National Oceanic and Atmospheric Administration (NOAA)
Responses to the Annual Environmental Information Services Working Group Report
January 28, 2020

The Environmental Information Services Working Group (EISWG) report provides six recommendations to the NOAA Science Advisory Board (SAB) concerning the Earth Prediction Innovation Center (EPIC). The EISWG report was generated in response to the inclusion of EPIC in the National Integrated Drought Information System Reauthorization Act of 2018 (P.L. 115- 423), which amends the Weather Research and Forecasting Innovation Act of 2017 (P.L. 115-25). These recommendations are also a result of the assessment of EISWG members of the EPIC Community Workshop that was held in Boulder, CO, on August 6-8, 2019. The EISWG transmitted this report to the SAB on September 3, 2019, and the SAB approved the report during its Fall meeting on September 9, 2019.

In general, the report offers a strong endorsement of the EPIC initiative by the EISWG, noting it is both timely and critical to the U.S. Earth-system modeling efforts and has the potential to bring value to public and private stakeholders. The report offers six recommendations to NOAA.

Recommendations on potential NOAA actions related to EPIC

Recommendation 1: *NOAA should implement EPIC's governance structure and processes as soon as possible, with a focus on the managing institution, leadership team, and advisory boards, and providing the community clear statements of the EPIC vision, mission, and values.*

NOAA Response: We agree, and we are developing and tuning our path of governance to achieve the vision of EPIC and to ensure the smooth transition of useful contributions to the operational weather forecast. NOAA decision and control will increase as products intended for the operational weather model move forward, whereas the ideas of how to make improvements on the areas NOAA identifies will largely left to the imagination of the community participants. NOAA should focus on the lessons learned over the past 5-7 years in our own internal improvements of Research to Operations, and Operations to Research, in which the presumed recipient of the new technology is closely aligned and well informed early to the research advances as they proceed. This process cannot exist in complete independence, or transition will be frustrated and put EPIC at risk.

Recommendation 2: *NOAA should work with the broader community to develop inclusive community engagement processes, and to anticipate and articulate the appropriate roles NOAA and other entities will play in EPIC.*

NOAA Response: Yes, we have been active in promoting community engagement by hosting workshops, industry day, requests for information and open sessions at professional conferences. The community cannot develop the EPIC program; NOAA must. We have taken much input to our benefit and all of our plans are well informed by the community.

Recommendation 3: *Early and direct efforts should be made to welcome into the Unified Forecast System (UFS) research and development sandbox contributions from other dynamic cores, physical parameterization schemes, Earth-system observation strategies and data assimilation techniques (atmosphere and ocean) and models (e.g., MPAS, UKMO Unified Model).*

NOAA Response: NOAA agrees with this recommendation. The UFS is a community modeling framework that will allow contributions that may not result in direct operational benefits. As long as operational standards are met with respect to unit tests and regression tests, and success metrics are evaluated; the UFS framework will allow contributions to earth system model development.

NOAA's Next Generation Global Prediction System (NGGPS) program selected the FV3 model as the dynamic core of the future through an evidence-based evaluation. The UFS will need to undergo a similar process for additional modeling components in the future. NOAA understands the possibility of the UFS accommodating other dynamic cores, but as NOAA has selected the FV3, we are not investing in or funding work on other cores. NOAA signed a Memorandum of Agreement (MoA) with the National Center for Atmospheric Research (NCAR) in 2017 that will allow for development of different model components within a common infrastructure to advance research and development efforts across organizations.

EPIC will provide a consistent code base and framework for multiple dynamic cores and physics options, but providing a common code base for additional options and supporting those options are distinct differences that NOAA is keenly aware of in establishing EPIC. It is important that EPIC remain aligned to operational outcomes for effective management and acceleration of the R2O process.

Recommendation 4*: NOAA should initiate a multi-agency R&D partnership program into which NOAA and other agencies contribute significant multi-year resources.*

NOAA Response: NOAA concurs with this recommendation. To address this, NOAA is engaging all partners to explain the role of EPIC and the importance of the UFS as a capability that integrates labs/centers/academia/private sectors/agencies as they conduct Earth-system model development to improve forecast skill. NOAA will continue to seek multi-agency R&D partnerships that will leverage resources and advance our collective missions.

Recommendation 5: *NOAA should organize its Cooperative Institutes that have existing capabilities in NWP and related areas into a nascent, distributed EPIC co-laboratory charged with quickly carrying out one or two narrowly focused R & D thrusts that have potential for near-term success.*

NOAA Response: NOAA will take the recommendation under consideration. NOAA is seeking quick wins by releasing a version of the UFS v1.0 in early 2020, which will leverage existing resources as mandated by the Weather Research and Forecasting Innovation Act of 2017. We are gradually transitioning all of our operational modeling codes to Github in an effort to fully realize the concept of open source development. The CIs maintain a vital role in NWP development at NOAA, and we will determine through proper planning the distribution of EPIC resources to gain near-term success.

Recommendation 6: *NOAA should immediately invest in and execute a Cloud implementation plan to promote community engagement and in support of research-to- operations.*

NOAA Response: NOAA concurs with this recommendation. To address this, EPIC plans to transition research and development of the UFS to a Cloud environment to dramatically improve Research to Operations (R2O) contributions from the community.

SAB Conclusion: *In conclusion, EISWG notes that EPIC is a program which will offer do great potential, but the delivery is dependent upon leadership, community engagement, successfully meeting early milestones, and long-term funding. Although*

the SAB approved the report, members acknowledged that a follow-up discussion would be needed to address several outstanding questions raised at the meeting. Such topics include the absence of cybersecurity and the role of the private sector, to what extent EPIC should remain an internal effort by NOAA, and the ability of NOAA to get funding for EPIC as outlined in Recommendation 6.

NOAA Response: NOAA concurs with the overall conclusion drawn by the SAB. Cybersecurity will be part of the contract to provide a robust and secure environment to transition codes back to NOAA's operational environment. NOAA envisions strong private sector involvement in model development, but we need to establish the requirements for attribution and licensing regulations.