

# WRF, MPAS and Unified Modeling

Chris Davis  
NCAR/MMM

Acknowledgements:

Joe Klemp, Bill Skamarock, Michael Duda, Dave Gill, Wei Wang, Jimmy  
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# Purpose of this Talk

- Define unified modeling
- Describe the relationship of WRF and MPAS in a unified framework
- Summarize ongoing work toward unification
- Provide some thoughts on the future of WRF





# MPAS

Model for Prediction Across Scales

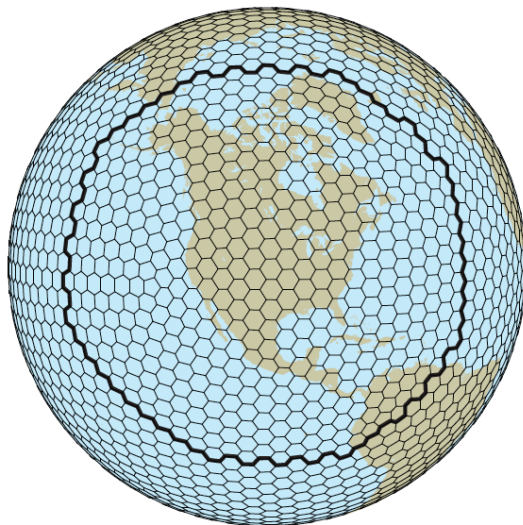
Los Alamos  
NATIONAL LABORATORY  
EST. 1943



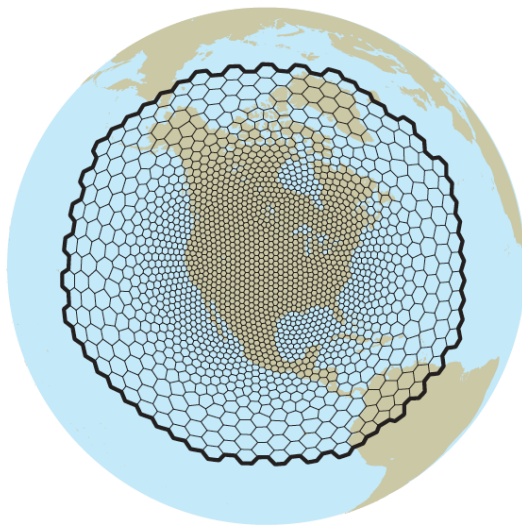
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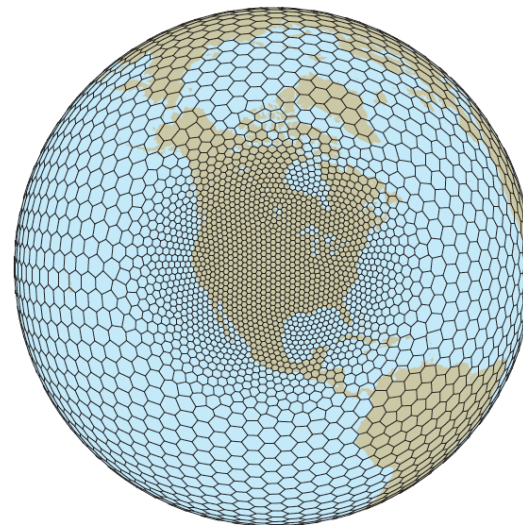
## UNIFORM



