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Jamie Wolff[1], Louisa Nance[1], Ligia Bernardet[2] and Barbara Brown[1]

[1]National Center for Atmospheric Research, Boulder, CO
[2]NOAA Earth System Research Laboratory and University of Colorado CIRES, Boulder, CO

1. Introduction

In order to establish widely publicized verification results for a variety of well-tested configurations of the Weather Research and Forecasting (WRF) model, the Developmental Testbed Center (DTC) has implemented the WRF Reference Configuration (RC) concept (Wolff et al. 2009). With these published baseline results, the DTC is aiming to serve both the operational and research communities. By conducting carefully controlled, rigorous testing, including the generation of verification metrics, RCs will provide the operational community guidance for selecting configurations with potential value for operational implementation. RCs will provide the research community with baselines against which the impacts of new techniques can be evaluated and may also aid researchers in selecting a configuration to use for their projects.

Over the past year, work towards designating several DTC RCs has been completed based on previous testing and evaluation projects the DTC has conducted. A website has also been constructed from which all RCs can be accessed (http://www.dtcenter.org/config/). In the rest of this paper, details illustrating the layout of this website and the type of information being made available to the user community will be presented.

2. Reference Configuration Information Dissemination

Widely publicizing the results of extensive testing and evaluation projects conducted by the DTC is vital to the success of establishing baseline results for the benefit of the entire user community. The DTC RC website will be the portal by which those results are shared. Fig. 1 shows a screen capture of the website.

*Corresponding author email address: jwolff@ucar.edu

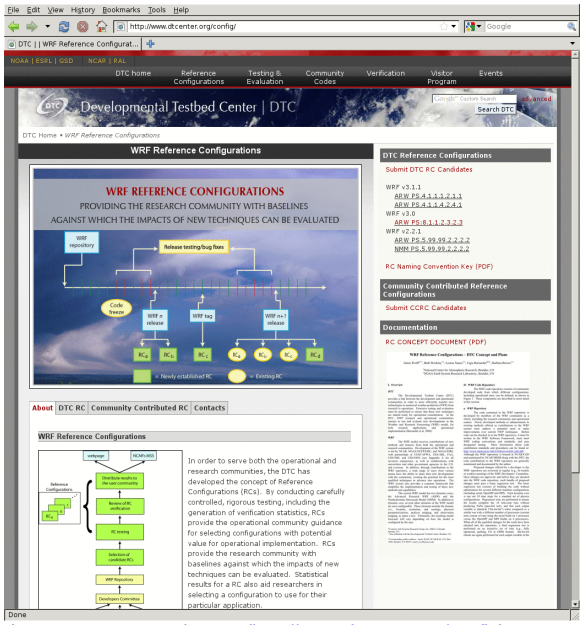

Figure 1. DTC RC webpage. (http://www.dtcenter.org/config)

From this webpage, basic background of the concept related to both DTC RCs and Community Contributed Reference Configurations (CCRCs) can be gathered from the main tabs in the center of the page and the concept document can be downloaded.

One the right-hand side of the webpage users can navigate to specific RCs as well as submit candidate configurations they have interest in being tested. These sections will be described in further detail in the next few paragraphs.

The naming convention utilized for easy identification of each RC includes the WRF core, version number, and corresponding *namelist* value for each of the physics parameterizations (in the order of: microphysics, shortwave and longwave radiation, surface layer, land surface model, planetary boundary layer and convection). By cursoring over each of the RC names on the right-hand side navigation, a popup window will appear describing the physics suite used.

To illustrate an example of the details provided for a specific RC, the first officially designated DTC RC will be described here. Forecasts for

this configuration were generated using the Advanced Research WRF (ARW; Skamarock et al. 2008) version 3.0 and the physics suite described in the table below (self described as: WRFv3.0 ARW PS:8.1.1.2.3.2.3).

Table 1. RC WRFv3.0 ARW PS:8.1.1.2.3.2.3 Physics Suite.

	WRFv3.0 ARW PS:8.1.1.2.3.2.3 RC
Microphysics	Thompson (8)
Radiation SW and LW	Dudhia (1) / RRTM schemes (1)
Surface Layer	Janjic (2)
Land-Surface Model	RUC (3)
Planetary Boundary Layer	Mellor-Yamada-Janjic TKE (2)
Convection	Grell-Devenyi (3)

The initial impetus for this configuration was as part of an intercomparison to test the impacts of the vertical placement of near-surface sigma levels on forecast verification statistics of atmospheric variables near the land surface. Further details on this test and evaluation intercomparison project (including a test plan, final report and archive document) can be found at http://verif.rap.ucar.edu/eval/wrfrr_vl/index.php.

