

A CLIMATE SERVICE IN NOAA

Connecting Climate Science to Decision Making

Vision and Strategic Framework

40 **Executive Summary**

41 Every place on Earth is sensitive to changes in climate and weather. Up to one-third of the U.S.
42 gross domestic product depends on accurate weather and climate information.¹ The local-to-
43 global-scale impacts of climate variability and change have fueled a growing public demand for
44 *climate services*—easily accessible and timely scientific data and information about climate that
45 helps people make informed decisions in their lives,
46 businesses, and communities.

47 For decades, the National Oceanic and Atmospheric
48 Administration (NOAA) and its partners have been providing
49 climate information that is essential to many aspects of policy,
50 planning, and decision-making. Climate observations,
51 monitoring, modeling, and predictions—underpinned by the
52 best available science—provide the foundation for today’s
53 climate services. Important new questions are arising about
54 how the nation can best prepare for anticipated changes in
55 climate in context with changing economic, ecological, and
56 social conditions.

57 As public and private sectors increasingly grapple with
58 complex climate-sensitive decisions, NOAA and its partners
59 in the U.S. Department of Commerce (DOC), the private
60 sector, academia, and other federal agencies will improve the
61 effectiveness of its climate services to meet growing public
62 demand for science that informs, but does not prescribe,
63 decision-making.

64 In February 2010 the U.S. DOC and NOAA announced their
65 intent to establish a Climate Service to fulfill society’s
66 growing needs for climate information and services. The
67 climate service will combine NOAA’s world-class climate
68 monitoring and modeling capabilities with a scalable new
69 partnership for sharing knowledge, increasing public
70 understanding, and building professional capacity at all levels
71 of society. NOAA expects the Climate Service to participate
72 vigorously in Federal interagency partnerships, which are vital
73 to fulfilling the demand for climate services, as each agency
74 has unique and complementary strengths. Recognizing the
75 unique roles of various agencies, a Climate Service in NOAA
76 would be well positioned to *connect climate science to*
77 *decision making*.

Climate Service Vision

By providing science and services, the Climate Service envisions an informed society capable of anticipating and responding to climate and its impacts.

To achieve this vision, the Climate Service mission is to...

Improve understanding and prediction of changes in climate and inform a climate-resilient society by:

- Monitoring climate trends, conducting research, and developing models to strengthen our knowledge of the changing climate and its impacts on our physical, economic, and societal systems
- Providing authoritative and timely information products and services about climate change, climate variability, and impacts
- Informing decision-making and management at the local, state, regional, national, and international levels

The Climate Service delivers products and services in collaboration with public, private, and academic partners to maximize social, economic, and environmental benefits.

¹ Dutton, J.A., 2002: Opportunities and Priorities in a New Era for Weather and Climate Services. *Bulletin of the American Meteorological Society*, 83, 1303-1311.

78 The establishment of the Climate Service is also an explicit recognition of the historic
79 opportunity to support a new category of economic innovation: entrepreneurs, as well as
80 established businesses, that will seek to specialize in the provision of services and products based
81 on environmental and climate data. This private climate service industry is central to the success
82 of the Climate Service. Similar to the development of the private industry around weather
83 information, the Department of Commerce expects that as better climate information is made
84 available to the public, entrepreneurs in the private sector would find opportunities to tailor
85 information to meet the unique needs of manufacturers, farmers, retailers, wholesalers, planners,
86 resource managers, and others for advice on how to adapt their business or community
87 development plans to a changing climate.

88 The Climate Service will work collaboratively with partners, including those in the DOC,² and
89 decision makers in the public and private sectors to achieve four interdependent strategic
90 objectives. The Climate Service objectives are from NOAA's Next Generation Strategic Plan
91 (NGSP):³

- 92 1. Improved scientific understanding of the changing climate system and its impacts
- 93 2. Assessments of current and future states of the climate system that identify potential
94 impacts and inform science, service, and stewardship decisions
- 95 3. Mitigation and adaptation efforts supported by sustained, reliable, and timely climate
96 services
- 97 4. A climate-literate public that understands its vulnerabilities to a changing climate and
98 makes informed decisions

