



THE CITADEL

JAMES B. NEAR CENTER FOR
CLIMATE STUDIES

ANNUAL REPORT 2020-21

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EXECUTIVE SUMMARY

2020-21 was the inaugural academic year of the Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies (NCCS). The foundation of the NCCS is Objective 6.3 of *Our Mighty Citadel 2026*: “Develop The Citadel Lowcountry Climate Center”. Highlights of the year were:

1. Hiring its Director, Dr. Scott Curtis*
2. Drafting a Charter
3. Receiving approval by the SC Commission on Higher Education*
4. Assembling an initial Executive Committee, Advisory Board, and core of faculty and students as “Climate Fellows”
5. Proposing and offering a new course “Extreme Weather and Climate” in the Department of Physics (cross-listed as a Strand course in Fall 2021)
6. Establishing The Citadel Weather Station
7. Granting \$47,190 in climate studies research to faculty in Physics, Biology, and Chemistry
8. Submitting over 1.5 million dollars in external research proposals and receiving \$147,721 in direct funds and \$53,049 in F&A
9. Building climate scholarship with 4 refereed journal articles, 7 conference presentations, and 4 poster presentations at Student Excellence Day

NCCS has engaged with key climate stakeholders in South Carolina and beyond, which has led to collaborations on research proposals and connections with industry and community organizations. NCCS’s short term goals are to refurbish Grimsley 126 to be the new innovation and collaboration space for the Center, establish a climate field station on Lining Island, and build on early successes in climate curriculum development, research productivity, and public-private partnerships. A primary challenge in achieving these goals is the lack of a dedicated administrative assistant. I hope you enjoy reading through the details of the early achievements of the NCCS, which present a good foundation for future success.

***“ [NCCS] will raise awareness from a super respected institution in the state that the climate science is real and the climate threat is real”
- Mark Wilbert, Chief Resilience Officer, City of Charleston***

Scott Curtis, Ph.D., Director
Near Center for Climate Studies

* KPI completed

VISION & MISSION

The NCCS serves the students and faculty of The Citadel and citizens of South Carolina by enhancing understanding of climate and its variability, change, and risks. The vision of the Center begins with the personal vision of Lt. Col. Jim Near. Near served twenty years in the USAF as a meteorologist and in fall 2014 returned to The Citadel as an adjunct professor of Physics. Near demonstrated extraordinary generosity by providing The Citadel Foundation (TCF) with a \$3.27 million gift to initiate the Center. Ever humble and not wanting to receive any recognition for his donation, he specified to TCF that his gift remain completely anonymous until his passing in March 2020.



During 2020-21 the vision and mission of the NCCS were defined, and the final versions (pending a vote from the Executive Committee and Advisory Board) are presented below. The complete charter can be found as Appendix A.

Vision

The Lt Col James B. Near, Jr., USAF, '77 Center for Climate Studies will be nationally recognized as an academic leader in *climate science*¹ and facilitating the transition of this science from research into operational use to assist in principled decision making.

Mission

The NCCS mission is to promote climate science through education, research, transition to operations, and community engagement and the development of public-private partnerships. The scope of the Center's activities will consist of the relation of Earth's climate to (a) national security, (b) coastal environment and infrastructure, and (c) human health and welfare.

1. climate science is defined as the science of how global, regional, or local climates are maintained and change over time and their effects on the environment and society

PERSONNEL

The NCCS is comprised of an Executive Committee, Advisory Board, and Climate Fellows. The organizational chart can be found in Appendix B.

Executive Committee

The Executive Committee is comprised of Citadel leadership and has oversight of NCCS activities as they pertain to fulfillment of the NCCS Charter.

- Dr. Darin Zimmerman (chair), Dean of Swain Family School of Science and Mathematics
- Dr. Kevin Bower, Associate Provost for Academic Affairs and Dean of General Studies
- Dr. Scott Curtis, Director of Near Center for Climate Studies
- Dr. Jeff Davis, Head of Department of Civil and Environmental Engineering*
- Dr. Dena Garner, Assistant Provost for Research and Policy
- Dr. John Weinstein, Head of Department of Biology
- Dr. Hank Yochum, Head of Department of Physics

* Dr. Ron Welch, Dean of the School of Engineering, served until 4/5/2021

Advisory Board

The Advisory Board is comprised of experts in the areas of environmental, climate, oceanic, atmospheric, and other closely-allied sciences. Members may also include educators, policymakers, and leaders of the community and industry whose skills and activities would inform the Executive Committee on Center activities and direction, as well as provide networking opportunities for students and Center Fellows. Full biographical information on the Advisory Board members can be found at: <https://today.citadel.edu/near-center-for-climate-studies-announces-advisory-board/>

- Col. Allison Dean-Love, Citadel Board of Visitors, *ex officio*
- Mr. Kevin Cooley, National Oceanic and Atmospheric Administration (NOAA), class of '90
- Dr. Kirstin Dow, University of South Carolina
- Dr. Fred Holland (chair), former Director of NOAA Hollings Marine Laboratory, class of '64
- Dr. Mike Johns, Winward Environmental LLC, class of '72
- Mr. David Johnston, Hamilton Advisors LLC
- Dr. Susan Lovelace, SC Sea Grant Consortium
- Dr. Hope Mizzell, SC State Climate Office
- Dr. Geoff Scott, University of South Carolina

One Advisory Board meeting was held on 4/15/2021. The agenda and minutes of the meeting can be found in Appendix C.

Climate Fellows

- Faculty Fellows
 - Dr. Jen Albert, Education
 - Dr. Jennifer Balmer, Biology
 - Dr. Patrick Bass, Mechanical Engineering
 - Dr. Mostafa Batouli, Civil and Environmental Engineering
 - Dr. Holly Bevsek, Chemistry
 - Dr. Pat Briggs, Physics
 - Dr. Kweku Brown, Civil and Environmental Engineering
 - Dr. Mei Chen, Mathematics
 - Dr. Mike Dorko, Chemistry
 - Dr. Sean Fourney, Public Speaking Lab Director, Leadership Studies
 - Dr. Simon Ghanat, Civil and Environmental Engineering
 - Dr. Danny Gustafson, Biology
 - Dr. Deepti Joshi, Cyber and Computer Science
 - Dr. Kaelyn Leake, Physics
 - Dr. Bo Li, Mathematics
 - Dr. Michelle Lomonaco, Associate Director of Sports Medicine
 - Dr. Clinton Moran, Biology
 - Dr. Deirdre Ragan, Mechanical Engineering
 - Dr. Richard Robinson, Mathematics
 - Dr. Claudia Rocha, Biology
 - Dr. Aicko Schumann, Physics
 - Dr. Nandan Shetty, Civil and Environmental Engineering
 - Dr. Nahid Vesali, Engineering Leadership & Program Management
 - Dr. John Weinstein, Biology
 - Dr. Lisa Zuraw, Chemistry
- Community Fellows
 - Dr. Merrie Koester, USC Center for Science Education
- Student Fellows
 - The following students were bestowed the title in 2020-21: *Mary Ballentine, Rian Burris, Logan Dix, Bonnie Ertel, Erin Garber, Malcolm Jackson, Robert King, Bailey Richardson, Anthony Sands, Ben Scott, Aaron Van Maanen, and Derek Webster*

The First NCCS meeting of the Climate Fellows was held 2/5/201. Shortly thereafter four standing committees were populated: Academic, Research, Engagement, and Industry. Each has key performance indicators.

