

EXTERNAL REVIEW
COOPERATIVE INSTITUTE for
MESOSCALE METEOROLOGICAL STUDIES
(CIMMS)

REVIEW PANEL MEMBERS

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SUBMITTED TO THE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Executive Summary

An external review of the strategic plan, science review, education/outreach and science management programs of the Cooperative Institute for Mesoscale Meteorological Studies (CIMMS) was conducted on August 17 and 18, 2015 in Norman, OK. Guidelines for conducting the review were provided by the Cooperative Institute Program Office within the National Oceanic and Atmospheric Administration's (NOAA) Office of Oceanic and Atmospheric Research (OAR). The review was conducted under the auspices of the NOAA Science Advisory Board (SAB) and, therefore, is subject to the requirements of the Federal Advisory Committee Act (FACA). A list of review panel members is provided in Appendix I. The review panel's on-site agenda is provided in Appendix II.

CIMMS is a Research and Development Partner located in the National Weather Center, where CIMMS serves as a catalyst for outstanding scientific exchange between university and NOAA scientists. University support for CIMMS has progressed over time and was well documented in the materials provided to the review team.

The review panel found the CIMMS research programs, directed by the leadership team of Interim Director Randy Pepler, Executive Director of Finance and Operations Tracy Reinke, and Assistant Director for NOAA Relations Sebastian Torres, universally and substantially benefit the NOAA partners. CIMMS profits from the relationship/opportunity the leadership and research investigators have to closely collaborate with a number of local NOAA facilities. CIMMS researchers and NOAA representatives from the National Severe Storms Laboratory (NSSL), National Weather Service (NWS), Radar Operations Center (ROC) for the WSR-88D (NEXRAD) Program, NWS National Centers for Environmental Prediction (NCEP), Storm Prediction Center (SPC), NWS Warning Decision Training Division (WDTD), NWS Norman Forecast Office (OUN), and NWS Training Center (NWSTC) in Kansas City, Missouri work in unison to produce better forecasts and warnings to protect and save lives and property.

I. Overview of CIMMS

Originally formed in 1978, CIMMS is one of the oldest of the NOAA Cooperative Institutes (CIs). CIMMS is sponsored jointly by the University of Oklahoma (OU) and the National Oceanic and Atmospheric Administration (NOAA) specifically through NOAA's Office of Oceanic and Atmospheric Research (OAR). CIMMS is a strong partner with several NOAA programs not only those also housed in the National Weather Center. Location at the National Weather Center provides for collaborative efforts by researchers from both federal and state agencies and the University of Oklahoma; this location allows CIMMS staff to serve as Principal Investigators.

CIMMS, in response to NOAA's request for proposals (RFP) in November 2010, concentrates and supports research and education/outreach services addressing five principal scientific themes:

- Weather radar
- Stormscale/mesoscale modeling
- Forecast and warning improvements
- Climate change and extreme weather events
- Societal and socioeconomic impacts of high-impact weather systems.

While the current financial status of CIMMS is good, promises for improved funding for Task I administrative funds are important to the work of the CI leadership. In addition, the panel strongly supports a request to the University administration for a commitment to continue a return of funds from the indirect category to CIMMS to allow for independent research in response to new opportunities and “bright ideas” in support of further promoting the outstanding research and development of the CIMMS scientists and their university colleagues.

The panel found the efforts of Interim Director Randy Pepler, Executive Director of Finance and Operations Tracy Reinke, and Assistant Director for NOAA Relations Sebastian Torres worthy of commendation for several reasons; foremost is their work to move forward on a new MOA between CIMMS and the University. The last agreement dates back to 1995; this document is 20 years old so the renewal is long overdue. Their leadership and attention to the future of CIMMS over the past sixteen months has been outstanding.

II. Strategic Planning

The strategic plan of CIMMS elucidates eight goals and a number of objectives associated with each goal. Five of these goals correspond to the five themes or foci that are the heart of the MOA establishing CIMMS. The remaining three goals and their associated objectives relate directly to the three tasks also outlined in the agreement. This plan describes clearly and concisely how CIMMS is enacting both its vision and mission statements. This review committee finds a high degree of congruence among all but one of the components (excepting climate due to the untimely loss of the previous director) of this strategic plan and the full range of research projects, outreach activities, coordination responsibilities and overall stewardship exercised by CIMMS administrators, researchers, and NOAA collaborators as outlined in the MOA.

