

NOTES FROM BREAKOUT GROUP A

Right track:

Build upon initial success with FV3. Need to explore our interaction with other “community” models like CESM.

Attempt to simplify NCEP production suite using a unified modeling framework with research lessons learned from other successful communities like WRF.

Emphasis is on NWS NWP needs.

NGGPS goals: i) unify regional/global; ii) unify weather/climate; iii) unify research/operations.

Near-term goals: unify GFS & CFS; unify meso/global. Different applications will need different physics modules/configurations.

NOAA/NCEP moving towards an open accessible system in the last few years. We are still a few months away for an early public release.

NOAA has made good progress for reaching out and has begun to develop a community around its modeling efforts. The recent trajectory is much better.

Adoption of ESMF/NUOPC layer is a step in the right direction which leverages coupled modeling developments in other agencies (DoD, NASA, DoE, NCAR etc.)

Short term: mostly internal NOAA development

Long-term: will count on community to define the path forward.

Gaps:

How to define community? Strategy for the next 5 years? How do other “community” Earth System models differ from NOAA’s?

How does the vision for unified modeling suite fit in with existing regional models like WRF? How to avoid competition?

Programmatic funding/resources need to be secured for inter-agency collaboration to advance unifying modeling.

Unified model needs coupling between Earth System components, which adds complexity. Needs commitment and agreement on common software infrastructure to sustain model and DA development. (Can ESMF/NUOPC provide the solution?).

How do we decide on design of couplers *a priori* in a monolithic setup? The unified framework has to support a few mature options vetted by core community developers.

Community can help define requirements, which then leads to design of tests and benchmarking before adoption.

How does the private sector engage with the unified modeling framework? Could use public release versions for running experiments and sharing results.

How does cloud computing fit in with NOAA’s modeling plans?

Need for a robust workflow management system in place for community ease of access.

Need for tutorials/workshops/training.

Consider dynamical bias corrections

NOTES FROM BREAKOUT GROUP B

Going right?

All here discussing huge improvement

Breadth of discussion

Very broad involvement

Broader than NCAR?

Bringing people into process at this stage

Structure in compartments

Looking forward to open release

Test versions available to community

Community can help find bugs

Infrastructure needed

How to get into more open repository

Should talk about open repository structure

Testbeds could handle

Structure for feeding back to EMC

EMC one of centers, not only center

Repository outside EMC

How to stop EMC from playing by own rules

- Depart from repository

Open communications on what EMC wants to do

Syncing of repository

Governance board

- Transparent and participatory

EMC needs to make operational code available

Researchers need to use latest code

Clear set of tests to enter repository?

Hierarchy of testing

Simplified validation required?

Shared tools, testing

Critical part - what are tests required?

Hierarchical testing

EMC more extensive testing

Computational benchmark

Who is responsible for meeting computational benchmark

Need more engineering in code

Strong partnership with computer vendors-performance, portability

What level of responsibility original scientist for performance of code?

Guidelines for next steps to get into repository

Containers-complete code made fit for different hardware

Basic requirements for acceptance

Better documentation of chain of steps for acceptance

Need to define interfaces

WRF huge code base-lot of components don't get used

- Exclude things that won't be used

Need to prune

Need expiration date

Many choices or carefully selected few parameterizations?

What people willing to give up?

EC--US too much money, not going to do anything

- Too many groups doing operational system
- Didn't have to pull together

Goal too broad

EC better metrics measurable

What is measurable metric?

Gigantic diverse inventory-what are we doing?

Metrics broader than before

How do forecasters make their requirements known?

Not all equal

Need to determine what can be delivered

Lot of goals

Best earth system

cOMMUNITY

Need to focus on something specific

NGGPS goals well-defined for next 1-2 years

Very concrete

Configuration

What does it take for you to engage

Miss opportunity for interaction between modeling and

Observing communities

tROPICAL pACIFIC TAO array will disappear

New system replace-need input from forecast community

Innovative obs tech emerging

Scientific community just beginning to use

Argo

Arctic--need obs

Missing engagement of modeling and observing comm

Next gen observing system

Need direct connection to observing community

Modelers are there

IBM hardware inclusion in software design missing

Availability of core components of software for testing

Software developers also interested

Efficiency output input

Community not defined

How it would work-need to break down barriers

Easy access and documentation

How to feedback to EMC

Metrics measure for success

Responsibilities better defined

Priorities model components, time scales

How people will interact in community

Need to define community

How to interact with EMC

Documentation, how to get help
Support for running GFS code
Can help with scientific validation
Clearly defined how depository can work
Clearly define validation
Get rid of complicated EMC production suite
Very focused strategic plan
More money
Higher level plan needed, scope
Very low bar for interaction
Big picture who we serve how we interact not defined enough
How to interact with EMC not clear
List of contacts dedicated staff at EMC needed
Liaisons needed
Don't think of EMC as only hub
Interact with community
EMC needs dedicated staff interacting with repository
EMC doesn't want to build community model-huge effort