EDUCATION

Academic Committee

Comprised of Fellows: Richard Robinson, Simon Ghanat, Lisa Zuraw, and Jen Albert. The charge of the Academic Committee is to propose educational and training opportunities for Citadel students and external constituents through curricular offerings, seminars and workshops, symposia, and continuing education. The committee will also engage with K-12 students and faculty. Their report for the 2020-21 academic year can be found in Appendix D.

Key Performance Indicators

- Number of students in climate studies classes
 - The definition of “climate studies classes” needs clarity, but here is a selection of classes and their enrollments that could serve this purpose:

Number	Title	#, Fall 2020	#, Spring 2021
PHYS 243	Meteorology for Aviators	0	0
PHYS 343	Applied Climatology	0	0
PHYS 244	Extreme Weather and Climate	0	12
NTSS 303	Biology, Environment, and Law	16	49
NTSS 303	Wild Injustice: Global Env. Cities	0	24
NTSS 305	Environmental Science	47	0
CRMJ 330	Emergency Management	20	0
GEOG 209	World Geography	0	8
CIVL 322	Intro to Env. Engineering	0	49
FSEM 101	Exploration and Innovation	25	0
ELES 301	Grand Challenges of the 21 st Century	0	26
HONR 300	Cultures and Controversy	0	9
TOTAL		108	177

- The bold course in the table above is a new Physics offering by Curtis, which will be cross-listed as a natural science sustainability Strand class in fall 2021.
- Number of K-12 faculty in the Lowcountry who infuse climate science into at least one lesson plan
 - This has not been evaluated for the 2020-21 academic year, and may require conducting a workshop for K-12 teachers on how to best present climate change to their students. It could be administered through The Citadel's STEM Center of Excellence.
- Number of Citadel faculty who infuse climate science into at least one lesson/module
 - This has not been evaluated for the 2020-21 academic year. A survey of faculty may be required during 2021-22, which could lead to a professional development activity.

Takeaways

While progress was made, especially the new course related to the mission of the Center, more could be done to increase the availability and prominence of climate science curricula at The Citadel. One task for the Education Committee in 2021-22 will be to propose an interdisciplinary climate studies minor. The NCCS will also need to begin to engage with K-12 teachers in partnership with the Citadel's STEM Center.

RESEARCH

Research Committee

Comprised of Fellows: Nandan Shetty, Deepti Joshi, Clinton Moran, and Mostafa Batouli. The charge of the Research Committee is to seek research strategies and communicate external funding opportunities to the Director. They will also review internal research proposals, including the annual Climatological Research Studies Grant (CRSG) competition. Other Faculty Fellows may be invited to serve as reviewers in case of conflict of interest and/or a low committee membership. The committee will promote ethical behavior in the practice of research and innovative problem solving in climate science. Their report for the 2020-21 academic year can be found in Appendix E.

Key Performance Indicators

- Number of CRSG applications.
 - The CRSG program is administered through the NCCS and funds Citadel faculty and students in climate studies. There were four applications submitted in fall 2020 and all received funding:

Last name	First name	Dept.	Amount	Title
Bevsek	Holly	Chemistry	\$12,000.00	Exploring the Role of Photocatalytic Decomposition of Perfluorooctanoic Acid on a Mineral Dust Proxy
Briggs	Patrick	Physics	\$11,250.00	Long-Term Study of Tides on the Ashley River: Flow Speed and Water Levels
Rocha	Claudia	Biology	\$12,068.00	Further Characterization of Potential Bacterial Pathogens in Nuisance Flooding Affecting Charleston: Implications for Human Health
Weinstein	John	Biology	\$11,872.00	Assessing the Role of Nuisance Flooding in Transporting Street-Associated Microplastic and Tire Wear Particle into Adjacent Tidal-Creek Salt Marsh Systems

- Number of external research grant submissions by Faculty Fellows
 - There were ten proposals submitted during the reporting period: three were funded, two were declined, and five are pending.

Short Title	Citadel PI	Program	Funded?	Extent	Direct Funds	F&A
ENSO Variability Changes during Abrupt Climate Events	Lisa Zuraw	NSF	YES	5/1/2021-4/30/2024	\$93,464	\$39,451
Predicting Drinking Water Contamination	Scott Curtis	EPA/U. Wyoming	YES	12/1/2020-11/30/2023	\$45,821	\$13,598
Detecting King Tide Flooding	Scott Curtis	SC Space Grant	YES	10/20/2020-8/14/2021	\$8,436	\$0
Coastal Resilience Initiative	Nandan Shetty, Scott Curtis, Mostafa Batouli	SC Sea Grant	PENDING	2/1/2022-1/31/2024	\$119,870	
Equitable Adaptation of Power Infrastructure Systems to Sea-Level-Rise	Mostafa Batouli	SC Sea Grant	PENDING	2/1/2022-1/31/2024	\$130,085	
Baseline understanding of how climate change will impact black seabass in SC	Clinton Moran	SC Sea Grant	PENDING	2/1/2022-1/31/2024	\$115,000	
Coastal Change Hub for Hampton Roads	Simon Ghanat, Scott Curtis, Nandan Shetty	NSF	PENDING	2021-2023	\$93,590	
Baseline understanding of how climate change will impact black seabass in SC	Clinton Moran	NSF	PENDING	2022-2025	\$450,000	
NISI–SOS Framework for Flood Risk Assessment and Communication	Mostafa Batouli, Deepti Joshi	NOAA	NO		\$76,992	
Downscaling and Delivering National Weather Service (NWS) Data	Scott Curtis	National Sea Grant	NO		\$460,716	

Research Products

- **Curtis, S., K. DePolt, J. Kruse, A. Mukherji, J. Helgeson, A. Ghosh, and P. Van Wagoner, 2021:** Spatially compounded surge events: an example from hurricanes Matthew and Florence. *Natural Hazards and Earth System Sciences*, 21, 1759-1767.

