NOAA Climate Working Group Meeting
July 30-31, 2012
Grand Hyatt, Washington DC

Summary

The CWG welcomed Bob Detrick as the new AA for OAR as well as the Climate Goal Champion. The CWG also congratulated Chet Koblinsky on his forthcoming retirement and thanked him for all his years of service as Director of the Climate Program Office (CPO) and all his efforts on behalf of the larger climate science community through some rather turbulent times.

This was the first meeting of the CWG since February, 2011. Given the uncertainty and ever-changing landscape in NOAA's Climate portfolio, the Climate Program Office chose not to have a CWG meeting in the intervening 18 months. As a result, this meeting served as more of a reset in terms of considering NOAA's climate activities, rather than an in depth look at any one particular area. The main topics for this meeting were the execution of the Climate Goal strategy across line organizations, an overview of observations and monitoring, regional climate modeling, the five societal challenges of coastal inundation, weather and climate extremes, drought/water resources, marine ecosystems, and mitigation/atmospheric chemistry, how to message NOAA's climate goal, and changes to the CWG Terms of Reference and membership.

All in all this was a positive meeting. A lot of interesting and high quality science was presented. However, consistent with past CWG reports extending back over many years now, no real strategy was presented as how the science and application questions being raised in the five societal benefit areas map back as requirements for the observational and modeling parts of the program. A comment was made by a NOAA official that it is not surprising that a rigorous requirements analysis was not available, because these societal benefit teams have only been in place for 6 months. The CWG found this to strain credulity as these societal benefit areas have been in existence since at least mid-2010 when the CWG provided specific feedback and comments on them as part of the draft "Strategic Vision and Framework for a Climate Service in NOAA". It should not take over two years to generate Level I requirements for these societal benefit areas. Moreover, for years the CWG has gone on record stressing the importance of the seasonal to interannual time scale and the regional spatial scale. At this meeting the S-I time scale and regional spatial scale were given more visibility, but many of the examples presented were ad hoc in nature and there was no evidence of systemic change to advance either the S-I time scale or the provision of climate information on regional spatial scales. An unfortunate example of which is this summer's disastrous drought. Yet, in the recent CPO modeling call for proposals there is little, if any, emphasis on the importance of advancing drought prediction on S-I time scales with application to regional spatial scales. This is all the more important given that reauthorization language for NIDIS that highlights drought prediction as an emerging priority for the Nation.

Day 1

NOAA Administrator's Introduction

The meeting began with Administrator Lubchenco describing how climate cuts across the whole of the agency. Although the agency was prohibited from going forward with a National Climate Service, NOAA is still obligated to provide climate services with an emphasis on the lower case. This will certainly require doing more with less. Given the funding issues among many of the line organizations, NOAA is considerably leaner, must be smarter about how it goes about its business, and the importance of forging partnerships. The CWG heard how both regionalization and the National Climate Assessment loom large

for NOAA's climate portfolio. The CWG was also introduced to the new matrix management approach to climate with the climate goal lead now at the AA level in the form of Bob Detrick with a cross-agency AA level climate goal board responsible for planning and execution.

CPO Director's Report and Climate Goal Budget

Chet Koblinsky described the challenge CPO is facing with a reduced budget of order 20-30%. One of the casualties of which was the IRI funding. CPO management made a conscious decision to protect long term observations, research and modeling that was unique to NOAA, and those activities it is mandated to support for the National Climate Assessment and NIDIS. Given the present budget "climate", CPO will need to develop a strategy for the long-term protection of core activities. For example, given the protection of long-term observations, adding new observations and observational technologies will need to be balanced against keeping a viable core concentration of research. The CWG appreciated the detailed presentation on the NOAA Climate budget. One important point that no one was in position to answer was, independent of ARRA stimulus funding in 2009, what caused the Operational Climate Programs budget line to increase from $272M in FY08 to $358M in FY10. This sizable increase is important to understand because maintenance of this level post 2010 appears to have led to the disproportionate decrease in the Competitive Research Program funding line in FY12. Had the Operational Climate Programs line in 2012 been held to an average of FY2008+FY2010, it would appear that the draconian cuts in the competitive research line may not have been as necessary.

Advancing Cross Line Office Execution: Achieving the Climate Goal Strategy

Bob Detrick briefed the CWG on the new Climate Goal Board and how it has been set up to deal with a number of the organizational challenges that need to be met in order to achieve NOAA's climate strategy. As such, the Climate Goal Board provides a forum to improve multiple LO execution. As presented, the coordinating execution to advance the Climate Goal within NOAA's Administrative Order for Strategy and Evaluation seemed rather bureaucratic with multiple actors/leads/working groups. Among the various execution agreements for each societal challenge, there did not seem to be the equivalent of a science working group where the actual scientific requirements would be designed be it for observations, modeling, or applications. Among the key issues presented was integration of NOAA's climate pieces across the agency, prioritizing new investments based in time scales, observation and monitoring, and societal challenges.