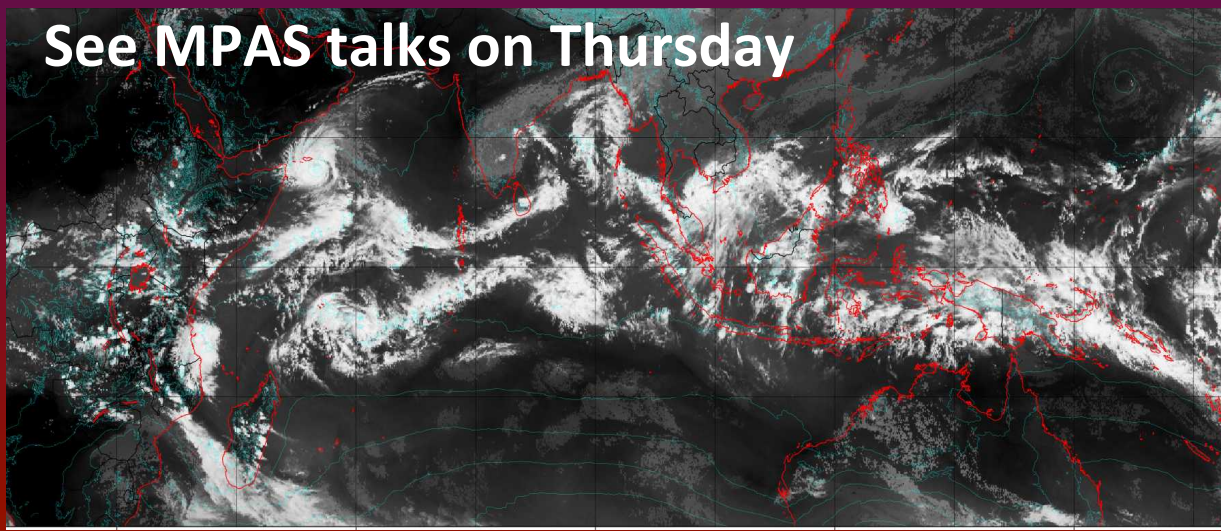
## REGIONAL



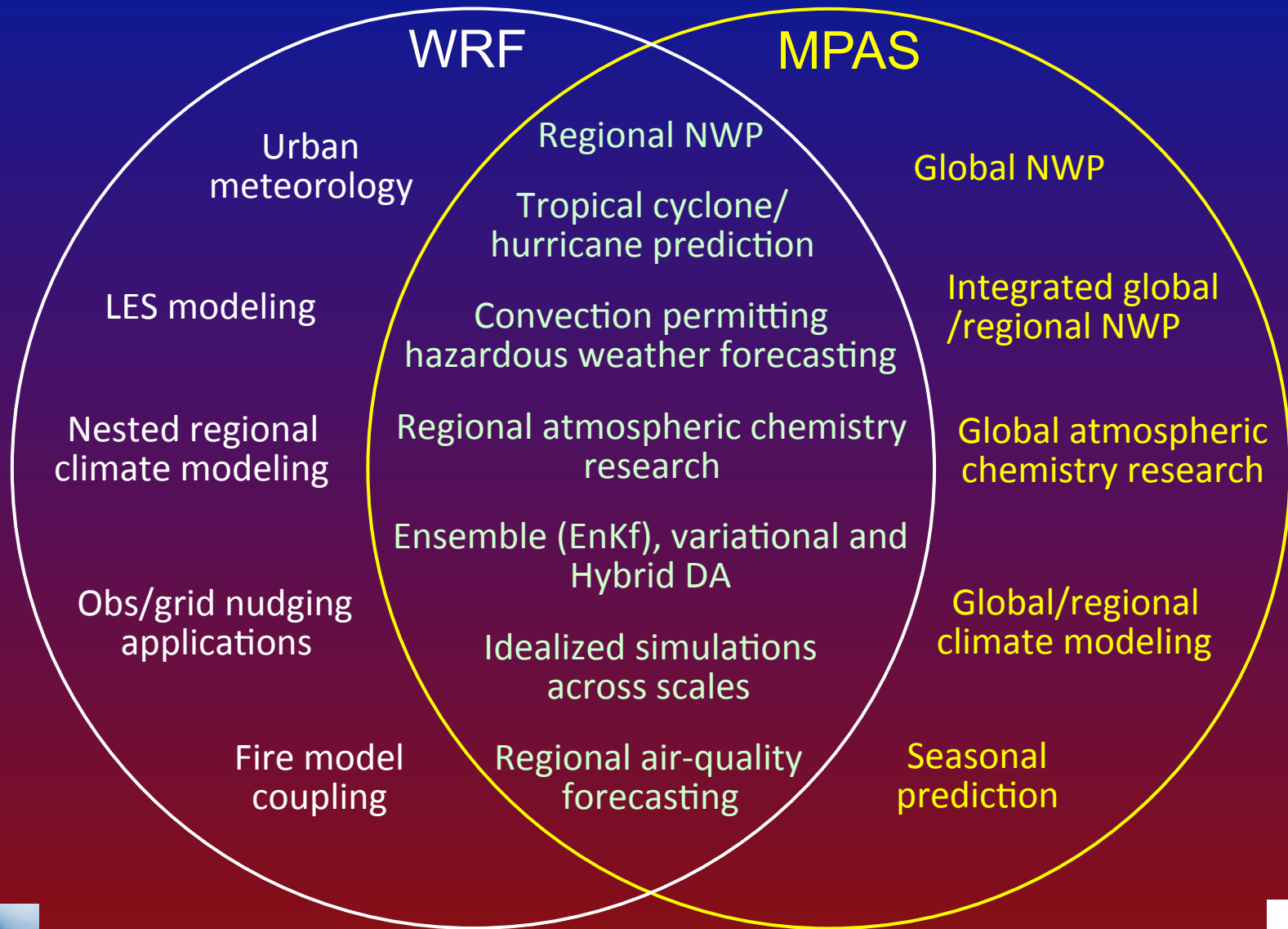
## VARIABLE



See MPAS talks on Thursday







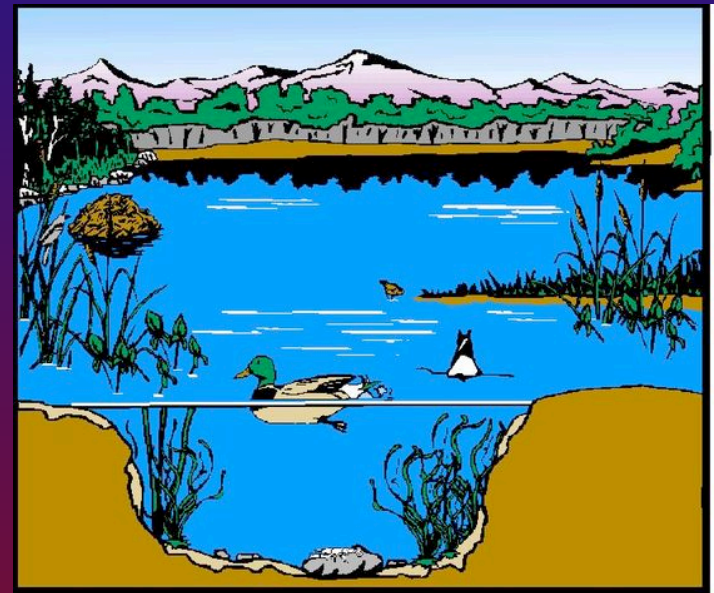


# “Unified” Modeling

Monolith



Ecosystem



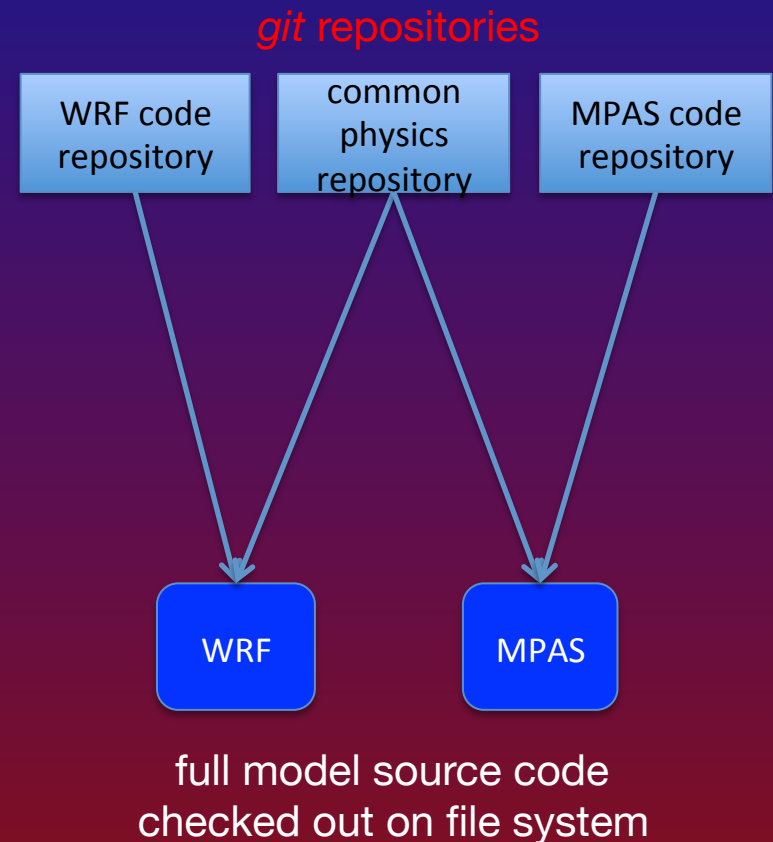
imgarcade.com

**We are NOT building a monolithic unified system.  
Unification will be realized through interoperability.**



# Interoperability of WRF and MPAS

- Common physics repository
- Interoperable physics driver/interface
- Common use of *git* for source code management
- Development/support of a limited number of well tested physics suites
- Coordination of user support
- Use of MPAS to initialize and drive WRF
- Common post-processing and graphics tools





