

Summary

Second Workshop of the Coordination Group for Meteorological Satellites Socioeconomic Benefits Tiger Team (SETT)



Credit: NOAA

January 20 – 21, 2015
Silver Spring, MD

Prepared by M.Kutny
February 2015

EXECUTIVE SUMMARY

The purpose of the Coordination Group for Meteorological Satellites (CGMS) Socioeconomic Benefits Tiger Team (SETT) is to develop credible methodology and common terminology for articulating the socio-economic benefit of satellite observing systems, and explore the most effective ways to communicate this information to desired stakeholders. On 20-21 January 2015, representatives of CGMS member organizations were joined by economists and representatives of the private sector for the Second CGMS SETT Workshop in Silver Spring, MD. The goal of the workshop was to initiate the CGMS SETT case study and develop a plan for execution of the study. The objective of the case study is to demonstrate the approaches and best practices for conducting socioeconomic benefit studies for CGMS members. Some of these approaches were outlined in the findings of the [first CGMS SETT Workshop](#).

The workshop's primary objectives were to:

- Gain a detailed understanding of the CGMS SETT proposed case study and its assumptions;
- Learn from the example of an operational entity on its methods to satisfy end user requirements including the role satellite data plays in advancing operational products and services;
- Evaluate the degree to which a quantitative economic analysis can best be incorporated in addition to the assessment of qualitative societal impacts;
- Identify opportunities and constraints to case study progress; and
- Agree upon next steps required to determine case study scope, participant contributions, and timeline for case study completion.

This workshop summary captures key outcomes and discussions from the workshop. It is not intended to be a transcript of every point made. Links to speaker presentations are provided in the Annex 2: Workshop Agenda. The summary is organized into the following sections:

- Executive Summary
- Workshop Overview
 - Case Study Discussion
 - Guidance Document Discussion
- Action Plan and Recommendations
- Annex 1: Case Study as proposed for the workshop
- Annex 2: Workshop Agenda
- Annex 3: Participant List

WORKSHOP OVERVIEW

Day One of the Workshop began with welcome remarks and introductory presentations that set the stage for the discussions that would shape the SETT's path forward. NOAA Satellite and Information Service Deputy Assistant Administrator Mark Paese welcomed participants to the workshop. As the leader of one of the CGMS members, Mr. Paese remarks helped shape the day's discussions by providing insight into the establishment of the SETT, and the types of information that would be most relevant and useful for CGMS members. David Yoskowitz, the NOAA Chief Economist, provided information on NOAA's current social science efforts and how they may relate to the work of the SETT.

Following the welcome remarks, CGMS SETT Chair Chuck Wooldridge began by outlining the CGMS SETT terms of reference, SETT accomplishments and discussions to date, and next steps as we approach the 43rd CGMS Plenary in May 2015. Ajay Mehta of NOAA's Joint Polar Satellite System (JPSS) highlighted the key findings of the program's recent economic benefit study highlighting some of the key challenges encountered during the process. And, Dr. Stephan Bojinski of the World Meteorological Organization (WMO) Space Program provided context to WMO polar activities with an overview of Global Cryosphere Watch and Polar Space Task Group.

Molly Brown from the University of Maryland and Vanessa Escobar of NASA introduced the proposed case study, and Pablo Clemente-Colon, Chief Scientist for NOAA's National Ice Center, provided additional context outlining the National Ice Center's operations and data requirements. A robust discussion helped to hone the proposed scope and improve the group's understanding of the challenges the case study may present.

NOAA Chief Economist David Yoskowitz moderated a panel of economists including Richard Bernknopf from the University of New Mexico, Jeff Lazo from NCAR, and Molly Macauley from Resources for the Future. The economists provided recommendations and key considerations for the design, development and execution of the case study highlighting lessons learned from past economic analyses, outlining data and resource requirements for the conduct of the case study, and weighing the relative merits of various economic methods and approaches.

The economists' recommendations and considerations – supplemented by a presentation from Jeff Lazo on a planned WMO publication "Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services" - shaped Day Two's discussions and the participant's recommendations regarding case study design and what would be most useful as a guidance document.

CASE STUDY DISCUSSION & RECOMMENDATIONS

On Day One, participants discussed the challenges and opportunities that may be created by the case study proposal (*Annex 1*), "Understanding and Assessing the Value of Improved Satellite Data for the Users of Operational Sea Ice Products and Information."

