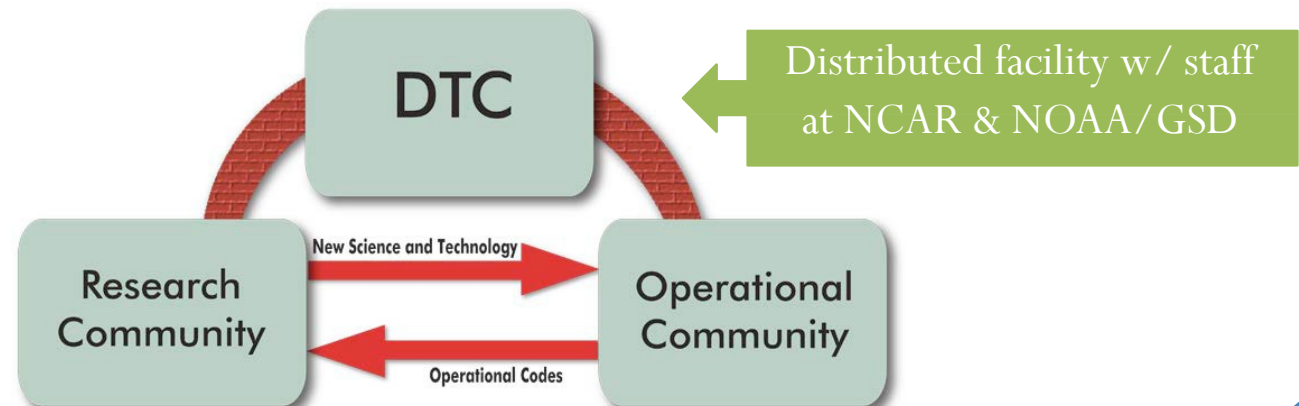


Developmental Testbed Center (DTC): Facilitating the R20 process for NWP

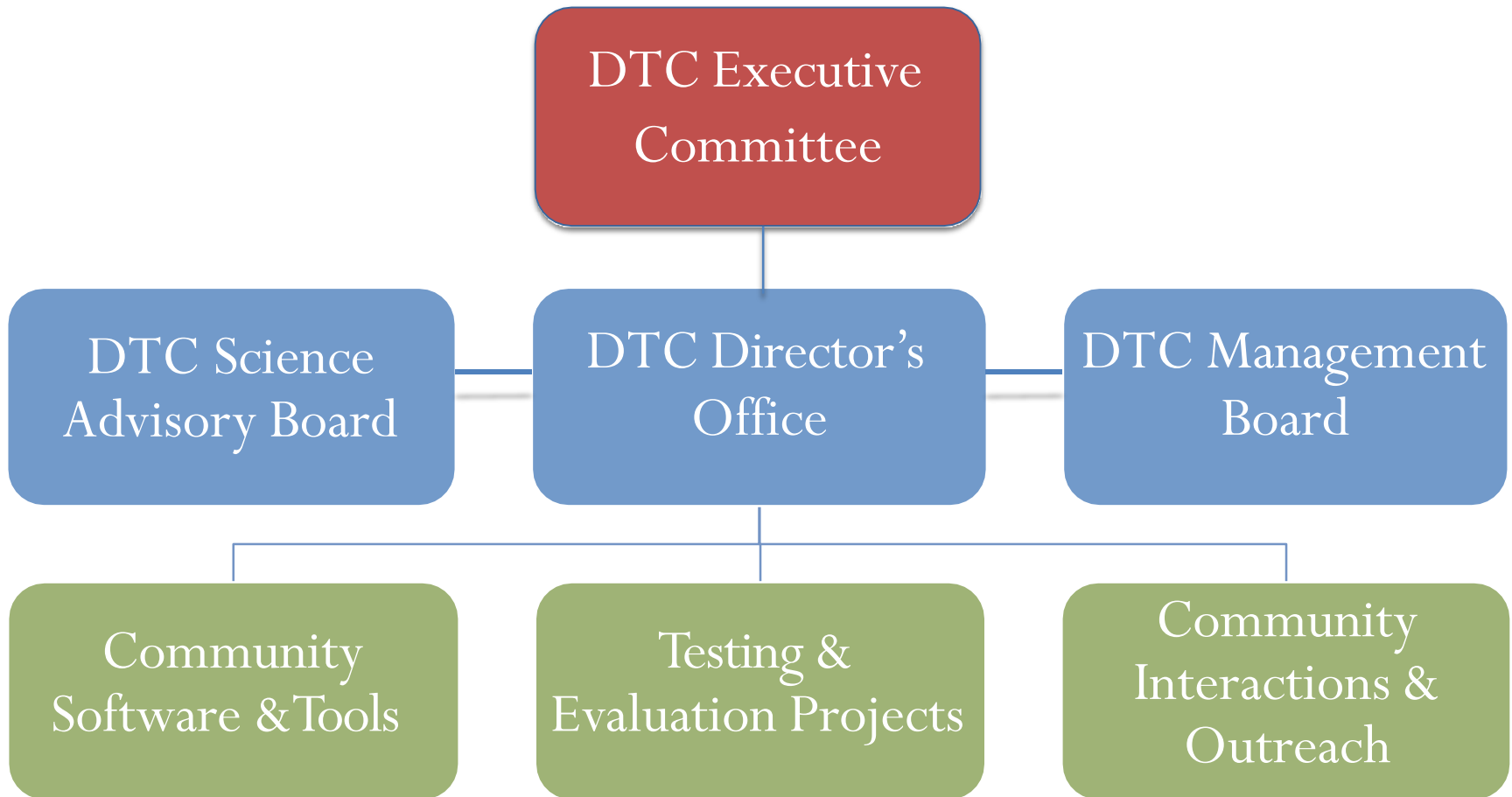
Louisa Bogar Nance
DTC Director

What is DTC?

- **Purpose:** Facilitate the interaction & transition of NWP technology between research & operations
 - **O2R:** Support operational NWP systems to the community
 - **R2O:** Provide developer support and perform T&E on promising NWP innovations for possible operational implementation
 - **Community:** Visitor Program, Workshops, Newsletter
- Jointly sponsored by **NOAA, Air Force, NCAR & NSF**



DTC Structure



Community software philosophy

- Shared resource w/ distributed development that includes capabilities of current operational systems
- On-going development maintained under mutually agreed upon software management plan
 - Code repository maintained under version control software
 - Clearly defined protocols for proposing & approving modifications to the software
 - Testing standards
 - Code review committee
 - Additional testing standards to more thoroughly check integrity of evolving code base
- Periodic releases made available to the community that include latest developments of new capabilities & techniques
 - Additional testing, including multiple computing platforms and compiler options
- Centralized support
 - Software downloads
 - Documentation
 - Tutorials (online and onsite)
 - User support mechanism – currently email helpdesk, but plan to transition to forums

