 1: Pre-train



Step 2: Transfer learning

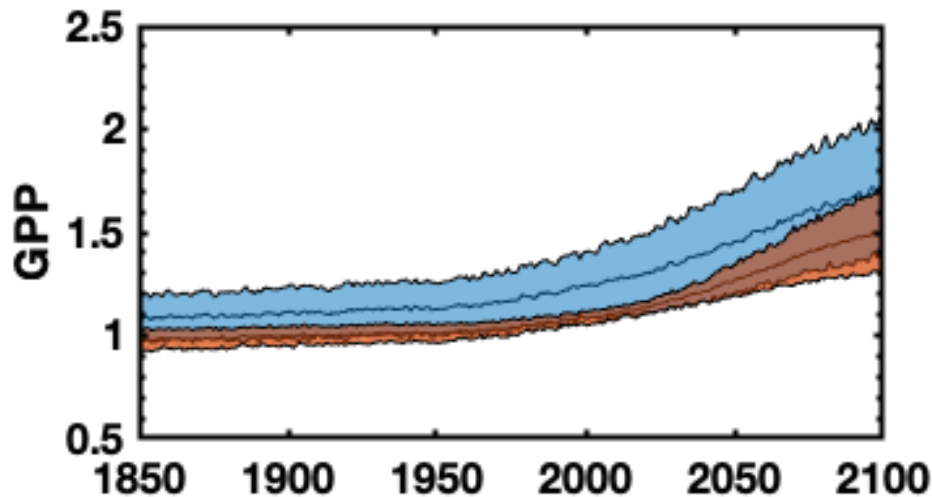
- Model inputs and outputs
- ▭ Tunable component
- ▨ Non-tunable component

CMIP-ML: machine learning surrogate models for CMIP  
**Target variable:** variable to be constrained  
**Climate forcing:** temperature, precipitation, radiation, [CO<sub>2</sub>]



# Results & future research

- Current work focus on GPP only
- Extend to GPP, RESP, LE, SH
- Compare CMIP5 vs CMIP6
- Improve physical constraints



Year	Uncertainty reduction
1950-2000	75%
2001-2050	80%
2051-2100	54%