

# **STAR ALGORITHM INTEGRATION TEAM (AIT) CAPABILITIES: USING ALGORITHM DEVELOPMENT LIBRARY (ADL) FOR TROUBLESHOOTING, TESTING AND GENERATING PRODUCT DATA**

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# Overview

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1

- Role of STAR AIT

2

- ADL Framework

3

- Testing and Troubleshooting

4

- Communication with DPES

5

- Quality Check

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---

1

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3

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4

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5

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# Role of STAR AIT

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- Code Testing in ADL
- Communication with Science Teams and DPES
- Troubleshooting
- Algorithm Package Preparation and Delivery
- Attending Science Team Meetings
- Reviewing ATBD and OAD documents
- Consultancy to Science Teams
- Emulation of Various Operational Scenarios
- Code Research and Analysis and Result Analysis
- Lead Algorithm Lifecycle Reviews

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4

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# ADL Framework

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- ADL is the Test System - Developed by Raytheon
- ADL mimics IDPS system
- ADL provides a Diagnostic Framework
- ADL is recommended by Data Products Engineering and Services (DPES)
- I-P-O Model (Input-Processing-Output)
- ADL Versions evolve with IDPS Versions (Example: IDPS MX8.3~ADL4.2\_MX8.3)

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---

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4

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# Testing & Troubleshooting in ADL

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- **Step 1:** Get ADL Version from Raytheon CM system
- **Step 2:** Put these versions in STAR AIT Common CM system giving this a distinct name to differentiate from other baselines
- **Step 3:** Create a Test Stream out of the above Main Integration Streams
- **Step 4:** Work with the Test Stream creating Future Emulation Scenarios
- **Step 5:** Commit these changes so that others can use their changes over your changes and create a new emulation scenario
- **Step 6:** Find out the Golden Day (special days for specific events) of interest from the science team member
- **Step 7:** Organize all the needed input files for this test date
- **Step 8:** Build ADL and Run the Executables to generate Product Data



# Testing & Troubleshooting in ADL

- ❑ **Step 1:** Get ADL Version from Raytheon CM system at 199.46.132.15/cqweb/

## ADL Source Tar Packages:

Reference the "ClearQuest Reports" section below to view fixed and release notes per planned release.

- ADL4.1 + Mx7.1 Code and Data Packages
- ADL4.1 + Mx7.2 Code and Data Patch Packages
- ADL4.2 + Mx7.2 Code and Data Patch Packages
- ADL4.2 + Mx8.0 Code and Data Packages
- ADL4.2 + Mx8.0 OMPS Data Update Packages
- ADL4.2.2 + Mx8.1 Code and Data Packages
- ADL4.2.2 + Mx8.3 Code and Data Packages

**Note:** We have installed COTS from University of Wisconsin site at [https://jpss-adl-wiki.ssec.wisc.edu/mediawiki/index.php/ADL\\_Installation](https://jpss-adl-wiki.ssec.wisc.edu/mediawiki/index.php/ADL_Installation). We obtained previous versions of ADL from this site

# Testing & Troubleshooting in ADL

- ❑ **Step 2:** Put these versions in STAR AIT Common CM system giving this a distinct name to differentiate from other baselines

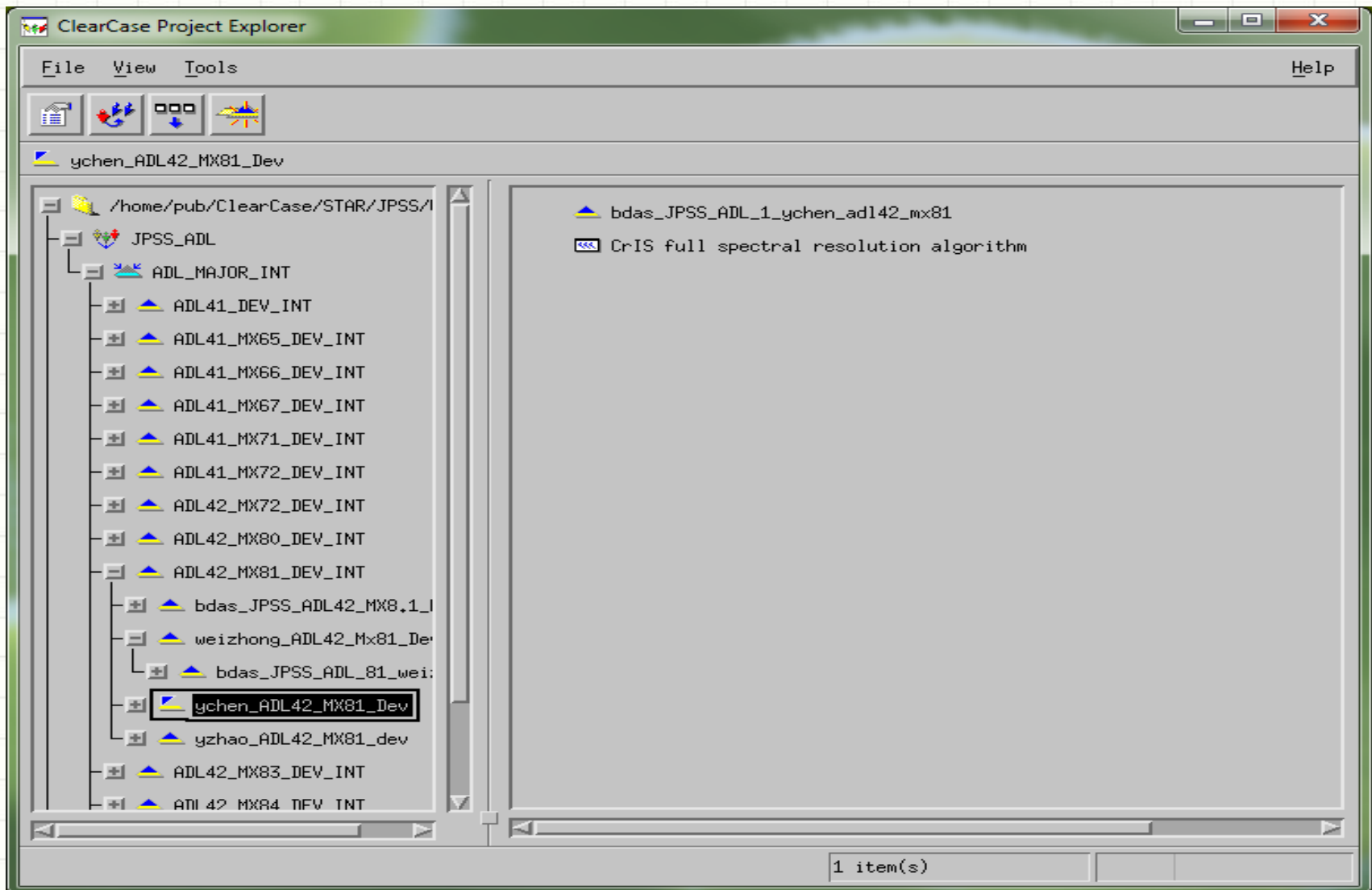
## Examples:

