Atlantic Oceanographic & Meteorological Laboratory

Review Response Plan

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This report lists the recommendations outlined in the AOML Review Panel Report and AOML's response to the recommendations.

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AOML greatly appreciates the time and attention devoted by our reviewers to identify areas that will further improve the overall function and achievement of our laboratory. In consultation with the AOML workforce and leadership, Dr. Robert Atlas, director, Atlantic Oceanographic and Meteorological Laboratory, proposes the following actions to address the reviewers' comments.

(Reviewers comments appear first in black italic text, with the AOML response following in blue text)

1. *Base funds and other-NOAA funds have been increased slightly in the past 5 years. However, because of tight government budgets and increased workloads, base funds have to be used to augment internal NOAA funds. Often this augmentation comes at the expense of delayed or simply loss of new government FTE hiring slots, and falling behind in facility maintenance. This situation has to be remedied by OAR and AOML through the current administrative channels, recognizing that even without major improvements or upgrades, sustaining existing observational network and maintaining an aging facility require more funds each year because of inflation.*

- AOML maintains regular communication with our line office management. By elevating the challenge of decreasing Federal hiring and facility maintenance during the lab review and during follow-on meetings with NOAA leadership, we feel that OAR and NOAA are well aware of our situation. We will continue to raise this as a concern and work with them to identify appropriate long-term solutions for funding a robust workforce and providing and maintaining an appropriate work environment for that workforce.

2. *In recent decades, satellite data have provided major advances in weather prediction and climate analysis through data assimilation; improvement in representation of physical, chemical and biological processes in climate models; diagnosis of model bias, and validation of model predictions. While the major research areas in AOML research have used satellite data to various degree, the overall usage of satellite data, and interactions and collaboration with satellite organizations within and outside NOAA have not been maximized. AOML is encouraged to consider the increase and better use of satellite data from NOAA and NASA and other satellite agencies, in conjunction with its own observational network and aircraft field campaign in data assimilation, for OSSE research and data analysis. This will also help to generate new ideas and research topics for collaborations with universities and outside partners.*

- As noted by the reviewers, AOML does use satellite data to varying degrees, including the partnership with NESDIS where AOML hosts the NOAA CoastWatch Caribbean Node, providing regional satellite data and products. In September 2014, AOML extended this collaboration with NESDIS to include the installation of a new JPSS satellite receiver to increase CoastWatch capacity. AOML hosted an on-site workshop

February 9-13, 2015, on satellite applications led by the Cooperative Institute for Meteorological Satellite Studies (CIMSS). Nineteen AOML scientists and partners attended to better understand the satellite products available from Ocean Watch, including data access.

- AOML also hosted a NESDIS OceanWatch/CoastWatchWorkshop in January 2016, which further introduced AOML scientists to these satellite products for consideration in their research.
- AOML scientists are now members of the NASA CYGNSS Science and Instrumentation Team. This satellite is scheduled for launch in October 2016. AOML scientists are also active participants and partners in the Joint Center for Satellite Data Assimilation.
- AOML's OSSE team conducted OSSEs for six proposed satellite systems in FY15, further increasing awareness of satellite data applications at AOML.

- AOML scientists continued efforts to include more satellite observations in their analysis. Expansion of satellite-based research included:
    - New NASA proposals to carry out research on 1) ocean processes that influence biases in Aquarius-derived sea surface salinity, 2) meridional changes of the South Atlantic Meridional Overturning Circulation and the effect of wind and density in causing these changes, 3) variability of the South Atlantic subtropical gyre and its link to the South Atlantic MOC changes, 4) investigation of sea level variability in the Black Sea, and 5) investigation of the variability of sea level in the Arctic Sea.

      Many of these projects are underway or near completion and have resulted in publications. These projects incorporate AOML scientists in the NASA Ocean Surface Salinity Science Team. As part of their work, they have deployed the first surface drifters with dual salinity sensors (surface and 5m deep) that allow better assessment of salinity in the vertical surface layer, a key to understanding satellite sea surface salinity observations. AOML also participated in the NASA SPURS-1 (Salinity Processes in the Upper Ocean Regional Studies) Project and provided expertise and enhanced ocean observations for experiments in the tropical Atlantic Ocean from 2012-2013. These scientists will also participate in the SPURS-2 experiment during 2016-2017.
    - A NOAA Coral Reef Conservation Program-funded proposal that draws heavily on satellite data: "Monitoring Ocean Acidification from Space in the Pacific". This project incorporates SST data from an optimal interpolated 9 km resolution product that combines microwave and infrared sensors, salinity data from the Hybrid Coordinate Ocean Model (HYCOM), and mid-tropospheric Carbon Dioxide Level 3 Monthly Gridded data from the AIRS and AMSU instruments on board the Aqua satellite. AOML developed a new product for this project, with ongoing verification and tuning in progress in 2016. The product is updated with new data every month, and plots and netCDFs are being generated for spCO2, pH,

