# GOES-R AIT: Updating the Data Processing System with data from the Himawari-8 Geostationary Satellite

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## Overview

- The GOES-R Algorithm Working Group (AWG) Algorithm Integration Team (AIT) maintains and updates a data processing framework for GOES-R algorithm processing.
- This system provides an environment for algorithm development and testing along with the ability to process multiple algorithms in sequence with product precedence. Most of the algorithms are able to process on multiple satellite datasets.
- With the launch of the Japanese Himawari-8 satellite in October 2014, a new next-generation geostationary dataset is available for use, and the AIT Framework is currently being updated to utilize these data.
- This poster describes updates made to the GOES-R Framework to process AHI data for algorithm use.

## Adapting the AWG Framework for AHI Data

- The majority of the AWG Level 2 geophysical algorithms were originally developed and tested with a primary source of satellite data, typically AQUA/MODIS, TERRA/MODIS, or MSG/SEVIRI. Additional datasets supported the development in some cases, for example, AVHRR.
- As preparation for the upcoming GOES-R, the algorithms were expanded for use with ABI-simulated data. These data are simulations from the WRF model.
- Approximately half of the 20 AWG algorithms were adapted to read and process on VIIRS data from the S-NPP mission. This work has occurred under the 'JPSS Risk Reduction Project.'
- Now, with the launch of the Japanese Himawari-8 satellite, data is available from the Advanced Himawari Instrument (AHI). AHI is a close proxy of the GOES-R Advanced Baseline Imager (ABI). In time, all of the AWG Level 2 algorithms will be modified to run on AHI data.
- The process to update the AWG algorithms for use with AHI data involves multiple groups of people and a step-by-step process before an updated algorithm is baselined in the AIT processing system. The figure to the right describes this process.

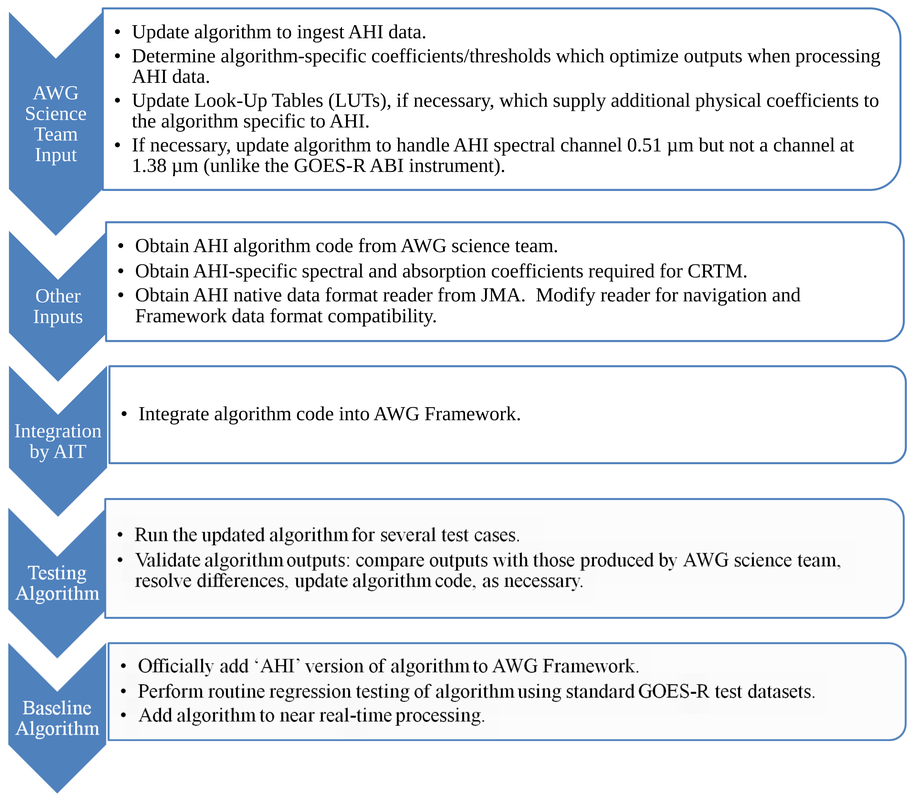


**Figure 1.** Description of the process taken to update the AWG retrieval algorithms to use Himawari/AHI data. Major steps and sub-tasks are shown.

## AHI Derived Motion Winds Project

- The first algorithm to be updated for use with Himawari/AHI data is the Derived Motion Winds (DMW) algorithm as part of the 'AHI Derived Motion Winds Project.'
- The development of an AHI Product Processing System will help continue algorithm continuity of operations for the MTSAT satellite (which is approaching end-of-life in 2015) and bridge the gap from S-NPP to the first JPSS satellite (J1) launched in 2017.
- The AHI Winds Project will exploit the Himawari-8/9 AHI data with an advanced geophysical algorithm while processing on high resolution AHI data.
- The project is a demonstration of NOAA's goal of 'Enterprise Solutions,' namely using similar algorithms for geostationary and polar orbiting satellites.
- The project will also provide an operational test of the GOES-R DMW algorithm before GOES-R launch.
- The DMW algorithm source code is being updated for use with AHI data by the AWG DMW science team. The Cloud Mask, Cloud Height, and Cloud Phase algorithms are also adapted by their respective science teams for AHI data since these algorithms are needed as inputs to the DMW algorithm.
- The most current versions of the DMW and cloud algorithms are being used in the Winds project. For the cloud algorithms, these versions are those that have been adapted to read and process on either NPP VIIRS and Himawari/AHI data. The DMW algorithm used in the Winds project will likely be quite similar to the GOES-R ABI version of the algorithm.

