



# Facilitating the Development of Complex Models with the CCPP and its Single Column Model

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# Common Community Physics Package

## CCPP Physics

- A library of physical parameterizations
- <https://github.com/NCAR/ccpp-physics>

## CCPP Framework

- Software infrastructure that allows using the CCPP-Physics in a host model
- <https://github.com/NCAR/ccpp-framework>

## CCPP Single Column Model

- A simple host model that employs the CCPP Physics and CCPP Framework
- <https://github.com/NCAR/ccpp-scm>

# Motivations for the CCPP

COMMON COMMUNITY PHYSICS PACKAGE

## **Code Management**

- Efficiency in physics development via centralization
- Process that facilitates research and transitions to operations

## **Interoperability to foster collaborations**

- A synergistic resource for research, development, transitions, and operations

## **Hierarchical tools**

- Promote process understanding and physics interactions
- Flexible for development; efficient for operations

# Host Models Using CCPP

## **CCPP Single Column Model**

- For hierarchical testing with CCPP

## **Unified Forecast System (UFS)**

- For research and NOAA operations
- CCPP scheduled for upcoming NOAA operational implementations and public releases

## **US Navy Research Laboratory NEPTUNE model**

- Using CCPP for pre-operational implementation tests

## **NCAR WRF, MPAS, CAM/CESM**

- Framework development
- In various stages of experimental adoption of CCPP-compliant physics

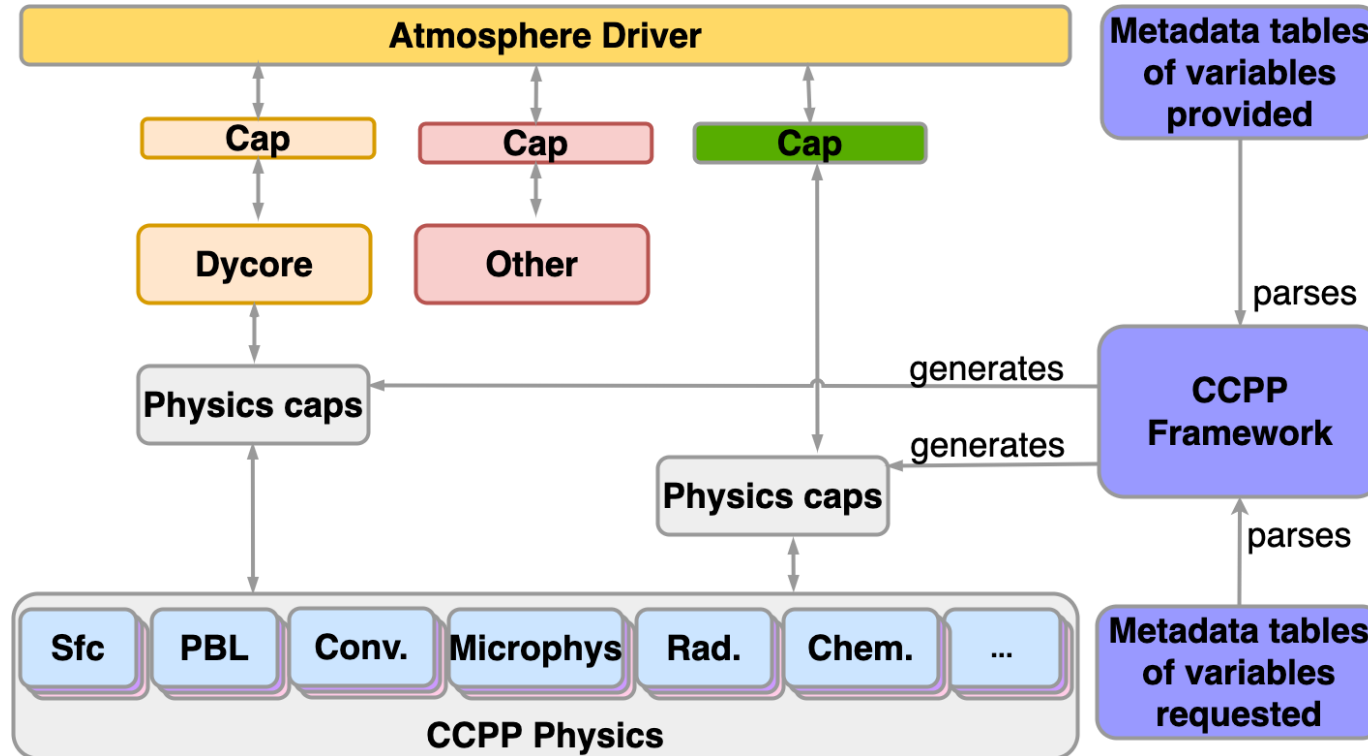
# CCPP v6.0 Public Release – June 2022

- Released as standalone (with SCM)
- Central hub: <https://dtcenter.org/ccpp>
- 23 supported schemes
- Online tutorial and documentation updated
  - [SciDoc, TechDoc, and User's Guide](#)
- Support provided via GitHub discussions
- Accepted manuscript Heinzeller et al. ([GMD preprint](#))

