



# Knowledge Transfer: Climate Modeling Centers

**Bill Collins**  
**UC Berkeley and LBL**

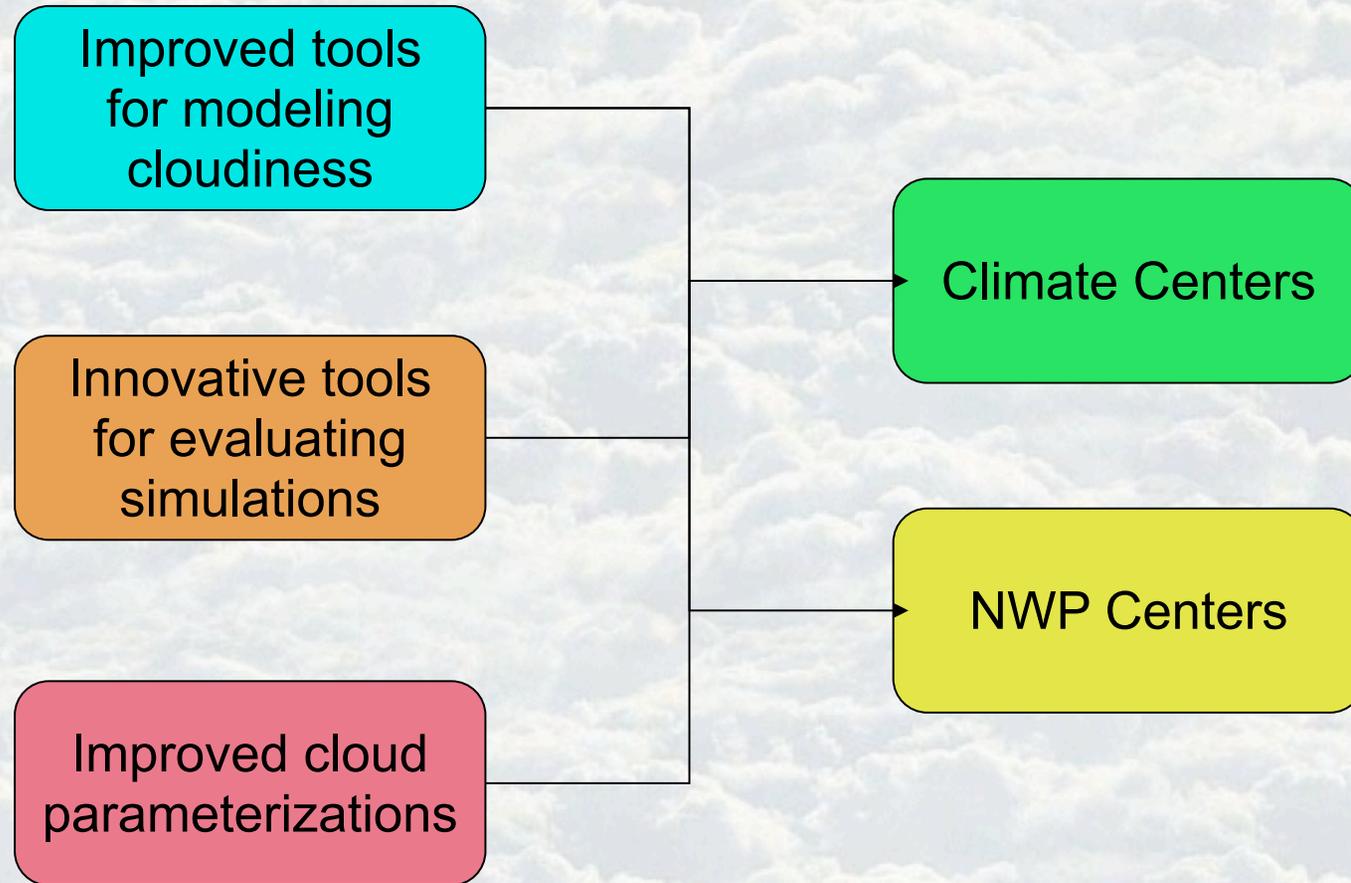


**Knowledge Transfer**





# Goals of Knowledge Transfer with weather and climate centers



Knowledge Transfer





# Recent developments in Knowledge Transfer



- **Objective: analyze Multiscale Modeling Frameworks using diagnostics familiar to climate and weather centers:**
  - National Center for Atmospheric Research
  - Geophysical Fluid Dynamics Laboratory
  - National Center for Environmental Prediction
- **This will help centers understand the implications of MMF using critical diagnostics for their applications.**