- Crawford, T., M.S. Islam, M.K. Rahman, B.K. Paul, **S. Curtis**, Md. G. Miah, and M.R. Islam, 2020: Coastal erosion and human perceptions of revetment protection in the lower Meghna estuary of Bangladesh. *Remote Sensing*, 12, 3108, doi:10.3390/rs12183108.
- **Gustafson, D.J.**, R.D. Porcher, J. Gramling, S. Eckert, and B. Owens, 2021: Long-term demography study of *Trillium pusillum* var. *pusillum* following Hurricane Hugo in 1989. *Castanea*, 86, 53-60.
- Paul, B.K., M.K. Rahman, T. Crawford, **S. Curtis**, Md.G. Miah, M.R. Islam, and Md.S. Islam, 2020: Explaining mobility using community capital framework and place attachment concept: A case study of riverbank erosion in the lower Meghna estuary, Bangladesh. *Applied Geography*, 125, 102199, doi:10.1016/j.apgeog.2020.102199.
- Presentation by **Rocha**: *Characterization of potential bacterial pathogens in nuisance flooding affecting Charleston, SC: Implications for human health*. ASM World Microbe Forum, Virtual, June, 2021.
- Presentation by Puzzio and **Shetty**: *Salt concentrations in Charleston city parks*. World Environmental and Water Resources Congress, Virtual, June 2021.
- Presentation by Kicklighter and **Shetty**: *Growth rates of street trees in Charleston, South Carolina*. World Environmental and Water Resources Congress, Virtual, June 2021.
- Presentation by **Sands** and **Shetty**: *Cooling effects of street trees in the urban heat island (UHI) of Charleston, SC*. World Environmental and Water Resources Congress, Virtual, June 2021.
- Presentation by **Curtis**: *Compound coastal water events: Definition and background*. Carolinas Climate Resilience Conference, Durham, NC, May 2021. (part of the symposium “Compound Coastal Water Events: A Multidisciplinary Approach to Resilience”).
- Presentation by **Ertel**: *Environmental fate of microplastic and tire wear particles from coastal floodwater in Charleston, SC*. Carolinas Climate Resilience Conference, Virtual, May 2021.
- Presentation by **Ertel**: *Encroaching tides and extreme rainfall: Floodwater as a source of microplastic and tire wear particles to coastal waterways*. North American Society of Environmental Toxicology and Chemistry (SETAC) 41st annual meeting, Virtual, November 2020.
- Presentation by **Curtis**: *Compound flooding in eastern North Carolina: Understanding stakeholder perceptions and needs*. 45th Annual Climate Diagnostics and Prediction Workshop, Virtual, October 2020. Proceedings at DOI: 10.25923/tpfe-4n87.
- Presentation by **Richardson**: *Impact of nuisance flooding on Charleston coastal waterways and streets: Are unwanted bacteria more prevalent in our backyards?* South Carolina Branch of the American Society for Microbiology (ASM), Virtual, October 2020.
- Presentation by **Ertel**: *Assessing nuisance floodwater in Charleston, SC as a potential pathway for street-derived microplastic and tire wear particles in coastal waterways*. NSF-NIH Oceans and Human Health annual meeting, Virtual, October, 2020.

- Four posters at the Student Excellence Day conference were co-authored by Student/Faculty Climate Fellows: Kaeley Johnston (Physics, mentor: Curtis); Ryan Skibicki (Cyber and Computer Science, mentor: Deepti); Erin Garber (Physics, mentor: Leake); Malcolm Jackson (Biology, mentor: Rocha). Bailey Richardson and Malcolm Jackson both participated in research under the direction of Dr. Rocha: “Detection of Bacteria in Nuisance Flooding”.

Takeaways

It was a successful year for climate research at The Citadel. Three grants were funded totaling over \$200,000 and research was conducted and disseminated by many students and faculty despite the pandemic. Furthermore, NCCS now acts as a hub for collaboration. One key example is the SC Sea Grant proposal led by Shetty (pending), which began as a brainstorming session organized by NCCS. For the first time, all Citadel faculty will be eligible for the 2021 CRSG competition, which should grow application numbers and increase the breadth of climate science research. The NCCS expects to provide \$60,000 in funding in 2021-22. The Research Committee recommends the NCCS develop awards to recognize excellence in research.

ENGAGEMENT

Engagement Committee

Comprised of Fellows: Jennifer Balmer, Claudia Rocha, Deirdre Ragan, and Kaelyn Leake. The charge of the committee is to facilitate NCCS outreach to the community (individuals, groups) in climate science and related environmental disciplines. The committee will listen to climate stakeholders and seek ways the Center can provide expertise and principled science-based leadership. Their report for the 2020-21 academic year can be found in Appendix F.

Key Performance Indicators

- Number of climate events organized by Citadel students and faculty and open to the public
 - Nothing to report. However, there will be a NOAA sponsored HeatWatch event at the end of July that will include student and faculty volunteers from The Citadel.
- Number of guest speakers on climate related topics
 - While not officially sponsored by the NCCS, the Charleston chapter of Sigma Xi hosted a climate speaker:
 Dr. Compton Tucker, Senior Scientist of NASA/Goddard Space Flight Center: *The Satellite Record of the Climate of the Pale Blue Dot: The Late 1970s to Now*, February 11, 2021 (303 Thompson Hall and Zoom)
- Number of community presentations/workshops by Citadel faculty on climate related topics
 - There were six presentations:
 Presentation by Curtis: *Managing Connected Climate Extremes: A Challenge of 'Spaces'*, part of an Earth Day panel: "Resilience in the 21st Century: Exploring the Social, Economic, and Environmental Aspects of Climate Change for Charleston", April 2021
 Presentation by Batouli: *Climate Risks, Infrastructure, and Income Disparity: Impacts of Sea-Level Rise on Social Inequity in South Carolina's Coastal Communities*, part of an Earth Day panel: "Resilience in the 21st Century: Exploring the Social, Economic, and Environmental Aspects of Climate Change for Charleston", April 2021
 Presentation by Batouli: *Climate Risks, Infrastructure, and Income Disparity: Impacts of Sea-Level Rise on Social Inequity in South Carolina's Coastal Communities*, Sea Grant Supported Seminar and Open Forum, February 2021
 Presentation by Curtis: *Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies*, Charleston Resilience Network, December 2020
 Presentation by Curtis: *Flood Threats in Rural Environments: A Case Study in Eastern North Carolina*, First Street Foundation Flood Lab Meeting, October 2020
 Presentation by Curtis: *Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies*, Exchange Club of Metropolitan Charleston, October 2020

