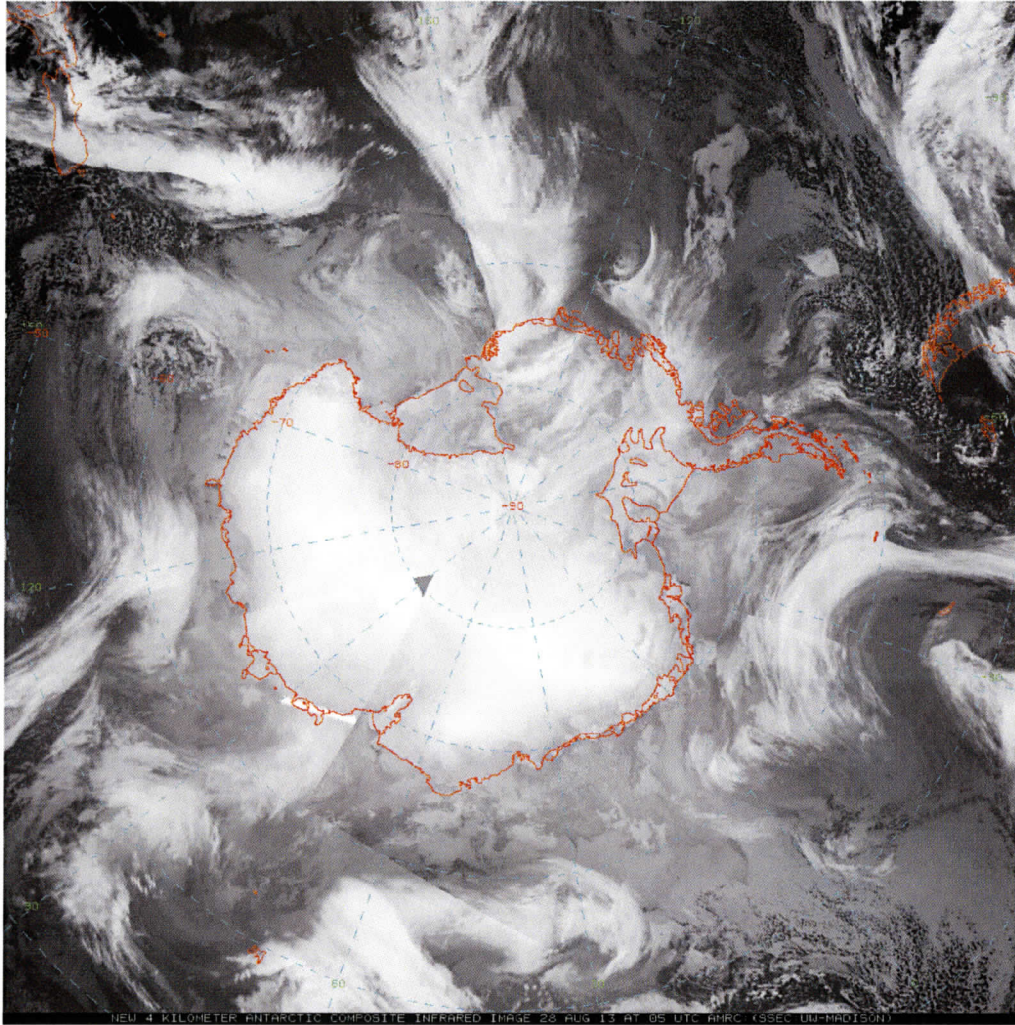


AMRC Final Project Report: NSF-OPP Grant #1141908, September 15, 2012 to August 31, 2013

Antarctic Meteorological Research Center

A Report to the Division of Polar Programs, Geoscience Directorate, National Science Foundation



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University of Wisconsin-Madison

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Preview of Award 1141908 - Annual Project Report

Cover

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PD/PI Name: Matthew A Lazzara, Principal Investigator
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Submission Date: N/A

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Accomplishments

* What are the major goals of the project?