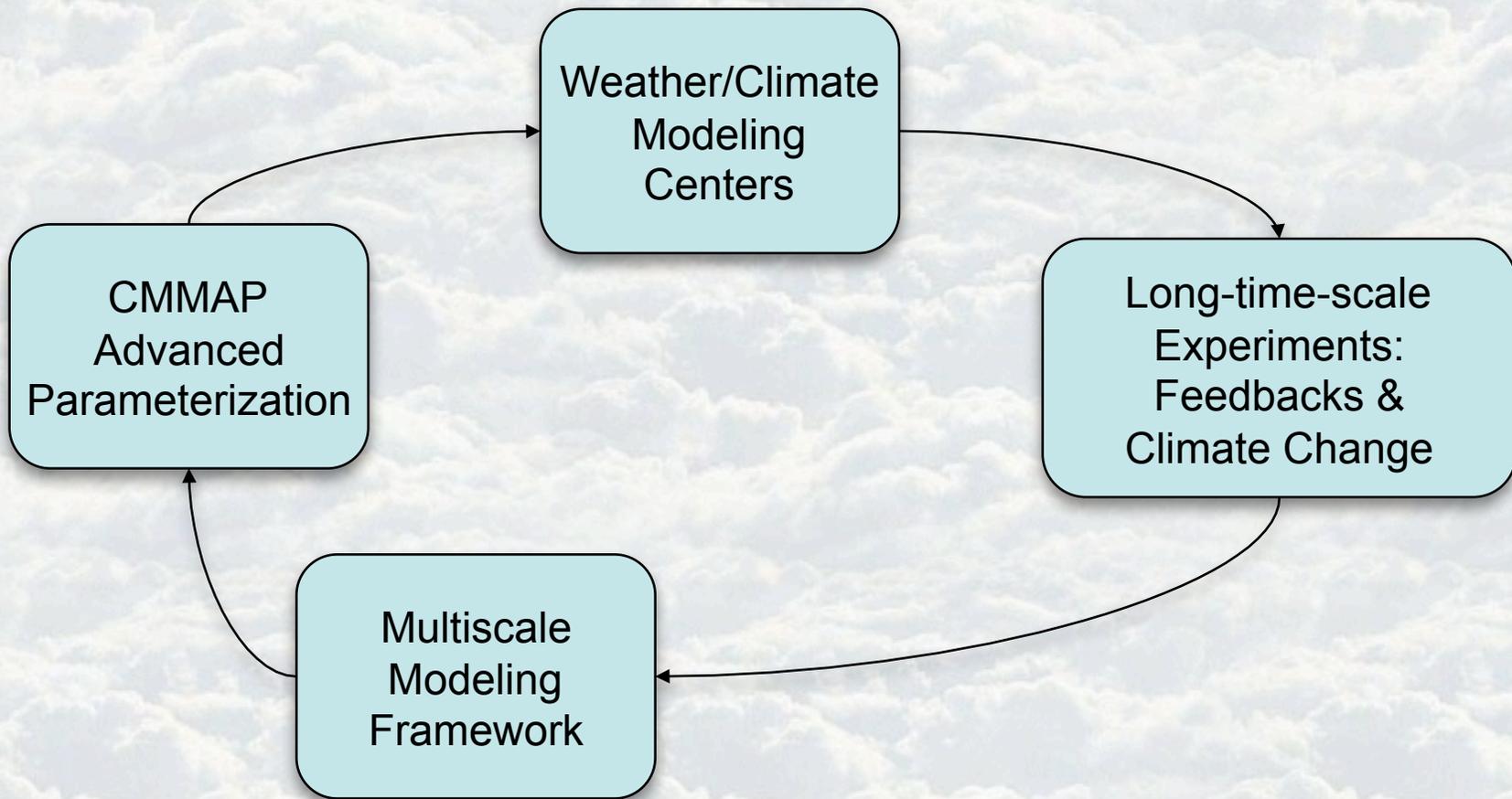


**Knowledge Transfer**





# Long-term goal: A feedback loop



**Knowledge Transfer**



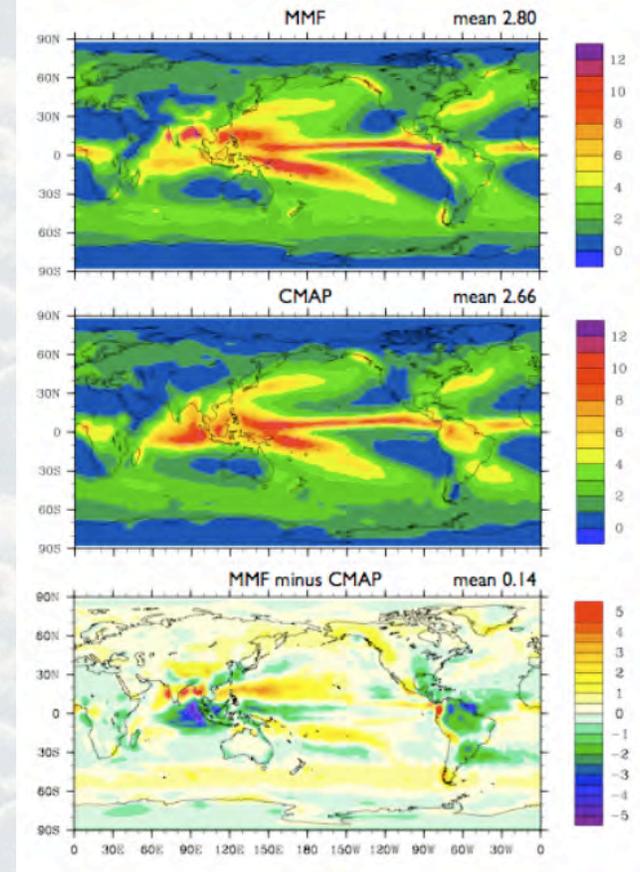


# Climatological simulation with Super CAM



- **Objective:**  
Examine the climate of Super CAM in the same way that climate models are analyzed.
- **Simulation:**  
Two-decade integration using observed ocean surface temperatures (SSTs) and sea ice distributions. This follows the *Atmospheric Model Intercomparison Project (AMIP) Protocol*.
- **Manuscript:**  
*Evaluation of the simulated interannual and subseasonal variability in an AMIP-style simulation using the CSU Multi-scale Modeling Framework*

Marat Khairoutdinov, Charlotte DeMott, and David Randall  
*J. Climate*, 2008, 21, 413-431.



