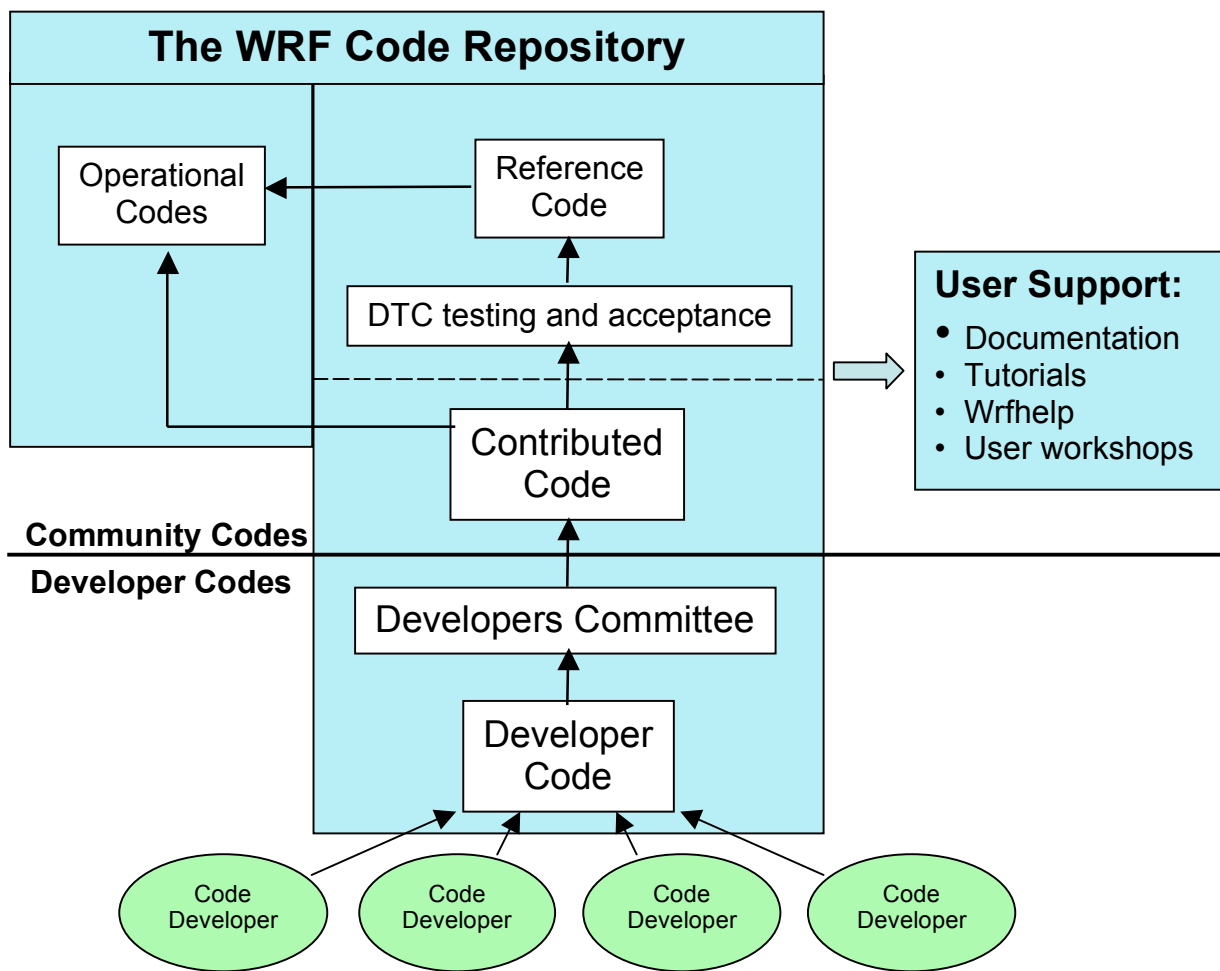


WRF Code Management and Support

1. The WRF Code Repository

The WRF code repository is a unified single-source code system containing all codes released for community use as well as codes in various stages of development. The WRF code repository was developed by the NCAR Earth and Sun Systems Lab (ESSL), Microscale and Mesoscale Meteorology (MMM) division and it is currently managed and maintained by ESSL/MMM. The expansion of the WRF effort with the establishment of the Developmental Testbed Center (DTC), housed in the Joint Numerical Testbed Program (JNT) of NCAR's Research Applications Laboratory (RAL), provides an opportunity for expansion of the repository to include code that has been through the DTC testing and evaluation process. Here, an approach to managing and maintaining an expanded unified repository that contains all developer, contributed, reference, and operational codes relevant to the WRF system is proposed. This approach builds on the success of current WRF code management and community support and strengthens community input and involvement.



