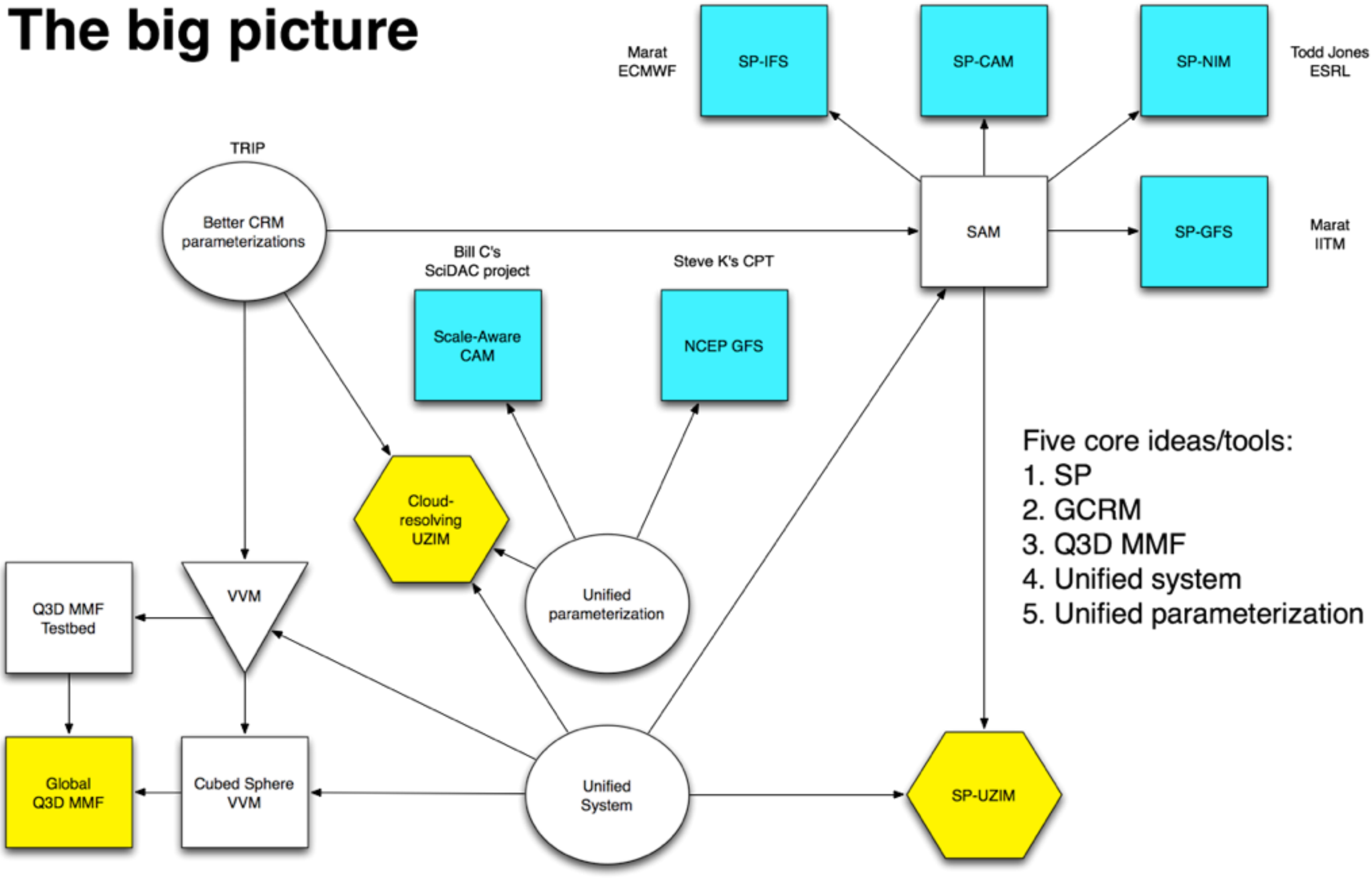