The scientists discussed a number of considerations in evaluating the proposed case study, including:

- Understanding the relative importance of various data sources (national and international, commercial and government) to the development of operational sea ice information products;
- Merits of focusing on operational forecasts over research or climate forecasts given the largely operational focus of the CGMS members;
- Role of scientific information in the development of the Polar Code;
- Merit of evaluating the value of existing systems or future systems;
- Consider addressing a broader set of observations than those listed in the original proposal (*Annex 1*) to increase relevance across U.S. and international agencies.

The economists made a number of recommendations the SETT should consider when designing and conducting a case study.

- Success depends on the ability to understand and to articulate how the information product is used in a decision and how the outcome can be improved (e.g. In terms of spatial, spectral, temporal resolution) with its addition relative to without the information (e.g. increased accuracy or precision, improved confidence, decreased uncertainty, etc.). In this microeconomics approach, economic analysis measures the value of the incremental change in the Earth observation (EO) information (i.e. data denial or counterfactual option)
 - Consider constructing a chart/information flow diagram of the EO data that are linked and used as input to sea ice information products, and to determine who can provide information about how those products impact decision making. Then the value of the new information can be measured as value-in-use. For example, if an observation contributes to a reduction in forecast error – what is the end user able to accomplish or how can the end user conduct business more efficiently?
- Understand the purpose of conducting the study. In this case, given the purpose and audience, the process may matter more than the results.
 - However, the economists did state that typically an agency would want to undertake a study that is relevant and not so small as to be insignificant. They cautioned that in this case currently less than 100 ships per year operate in the Arctic.
- The topic of Arctic sea ice information could lend itself to a bottom up (microeconomic) approach to the case study.
 - In this case the numbers may be small, but it would likely produce a methodology that is tractable.
 - Framing is critical. A successful bottom up study will require access to data, information on decision making, and a decision/outcome that is sensitive to changes in the observation being analyzed.
 - However, it is difficult to scale up a bottom-up study, aggregation is challenging.
- An example of societal impact could be the use of sea ice information products by tribal communities.
- Recognize the national decisions regarding investments in observational systems can be driven by qualitative considerations as well as economic benefits (e.g. national security, enhanced national technology development capacity, etc.)
- Important to understand the timeframe over which the benefits accrue.
- Value of information questions are a growing area of concern and the proposed study could fit this model well – could have a value-in-use study to evaluate the information in a decision framework.
- Given CGMS members are primarily government agencies, the SETT may wish to focus its case study on a government function (e.g. disaster risk reduction or response) rather than a private sector good.
 - Given regulatory cost effectiveness is not as relevant to CGMS Members, disaster response may be a more relevant case study example than a focus on the Polar Code.
 - Could consider a counterfactual (i.e., impact of absent information) in evaluating rapid response for tactical operations and prevention purposes.
- Be sure the audience for the study is sufficiently well-defined.

In addition, they provided questions that could help determine whether the proposed study has the attributes of a strong case study including:

- Is the economic model generalizable enough to be useful in other contexts?
- Does sufficient data exist to conduct an empirical analysis?
- Is the case study meant to inform a near-term decision? If so, that may adversely impact the timeline and scope of the SETT case study or lead to inappropriate application of the results. It may also introduce challenges due to political sensitivities.

- Can it be simplified through a set of tenable, defensible assumptions, and can it be subjected to a sensitivity test(s)?

As a result of the discussions on Day One the recommendation was to adjust the study objective to focus more specifically on the benefits of remote sensing observations via sea ice information products used by ship operators in the Arctic for rapid response to adverse events. Which operators/end users, product(s), and observations will be evaluated will be determined after consultation with the National Ice Center and end users.

On Day Two, Molly Brown presented a revision of the original proposal and the participants recommended the following next steps for the case study:

- **Develop and Finalize a Case Study Design** recognizing the need to:
 - Include a plan to determine which products(s) are used by decision-makers (e.g. ship operators) and how the product(s) impacts decision making and the outcomes;
 - Consider potential options for soliciting information from end users:
 - Informal listening session(s) could be used to gather general information needed for case study design (e.g. generally which products are used and how are they used)
 - Expert elicitation could be used to solicit end user input for the case study execution, providing a structured method to get experts in their field to set parameters and feeding the input into the economic analysis.
 - Identify the data inputs key to the development of the product(s) used;
 - Diagram the information flow;
 - Decide which data/data characteristic(s) to evaluate in the case study (types, frequency and resolution);
 - (e.g. Removing an entire class of satellite data to ensure sufficient contrast in outcomes, adding in Cryosat-2 which is not being included currently; and evaluating SAR Data/addition of Sentinel data?/spatial resolution)
 - Determine how to analyze the contribution of the data (e.g. data denial experiment);
 - Build a decision model;
 - Determine the best economic approach to evaluate the resulting change;
 - Develop a nominal timeline/schedule for completion of the case study
- **Solicit resources to conduct case the study**, acknowledging that one lesson learned from the CGMS SETT workshops is that a good case study (see attributes above) that is defensible requires a commitment of human and financial resources
 - It was noted that while any economist can be hired to conduct an analysis, an economist with expertise in this field of study (i.e. satellites, weather, etc.) may produce more meaningful results.
 - Resources needed may also include data sets and other in-kind contributions
- **Conduct the Study**
- **Communicate results of the case study** to both the end users who contributed information on their decision making processes, and the intended audience (CGMS members) in a relevant and meaningful fashion

GUIDANCE DOCUMENT DISCUSSION & RECOMMENDATIONS

Participants agreed that a more near-term deliverable of the SETT should be a Guidance Document on the conduct of socio-economic benefit studies. This document must meet three key criteria to ensure its value and use by CGMS Members. The guidance document must be:

- Brief;

- Specific to the challenges of measuring the benefits (quantitatively or qualitatively) of space-based observing instruments and/or systems; and
- General enough to address the range of motivations that may drive a CGMS member to undertake a socioeconomic benefit analysis

This conclusion was based on the recognition of the existence of valuable resources such as the planned WMO/ World Bank Publication “Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services,” the NASA primer, and a planned American Society for Photogrammetry and Remote Sensing (ASPRS) virtual manual which will include a socioeconomic benefits chapter led by Rich Bernknopf. Participants agreed to exploit these references in an acknowledgment of the resource and time constraints that would limit SETT members to develop a comprehensive primer.

Lessons learned at the completion of the proposed case study would be incorporated into a subsequent revision of the Guidance Document.

ACTION PLAN AND RECOMMENDATIONS

Three key next steps were identified:

(1) Refine Case Study Design

Lead(s): Chuck Wooldridge, CGMS SETT Chair, Molly Brown, University of Maryland, Vanessa Escobar, NASA, and Pablo Clemente Colon, NOAA National Ice Center
 Deadline: 17 April 2015

(2) Develop Guidance Document Proposal

Lead(s): Stephan Bojinski, WMO, and Mary Ann Kutny, NOAA/NESDIS
 Deadline: 17 April 2015

Develop a proposal for the guidance document that can be presented by the SETT Chair at CGMS. The proposal should consider existing primers, manuals, and guidance documents, and will state the goal and objectives of the guidance document, an outline of proposed content, and timeline for completion.

(4) Report to the 43rd CGMS Plenary

Lead(s): Chuck Wooldridge, CGMS SETT Chair
 Deadline: 18 May 2015

It was agreed that the SETT Chair will present at the 43rd CGMS Plenary in May 2015 on the activities of the SETT to date, and propose two future activities for the SETT including (1) development of a guidance document to aid CGMS members in conducting or procuring socioeconomic benefit analyses, and (2) a Case Study on Understanding and Assessing the Value of Improved Satellite Data for the Users of Operational Sea Ice Products and Information.

In addition, the workshop participants recommended the SETT:

- (1) Consider Ken Carey’s offer to participate in the Socioeconomic Benefits Panel Discussion during the NOAA Satellite Users Conference 27 April – 1 May 2015 in Greenbelt, MD.
- (2) Update the list of relevant publications

The next SETT meetings following the CGMS Plenary in May, will be a teleconference in June and a Fall meeting in Europe.

Understanding and Assessing the Value of Improved Satellite Data for the Users of Operational Sea Ice Products and Information

Draft Proposal for CGMS SETT Workshop Case Study

Vanessa Escobar and Molly Brown

OVERVIEW

OBJECTIVE: This case study will focus on identifying and quantifying the socioeconomic impacts of improved satellite data on the development of operational sea ice products relied upon by end users.

RATIONALE: By assessing improvements in sea ice information due to improved satellite data, we can then connect this information to changes in end user decision-making processes.