TA, Ωca and Ωar. Once the verification is completed a NOAA technical report will be prepared and AOML will publish the tool online.

Additional efforts to increase use of satellite observations to develop ocean carbon products include participation in the working group for Satellite Earth Observation for Atmosphere-Ocean Gas Exchange sponsored by the International Space Science Institute (ISSI). This working group functions as a think tank contemplating use of space-based observations to determine ocean carbon fluxes. It is uniquely science-problem focused rather than instrument-focused. ISSI is part of the European Space Agency (ESA), which is pioneering the problem-based approach, using remote sensing and in situ data. Lessons learned will be particularly useful to strengthen interactions with NESDIS (through Coastwatch/Oceanwatch), ESA and NASA to obtain the needed space based data.

- AOML and CIMAS participate in the National Hurricane Center (NHC) GOES-R Proving Ground team, and developed several satellite products for evaluation. This provides forecasters early exposure to upcoming GOES-R satellite products in the 5 years leading up to the launch of the next generation GOES-R satellites in fall 2016. Pre-operational demonstrations of these GOES-R products provide NHC operational forecasters with an opportunity to critique and improve the products relatively early in their development. Scientists at AOML and CIMAS developed several new types of satellite imagery under this effort that are not available on the current suite of GOES satellite sensors, but will be available using the GOES-R satellite series. Although these satellite products are experimental, they are actively used by forecasters at NHC's Hurricane Forecaster Unit and Tropical Analysis and Forecast Branch to support real-time operations.

  Demonstration products include pseudo natural color, Saharan Air Layer infrared split window, and RGB airmass satellite imagery. These products were evaluated in real-time by forecasters at NHC's Hurricane Forecaster Unit and Tropical Analysis and Forecast Branch (TAFB) during the 2015 Atlantic hurricane season. A technical report summarizing the 2015 NHC GOES-R Proving Ground evaluation of these and other satellite products, as well as plans for continued product evaluation in 2016 will be available in summer 2016.

In addition to these activities, AOML scientists will continue enhancing their use of satellite observations in NOAA-funded work. Examples include:

- The Climate Program Office support of three AOML proposals to monitor indices and indicators in the Atlantic Ocean, such as strength and location of key ocean currents and meridional heat transport, using a suite of satellite and hydrographic observations. These indicators are provided to the numerical prediction and projection communities to assess and validate their models.
- AOML integrates satellite and in situ data from several sources, with the capability to create ecoforecasts of marine environmental phenomena such as

coral bleaching and upwelling, and potentially fish and invertebrate spawning and migration. In FY16, AOML invested in a position dedicated to knowledge engineering to write the appropriate expert system code to transition the expert system code into a portable format that could potentially be used by NOS for operational use.

- Investigating a newly discovered phenomenon called the tropical cyclone diurnal cycle, which appears to be a fundamental process in mature tropical cyclones. It presents itself as a regular outward expansion or pulse in the storm's cloud field each day. AOML scientists use an infrared satellite differencing technique applied to the GOES, MSG, MTSAT, and Meteosat geostationary satellites to track the evolution of tropical cyclones diurnal pulses globally and investigate how they can impact storm intensity and structure, as well as satellite-based estimates of storm intensity.

AOML scientists plan to continue increasing the number of projects that include satellite observations, focused on supporting NOAA's goals.

3. *Overall, AOML meets expectation in its outreach, education and transition from research to operations. Better results and enhanced effectiveness can be achieved through improved communication with local organizations and stakeholders. AOML is encouraged to implement a more formal process for including stakeholder input into planning, prioritization and selection of research projects, product and services to be provided to stakeholders within and outside NOAA.*

Increased regular solicitation of ideas, internal reviews, and communications among AOML divisions will help to find new directions and opportunities. Regular consultation with stakeholders can ensure that products and services provided by AOML are optimally used.

