CESM interaction with American Society of Civil Engineers

February 8, 2015

CESM Societal Dimensions Working Group Meeting

Chris Anderson – Iowa State University

ASCE

Committee on Adaptation to a Changing Climate (CACC)

Purpose: Identify and communicate the technical requirements and civil engineering challenges for adaptation to climate change.

Executive Committee:

- Richard N Wright, Ph.D., NAE, Dist. M. ASCE, Chair
- Bilal M Ayyub, Ph.D., P.E., F.ASCE, Vice-Chair
- Christine F Andersen, P.E., M.ASCEC, TA Liaison
- Ana Paula Barros, P.E., M.ASCE, Member
- J Rolf Olsen, A.M.ASCE, Member
- Ted S Vinson, Ph.D., P.E., M.ASCE, Past-Chair
- Dan Walker, Member
- Jonathan Carl Esslinger, P.E., F.ASCE, ASCE Staff Contact

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Committee on Adaptation to a Changing Climate (CACC)

- Primary body within ASCE working to promote understanding and response to climate change
- ASCE has 147,000 members and is the world's largest civil engineering society
- ASCE provides continuing education opportunities, and promotes standards of practice
- CACC is actively involved with more than a dozen ASCE Institutes, Councils, and Committees

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Goals

Committee on Adaptation to a Changing Climate

1. Foster understanding and transparency of analytical methods necessary to update and describe climate, weather and extreme events for engineered systems. **(CLIMATE CHANGE)**
2. Identify and evaluate methods to assess impacts and vulnerabilities of engineered systems caused by changing climate conditions. **(IMPACTS)**
3. Promote development and communication of best practices for addressing uncertainties associated with changing conditions, including climate, weather, extreme events and the nature and extent of engineered systems. **(POTENTIAL ACTIONS)**

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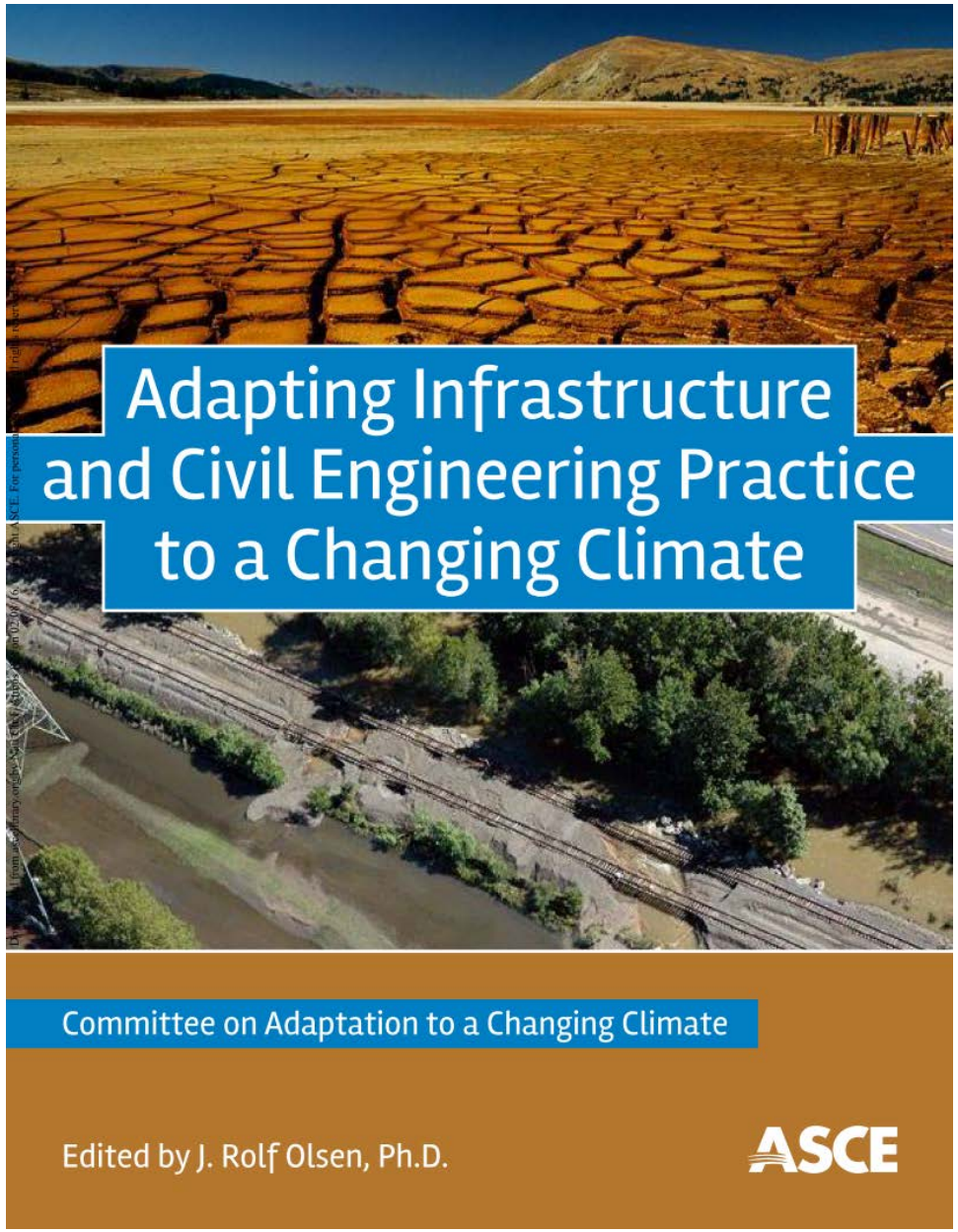
CACC 2015 White Paper Framing Climate Change and Civil Engineering

