

# Report of the Seventh External Advisory Panel

for the

## National Science Foundation Science and Technology Center **Center for Multi-Scale Modeling of Atmospheric Processes**

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### **Introduction**

The Center for Multi-scale Modeling of Atmospheric Processes (CMMAP) External Advisory Panel (EAP) convened in Fort Collins on August 8 and 9, 2013, after the CMMAP Team Meeting from August 6-8 and Education and Diversity retreat August 5, to review progress to date and provide advice to CMMAP management. We gave an overview of our recommendations and questions to the CMMAP Executive Committee at an executive session on the morning of August 9. This report represents a written summary of our advice, in light of that discussion.

Overall the EAP is very impressed with the state of CMMAP, pleased with its progress over the time of our appointments, and optimistic about its trajectory and future transitions. CMMAP appears to be on track to fulfill its stated goals. The panel is satisfied with CMMAP's responses to last year's EAP report.

With just 20 more months of full funding before a final two years of ramp-down, the Center increasingly needs to consider securing its future beyond the end of its STC funding. Fortunately, the growing need to gather, document, and accessibly archive the Center's diverse materials coincides with growing technological capabilities in those areas. These issues appear to be a rising theme, as discussed further below. Management seems appropriately alert to the timeline and how it informs activities and plans to accomplish the Center's goals. The Center's many collaborations, in all areas of its purview, make its formal funding boundaries almost hard to spot in its annual Team Meeting. Post-CMMAP institutional frameworks are being developed already for future continuations. As a result, we anticipate a smooth transition to a

long future of vigorous effort and continuing leadership in the field, far more than just a “soft landing.”

This brief document discards the cruff of past incremental EAP report editing, and instead features a list-like documenting of suggestions and reactions from the EAP at this year’s meeting specifically. These are organized into Concerns, Questions, and Praises. A separate narrative section on the E&D issues follows the general listing.

## **Concerns, questions, and praises raised by the EAP:**

### **Concerns:**

- One top concern shared by the panel was that ClimateSense might not have a niche and readership as it is presently scoped. There are so many sources of climate change information at so many levels of sophistication already, what is the unique contribution of Climate Sense? Is it reader oriented? Is it viable?
- The sustainability of education activities beyond its STC support is a growing concern. What is the future? Is scaling up to national markets the way forward? A separate section at the end of this report elaborates our advice on ED activities.
- Is the Q3D model on track to be a success in the time available? A 6% global coverage fraction of points seems like only moderate computational savings. Work presented at the meeting remains preliminary in feel. Some approach interpretations (advective vs. gravity wave for the nudging timescale) and evaluation diagnostics (vortex position) seemed debatable. Still, genuine progress was reported at the meeting, and this part of CMMAP has always been the most technically ambitious. Interesting results do appear imminent. We look forward to seeing its success.
- The UZIM model progress remains slower than hoped in the past, although the efforts are impressive, creative, and elegant – the word “cool” was used. Will a benchmark run be soon shown? Again, we look forward to success in these ambitious core technical undertakings of CMMAP.
- An amazing range of activities is on display. Almost too much? Might more focus and prioritization be needed for a successful transition strategy? Perhaps not, since quality seems high in all areas.
- The education-science gap remains striking to EAP members. It is challenging, structural in nature, and this report’s form is no exception.

### **Questions:**

- Is Q3D (or cubed-sphere VVM) aimed at becoming a broader community accessible model? Is there any validity to “double counting” concerns, is the vision sound?