99 To meet these objectives, the Climate Service will draw from NOAA's four existing climate core
100 capabilities:

- 101 1. *Observing Systems, Data Stewardship, and Climate Monitoring.* NOAA collects,
102 preserves, and analyzes the global environmental record for continuous climate
103 monitoring and for developing periodic assessments in support of climate services. This
104 readily accessible long-term archive serves the nation's need for trusted climate-related
105 data and information about the current and changing state of the climate system. This
106 capability provides the foundation for understanding the climate system; for identifying
107 and monitoring regional to global scale trends; for helping to characterize scientific
108 uncertainties; for tracking and quantifying of climate forcings, feedbacks, and their
109 impacts; and for evaluating Earth system models.
- 110 2. *Understanding and Modeling.* NOAA advances the understanding of climate variability
111 and change, and informs climate-sensitive decisions. This capability focuses on
112 developing a comprehensive understanding and description of current and future states of
113 the climate system. Analysis and modeling activities include process studies to advance

² The Department of Commerce includes the climate-relevant agencies such as the International Trade Agency, the National Institute of Standards and Technology, the Economic Development Administration, and the Census Bureau. These agencies offer considerable expertise and capability related to business and socio-economic issues.

³ NOAA's Next Generation Strategic Plan (final draft Version 5.0, October 2010).

114 predictability and assess model performance, applications of climate models to diagnosis
115 and explain climate processes, identification and interpretation of changes in climate
116 forcings, feedbacks and their impacts at global to regional scales, and characterizations of
117 the uncertainties in capabilities to measure and predict climate variability, change, and
118 impacts.

- 119 3. *Predictions and Projections.* NOAA climate predictions and projections provide
120 information on timescales from weeks to centuries. Development of climate system
121 predictions and projections focuses on improved reliability, content, and delivery to
122 support public and private sector preparedness, precautionary responses, adaptation, and
123 other climate-sensitive decisions. Ongoing assessments of the performance of climate
124 predictions and projections helps users understand skill and confidence and guides
125 internal development efforts. Experimental analysis and translation tools will be
126 developed with our stakeholders to transform model predictions and projections into
127 useful phenomenological information at the spatial and temporal scales where people
128 live, work, and manage resources.
- 129 4. *Integrated Service Development and Decision Support.* NOAA provides local to regional
130 to global decision makers with timely and relevant climate information. NOAA supports
131 partnerships to facilitate scientists and decision makers developing a shared
132 understanding of changing and varying climate conditions and using those insights to
133 inform adaptation decisions and climate policy. NOAA delivers data and information
134 streams from which climate service providers can develop decision-support tools and
135 other applications. NOAA also provides effective communication and education based on
136 an interactive dialog with the public. An ongoing process of user engagement and needs
137 assessments are used to ensure an appropriate mix of usable climate information products
138 and services are being provided.

139 The four core capabilities provide the foundation for the services the Climate Service and its
140 partners will deliver. The basic climate services currently provided by NOAA will grow and
141 evolve through the sustaining and strengthening of the Climate Service core capabilities. Since
142 many sectors and regions served through the NOAA's existing core capabilities are strongly
143 linked to missions of other federal agencies, the Climate Service will continue to work with
144 federal, state, tribal, and local partners to ensure the best possible set of climate services are
145 delivered to the nation.

146 Additionally, the Climate Service will direct investments to new services that address
147 strategically important climate-related societal challenges. New Climate Service services will
148 also strengthen elements of the existing core capabilities, thus benefitting all other services,
149 sectors, and regions. For each of the selected societal challenges, NOAA has mission
150 responsibility, expertise, established partnerships, considerable demand from stakeholders
151 interested in adaptation and mitigation, a proven track record in providing services, and
152 identified resources.

153 The Climate Service will initially focus on four societal challenges:

- 154 1. *Climate Impacts on Water Resources.* The Climate Service will improve the nation's
155 capacity to manage its water resources. Effective water resource management is critical

156 to numerous economic, social, and environmental sectors in a changing climate. For
157 example, investments in many types of infrastructure are sensitive to altered temperature
158 and changes in precipitation runoff, timing, volume, and location. The expected outcome
159 is a coordinated and authoritative early warning information system that provides
160 actionable and cost-effective guidance for the nation’s water managers from local water
161 districts to federal water agencies.

