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This Synthesis and Assessment Product, described in the U.S. Climate Change Science Program (CCSP) Strategic Plan, was prepared in accordance with Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554) and the information quality act guidelines issued by the Department of Commerce and NOAA pursuant to Section 515 <<http://www.noaaneews.noaa.gov/stories/iq.htm>>. The CCSP Interagency Committee relies on Department of Commerce and NOAA certifications regarding compliance with Section 515 and Department guidelines as the basis for determining that this product conforms with Section 515. For purposes of compliance with Section 515, this CCSP Synthesis and Assessment Product is an “interpreted product” as that term is used in NOAA guidelines and is classified as “highly influential”. This document does not express any regulatory policies of the United States or any of its agencies, or provide recommendations for regulatory action.



Decision-Support Experiments and Evaluations using Seasonal-to- Interannual Forecasts and Observational Data: *A Focus on Water Resources*

Synthesis and Assessment Product 5.3
Report by the U.S. Climate Change Science Program
and the Subcommittee on Global Change Research

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November, 2008

Members of Congress:

On behalf of the National Science and Technology Council, the U.S. Climate Change Science Program (CCSP) is pleased to transmit to the President and the Congress this Synthesis and Assessment Product (SAP) *Decision-Support Experiments and Evaluations using Seasonal-to-Interannual Forecasts and Observational Data: A Focus on Water Resources*. This is part of a series of 21 SAPs produced by the CCSP aimed at providing current assessments of climate change science to inform public debate, policy, and operational decisions. These reports are also intended to help the CCSP develop future program research priorities.

The CCSP's guiding vision is to provide the Nation and the global community with the science-based knowledge needed to manage the risks and capture the opportunities associated with climate and related environmental changes. The SAPs are important steps toward achieving that vision and help to translate the CCSP's extensive observational and research database into informational tools that directly address key questions being asked of the research community.

This SAP evaluates decision support experiments that have used seasonal-to-interannual forecasts and observational data. It was developed with broad scientific input and in accordance with the Guidelines for Producing CCSP SAPs, the Information Quality Act (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554)), and the guidelines issued by the Department of Commerce and the National Oceanic and Atmospheric Administration pursuant to Section 515.

We commend the report's authors for both the thorough nature of their work and their adherence to an inclusive review process.

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CCSP Synthesis and Assessment Product 5.3 (SAP 5.3) was developed with the benefit of a scientifically rigorous, first draft peer review conducted by a committee appointed by the National Research Council (NRC). Prior to their delivery to the SAP 5.3 Author Team, the NRC review comments, in turn, were reviewed in draft form by a second group of highly qualified experts to ensure that the review met NRC standards. The resultant NRC Review Report was instrumental in shaping the revised version of SAP 5.3, and in improving its completeness, sharpening its focus, communicating its conclusions and recommendations, and improving its general readability. We wish to thank the members of the NRC Review Committee: Soroosh Sorooshian (Chair), Departments of Civil and Environmental Engineering and of Earth System Science, University of California, Irvine; Kirstin Dow, Department of Geography, University of South Carolina, Columbia; John A. Dracup, Department of Civil and Environmental Engineering, University of California, Berkeley; Lisa Goddard, International Research Institute for Climate and Society, Columbia University; Michael Hanemann, Department of Agricultural and Resource Economics, University of California, Berkeley; Denise Lach, Department of Sociology, Oregon State University, Corvallis; Doug Plasencia, Michael Baker, Jr., Inc., Phoenix, Arizona; Paul C. Stern, Study Director; Jennifer F. Brewer, Staff Officer; and Linda Depugh, Administrative Assistant.

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Faced with mounting pressures from a changing climate, an increasing population, a transitory populace, and varying access to available natural resources, decision makers, scientists, and resource managers have an immediate need to understand, obtain, and better integrate climate forecasts and observational data in near- and long-term planning. Reducing our societal vulnerability to variabilities and changes in climate depends upon our ability to bridge the gap between climate science and the implementation of scientific understanding in our management of critical resources, arguably the most important of which is water. Our ability to adapt and respond to climate variability and change depends, in large part, on our understanding of the climate and how to incorporate this understanding into our resource management decisions. This Product focuses on the connection between the scientific ability to predict climate on seasonal scales and the opportunity to incorporate such understanding into water resource management decisions. It directly addresses decision support experiments and evaluations that have used seasonal-to-interannual forecasts and observational data, and is expected to inform (1) decision makers about the relative success of experiences of others who have experimented with these forecasts and data in resource management; (2) climatologists, hydrologists, and social scientists on how to advance the delivery of decision-support resources that use the most recent forecast products, methodologies, and tools; and (3) science and resource managers as they plan for future investments in research related to forecasts and their role in decision support. It is important to note, however, that while the focus of this Product is on the water resources management sector, the findings within this Synthesis and Assessment Product may be directly transferred to other sectors.

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Report Motivation and Guidance for Using this Synthesis/Assessment Report

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P.1 MOTIVATION AND GUIDANCE FOR USING THIS SYNTHESIS AND ASSESSMENT PRODUCT

The core mission of the U.S. Climate Change Science Program (CCSP) is to “Facilitate the creation and application of knowledge of the Earth’s global environment through research, observations, decision support, and communication”. To accomplish this goal, the CCSP has commissioned 21 Synthesis and Assessment Products to summarize current knowledge and evaluate the extent and development of this knowledge for future scientific explorations and policy planning.