WRFv3.0 ARW PS:8.1.1.2.3.2.3 is a general application configuration for mid-latitude forecasting. Fig. 2 shows a screen capture of the specific website for this DTC RC.

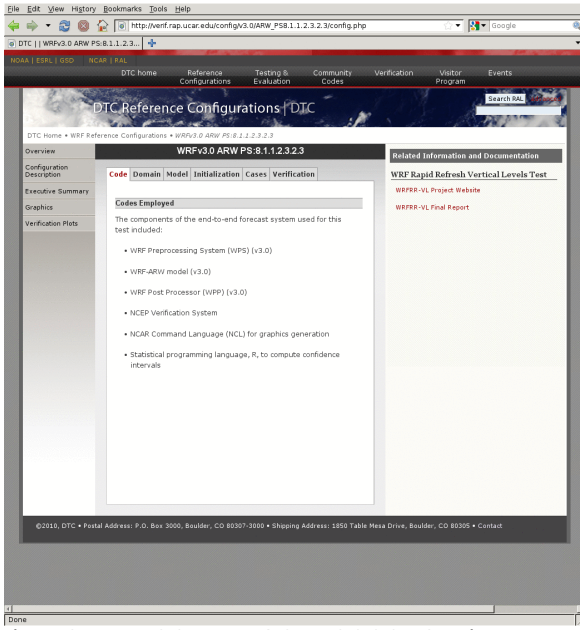

Figure 2. WRFv3.0 ARW PS:8.1.1.2.3.2.3 RC webpage. (http://verif.rap.ucar.edu/config/v3.0/ARW_PS8.1.1.2.3.2.3/index.php)

From this webpage the full details of the configuration and resulting verification statistics can be accessed. On the left-hand side navigation the "Overview" section provides general information on why this particular configuration was tested, as well as an overview of the intended usage of this configuration (e.g. general application configuration for mid-latitude forecasts). The "Configuration Description" section includes multiple tabs (Fig. 3), each describing details related to "Code", "Domain", "Model", "Initialization", "Cases" and "Verification". Under the "Code" tab, the software packages utilized, along with their version numbers are described (Fig. 2). For the "Domain" tab, the horizontal and vertical grid dimensions are defined as well as links to the WPS and WRF *namelist* files used. The "Model" tab includes run-time settings for the physics suite used and the "Initialization" tab details the models used for initial and lateral boundary conditions, as well as describes any type of data assimilation used, if applicable. The forecast dates, initializations and forecast length are discussed in the "Cases" tab, along with any known cases that did not successfully complete the end-to-end process.

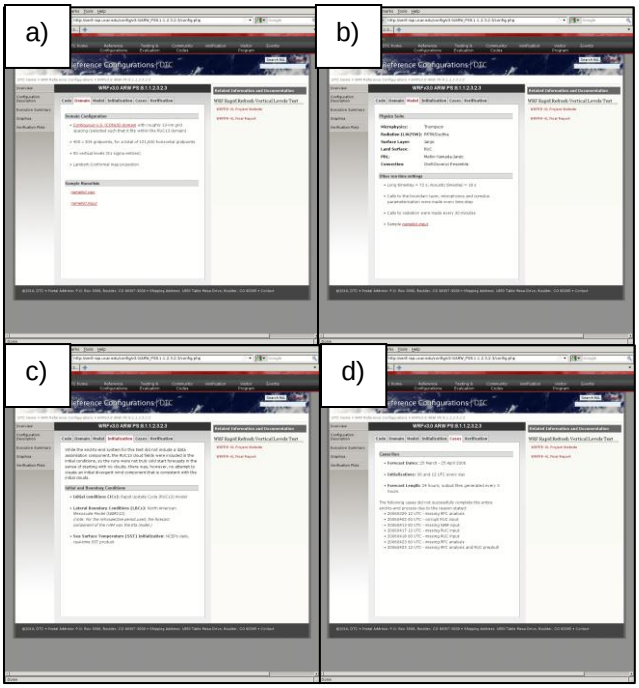

Figure 3. Configuration Description section of the WRFv3.0 ARW PS:8.1.1.2.3.2.3 RC webpage for the a) "Domains" tab, b) "Model" tab, c) "Initialization" tab and d) "Cases" tab. (http://verif.rap.ucar.edu/config/v3.0/ARW_PS8.1.1.2.3.2.3/config.php)

The "Verification" tab describes the system utilized to compute the objective verification statistics (Fig. 4). At a minimum, the variables

included in the evaluation will contain surface and upper-air predictions for temperature, dew point temperature and wind, as well as precipitation. Standard verification metrics widely used in the community (e.g. Bias Corrected Root Mean Square Error (BC-RMSE), mean error (bias), Equitable Threat Score (ETS; aka Gilbert Skill Score (GSS)) and frequency bias) will be computed, along with any new verification techniques relevant for that particular configuration and its intended application.