Knowledge Transfer

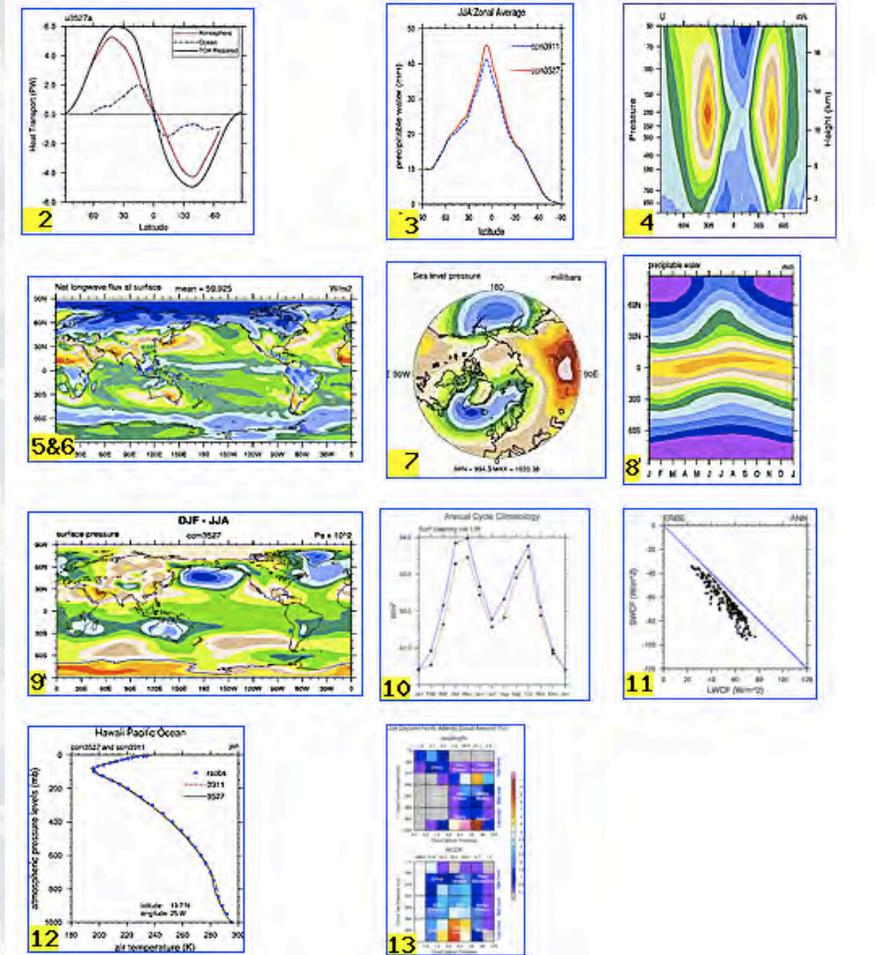




# Climate Diagnostics for Multiscale Framework



- CSU has analyzed the climatological run with the diagnostics used by the Community Climate System Model project.
- The diagnostics include measures for both mean climate and climate variability.
- These are exactly the same diagnostics used for the operational climate model.
- CMMAP has provided the diagnostics for free and open use by the whole CCSM.

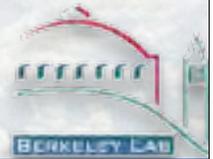


Knowledge Transfer



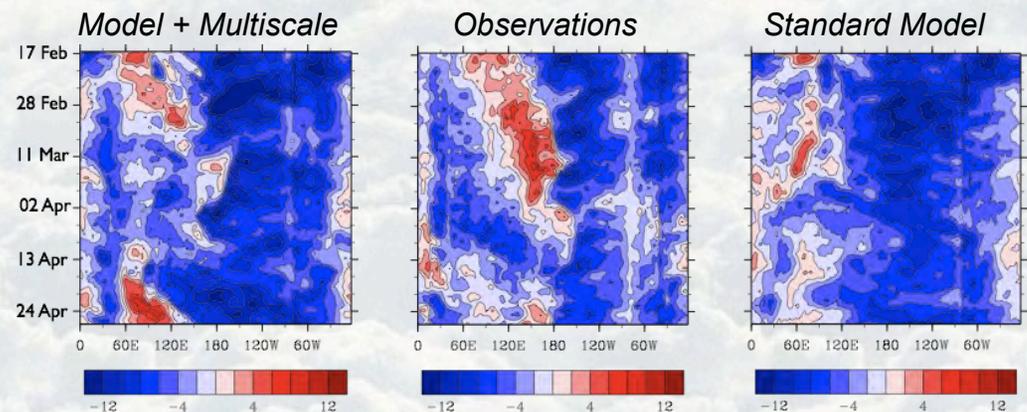
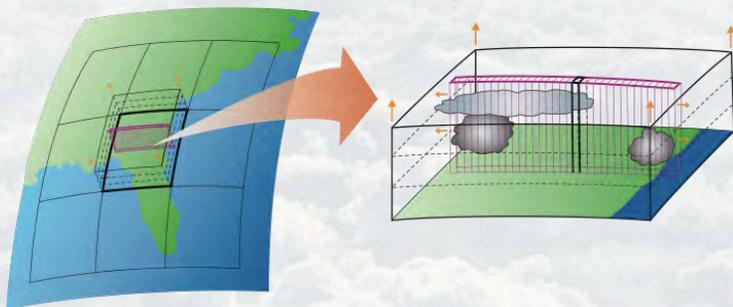


# First presentation on MMF to the CCSM Project



- Dave Randall and Bill Collins discussed MMF and the diagnostics with the Atmospheric Model Working Group, part of the Community Climate System Model project, at their Feb. 2008 meeting.
- Goals of the presentations:
  - *Introduce the scientific scope of the MMF project*
  - *Highlight some early scientific achievements*
  - *Showcase analysis of MMF with CCSM climate diagnostics*