The major goals of this project focus on improvements to the Antarctic satellite composite imagery. The improvements include both temporal resolution as well as improvements in the compositing process. Additional navigational display of the composite in grid coordinates (with Greenwich (0 degrees longitude) at the top of the display is an objective of the project along with a re-compositing effort to generate an archive-quality composite made over 12 hours later or longer to include as much satellite imagery as possible. Other efforts include on-going Antarctic meteorological data collection, distribution, and archive, especially United States Antarctic Program (USAP) main station observations, USAP vessel situation reports (SITREPs), and other miscellaneous Antarctic meteorological data.

What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?

Major Activities: This project has purchased the new hardware needed to create the improved Antarctic satellite composites. This system is now running, with all 5 channels being generated in real-time (Figure 1). Testing is underway to verify that these composites are an improvement over prior generation composites. Once this is complete, additional tasks associated with the satellite composites will be pursued (including the 12 or more hour later created composite, and the re-navigated composite with Greenwich (0 degrees longitude) oriented at the top of the imagery). A new server has been installed at McMurdo Station to better collect and process newer satellites (e.g. Suomi-NPP) to be included in the Antarctic satellite composite.

Antarctic meteorological data efforts have continued during the past year. Effort has gone into migrating to newer computer hardware during the last several months of this

year, which offers a more stable platform for data collection, display, distribution, and archive. Most importantly, it offers a dramatic increase in storage capacity, which was limited on the prior system.

A paper on satellite compositing has been written and accepted for publication. This paper represents both a description of the methods used to make the composites and the evolution of changes and improvements made to the composite process to meet challenges faced when merging satellite observations. While the paper covers a range of composites made at the University of Wisconsin-Madison (UW-Madison) it has a section that highlights AMRC's efforts over the years and during this project. Applications of the composites are included in the publication as well.

Specific Objectives:

One specific objective of this project is to benefit from lessons that are being learned on other satellite compositing projects to benefit the Antarctic satellite composite effort. An on-going project with National Oceanic and Atmospheric Administration (NOAA) to migrate Arctic satellite composite imagery from a research phase to NOAA operations has provided the opportunity to benefit this project (rather than the other way around), especially in implementing improved software with fewer complications.

An additional specific objective is attempting to work with the newest satellite observations in making the composites. The new Suomi-NPP satellite is also offering such an opportunity. A server system in Antarctica is capturing this data, processing it using University of Wisconsin development software, and efforts are still on-going to converting the output into source data that can be used in the making of the Antarctic satellite composites.

Significant Results:

Key outcomes or Other achievements:

A paper has been accepted on the satellite composite methodology, done in conjunction with colleagues within the same department in the University as the PI (Space Science and Engineering Center (SSEC)) who have applied the similar methods to other satellite compositing efforts (for education, outreach, aviation applications, etc. and in various other projections including Mercator, rectilinear world-wide coverage, Mollweide, etc.).

* What opportunities for training and professional development has the project provided?

This project has been providing a key opportunity for training one of the staff members on the project, Dave Mikolajczyk, on the new compositing methodology. Additionally, students working on the project, Carol Costanza and Nick Weber, are having the opportunity to work with the meteorological data displays and data sets - both their display and archiving. Everyone in the MRC team are learning skills in various meteorological software systems including McIDAS, LDM, etc. along with learning about data servers (FTP, Web, McIDAS ADDE, RAMADDA, rsync, etc.).

How have the results been disseminated to communities of interest?

Efforts associated with this project have been communicated via the following means:

1. Conference presentations

2. Paper on the satellite composite portion of the project.

3. Keeping in touch with the community via AMRC e-mailing lists, etc.

General activities of this project are discussed in outreach events include students visiting the AMRC, and the AMRC attending the Wisconsin State Fair.

Utilization of internet and social media (Facebook, Twitter, YouTube, etc.) to communicate to the boarder community.