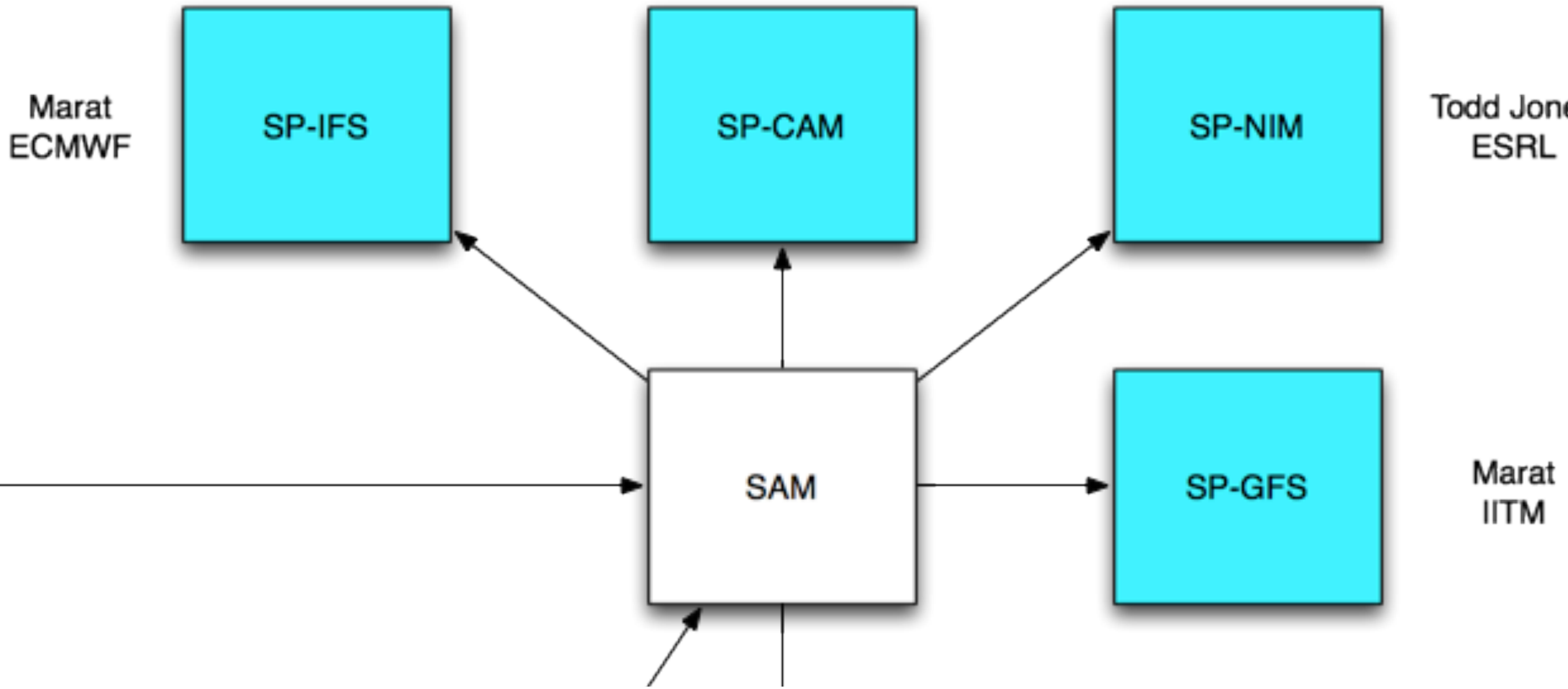
The big picture