Observations and Monitoring: Accomplishments and Challenges

On the morning of the first day of the CWG there was a session on Observations and Monitoring: Accomplishments and Challenges with two presentations and follow-on discussions.

Jim Butler reported on the 40th Global Monitoring Conference, hosted by ESRL in Boulder in May 2012. The conference, with a focus on atmospheric monitoring from the perspectives of climate forcing, ozone depletion, and baseline air quality, drew many international and academic as well as NOAA and other U.S. agency participants. The NOAA Global Monitoring Division (GMD) participates in observations addressing the carbon cycle, halocarbons, ozone and water vapor, and aerosols and radiation.

Butler showed a number of examples in which the monitoring efforts are key to providing and understanding of the state and evolution of the atmosphere. An example is the finding of the doubling over the past 50 years in the carbon dioxide uptake by the land and ocean; another example is that the ocean is no longer a sink but now a source of methyl bromide. Butler indicated that work needs to continue to further synthesize global long-term in-situ atmospheric observations, to integrate remote sensing and earth network observations, and to develop the capabilities to present more comprehensive products, such as for "carbon weather".

Robert Weller, the CWG liaison to the NOAA Climate Observation Division's (COD) Climate Observing System Council (COSC), reported on the in situ ocean observing networks supported by

NOAA. The COD supports observing systems including tide gauges, Argo profiling floats, tropical moored buoys, ocean reference stations, ocean carbon observing, Arctic observations, drifting surface buoys, and shipboard sampling, as by XBTs (expendable bathythermographs). Ocean climate observations have made strong progress since a 1998 global conference, Ocean Obs 98, with systems such as Argo contributing increased global observing of temperature and salinity own to 1,500 to 2,000 m. Other accomplishments include development of tropical moored buoy networks in each ocean, with significant participation and ship time from India, China, Japan, Brazil, Indonesia, and France.

In the face of this progress there are a number of challenges. International planning for ocean observations points to paths forward that require a greater multidisciplinary approach, adding sensors to address biogeochemical, biological, and ecosystems observing needs. This was stressed at the second international ocean observing conference, Ocean Obs 09, and has been formalized in an international Framework for Ocean Observing. The COD plays an important role in this international context for sustained ocean observing, contributing from its staff participants in the JCOMM-OPS (the IOC-WMO Joint Commission on Oceanography and Marine Meteorology Operations) effort that coordinates ocean observing internationally. However, the interlaced nature of ocean observing is a challenge for COD as well. COD contributes to networks that are international, and efforts by COD to control cost by reducing such contributions should not be done without discussion with its international partners. In a larger sense, a COD challenge is the need for a framework for resource management at the international level; and it may be that higher levels of NOAA need to be more proactive to meet this challenge.

COD acknowledges the decision by the Climate Program Office that has placed a high priority on sustaining the observations. COD noted to the CWG several additional challenges in going forward with this priority. First, COD needs to better develop the tools to demonstrate the values of the observations and the guidelines for the evolution of the ocean observing system, including awareness of the contributions the ocean observing system makes toward NOAA OAR and NOAA overall goals. Second, the methodologies for guiding the evolution of the ocean observing system, including adoption of new technologies and assessing the merit of existing and proposed observing system elements, need to be matured, recognizing that model-based assessments of the observing system are useful but have limitations associated with the varying levels of realism in the models. Finally, and of greatest concern to the COD is the challenge of having sufficient ship time to carry out the present and future ocean observing. NOAA OMAO is having difficulty providing ship time to support the ocean observing mission, and use by COD of its own funds to charter vessels further limits what observations COD can sustain. Weller passed on the request from the COSC that the CWG and the SAB address the challenge of insufficient ship time.

Panel Discussion on Regional Climate Modeling – ISI to DecCen

NOAA progress on modeling and predicting regional climate variability on time scales from intraseasonal, seasonal, and interannual (ISI) to decadal and centennial was surveyed in a panel discussion reviewing several related endeavors.

Thomas L. Delworth, Geophysical Fluid Dynamics Laboratory (GFDL), described the evolution of GFDL simulation and prediction models, with an emphasis on progress in high-resolution ocean modeling. GFDL is attempting, he said, to answer two questions: What predictability exists in the climate system? What are the mechanisms that produce predictability, especially in the oceans? The Atlantic Multidecadal Oscillation (AMO) and high-latitude cooling in the Southern Hemisphere seem to offer some potential for decadal prediction.