- Wants community models there
- Tutorials for hundreds of graduate students

EMC needs to give up

- Becomes customer of central repository

NOTES FROM BREAKOUT GROUP C

- Fact that they're holding the meeting at all and engaging community. Open call to attend
- Missing: issue of high-performance computing and architecture not explicitly addressed. Make sure software is ready, don't let it fall through the cracks
- Unclear how larger community connects with operations.
- Long-term plan not well defined, which makes short-term planning difficult
- Needs to be an OAR research funding component to advance past 2019
- Effort to include community represents a cultural shift, or the beginnings of one
- Discussion of code repositories and packaging is good. Making code available and well documented is necessary
- Development of standing groups made up of wide array of experts is good. Continuation of groups is critical to avoid dissolution
- Need process by which recommendations are received and addressed. Trust needs to be established with community
- Need more information on the scope of code changes that will be accepted, the testing required to accept a change, etc. Need an actual example of the process (global model testbed may be an example). Suggest a short-fuse review
- Code management and infrastructure has a ways to go but is on the right track to no longer being a development barrier.
- Verification and validation efforts on the right track. There's a recognition of its importance. Private sector may be leveraged in this effort
- Intellectual property policies need to be established
- Research agenda established with OAR and NWS input. Suggest a pipeline between NWS and OAR so research community understands NOAA needs

NOTES FROM BREAKOUT GROUP D

1. What did we get right?

Trying to gather a community

Progress on access to GIT HUB and easier access to codes,

Vlab allows for invited collaboration, reduction in code hosting servers

Identified time for X-C WG interactions

Defined a continuous process for WG

Well defined strategy/plan for global

Choosing a 3 year short term strategy before beginning the SIP process correct

Allow for empower community in parallel to global development

2. Gaps

Security vs community → more integrated

Ease of access for community (roadblocks)

Access to computing

NGGPS does not have its own Vlab community

Still a secondary code repository in NCEP

Vlab is a NOAA developed solution that requires external collaborators to adapt (wrong message); doesn't have all the tools

Need Infrastructure group to identify collaboration tools

Did we get the team breakdown right in terms of working group

- Overlap between SA WG and Infra WG
- Timeline of WG too short considering the scope

Did we define community properly; more time needed to define

Not a well defined strategy for regional or sub-seasonal unified modeling

How does community plug into a fast moving target like FV3 implementation

Not enough computing for community

3-year time-frame seems short and gives messages that most decisions have been made? Need better communication on how our planning is done;

How we define **requirements** with community input; how does it impact our planning

Clearly identify why we are doing community modeling → research, improve operational prediction

Need for regional only stand-alone modeling capability → does it have high enough priority?; Who in community can help develop

Development restricted to a few scientists. How to expand the knowledge base ?

Where do we go from here ? How do define community better ? Central messaging needed ? Which model of community

- **Central repository shall be outside firewalls, universal visibility and limited commit privileges (eg: GSI approach)**
- **Who owns the central repository or decision making process (governance)?**

NOTES FROM BREAKOUT GROUP E

What appears to be on the right track?

- Great to have cooperation among many different groups and agencies
- FV3 has a physics package (single-moment GFDL microphysics) for convective-scale prediction that will be available in the HWT Spring experiment this year
- Engaging the right groups; building trust - would not have happened several years ago; increased communications
- Breakout groups beneficial for facilitating discussions with researchers and NOAA/EMC

What are we missing? What gaps remain?

- Concern that NOAA will "take over" the entire process
- Not a clear layout for the goal/scope; not properly defined - i.e. what is the temporal/spatial scale for the community model?
- What is the pathway of FV3 to operations for convective-scale modeling? Not as clear as the T2O plan for the global model. FV3 should be able to provide sufficient forecast guidance but we'll have to wait and see.
- Storage/computing power concerns; how to prioritize
- Need to establish clear expectations so that researchers are aware of milestones they need to fulfill
- Is the gap between EMC and the research community too large and what can be done to mitigate this?
- Unlikely that all agencies (i.e. OAR, NCAR, etc.) are currently phasing out developmental efforts on other models and transitioning to FV3 like EMC - how to push community to do this
- Currently, incentives to have an impact on what's in operations are small/limited for universities, research community
- For the research community that has grants to improve weather forecasts, the T2O process is difficult if they don't have much interaction with EMC, like the NCAR CESM business model
- Frequency/scope of annual meetings for working groups, community
- Strongly encourage those with NOAA grants to attend the NPSR
- How to structure the common code repository? Perhaps utilize the 3 tier approach: NCO, EMC, community code repositories; don't want them to be completely separate either (semi-permeable)
- Need to be careful about not going down the ARW-WRF approach for how community model development has happened
- Who are the code reviewers and managers for a central code repository and where do those resources come from? Need a code review panel but also 1 person who reviews code, makes changes, informs panel.