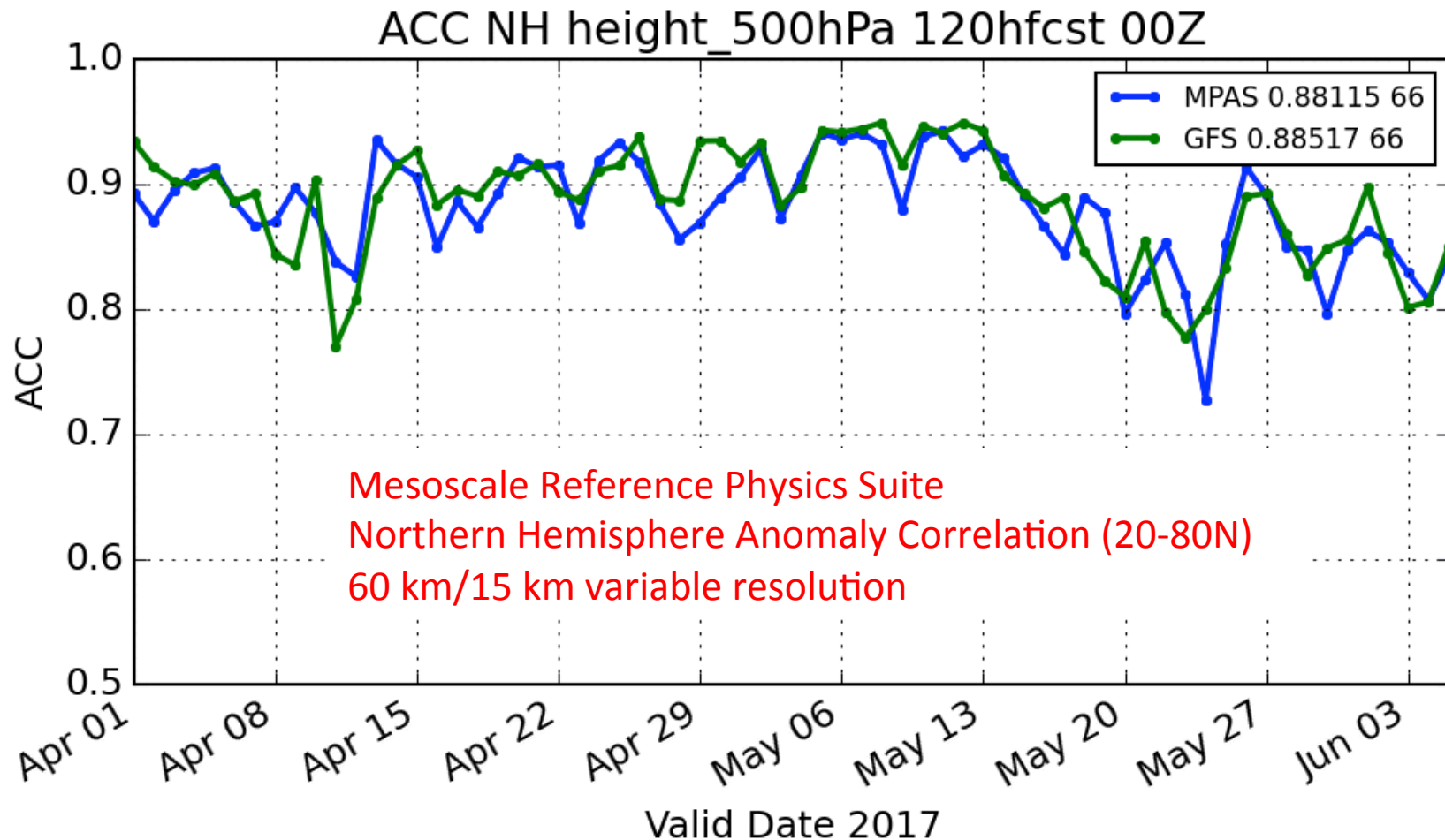
# Common Physics Suites are Essential

- More extensive testing possible
  - Reduced resources for support
  - Testing in MPAS can examine global suitability (benefits WRF)
  - Feasible for only a small number of suites
- Better for migrating to future computing architectures
- Intercomparison of results much easier
- Recommendation to users is simplified
- Emphasizes scale-insensitive physics



