WHERE TO INCORPORATE CLIMATE INFORMATION?

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1. Where to incorporate climate information?

Existing processes are the best spot to incorporate climate information, as compared to generating new processes. These process

2. Climate change

3. Unified Facilities Criteria

The Unified Facilities Criteria (UFC) provide guidance for developing and maintaining unified facilities design and construction for planning, design, construction, sustainment, restoration, and modernization of DoD facilities ()(`https://www.wbdg.org/ccb/browse_cat.php?c=4`). The United States Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and the Air Force Civil Engineer Center (AFCEC) administer the UFC system within their own departments () (`https://www.wbdg.org/ccb/browse_cat.php?c=4`). UFCs intended for all participating agencies have a document number that does not end in an alphabetical letter. Otherwise, a document with an 'A', 'N', or 'F' at the end of the document corresponds to guidance intended solely for the USACE, NAVFAC, or AFCEC, respectively ()(`https://www.wbdg.org/ccb/browse_cat.php?c=4`). UFCs are organized into four series: (1) Policy, Procedures, and Guidance; (2) Master Planning; (3) Discipline-specific Criteria; and, (4) Multi-disciplinary and Facility-Specific Design. A complete listing of the current UFCs can be found at `https://www.wbdg.org/ccb/browse_cat.php?c=4`.

The UFCs are a good program to use as a platform for resilience building for several reasons. First, UFCs are an existing program and would not require the creation of a new program, training users, and other associated costs of such an effort. Second, given its use throughout the services, small changes in the UFCs could lead to large changes in resilience. Third, there are multiple points in the UFC program where climate information could be integrated. Finally, the program directly ties into the systems that we care about.

Of the complete set of UFCs, we performed a cursory analysis to identify UFCs that would benefit from the integration of climate information, as well as climate projections.

Series 1: Policy, Procedures, and Guidance

(1) UFC 1-200-02 High Performance and Sustainable Building Requirements, with Change 3 (03-01-2013)
(2) UFC 1-201-01 Non-Permanent DoD facilities in Support of Military Operations (01-01-2013)

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(3) UFC 1-201-02 Assessment of existing facilities for use in Military Operations (06-01-2014)
(4) UFC 1-202-01 Host Nation Facilities in Support of Military Operations (09-01-2013)
(5) UFC 1-300-07A Design Build Technical Requirements (03-01-2005)
(6) UFC 1-300-09N Navy and Marine Corps Design Procedures, with Change 2 (05-01-2014)

Series 2: Master Planning

(1) UFC 2-000-05N (formerly P-80) Facility Planning Criteria for Navy/Marine Corps Shore Installations
(2) UFC 2-100-01 Installation Master Planning (05-15-2012)

Series 3: Discipline-specific criteria

(1) UFC 3-201-01 Civil Engineering (-06-01-2013)
(2) UFC 3-220-05 Dewatering and Groundwater Control (01-16-2004)
(3) UFC 3-320-01 Water storage, Distribution, and Transmission, with Change 2 (11-01-2012)
(4) UFC 3-230-03 Water Treatment (11-01-2012)
(5) UFC 3-230-06A Subsurface Drainage, with Changes 1-2 (01-16-2004)
(6) UFC 3-240-01 Wastewater Collection, with Change 1 (11-01-2012)
(7) UFC 3-240-02 Domestic Wastewater Treatment (11-01-2012)
(8) UFC 3-260-01 Airfield and Heliport Planning and Design (11-17-2008)
(9) FC 3-260-06F Air Force Design, Construction, Maintenance, and Evaluation of Snow and Ice Airfields in Antarctica (06-01-2015)
(10) UFC 3-301-01 Structural Engineering, with Change 1 (06-01-2013)
(11) UFC 3-400-02 Design: Engineering Weather Data (02-28-2003)
(12) UFC 3-401-01 Mechanical Engineering, with Change 1 (07-01-2013)
(13) UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems, with Change 2 (07-01-2013)
(14) UFC 3-810-01N Navy and Marine Corps Environmental Engineering for Facility Construction (03-01-2016)

Series 4: Multi-disciplinary and facility-specific design

(1) UFC 4-141-10N Design: Aviation Operation and Support Facilities (01-16-2004)
(2) UFC 4-150-02 Dockside Utilities for Ship Service, with Change 5 (05-12-2003)
(3) UFC 4-150-06 Military Harbors and Coastal Facilities, with Change 1 (12-12-2001)
(4) UFC 4-150-07 Maintenance and Operation: Maintenance of Waterfront Facilities, with Change 1 (06-19-2001)
(5) UFC 4-151-10 General Criteria for Waterfront Construction, with Change 1 (09-10-2001)
(6) UFC 4-152-01 Design: Piers and Wharves; with Change 1 (07-28-2005)
(7) UFC 4-152-07 Design: Small Craft Berthing Facilities; with Change 1 (07-14-2009)
(8) UFC 4-159-03 Design: Moorings, with Change 1 (10-03-2005)
(9) UFC 4-171-01N Design: Aviation Training Facilities (01-16-2004)
(10) UFC 4-213-10 Design: Graving Drydocks, with Change 1 (08-15-2002)

(11) UFC 4-213-12 Drydocking Facilities Characteristics (06-19-2003)

4. Guidance documents: Sea Level Rise

These documents represent the extent of guidance documents for the military services on incorporating sea level rise into existing planning mechanisms, operations, etc.

