

# Towards Community-Based Objective Summaries of Earth System Model Performance

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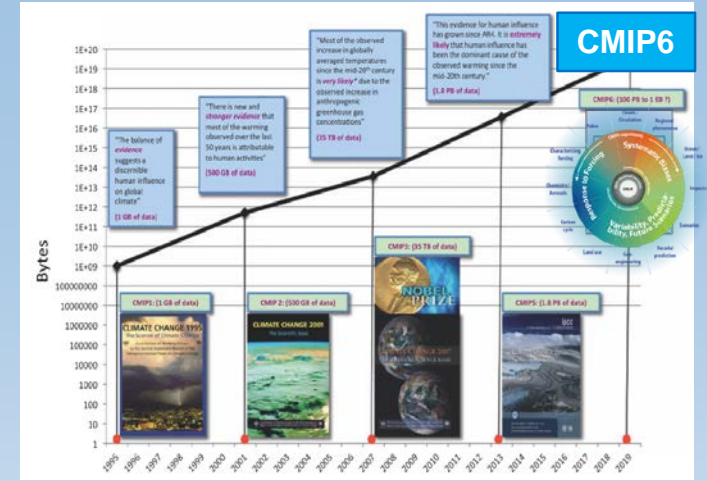
and many external collaborators

## TALK OUTLINE

- **Motivation**
- **The PCMDI Metrics Package and its applications**
- **Community engagement via the Coordinated Model Evaluation Capabilities (CMEC)**

# Motivation

A need for more systematic baseline evaluation of Earth System Models



- Facilitate understanding via objective synthesis of a growing number of simulations
- More directly contribute to model development (via useful quick feedback)

# The PCMDI Metrics Package (PMP)



A diverse suite of robust high-level summary statistics comparing models and observations across realms, space and time scales

Includes metrics and underlying diagnostics from:

- PCMDI research
- Collaborations with community experts and teams

Leveraging DOE supported CMIP data conventions, archive and python-based tools (CDAT)

[https://github.com/PCMDI/pcmdi\\_metrics](https://github.com/PCMDI/pcmdi_metrics)

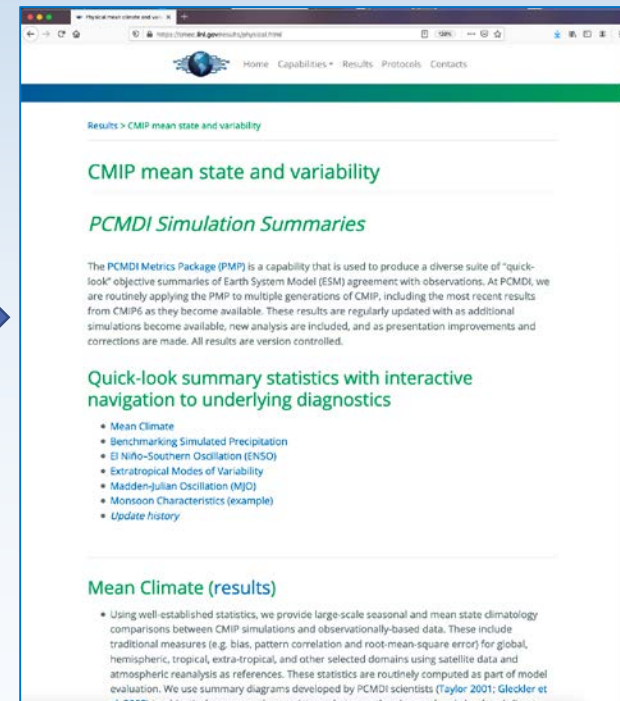


# How is the PMP being used?



- In collaboration with expert teams, to establish a benchmarking framework for a suite of physical climate characteristics
- Enabling E3SM, GFDL and other modeling groups to apply the PMP to inform model development
- Summaries available to the broader research community