A number of key dimensions salient to the terms of the MOA have evolved over time, and the CIMMS staff has worked diligently and successfully to both stay within the parameters of the MOA and to adapt to the changes in NOAA and other governmental agencies as these have reinvented their own strategic plans. Of note is the shift in emphasis of NOAA to a strategic plan that focuses on community outcomes that both follow and precede severe weather as described by the phrase “Weather Ready Nation.”

Wisely, and in anticipation of a broader social and public shift away from a narrow focus in single disciplinary approaches to problems, CIMMS has actively pursued an approach to research that is multi- and cross-disciplinary. Drawing across a range of physical and atmospheric sciences as well as social, behavioral, and economic fields, much of CIMMS agenda is at the cutting edge of both basic and applied research in direct support of its mission and plan.

Finding: The key to CIMMS outstanding success is its interdisciplinary approach to research, outreach, and education.

Finding: CIMMS pursuit of its strategic plan is attempting to remain consonant with the shift in NOAA’s mission.

Finding: CIMMS is awaiting the successful completion of its search for a new Director, a crucial hire in regard to how the strategic mission will be realized.

Recommendation: The selection of a new Director needs to be made in light of need for CIMMS to stay in alignment with NOAA's evolved strategic plan that emphasizes the need to place an equal weight upon incorporating the expertise from the social/behavior/economic and related disciplines.

Finding: CIMMS is avidly pursuing its stated strategic goals and successfully meeting objectives as described under each of the eight goals.

Recommendation: The strategic goal involving climate change should be reenergized in the face of the natural slow down in this area resulting from the untimely death of its previous Director.

III. Science

CIMMS is embedded in a vibrant research and application environment that includes federal and state organizations along with the University of Oklahoma and several private-sector firms. Thus they have links to the full spectrum of the weather enterprise as it is understood today, and make good use of those links in focusing the research efforts toward the needs of the NOAA entities and moving results of the research toward operational status where appropriate. As the contributions of the private sector to the operational component of the enterprise increase, however, CIMMS would do well to further enhance its links to the private sector.

The CIMMS Strategic Plan lists Goals and Objectives in five science areas, and we outline here some of the highlights and accomplishments in each of those areas.

Weather Radar: Over half of the work in CIMMS is related to weather radar, principally supporting NSSL, ROC, WDTD and the local WFO. One highlight is certainly their many contributions to the NEXRAD Product Improvement program, especially in the area of data quality enhancement. The increased attention to NEXRAD observations of winter weather is filling an important gap. CIMMS development and application of the novel mPING smart-phone app for collecting precipitation-type data is proving useful in this and other areas. The CIMMS work on the MPAR program is contributing directly to policy setting and decision making at the Agency levels, as the time approaches when major decisions will be required about modernizing the nation's radar observing systems. The Multi-Year Reanalysis of Remotely Sensed Storms (MYRORSS) project should have interesting research applications, providing a large severe storm climatology ripe for data mining.

Stormscale and Mesoscale Modeling: Modeling efforts focus on forecasting storms at both the regional and individual storm scale and are done in collaboration with NSSL and NOAA/ESRL. On the regional scale, NSSL-Weather Research and Forecasting (WRF) model is used to produce forecasts twice a day out to 36 hours, providing fields such as updraft helicity to identify potential outbreaks with numerous supercells. The recent development of the NSSL-WRF ensemble adds to the strength of this effort. The Warn-on-Forecast effort, in contrast, focuses on creating probabilistic hazard information over shorter time scales, in line with NOAA goals. The system can identify supercells, which have a higher probability of producing tornadoes than do other storm types. Discerning tornadic from nontornadic supercells remains an outstanding problem for the field. Storm-scale data assimilation efforts use WRF-Data Assimilation Research Testbed (DART) and support the other modeling and radar efforts through analysis of value gained from the assimilation of radar data, including data of differing temporal resolution. Overall, the modeling efforts undertaken by CIMMS nicely support NOAA goals.