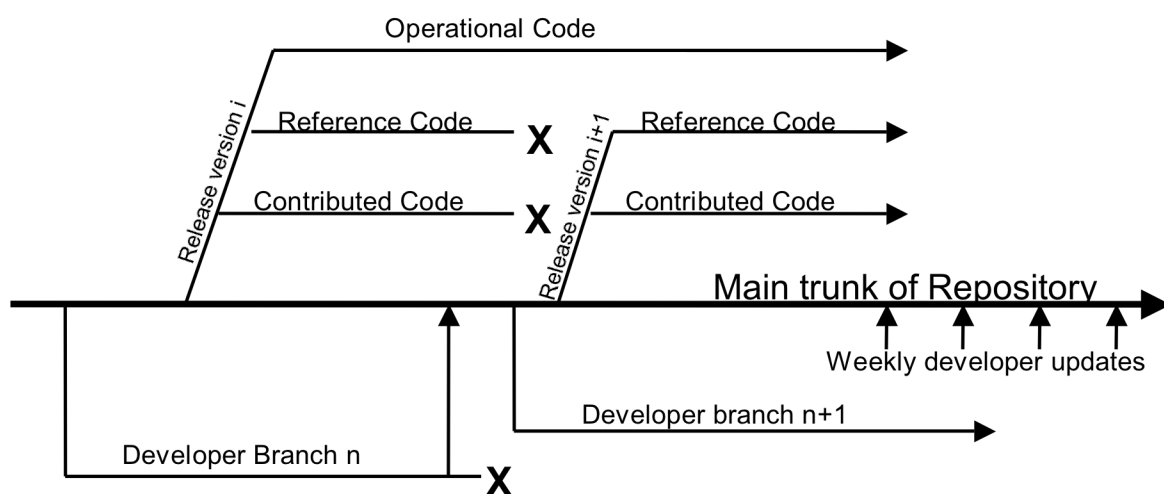
The WRF Code Repository will include:

- The WRF software infrastructure
- The NMM and ARW numerical cores
- Physics, and related modules
- WRF data assimilation systems
- Code for the WRF system under development
- Specialized versions of the WRF system, including:
 - WRF Chem
 - The Nested Regional Climate Model
- Special suites of code, including:
 - Verification packages
 - Pre-processing code
 - Regression testing code
 - Visualization packages.
- Operational configurations of WRF code employed by Operational Centers

The code within the repository will fall into three classes: Developer Code, Contributed Code, and Reference Code. In addition, the repository will contain configurations of WRF code used by operational centers. These operational code configurations may be drawn from the Reference and Contributed Codes as operational centers deem appropriate.

Code development, repository updates, and community releases will be managed using state-of-the art version control software. Major code development projects will be conducted on branches of the repository that are merged back into the main trunk upon completion and acceptance by the Developers Committee. Community releases of WRF code will be maintained as branches from the main trunk of the repository. NCAR will

WRF Code Repository Flow Diagram



X - terminated branch

maintain and manage the Contributed Code in the repository and will oversee repository updates of Developer Code and the Reference Code, and oversight of the operational-code configurations will be provided by the responsible operational centers.

Developer Codes are codes being developed by individuals or groups within the WRF partnership or the broader research and operational communities for entry into the WRF system as Contributed Code. Codes may be developed in personal copies of the repository code or designated branches from the trunk of the repository. The cost of establishing Developer Code will be the responsibility of the developer. Completed Developer Code will be considered for inclusion in the main trunk of the repository (Contributed Code) by the Developers Committee.