Presentation by Curtis: *Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies, Citadel Club, October 2020*

- Number of community Fellows in the Center
 - Currently there is one community fellow: Dr. Merrie Koester

Center Contacts

- The Table below lists the government and community organizations the NCCS has engaged with thus far

Name	Contact Person
City of Charleston, Resiliency	Mark Wilbert
City of Charleston, Sustainability	Katie McKain
City of Charleston, GIS	Robert Hauck
Town of Mount Pleasant	Mayor Will Haynie
Charleston County, Hazards Mitigation	Encarna Robinson
Charleston Climate Coalition	Jen Wright
USACE, Charleston District	LTC Rachel Honderd
Charleston Resilience Network	David Johnston
C of C's Lowcountry Hazards Center	Norm Levine
MUSC Sustainability Department	Christine Von Kolnitz
South Carolina Sea Grant	Susan Lovelace & Landon Knapp
South Carolina Coastal Conservation League	Laura Cantral
Insurance Institute for Business and Home Safety	Anne Cope
National Weather Service, Charleston	Michael Emlaw; Blair Holloway
Carolinas Integrated Sciences and Assessment	Kirstin Dow
South Carolina Climate Office	Hope Mizzell
National Integrated Drought Information System (NOAA)	Meredith Muth

Media Exposure

- The Citadel Office of Communications and Marketing (OCM) worked closely with NCCS to promote stories related to the foundation of the Center and early research endeavors. This led to nine Citadel Today pieces and ten local, regional, or national media reports:
 - E.W. Scripps Television Stations, May 6, 2021
“National study to examine extreme summer heat in communities”. Aired in Scripps TV stations in Nashville, Baltimore, Denver, Tampa, and Las Vegas
 - ABC, News4 Charleston, April 22, 2021
“9 experts weigh in on climate change in Charleston ahead of Earth Day”
 - The Post & Courier, Charleston, SC, April 15, 2021
“Charleston joining national heat-mapping projects this summer”
 - The State, Columbia, SC, April 15, 2021
“So, how hot is Charleston really? City grappling with climate change joins heat study”
 - ABC, News4 Charleston, April 15, 2021
“Charleston selected for urban ‘heat island’ study, tracking hotter temps in urban areas”
 - Letter to the Editor, December 15, 2020
“Trees Offer Many Benefits Beyond Helping with Storm Water”
 - SC Business Review, December 4, 2020
“The Economic Impact of Climate Change
 - NBC, News2 Charleston, October 28, 2020
“Weather Wednesday: What’s Lurking in our Flood Waters?”
 - NBC, News2 Charleston, October 21, 2020
Interviewed in news story: “Citadel faculty, staff to participate in study of Charleston sunny day flood waters”
 - The Post & Courier, Charleston, SC, September 28, 2020
Quoted in news story: “Citadel launches climate science research center with \$2 million donation”. Also reported by ABC 4 News (Charleston), LowcountrybizSC, NewsBreak, The Island Eye News, The Island Connection, Moultrie News

Takeaways

The NCCS in its first year of operations has engaged with several organizations in the Lowcountry. The Director also served on the following committees: City of Charleston Climate Action Plan Education Sub-Committee; Charleston Resilience Network Governance Committee; SC Sea Grant Coastal Resilience Program Advisory Committee. The Director attends monthly calls of the Carolinas Integrated Sciences and Assessment group and Southeast Regional Partnership for Planning and Sustainability. To address the first KPI, the Engagement Committee recommends the NCCS host a citizen science activity in and around campus. To address the second KPI, a social hour and speaker series is recommended. These will become more likely in 2021-22 with the relaxation of COVID restrictions.

INDUSTRY

Industry Committee

Comprised of Fellows: Mike Dorko and Nahid Vesali. The charge of the committee is to establish industry partnerships that benefit NCCS partners and provide research, internship, and other development opportunities for Citadel students and Fellows. The committee will provide mentoring and network opportunities for students interested in climate-related careers. Their report for the 2020-21 academic year can be found in Appendix G.

Key Performance Indicators

- Number of climate related internships provided to Citadel students
 - Nothing to report.
- Number of climate career mentoring workshops attended by Citadel students
 - Nothing to report.
- Number of industry Fellows in the Center
 - None

Center Contacts

- The Table below lists the businesses and industries the NCCS has engaged with thus far

Name	Contact Person
Charleston Metro Chamber of Commerce	Scott Barhight
Robinson Design Engineers	Joshua Robinson
International Environmental Law Group	Ken Rivlin
Ben Pogue Law	Ben Pogue
HySpecIQ	Charlie Mondello
Palmetto (Solar Power)	Chris Kemper
Storm Water Storage, LLC	Bobby Riggs
Deltares USA	Claire Jeuken

Takeaways

The NCCS in its first year of operations made contact with several industries, but has not developed strong relationships thus far. The NCCS received a letter of support from the Charleston Metro Chamber of Commerce in its application to the SC Commission on Higher Education (see next section). The letter stated: “The Center for Climate Studies will ... work to create a ‘pathway to prediction’ to improve weather predictions and better prepare businesses and healthcare providers during natural disasters. We value the critical importance of preparing our organizations to minimize the potential economic impact.” The NCCS is also in the process of writing an MOU with HySpecIQ, based in Columbia. They are interested in integrating weather information into their remotely sensed and hyperspectral decision support tools. The NCCS Advisory Board recognizes the importance of nurturing public-private partnerships and is seeking additional board members in relevant industries (see Appendix C). Furthermore, the Industry Committee has presented a list of potential industrial partners.

OTHER MISSION RELATED ACTIVITIES

Charter Committee

- One ad hoc committee, the Charter Committee, was organized in 2020-21 to review the Charter and provide input. This committee was comprised of Fellows: Danny Gustafson, Pat Briggs, Mike Dorko, and Michelle Lomonaco. Their contributions to the charter are reflected in the final version (see Appendix A).

SC Commission on Higher Education

- The application for NCCS to be a new Center in the state was successfully ushered through the Commission on Higher Education approval process. It was unanimously approved on 3 June 2021.