- More broadly, what CMAP models will get finished in the time available?
- What has become of data archiving? Last year, Charlotte led a session querying and tallying all who have ever run an SP-CAM model, and was going to make a table with links that could lead all the way to datasets. What became of that effort?
- Why is SP-CAM as successful as it is? The hunger to understand its performance better remains unsatisfied, although it is hard to say what exactly would satisfy it.
- Are the extratropics a little under-represented in the CMAP research portfolio? The Arctic work was a refreshing notable exception.
- Improvements to SAM would have a broad impact, and are encouraged. Numerics and parallel I/O are listed in “praises” below, but are there new opportunities and needs too? For example, given the nonlinear nature of cloud microphysics and the marginal resolution of cloud updrafts by CRMs, should we represent subgrid variability in cloud microphysics in CRMs? The higher order turbulence schemes with assumed pdf structures can provide a framework for doing so and DOE expertise can be brought to bear on efficiently sampling the joint pdfs that determine the nonlinear microphysical interactions such as droplet collection, but further work is needed to determine vertical and horizontal correlations of the various cloud microphysical species. LES simulations could guide this effort. Ice is harder, being non-diagnostic.
- Is the promise of GPU being fully considered for appropriate problems?
- Lack of topographic interactions is lamented. It is impossible in periodic SAM: might this be a key Q3D strength?
- One CMAP founding idea was to guide traditional parameterization. How is that prong progressing? Are there successes other than the UP finite-area correction?
- The education - advocacy line was mentioned. Should one confront misconceptions and counter-information? Or ignore it in order to avoid legitimizing it? Do ATMS grad students feel unable to express their views freely, as was mentioned (off-handedly) in the meeting? In any case, should there be a website available to the public with useful information? Can that be an ongoing graduate student project ?

- Are CMMAP-created orientation and training materials for graduate students encountering the world of supercomputing being shared as widely as they would be appreciated?

**Praises:**

- C-level rise is a creative and intriguing idea. We look forward to hearing how it goes. Will it be a repeating program, or a onetime thing?
- The second Giga-LES, with a land case, is an exciting prospect. A suite of lower-resolution simulations, and perhaps coarse-grainings of the large high-resolution datasets, will provide fascinating context and comparisons. We hope data access methods are devised to facilitate studies with this fascinating resource.
- The JAMES impact factor is a proud achievement of CMMAP. Congratulations!
- The acceptance of SP-CESM as a supported model version is a major success of CMMAP.
- The Big Picture slide was helpful for seeing the Five Core Ideas: SP, GCRM, Q3D, the Unified Eqns, for UZIM, and Unified Parameterization. The EAP thanks you for the overview.
- Dataset publication and traceability by DOI is a good idea. Thanks to CMMAP for leading and exemplifying this aspect of best practices.
- SAM with distributed landscapes is coming along nicely, and land surface group collaborations appear lively. Are there prospects for topography someday, somehow? Will that become Q3D's main strength?
- The new GFS-SAM is an interesting prospect for impacting real prediction models. The NCEP connections fostered by CMMAP are also praiseworthy.
- We enjoyed Howard Drossman's SOTL presentation very much.
- CMMAP meetings display an amazing range of activities, very impressive.
- SAM optimizations like parallel I/O and fft numerics will be warmly welcomed by many users.

## Education and diversity: praises and concerns.

### Praises:

- The education and outreach component of CMMAP continues to do well. In addition to the direct education of graduate students, thoughtful education is occurring at several levels. It is one of the most comprehensive outreach attempts by any STC.
- [Graduate students now have an opportunity to plan and teach a 3-week intensive course](#) at Colorado College. Many students have taken advantage of this opportunity. One student did it twice and said she loved it and learned a lot from the experience, which will be useful to her in the future. If practical, this could be an ongoing feature in the preparation of interested graduate students who will be future faculty members.
- [Summer interns](#) continue to be drawn from all over the U.S. This is a diverse group and has resulted in bringing diverse students to graduate studies in CMMAP. The poster presentation demonstrated good mentoring in the way the interns presented and answered questions. It was good to see that graduate students (e.g., Melissa ) also acted as mentors to the interns.
- [Plan to apply for a REU site](#). This should be a good way to continue the intern program, which is good in so many ways – for graduate recruiting, for diversity.
- [The association with the educational arm, SPARK of NCAR and with the SOARS program](#) is strong, and the SOARS protégées continue to provide a good pool for graduate students.
- [Teacher development courses](#) (two, each one week) continue. Assessments show that the courses are very effective and valued by teachers. A strong effort is being made to transition this to a sustainable business model with other educational activities via the non-profit REACH.
- CMMAP is looking to complement the in-person Weather & Climate course with an online course with a discussion board and Q& A etc. It has not been decided whether the Institute or Reach will have this course. The discussion board is housed at: <http://reachscience.org/tcsocial/> and is an active site that was announced at this year's teacher's course and to the alumni of the course.
- There was considerable discussion about the pricing for the teacher course. This information needs to be discussed and compared to the market research that was done before developing the current Reach business plan. Some discussion was on whether the market (teachers or their schools) can afford the price they will have to charge to continue to make it viable.