- While AOML informally gathers regular input from stakeholders, we agree that there is great benefit gained by formally seeking, reviewing, and incorporating this input into our planning process. In seeking how to best establish a formal mechanism to objectively gather input from our stakeholders, we devised an approach that will simultaneously better educate stakeholders as well as increase dialogue with internal and external stakeholders. AOML launched a colloquium series, called Bite-Sized Science, on November 10, 2015 that features each of the research themes AOML identified in preparing for its recent Operations and Management Review:
  - QOSAP
  - HFIP
  - Hurricane Observations
  - Global Ocean Observations
  - Climate changes and associated impacts on extreme weather events,
  - Ocean & Coastal Circulation and Ecosystems
  - Ocean Acidification
  - Coral Monitoring

- Microbiology

Every other month, we feature an AOML speaker presenting an overview of one of these topics. The presentations are 'plain language' overviews of the big picture of the scientific and programmatic drivers (why are we doing this research), ties to NOAA priorities and partners, and recent achievements. AOML invites targeted stakeholders to attend either in person or via Go-to-Meeting. Discussion and interaction with stakeholders is actively encouraged during the presentation, and AOML will further engage stakeholders by formally requesting feedback from those in attendance. Questions will include:

- Were you aware AOML is conducting this research?
- Are you currently engaged in this topic with AOML scientists?
- Based on the presentation and discussion, do you feel this is an appropriate topic for AOML to pursue?
- What do you find most valuable in the described approach to this topic?
- What would you like to learn more about?
- What is AOML currently not doing that could further advance this area of research?

The first Bite-Sized Science presentation was November 10, 2015, and featured Dr. Robert Rogers discussing hurricane observations, with 35 in attendance, including the NHC Science Operations Officer. Dr. Kelly Goodwin presented 'Omics on January 12, 2016 with 20 in attendance, including scientists from the Office of Ocean Exploration and Research. The third presentation was on March 15, 2016, featuring Dr. Ian Enochs discussing Coral Reefs in High CO2 Seas, with the NOAA DUS VADM Brown in attendance. To date we have not formally requested feedback from stakeholders, but we have received positive feedback from stakeholders about the program and appreciation for being included. After the series of selected topics are covered we will re-evaluate this effort to determine if it is an appropriate method to educate stakeholders and solicit their input.

- A targeted effort was made to improve our collaboration with NOAA's National Hurricane Center. AOML and NHC leadership met on February 11, 2016 to develop a prioritized list of tasks that would address NHC's highest priorities. A statement of work was developed for OAR outlining those tasks that could be tackled in the first year. One of the key objectives will be to position AOML to better support NHC to develop improved guidance products within NHC's existing AWIPS II and ATCF development environments, with the potential for AOML acquiring an AWIPS II development capability within a year working with NHC and NWS.

The strategy developed with NHC was to start tasks that are easy to implement while AOML explores options to acquire an AWIPS II terminal. AOML is supporting an NHC contractor to work with AOML scientists and the NHC AWIPS II development folks to pursue three developments that could be transitioned to AWIPS II when the national centers framework comes online after the 2016 hurricane season:

1. Develop a G-IV targeting strategy to address intensity as well as track forecast improvements, port code to platform transitional to AWIPS II, evaluate a proposed new sampling strategy using the AOML hurricane OSSE capability;
2. Develop improved applications to display aircraft reconnaissance data within the AWIPS II development framework; and
3. Assist NHC with transition of the HRD-developed Rapid Intensity Index (RII) to the new WCOSS Phase II high performance computing (HPC) environment.

4. *Currently, the AOML workforce is more than 50% Cooperative Institute for Marine and Atmospheric Studies (CIMAS) scientists, whose support mainly comes from proposals. This ratio is likely to increase in the near future because of constraints in government hires. In some areas, CIMAS scientists are already carrying a heavy burden in generating external funds through proposals. AOML needs to explore other ways, such as through non-NOAA reimbursable funding, to maintain a robust workforce with the proper balance between FTE and CIMAS scientists, compatible with the proportion of funding available for operational versus basic research.*

- CIMAS completed a 5-year review soon after the 2014 AOML review. The feedback concluded that the current balance of CIMAS and federal staff at the NOAA facilities is appropriate. Challenges in bringing in additional funding from non-NOAA reimbursable funding such as NSF, NASA, and other federal sources to support CIMAS staff is that they often will not fund NOAA-oriented projects or view CIMAS staff as an extension of NOAA funded staff that do not require external support. This leaves a very limited pool of opportunities from which to bring in additional funds. AOML values the contribution of CIMAS staff and will seek ways to improve the career development and funding opportunities for all staff (see response to comment 6 below).