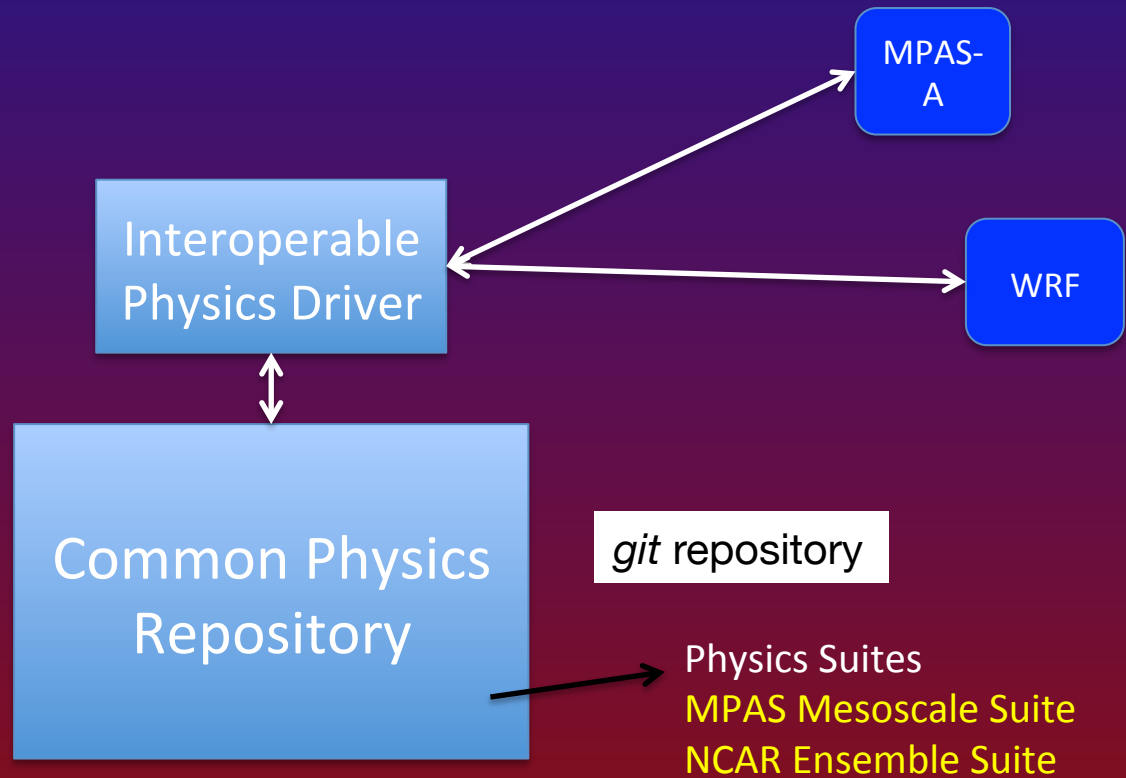


# MPAS in Real-Time: Testing a Physics Suite



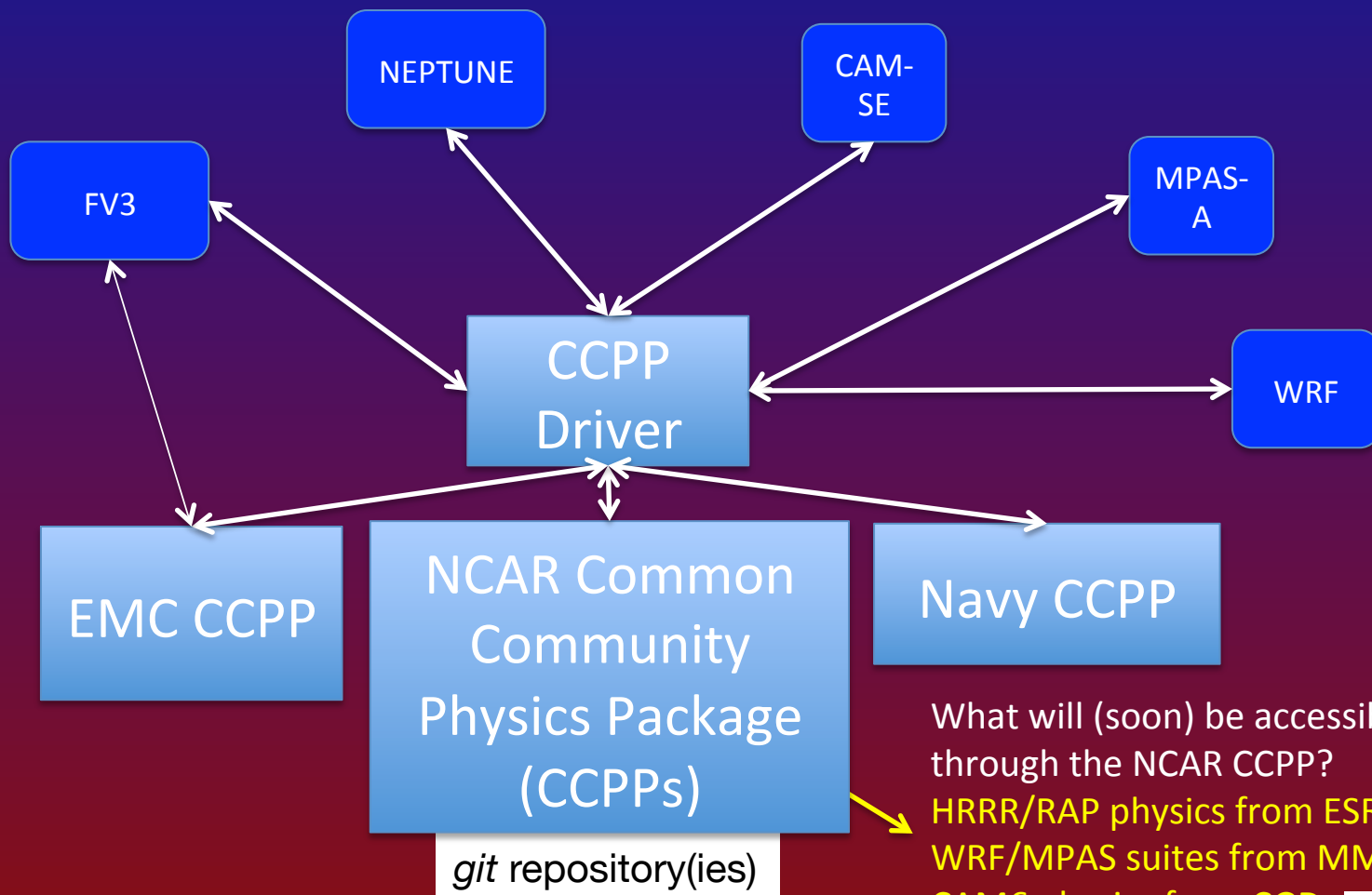


# Interoperable Physics





# Interoperable Physics





# Advantages of Interoperable Driver

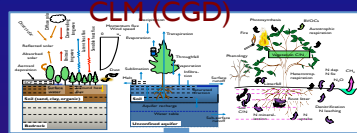
1. Reduced effort to port physics to different dycores
2. Unambiguous single-source physics codes
3. Clean intercomparisons with different dycores and physics
4. More groups have a common ground on which to work together. R2O and O2R more likely.
5. Accessible innovation: sharing next-generation technology



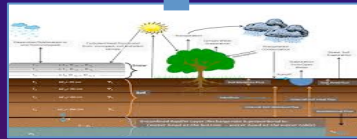


# Earth-System Modeling: System of Ecosystems

Land

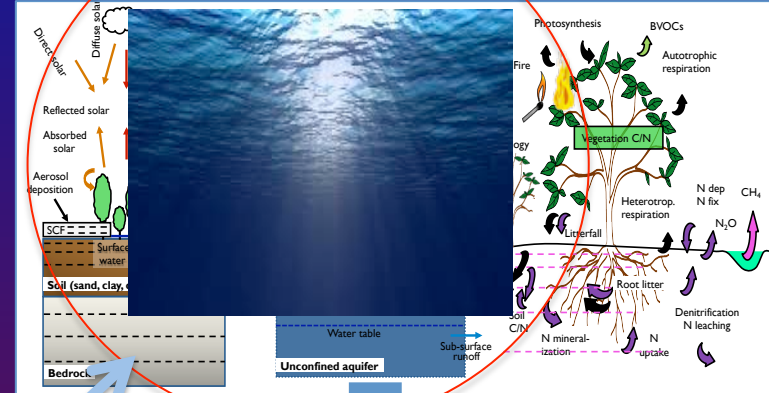


CTSM



CLM (CGD)

Ocean

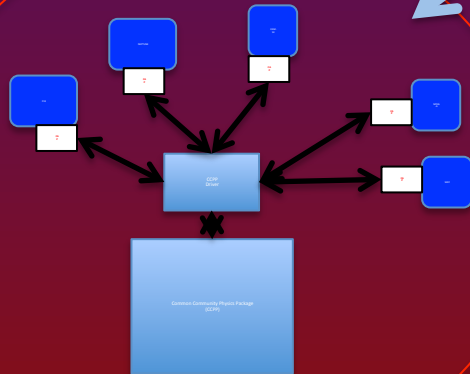


CTSM

Ice



Atmosphere



NUOPC  
Mediator  
(CIME)

Noah-MP, WRF-Hydro (RAL)



# Work in Progress

- MMM
  - Common physics repository and testing (part of CCPP)
  - Regional MPAS: driving WRF and regional MPAS from global MPAS
  - Ensemble-variational DA for WRF and MPAS
  - Unified web-based community support for WRF and MPAS
- NCAR-wide: Adapting CESM to support NWP as well as climate
- NCAR/NOAA/NRL: Building and testing CCPP Driver with different physics and dycores





# The Future of WRF and MPAS

- WRF
  - Will remain as part of the NWP ecosystem
  - Will improve through development and testing of physics, chemistry and data assimilation
  - Will continue to address a range of applications and to capture sub-km scales.
- MPAS
  - Will subsume a growing fraction of NWP science from WRF
  - Will move into seasonal prediction science using CESM components
  - Will be more easily adapted to future computing architectures
- MPAS and WRF
  - Will share physics, pre-processing, post-processing, data assimilation and community support as part of an interoperable modeling ecosystem





