AMWG: 2018-02-13

Plans for infrastructure development in CESM-CAM

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CESM (including CAM) is moving to git

- CESM2 will be released from a GitHub repository
  - git is a distributed version control system, GitHub is a cloud-based git workflow service
  - CIME has been in git (at GitHub) for over two years
  - CLM5 (part of CESM2) was recently released on GitHub
- CAM will move to GitHub after the CESM2 release
Why git? Why GitHub?

• git is becoming the standard for open source collaborative development.
• Distributed version control makes it easier for anyone in the community to keep their developments in version control.
• GitHub provides great collaborative tools for code development and review.
• Integration of code, issues and project management creates greater transparency.
• We will develop new, transparent development procedures for future community CAM development.
• Questions? Want to help? Please contact me.
Requirements for CAM Physics -- after CAM6

• Support for new physics suites (packages) while maintaining ability to run older suites
  – Interoperable development of new unified physics suite
  – Ability to continue to run mainline CAM and WRF physics suites
• Interoperability between NCAR atmosphere models (WRF, MPAS, CAM)
  – For example, run WRF physics inside CAM without any changes to parameterizations or suite definition
• Ability to run chemistry and/or physics on different grid from dynamics
What is wrong with what we have?

- CAM physics parameterizations depend on several CAM-specific data structures (physics_state, physics_tend, surface fields in, surface fields out, PBUF). Other models have very different state data structures.
  - This inhibits portability between models.
- phypkg (tphysbc, tphysac) logic has combined implementation of CAM3, CAM4, CAM5 & CAM6 including several options for CAM5 and CAM6.1
  - Increases difficulty in experimenting with new physics parameterizations and suites.
What is the Community Physics Driver Framework?

- Multi-model effort to build flexible physics-package driver with a common, model-independent interface
- Replaces hardcoded, complex logic with a data-driven schedule of parameterization calls
- Handles data flow to and from host model as well as between parameterization calls
- Recently funded for implementation by CGD (CAM), MMM (WRF & MPAS), ACOM (Chemistry package)
- Goal is to also be compatible with NOAA (NGGPS, CCPP)
CAM6 Physics vs. CPD

CAM6 ⇒ CPD

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CAM6 Physics Parameterization vs. CPD

**CAM6 Physics Parameterization**

- Gather data from state, previous tendencies, & physics buffer
- Update state, tendencies, physics buffer & diagnostic output

Parameterization portable layer (all I/O through Fortran arrays)
Examples: microphysics, cloud physics, radiation

**CPD**

Parameterization Cap (Fortran code generated from Parameterization metadata)

Parameterization portable layer (all I/O through Fortran arrays)
Examples: microphysics, cloud physics, radiation

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Summary

• Physics parameterizations and suites can be shared among models without modification.

• The CPD creates a uniform data interface for parameterization inputs and outputs.

• Shared infrastructure lowers coding, testing, and maintenance costs.

• Well-documented interfaces makes it easier for the community to contribute usable parameterizations.
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## Parameterization CAP

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Physics Suite

<suite name="Held_Suarez">
  <init>held_suarez_init</init>
  <ipd part="tphysbc">
    <subcycle loop="1">
      <scheme>check_energy_fix</scheme>
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      ...
      <scheme>physics_update</scheme>
    </subcycle>
  </ipd>
</suite>
The Pitch

• Both the move to GitHub and conversion to a common physics framework will enhance community engagement with CAM.
• There are decisions to be made along the way and we hope the community will be involved!
• Questions? Want to help? Please contact me.