

2022 DTC Science Advisory Board Report

Participating Science Advisory Board (SAB) Members:

Alex Reinecke, NRL
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Ryan Torn, SUNY-Albany
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Meeting Dates: Sept. 23, Sept. 28, and Oct. 6

Overview

As with the prior two years, the Science Advisory Board (SAB) meetings were conducted virtually partially due to the COVID-19 pandemic but also for the convenience of many members. Again, pre-recorded presentations on DTC activities were provided to the SAB, and live presentations and open discussions were held via Google Meet and coordinated via a Slack channel.

One of the primary requests of the SAB was to get additional short-term (1-2 years) and even long-term (3-5 years) goals from the SAB without taking into account the budgetary concerns of the DTC. From the updates on projects we received, the SAB suggests the DTC prioritize addressing known scientific/technical gaps and deficiencies in existing software and services provided to the research and operational community. In particular, we are still wary of the transition of community support, especially scientific support, of the Unified Forecast System (UFS) to the Earth Prediction Innovation Center (EPIC) organization and would advocate that nothing gets lost in the transition. DTC is well-suited with the scientific expertise in several areas to identify, draw attention to, and maybe mitigate any shortcomings in this regard. If done right, however, the shift of software management responsibilities to EPIC is much needed as it will free up resources for DTC to set more of their attention to using their subject matter expertise in Testing and Evaluation (T&E)

activities. As for the extended period, the SAB advises DTC to extract meaningful targets of opportunity, which align with the strengths of the current staff, and persist in obtaining stable funding so as to better facilitate longer-term initiatives that are impossible to undertake without that stability. Once these steps are taken, then the SAB will be more suited in the future to offer specific advice on prioritizations and maybe suggestions for improving the long-term plans.

One topic which came up last year and persists into this year was the fact that some SAB members were still unclear as to the overarching purpose of the DTC, and especially the role they play for the government, academic and private sectors. Part of the problem appears to be the lack of knowledge on all DTC funded, piecemeal projects and the net tangible benefits of how those efforts tie together to serve the entire community. Better advertisement of DTC activities, including outreach through the Visitors Program, continues to be a firm recommendation from the SAB which DTC supports but progress has been hampered due to budget cuts. DTC has made successful progress with promotion of and support for its primary T&E tool, METPlus, through Github resources as well as with the many in-person and online training tutorials and workshops. Still, users find it challenging to replace existing T&E tools with METPlus, and some specific recommendations will be spelled out below detailing possible improvements.

Comments and Suggestions from the SAB

- 1.) The DTC should continue to pursue the development of vision and mission statements which clearly identifies their purpose and goals as being the T&E “clearinghouse” for the community.**

Once these are finalized, we advise the organization to work with the Management Board and Executive Committee on exploring avenues for long-term base funding increases. These additional resources will be inherently necessary to accomplish the considerable work which fulfills the vision.

- 2.) Facilitate and collaborate with EPIC on the transition of software support, ensuring that scientific support, training, and T&E activities continue at DTC.**

As of now, EPIC appears to lack scientific expertise, leaving a critical gap in scientific support and training of the UFS, particularly in data assimilation. DTC has expertise in this area and could provide an important service to the community by working with EPIC to provide that scientific expertise.

- 3.) The DTC should better advertise its projects and significance to the government, private, and academic communities, including but not limited to DTC’s accomplishments on bridging and accelerating R2O and O2R.**

The DTC website has been identified in the past by the SAB as one avenue for this effort. When feasible, effort should be devoted to overhauling and enhancing web page content which fulfills this goal. Another recommendation in this regard would be to reach out to the President’s Advisory Committee on University Relations (PACUR) to establish and strengthen connections with universities and then get exposure at the

[UCAR members meeting](#). It would also be advantageous for the DTC to extend the framework of remote support for research and operational organizations beyond COVID, such as participation in the Visitors Program. Finally, given its central role in facilitating R2O and O2R for the community, the DTC should be more involved in T&E aspects within the various NOAA testbeds (<https://www.testbeds.noaa.gov/>). One lingering question is how DTC's Global Model Testbed (<https://dtcenter.org/testing-evaluation/global-model-test-bed>) fits into the portfolio of testbeds as most of the information appears to be outdated from several years ago (e.g., broken links). The SAB recommends that DTC make it clear on the webpage whether this is still an active component and also provide an up-to-date status of the hierarchical testing framework.

- 4.) Suggest DTC to continue its partnership with the UFS model developers to advance the development of the UFS operational applications (GFSv17/GEFSv13, RRFsv1 and HAFsv2) using process level evaluation under a hierarchical paradigm (SCM, SRW app, MRW app coupled/uncoupled etc.) in collaboration with the UFS-R2O development teams, and complement UFS evaluation groups such as, for instance, the EMC Model Evaluation Group (MEG).**

The MEG group provides excellent overviews of difficult cases and suggests hypotheses for what might be going wrong within models, but has limited capability to diagnose the source(s) of the error and test improvements that might address this. DTC could act as the bridge between the MEG and model developers, thus providing a unique place in the R2O-O2R funnel. Many forecast failures appear to be strongly tied to PBL processes, so it would be worthwhile to concentrate there.

- 5.) Continue to expand and improve existing capabilities for METPlus**

Some examples include the ability of running on a “cloud” infrastructure and adding verification of aerosol and aviation (e.g., turbulence and icing) products. Also, the DTC should continue on improving the ability of the software to work with uncommon grid configurations utilized within the NWP community (e.g., NCAR Model for Prediction Across Scales). Finally, investments should be devoted to increasing computational performance with METPlus as both modeling and observational datasets continue to grow.

- 6.) Recommend DTC improve documentation organization for T&E tools, with a focus on METPlus. The DTC should continue to improve METPlus training and find innovative ways to facilitate outreach to the community.**

With METPlus, the documentation could be enhanced especially for tailoring specific use cases for the broader community. Also, the documentation could be better organized by using hyperlinks to explain arguments and topics. As for the training, the DTC has made great strides towards improving this aspect recently. The available resources on the DTC website have improved and the recent virtual training series, recordings of which are available online, was well attended. However, there are still groups in the user community who are not proficient enough at METplus to incorporate it into their T&E workflow. An example is the UFS-R2O physics parameterization development team,

many members of which still use the VSDB verification tool for their needs. It came up in the SAB meeting that DTC is helping to incorporate METplus into the workflows that the UFS-R2O team uses and should be available in the near future. The DTC could seek out other groups who have a need for the METplus tools, but haven't made the jump to incorporating it yet, and offer guidance to get it running, or these groups could solicit such help via the GitHub Discussions forum in the METplus repository. Providing a METplus quick-start guide (perhaps modeled after the "10 minutes to pandas" guide for the pandas Python package) and/or clearer, more comprehensive documentation for existing METplus use cases (particularly practical considerations that motivated their development but are not well-explained in the documentation) may be fruitful endeavors in this regard.

7.) Encourage continued development and support of Common Community Physics Package (CCPP)

The DTC SAB encourages adoption of CCPP infrastructure in all NCAR atmospheric modeling systems including CESM and SIMA.

8.) Reach out to other earth system/atmospheric composition modeling communities, especially the community modeling groups, for T&E with their models.

As the focus of UFS expands beyond short-term weather to applications that include coupling with more components, there may be additional opportunities to apply the model assessment capabilities that have made METplus such a success for evaluating physical atmospheric simulations to other parts of the forecast system, including atmospheric chemistry, air-quality, cryosphere or oceanic phenomena. Community modeling groups dealing with these components may be valuable partners for DTC in identifying opportunities for a natural expansion of METplus into these areas.