Marat
ECMWF
SP-IFS
SP-CAM
SP-NIM
Todd Jones
ESRL
SAM
SP-GFS
Marat
IITM

Bill C's
SciDAC project

Steve K's CPT

Scale-Aware
CAM

NCEP GFS

Cloud-
resolving
UZIM

Unified
parameterization

A CPT for Improving Turbulence and Cloud Processes in the NCEP Global Models

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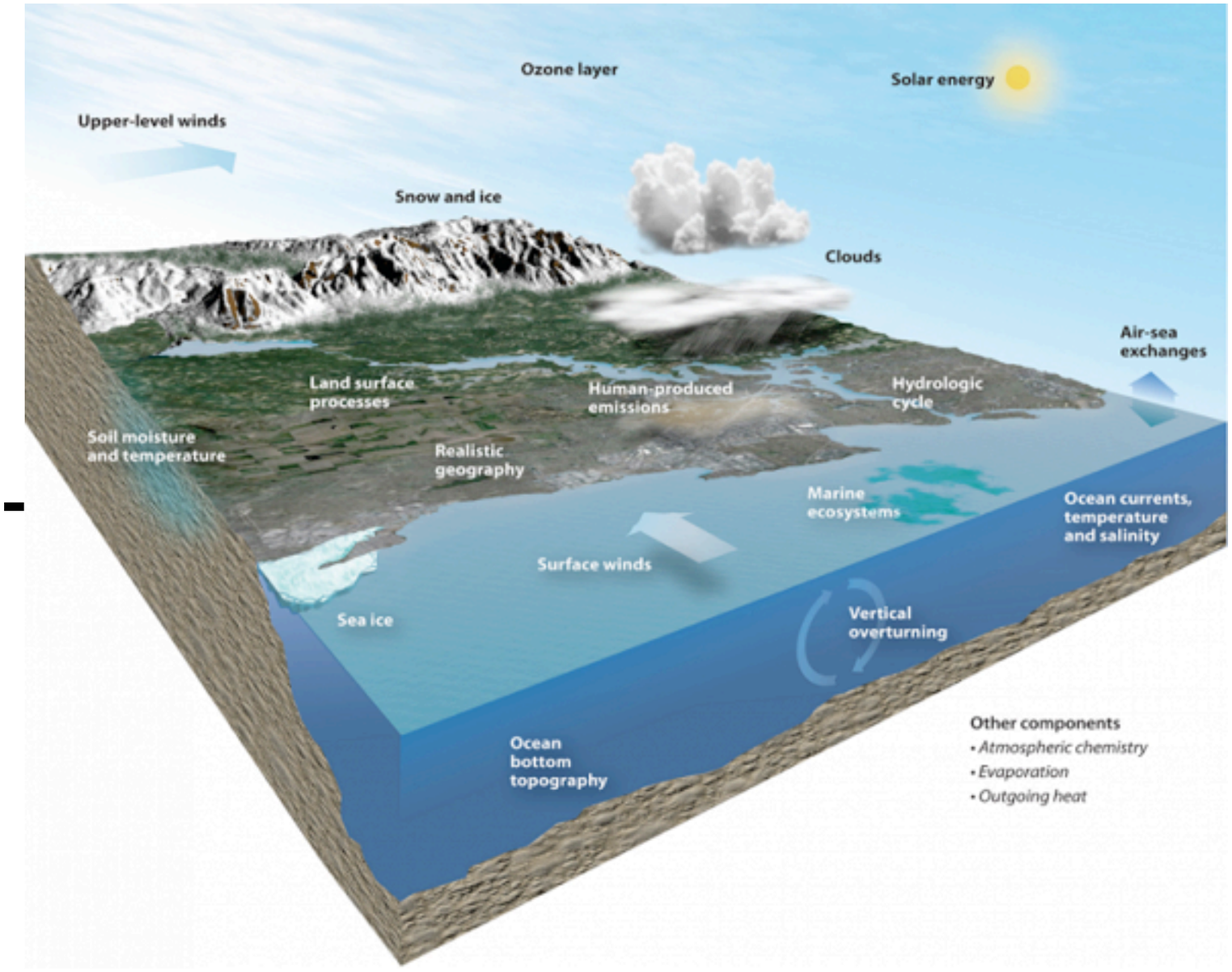
Shrinivas Moorthi (EMC/NCEP)
Robert Pincus (U. of Colorado)
David A. Randall (CSU)
Peter A. Bogenschutz (NCAR)
Fanglin Yang (EMC/NCEP)

Funding Opportunity Details

- CPTs solicited by this call should focus on the improvement of climate and Earth System models (including state-of-the-art models at GFDL and NCEP) by testing and evaluating the impact of improved process models when embedded in the global models.



Funding Opportunity Details

- Proposed CPTs should focus on those processes that have a mature observational and theoretical base, and scope proposed research so that significant progress can be made, over the duration of the project.

