Experiences in Bridging the Gap Between Science and Decision Making at NASA’s GES DISC Earth Science Data and Information Services Center (GES DISC)

Steve Kempler*, Bill Tang, Lawrence Fried, Chinu Lynn, Gregory Lepistalo

NASA Goddard Space Flight Center, NASA Goddard Space Flight Center/SEDIA, NASA Headquarters

Steven.J.Kempler@nasa.gov

**Abstract**

- Recognizing the significance of NASA remote sensing Earth science data in monitoring and better understanding our planet’s natural environment, NASA has implemented the ‘Decision Support Through Earth Science Research Results’ program (NASA ROSS) solicitations.
- This successful program has yielded several monitoring, surveillance, and decision support systems through collaborations with benefiting organizations.
- The Goddard Space Flight Center (GSFC) Earth Sciences Data and Information Services Center (GES DISC) has participated in this program on two projects (one completed, one ongoing), and has had opportunity to address collaborations gaining much experience in the formulation, management, development, and implementation of decision support systems utilizing NASA Earth science data.
- In addition, GES DISC’s understanding of Earth science missions and resulting data and information, including data structures, data usability and interpretation, data interoperability, and information management systems, enables the GES DISC to identify challenges that come with bringing science data to decision makers.
- The purpose of this presentation is to share GES DISC decision support system project experiences in regards to system sustainability, required data quality (versus timeliness), data provider understanding of how decisions are made, and the data receiver willingness to use new types of information to make decisions, as well as other topics. In addition, defining metrics that ‘really’ evaluate success will be exemplified.

**NASA’s ‘Decision Support Through Earth Science Research Results’ Program**

NASA’s Applied Research Program focuses on extending Earth science research results to decision making activities. Through the ‘Decision Support Through Earth Science Research Results’ proposal solicitation, NASA has strives to develop and demonstrate innovative and practical applications of NASA Earth science observations and research in eight applications areas for the purpose of improving decision making activities.

- Agricultural
- Air Quality
- Climate
- Disaster Management
- Ecological Forecasting
- Public Health
- Water Resources
- Weather (Aviation)

**Using NASA TRMM Precipitation Data for Monitoring Crop Conditions**

Using NASA TRMM Precipitation Data for Monitoring Crop Conditions

http://disc.gsfc.nasa.gov/document/funded/568

The GES DISC’s Agricultural Information System (AIS) provides NASA environmental data and information to support global crop monitoring at the U.S. Department of Agriculture (USDA) Foreign Agricultural Service (FAS) and the U.N. World Food Program (WFP). The primary goal of FAS is to improve foreign market access for U.S. agricultural products. The WFP uses food monitoring to meet emergency needs and to support economic and social development.

**Using NASA Soil Moisture Data in NASA/NOAA Land Surface Models to Enhance the National Weather Service River Forecast System (NWSRFS)**

Using NASA Soil Moisture Data in NASA/NOAA Land Surface Models to Enhance the National Weather Service River Forecast System (NWSRFS)

Funded by NASA/RASER DECISIONS/ENHANCEMENTS, Feb 2009, currently with the Indiana University Purdue University Indianapolis (IUPUI)

This project focuses on improving stream temperature (ST) inputs to the NWSRFS, a sub-Decision Support System of the NWS’s Advanced Weather Interactive Processing System (AWIPS). By integrating NASA’s Aquatic-AMS-R and TRMM/MTI soil moisture products into land surface models that provide improved ST data seamlessly to the NWSRFS, the capability for flood and drought forecasting and water resource management is expected to be greatly enhanced. The project focuses on the Ohio River Forecast Center (ORFC), for which floods and droughts are two major natural hazards that have significant impacts on the region’s agriculture, industries, commercial navigation, and residential communities.

**The Use of Science Data for Decision Making**

<table>
<thead>
<tr>
<th>For Science</th>
<th>For Decision Making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeliness availability</td>
<td>Not urgent for se research</td>
</tr>
<tr>
<td>System Sustainability</td>
<td>Part of Science</td>
</tr>
<tr>
<td>Data Documented</td>
<td>Algorithms; product description</td>
</tr>
<tr>
<td>Data Requirement</td>
<td>Science data to science decision making</td>
</tr>
<tr>
<td>Desired Display/representation</td>
<td>Clear concept</td>
</tr>
<tr>
<td>Spatial and Temporal of Data</td>
<td>Data for analysis; Image browse</td>
</tr>
<tr>
<td>Data Validation</td>
<td>Highest quality</td>
</tr>
</tbody>
</table>

**Bridging the Gap - Challenges**

- Translating science data for decision support systems
- Understanding the decision space to determine relevant science data inputs to decision making
- Determining the best way to communicate science content to decision makers
- Determining the appropriate selection of decision makers
- Providing data formats that can be easily understood and transparently used by the decision makers
- Co-registering science data with application data
data (often collected by boundary region, e.g., states)
- Determining the right balance: Highly validated data vs. acceptable lower validated data
- How highly validated do NASA data need to be?
- How will data (or images) be used?
- Maintaining information systems to sustain the operational decision making system: New data sets, new tools, new technologies
- Meeting required spatial and temporal resolution to facilitate decision making
- Changing the decision making tools paradigm by demonstrating the benefits to decision making organizations of employing new tools and technologies
- Maintaining continuous near real time science data inputs to decision makers. (i.e., Maintaining the timeliness of data for making decisions)
- Overcoming inertia in the decision making environment.
- Integrating new data and technologies seamlessly into an operational environment
- Continuity of NASA data

**Bridging the Gap - Mitigations**

- Keep method of data transfer flexible, to avoid the project of the latest technology advances
- Acquire deep understanding of the decision-making environment (DMF) and needs (i.e., follow the consumption chains from usage scenarios back to relevant data)
- Strive for seamless as possible an integration of project data and services into existing DMF
- As much as possible, get stakeholders to really feel they have a stake in the project. The reason for this is that the project should come from the DME as well as the provision of project data services
- Plan for possible changes to the proposed collaboration; DMF are operational and their needs could change
- Involve the expertise of science data providers (e.g., algorithm developer), preferably as members of the collaboration
- Plan for training in use of science data and services by DME personnel
- Transition DME into a sustainable framework
- Build for low maintenance costs
- Understand upfront, with the decision making organization, how the DME will be sustained
- Should be designed from the beginning to be integrated with the decision making organization systems
- Document the DME: Development and operations

**Bridging the Gap - Metrics for Success**

- Science data arrives on time to be utilized for decision support at a percent of the time to be specified by the decision making organization
- Science data utilization in the decision support system results in a marked improvement in prediction correctness. Before and after prediction analysis should be planned
- Science data are routinely used by a specified percent of the decision making organization’s staff
- Number of references, reports, or publications that cite science data as input to decision making process
- Is this success? Number of new potential decision support users of NASA science data based on previous success
- Emerging opportunity to further collaborate (e.g., requesting additional useful science data products)
- Formalizing data interfaces and science data transfers due to growing dependency on the data

**Suggestions?**

E-mail: Steven.J.Kempler@nasa.gov

---

https://ntrs.nasa.gov/search.jsp?R=20090011241 2018-04-09T23:54:14+00:00Z