The Citadel Weather Station

- Using Curtis' start-up funds, an AutoMet 580 Meteorological Monitoring System was purchased and installed near the Swain Boating Center. It measures air temperature, atmospheric pressure, relative humidity, wind speed and direction, rainfall, and incoming solar radiation. The minimum averaging time is 1 minute, with a nominal time of 5 minutes. Data has been routinely collected since mid-April 2021. NCCS is working with the manufacturer and Citadel ITS to make the data publicly available over the web.



BUDGET

Revenue per year from the endowment (and possibly F&A, see next section) is somewhat difficult to track making expenditure planning decisions a challenge.

- Dr. John Lining Professorship
 - Revenue: Funded by TCF Program for Climatological Studies Endowment listed on TCF Grant Summary. Budget to be established with TCF Grant budget entries
 - Expenses:
 - Director Stipend: \$10,000 + \$3,306 (fringe)
 - Advisory Board Meeting: \$180
 - Sponsorship of the Carolinas Climate Resilience Conference: \$500
 - Registration for the Carolinas Climate Resilience Conference: \$250
- TCF - Climatological Research Grant
 - Revenue: Funded by Near Gift held at TCF. Billing will occur quarterly for actual expenses. Budget to be established with TCF Grant budget expenditures
 - Expenses:
 - 2020 Climatological Research Studies Grant: \$47,190 (maximum)
 - Salary above Physics base salary: \$27,809 + \$10,846 (fringe)

GOALS & CHALLENGES

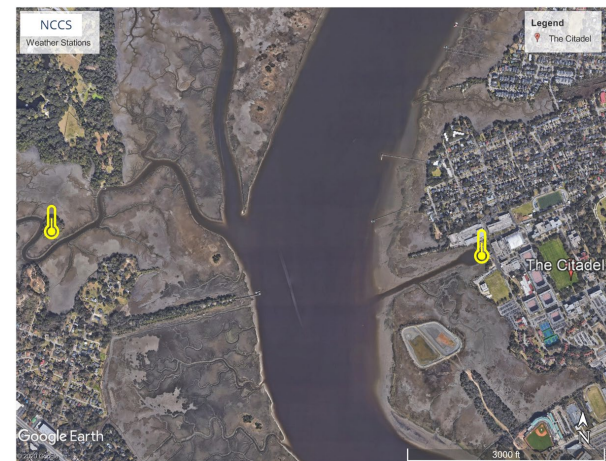
- **NCCS Innovation and Collaboration Space**

One main goal of 2021-22 is to repurpose Grimsley 126 to become the lab space for NCCS. The process will begin in summer 2021 with a design by MPS Architects and conclude with construction in summer 2022 and a grand opening in fall 2022. The initial cost estimate is \$120,000.



- **Lining Island**

Dr. Chris Swain has provided Lining Island for NCCS to use as a research and educational climate field station. One goal for 2021-22 is to make plans for the property and raise the necessary funds. There are many advantages for installing a second AutoMet weather station in close proximity to the one on campus. For example, micro-climate variations between natural versus built environments and east versus west bank of the Ashley River could be investigated (see map).



- **Administration and Communication**

One of the biggest challenges in 2020-21 was not having dedicated administrative assistance for the NCCS. Currently the Center is partially supported by the Dean of the Swain Family School of Science and Mathematics' office and the Department of Physics' office, but the Director spends an inordinate amount of time on administrative tasks. A staff assistant would benefit NCCS in several ways:

- Keeping records of revenues and budgetary expenses
- Engaging with TCF in managing proposals, grants, and gifts
- Accurately measuring KPIs by gathering data from Climate Fellows
- Communicating important NCCS meetings and events to Fellows and the larger Citadel community
- Working with OCM to promote NCCS successes and connect with alumni (through press releases, newsletters, and an up to date website)

- **F&A Sharing**

It is unclear if the Center will receive a return (to be added to revenue) for F&A. Climate science funded projects awarded in 2021-21 would generate \$53,059 over the next three years. If 10% was to return to the Center, then approximately \$1,768 would be added to the budget each year.

APPENDICES

- Appendix A

CITADEL LOWCOUNTRY CLIMATE CENTER, THE CITADEL MISSION AND CHARTER

NAME

The Center shall be called the Lt Col James B. Near, Jr., USAF, '77 Center for Climate Studies (NCCS).

VISION

The Lt Col James B. Near, Jr., USAF, '77 Center for Climate Studies will be nationally recognized as an academic leader in *climate science*¹ and facilitating the transition of this science from research into operational use to assist in principled decision making.

MISSION

The NCCS mission is to promote climate science through education, research, transition to operations, and community engagement and the development of public-private partnerships. The scope of the Center's activities will consist of the relation of Earth's climate to (a) national security, (b) coastal environment and infrastructure, and (c) human health and welfare.

CHARTER

The NCCS serves the students and faculty of The Citadel and the citizens of South Carolina by: (a) facilitating interdisciplinary collaboration among faculty, students, and external constituents; (b) fostering partnerships between industry, government agencies, and academia; (c) providing students, faculty, and external constituents access to data, emerging technologies, and other resources related to climate science and climate change; (d) facilitating innovative and entrepreneurial solutions to real-world concerns related to climate change by developing technical and non-technical knowledge and skills.

I. Membership

Members of the NCCS are designated Fellows and may consist of Citadel faculty ("Faculty Fellows"), staff, and students, industry partners, and community partners. Only Faculty Fellows are voting members.

A. Nomination and Election

An individual becomes a Fellow by:

1. Serving as a PI or co-PI on Center grants (e.g. Climatological Research Studies Grant), or
2. Receiving a nomination from a Fellow or Executive Board member, and
3. Receiving a majority of positive votes from sitting Fellows, and
4. Receiving approval from the Center Director, her/his Department Head and Dean, and the Provost.
5. At least 50% of Fellows must reside in the Swain Family School of Science and Mathematics.

B. Tenure

There are no terms of service for Fellows. A Fellow remains a member until:

1. He/she resigns, or
 2. Two-thirds of the Fellows/Center Director vote to remove her/him and the Provost approves.
- The Center Director may request the resignation of a Faculty Fellow if she/he has not engaged with the Center (e.g. no contribution to the annual report, no service on a committee) for a full year.

C. Fellows Rights and Responsibilities

1. Fellows will be recognized for climate science/studies research, instruction, and outreach.
2. Fellows will receive priority in NCCS funding, including the Climatological Research Studies Grant.
3. Fellows will benefit from NCCS campus resources, interdisciplinary collaborations, and external partnerships.
4. Fellows are expected to attend the semi-annual meetings of the Center (spring and fall) unless precluded by unexpected circumstances (see section II F).
5. Faculty Fellows are expected to serve on at least one steering committee (see section II C).
6. Faculty Fellows are expected to give climate-related annual reporting data (e.g. DigitalMeasures) to the Center.