Funding Opportunity Details

- **Each CPT should comprise a number of co-Is and institutions proposing as a collaborative group. Each team must involve co-Is from at least one, and preferably more, of NOAA's global modeling centers as collaborating institutions.**
- **A CPT may be proposed as part of Climate Test Bed (CTB) activities.**

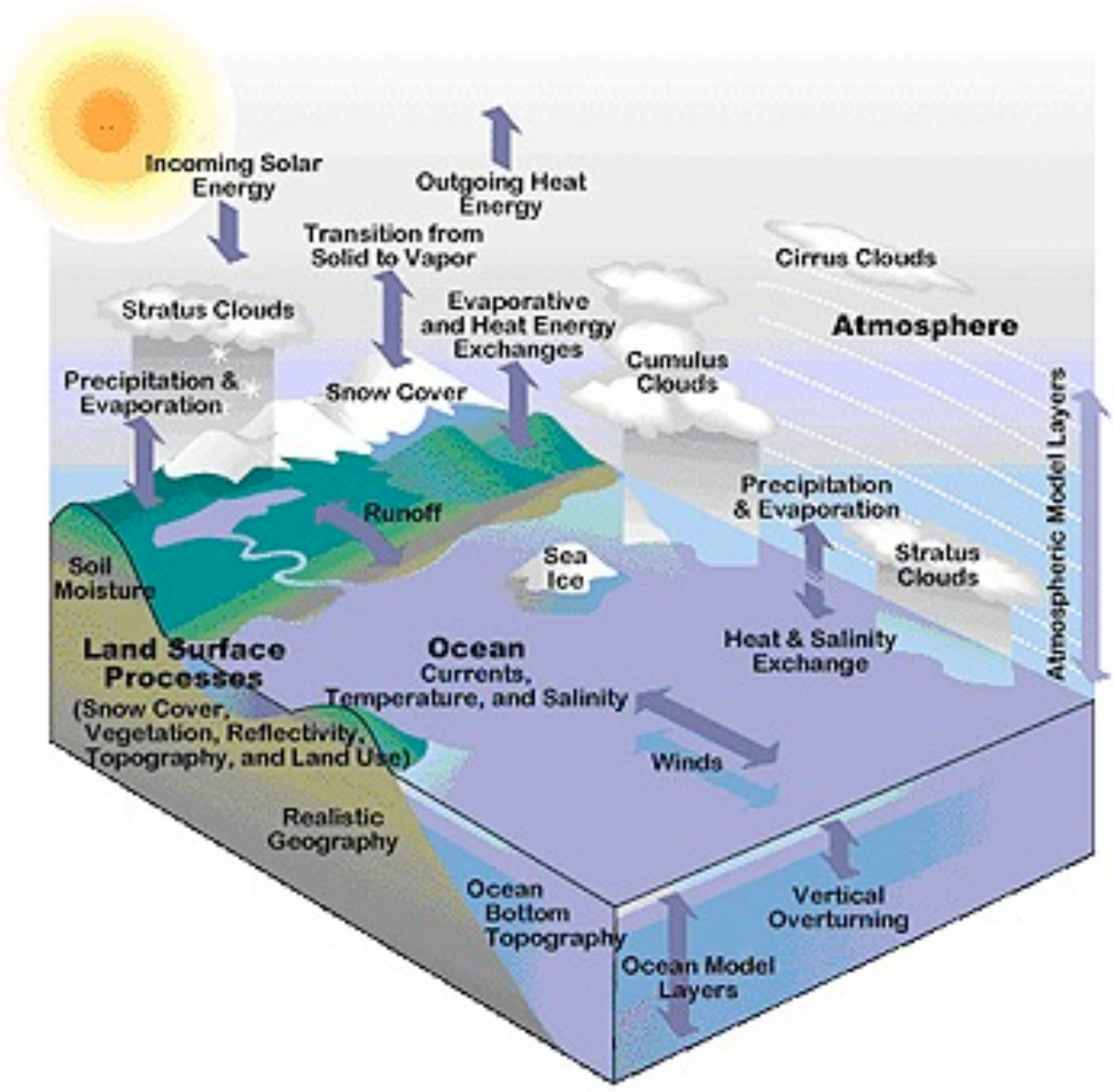
Knowledge Transfer

- The role of the academic scientists in the proposed project is to convey parameterizations — distillations of scientific understanding — to the EMC, and to guide their implementation into the NCEP global models.

- The role of the EMC in the proposed project is to facilitate the transfer of advanced knowledge gained through the academic research into NCEP operations.

Proposal Summary

- We proposed a CPT to unify the representation of turbulence and SGS cloud processes and to unify the representation of SGS deep convective precipitation and grid-scale precipitation as the horizontal resolution decreases.