The **Developers Committee** is the group of developers preparing codes for inclusion in the WRF code repository or helping support existing Contributed Code. This committee will convene regularly (typically once a week via conference call) to discuss and approve additions (updates) to the repository and, when necessary, timelines for community releases. Individuals participate in the Developers Committee at their own cost. The Committee evaluates proposed updates for compliance with the technical requirements for qualification as Contributed Code, and conducts code reviews as necessary as part of this process. Individual committee members have final authority over proposed updates that significantly impact major WRF system components for which they are the primary developer. The Committee will not be responsible for decisions regarding resource allocation or funding for code maintenance. The Developers Committee will provide documentation explaining the WRF Code Development Process to provide guidance for community developers. NCAR and other primary developers will also provide consulting assistance to community developers as resources permit.

Contributed Code may originate from any individual or organization (research or operational) within the WRF partnership or the broader research and operational communities. It must pass a set of basic software requirements to be accepted, including:

- Conformance with stated WRF coding standards.
- Integration with the WRF software infrastructure.
- Demonstrated stability.
- No adverse impact on other parts of the WRF code.
- Passing regression tests to ensure code integrity is maintained.
- Code is of potential benefit to weather research and forecasting or to related applications.
- Code documentation meets the standards for community support established by the Developers Committee.

Contributed Code will be made available for community use and will be maintained and supported by NCAR and other Contributed-Code developers. If a developer of Contributed Code is unwilling or unable to help provide support for that code, and if another source of support cannot be arranged, that code may be designated as unsupported or experimental code. Releases will be scheduled and enabled by the

Developers Committee based on the progress of code development and resource constraints. Community releases consist of WRF code in the main trunk of the repository at the time the release branch is created.

Reference Code is code that has been systematically tested by NCAR and approved for this designation based on performance criteria in collaboration with the research and operational communities. Reference Code will be maintained within the WRF repository as a subset of the code contained in the releases of WRF code to the community. Reference Code differs from Contributed Code in that it has been through a more comprehensive testing procedure, which includes:

- Case-study Testing;
- Retrospective Testing
- Real-Time Testing.

Interoperability of Reference Code across dynamic cores will be a desirable capability when feasible. NCAR has responsibility for oversight of the Reference Code and will ensure that this code is fully maintained, documented, and supported.

Operational code configurations have passed system standards specified by the relevant operational organization. These configurations will generally, but not always, be derived from Contributed or Reference Code. Operational codes may be contained in repository branches released to the community or in separate release branches specifically for operational use. Operational code may also be maintained by an operational center outside of the WRF Code Repository. Operational codes will be maintained and managed by the operational centers or their associated Operational Testbed Centers, and will be available to the general community at the discretion of the individual operational centers.

2. Oversight of the WRF Code Repository

Within NCAR, the DTC and MMM Directors will jointly oversee the maintenance and development of the WRF Code Repository. As a general rule:

- The MMM Director will be responsible for the oversight of Developer and Contributed Code, working with consideration to guidelines recommended by the DTC Advisory Board;
- The DTC Director will be responsible for the oversight of Reference Code, working within guidelines established by the DTC Advisory Board; and
- Responsibility for operational code will remain with the relevant Operational Center.

The DTC Advisory Board (DAB) will provide advisory guidance to NCAR on matters relating to the WRF Code Repository and WRF model community support. For this purpose the DAB will assess these activities annually and provide written recommendations to NCAR and to the WRF Executive Oversight Board (WExOB) for their consideration. To ensure strong participation by the broader community, and to provide guidance for the WRF code management and community support conducted by

NCAR, the DAB should be established as an *external* advisory body. Members should be recognized experts in the research and operational aspects of numerical weather forecast modeling and represent community interests outside of the WRF Partnership. DAB should consist of about seven members to function effectively, and membership should represent a balance of academic and operational interests, and include at least one representative from the private sector. The DTC and MMM Directors should also serve on the DAB in an ex officio (non voting) capacity. Appointments to the DAB should be made by the DTC Executive Committee (DEC). To maintain the desired balance between research and operational interests, the DEC membership should consist of representatives from NCEP, AFWA, NCAR, and NSF. As an external advisory committee, the DAB will provide overall guidance and recommendations, but not serve as a decision-making body.

3. Community Interactions

NCAR will conduct community workshops, training, tutorials and related community interactions. The current WRF Help Desk will be maintained and expanded. Generally, NCAR will handle queries regarding Contributed Code and Reference Code as well as queries regarding Contributed Code not supported by the code developers as resources permit.