II. Structure

A. Executive Committee

The Executive Committee consists of the Center Director, Associate Provost for Academic Affairs and Dean of General Studies, Dean of the Swain Family School of Science and Mathematics, Dean of the

School of Engineering (or representative), Assistant Provost for Research and Policy, Head of the Department of Physics, and Head of the Department of Biology. The Executive Committee has responsibility for the oversight of Center activities as they pertain to fulfillment of the Center Charter.

B. Program Director

One tenured, senior faculty member from the Swain Family School of Science and Mathematics (SFSSM) will be appointed by the Dean of the SFSSM and approved by the Provost to serve as the Center Director. He/She will coordinate the efforts of the Center to accomplish its Vision, Mission and Charter and serve as the primary point of contact for NCCS. The Director will prepare an annual report of Center activities and will be expected to be an expert in climate science and teach interdisciplinary courses in this area. He/She will have a reduced teaching load of 6 contact hours per semester.

C. Steering Committees

Four standing steering committees, composed of at least three Faculty Fellows per committee, will oversee NCCS activities in the areas of Academics, Engagement, Research, and Industry. Ad hoc committees may be created by the Director at his/her discretion to accomplish specific tasks assigned by NCCS leadership.

1. Academic Committee Charge: The committee will propose educational and training opportunities for Citadel students and external constituents through curricular offerings, seminars and workshops, symposia, and continuing education. The committee will also engage with K-12 students and faculty.
 - a. Key performance indicators
 - i. Number of students in climate studies classes.
 - ii. Number of K-12 faculty in the Lowcountry who infuse climate science into at least one lesson plan.
 - iii. Number of Citadel faculty who infuse climate science into at least one lesson/module.
2. Engagement Committee Charge: The committee will facilitate NCCS outreach to the community (individuals, groups) in climate science and related environmental disciplines. The committee will listen to climate stakeholders and seek ways the Center can provide expertise and principled science-based leadership.
 - a. Key performance indicators

- i. Number of climate events organized by Citadel students and faculty and open to the public (e.g. environmental cleanup, citizen science, awareness events).
 - ii. Number of guest speakers on climate related topics.
 - iii. Number of community presentations/workshops by Citadel faculty on climate related topics.
 - iv. Number of community Fellows in the Center.
- 3. Research Committee Charge: The committee will seek research strategies and communicate external funding opportunities to the Director. They will also review internal research proposals, including the annual Climatological Research Studies Grant (CRSG) competition. Other Faculty Fellows may be invited to serve as reviewers in case of conflict of interest and/or a low committee membership. The committee will promote ethical behavior in the practice of research and innovative problem solving in climate science.
 - a. Key performance indicators
 - i. Number of CRSG applications.
 - ii. Number of external research grant submissions by Faculty Fellows.
- 4. Industry Committee Charge: The committee will establish industry partnerships that benefit NCCS partners and provide research, internship, and other development opportunities for Citadel students and Fellows. The committee will provide mentoring and network opportunities for students interested in climate-related careers.
 - a. Key performance indicators
 - i. Number of climate related internships provided to Citadel students.
 - ii. Number of climate career mentoring workshops attended by Citadel students.
 - iii. Number of industry Fellows in the Center.

D. Advisory Board

The Center will engage with and benefit from the NCCS Advisory Board, whose members, nominated by the Executive Committee and appointed by the Provost, are experts in the areas of environmental, climate, oceanic, atmospheric, and other closely-allied sciences. Advisory Board members may also include educators, policymakers, and members of the community and industry whose skills and activities would inform the Executive Committee on Center activities and direction, as well as provide networking opportunities for students and Center Fellows. Advisory Board members will have a term of two-years and can be appointed to three consecutive terms.

E. Faculty Senate Representation

If the NCCS membership does not include a sitting faculty senator; one will be appointed to communicate pertinent business of the Center to the Faculty Senate. This Faculty Senate Liaison will coordinate pertinent information to and from the Faculty Senate. He or she may bring the committee reports and actions of the Center to the Senate, or invite another Fellow to do so.

F. Meetings and Attendance

NCCS Fellows are expected to attend the semi-annual meetings of the Center (spring and fall) unless precluded by unexpected circumstances. Additional meetings may be called by the Center Director or in writing by at least one-third of the Fellows.

III. Activities

A. General Activities

Center activities will include, among others:

1. Seeking external funding and distributing grants to Fellows through a competitive Request for Proposals process;
2. Establishing industry, community, and government partnerships that benefit NCCS partners and provide research, internship, and other development opportunities for Citadel students and Fellows;
3. Establishing a resource hub for faculty, students, and external constituents to facilitate collaboration and interaction in the development of innovative science and technology related to climate science and the study of climate change;
4. Fostering career-path mentoring and networking opportunities for Citadel students;
5. Providing educational and training opportunities for students and external constituents through curricular offerings such as a minor or certificate in Climate Science, seminars and workshops, symposia, and continuing education;
6. Examining and fostering the implementation of best practices and strategies for recruitment, retention, and evaluation of students in STEM disciplines that intersect with climate science and related employment sectors;
7. Providing a platform for accomplishing The Citadel's four-year leadership model;
8. Maintaining the Center website and disseminating information (including research results) to constituents and other interested parties;

9. Promoting ethical behavior in the practice of research and innovative problem solving in climate science;
10. Facilitating outreach to the community (K-12, individuals, groups) in climate science and related environmental disciplines.

