

Sandy Supplemental Grant Recipient Quarterly Progress Report

**Improving the Use of Satellite-derived AMVs in the GDAS/GFS to Mitigate
the Impact from Potential Satellite Data Gaps**

Award Number: NA14NES4830004

The National Oceanic and Atmospheric Administration
National Environmental Satellite Data and Information Service
Center for SaTellite Applications and Research (STAR)

For the Period
1 April 2015 – 30 June 2015

On behalf of
The Cooperative Institute for Meteorological Satellite Studies (CIMSS)
Space Science and Engineering Center (SSEC)
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I. Introduction

Cooperative Institute Description

The Cooperative Institute for Meteorological Satellite Studies (CIMSS) is a collaborative relationship between the National Oceanic and Atmospheric Administration (NOAA) and the University of Wisconsin-Madison (UW-Madison). This partnership has and continues to provide outstanding benefits to the atmospheric science community and to the nation through improved use of remote sensing measurements for weather forecasting, climate analysis and monitoring environmental conditions. Under the auspices of CIMSS, scientists from NOAA/NESDIS and the UW-Madison Space Science and Engineering Center (SSEC) have a formal basis for ongoing collaborative research efforts. CIMSS scientists work closely with the NOAA/NESDIS Advanced Satellite Product Branch (ASPB) stationed at the UW-Madison campus. This collaboration includes a scientist from the National Climate Data Center (NCDC), who joined the NOAA NESDIS employees stationed at CIMSS.

CIMSS conducts a broad array of research and education activities, many of which are projects funded through this Cooperative Agreement with NOAA. This Cooperative Agreement identifies four CIMSS themes:

1. Satellite Meteorology Research and Applications, to support weather analysis and forecasting through participation in NESDIS product assurance and risk reduction programs and the associated transitioning of research progress into NOAA operations,
2. Satellite Sensors and Techniques, to conduct instrument trade studies and sensor performance analysis supporting NOAA's future satellite needs as well as assisting in the long term calibration and validation of remote sensing data and derived products,
3. Environmental Models and Data Assimilation, to work with the Joint Center for Satellite Data Assimilation (JCSDA) on improving satellite data assimilation techniques in operational weather forecast models, and
4. Outreach and Education, to engage the workforce of the future in understanding and using environmental satellite observations for the benefit of an informed society.

CI Management and Organizational Structure

CIMSS resides as an integral part of the Space Science and Engineering Center (SSEC). CIMSS is led by its Director, Dr. Steven Ackerman, who is also a faculty member within the UW-Madison Department of Atmospheric and Oceanic Sciences. Executive Director Wayne Feltz provides day-to-day oversight of the CIMSS staff, science programs, and facilities. The education and outreach activities at CIMSS are coordinated by Senior Outreach Specialist Margaret Mooney. The individual science projects are led by University Principal Investigators (PIs) in conjunction with a strong and diverse support staff who provide additional expertise to

the research programs. CIMSS is advised by a Board of Directors and a Science Advisory Council.

The CIMSS administrative home is within the Space Science and Engineering Center (SSEC), a research and development center within the UW–Madison’s Office of the Vice Chancellor of Research. The independent CIMSS 5-year review panel for administration wrote that they were “...impressed by the people, systems and processes in place.” The SSEC mission focuses on geophysical research and technology to enhance understanding of the Earth, other planets in the Solar System, and the cosmos. To conduct its science mission on the UW-Madison campus, SSEC has developed a strong administrative and programmatic infrastructure. This infrastructure serves all SSEC/CIMSS staff.

The CIMSS mission includes three goals:

- Foster collaborative research among NOAA, NASA, and the University in those aspects of atmospheric and earth system science that exploit the use of satellite technology;
- Serve as a center at which scientists and engineers working on problems of mutual interest can focus on satellite-related research in atmospheric and earth system science;
- Stimulate the training of scientists and engineers in the disciplines involved in atmospheric and earth sciences.

Executive Summary of CI Banner Research Activities

CIMSS is a collaboration between NOAA and UW–Madison that has increased the effectiveness of research and the quality of education in the environmental sciences. In a *Space Policy* article in 1986, William Bishop, former acting Director of NESDIS, noted, “Remote sensing from space can only thrive as a series of partnerships.” He used CIMSS as a positive working example of the government-academia partnership, noting “The Institute pioneered the computation of wind speeds at cloud heights by tracking cloud features from image to image. These are now a stable product provided from the satellites to the global models at the National Meteorological Center.” CIMSS continues to be a leader in the measurement of winds from satellite observations and leads the way in many other research endeavors as outlined above. There is great value to NOAA and UW-Madison in this long-term collaboration known as CIMSS.