*** What do you plan to do during the next reporting period to accomplish the goals?**

With the initial goals nearly met at the one year mark, once the satellite compositing technique is stable, additional software will be introduced into the winter of 2013-2014 to create the Greenwich (0 degree longitude at the top of the image) projection of the composite. After this milestone is accomplished, the remaining large task, the re-creation of the composites 12 or more hours later for an inclusive-as-possible of all available satellite observations to make the most complete composites will be attempted. Throughout this period, usage of the Suomi-NPP satellite observations and other new satellite observations will be attempted.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Figure1.pdf	Figure 1. These examples of new Antarctic composites in development at the AMRC show the 5-channel, 4-kilometer resolution composites using a new compositing methodology.	Matthew Lazzara	08/27/2013

Products

Journals

Kohrs, R.A., M.A. Lazzara, J.O. Robaidek, D.A. Santek, S.L. Knuth (). Global Satellite Composites - 20 Years of Evolution. *Journal of Atmospheric Research*.

Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1016/j.atmosres.2013.07.023

Books

Book Chapters

Thesis/Dissertations

Conference Papers and Presentations

Lazzara, M.A., D.E. Mikolajczyk, R.A. Kohrs, J.O. Robiadek, D.A. Santek, N. Bearson, and S.L. Knuth (2013). *Antarctic Satellite Composite Imagery: 20 Years of Polar Observations*. 12th Conference on Polar Meteorology and Oceanography. Seattle, WA.

Status = OTHER; Acknowledgement of Federal Support = Yes

Lazzara, M.A. (2013). *Discussion Topic: Antarctic Observational Meteorological Data*. 8th Antarctic Meteorological Observation, Modeling, and Forecasting Workshop. Madison, WI.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Lazzara, M.A. and D.E. Mikolajczyk (2013). *Satellite Status Report*. 8th Antarctic Meteorological Observation, Modeling and Forecasting Workshop. Madison, WI.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Other Publications

Technologies or Techniques

This project is in fact benefiting from other compositing projects within the Space Science and Engineering Center, University of Wisconsin-Madison, to date. Descriptions of the methodology can be found in the recently accepted paper:

Kohrs, R.A., M.A. Lazzara, J.O. Robaidek, D.A. Santek, and S.L. Knuth, 2013: Global satellite composites - 20 years of resolution. Atmospheric Research, in press, doi: [10.1016/j.atmosres.2013.07.023](https://doi.org/10.1016/j.atmosres.2013.07.023)

In the future, additional efforts will add value to what has been developed and applied here.

Patents

Nothing to report.

Inventions

Nothing to report.

Licenses

Nothing to report.

Websites

Title: Antarctic Meteorological Research Center

URL: <http://amrc.ssec.wisc.edu/>

Description: This is the main portal of the Antarctic Meteorological Research Center. It offers access to real-time display of Antarctic meteorological data central to this project, as well as information on sister projects including the Antarctic Automatic Weather Station Program. At this submission of this report, the website is undergoing renovations as it is moved to newer hardware that will offer additional capability and more storage.

Other Products

Product Type: Databases

Description: The AMRC is in essence an Antarctic Meteorological Data Center. Its holdings include a variety of datasets including, but not limited to the following:

- AMRC - Schwerdtfeger Library Joint Paper Data Archive
- Antarctic Automatic Weather Station (AWS) Observations
- Antarctic Local Area Coverage (LAC) NOAA AVHRR Observations
- Antarctic Satellite Composite Observations
- Antarctic Tropospheric Ozone Observations
- Arctic Satellite Composite Observations
- Atmospheric Motion Vectors
- Numerical Weather Prediction Analysis, Forecasts, and Other Gridded Observations
- Point Source In Situ Observations (Synoptic, METAR, Aircraft, weather balloon, etc.)
- Polar Orbiting Satellite Navigation Information
- Projects and Field Program Data Collections
- Terminal Aerodrome Forecasts
- United States Antarctic Program (USAP) Field Camp Observations
- United States Antarctic Program (USAP) Ship Observations