Multiscale Framework

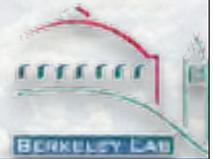


Knowledge Transfer

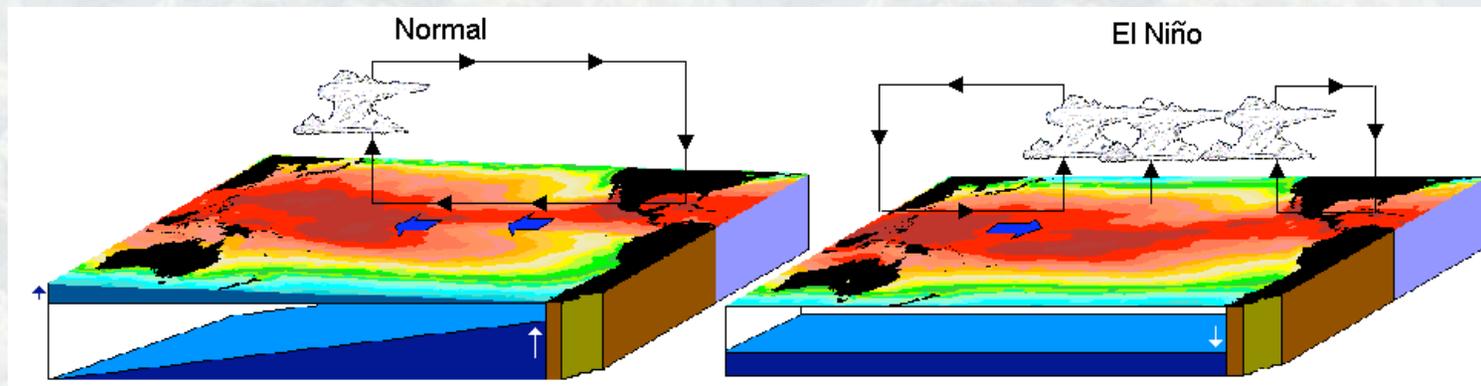




# Future coupled climate studies with Multiscale Framework?



- **Studies suggest that intraseasonal variability can affect major modes of interannual variability**
  - ▶ Example: Influence of Madden Julian Oscillation (MJO) on El Niño Southern Oscillation (ENSO)
- **Objectives:**
  - ▶ Quantify differences between traditional parameterizations and MMF
  - ▶ Couple Super CAM to the CCSM ocean model to study interactions of the improved MJO with ENSO
- **Studies to understand the coupling issues are underway.**



Knowledge Transfer

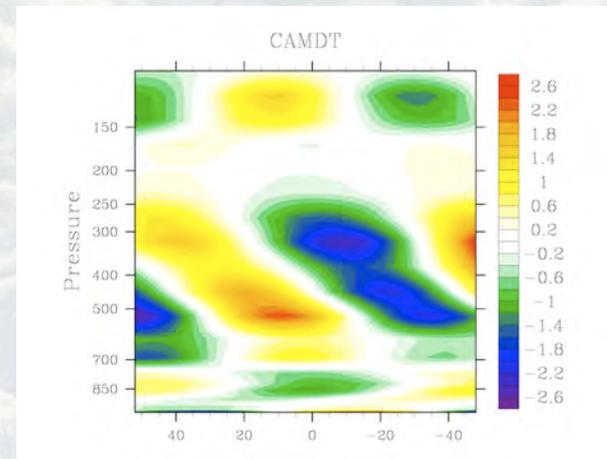
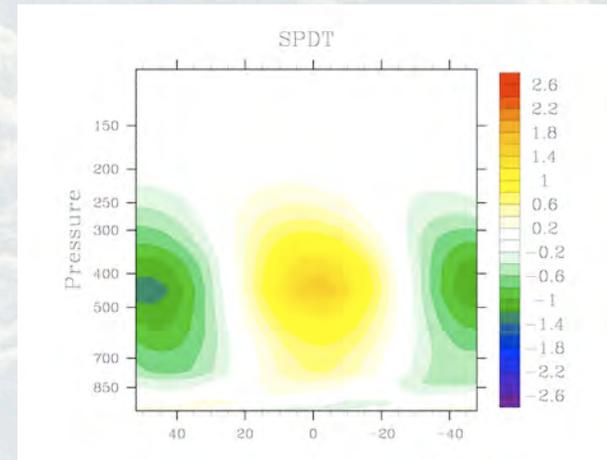




# Experiment on Madden-Julian Oscillation



- **Objective:** Understand how do MMF and standard physics differ throughout life cycle of MJO event?
- **Methodology:** Run MMF and standard physics side-by-side on same atmospheres.
- **Status:** First experiments complete
  - ▶ Control
  - ▶ 4 x CO<sub>2</sub>
- **Diagnostics:**
  - ▶ Tendencies in q, T, cloud water
  - ▶ Parallel MMF & standard physics
- **Analysis:**
  - ▶ MJO compositing



Knowledge Transfer





# Extensions to MJO experiment

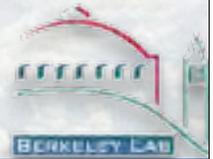


- **Test other convective schemes ported to CAM?**
  - ▶ Donner
  - ▶ Relaxed Arakawa Schubert (RAS)
  - ▶ Emanuel
- **Test other physics besides convection?**
- **Test other cloud types beside deep convective?**