# Questions?





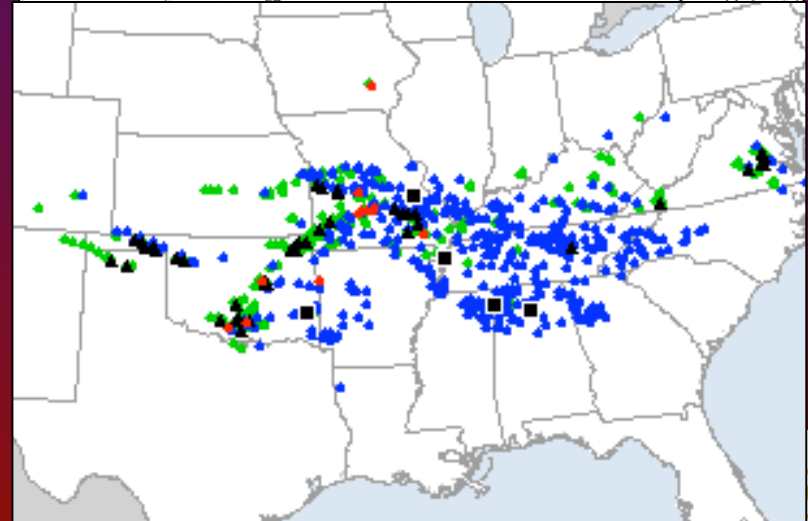
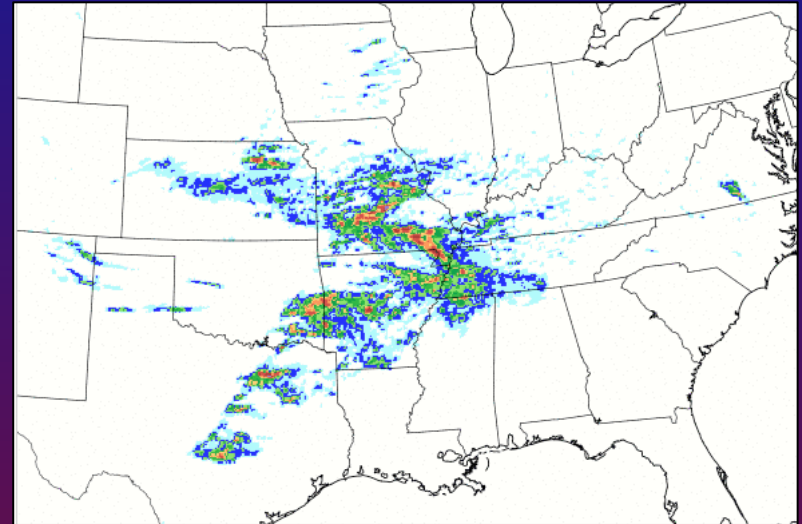
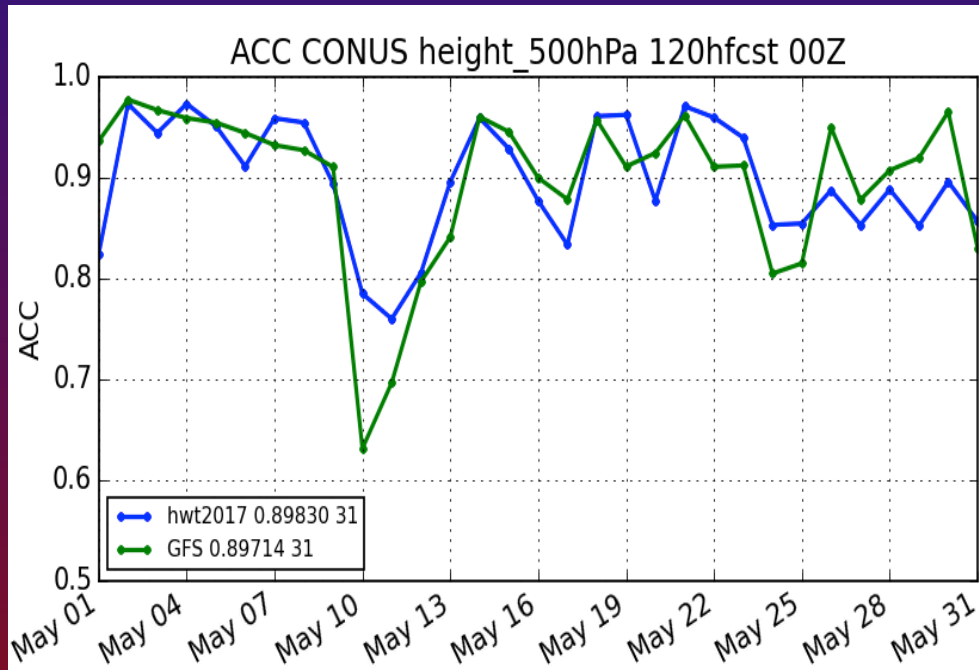
# Extra Slides