# CCPP v6.0 Supported Parameterizations & Suites

Type	Operational	Developmental				
Suites	GFS_v16	GFSv17_p8	RAP	RRFS_v1beta	WoFS	HRRR
UFS regional	✓			✓	✓	✓
SCM	✓	✓	✓	✓	✓	✓
Microp	GFDL	Thomp	Thomp	Thomp	NSSL	Thomp
PBL	TKE EDMF	TKE EDMF	MYNN	MYNN	MYNN	MYNN
Sfc lay	GFS	GFS	MYNN	MYNN	MYNN	MYNN
Deep cu	saSAS	saSAS + CA	Grell-Freitas	N/A	N/A	N/A
Shal cu	saMF	saMF	Grell-Freitas	N/A	N/A	N/A
Radiation	RRTMG	RRTMG	RRTMG	RRTMG	RRTMG	RRTMG
GWP	cires_ugwp	unified_ugwp	drag_suite	cires_ugwp	cires_ugwp	drag_suite
LSM	Noah	NoahMP	RUC	NoahMP	Noah	RUC

# CCPP Architecture



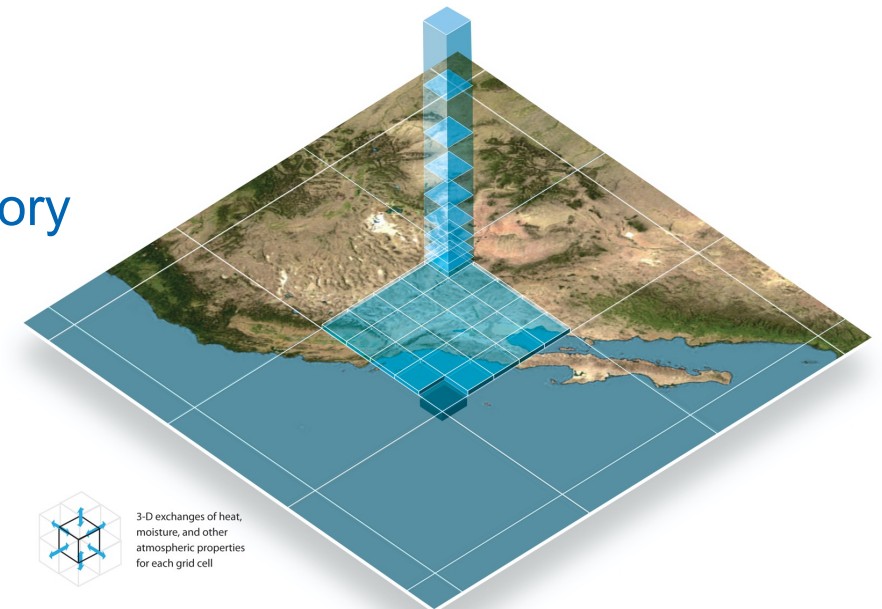
## Highlights

- Physics can be subdivided in groups and called from different parts of the host model
- Slow and fast physics possible
- Subcycling in slow physics is possible



# CCPP Single Column Model Overview

- All CCPP schemes/suites are available to use with the SCM
- Decouples physics from dynamics for hierarchical studies
- Initialization from field program data
  - GASS/TWP-ICE (maritime convection; near Australia)
  - ARM Great Plains (continental convection)
  - EUCLIPSE/ASTEX (stratocumulus)
  - LASSO (shallow cumulus)
  - GABLS3 (mid-latitude continental)
  - Other cases offered through the DEPHY case repository



# Upcoming developments for next release

- **New schemes**
- **Initialization from UFS history files**
  - Enables more closely exploring the sources of UFS biases
- **Parameterization simulator for SCM**
  - Ability to run a single parameterization, all others forced by data models

# Opportunities for Engagement

- **CCPP hub at [dtcenter.org/ccpp](https://dtcenter.org/ccpp)**
  - Code, documentation, tutorial, support
- **DTC Visitor Program ([dtcenter.org/visitors](https://dtcenter.org/visitors))**
  - Assess and improve parameterizations in CCPP
  - Add cases to Single Column Model, etc.
- **CCPP Visioning Workshop**
  - Virtual, week of August 14
  - Inform the community about capabilities
  - Discuss future direction

# Summary

- Opportunities for collaborative physics development and testing
- Flexibility and configurability for research and development
- Performance for operations
- On track for first operational implementation at NOAA in 2023
- Being integrated onto Navy and NCAR models
- Public releases and workshops offer opportunities for engagement

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# 2023 CCPP Visioning Workshop (virtual, week of August 14, 2023)

**What:** discuss future direction for CCPP

## **Who**

- CCPP project leads and developers
- Physics and atmospheric composition/chemistry developers
- Scientists working on coupling for ESMs, especially physics-dynamics coupling
- NOAA, NCAR, NRL, NASA, academia, private sector, etc.

**Which models:** UFS, SCM, NEPTUNE, SIMA etc.

## **Goals**

- Inform the community about capabilities
- Gather input from developers/SMEs
- Discuss best practices for interoperability and collaborative development
- Create a prioritized list of required advancements for CCPP

## **Desired outcome**

- Common understanding of the state of CCPP and prioritized requirements and needs to meet scientific and technological frontiers in the next 5-10 years