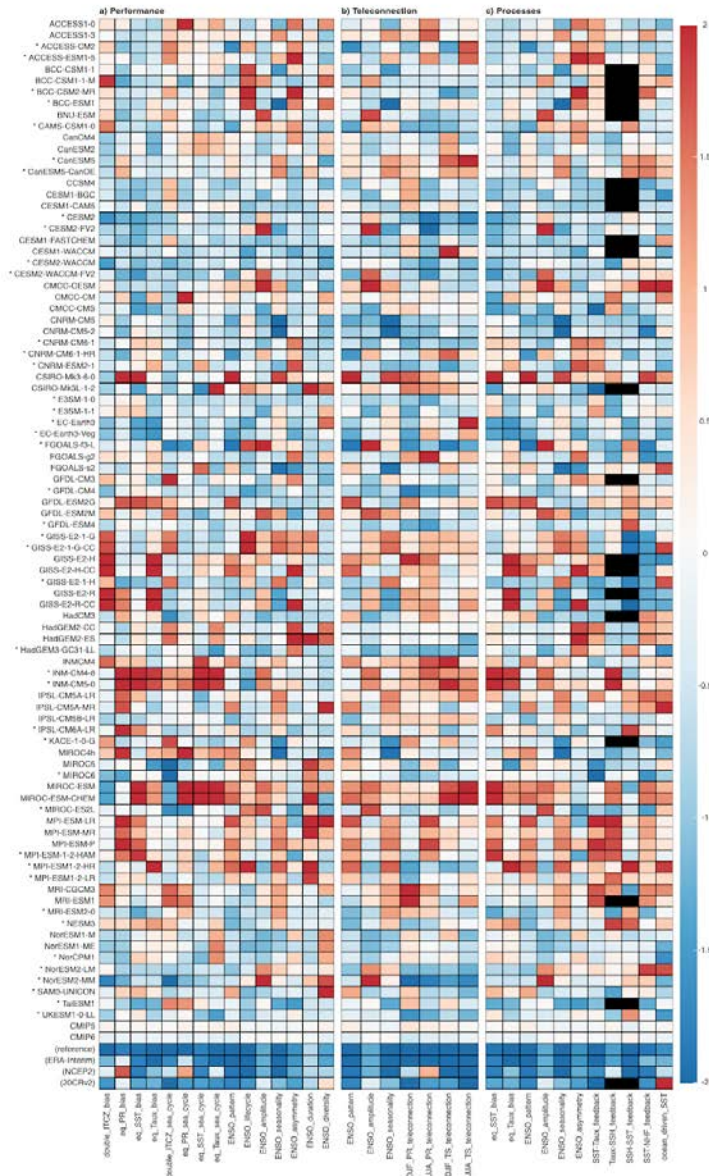
<https://cmec.llnl.gov/results/physical.html>



# ENSO Metrics

## ENSO CLIVAR 2020 Metrics in Collaboration with PCMDI and IPSL/LOCEAN

**Versions**  
 Version controlled results updated as new models simulations are made available, improvements are implemented, and on-going quality control is applied.  
 Interactive portal page: v20200214  
 Calculation and dive down plots: v20200427



- ENSO performance, teleconnections and process-oriented metrics developed in collaboration with CLIVAR Pacific Panel (Planton et al, 2020)
- Current research: PCMDI leading research on the role of intrinsic variability (large ensembles) in gauging model performance.
- Interactive roadmap from metrics to underlying diagnostics