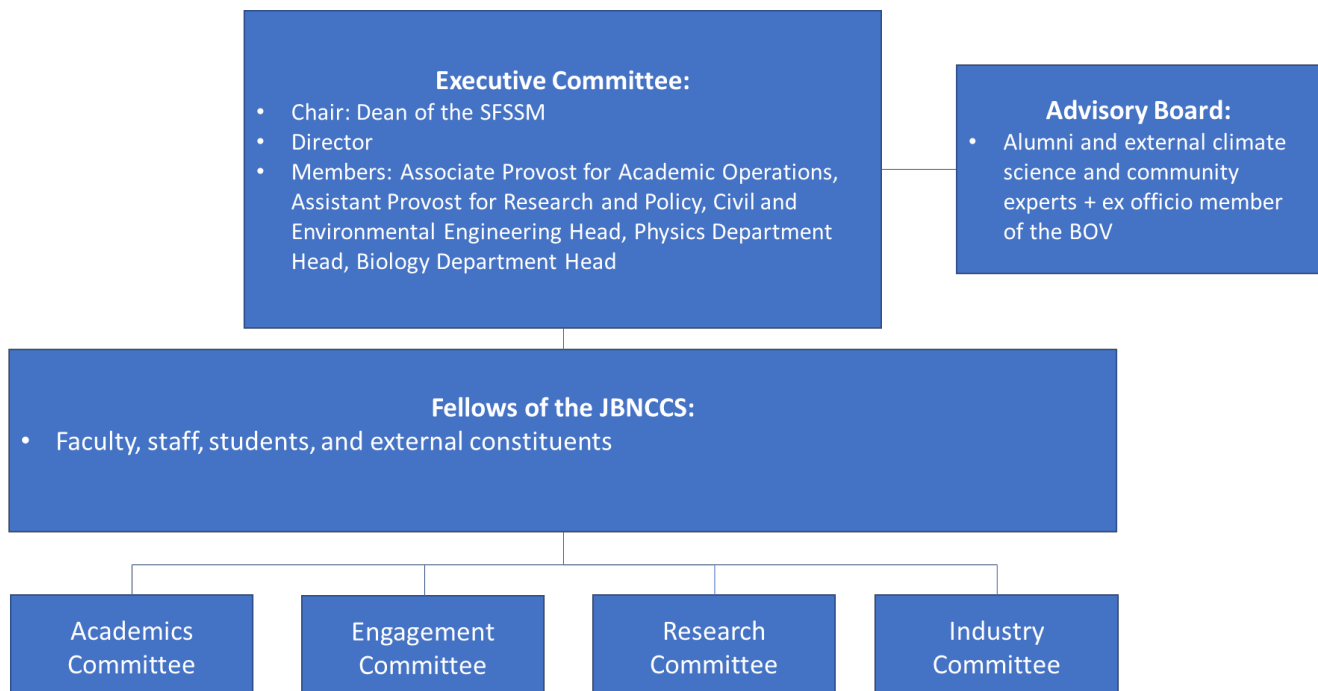
B. Annual report

Using input from Fellows, the Center Director will prepare an annual report routed through her/his Department Head, Dean, and the Provost summarizing Center activities over the previous academic year. The report must include all decisions of the Center, excluding confidential matters. Copies of this report will be posted to the Faculty Senate SharePoint folder allocated to the NCCS and made publicly available.

IV. Amending the Charter

NCCS members will review the Charter at least every 5 years or as needed in consultation with Provost and Faculty Senate. Proposals for changes will be discussed at the bi-annual meeting of the NCCS. Amendments to the Charter must be approved by a majority vote of the Executive Committee and Advisory Board.

• Appendix B



- Appendix C

April 15, 12:00-4:00

Advisory Board Meeting

Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies (NCCS)

Location: Copeland Auditorium (Grimsley 117). Also, Grimsley 126 (future home of Climate Center) will be open for touring.

12:00-12:15 Welcome by

- Dr. Darin Zimmerman, *Dean of the Swain Family School of Science and Mathematics and Chair of the NCCS Executive Committee*
- COL Allison Dean-Love, *Citadel Board of Visitors and ex officio NCCS Advisory Board member*

12:15-1:00 Lunch and Introductions

1:00-1:30 Presentation by Dr. Scott Curtis - discuss successes, budget, needs

1:30-2:00 Presentations by Faculty Fellow and Student Fellow

- Dr. Deepti Joshi, *Cyber and Computer Science*
- Ms. Bonnie Ertel, *Masters student, Biology*

2:00-2:15 Remarks by Dr. Sally Selden, *Provost*

2:15-2:30 Break

2:30-4:00 Dr. Fred Holland, Chair of the Advisory Board, facilitates discussion

Minutes of the Advisory Board (AB) Meeting

12:00-3:30, April 15, 2021

Present: Scott Curtis (Director), Fred Holland (Chairperson), Allison Dean Love, Kevin Cooley, Kirstin Dow, Mike Johns, David Johnston, Susan Lovelace, Hope Mizzell, and Geoff Scott.

Representatives from the Citadel Board of Visitors (Col. Allison Dean Love), the Citadel Administration (Provost Brig. Gen. Sally Selden), and the Dean of the Swain Family School of Science and Mathematics (Col. Darin Zimmerman) provided an overview of the history of the James B. Near Center for Climate Studies (NCCS) and informed the AB about how it fits into the Citadel's future. The Climate Center's Director (Lt. Col. Scott Curtis) reviewed the NCCS charter with the AB and outlined the AB duties and responsibilities. Advisory Board members introduced themselves and made general comments about the charge of the AB and its roles and responsibilities.

Dr. Deepti Joshi (NCCS faculty fellow) gave a brief presentation of her current research activities evaluating using twitter posts to assess responses to hurricane evacuation announcements.

Ms. Bonnie Ertel (NCCS student fellow) provided an overview of her research on nuisance flooding and microplastics associated with climate change.

Dr. Curtis and Dr. Holland suggested that the AB needed to be approximately doubled in current size (8) by the end of 2021 so that terms could be staggered (i.e. half the AB members' terms would expire each year). Dr. Holland asked for ideas on increasing board membership.

Dr. Lovelace suggested that seeking diversity on the AB is important and she thought adding an emergency manager or resilience officer would be beneficial. She agreed to look into specific suggestions from those professions.

Mr. Cooley suggested that the Center should focus on research to operations (R2O) and include a R2O expert in developing products and tools from applied research on the AB - possibly someone from the engineering field. He further noted that science that transitioned to actionable policy and decision making is important and should be integrated in the vision and mission.

Dr. Johns noted that this was similar to his idea of “principled decision making”, where science and engineering can be responsive to stakeholders with varying levels of risk tolerance and economic or cultural priorities.

Dr. Holland suggested a representative for the local Army Corp of Engineers office should be included on the AB to represent climate change and port security.

This led to Dr. Johns’ suggestion of bringing in someone from the Charleston office of SPAWAR, which is now called NAVWAR (NIWC Atlantic), to enhance the focus of the NCCS on national security. There was general agreement that this would also assist in incorporating research to operations. Mr. Cooley agreed to reach out to his contacts in NAVWAR about a Charleston connection.

Dr. Scott also thought a member of the Charleston Chamber of Commerce would bring in industry and a solution-minded approach. Mr. Johnston said he had a contact in the Chamber and thought someone from industry was a plus. He agreed to determine if he could obtain a recommendation from his contact.