William M. LaPenta, Environmental Modeling Center, surveyed the operational requirements and capabilities of the computer models of the National Centers for Environmental Prediction (NCEP) with a focus on the interactions with modeling systems of other federal agencies and the National Multi-Model Ensemble (NMME) seasonal prediction system. EMC is starting to plan for development of the Climate Forecast System Version 3 (CFSv3) and will seek considerable involvement and collaboration of both the modeling community and of users.

Don Anderson, Climate Program Office, described the Modeling Analysis, Prediction, and Projections (MAPP) program as an approach to strategically connect atmospheric and oceanic ISI modeling in NOAA laboratories, other agencies, and the external community. One emphasis is on high-resolution modeling relevant to regional issues, another is the development and evolution of the NMME as an example of research to operations and an important pathway to future progress in ISI prediction.

The CWG commends the three organizations for their progress, but pointed out that regional climate modeling and prediction seemed to be an accessory benefit to efforts with other goals. Moreover, the CWG observed that the somewhat parallel and complementary modeling efforts underway at GFDL, NCEP, in the CPO grants program, and in the Earth System Research Laboratory (ESRL) might produce greater benefits within a more formal management or collaborative structure. In fact, these modeling efforts might be formulated as a NOAA enterprise rather than as separate efforts. At some point a decision must be made whether to commit to NMME as an operational rather than a research capability and it is not clear how that decision will be made or how external input will be sought and considered. This is a prime example of the sort of activity that has the potential to be transitioned from research to operations, and as such, is an excellent test case for multiple LO execution within the Climate Goal Board.

The CWG also pointed out that an important fraction of the present computer capability enabling some of the reported progress was acquired with a large grant from the economic Recovery Act and inquired how NOAA intended to maintain the capital investments required to sustain this capability in the years to come. The meaningful analysis of outputs from this nearly peta-scale computing capability presents significant concomitant challenges as well.

Day 2

Morning:

<u>Climate Information Products: Focus on the Societal Challenges: Major programs/activities and how the CWG can help</u>.

1. Coastal Inundation (M. Davidson)
2. Weather Extremes (T. Karl)
3. Drought/Water Resources (C. Koblinsky; R. Pulwarty, R. Webb by phone)

Overall Comments

Presentations and discussion about the Societal Challenge Areas (SCAs) acknowledged the challenge of moving NOAA climate services forward in the absence of a dedicated Climate Services line organization. Instead, climate services will have to evolve through collaboration and coordination across NOAA units, including NESDIS, NOS, NWS, and OAR.

Each presentation identified a common structure for coordinating across NOAA units. Each societal challenge area has an Executive Working Group (EWG), with a project lead. The EWGs are overseen by an administrator-level Climate Goal Board with a Goal Champion, i.e., the head of OAR. A step forward from prior presentations to the CWG is the designation of individuals with responsibility and accountability for progress towards goals, i.e., the Climate Goal Champion and the project lead for each SCA EWG. However, with so many executives identified as serving multiple EWGs, there is skepticism that they can be sufficiently engaged and implementation can be effective across all SCAs.

Questions came up for all three SCAs about how the CWG could be most helpful. A useful advisory role for the CWG is difficult for short horizons, considering that even the FY14 budget is now being developed. However, each of the Tuesday morning presentations focused on the short term (i.e., FY12 activities, and FY14 priorities communicated to OMB/OSTP for one SCA), with no coverage of the time horizon over which CWG comments can have impact.

A recurring theme was a request by NOAA for the CWG to represent stakeholder perspectives, identify priority products, and help communicate the importance of NOAA in providing climate services. The overall impression is that NOAA simply wants to be told what products and services to provide, rather than develop an explicit internally responsive process for prioritization based on a broad range of assessments that include substantive community engagement and social science research.

There still seems to be a lack of appreciation of strategic planning. The SCAs seem to be seen more as a structure for reporting on ongoing activities, rather than using the needs for addressing the challenges as the basis for prioritizing within and across NOAA's climate activities. Each of the three SCAs uses a different framework for categorizing its needs, rather than a common framework, e.g., observations, modeling, prediction and projection, and services. The Coastal Inundation SCA breakout is: observations, modeling, display software, and outreach/customer support. The Extremes SCA breakout is: detection, physical science basis, predictions and projections, and interpretation and communication. The Water Resources/Drought SCA breakout is: monitoring and forecasting, impacts and risk assessment, and informing adaptation; with a different breakout for NIDIS (integrated monitoring and forecasting; interdisciplinary needs assessment, research, and applications; the Drought Portal; public awareness and education; and engaging preparedness communities). This variety of frameworks makes it difficult for the SCAs to feed into the cross-cutting NOAA climate activities framework (observations, modeling, prediction and projection, services).

