INTRODUCTION

This Synthesis and Assessment Product (SAP), "Uses and Limitations of Observations, Data, Forecasts, and Other Projections in Decision Support for Selected Sectors and Regions" (SAP 5.1), examines the current and prospective contribution of Earth science information/data in decision-support activities and their relationship to climate change science. The SAP contains a characterization and catalog of observational capabilities in an illustrative set of decision-support activities. It also contains a description of the challenges and promises of these capabilities and discusses the interaction between users and producers of information, including the role, measurement, and communication of uncertainty and confidence levels associated with decision-support outcomes and their related climate implications.

The organizing basis for the chapters in this SAP is the decision-support tools (DST), which are typically computer-based models assessing such phenomena as resource supply, the status of real-time events (e.g., forest fires and flooding), or relationships among environmental conditions and other scientific metrics (for instance, water-borne disease vectors and epidemiological data). These tools use data, concepts of relations among data, and analysis functions to allow analysts to build relationships (including spatial, temporal, and process-based) among different types of data, merge layers of data, generate model outcomes, and make predictions or forecasts. DSTs are an element of the broader decision-making context—the Decision-Support System (DSS). DSSs include not just computer tools but also the institutional, managerial, financial, and other constraints involved in decision making.

Our approach to this SAP is to define and describe an illustrative set of DSTs in areas selected from topics deemed nationally important and included in societal benefit areas identified by the intergovernmental Group on Earth Observations (GEO) in leading an international effort to build a Global Earth Observation System of Systems (GEOSS). The areas we have chosen as our focus are air quality, agricultural efficiency, energy management, water management, and public health. The DSTs we characterize are:

1. The Production Estimate and Crop Assessment Division (PECAD) and its Crop Condition Data Retrieval and Evaluation (CADRE) system of the United States (U.S.) Department of Agriculture (USDA), Foreign Agricultural Service (FAS). PECAD/CADRE is the world's most extensive and longest running (over two decades) operational user of remote sensing data for evaluation of worldwide agricultural productivity.
2. The Community Multiscale Air Quality (CMAQ) modeling system of the U.S. Environmental Protection Agency (EPA). CMAQ is a widely used, U.S. continental/regional/urban-scale air quality DST.
3. The Hybrid Optimization Model for Electric Renewables (HOMER), a micropower optimization model of the U.S. Department of Energy's National Renewable Energy Laboratory (NREL). HOMER is used around the world to optimize deployment of renewable energy technologies.
4. The DSS to Prevent Lyme Disease (DSSPL) of the U.S. Centers for Disease Control and Prevention (CDC) and Yale University. DSSPL seeks to prevent the spread of the most common vector-borne disease, Lyme disease, of which there are tens of thousands of reported cases annually in the U.S.
5. RiverWare, a system developed by the University of Colorado-Boulder's Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) in collaboration with the Bureau of Reclamation, Tennessee Valley Authority, and the Army Corps of Engineers, is a hydrologic or river basin modeling system that integrates features of reservoir systems, such as recreation, navigation, flood control, water quality, and water supply, in a basin management tool with power system economics to provide basin managers and electric utilities with a method of planning, forecasting, and scheduling reservoir operations.

Taken together, these DSTs demonstrate a rich variety of applications of observations, data, forecasts, and other predictions. In four of our studies—agricultural efficiency, air quality, water management, and energy management—the DSTs have become well established as a basis for public policy decision making. In the case of public health, our lead author points out reasons why direct applications of Earth observations to public health have tended to lag behind these other applications and, thus, is a relatively new applications area. He also reminds us that management of air quality, agriculture, water, and energy—in and of themselves—have implications for the quality of public health. The DST selected for public health is a new and emerging tool intended to assist in the prevention of the spread of infectious disease.

With the exception of DSSPL, none of the DSTs we considered for potential selection, nor those we discuss in this report, have to date made extensive use of climate change information or been used to study the effect of a changing climate. However, in all cases, the developers and users of these DSTs fully recognize their applicability to climate change science. In the discussion of the five DSTs presented in this SAP, the authors describe how reliable climate data and/or predictions might be used in these DSTs so that long-range decisions and planning might be accomplished.

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