Dr. Holland asked about including a public health and welfare representative on the AB. Dr. Scott suggested Dr. Paul Sandifer, who is local and affiliated with the College of Charleston. Dr. Holland agreed to contact Dr. Sandifer to determine if he was interested.

Dr. Dow suggested a sustainability officer at one of the local bases (e.g., Parris Island Marine Corps Recruit Depot) or corporation/business should be included on the AB.

Dr. Lovelace also suggested the public health component could be strengthened with an emergency room physician or nurse. Mr. Johnston said he was on the Neuroscience Advisory Board at the Medical University of South Carolina (MUSC) and would investigate seeking a representative from MUSC who was an expert on heat-related illnesses.

Insurance was also brought up, but Dr. Holland said Col. Dean-Love, who has experience with insurance, was already engaged with the Center and could serve as the AB insurance representative.

Dr. Scott also thought someone in agriculture would benefit the AB because of the impacts of climate change on surface and ground water quality and supply. He further noted agricultural practices lead to lake eutrophication.

Dr. Holland asked for volunteers to serve on a Membership Committee. This committee would be responsible for identifying potential board members and recommending to the AB a process for including new members in the future. Dr. Holland, Dr. Lovelace, and Mr. Johnston agreed to serve on this committee.

Dr. Holland then asked for volunteers to serve on an Outreach Committee. This committee would spread the word about the Center and seek partnerships in the business community. Dr. Johns, Dr. Dow, and Dr. Scott agreed to serve on this committee. Dr. Scott and Mr. Johnston reiterated the importance of establishing industry connections.

Dr. Holland then asked whether anything needed to be added/modified in the Charter.

Mr. Cooley reiterated his preference for including R2O in the Charter. He said that R2O is a priority for the NWS and including this goal into the mission and vision statements would make the Center truly unique. Dr. Dow said a challenge for “applied science” is getting it applied - or into the hands of

those who will actually use it. She also had specific comments on the Charter based on her experience with Centers.

Action Items:

The Membership Committee will convene as needed before the next AB meeting (Nov 2021) to select a chairperson, identify potential candidates for inclusion on the AB, and to recommend a process for bringing new AB members on board.

The Outreach Committee will convene as needed before the next AB meeting (Nov 2021) to select a chairperson and to develop a communications and outreach plan for spreading the word to the business community.

Dr. Curtis and Dr. Holland will prepare minutes for the AB meeting and circulate them to the AB by 15 May 2021.

Dr. Curtis will collate comments on the draft charter and circulate a revised draft for final comments and review by the AB by 1 June 2021.

- **Appendix D**

Educational Committee - Center for Climate Studies
Minutes from meeting on April 23, 2021 2-230pm
Attendees: Ghanat, Zuraw, Albert, and Robinson

Point of Contact: Richard Robinson

Key Performance Indicators:

The group came up with three main key performance indicators (KPI):

KPI 1. Number of students in Climate Studies Classes.

-may be dependent on scheduling (of students and teachers)

-Physics 244. Scott Curtis is currently teaching.

-Ghanat is waiting to hear on NSF grant that could allow for a new course. That could be another 50 students

KPI 2. Number of K-12 faculty in the Lowcountry who infuse climate change into at least one lesson.

- Offer a workshop, k-12 - could run it through STEM CENTER
- Infusing climate change
- Increasing the number of points of contact in the K-12 space. (i.e. the number of teachers/students impacted by the center)
- store example lessons/activities on a website

KPI 3. Number of Citadel faculty who infuse climate change into at least one lesson.

- provide teachers PD that gives them the space to create infusing ideas
- Helps to crowd source examples
- Interact with Citadel faculty about what would it look like to discuss climate change in other subjects?
- store example lessons/activities on a website

The committee believes there is a good start with respect to course offerings, but clearly there is much room for growth. We also value infusing climate studies throughout the curriculum, as opposed to a "one shot deal."

- **Appendix E**

Here are the highlights from the Research Committee meeting:

1. We started with who will lead the committee - Clinton or me. It wasn't clear so Mostafa has asked Scott to send ballots for a quick vote. We are a very small committee - so not sure what that will look like, but we can wait and see. Also, if we do elect a chair of sorts, I guess a term for the chair should be decided as well. I definitely won't want to be the chair indefinitely. If that becomes the case, Clinton, you can have that position for sure :).
2. Next, Scott read the charter that he had also shared in an email.
3. The main charges of the committee will be to:
 - a. Forster research at The Citadel in the Climate Sciences and related areas.
 - b. Communicate external research funding opportunities.
 - c. Update the internal grant call, and review the applications to recommend for funding. Scott will still be the point of contact for receiving the applications and also sending the call out.
4. Scott mentioned that he wants us to also review the charter and add some key performance indicators for the committee.
5. Finally, the committee needs to produce an annual report.

Some other discussions were centered around some of these topics such as hosting research talks by the PIs for the CSRG grants for the fellows, and creating awards for both faculty and students. Having invited speakers for the larger talks.

We also discussed a bit a mechanism for sharing information within the fellows and the committee. Perhaps a OneDrive shared folder, or a Canvas course where announcements can be made, and opportunities shared and discussed.

- **Appendix F**

The Engagement Committee had three suggestions

1. A citizen science activity that could be hosted by the NCCS or possibly tied into a larger program. This could be based on the presence of flooding or flora/fauna and recorded in google forms
2. A social hour where speakers from the community could be invited and talks could be geared to a wide audience
3. The climate center could be an outlet to educational institutions. This would cross-over into the academics committee

- **Appendix G**

Nahid and I (Mike Dorko) had our first meeting of the Industry Committee for the Near Center for Climate Studies. We discussed a number of organizations that we thought may be relevant to the charge that we were given and agreed that we would need your input on how to get things started in terms of how to contact them, who to contact, do we have any contacts there already, *etc.* The organizations are:

MUSC
 Roper
 NASA
 JPL
 Edgewood Arsenal
 NOAA
 EPA
 Tesla
 Naval Information Warfare Systems
 Department of Homeland Security
 U.S. Coast Guard

FBI

CACI (Their website says they are in Charleston and they have lots of military contracts)

Emergent, Inc. (Their website says they are in Charleston and they have lots of military contracts)

Nahid said she was going to think about more climate-related businesses/organizations and add them as she is able to. We decided that I would be the point person for ease of communication and we were both wondering if the committee had a charter yet? Overall, I think we had a pretty productive meeting and I think we need a bit of guidance.