Forecast and Warning Improvements: The Hazardous Weather Testbed (HWT) and the associated Experimental Forecast Program and Experimental Warning Program provide direct feedback to NOAA and CIMMS regarding the utility of new technologies as well as the need for modifications and improvements. These are held up as the “gold standards” for testbeds across NOAA. Development, enhancement and application of the Multi-Radar/Multi-Sensor (MRMS) system provide improvements in storm diagnosis and flash-flood warnings, while also supporting hydrologic modeling.

Societal and Socioeconomic Impacts of Extreme Weather Events: An assessment of the events surrounding the 20 May 2013 Oklahoma tornado episode has provided important insights into the distribution of warnings and the responses that occur. CIMMS has seized opportunities to obtain information regarding sheltering decisions during severe weather events by surveying local residents that seek shelter in the National Weather Center. In addition, work and research involving the development of the PHI tool has encompassed both forecasters and emergency managers and is conducted under the auspices of both physical and social/behavior scientists.

Climate Change and Extreme Weather Events: Efforts regarding the weather-climate interface, trends in extreme events, and impacts of hazardous weather events contribute significantly to several of NOAA’s objectives. Trends and regional shifts in extreme events are of particular interest, given increasing emphasis on public awareness, planning, and increasing resilience.

Finding: CIMMS is well-positioned to be a leader in the area of storm-scale data assimilation and numerical modeling, utilizing a fusion of radar, satellite, lightning, and other observational data to improve understanding and prediction of high-impact weather phenomena. CIMMS strengths in these areas could be further enhanced through expanded partnerships with complementary organizations.

Finding: Preliminary work is under way in use of satellite (e.g. GOES-R) and lightning data for forecast and warning applications.

Recommendation: CIMMS should expand partnerships with OU faculty, investigators from other NOAA CIs, EMC, ESRL, NASA, Visiting Scientist programs, and collaborations with other Universities to further the growth of storm-scale satellite/radar/lightning data assimilation techniques.

Recommendation: Explore potential utility of developments in disciplines beyond the atmospheric sciences, such areas as data mining and machine learning.

Finding: Research is excellent in most of the major CIMMS scientific themes (e.g., efforts in radar, storm-scale modeling and MRMS) and well aligned with the NOAA strategic plan and the needs of the NOAA units it supports. In fact, CIMMS contributions are essential for the success of several of the NOAA partners.

Finding: The HWT has been exceptional for facilitating the evaluation of convection-allowing models, which are often developed in parallel, uncoordinated efforts across the numerical modeling community.

Recommendation: Consider the possibility of enhancing Hazardous Weather Testbed (HWT) participation through the use of parallel experiments at remote sites, such as universities and other agencies, and possibly expanding the focus to include evaluation of storm-scale data assimilation efforts, which are similarly parallel and uncoordinated.

IV. Science Management

The science at CIMMS is very well-managed, as is clear from the degree to which the NOAA management is pleased with the support that CIMMS provides in the execution of the NOAA mission functions and the level of satisfaction, the sense of achievement, and the opportunities in research expressed by the CIMMS scientists whom we met. The scientists seem to have a clear sense of their function, and a strong commitment to it. The result is that CIMMS produces excellent science that advances the NOAA objectives significantly and efficiently. The science and its production are very successful.

There are some areas, however, in which the management could be improved, with some assistance from the University of Oklahoma Administration.

The first is in the area of career track. It is important in any profession that individuals see opportunities for advancement and recognition for their achievements and professional maturing in the form of promotions. In the federal government, scientists often enter at a high GS12 or low GS13 level, and as they progress in their careers, they advance to the GS14, and ultimately the GS15 level. This advancement is a visible indication of the level of seniority and achievement of a scientist, and the recognition of those factors by the employer provides both incentive and positive feedback for their successful career progression. At the University, the academic equivalent of that career trajectory is assistant professor, associate professor, and full professor. The CIMMS scientists have no such official distinction between early-career and more senior scientists, yet they perform at the interface of two environments – government and academic – where such recognition and distinction is the norm, and they see their colleagues advance in their positions and stature, while they themselves appear to remain stagnant, at least in their job classification. This situation creates a negative distinction between the CIMMS scientists and the academic and federal colleagues with whom they work side-by-side.

