CCPP SCM Background

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Developmental Testbed Center-

Historical Context

- DTC tasked with developing a hierarchical testing framework (HTF) for US NWP physics in 2015 based on spectral GFS
 - GFS-based SCM from NOAA was no longer being maintained and was out-of-date by many years
 - DTC developed its own flexible SCM to serve in this role
 - Configurable vertical coordinate, time integration scheme, forcing methods
- Simultaneously, DTC was also tasked with developing a Common Community Physics Package (<u>link</u>)
 - Software framework for "autogenerating" physics driver, matches variables requested by physics suites to those provided by a host model through the use of variable metadata
 - Repository of compliant physics schemes that can be assembled into user-configurable suites

Historical Context

- Shortly thereafter, a new dycore (FV3) was chosen for the GFS and all physics are to be called through the new CCPP software framework (also GFS rebranded to UFS)
- The SCM was reconfigured to match:
 - Calls physics through the CCPP
 - Uses FV3-based vertical coordinate
- Current Roles:
 - Fulfills SCM role in UFS-based HTF
 - CCPP host model example (publicly released with CCPP code)
 - Teaching tool for the CCPP



Parameterizations in master CCPP code February 2020

Microphysics	Zhao-Carr, GFDL (incl. sat adj in dycore), MG2-3, Thompson, F-A				
PBL	K-EDMF, TKE-EDMF, moist TKE-EDMF, YSU, saYSU, MYJ				
Surface Layer	GFS, MYNN, MYJ	Implementation			
Deep Convection	saSAS, Chikira-Sugiyama, GF, Tiedtke	DTC			
Shallow Convection	EDMF, GF, Tiedtke	GSD			
PBL and Shal Convection	SHOC, MYNN	EMC			
Radiation	RRTMG				
Gravity Wave Drag	GFS orographic, GFS convective, uGWD, RAP/HRRR drag suite				
Land Surface	Noah, Noah-MP, RUC				
Ocean	Simple GFS ocean				
Sea Ice	Simple GFS sea ice				
Ozone	2006 NRL, 2015 NRL				
H ₂ O	NRL				

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CCPP v4 Supported Suites Operational and Experimental

	Operational	Experimental					
	GFS_v15p2	GFS_v16beta	csawmg	GSD_v1			
Microphysics	GFDL	GFDL	M-G3	Thompson			
Boundary Layer	K-EDMF	TKE EDMF	K-EDMF	saMYNN			
Surface Layer	GFS	GFS	GFS	GFS			
Deep convection	SAS	SAS	Chikira-Sugiyama	Grell-Freitas			
Shallow Convection	SAS	SAS	SAS	MYNN and GF			
Radiation	RRTMG	RRTMG	RRTMG	RRTMG		RRTMG	
Gravity Wave Drag	uGWP	uGWP	uGWP	uGWP			
Land Surface	Noah	Noah	Noah	RUC			
Ozone	NRL 2015		NRL 2015	NRL 2015			
H ₂ O	NRL	NRL	NRL	NRL		NRL	
Additional parameterizations and suites are under- development; notably HWRF suite by DTC/EMC and shared WRF/MPAS/CESM suite by NCAR							

Cases, etc.

- Limited number of cases
 - GASS
 - ARM shallow cu (summer 1997 @ ARM SGP site)
 - BOMEX shallow cu
 - TWP-ICE maritime deep convection
 - EUCLIPSE ASTEX lagrangian sc-cu transition
 - LASSO (@ ARM SGP site)
 - UFS output (*in progress)
- Format
 - one netCDF file with initial conditions and time- and verticallyvarying forcing (very similar to proposed format)
 - one Fortran namelist-based case configuration namelist (similar to global attributes in proposed format)

Proposed format comments

- No major impediments to using proposed format!
- Minor questions
 - 1. Standard way to extend case data to arbitrary heights?
 - 2. Theta_il instead of theta_l?
 - 3. Upvote for CF conventions on standard naming
 - 4. Split advective forcing into horizontal and vertical parts for forcing flexibility?
 - 5. Domain size information or at least "applicable horizontal scale"?
 - 6. LSM initialization data (at least soil moisture and temperature profiles to 2m)?
- What about revisions to the standard? Will a committee exist after this workshop to maintain the format?