NOTES FROM BREAKOUT GROUP F

Begin here

Things getting right:

- 1) Interactions are good.
- 2) we have the feedback loop and products,
- 3) HFIP may be a good example to follow
- 4) Good leadership
- 5) NGGPS is successful so far. Good to follow. Bridge to beyond 3 years
- 6) unification and verification and other software

Major things missing:

- 1) Too focused on means and how to get there
- 2) Ocean, land, and aerosol priorities and desire.
- 3) What is our vision? Confusion on engagement on improving the model and how to get there.
- 4) Vision beyond community modeling, a little bit diverging? How to refine community modeling and operational? CEMS .vs. FV3GFS climate vs. seasonal. Building a community model that people like to use. Building a structure that have our agreements on, chosen by community.
- 5) Data talked about yesterday is more software oriented.
- 6) A unified model excludes models in other center? Unrealistic to cross all scale?
- 7) Ensemble scale from ECMWF is better. Costs from different users are high. The cycle for model development is expensive. Average and medium are always better.
- 8) Where we are going? Seamless vs. unified modeling. Short term and long term testing is not clear.
- 9) People need time to grow confidence on FV3. orbiting around it.
- 10) Confusions on configuration and framework. How do we think about resources? Elaborate conceptions. What is the model we need to use? Resources constrain our approach greatly.
- 11) We make a decision based on today for future. Who is the center to make decision? Community or NCEP.

NOTES FROM BREAKOUT GROUP G

“Right track items”:

- Starting dialogue
- planning long term
 - EMC re-org significant positive step forward
 - Silo breakdown
- Shift from reactive to proactive action
- Working groups and teams for SIP
- , culture shift toward more community engagement. Have appropriate scope, including across timescales with inclusion of metrics for eval.

Establishment of independent program as a cornerstone to the success of the program.

Missing/gaps

- Resources: HPC, funding, staff support
- Best subcomponent of a system doesn't yield the best overall system
- Consider contribution of OAR research programs
- Science steering com
- Need to define reqs for community code mgmt
 - Needs of operations, NOAA, community, academic, etc.
 - Need a community code repo governance and community support strategy
 - Can be distinct entities
 - Assessment of best practices and lessons learned from past community experiences to inform code management
- Motivation for community to work with ops systems
- Support for community O2R and R2O

NOTES FROM BREAKOUT GROUP H

Data quality control: Identification as a potential gap but probably too specific of a technical detail and could be deferred to DA & Ensemble WGs.

Prioritization and step zero: How will the process be set up for prioritization? How will it evolve over time? What is going to happen with all of the information provided by the WGs?

Inevitably, decisions will have to be made resulting in winners and losers. How will those on the “losing end” have incentive to stay engaged? [The transparency and metrics noted below as part of a regular, evolving process.]

The good (right track): NOAA/NCEP steps to host a workshop, moving toward more openness with regard to repository, verification, etc. **Transparency** is critical. Metrics/scorecards established a-prior is a strength that should be continued to inform evidence-based decision making. Updating metrics on a regular basis. Some caution should be taken with regard to metrics and they should be designed carefully. Objective metrics-only decision making can lead to problems.

Use of a real-world example to help inform outcome of workshop. Example given of FAA utilizing someone on the outside to develop a product for NOAA to then implement. Where do end-users and requirements fit into the WGs and broader plan? Perhaps elevation of focus on testbeds within WG?

Better understanding the landscape for resources and how it will evolve over time. What other mechanisms to get community engaged? Within NOAA: CSTAR, CPO, GOES-R/JPSS PG, OWAQ, JTTI. Laying out the resources for this: not just the transition work but also the R&D. What is the resourcing? While led by EMC, how will this find its way to other parts of NOAA?

NWS is stakeholder in OAR and this needs to be articulated to decision makers. NOAA (NWS and OAR) leadership has stated this and are in agreement.

Essential for common, up-to-date repository with broad access. Having a standalone regional version of a community model is high priority for storm-scale/convective applications [CAM WG has been formed, was a former gap].

Good: Focus on modularity and separation of concerns within the software.

We still do not have test protocols, benchmarks, data models, for testing (particularly hierarchical). Central location for metrics, test data, etc.?

Integration, verification, testing within context of interacting components, coupling, feedbacks.

Resources from non-NOAA agencies (DOD, NASA) and how to focus and integrate within this community effort? National ESPC, JCSDA as examples. Mid-level buy-in is big challenge. Evolving budget situation may be a huge motivator.

Governance: Still abstract and really need to get this more into focus. This needs to be well defined.

With NOAA being asked to give up things to focus on some community efforts, how will the other direction happen? Some diversity may be helpful.

User support: Who is going to do it? What is role of DTC/GMTB versus the development agencies?

Communications and outreach will be critical for getting buy-in from community. WG just formed. Interaction with end-users.

V&V is significantly under-resourced.

Need to deal with the fact that some things will remain “inside firewall”. Who is going to be in charge? How will support, etc., be resourced?