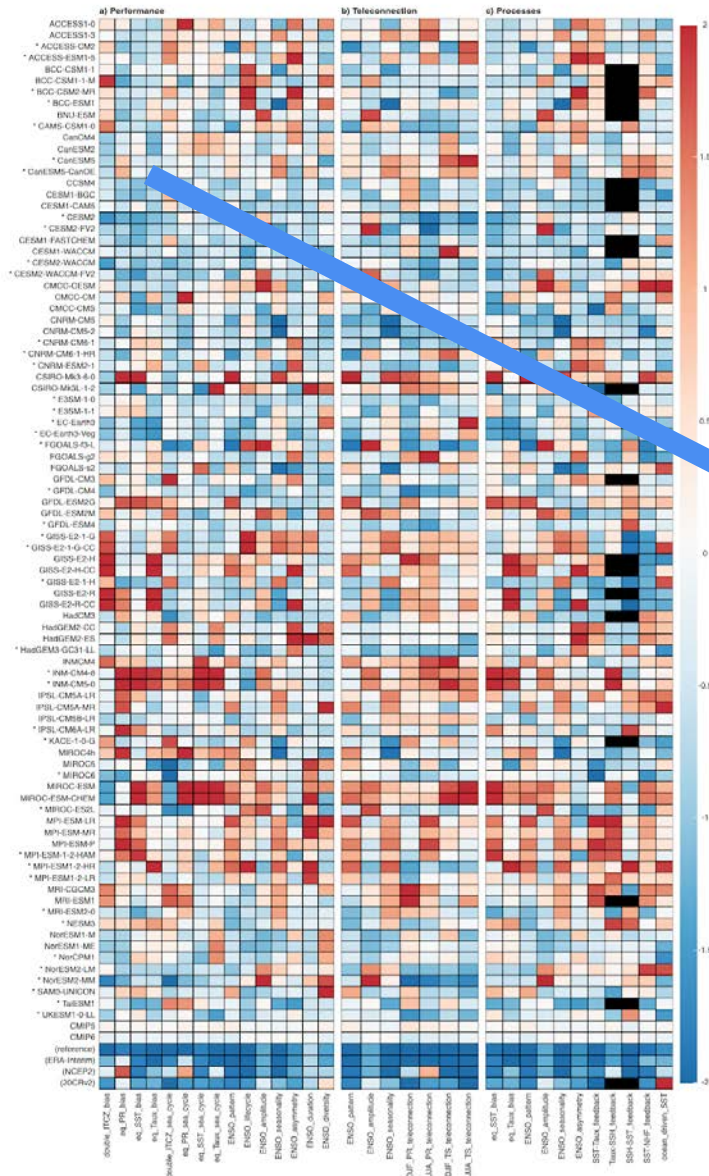
<https://cmec.llnl.gov/results/enso>

Planton, Y., E. Guilyardi, A. T. Wittenberg, J. Lee, P. Gleckler, T. Bayr, S. McGregor, M. McPhaden, S. Power, et al (2020): Evaluating climate models with the CLIVAR 2020 ENSO metrics package, *BAMS*

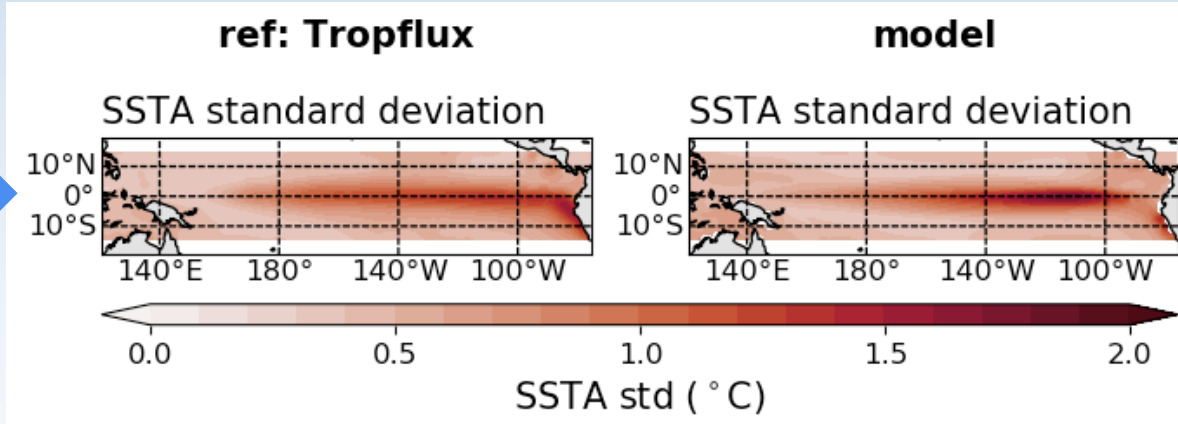
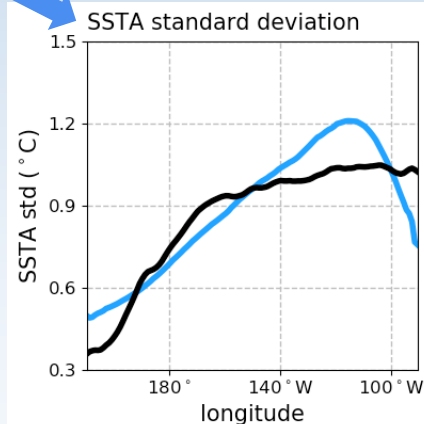
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# Collaborations