SCOPE: The case study will begin by evaluating the impact of improved satellite data on the accuracy/timeliness of operational sea ice products, specifically sea ice area, extent, thickness, and extent. In addition, the case study will investigate the role of sea ice products in end user* decision-making, and evaluate the qualitative and/or quantitative value of the improved sea ice products to end users and/or society.

**End User Note:* CGMS SETT members will determine which end user(s) to focus on in consultation with the workshop participants. The potential end user(s) could include the oil and gas industry, maritime navigation/transportation industry, reinsurance industry, commercial fisheries, coast guard operations, and/or the Arctic Council.

OVERALL METHODS: For this case study, the CGMS SETT will engage with the research, operational, and socioeconomic communities to understand:

(1) The benefits and tradeoffs of satellite remote sensing data within the operational sea ice modeling system. Examples of the value of satellite-derived sea ice parameters (extent, area, concentration, thickness) requires also due consideration of existing missions and datasets: passive microwave radiometers (AMSR, SMMR, SSM/I, for deriving extent, area, concentration), the SAR altimeter SIRAL on the ESA Cryosat-2 for all-weather high-resolution ice thickness maps, and optical sensors (AVHRR, MODIS, VIIRS). All techniques have strengths and weaknesses, which should be taken into account in their impact on the application and operational use.

- This may be determined, in part, using aircraft data and simulated data prior to the launch of a mission

(2) How the data are distributed from the research (e.g. Naval Research Lab, NRL) to the operational communities (e.g. National Ice Center, NIC) to the end user

(3) How the data are used by the end user(s)

- This could include use by the oil and gas and/or maritime transportation industry in the Arctic, or the use of products by insurance syndicates to evaluate risk and value insurance contracts for working in the Arctic.

(4) The quantitative and/or qualitative impact of satellite data to the end user(s)

- E.g. the impact of NRL data in commercial maritime navigation (with and without the integration of satellite data, the impact of data resolution scales on operational decisions, the impacts of long and short data latency and/or the requirements of the Arctic Code and how satellite information will help operators make better (quantifiable) decisions

BACKGROUND

The case study will focus on the use of meteorological satellites to derive sea ice extent and thickness information. The U.S. government has an operational responsibility to provide daily updates of sea ice conditions to vessels navigating in the Arctic.

One example is provided below. CGMS SETT Members and Workshop #2 participants are encouraged to suggest/submit additional examples.

EXAMPLE ONE: One of two U.S. operational systems, the Arctic Cap Nowcast Forecast System (ACNFS) is a coupled sea ice and ocean model that provides nowcasts and forecasts of sea ice conditions in the Northern Hemisphere. Each day the ACNFS runs a 3-day hindcast to collect all of the satellite data produced within the last 72 hours, a nowcast, and a 7-day forecast, and produces an approximate 50 products, which include ice thickness, ice concentration, ice drift, snow convergence/divergence, rate of opening, sea surface temperature and ocean currents. ACNFS products are integrated in the forecast process of the NWS Sea Ice Program, and are used by the National Ice Center (NIC), among other external customers, to provide the Navy fleet with daily ice forecasts. The research organization, the Naval Research Laboratory (NRL), will use this data on ice thickness and sea ice freeboard data for assimilation into the ACNFS or for model validation to improve ice edge forecasts for the entire Arctic Marginal Ice Zone (MIZ).

As an Early Adopter of NASA's Ice, Cloud and land Elevation Satellite-2 (ICESat-2) mission, the NRL will work with MABEL (Multiple Altimeter Beam Experimental Lidar) and mission simulated data products to better prepare for the real observation data after ICESat-2 launches. Over the next two years, the NRL will work with the ICESat-2 Science Definition Team to prepare ACNFS for the mission data products and provide feedback to the ICESat-2 mission about challenges and gains they experience as Early Adopters of prelaunch mission data. This communication is geared to enhance knowledge of how data will be used during the development stages of the data algorithms and inform the mission scientists of how the mission data products may perform in real world applications. NRL believes that ICESat-2 products will provide a unique opportunity to evaluate the ACNFS performance. NRL expects that the ICESat-2 Global Geolocation Photon Data and the Arctic Sea Ice Elevation products will provide a unique training data set for their MIZ retrieval algorithm and sea ice model—expanding the MIZ ice edge validation to the entire Arctic domain. NRL would use the 21-day and 45-day old products for validation, but believes it may be able to improve the real-time system for ice thickness even with 45-day latency data.