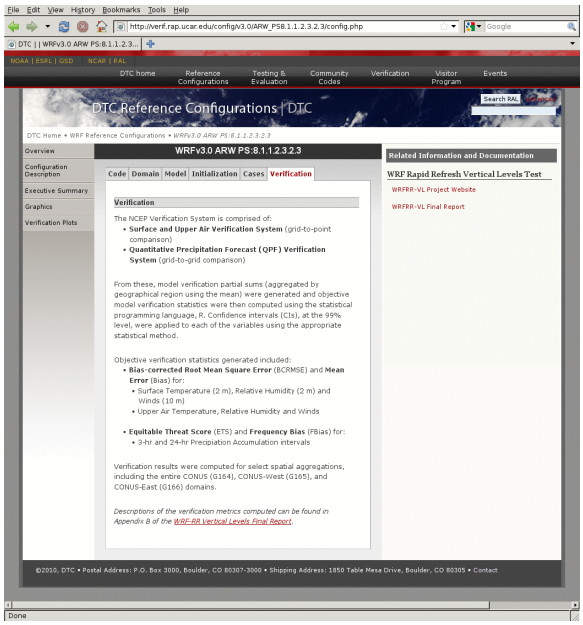

Figure 4. Configuration Description section of the WRFv3.0 ARW PS:8.1.1.2.3.2.3 RC webpage for the "Verification" tab. (http://verif.rap.ucar.edu/config/v3.0/ARW_PS8.1.1.2.3.2.3/config.php)

Back on the left-hand side navigation, the "Executive Summary" section provides a general overview of the objective performance of the configuration for all of the variables evaluated, while the "Verification Plots" section offers a web interface (Fig. 5) to display resulting graphics stratified by (if applicable for a particular configuration) temporal aggregation, domain (e.g. CONUS, CONUS-East), variable (e.g. temperature, dew point temperature, wind, precipitation accumulation), initialization hour (e.g. 00 or 12 UTC), lead time and verification metric (e.g. BC-RMSE, bias, ETS).

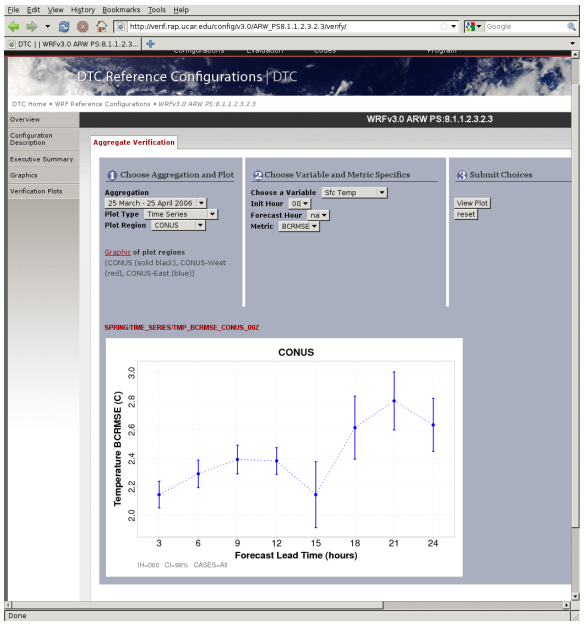

Figure 5. Verification Plots section for the WRFv3.0 ARW PS:8.1.1.2.3.2.3 RC webpage. (http://verif.rap.ucar.edu/config/v3.0/ARW_PS8.1.1.2.3.2.3/verify/).

Finally, the "Graphics" section is an additional web interface that allows a user to access spatial plots of surface and upper air fields for each forecast time (Fig. 6). Some examples of the plots available include mean sea level pressure with precipitation, composite reflectivity, surface temperature or dew point temperature with wind, 850 hPa temperature, relative humidity or wind, 700 hPa vertical velocity, 500 hPa absolute vorticity or 250 hPa wind.