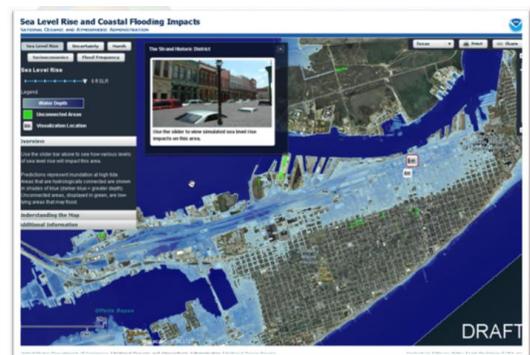
- 162 2. *Coasts and Climate Resilience.* The Climate
163 Service will characterize the physical processes
164 of climate variability and change that affect
165 coastal regions and communities such as local
166 sea-level rise and inundation. The Climate
167 Service will also promote public understanding
168 of the potential impacts that sea-level rise has on
169 communities and ecosystems. The expected
170 outcome is that decision makers have access to
171 the best available information and are proficient
172 in applying that information in ways that reduce
173 risks and vulnerabilities in their communities.
- 174 3. *Sustainability of Marine Ecosystems.* The
175 Climate Service will enhance resource managers’
176 access to, and application of, the best available
177 information to manage large marine ecosystems
178 in a changing climate. The expected outcome is
179 that federal, state, tribal, and local fisheries
180 resource managers prepare for, and respond to,
181 the impacts of climate on large marine
182 ecosystems through improved understanding of
183 how climate can alter ocean circulation and
184 composition, and how changes in ocean
185 properties impact living marine resources.
- 186 4. *Changes in the Extremes of Weather and
187 Climate.* The Climate Service will provide the
188 best available information to help the public,
189 resource managers, and policy makers anticipate,
190 prepare for, and adapt to ongoing changes in
191 weather and climate extremes and their impacts.
192 The expected outcome is the development and
193 delivery of information to prepare for and adapt
194 to weather and climate extremes—including
195 changes in frequency, intensity, seasonality, and
196 geographical distribution—on an ongoing basis.

197 Effective management of the Climate Service will be
198 necessary to ensure that the best available climate
199 information is delivered to support public and private

Example Activities: Sea Level Rise and Coastal Flooding Impacts

Coastal communities and planners have a vast exposure to the potential effects of climate variability and change. Their needs for climate services require NOAA to integrate multiple capabilities – observing, modeling, prediction, and decision support – and multiple scientific disciplines – climatology, meteorology, oceanography, economics, and social science. The Climate Service will provide an integrating foundation to bring together these capabilities and disciplines in service of the decision makers.

NOAA’s Sea Level Rise and Coastal Flooding Impacts Viewer is one example of the first steps towards an integrated tool. It provides simulations of sea level rise at local landmarks, communicates the uncertainty of mapped sea levels, models potential marsh migration, overlays social and economic data, and examines how tidal flooding will become more frequent.



In addition, the Climate Service will be well positioned to investigate critical and complex issues such as effects of weather and climate extremes on coastal communities and ecosystems.

200 sector policy, planning, and decision-making. Making the Climate Service work well will require
201 management principles, business practices, and partnerships designed to integrate NOAA's
202 climate assets in support of adaptation and mitigation decision-making. Strong leadership will
203 help create a unified Climate Service, able to deliver accessible, authoritative climate science and
204 services necessary to help the country adapt to climate variations and changes and mitigate
205 undesirable changes. A continuous process of evaluation and feedback from stakeholders will
206 ensure that the Climate Service delivers state-of-the-art information that empowers individuals
207 and governments at local, state, regional, tribal, and national levels to anticipate and to respond
208 to climate and its impacts.

209 The nation's need for climate services exceeds the scope of any individual organization or
210 agency. Accordingly, a strong framework of partnerships is key to success of the Climate
211 Service. The Climate Service will bring together diverse scientific and service communities,
212 including other parts of NOAA, federal, state, tribal and local agencies, cooperative institutes
213 and other academic partners, the private sector, non-governmental agencies, and the international
214 community.

215 Figure ES.1 illustrates the Climate Service strategic framework and the interactions between
216 climate-related societal concerns, the Climate Service core capabilities and partners, the basic
217 climate services, and the initial societal challenges. Research and service are a vital part of all
218 four capabilities but play differing roles in each capability. As climate science is a developing
219 field, the Climate Service views climate research itself as a product. The role of research in the
220 Climate Service is to add to the scientific knowledge base and its practical application, thereby
221 supporting the development of new products, new services and new industries.