The committee recommends that CIMMS and the University of Oklahoma establish a framework that includes job titles that are reflective of the different degrees of seniority and achievement among its scientists. As an example, at the sister Cooperative Institute for Research in Environmental Sciences (CIRES), there is a career track for research scientists that maps to the tenure track faculty positions with the title “Research Scientist 1” as the equivalent in seniority and stature to an assistant professor, Research Scientist 2 as the equivalent to an assistant professor and Research Scientist 3 as the equivalent to a full professor.

Another area of potential improvement is in the area of rewards and recognition. When teams of NOAA and CIMMS employees produce an achievement that is recognized by NOAA or the Department of Commerce, federal regulations are such that only the federal employees can be explicitly identified in the award and provided compensation. As a result, even though the CIMMS personnel may have contributed substantially to the work, they are omitted from the recognition. It would be helpful for CIMMS if the University could set up their own recognition system that publicly recognizes, through an award at a public ceremony, the contributions of the CIMMS employees to the achievement being recognized by the federal agency. Doing so

would improve morale, giving the CIMMS employees the sense that they are recognized key players in these activities.

A major strength of the Cooperative Institute is its multi-disciplinary and interdisciplinary research capabilities, which are targeted at addressing very societally relevant challenges – challenges that are invested in heavily by NOAA. As a result, the University of Oklahoma benefits substantially in terms of its stature and the kinds of problems it can address, and in terms of financial resources that the cooperative agreement brings in. CIMMS is the single largest source of research revenue at the University of Oklahoma, and the source of these funds is fairly stable and reliable from year to year. As such, the OU administration would benefit from putting some serious thought into how those investments by NOAA can be leveraged. There is already a very strong core there upon which to build. One mechanism for leveraging that investment is the assignment of faculty lines to CIMMS. Doing so would provide a robust bridge between the academic aspects of CIMMS and the federal aspects of CIMMS. Faculty with access to the CIMMS administrative infrastructure and whose alignment is primarily with CIMMS rather than a department could build strong interdisciplinary groups and would likely secure substantial extramural funding. A very strong core is in place, and thoughtfully building an academic research capability of faculty, postdocs, and graduate students around that core could position CIMMS as an entity to successfully compete for resources in areas that go far beyond its support of NOAA.

CIMMS is a very strong research organization on campus, and its success is clear evidence that it is well managed. It is effective in its support of NOAA, and it is producing world-class scientific achievements. However, the findings and recommendations listed above represent opportunities for CIMMS to become an even stronger interdisciplinary powerhouse in meteorological research and applications.

Finding: There is no career-track equivalent to faculty or federal promotions, such as assistant professor, associate professor and full professor, or the GS12, GS13, GS14, and GS15.

Recommendation: Establish within CIMMS and the university framework job titles that distinguish between degrees of seniority and achievement.

Finding: There is no formal mechanism for publicly recognizing achievements by CIMMS personnel or CIMMS contributions to federal awards.

Recommendation: Establish a mechanism that recognizes these contributions and other achievements publicly.

Finding: A major strength of the CI is its multi- inter-disciplinary approach, bringing together scientists and engineers from a range of disciplines, to study important problems.

Finding: CIMMS is a major source of revenue and stature for the University of Oklahoma, and the investment by OU is not such that its full potential contribution to the University can be realized. As a hub of interdisciplinary research that spans the physical sciences, computer science, engineering, and the social sciences, the diversity and interdisciplinary nature is more ad-hoc than thoughtfully constructed. As such, its potential contributions to the university are not being fully realized.

Recommendation: OU should consider providing faculty lines to CIMMS, from the relevant disciplines within CIMMS, where the primary alignment is with CIMMS rather than a department. These lines should be geared toward establishing collaborations both within CIMMS and with departments at the University. Also, interdisciplinary research should be promoted and rewarded, through some internal funding or other support mechanisms.

V. Education and Outreach

CIMMS has a successful track record of communication, education, and outreach that effectively facilitates NOAA's objective to provide "an engaged and educated public with an improved capacity to make scientifically informed environmental decisions." CIMMS participation in wide-ranging education and outreach activities allows them to effectively leverage knowledge drawn from each of their five main research themes. These activities include surveying the general public during severe weather events, training operational forecasters, and facilitating formal education of students at the post-secondary level.

