Sandy Supplemental Grant Recipient Quarterly Progress Report

Himawari-8 BUFR Development for Winds Processing and Radiances – Cloud Mask, Cloud Phase, Cloud Height

Award Number: NA14NES4830006

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

For the Period
1 January 2015 – 31 March 2015

On behalf of
The Cooperative Institute for Meteorological Satellite Studies (CIMSS)
Space Science and Engineering Center (SSEC)
at the University of Wisconsin-Madison
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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: NA14NES4830006

Project Title: Himawari-8 BUFR Development for Winds Processing and Radiances – Cloud Mask, Cloud Phase, Cloud Height

PI: Dr. Steve Ackerman

NOAA Sponsor: Walter Wolf

NOAA Sponsoring Organization: NOAA NESDIS/STAR

Reporting Period: 1 January 2015 – 31 March 2015

Description of Task I Activities

Primarily 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

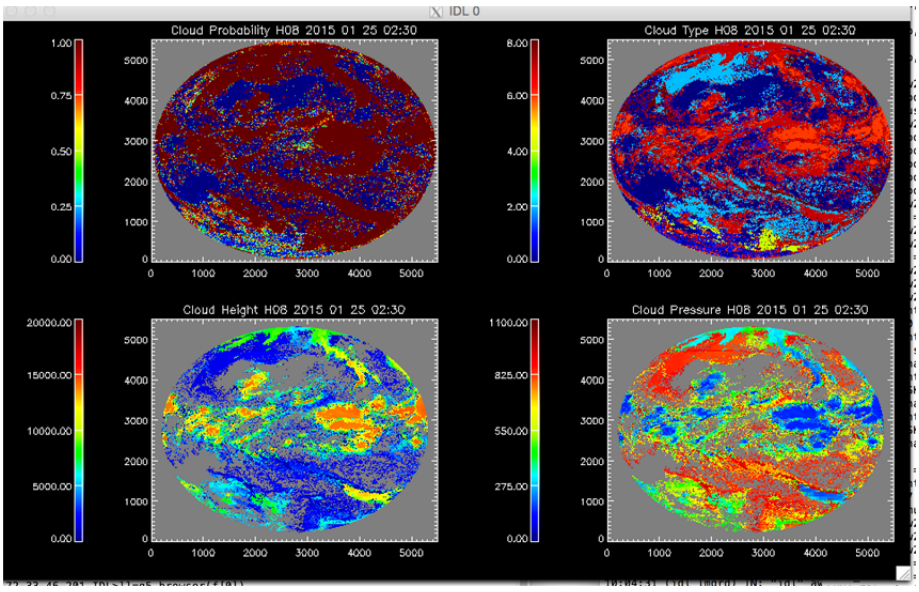
This project involves the implementation of the GOES-R AWG Cloud Algorithms, developed by CIMSS and NESDIS/ASPB, to the data from the new geostationary Japanese Meteorological Agency (JMA) satellite, Himawari-8, which contains an ABI-like instrument, the Advanced Himawari Imager (AHI). Himawari-8 was launched in late 2014 and is slated to become operational in late 2015. Specifically, this project covers the implementation of the ABI cloud mask (ACM) and the ABI Cloud Height Algorithm (ACHA) for AHI. In all, this project covers the generation on AHI of the following cloud products: clear-sky mask, cloud type/phase, cloud top height, temperature and pressure. The motivation for this project is to provide accurate cloud location and height information for both the Atmospheric Motion Vectors (AMV) algorithm as well as for use at the Aviation Weather Center. Because AHI is very similar to ABI, especially for the cloud mask and height algorithms, it will also serve as a demonstration for ABI, which will be launched after AHI is operational.

Algorithm Development Progress

Significant progress has been made during this quarter. In mid-January 2015, an initial set of Post Launch Test (PLT) data from the first week of January was delivered to National Environmental Satellite Data and Information Service's (NESDIS) Center for Satellite Applications and Research (STAR) and transferred to CIMSS for testing. While the initial data did not have the navigation turned on, it did provide CIMSS the ability to test out and fix the ingest readers due to header changes which Japan Meteorological Agency (JMA) made. Other PLT data was provided after the navigation was turned on allowing for progress in analyzing data from AHI. In addition, JMA provided a publically released dataset from 25 January 2015 at 0230Z. Finally, in late March, JMA began providing near realtime (NRT) data from their Cloud server, which was then distributed to CIMSS as part of the algorithm development effort.

The Algorithm Integration Team at CIMSS (AIT-Midwest) developed a C++ library reader (libHimawari) which can be used to directly read the Himawari Standard Data (HSD) or can be

used, with a set of Python wrappers, to output raw counts in a GRB-style netCDF file. Each of the algorithm frameworks used by the Cloud Algorithm Working Group (AWG) to develop and test the cloud algorithms, GEOstationary Cloud Algorithm Test-bed (GEOCAT) and Clouds from AVHRR Extended (CLAVR-x), were adapted to read in the HSD data using libHimawari library along with adding in the PFAAST RTM, which is necessary to provide clear sky information for the cloud algorithms. The figure below shows an example of the Cloud Probability, CLAVRx Cloud Type, Cloud Height and Cloud Pressure from the publically released data using CLAVR-x.



Each of the products shown is used as precedent algorithms to the winds product. This shows that there has been significant progress made in doing an initial evaluation of these algorithms using AHI data. In addition, the team participated in a successful Critical Design Review (CDR) in late March 2015. This review was conducted by STAR and involved persons from various parts of NOAA, including the National Weather Service and demonstrated the maturity of the design system as well as the maturity of the algorithms.

Work in the next quarter will focus on understanding the unique characteristics of the AHI instrument along with developing AHI specific lookup tables and thresholds. Work will also focus on integrating the necessary changes into the STAR Algorithm Processing Framework (SAPF).