- United States Antarctic Program (USAP) Station Observations

These data are shared with the community via a variety of means including:

- RAMADDA (via web portal) <https://amrc.ssec.wisc.edu/repository>
- FTP <ftp://amrc.ssec.wisc.edu/>
- rsync service
- McIDAS ADDE service
- LDM service

Other:

Participants

Research Experience for Undergraduates (REU) funding

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Linda M Keller	Co PD/PI	1
Kathy Strabala	Technician	0
Katie Stockwell	Undergraduate Student	1
Matthew A Lazzara	PD/PI	2
Nick Weber	Undergraduate Student	3
Joey Snarski	Undergraduate Student	5
David Mikolajczyk	Technician	2
Rick Kohrs	Technician	1
Andrew Hermus	Undergraduate Student	0
Carol Costanza	Undergraduate Student	2
Bill Bellon	Technician	0
David Santek	Technician	0

What other organizations have been involved as partners?

Nothing to report.

Have other collaborators or contacts been involved? N

Impacts

What is the impact on the development of the principal discipline(s) of the project?

The Antarctic satellite composite imagery is a significant contribution to polar meteorology. This effort is a part of the leading edge of meteorological satellite compositing. The methods used here are second to none and the resulting composites are often sought after for weather depiction, research and forecasting. Further, this project enables the AMRC to be an Antarctic meteorological data resource to the community. Its meteorological data offerings are in some cases unique as the data is not readily available elsewhere.

What is the impact on other disciplines?

Nothing to report.

What is the impact on the development of human resources?

This project develops the human resources of team members as well as impacts those who are the target of AMRC outreach activities. Both the staff members and the undergraduate students are continuously gaining skills as they take on their assigned tasks. In some cases, training has been an integral part of the job task. For the hundreds of school children, variety of adult visitors and chaperons and the general public, they are impacted by their interaction with the AMRC during its outreach activities. This effort will be expanded in the coming year to include a focus on senior citizens.

What is the impact on physical resources that form infrastructure?

The AMRC is, in essence, a data center. Hence, the AMRC's server systems are a virtual infrastructure to the community. These systems provide the community with a reliable source of some unique Antarctic meteorological datasets.

What is the impact on institutional resources that form infrastructure?

The AMRC is the polar, and specifically, Antarctic data arm of the Space Science and Engineering Center (SSEC), and with ties to the SSEC Data Center. This project extends its a key role in the Antarctic meteorological area of expertise within the UW-Madison and broader and larger community.

What is the impact on information resources that form infrastructure?

AMRC data sets and on-line resources are acquired on the order of 30 to 80 Gb per month and are being accessed via Web, FTP, rsync and other servers. Additional 7 Gb or more per day are distributed across the Antarctic-Internet Data Distribution service (also known as Local Data Manager or LDM).

What is the impact on technology transfer?

While not directly from this project, the NSF funding the Antarctic satellite composite project has led to the NSF funding of an Arctic satellite composite demonstration project. The Arctic satellite project, in turn, has led to funding from National Oceanic and Atmospheric Administration (NOAA) to transfer the Arctic composites to NOAA's satellite operations for routine generation. It is possible that the Antarctic composites may also have a similar opportunity in the future (although not available as of this report).

What is the impact on society beyond science and technology?

The animation of these composites have provided a clear sense of how weather systems move about the Southern Ocean and around/over the Antarctic. This impact has been on-going since the first satellite composites were generated over 20 years ago.

Changes

Changes in approach and reason for change

Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them

Nothing to report.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

Nothing to report.