(1) ER 1100-2-8160: Policies for Referencing Project Elevation Grade to Nationwide Vertical Datums (03-01-2009)
(2) ER 1100-2-8162: Incorporating Sea Level Change in Civil Works Program (12-31-2013)
(3) ETL 1100-2-1: Procedures to Evaluate Sea Level Change (06-30-2014)
(4) ER 1105-2-100: Planning Guidance Notebook (04-2000) http://www.publications.usace.army.mil/USACEPublications/EngineerRegulations/tabid/16441/u43546q/313130352D322D313030/Default.aspx
(5) EM 1110-2-6056: Standards and Procedures for Referencing Project Elevation Grades to Nationwide Vertical Datums. http://www.publications.usace.army.mil/USACEPublications/EngineerManuals/tabid/16439/u43544q/313131302D322D36303536/Default.aspx
(6) ECB 2016-5: Using Non-NOAA Tide Gauge Records for Computing Relative Sea Level Change (01-27-2016)
(7) National Research Council (1987) Responding to Changes in Sea Level: Engineering Implications. Washington, DC: National Academy Press. http://www.nap.edu/catalog.php?record_id=1006
(8) National Research Council (2012) Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Committee on Sea Level Rise on California, Oregon, and Washington, Board on Earth Sciences and Resources and Ocean Studies Board. Washington, DC: National Academy Press.
(9) Intergovernmental Oceanographic Commission (1985) Manual on Sea Level Measurement and Interpretation, Volume I. Intergovernmental Oceanographic Commission Manuals and Guides-14. http://unesdoc.unesco.org/images/0006/000650/065061eb.pdf
(10) Intergovernmental Oceanographic Commission (2012) Manual on Sea-Level Measurements and Interpretation. Volume 4 An Update to 2006 (T. Aarup, M. Merrifield, B. Perez, I. Vassie, and P. Woodworth, eds.). IOC Manuals and Guides No. 14, vol. IV; JCOMM Technical Report No. 31; WMO/TD. No. 1339. Paris, France: Intergovernmental Oceanographic Commission.
(11) C. Zervas, S. K. Gill, and W. Sweet (2013) Estimating Vertical Land Motion from Long-Term Tide Gauge Records. Technical Report. Silver Spring, MD: Center for Operational Oceanographic Products and Services, National Ocean Service, NOAA.
(12) Flick, R., K. Knuuti, and S. Gill (2012) Matching mean sea level rise projections to local elevation datums. Journal of Waterway, Port, Coastal, and Ocean Engineering 139(2): 142146.
(13) Breaker, L. C., and A. Ruzmaikin (2013) Estimating rates of acceleration based on the 157-year record of sea level from San Francisco, California, U.S.A. Journal of Coastal Research 29(1): 4351. doi: http://dx.doi.org/10.2112/JCOASTRES-D-12-00048.1

(14) Church, J. A., P. Woodworth, T. Aarup, and W. S. Wilson (2007) Understanding sea level rise and variability. EOS, Transactions of the American Geophysical Union 88(4): 43.
(15) Bindoff, N. L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Qur, S. Levitus, Y. Nojiri, C. K. Shum, L. D. Talley, and A. Unnikrishnan (2007) Chapter 5, Observations: Oceanic Climate Change and Sea Level. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, eds.). Cambridge, United Kingdom, and New York, NY: Cambridge University Press. http://www.ipcc.ch/pdf/assessmentreport/ar4/wg1/ar4-wg1-chapter5.pdf
(16) NOAA 2010 National Oceanic and Atmospheric Administration (2010b) Mean Sea Level Trends, San Diego, CA. Center for Operational Oceanographic Products and Services, NOAA. http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=9410170.
(17) National Oceanic and Atmospheric Administration, Climate Program Office. http://cpo.noaa.gov/Home/AllNews/TabId/315/ArtMID/668/ArticleID/80/Global-Sea-Level-Rise-Scenarios-for-the-United-States-National-Climate-Assessment.aspx.
(18) Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, J. Hall, R. Horton, K. Knuuti, R. Moss, J. Obeysekera, A. Sallenger, and J. Weiss (2012) Global Sea Level Rise Scenarios for the U.S. National Climate Assessment. NOAA Technical Report OAR CPO-1. Washington, DC: 31 Dec 13 USACE Climate Change Adaptation Policy Statement, 3 June 2011. http://www.corpsclimate.us/docs/USACEAdaptationPolicy3June2011.pdf
(19) Climate Change Science Program (CCSP) (2009) Synthesis and Assessment Product 4.1: Coastal Sensitivity to Sea level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Program and the Subcommittee on Global Change Research [J. G. Titus (Coordinating Lead Author), E. K. Anderson, D. Cahoon, S. K. Gill, R. E. Thieler, J. S. Williams (Lead Authors)]. Washington, DC: U.S. Environmental Protection Agency. http://www.climatescience.gov/Library/sap/sap4-1/final-report/default.htm
(20) Intergovernmental Oceanographic Commission, IOC Manual on Sea Level Measurement and Interpretation (1985-2006) Volumes I-IV, http://www.psmsl.org/train_and_info/training/manuals/
(21) Zervas, C.E. (2009) Sea Level Variations of the United States, 1854-2006. National Oceanic and Atmospheric Administration, U.S. Department of Commerce, National Ocean Service, Center for Operational Oceanographic Products and Services, http://www.co-ops.nos.noaa.gov/publications/Tech_rpt_53.pdf