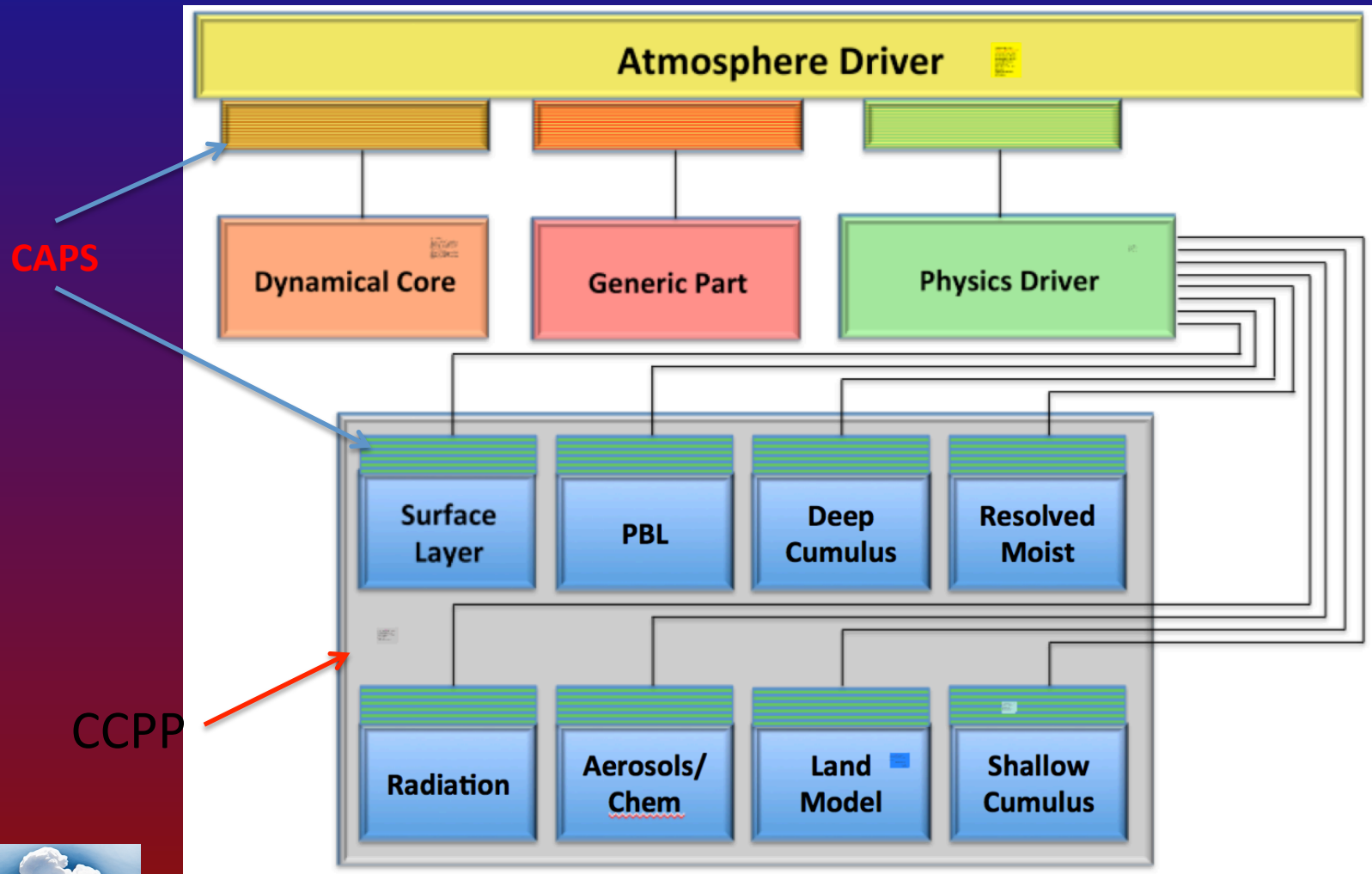
# 2017 HWT Forecasts

76-100 h forecast of 24-h maximum updraft helicity, initialized 00 UTC 24 May





# CCPP Driver



Courtesy of Dave Gill  
NCAR