Once data products have been processed by the NRL the information has a cascade of impacts. The National Ice Center (NIC) provides global ice and snow (including the Great Lakes and the Chesapeake and Delaware Bay systems) analysis and forecasting services.

AGENDA

TUESDAY, JANUARY 20, 2014

1311 East West Hwy, Silver Spring, MD

- 8:15 a.m. **Welcome & Introductions**
8:15 – 8:25 a.m. **Introductions of Participants**
8:25 – 8:30 a.m. **Meeting Logistics & Overview of Agenda**, Chuck Wooldridge
- 8:30 a.m. **Welcome Remarks**, Mark Paese, Deputy Assistant Administrator, NOAA/NESDIS
- 8:45 a.m. **Setting the Stage**
8:45 – 9:00 a.m. **Introductory Remarks**, David Yoskowitz, NOAA Chief Economist
9:00 – 9:15 a.m. [Recap of Workshop #1 Findings & Review of Workshop Goals](#),
Chuck Wooldridge, SETT Chair
9:15 – 9:30 a.m. [Review of JPSS Economic Benefit Analysis](#), Ajay Mehta,
NOAA/JPSS
9:30 – 10:00 a.m. [Overview Relevant WMO Work](#), Stephan Bojinski, WMO
- 10:00 a.m. **Break**
- 10:15 a.m. [Introduction of Proposed Case Study: Understanding and Assessing the Value of Improved Satellite Data for the Users of Operational Sea Ice Products and Information](#), Molly Brown, University of Maryland, and Vanessa Escobar, NASA
- 11:30 a.m. **Lunch**
- 1:00 p.m. [Overview: Operational Product Development & Distribution](#)
Pablo Clemente-Colon, Chief Scientist, National Ice Center (NIC)
- 2:15 p.m. **Break**
- 3:00 p.m. **Panel of Economic Advisors**
Moderator: David Yoskowitz
[Richard Bernknopf](#), UNM
Jeff Lazo, NCAR
[Molly Macauley](#), RFF

5:15 p.m. **Wrap up of Day**
Chuck Wooldridge

5:30 p.m. **Adjourn for the Day**

WEDNESDAY, JANUARY 21, 2014

SSMC-1 1335 East West Hwy, Silver Spring, MD Rm. 7236

8:30 a.m. **Overview of Day 2 Agenda**
Chuck Wooldridge, SETT Chair

8:40 a.m. **Summary & Synthesis of Day 1 Presentations**
Mary Ann Kutny, NOAA

[Overview of Planned WMO Publication on “Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services”](#)

Jeff Lazo, NCAR

9:00 a.m. **Future Work Plan (All)**

- *Context*
 - Identify specific question case study will address
- *Methodology*
 - Outline how/why data is used in decision-making
 - Review how impact of observation will be determined
 - Opportunities for quantitative/qualitative analyses
- *Data Requirements*
 - Determine data required
 - Identify relationships needed with user community to acquire data
- *Identification of required expertise and assignment of roles/responsibilities*
 - Technical Expertise (Operational and Research)
 - Socioeconomic Expertise
- *Set Timeline*

Workshop Summary & Actions

Chuck Wooldridge, SETT Chair

12:30 **Adjourn**

ANNEX 3: PARTICIPANT LIST

SETT MEMBERS

Chuck Wooldridge, NOAA & SETT Chair

Stephan Bojinski, WMO

Ajay Mehta, NOAA/NESDIS

John Furgerson, NOAA/NESDIS

Mary Ann Kutny, NOAA/NESDIS

Molly Brown, University of Maryland

Vanessa Escobar, NASA

INVITED PARTICIPANTS

Richard Bernknopf, University of New Mexico

Ken Carey, Earth Resources Technology

Pablo Clemente-Colon, National Ice Center

Steve Goodman, NOAA/NESDIS GOES-R

Robert Husband, EUMETSAT (Virtual TBC)

Jeff Lazo, National Center for Atmospheric Research (NCAR)

Molly Macauley, Resources for the Future (RFF) Laura Lopez Delgado, Secure World Foundation

Bill Mackey, Canadian Space Agency

Mark Paese, Deputy Assistant Administrator, NOAA/NESDIS

David Yoskowitz, Chief Economist, NOAA