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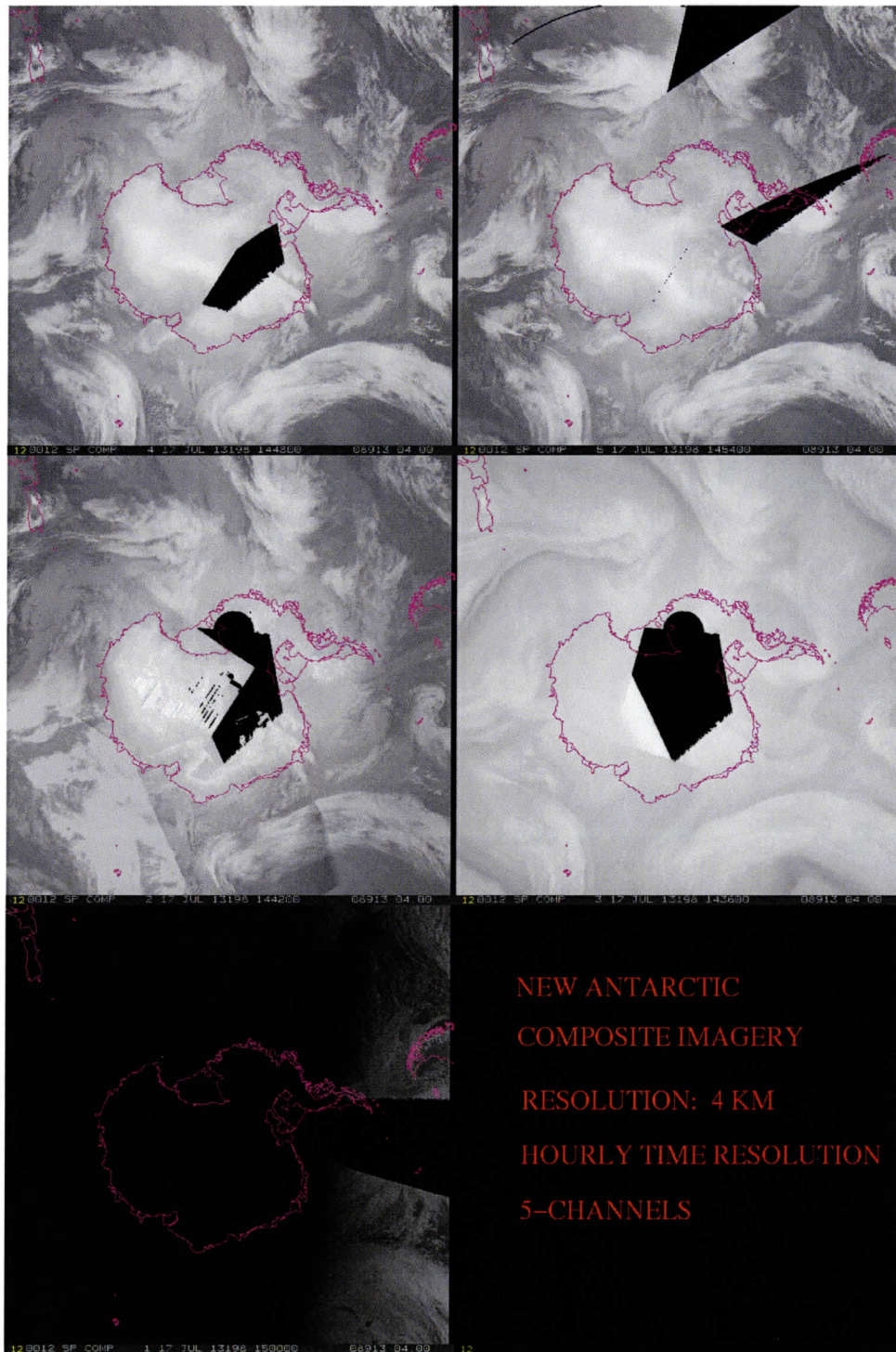


Figure 1. These examples of new Antarctic composites in development at the AMRC show the 5-channel, 4-kilometer resolution composites using a new compositing methodology.