**Table 1.** Current status of Winds project. Key required elements are listed and an indication if these elements have been completed.

| Wind Project Element | Received from AWG team? | Integrated into AIT Framework? | Tested? | Updates, if necessary, based on testing? |
|---|---|---|---|---|
| AHI data reader code* | Yes | Yes | No | N/A |
| AHI-specific coefficients for CRTM | Yes | Yes | Yes | N/A |
| Cloud Mask Algorithm code | No | No | No | No |
| Cloud Mask Algorithm Look-Up Tables | No | No | No | No |
| Cloud Phase Algorithm code | No | No | No | No |
| Cloud Phase Algorithm Look-Up Tables | No | No | No | No |
| Cloud Height Algorithm code | No | No | No | No |
| Cloud Height Algorithm Look-Up Tables | No | No | No | No |
| Winds Algorithm code | No | No | No | No |
| Winds Algorithm Look-Up Tables | No | No | No | No |

* AHI data reader code: code from JMA to read AHI L1b files (radiances, BTs); 'geos_transform.c' from William Straka (CIMMS) for latitude/longitude calculations; AIT updates to code to make AHI data compatible with Framework data structures.

## AHI Winds Product System Operational Design

- The AHI Product Processing System is being developed by various partners:

1) Scientific algorithm development for the Cloud and Wind algorithms is performed by the Algorithm Working Group (AWG) science teams at NOAA/NESDIS/STAR.
2) The software processing system is developed by the Algorithm Integration Team (AIT) at NOAA/NESDIS/STAR.

- The processing system is being developed as an operational demonstration (pre-operational) running in near real-time as data is obtained from the Japan Meteorological Agency (JMA).
- Algorithm software is written in Fortran 90 that conforms to strict coding standards.
- Upon completion, the system will be transitioned to NOAA/OPSO for further development and testing. Operational processing of the system will occur at NOAA/ESPC. Operational Winds (at 6 visible to IR wavelengths), Cloud (Cloud Mask, Cloud Top Phase, Cloud Type, Cloud Top Temperature, Cloud Top Pressure, Cloud Top Height), Cloud and Moisture Imagery (at 16 visible to IR wavelengths), and Radiance (at 16 visible IR wavelengths) data products will be sent to the National Weather Service (NWS). Data products will be available at the NOAA Distribution Environment (DDS).

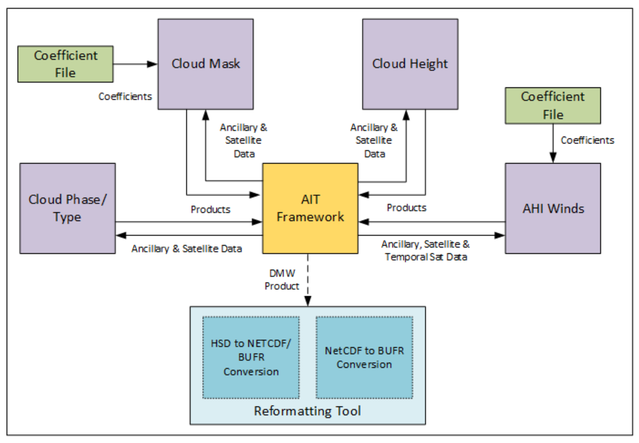


**Figure 2.** System-level diagram of the AHI Winds Product System.

## AHI Winds Data Users

- AHI Radiances wills be used by the NWS for data assimilation and Imagery product creation.
- DMW will be used by the NWS field offices.
- The DOD will use the AHI radiances in model forecasts.

## Cloud and DMW Algorithm Inputs

**Table 2.** The following table lists the inputs for the three Cloud algorithms (that are run prior to running the DMW algorithm) and the DMW algorithm itself.

| | Cloud Mask | Cloud Phase/Type | Cloud Height | AHI Winds |
|---|---|---|---|---|
| AHI L1B | √ | √ | √ | √ |
| NWP – GFS | √ | √ | √ | √ |
| OISST | √ | | | |
| Snow Mask | √ | √ | | |
| Land Mask | √ | √ | | √ |
| Desert Mask | √ | √ | | |
| Coast Mask | √ | √ | | |
| Surface Type | √ | √ | √ | |
| Surface Elevation | √ | √ | √ | |
| Surface Emissivity | √ | √ | √ | |
| Pseudo Emissivity | √ | √ | √ | |
| Surface Albedo | √ | | | |
| CRTM | √ | √ | √ | |
| AHI Cloud Mask | | √ | √ | √ |
| AHI Cloud Phase/Type | | | √ | √ |
| AHI Cloud Top Height, CTP & CTT | | | | √ |
| Expected Error Coefficient File | | √ | | √ |
| Clear Sky Coefficient File | √ | | | |

## Future Work

- Complete integration and testing of AHI data reader and CRTM outputs.
- Obtain AHI versions of the Cloud Mask, Cloud Phase, Cloud Height, and DMW algorithm code from AWG science teams and integrate/test these codes in the AWG Framework system.
- Generate AHI Product System outputs in a near-real time operational demonstration.
- Prepare the Algorithm Package (DAP) for the AHI Product System and deliver to NOAA/OSPO.
- Obtain AHI versions of the remaining Level 2 processing algorithms from AWG science teams and integrate these in the AWG Framework system.
- Perform routine regression testing and near-real time processing for AHI versions of the Level 2 algorithms.

## References

1 GOES-R Algorithm Theoretical Basis Documents (http://www.star.nesdis.noaa.gov/goesr/docs_reports_ATBD.php)

## Acknowledgments

Thanks to William Straka (Univ. Wisc./CIMMS) for software used in the AWG Framework for AHI data navigation calculations.

Thanks to the JMA for sample source codes to read the Himawari standard data.