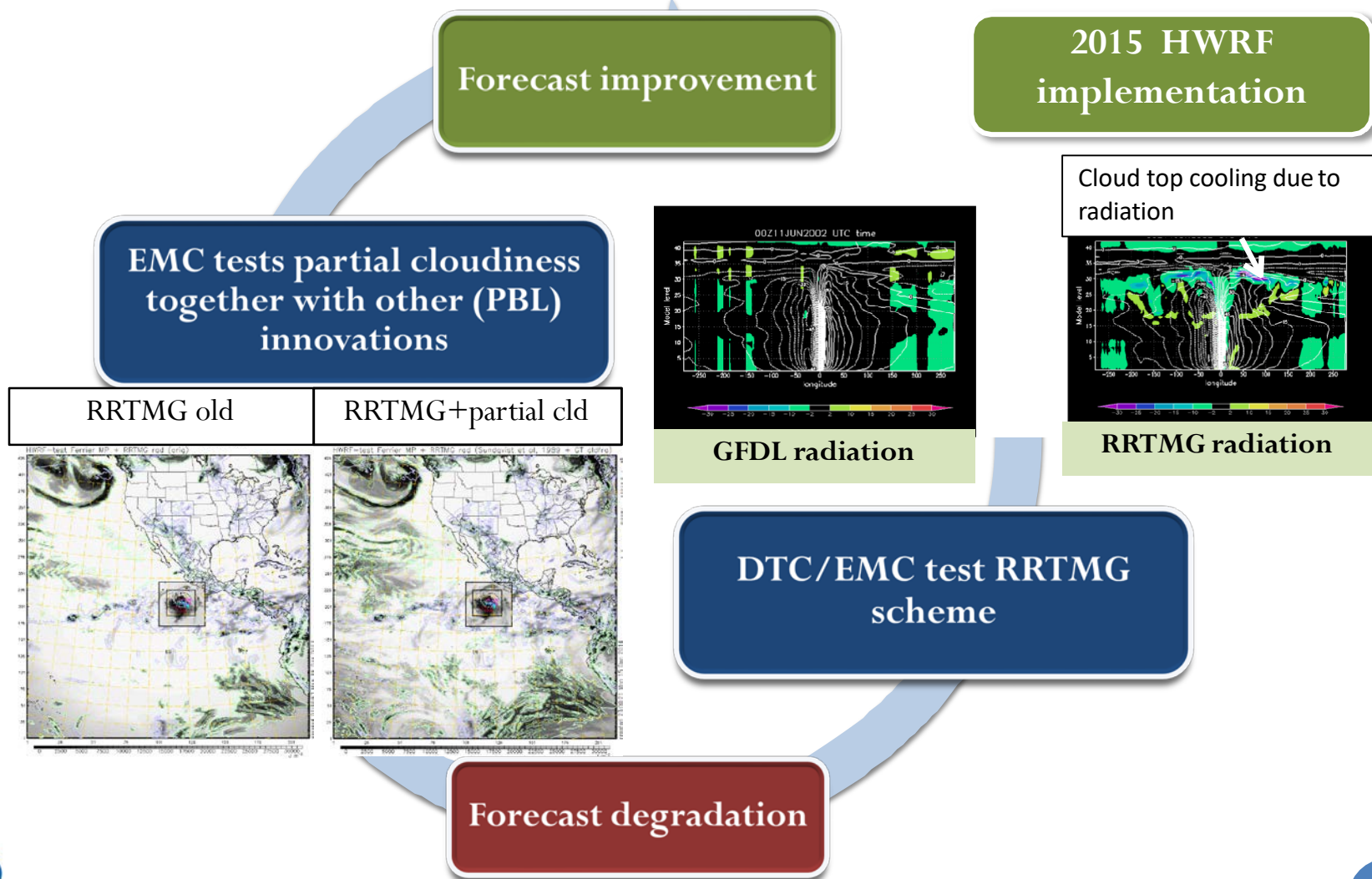
DTC-supported software and tools

- Legacy systems
 - WRF (contribution to MMM repository maintenance)
 - Gridpoint Statistical Interpolation (GSI) and Ensemble Kalman Filter (EnKF) data assimilation systems
 - Hurricane WRF (end-to-end system, including workflow)
- Core capabilities
 - Unified Post Processor (UPP)
 - GFDL vortex tracker
 - METplus (verification package)
 - Common Community Physics Package
 - Single Column Model (SCM)
- Future capabilities
 - Unified Forecast System (UFS) applications
 - Convective Allowing Model (CAM) or Standalone Regional (SAR)
 - GlobalWeather

Successful strategies for T&E

- Engage appropriate subject matter experts (SMEs) in an iterative process
 - DTCVisitor Program PIs
 - Developers w/ directed funding (e.g., HFIP or NGGPS)
 - Developers residing at home institution
- Maintain sustained focus through multi-year testing
 - Establish relationship with developers
 - Multi-year consistency provides collaborative environment for digging into complex interactions
 - Provides opportunity for staff to develop expertise on innovation
- Common workflow for research and operations supported by the DTC provides framework where results are more immediately relevant to implementation decisions

Example – connecting the pieces: Multiple SMEs – bundled development



Strengths of partnerships

- Investment in common software/tools allows greater progress to be made standing up capabilities
 - Development of MET was originally funded by AF – looking to take advantage of advanced verification techniques developed at NCAR – then supported by NCAR base and now both NOAA and AF are also investing in the package, with the potential for other partners joining the effort.
 - NOAA funding for GSI support activity was initially sub-critical – AF joined the effort and through its investment, DTC was finally able to get activity off the ground.
 - NOAA provided initial funding for development of CCPP and now NCAR has joined the effort through non-DTC NCAR base funds (e.g., joint infrastructure development – NCAR-NOAA MOA).
- Diversified funding has allowed more testing activities to be undertaken - tools and approaches developed for each activity allow for a larger base to pull from for future testing activities.

Current state of DTC

- Strengths
 - Established frameworks that led to numerous innovations being added to NOAA's software systems – thereby making these innovations available to both the research and operational communities, as well as more portable codes
 - Extensive experience setting up robust workflows for conducting extensive tests of innovations