http://ascelibrary.org/doi/book/10.1061/9780784479193

Contributions from

Bilal M. Ayyub
Ana Barros
Brian Beucler
Ben Harding
Miriam Heller
Nir Y. Krakauer
Arthur Lee
Wayne Lei
Franklin Lombardo
Jay R. Lund
J. Rolf Olsen
Miguel Medina
Joel Smith
Orson P. Smith
Eugene Z. Stakhiv
Jonathan Tan
Ted S. Vinson
Dan Walker
Richard N. Wright



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CACC Priorities from White Paper Recommendations

1. Engineers should engage in cooperative research involving scientists from across many disciplines

2. Practicing engineers, project stakeholders, policy makers and decision makers should be informed about the uncertainty in projecting future climate

3. Engineers should develop a new paradigm for engineering practice

4. Critical infrastructure that is most threatened by changing climate in a given region should be identified

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CACC 2018 Goal

By the end of 2018, best practice in the field of civil engineering will be to consider and design for potential climate impacts over the lifespan of new and existing infrastructure and managed environmental systems.

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CACC 2018 Supportive Goals

ASCE Internal Partner goals:

1. Active use of risk-based decision making as a method for treating uncertainty due to changing climate conditions in engineering practice
2. Low-regret, robust decision making, and observational method is widely incorporated in appropriate ASCE and infrastructure community standard
3. Risk-based, low-regret design thinking is well represented in various certification programs (potentially interface with Institute for Sustainable Infrastructure (Envision), US Green Building Council (LEED) etc.)
4. Research-based improvements in the understanding the range of tradeoffs across costs and benefits of practices and standards are well established

CESM SDWG connects into ASCE External Partner goals:

5. Review of climate and weather research and studies to identify needs and opportunities for improvement of civil engineering practice and standards is ongoing
6. Research-based improvements in the bounds and characterization of future climate and weather extremes are more available
7. Investigations of extreme climate and weather events and their implications for the improvement of engineering practice and standards are underway
8. Civil engineering practice is well represented in efforts directed toward incorporating climate adaptation into Federal facilities
9. The scope and accessibility of relevant climate information for civil engineers reflects the input of practitioners.

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CACC 2015-16 Milestones are Raising Awareness within ASCE

1. Presentation on white paper to National Academy of Engineering on October 5, 2015 and several engineering summits and conferences

2. Participation of CACC with COS, ILC and IRD in planning and conduct of the ASCE Resilience Summit in 2016.

3. Propose and participate in one or more pilot efforts for incorporating low-regret decision making and observational method in ASCE standards

4. Discuss with selected ASCE journal editors the possibility of a special issue in each of their journals addressing CACC topics in their subfield

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CACC 2016-17 Milestones Will Promote a Federal Research Agenda

5. Plan and propose Federal agency support of research to address the public policy, financial and legal issues, as well as the scientific and technical issues

6. Plan and propose, in cooperation with the American Meteorological Society or similar entities, Federal agency support of multi-disciplinary research to gain an adequate, probabilistic understanding of the magnitudes of future extremes, their effects on infrastructure systems and their economic, environmental and social consequences

7. Recommend a National Research Council panel be assembled to identify needs and recommend actions to facilitate infrastructure adaptation to a changing climate

2016-2017 Work Plan for Addressing Engineering Standards

- Standards are a primary mechanism linking scientific knowledge with engineering practice. Compliance helps protect engineers and other users from findings of negligence.

- Attend and participate in CESM Workgroup Meetings

- Convene a 1-day meeting at ASCE Headquarters for engineers and climate scientists to discuss engineering design standards and the potential use of climate information and climate data requirements for precipitation loads and design floods.

