

DECISION SUPPORT IN NOAA'S NATIONAL WEATHER SERVICE

Fiona Horsfall[†], Jim Laver^{**}, Peter Schultz^{***}

^{*}NOAA/NWS/OCWWS/Climate Services Division, Silver Spring, MD

^{**}NOAA/NWS/NCEP/CPC, Camp Springs, MD

^{***}U.S. Climate Change Science Program, Washington, DC

1. INTRODUCTION

The National Weather Service (NWS), a line office within the National Oceanic and Atmospheric Administration (NOAA), has a mission to provide other governmental agencies, the private sector, the public, and the global community with data and "...weather, hydrologic, and climate forecasts and warnings....for the protection of life and property and the enhancement of the national economy." As a service organization, these pro forma activities are rarely recognized as decision support services. They are, however, products and services to help all sectors of this Nation and beyond make decisions -- whether these are immediate decisions when life is threatened, or longer-term decisions for seasonal or longer planning. In some cases, NWS products serve as decision support "tools." This paper proposes definitions distinguishing between climate decision support services and decision support tools, and provides a few illustrations of NWS' provision of both types.

2. CLIMATE DECISION SUPPORT SERVICES AND TOOLS

The U.S. Climate Change Science Program (CCSP) Strategic Plan (CCSP, 2003) provides the following overarching definition of decision support resources:

"the set of analyses and assessments, interdisciplinary research, analytical methods (including scenarios and alternative analysis methodologies), model and data product development, communication, and operational services that provide timely and useful information to address questions confronting policymakers, resource managers and other stakeholders."

This definition encompasses tools and services produced by both the research and operational climate communities. A more general definition currently in use at CCSP describes decision support resources, systems, and activities as climate-related

products or processes that directly inform or advise stakeholders to help them make decisions.

In 2001, the Board on Atmospheric Science and Climate of the National Research Council (NRC, 2001) defined climate services as:

"[T]he timely production and delivery of useful climate data, information, and knowledge to decision makers."

The term "decision maker" describes "...anyone who uses climate information in the decision process...." This definition can be translated into decision support services in that it articulates climate support to aid in the decision making process. An important implication of this definition is that decision support service is associated with providing information to stakeholders to help them make decisions. Such decisions may range from those that hinge very tightly on climate information to those in which climate is only one of many considerations. Support for these diverse types of decisions can be provided in a wide range of ways, including through oral communication, provision of data, delivery of reports, etc. Examples of providers of such services are State Climate Offices and Federal agencies, such as USDA, Natural Resource Conservation Service, and NWS

One aspect of decision support service is the provision of decision support tools that aid in the making of one or more specific decisions. Typically, a set of options already exists; *the tools help evaluate those options by framing the information available and making it relevant to the decision at hand.* A climate product can serve as a *tool* when information is framed into a product specifically relevant to decision makers to enable them to assess risk, evaluate costs and make choices for options relevant to their decisions. The tools are very often models, studies, reports, etc., that when properly structured or packaged, are clearly applicable to a set of problem choices. NOAA's Regional Integrated Sciences and Assessments (RISA) program supports research the development of tools that aid in regional decision making processes. The Southeast Climate Consortium, for example, is funded by the RISA program and has a mission which includes "...to provide scientifically sound information and decision support tools for agriculture, forestry, and water resources management in the Southeastern USA." (Southeast Climate Consortium). The tools they have

^{*}Corresponding author address: Fiona Horsfall, W/OS4, National Weather Service, 1325 East West Highway, Silver Spring, MD 20910 email: Fiona.Horsfall@noaa.gov

developed through their research activities range from crop simulation models to cattle heat stress forecasts.

3. DECISION SUPPORT SERVICES AND TOOLS IN NWS

NWS climate products and services range from assessments of the state of the El Niño Southern Oscillation (ENSO) phenomenon to Local 3-Month Temperature Outlooks (L3MTO). The ENSO-related products (Climate Prediction Center – CPC) include a broad array of information, from sea surface temperatures (SST) to outgoing longwave radiation (OLR), as well as expert discussions and updates on the potential for evolution of an El Niño event and related impacts. Of 57 responses from World Meteorological Organization Member States to a survey requesting information on indices and definitions in use operationally, approximately 61% rely on NWS products officially (16% reported no definitions in use) (Horsfall, 2006). Unofficially, many countries reported reviewing these products to assess their potential impacts or gain more information on the current state of ENSO (personal communications, 2004-2006), with the ultimate goal of providing their respective governments timely information to help make decisions. Indeed, many rely on these timely products provided by CPC as a source of decision support, and the products therefore contribute to NWS decision support services.

The L3MTO products (NWS website) extend NWS decision support services to the regional and local level. They provide basic and valuable information as a service that can be used by the public and private sectors to build tools to aid decision makers in managing risks and opportunities. The products were developed in response to customer demand for more relevant climate information that they could incorporate into their decision-making processes.

Another notable decision support service for the public is the Drought Monitor. NWS partners with other NOAA offices, the U.S. Department of Agriculture, and the National Drought Mitigation Center in the development of the Drought Monitor (<http://www.drought.unl.edu/dm/monitor.html>), which is an assessment of the state of drought nationally. This again is a decision support information block that provides fundamental information to users for incorporation into decision support tools.

NWS products serve as tools when the information provided is so basic that little or no further information needs to be incorporated for decision making. An example is information that elicits an immediate response, such as a tornado warning in which the information is the only variable incorporated into a “model.” The model is a decision maker him/herself who may have defined options (go to basement, leave house, seek shelter) in response to

a type of information (tornado warning). In this case, the NWS information can be regarded as the decision support tool. An NWS climate product or service is a decision support tool if the information provided is used directly to make a decision without input of any other product or service. The Drought Monitor may serve as a decision support tool to a user who determines whether or not to respond to drought conditions based on the information in the Drought Monitor.

In the case of a climate forecast, the information provided in this service is presented in a product that is used as input to a specific tool. Forecast products are incorporated into models that are tailored to provide more specific information to a stakeholder. For example, Yang (2006) uses CPC forecast products for July to August in assessing the risk of soybean rust (a fungus) in the Gulf Coast regions, but this is not the only factor used in determining the risk to crops, as the occurrence of soybean rust during the previous spring in the Gulf region contributes to the assessment, as well as the northward movement of soybean rust spores.

Generally, NWS products are fundamental building blocks on which an infinite number of tools can be based to help various sectors, such as the soybean rust example and others in insurance, energy, agriculture, tourism, water, fire management, and even commerce. The tools themselves can incorporate many variables; for example, in a model to determine crop planting geographies, inputs may include information on supply, potential demand, herbicides, costs, harvest time, disease risk, availability of labor, as well as NWS climate information. NWS climate outlooks and forecasts provide essential information for plant disease forecasting, resource allocation, drought, and flood monitoring for agricultural purposes (Pasteris et al, 2004).

4. SUMMARY

Decision support resources incorporate a broad array of information sources, from research activities to analyses and assessments to services and tools. In this paper, decision support services are defined as services that provide information to stakeholders to help them make decisions, and include oral communication, reports, data, and products that aid in this function. Decision support tools are tools that help evaluate options by framing the information available and making it relevant to specific decisions. NWS provides its customers with decision support services, and in some cases, tools. The next step is identifying how to build on NWS decision support resources to make them more effective for delivery of climate-related information to manage risks and opportunities. Currently, customer surveys and product feedback mechanisms are in place, and partnerships with the research community, especially through the RISA

program, to identify more effective methodologies have resulted in more user-friendly services.

5. REFERENCES

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