 - Expertise in verification/validation methodologies, including more advanced diagnostic techniques
 - Development and support of tools to advance model development – simply plugging in a new scheme does not generally lead to consistent forecast improvement!
- Limiting factors
 - Available resources stretched too thin by the number of different modeling systems DTC is required to support - move to Unified Forecast System should eventually help mitigate this factor, but likely still sub-optimal
 - HPC resources
 - Access limitations – application process for NOAA HPC high bar for non-NOAA researchers – nearly impossible for foreign nationals
 - Availability of resources between NOAA research and NCAR is simply not sufficient to support large number of tests needed to substantially impact R2O process

A close collaboration between the DTC and EPIC could address the limiting factors that have restricted the throughput for testing promising innovations.

Key elements for successful community modeling with the ultimate goal of R20

- Well documented portable code that provides enough flexibility to conduct exploratory research
 - Idealized configurations
 - Ability to turn on/off components, so researchers can dig into complex interactions
- Clearly defined and documented protocols for how the community can engage in advancing the capabilities of the system that also welcome community contributions
- Centralized support –
 - Instructions on how to obtain code, build, configure and run
 - Training – online how-to guides and in-person tutorials
 - Support mechanisms
 - General user questions
 - Support for the research community to engage in code management plans (i.e., developer support)

Key elements for successful community modeling with the ultimate goal of R20

- Framework for testing innovations
 - Support for multiple computing platforms
 - Workflow that can be configured to emulate operations but flexible enough for experimentation
 - Clearly defined metrics for making decisions as to which innovations are showing promise
 - Advanced verification and diagnostic tools broadly available so community can utilize and share information
- Mechanisms for operational community to communicate major forecast problems to the research community and funding opportunities directed at engaging in these issues.
- Community events that provide opportunities to share research results, connect with developers and share difficulties using the system, as well as needed capabilities
- Engagement of primary developers in support activities and community events to build the sense of community!