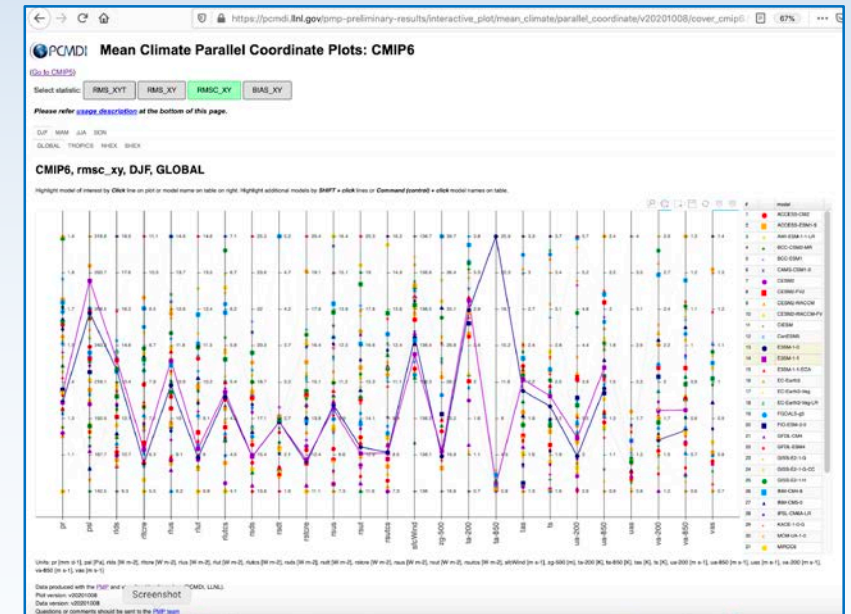
- ENSO metrics team (CLIVAR)
- WGNE MJO task force and D. Kim (UW)
- DOE led precipitation teams
- U.S. CLIVAR AMOC team (GFDL-NCAR-PCMDI)
- Extremes (collaboration with M. Wehner, LBL Cascade)
- Assessment of modes of variability in US models
- Sea Ice (collaboration with J. McClean, S. Gille and D. Ivanova at UCSD)
- CLIVAR Monsoon Panel
- NOAA MDTF – CMEC connections

# Next steps with the PMP

- Further implementation of variability, precipitation and other selected metrics
- Documentation of all PMP metrics in Jupyter notebooks
- Increased emphasis on benchmarking (model specific performance changes)
- Ongoing expansion of public “quick-look” simulation summaries
- Develop synthesis of PMP metrics to help inform E3SM development

“quick-look” simulation summaries

<https://cmec.llnl.gov/results/physical.html>





# Broadening engagement

- PMP designed for a specialized data/computing environment with the goal of synthesizing performance across six generations of CMIP (over 25 years of model development)
- Efforts underway to make the PMP more accessible for other applications (e.g., evaluation of E3SM, targeting higher resolution)
- We welcome additional collaborations – contact us if you are interested
- CMEC (Paul Ullrich’s presentation) provides a framework to enable broader engagement and scope by accommodating multiple analysis packages using different analysis tools