# Collaboration with UC Berkeley and Lawrence Berkeley National Lab



- **CSU won a large DOE computing award to test the global cloud system resolving model (GCSR)**
- **Independent of this, CSU and LBNL are working to:**
  - Develop the design of a 20 million CPU machine customized to run climate model integrations at the kilometer scale
  - Primary goal: reach sustained petaflop performance
  - Secondary goal: build a low-power “green” computer
  - Method: custom embedded processor technology



**Knowledge Transfer**

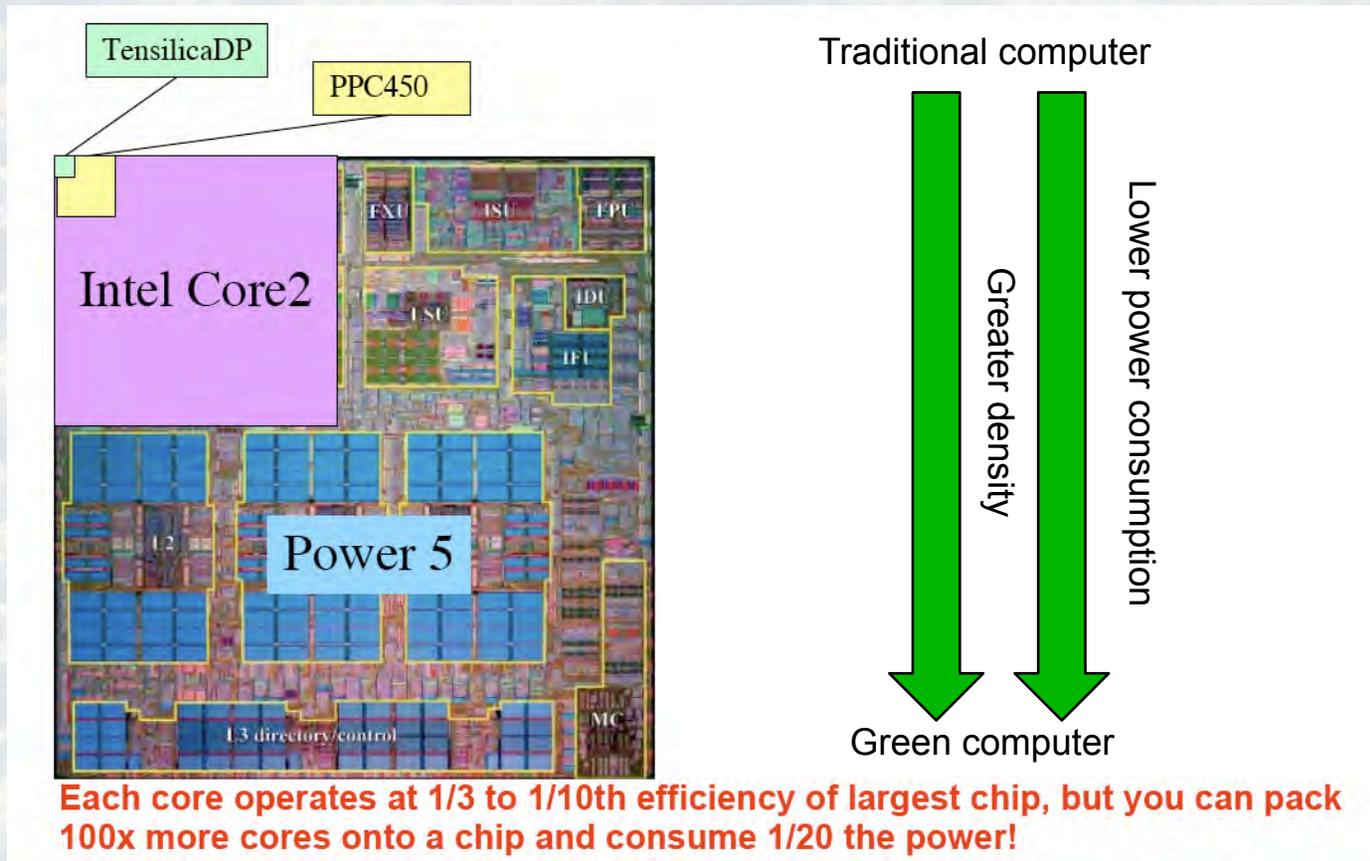




# Prospects for a Green Climate Computer



LBNL is exploring concepts for a “green” climate computer based upon CMMAP GCSRMs.



Knowledge Transfer