- CSU involvement with courses to be offered through Reach: Scott Denning has been teaching a course through OSHER (senior citizens). They are making it a bit more customized to offer as an on-line course targeted to teachers. CSU has approved this for CEU (Continuing Education Units) credits. So the attendees will have the option of getting CEU credits from CSU at a cost \$50 per credit in addition to the base fee.
- [The K-12 Outreach via Little Shop of Physics](#) seems to be flourishing and pursuing K-12 education events vigorously. They do a large number of programs regionally. They have introduced new programs like *After Dark* for adults and done a stadium performance on *Weather* with huge props, in collaboration with a radio station, an event that had an audience of 10,000 students! LSOP (Brian Jones) feels that they will have no problem continuing to get funding for their efforts. They have received a small endowment; and hope to grow that as a means to sustainability. (They have existed longer than CMMAP)
- [The diversity in the graduate student population is impressive](#). About half of the entering graduate students are women. Minority representation has gained considerably from a targeted recruiting effort by Melissa Burt and Consultant Tom Windham who have chosen some strategic feeder colleges to develop relationships. Having a fund to bring faculty from these institutions for summer research can be a way of developing these relationships further and resulting in these faculty members being “scouts” for future graduate students. This also adds another educational component to their many-faceted education portfolio.
- Melissa is scheduled to finish her PhD in two years or so under the direction of David Randall. Her professional development and balancing the management of CMMAP education & diversity efforts with her graduate work sets a good example. David is to be commended for that mentorship.

### Concerns:

There has been much good work on education. It would be a pity to see it fall by the wayside after the Center transforms. But there needs to be very strong and dedicated leadership to integrate the educational part into a usable and widely available form!

Although good planning is being done for the transition of the Center into an Institute after the STC funding is finished in 2016, the funding after that time to maintain the educational outreach program after that is a concern. Funding “indirect” and “general” educational projects like these is becoming harder and harder.

The educational aspect needs to go through a serious strategic planning exercise. The non-profit educational concern, Reach, has been established and they have hired a business planner, made a business model, and are pricing the products. It is not clear how they will be

able to raise the basic operating budget. The business manager, Hannah Pechan is looking into corporate foundations etc.

Reach (“**Reach** is a nonprofit organization that supports science education”, <http://www.reachscience.org>) is developing various apps, organizing community educational events for fundraising, and producing publications for science literacy, primarily the periodical Climate Sense. Climate Sense might want to venture into providing resources for teachers and others doing energy education or energy management, rather than just have informational articles. It is not clear what readership there might be for articles about climate change. If it is designed strategically towards a “green-minded” people with useful information, they might be able to generate revenue with small ads from *local* stores and other local businesses that would like the readership – their consumers- to know about their green business practices. . It is time for a clear and more specific statement of mission (and vision), and a staged plan including products and funding strategy.

It seems like they have to fund raise vigorously to sustain the effort. It may be wise in the early stages to raise funds via research and education –related proposals, e.g., for research on the teacher courses, maybe even on pedagogy and with a larger focus on energy literacy rather than just climate change.