Finding: CIMMS partners have an impressive record of educational work at the post-secondary level, including service on M.S. and Ph.D. committees, numerous instructional assignments, and mentoring service. CIMMS students have an outstanding record of accomplishments.

Recommendation: Expand education efforts to the K-12 population, perhaps by exploring participation in the Oklahoma STEM network that connects OU statewide to districts and programs. Additional opportunities might be found in module development for project-based learning or participating in local school district Family Math Science nights.

Finding: Through participation with the National Weather Festival, AMS conferences, public surveying, citizen-based science, and social media presence, CIMMS has excellent outreach efforts with the local community as well as the greater public.

Recommendation: Expand this beyond the local area, perhaps utilizing the recent communications specialist hire to develop a plan for greater outreach efforts.

Finding: CIMMS has had great success regarding education/training of NOAA/NWS forecasters, for example, through the HWT and WDTD.

Recommendation: Expand participation beyond the traditional NOAA forecasters, possibly distributing data and tools or providing remote access to outside Universities and other agencies; cast a wide net.

VI Summary and Conclusions

Following a thorough review of the strategic planning, science program, education and outreach, and science management performed by CIMMS, the review panel finds a significant number of strengths. The ongoing and completed research by CIMMS scientists and their partners is impressive. The NOAA science partners clearly indicate they could not accomplish their goals without the support of this Cooperative Institute. CIMMS has considerable impact on research that addresses issues of national interest.

Under the present guidelines for a CI review, the review panel unanimously agreed to a performance rating of Outstanding. The review panel's findings and recommendations are items presented for consideration by the CIMMS leadership, the NOAA partners and University administration.

Review Panel Members
August 17-18, 2015

Chair

Jean May-Brett
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During her 25-years of classroom teaching Ms. May-Brett taught Earth Science, Environmental Science, and Mathematics to students in New York and Louisiana at the middle and high school levels. Before assuming her position at the LA Department of Education, Jean served as the Assistant Director of Educational Services at Louisiana Public Broadcasting. She was the Curriculum Director and Content Producer for two award winning video series - an environmental science for middle school students and a professional development series for classroom teachers. Ms. May-Brett is an officer in both the Louisiana Science Teachers Association and the Louisiana Association of Teachers of Mathematics. She is a Board Member of the API, Delta Chapter and GNOSTEM. Jean is a past-president of the Southern Association of Marine Educators (SAME) and the National Marine Educators Association (NMEA). She has served on the Council for the National Science Teachers Association, the CGOM COSEE Management Council and the LA Governor's Environmental Education Commission.

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Dr. Abdalati is the Director of the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado and a Professor in the university's Department of Geography. CIRES, established through a cooperative agreement the National Oceanic and Atmospheric Administration (NOAA), is a diverse institute that focuses on understanding the Earth System and its components, as well as the human relationship with our environment. His research interests are in the use of satellite and airborne remote sensing techniques, integrated with in situ observations and modeling, to understand how and why the Earth's ice cover is changing and the implications for sea level rise. In addition to his academic experience, he has a

wide range of experience in various positions at NASA that include research scientist, program manager, supervisory scientist, and most recently NASA Chief Scientist. Dr. Abdalati received a B.S. in Mechanical Engineering from Syracuse University in 1986, a M.S. in Aerospace Engineering and a Ph.D. in Geography from the University of Colorado in 1991 and 1996 respectively. His approximately 60 peer-reviewed papers, book chapters, and NASA-related technical reports have received more than 3000 citations in the peer-reviewed literature. In addition, Dr. Abdalati has received a number of awards for his research and service from the White House, NASA, and various professional organizations.

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Dr. Baldwin received a B.S.E. in Atmospheric Science from the University of Michigan (1988), and M.S. (1991) and Ph.D. (2003) degrees in Meteorology from the University of Oklahoma. Dr. Baldwin presently holds a faculty position in the Department of Earth, Atmospheric, and Planetary Sciences at Purdue University where he teaches undergraduate and graduate courses in weather analysis and forecasting, scientific computing, and numerical weather prediction. Dr. Baldwin carries out research on analysis and prediction of high-impact weather events, effects of climate change on the characteristics of convective weather systems, and advances in forecast evaluation methods. He currently serves on the Unidata Users Committee, the AMS Committee on Artificial Intelligence Applications to Environmental Sciences, and recently completed a term as Editor of the AMS journal Weather and Forecasting.