These Products fall within five goals, namely:

1. Improve knowledge of the Earth’s past and present climate and environment, including its natural variability, and improve understanding of the causes of observed variability and change;
2. Improve quantification of the forces bringing about changes in the Earth’s climate and related systems;
3. Reduce uncertainty in projections of how the Earth’s climate and environmental systems may change in the future;
4. Understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes; and
5. Explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change.

CCSP Synthesis and Assessment Product 5.3 is one of three products to be developed for the final goal.

This Product directly addresses decision-support experiments and evaluations that have used seasonal-to-interannual forecasts and observational data, and is expected to inform (1) decision makers about the experiences of others

who have experimented with these forecasts and data in resource management; (2) climatologists, hydrologists, and social scientists on how to advance the delivery of decision-support resources that use the most recent forecast products, methodologies, and tools; and (3) science and resource managers as they plan for future investments in research related to forecasts and their role in decision support.

P.2 BACKGROUND

Gaining a better understanding of how to provide better decision support to decision and policy makers is of prime importance to the CCSP, and it has put considerable effort and resources towards achieving this goal. For example, within its Strategic Plan, the CCSP identifies decision support as one of its four core approaches to achieving its mission¹. The plan endorses the transfer of knowledge gained from science in a format that is usable and understandable, and indicates levels of uncertainty and confidence. CCSP expects that the resulting tools will promote the development of new models, tools, and methods that will improve current economic and policy analyses as well as advance environmental management and decision making.

CCSP has also encouraged the authors of the 21 Synthesis and Assessment Products to support informed decision making on climate variability and change. Most of the Synthesis and Assessment Products’ Prospectuses have outlined efforts to involve decision makers, including a broad group of stakeholders, policy makers, resource managers, media, and the general public, as either writers or as special workshop/meeting participants. Inclusion of decision makers in the Synthesis and Assessment Products also helps to fulfill the requirements of the Global Change Research Act (GCRA) of 1990 (P.L. 101-606, Section 106), which directs the program

¹ The four core approaches of CCSP include science, observations, decision support, and communications.

to “produce information readily usable by policymakers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of global change” and to undertake periodic science “assessments”.

In November 2005, the CCSP held a workshop to address the potential of those working in the climate sciences to inform decision and policy makers. The workshop included discussions about decision-maker needs for scientific information on climate variability and change. It also addressed future steps, including the completion of this and other Synthesis and Assessment Products, for research and assessment activities that are necessary for sound resource management, adaptive planning, and policy formulation. The audience included representatives from academia; governments at the state, local, and national levels; non-governmental organizations (NGOs); decision makers, including resource managers and policy developers; members of Congress; and the private sector.

P.3 FOCUS OF THIS SYNTHESIS AND ASSESSMENT PRODUCT

In response to the 2003 Strategic Plan for the Climate Change Science Program Office, which recommended the creation of a series of Synthesis and Assessment Product reports, the National Oceanic and Atmospheric Administration (NOAA) took responsibility for this Product. An inter-agency group comprised of representatives from NOAA, National Aeronautics and Space Administration, U.S. Environmental Protection Agency, U.S. Geological Survey and National Science Foundation wrote the Prospectus² for this Product and recommended that this Synthesis and Assessment Product should concentrate on the water resource management sector. This committee felt that focusing on a single sector would allow for a detailed synthesis of lessons learned in decision-support experiments within that sector. These lessons, in turn, would be relevant, transferable, and essential to other climate-sensitive resource management sectors. Water resource management was selected, as it was the most relevant of the sectors proposed and would be of interest to all agencies participating in this process. The group wrote a Prospectus and posed a series of questions that they felt the CCSP 5.3 Product authors should address in this Report. Table 1.2 lists these questions and provides the location within the Synthesis and Assessment Product where the authors addressed them.

P.4 THE SYNTHESIS AND ASSESSMENT WRITING TEAM

This study required an interdisciplinary team that was able to integrate scientific understandings about forecast and data products with a working knowledge of the needs of water resource managers in decision making. As a result, the team included researchers, decision makers, and federal government employees with varied backgrounds in the social sciences, physical sciences, and law. The authors were identified based on a variety of considerations, including their past interests and involvements with decision-support experiments and their knowledge of the field as demonstrated by practice and/or involvement in research and/or publications in refereed journals. In addition, the authors held a public meeting, in January 2007, in which they invited key stakeholders to discuss their decision support experiments with the committee. Working with authors and stakeholders with such varied backgrounds presented some unique challenges including preconceived notions of other disciplines, as well as the realization that individual words have different meanings in the diverse disciplines. For example, those with a physical science background understood a more quantifiable definition for the words ‘confidence’ and ‘uncertainty’ than the more qualitative (*i.e.*, behavioral) view of the social scientists.

The author team for this Product was constituted as a Federal Advisory Committee in accordance with the Federal Advisory Committee Act of 1972 as amended, 5 U.S.C. App.2. The full list of the author team, in addition to a list of lead authors provided at the beginning of each Chapter, is provided on page 3 of this Report. The editorial staff reviewed the scientific and technical input and managed the assembly, formatting, and preparation of the Product.

² The Prospectus is posted on the Climate Change Science Program website at: <http://www.climatechange.gov>.