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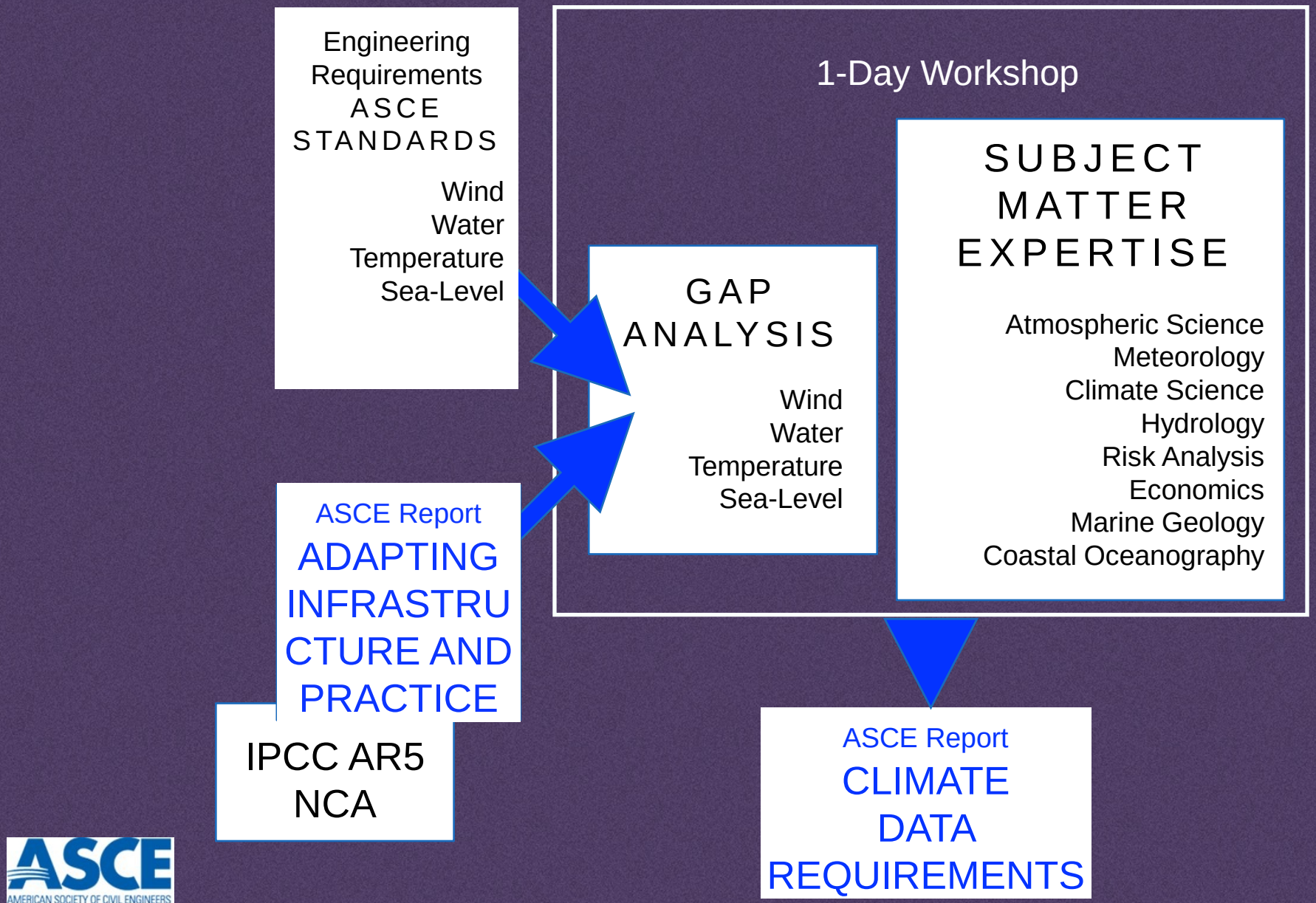
Illustration of Process for Workshop to Define Climate Data Requirements for Development of Engineering Standards



Conveying climate change uncertainty to CACC: CESM SDWG Perturbed Physics Experiment

- Address goal #6: “Research-based improvements in the bounds and characterization of future climate and weather extremes are more available”

- Do climate change projection ensembles capture the full range of response by precipitation extremes, specifically extremes relevant to metrics used in precipitation load standards?

- Perturbed Physics Ensemble (PPE) with plausible parameter configurations to be comparable with CESM-ME and CESM-LE, with a range of:
  - Climate sensitivity (highest and lowest plausible)
  - Carbon cycle feedback (highest and lowest plausible)
  - Future extreme precipitation behavior in 3 US regions: midwest, west coast, and southeast

Conveying uncertainty to CACC

- Do climate change projection ensembles capture the full range of response by precipitation extremes, specifically extremes relevant to metrics used in precipitation load standards?
    - If PPE has variability larger than ensembles in current climate assessments, then it means the metrics relevant to engineering standards WILL NOT contain full characterization of uncertainty in climate change projections.
    - If true, then this would demonstrate an important shortcoming of current climate projection ensembles for engineering standards that incorporate climate projection data.
    - The practical outcome of the experiment is to provide feedback to those who design climate projection ensembles in order to improve climate change assessments for engineering standards.

Conveying uncertainty to CACC

- This initial PPE serves the following purposes to further engagement with CACC:
  - Generates initial dialogue and connectivity to CESM community
  - Conveys magnitude of variability in extreme rainfall under transient climate change
  - Provides context on whether simulation variability of extreme rainfall is from model parameter settings, model structure, or initial conditions.

- This helps CACC by
  - Understanding the envelope of change in extreme rainfall
  - Providing climate simulations that have been developed specifically with extreme precipitation studies in mind
  - Raising discussion on how uncertainty propagates when going from global models to localized rainfall and streamflow used in engineering standards
  - Providing engineers with a voice in the process of designing ensembles for the next round of CMIP and IPCC climate assessments