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Dr. Jasko holds a Ph. D. in Human Communication from The Ohio State University, where she also earned her MA in Communication in the Public Interest. She has served at several institutions of higher education in capacities such a faculty member, department chair, director of the basic course and of two graduate programs, and as an assistant to the Dean of Liberal Arts. Her scholarship and interests include contemporary media (including social media), persuasion, interaction and identity, message design, and communication in organizations. She has served on two NOAA Service Assessment Teams, worked with a number of Weather Forecast Offices, assisted in the launching of several Integrated Warning Teams, and advises on the application of

social media to the diffusion of weather information. She currently also serves on the advisory board of the AGU's Thriving Earth Exchange, and as a Councilor for the AMS, and on its Executive Committee. She currently teaches courses in public presentation, communication theory, organizational communication, and public relations.

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Dr. Richardson received a bachelor's degree in physics in 1990 from the University of Wisconsin-River Falls and M.S. (1993) and Ph.D. (1999) degrees in meteorology from the University of Oklahoma. Dr. Richardson presently holds a faculty position in the Department of Meteorology at the Pennsylvania State University where she teaches undergraduate and graduate courses in mesoscale meteorology and convective cloud dynamics. Dr. Richardson carries out research on severe local storms using numerical modeling and observations from field programs. She currently chairs the President's Advisory Committee on University Relations (PACUR) for the University Corporation for Atmospheric Research (UCAR), and serves as a Councilor of the American Meteorological Society (AMS) and an editor for the AMS journal Monthly Weather Review. She is also a co-author of the textbook Mesoscale Meteorology in Midlatitudes.

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Dr. Smith received a bachelor's degree in Physics in 1955, an M.S. in Electrical Engineering in 1957 and a Ph.D. in Electrical Engineering from Carnegie Institute of Technology in 1960. He is presently Professor Emeritus in the Atmospheric and Environmental Sciences Program at South Dakota School of Mines & Technology, where he advises graduate students and conducts research in radar meteorology and cloud physics. He currently serves on the NEXRAD Technical Advisory Committee and has served on or chaired several National Research Council committees and panels as well as the American Meteorological Society's Committee on Radar Meteorology. He is also a past member of the Executive Committee of the International Commission on Clouds and Precipitation.

Agenda

**CIMMS Year 4 Review
 Conducted by the NOAA Science Advisory Board
 August 17-19, 2015
 National Weather Center
 University of Oklahoma**

August 17 - Science Review Day 1 - National Weather Center

<u>Time</u>	<u>Topic</u>	<u>Presenter</u>	<u>Location</u>
7:00-8:00 am Express	Breakfast (closed)	Review Panel & NOAA Guests	HI
8:00-8:30 am	Travel to National Weather Center		
8:45-9:00 am	Welcome and Introductions	Kelvin Droegemeier (VP for Research, OU)	NWC 3910
9:00-9:30 am	CIMMS Introduction and Overview	Randy Peppler (Interim Director, CIMMS)	NWC 3910
9:30-9:45 am	Break		
9:45-11:15 am	Science Presentations: Weather Radar R&D		NWC 3910
9:45-10:00 am (Curtis)	WSR-88D Radar Data Quality Improvements Using Range Oversampling		
10:00-10:15 am	New Concepts in Utilization of Polarimetric Radar (Schuur)		
10:15-10:30 am	Examples of Polarimetric Radar and Numerical Weather Prediction Synergies (Snyder)		
10:30-10:45 am	MRMS Quantitative Precipitation Estimation (Martinaitis)		
10:45-11:00 am	MPAR Engineering Research (Torres)		
11:00-11:15 am	MPAR Research at the ARRC (Palmer - ARRC)		
11:15-11:30 am	Break		
11:30-1:00 pm Deck	Lunch (closed)	Review Panel with Local NOAA Leadership	NWC Obs
1:00-1:15 pm	Break		
1:15-3:00 pm	Science Presentations: Stormscale Modeling R&D and Forecast and Warning Improvements R&D		NWC 3910