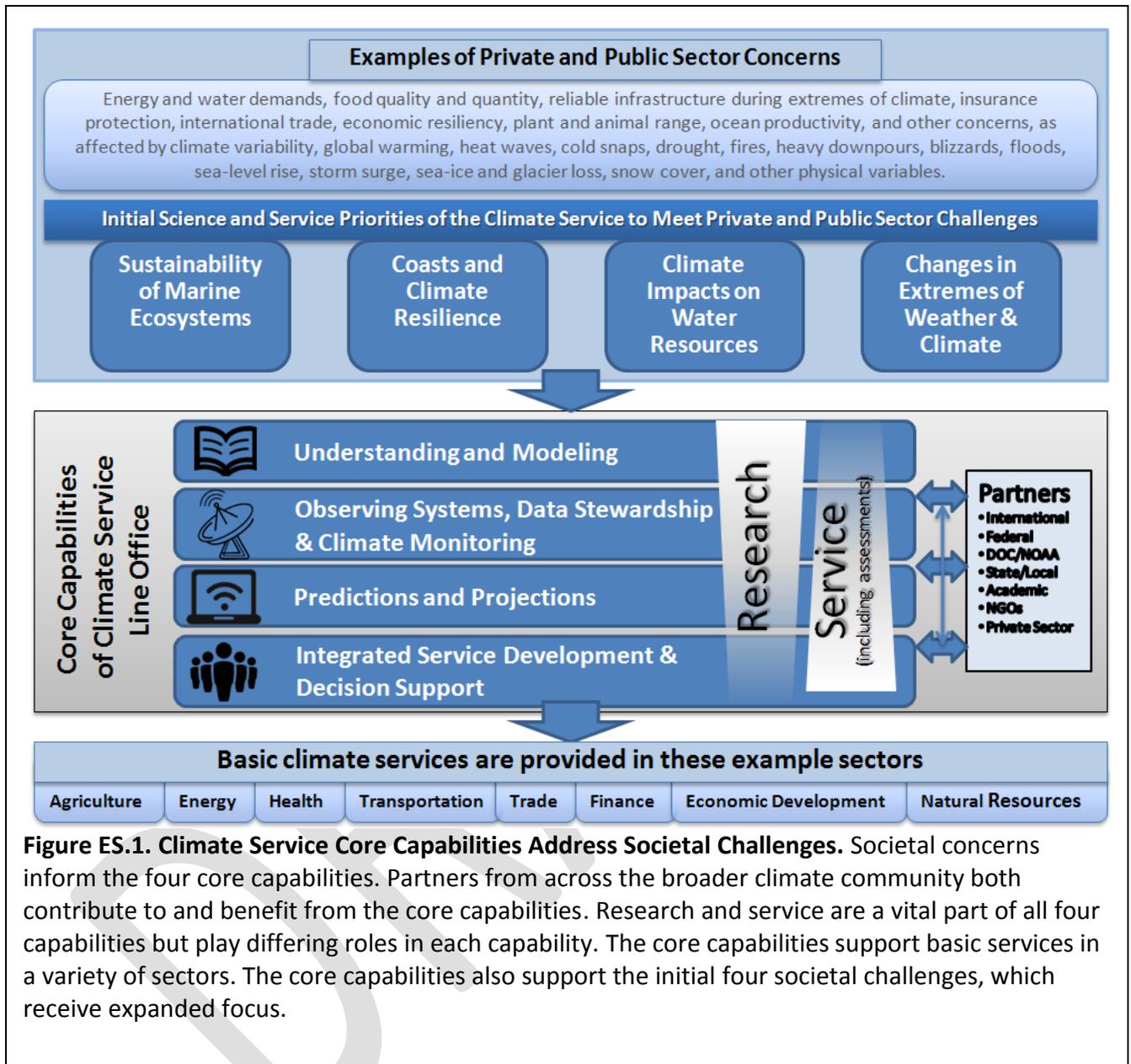


Figure ES.1. Climate Service Core Capabilities Address Societal Challenges. Societal concerns inform the four core capabilities. Partners from across the broader climate community both contribute to and benefit from the core capabilities. Research and service are a vital part of all four capabilities but play differing roles in each capability. The core capabilities support basic services in a variety of sectors. The core capabilities also support the initial four societal challenges, which receive expanded focus.

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