5. *The director position of Ocean Chemistry and Ecosystem Division has been vacant for too long. It needs to be filled as soon as possible with a forward-looking visionary and highly respected scientist.*

- AOML advertised this position and selected Dr. Jim Hendee as AOML's director of the Ocean Chemistry and Ecosystems Division. Dr. Hendee began the position in February 2015 and we feel that the division is progressing very well under his leadership.

6. *It is important for AOML to nurture and develop a high performing young/mid-career science workforce well attuned to the unique science and operational needs of the organization.*

These people will be the future leaders of AOML. This can be done through orientation meetings, listening sessions, mentoring programs, proposal writing tutorials, and presentation and skill training. To the extent possible, junior and mid-career scientists should be given high priority to go to science meetings to present papers, so as to expose their research to the wider research community. Individual performance metrics should include credits for doing operational work, which does not lead to refereed publications.

- AOML hosted a listening session /brown bag on this topic with early career employees in early October 2014. Based on the feedback received in this listening session AOML implemented the following actions:
    - In November 2015, AOML unveiled the AOML Ambassador Program, with a goal of pairing all new AOML employees (Federal, post-docs, and CIMAS) with a more seasoned AOML employee (Federal, post-docs, and CIMAS) to assist with successful assimilation into the AOML community. To date two of our newest AOML employees have taken advantage of this program and are paired with a more established employee to serve as their Ambassador.
    - AOML established a Colloquial series, known as the Bite-Sized Science series (described in detail in item 3). We created a special video announcement to help market this series and encourage new employees and scientists from other AOML divisions to learn more about what their colleagues do at AOML. The presentations take place during lunch to avoid conflicts with standing meetings. Management encourages scientists to lead these presentations as part of professional development.
    - AOML holds regular science meetings within divisions where research topics are formally presented and potential new areas of research discussed (monthly within HRD and OCED and annually within PhOD). We also have informal gatherings at the division level where conversation is meant to foster better interpersonal relations amongst colleagues (weekly to monthly across all divisions). While both types of events are well attended and appreciated, AOML was interested in offering a more frequent and less formal opportunity to interact with colleagues. While no lab-wide gatherings have taken place, informal coffee gatherings or pizza lunches are starting to become routine in workgroups around the lab. These gatherings are often initiated by members of leadership and are attended by employees from all backgrounds and job functions (not just mangers or senior scientists). We will continue to encourage these smaller, informal social gatherings to see if they help meet our needs to foster communication throughout the lab.
    - AOML has substantially increased training opportunities this past year and participation is always open to employees of all stages of their careers. Featured training included: Satellite Training Workshop (February 2015), Contracting Officer Representative October 2015, Mediation Training (August, 2015), Plain

Language Training (March, 2015), Appropriation Law Training (May 2015), CPR/AED Training (February 2015, February 2016), EEO Training (July 2015), Purchase Card training (April 2015), Contracting Officer Representative (October 2015), and MS Excel (December 15, 2015).

    - AOML senior management held a training session for all rating officials and supervisors on March 29th, 2106 to review best practices for conducting performance reviews. This training covered expectations and examples of well crafted performance plans, examples of the competencies and accomplishments associated with the official CAPS performance rubric, as well as a tool to help rating officials score employee performance in alignment with the rubric. We also reviewed tools such as Individual Development Plans that can be used help clarify what skills are needed to either improve job function or prepare for future career opportunities. Once NOAA releases its research career promotion plan, a training session will be held with federal employees to review the expectations and process for successfully moving from ZP-3 to ZP-4, and ZP-4 to ZP-5. We will hold a similar session with CIMAS employees to review the UM/CIMAS policies for career promotion and advancement.