<u>Coastal Inundation SCA</u>

Individuals have been assigned to the Coastal Inundation EWG, which is designed to facilitate working across climate issues, across NOAA units, and with external partners and customers. The assignments go so far as to identify which NOAA units within NESDIS, NOS, NWS, and OAR will be responsible for activities related to four components of coastal inundation (storm surge, tsunamis, rivers, sea level change).

The slide set identified key needs applicable across all four coastal inundation components, although they weren't discussed. The needs are:

- Observations: bathymetric and topographic data, water level observations.
- Modeling: models for each of the four coastal inundation components need coupling to the Earth System Modeling Framework (where the science allows).
- Display software: Display program for the four coastal inundation components need user-friendly mapping software, with standard GIS formats and methods, and with a common look and feel.
- Customer support: Similar services and dissemination methods based on social science best practices.

Coastal Inundation SCA efforts will be focused on (1) impacts, (2) strategies for communicating with communities about risk assessment, and (3) community modeling. There is a clear sense that the coastal inundation leaders appreciate that their challenge is one of networking and collaborating across many internal and external organizations. The major areas receiving attention include (1) working with planning

organizations on impacts and risk evaluation and communication, (2) working with the diverse coastal modeling community (e.g., 13 inundation models) to develop more of an open source modeling framework, (3) integrating social sciences, including across the hazards and climate fields, and (4) connecting across NOAA units and external partners in more of an open services framework.

Concerns raised by the CWG include:
1. The Coastal Inundation SCA EWG still seems under-developed and more aspirational than demonstrably effective. For example, NWS participation is limited to NCEP and OHD, although OCWWS and the WFOs (e.g., through regional HQs) have significant roles for engagement, product development, and day-to-day services.

2. It is unclear what the principles and processes are for setting boundaries for engagement across units and partners, i.e., who will be responsible for what?

3. Given an emphasis on integrated solutions and cascading hazards that requires working with partners, it is also unclear what NOAA's distinct contributions are, and how those will be negotiated.

4. It is unclear how NOAA will embrace and put into practice open source concepts, which require skills distinct from the traditional research, modeling, and product delivery activities.

5. Social science capabilities, whether for hazards, climate, or other topics, are very diffuse, limited in capacity, and personality dependent. It's not clear how the Coastal Inundation effort will engage social scientists at a level that achieves national, rather than local, impact.

<u>Weather and Climate Extremes</u>
The Weather and Climate Extremes SCA has identified an overarching goal and outcome to provide a focus for activities. An unwritten goal is to obtain a dedicated budget line focused on extremes, analogous to NIDIS.

The Extremes SCA has identified their EWG members. They are the only EWG to include the Director of the OCWWS. However, WFOs are not represented, although WFO Warning Services Coordinators provide key operational linkages with local communities and emergency preparedness networks.

The Extremes SCA specifically asked the CWG how to prioritize their scientific challenges. Currently, activities of the Extremes SCA consist of leveraging efforts and expertise, rather than having the SCA priorities drive activities of the NOAA units. The FY14 Priorities Memo developed for OMB/OSTP identified Extremes SCA priorities as extreme thresholds and tipping points, detection and attribution, understanding human-natural interactions, prediction and projection, and adaptation.

A key external collaboration for the Extremes SCA centers on moving from a triad of proprietary catastrophic risk models to an open source risk model, the North American Risk Model. The objective is to provide insurers and banks with the transparency needed to evaluate impacts and implications of large and rapidly increasing risks and damages. NOAA role is focused on connecting data to the model. However, this effort requires more resources than being contributed by the private sector, with

implications (that remain unaddressed) for shifting priorities and resources within NOAA to serve this specific sector.

Concerns raised by the CWG include:
1. Even though EWG executives have been designated, there is no process for determining priorities that will affect NOAA unit activities. The Extremes EWG will be evaluating an initial attempt to do this in the fall, but contend that an even larger group (an interagency working group) is needed.

2. While there are activities related to shorter climate timescales (e.g., to develop monthly and seasonal severe storm and tornado outlooks, link cascading hazards, and update probable maximum precipitation values), NOAA could benefit from an explicit focus on shorter timescales, with timescales that vary according to the phenomenon (extreme storms, drought).