II. Funded Project

Award Number: NA14NES4830004

Project Title: Improving the Use of Satellite-derived AMVs in the GDAS/GFS to Mitigate the Impact from Potential Satellite Data Gaps

PI: Dr. David Santek

NOAA Sponsor: Sid Boukabara

NOAA Sponsoring Organization: NOAA NESDIS/STAR

Reporting Period: 1 April 2015 – 30 June 2015

Description of Task I Activities

Primary activity involves quarter reporting.

NOAA Strategic Goal(s)

NOAA Mission Goals

1. Climate Adaptation and Mitigation: An informed society anticipating and responding to climate and its impacts
2. Weather-Ready Nation: Society is prepared for and responds to weather-related events

NOAA Strategic Plan-Mission Goals

1. Serve society's needs for weather and water
2. Understand climate variability and change to enhance society's ability to plan and respond
3. Provide critical support for the NOAA mission

Research Progress

The objectives (from the proposal) of this project are to:

1. Apply the LNVD QC method to VIIRS polar winds in the GDAS/GFS. We will follow the JCSDA and NCEP/EMC established protocol for transitioning any GSI modifications to operations.
2. Perform data denial experiments with the polar and LEO/GEO AMVs to simulate the loss of polar satellite data coverage.
3. Monitor the maturity of the AIRS and ATMS AMVs, and investigate possible GDAS/GFS experiments as time and resources permit.
4. Participate in a JCSDA effort to better understand the varied impact of satellite-derived AMVs in the global models at the JCSDA, NCEP, NRL, and GMAO.

The status of the objectives is detailed in the following subsections.

1. LNVD QC method applied to VIIRS

See the previous quarterly report (1 Jan - 31 Mar 2015) for final status on this aspect of the project.

2. Satellite data gap simulations

A major activity of this project is to run experiments simulating the loss of data from specific polar orbiting satellites. One of the data sets proposed to mitigate the impact is the LEO/GEO winds product, which is designed to optimally derive AMVs from all available satellite platforms.

The LEO/GEO winds are produced and archived at CIMSS in real-time. A GOES-R Risk Reduction (GOES-RRR) project¹ at CIMSS is in the process of re-evaluating the impact of the LEO/GEO winds using the T670 GDAS/GFS, with the eventual goal of transitioning the product generation to NESDIS operations for use at NCEP. The product is currently assimilated into the operational global models at NRL and the Met Office.

To produce case studies of wind sets in which data from a specific satellite has been removed, the LEO/GEO composite satellite images must first be regenerated and then the winds re-derived. This requires retrieving data from the following satellite archives: the SSEC Data Center (geostationary), CLASS (NOAA and Metop polar), and the SSEC Atmosphere PEATE (Terra and Aqua MODIS). We have completed gathering these data for the first season experiment (April and May 2014). We are now in position to regenerate the composites, and re-derive the AMVs. The scripts are being tested on a subset of the dataset, to optimize the reprocessing on an SSEC cluster computer system, iris. This will allow different satellite gap scenarios to be investigated by rapidly reprocessing the composites and AMVs on the cluster.

Following the AMV reprocessing, we will run several assimilation and forecast impact experiments on S4-cardinal.

3. AMVs from sounding retrievals

The AIRS retrieval AMVs are being generated in real-time at CIMSS:
<http://stratus.ssec.wisc.edu/cgi-bin/polarwinds?airs>

and are being distributed and evaluated by the following NWP sites: US Navy, NASA/GMAO, and JMA.

The generation of AMVs from ATMS moisture retrievals is being investigated. Data gathering and processing scripts for real-time and case studies are being tested. Since the availability of the ATMS retrievals from a NOAA public server is delayed by one day, a request has been sent to NOAA/OSPO for retrieving the ATMS Level 1 data in near real-time. A decision on the request is expected by the end of July 2015. If the Level 1 data is available, we will use the Microwave

¹ Assimilation and Forecast Impact of High Temporal Resolution Leo/Geo AMVs in the High-Latitude Data-Gap Corridor (Hoover, PI; Santek, CoI; Key, CoI)

Integrated Retrieval System (MIRS) Software from the Community Satellite Processing Package (CSPP), which is packaged at CIMSS.

4. JCSDA AMV-focus team

We continue to participate in bi-weekly AMV telecons, facilitated by Andrew Collard, with participants from the JCSDA, GMAO, NCEP, and CIMSS.

Resolved Issues and/or Risks

None.

New Issues and/or Risks

None.