- AOML leadership continues to work closely with NOAA Human Resources and OAR management to push for a resolution of planned career promotion and hiring process improvements. AOML actively participated in advancing the draft guidance by providing one of our Division Directors to serve on the panel to finalize the recommendations for "developmental scientist" promotions. In spite of the uncertainty in the process for scientific career tracks and promotion, AOML is pleased to have accomplished advancement of 10 AOML employees in FY15 through various promotion vehicles, including accretion of duties, promoting laddered positions (band 3 to band 4), open competition, and establishment of a new ST position, which was largely motivated by the comments from our review team.
- Early career scientists are largely CIMAS employees, who do not have travel restrictions or ceilings as imposed on federal travel. In alignment with the panel recommendation, AOML continues supporting its early career science, science support, and engineering personnel to attended meetings to contribute to their growth. In addition to sending early career and support staff to scientific meetings to present results, our senior scientists have adopted approaches to further engage early career scientists. To date AOML has brought four early career researchers to OAR HQ to meet with program staff and give presentations on their research, the most recent of which took place in November 2015. Both HQ staff and program office leadership have expressed great appreciation for the opportunity to meet and hear directly from the researchers they are funding. Another recent effort involved six AOML scientists (CIMAS, Federal and post-doc employees) presenting their research to students in the National Science Foundation's Research Experience for Undergraduates at the Little Cayman Research Center in the summer of

2015. AOML scientists also mentored the students during this opportunity to further engage these potential future colleagues.

- AOML and CIMAS leadership met in June 2015 to identify challenges and opportunities for CIMAS employees as well as strengthening the relationship with the University of Miami. Areas of possible increased collaborations were identified including CIMAS staff formally sponsoring graduate students as chairpersons on committees, taking advantage of the formalized advantageous arrangements provided to University staff supervising students (e.g. offering Teaching Assistance funding to graduate students already funded for three years by a grant). A plan was developed and we are now awaiting University approval.

7. *To increase the viability of the workforce, consideration should also be given to increased collaboration with universities through joint projects, and advising graduate students, and promoting student interns. AOML should consider the expansion of its post-doctoral program, such as the National Research Council fellowships available at federal laboratories, and other internship programs. To promote outreach and applied research, more engagement with students, and local communities through open house, webinars, and school science projects could be helpful.*

- In the summer of 2015, AOML welcomed 23 summer students who worked alongside AOML scientists and professionals. Students largely came from undergraduate and graduate programs from national and international universities. AOML also made a targeted effort to increase high school opportunities, with a total of 10 student interns from secondary education institutions. AOML also attracted four students from NOAA sponsored education programs such as the Hollings Scholar and Environmental Partnership Programs. AOML also hosted one summer student sponsored by MPOWIR (Mentoring Physical Oceanography Women to Increase Retention). These numbers build on a solid record of student investment where AOML hosted 17 students each in 2014 and 2013, and 14 students in 2012 and again in 2011. AOML will continue to advertise opportunities for students through the NOAA Education Office, as well as local high school partners.
- Twelve AOML scientists, including the AOML director and division directors, currently serve on graduate committees, and in addition, six of those graduate students are currently AOML or CIMAS employees. AOML will continue to encourage this type of participation and lead by example through its active participation in these programs.
- AOML typically funds one-to-two new post-doc positions each year, which augment our healthy cadre of post-doctoral employees. Currently AOML supports ten post-doc positions across all three of our research themes. AOML also reviewed our NRC post-doc announcements and determined that our advertised salary was not in alignment with other offices. We increased the NRC post-doc salary in May of 2015 and re-advertised current opportunities with the more competitive salary. We have not filled the positions to date.

8. *Achievements and service awards and working group memberships seem to be mostly coming from NOAA or NOAA related programs. More visibility through serving as chairs or members of non-NOAA committees and international programs needs to be demonstrated. AOML scientists are encouraged to participate and sign up for elective services in major science organization, such as conveners, chair and member of program committees in American Meteorological Society (AMS) and American Geophysical Union (AGU). Senior scientists and administrators are encouraged to nominate young and mid-career scientists for awards outside of the NOAA organization.*

- AOML values employee participation in scientific leadership positions and will encourage greater participation in professional societies, especially for early and mid-career scientists. Supervisors will continue to encourage employees to look for opportunities to serve in these capacities. AOML is proud that one of our early career scientists received the IUGG Early Career Scientist Award in June 2015. We have nominated other early career scientists for external NOAA awards and will continue to do so in hopes of increasing recognition of their achievements.