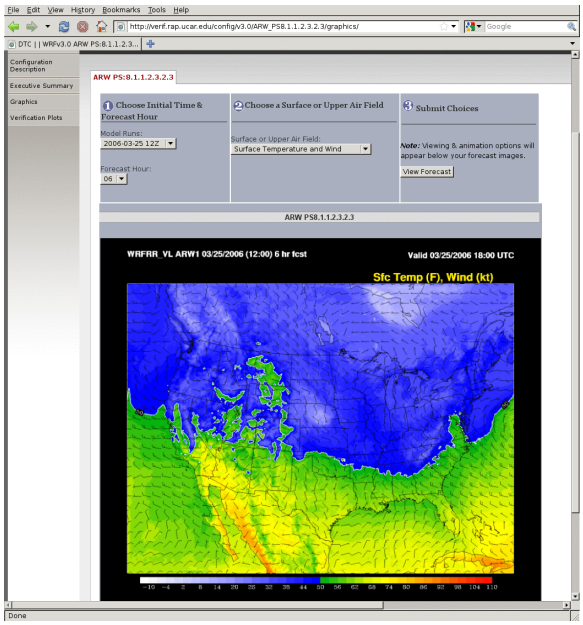

Figure 6. Graphics section for the WRFv3.0 ARW PS:8.1.1.2.3.2.3 RC webpage. (http://verif.rap.ucar.edu/config/v3.0/ARW_PS8.1.1.2.3.2.3/graphics/).

In order to solicit feedback on particular configurations of interest to establish and maintain from the user community, an RC candidate configuration submission page has also been established for both DTC RCs and CCRCs (Fig. 7). Again, this is accessible from the top level DTC RC webpage. When submitting a DTC RC candidate, details regarding the model description (i.e. dynamic core, physics suite) and the application or intended usage for that particular configuration will be requested. If submitting a CCRC candidate, additional information detailing how the model will be (has been) initialized, what cases will be (have been) run and further details on the domain description (e.g. grid spacing, domain size) will also be required.

Striking a balance between keeping a traceable history of results from year to year and testing new features and capabilities in NWP will be critical in considering which configurations will be tested. Ultimately, the candidate configurations will be selected based on their potential use and value added to the research and operational communities. A prioritized list of candidate configurations will be drafted by the DTC and presented to the DTC Advisory Board for review and the DTC Executive Committee for final approval.

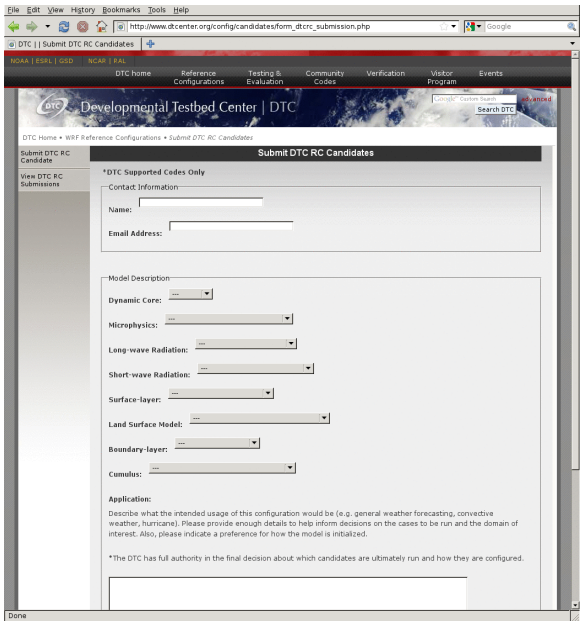

Figure 7. Candidate RC submission web form. (http://www.dtcenter.org/config/candidates/form_dtcrc_submission.php)

3. Summary

The DTC has established the first official Reference Configuration and published the results for broad distribution to the WRF user community via the DTC website. Feedback on the type of information the DTC is disseminating related to each designated RC, as well as submissions for future DTC RCs or CCRCs, is solicited from the user community at this time.

4. References

Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, W. Wang and J. G. Powers, 2008: A Description of the Advanced Research WRF Version 3, NCAR Tech Note, NCAR/TN–475+STR, 113 pp.

Wolff, J.K., L. Nance, L Bernardet, and B. Brown, 2009: WRF Reference Configurations. *Preprints*, *23rd Conf. on Weather Analysis and Forecasting/19th Conf. on Numerical Weather Prediction*, Omaha, NE 1 Jun – 5 Jun. Amer. Met. Soc., Boston.

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