1:15-1:30 pm Stormscale Modeling Overview (Potvin)
 1:30-1:45 pm Stormscale Data Assimilation Activities (Yussouf)
 1:45-2:00 pm Warn-on-Forecast Overview (Wheatley)
 2:00-2:15 pm Warning Improvements Overview (Smith)
 2:15-2:30 pm SPC GOES-R Proving Ground (Line)
 2:30-2:45 pm Evaluation of Lightning Products for NWS Warning Services (Calhoun)
 2:45-3:00 pm WDTD Overview (Wood)

3:00-3:15 pm Break

3:15-4:00 pm WDTD Immersive Learning Exercise Review Panel & NOAA Guests NWC 4820

4:00-4:15 pm Break

4:15-5:30 pm Electronic Poster Session All NWC 2nd Floor

1. Forecast Improvements Owing to the HWT-Experimental Forecast Program (EFP)

(Knopfmeier) - *Forecast Improvements*

2. HWT-Experimental Warning Program (EWP) (Kingfield) - *Warning Improvements*

3. SCIPP: Helping Communities Manage Extreme Events (Shafer and Boone - OCS)

Impacts of Climate Change & Outreach/Extension

4. The Coastal and Inland Flooding Observation and Warning (CI-FLOW) Project (Monroe) - *Outreach/Extension*

5. Using Bragg Scatter for ZDR Calibration (Melnikov) - *Radar*

6. Improving the Quality of Correlation Coefficient (Ivic) - *Radar*

5:30 pm Return to Hotel

7:00-9:00 pm Dinner at Benvenuti's Review Panel, CIMMS Leadership, CIMMS Executive Board, OU Leadership, Local NOAA Leadership, NOAA Guests

August 18 - Science Review Day 2 - National Weather Center

<u>Time</u>	<u>Topic</u>	<u>Presenter</u>	<u>Location</u>
7:00-8:00 am	Breakfast (closed)	Review Panel	HI Express
8:00-8:30 am	Travel to National Weather Center		
8:45-9:00 am	Welcome	Nick Hathaway (Executive VP, OU)	NWC 1120

9:00-10:45 am Science Presentations: Societal Applications, Outreach/Extension, NWC 1120 and Research-to-Operations			
9:00-9:30 am	Perspectives on Severe Weather Communication (Correia, Ripberger, Friedman, Brooks) - <i>Societal Applications</i>		
9:30-9:45 am	Forecasting a Continuum of Environmental Threats - FACETs (Stumpf) - <i>Societal Applications & Forecast and Warnings Improvements</i>		
9:45-10:00 am	Crowdsourcing Hydrometeor Reports Using mPING (Elmore) - <i>Outreach/Extension & Radar</i>		
10:00-10:15 am	CIMMS Involvement at the Norman NWS Forecast Office (Garfield) - <i>Forecast and Warning Improvements & Outreach/Extension</i>		
10:15-10:30 am	R2O: Innovative Techniques to Improve Radar Data Quality (Warde) - <i>R2O</i>		
10:30-10:45 am	R2O Efforts: Multi-Radar/Multi-Sensor (MRMS) System (Reeves) - <i>R2O</i>		
10:45-11:00 am Break			
11:00-12:00 pm	Student Poster Session	All	NWC
2nd Floor	<ol style="list-style-type: none"> 1. Storm Lab (McGovern, Balfour, Davis) - <i>Outreach/Extension</i> 2. Flash Flood Forecasting Decision Support Development (Flamig and Argyle) - <i>Hydrometeorology</i> 3. Can Phased Array Radars Behave Like Humans? (Schvartzman) - <i>Radar</i> 4. PECAN Field Activities (Waugh) - <i>Field Programs</i> 		
12:00-1:00 pm	Executive Session Lunch (closed)	Review Panel and	NWC Obs
Deck		CIMMS Leadership	
1:00-3:00 pm	Executive Session (closed)	Review Panel	NWC 1120
1:30 pm	Optional Tour of the NWC for Other Visitors by Pat Hyland		
3:00-3:30 pm	Report Out of Preliminary Findings and Tentative Recommendations	Review Panel, CIMMS Leadership, OU Leadership, Local NOAA Leadership, NOAA Guests	NWC 1120
3:30 pm	Adjourn		