Water Resources/Drought

The Water Resources/Drought EWG is less developed than for the others, with only the NOAA units identified, not specific positions or individuals. The EWG does not include NWS OCWWS or regional headquarters (to represent WFOs), the Climate Program Office, or the Regional Climate Service Directors. The EWG does include the NIDIS Executive Council, although that group has met only once, for a day, "a couple years ago".

The bulk of the presentation focused on NIDIS, which is clearly seen as the flagship for coordinated NOAA climate services. However, NIDIS has no operational service responsibilities. Rather, NOAA sees NIDIS as a prototype development laboratory and a bridge between research and operations communities. NIDIS identifies the NOAA operations communities in different ways. For the regional drought early warning systems, NOAA operations are identified as CPC and the RFCs for monitoring and forecasting, and the OCWWS Climate Services Division for education and outreach. In the context of drought research, the operations community is identified as the NCDC Regional Climate Services Directors, the Regional Climate Centers, and state climatologists (the latter two existing outside NOAA). NIDIS has no designated linkage to NWS regional headquarters that oversee the WFOs.

NIDIS plans are to experimentally establish 12-13 pilot regional early warning systems, and then assess them to determine how to implement regional early warning systems nationwide. Currently there are four pilots, with three new ones being established and two others identified. NIDIS is also instituting a network of regional drought information coordinators for the existing pilots.

NIDIS does not appear, at this point, to actually have a process to transfer, or prioritize the transfer, of prototypes to NWS climate service operations; nor do they seem to have any planning to sustain the pilots operationally. NIDIS is providing input to other NOAA activities (e.g., the NOAA Science Challenge Workshop), but the relationship between NIDIS and the Climate Test Bed is not clear.

Metrics for evaluating NIDIS are not explicitly aligned with NOAA operations. Rather, most metrics concern conditions outside NOAA. They include the number of states and institutions with drought response capacity, the number of staff in those institutions that are trained and working on drought services, the number of drought-related research projects, and the percentage of population covered by an adequate drought early warning system.

Afternoon:

Marine Ecosystems

Roger Griffis of NMFS presented the societal challenge on Sustaining Marine Resources in a Changing Climate. The presentation stressed the diverse audience for marine-climate products and services with an increasing demand for regional products. The time scales of interest are annual to decadal. Given the locus of NOAA lab activities in the Pacific Northwest, there has been a strong emphasis on marine-ecosystem-climate interactions in this region. During the course of the presentation, the terms projections versus prediction were used rather loosely. Upon further clarification it was stated that short time scale predictions were important for fish, and the long-term scales projections were important for marine mammal studies. Next, the CWG raised the question as to what is or should NOAA be doing about coastal prediction? Given the importance of the prediction of nutrient and sediment loading for coastal fisheries, where is such work being done in NOAA? This, then, raised an even larger issue. When speaking of the prediction marine ecosystems, this is a topic that cuts across every LO in NOAA: NMFS, NOS, OAR, NESDIS, and NWS. Yet, it is very unclear who has the lead responsibility for funding such research. Certainly, in the past this has not been a priority for CPO or for that matter the Climate Goal.

Mitigation/Atmospheric Chemistry

Ravishankara, Jim Butler, and Ramaswamy described NOAA efforts in Boulder and Princeton pertaining to short-lived climate pollutants and their role in climate change and variability. The case was made for the need for a better understanding of the role of aerosols given their offset or masking of GHG forcing, their shorter lifetime, role in air quality, and ability to confront with existing regulations. Given the role of aerosol-cloud interactions on a regional scale, recent research at GFDL has suggested a significant weakening impact on the South Asian summer monsoon.

Climate Goal Communication

The content of NOAA's communication strategy on balance is very good. Discussion focused on how to message NOAA's Climate Goal and how to better articulate value. The apparent pressure to perform real-time attribution was questioned versus using this summer's drought as a teachable moment.

Membership/Terms of Reference

Given this was the first CWG meeting in 18 months there will be considerable turnover in the CWG membership going into 2013. The potential exists for a certain loss of "corporate memory, hence it will prove important that the SAB and its liaison to the CWG continue to guide this transition. Bob Detrick also discussed his intention to streamline the Terms of Reference for the CWG to better reflect the new demands and realities of the program. This is consistent with the discussion that the CWG had with respect to the ToRs in October 2009 and subsequently with the SAB when, "The CWG noted that the CWG ToR were uneven with respect to execution, guidance and advice relative to observations, modeling, and services. Rather than recommended

changes at this time, the CWG thought it prudent to wait until plans for a NOAA Climate Service solidify and revisit at that time". At the 2012 meeting the CWG decided it would be appropriate to revise its ToR in 2013 in partnership with the new slate of CWG members and its new Chair.

Respectfully Submitted on Behalf of the NOAA Climate Working Group
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