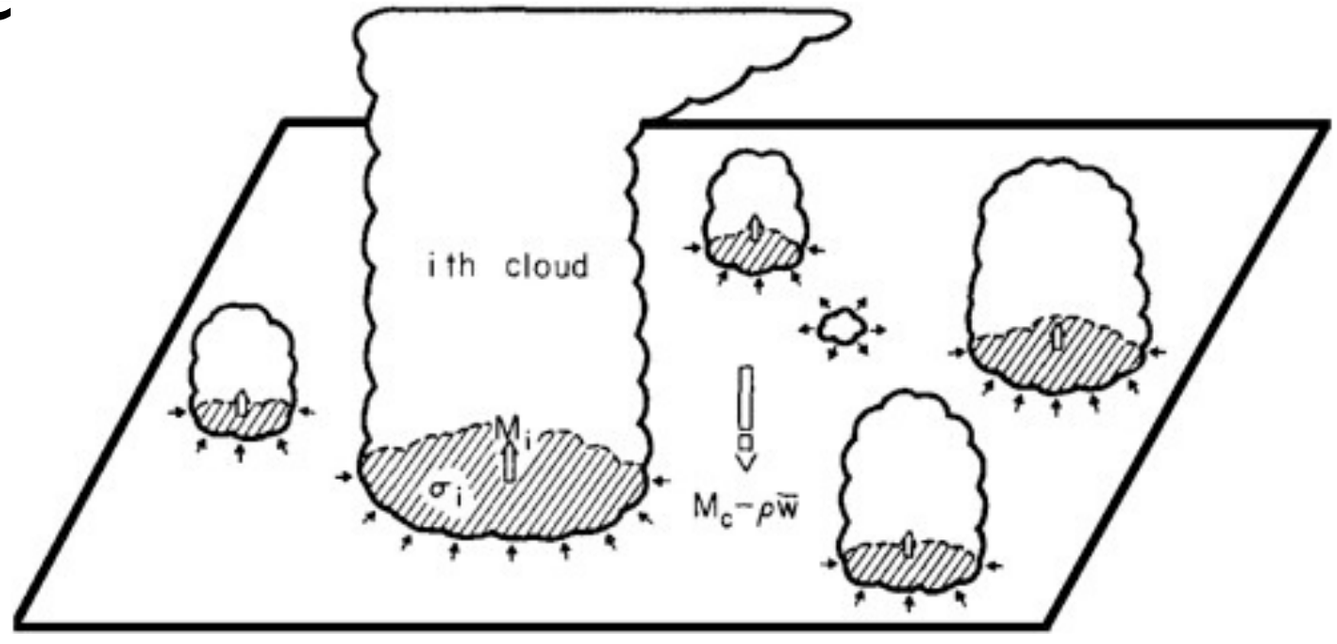


Proposal Summary

- We will implement a PDF-based subgrid-scale turbulence and cloudiness scheme that would replace the boundary layer turbulence scheme, the shallow convection scheme, and the cloud fraction schemes in the GFS and CFS.

Proposal Summary

- We will improve the treatment of deep convection by introducing a unified parameterization that scales continuously between simulating individual clouds on fine grids, and the behavior of a conventional parameterization of deep convection on coarse grids.



Proposal Summary

- We will improve the representation of the interactions of clouds, radiation, and microphysics in the GFS/ CFS by using the additional information provided by the PDF-based SGS cloud scheme.
- The team will evaluate the impacts of the model upgrades with metrics used by the NCEP short-range and seasonal forecast operations.

Operational Implementation

- Code or algorithm development and repeated refinement based on case studies, proof of concept, and elimination of coding errors.

- Interfacing with operational codes and data structures, making the code robust and efficient to fit the CPU time and/or memory available.

Operational Implementation

- Preliminary runs include (research quality) low-resolution case studies with static initialization, relevant diagnostics, winter and summer cases, short-term low-resolution climate runs, etc.
- Next are low-resolution parallel runs with fully cycled data assimilation experiments for all seasons (similar runs with the operational forecast system may need to be done to facilitate evaluation of the new forecast system).

Operational Implementation

- Once satisfied with the low-resolution experiments, a full-resolution pre-implementation experiment through full cycling needs to be carried out with full verification.
- Once this is satisfactory, NCEP Central Operations (NCO) will perform comprehensive real-time pre-implementation testing, documentation, verification, and notification to the downstream users.