- ❑ ADL41\_MX65\_DEV\_INT
- ❑ ADL41\_MX72\_DEV\_INT
- ❑ ADL42\_MX72\_DEV\_INT
- ❑ ADL42\_MX80\_DEV\_INT
- ❑ ADL42\_MX81\_DEV\_INT
- ❑ ADL42\_MX83\_DEV\_INT

- ❑ **Step3:** Create a Test Stream out of the above Main Integration Streams

**Examples:** bdas\_JPSS\_ADL\_ADL4.2  
weizhong\_Adl\_42\_Mx80\_Dev

# Testing & Troubleshooting in ADL



# Testing & Troubleshooting in ADL

## ❑ **Step 4:** Work with the Test Stream creating Future Emulation Scenarios

### **Examples:**

- ❑ Use changes for DR 7259 (OMPS TC SDR) to MX8.0 Baseline Version
- ❑ Use changes for DR 7310 (OMPS TC EDR) to MX8.0 Baseline Version
- ❑ Use both changes for DR 7259 and DR 7310
- ❑ Use changes in DR 7259 for TC SDR and DR 4823 for NP SDR and find the effect on NP EDR IMOPO

## ❑ **Step 5:** Commit these changes so that others can use their changes over your changes and create a new emulation scenario

### **Examples:**

Weizhong commits cloud mask algorithm related changes

Bigyani commits aerosol related changes

Bigyani can test the effect of VIIRS SDR related changes & Cloud Mask related changes on Aerosol before all of them are available in a future IDPS version

# Testing & Troubleshooting in ADL

- ❑ **Step 6:** Find out the Golden Day (special days for specific events) of interest from the science team member
- ❑ **Step 7:** Organize all the needed input files for this test date

## Example:

- ❖ AIT has version 8.3 of ADL
- ❖ Somebody wants to test for Golden Day on April 23, 2013 for Aerosol EDR Team
- ❖ Version 8.3 of ADL packs the data with VIIRS first track files that are updated in February 2014
- ❖ We cannot use these files for April 23, 2013. So, get the compatible files
- ❖ Get the hdf5 files for this date from CLASS and search the metadata to check what LUTs, ancillary files were used
- ❖ Updated LUTs, compatible first track files and compatible ancillary files such as Polar Wander, NCEP, NAAPS files etc. to generate the result



# Testing & Troubleshooting in ADL

❑ **Step 7:** Organize all the needed input files for this test date (continued)

## Example:

- 1) AIT has to test Aerosol Algorithm with MX8.3 baseline for spatial filter
- 2) Get this version of the algorithm from Raytheon Common CM or AIT CM manager gets it and puts it in our AIT Common CM system
- 3) Install ADL, build and create the executables
- 4) Check the data that come with ADL 8.3
- 5) Some files for VIIRS SDR are first track: VIIRS-SDR-GEO-DNB-PARAM-LUT, VIIRS-SDR-DNB-C-COEFFS-LUT, VIIRS-SDR-DG-ANOMALY-DN-LIMITS-LUT etc. The data that come with ADL 8.3 has all of these recent files. I get these files from Raytheon Common CM or Gravite Information Portal site.

# Testing & Troubleshooting in ADL

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❑ **Step 7:** Organize all the needed input files for this test date (continued)

- 6) Some files are actual non-first-track LUT changes, such as VIIRS-SDR-RSR file which is replaced by 3 more files in MX 8.3 such as RSBAUTOCAL and VIIRS-SDR-DNB-LGS-GAINS-LUT and VIIRS-SDR-DNB-GAIN-RATIOS-LUT etc. I use these actual LUT changes that are not first track, but improvements in coefficients
- 7) Generate SDRs that are reflective of MX 8.3 changes.

# Testing & Troubleshooting in ADL

❑ **Step 7:** Organize all the needed input files for this test date (continued)

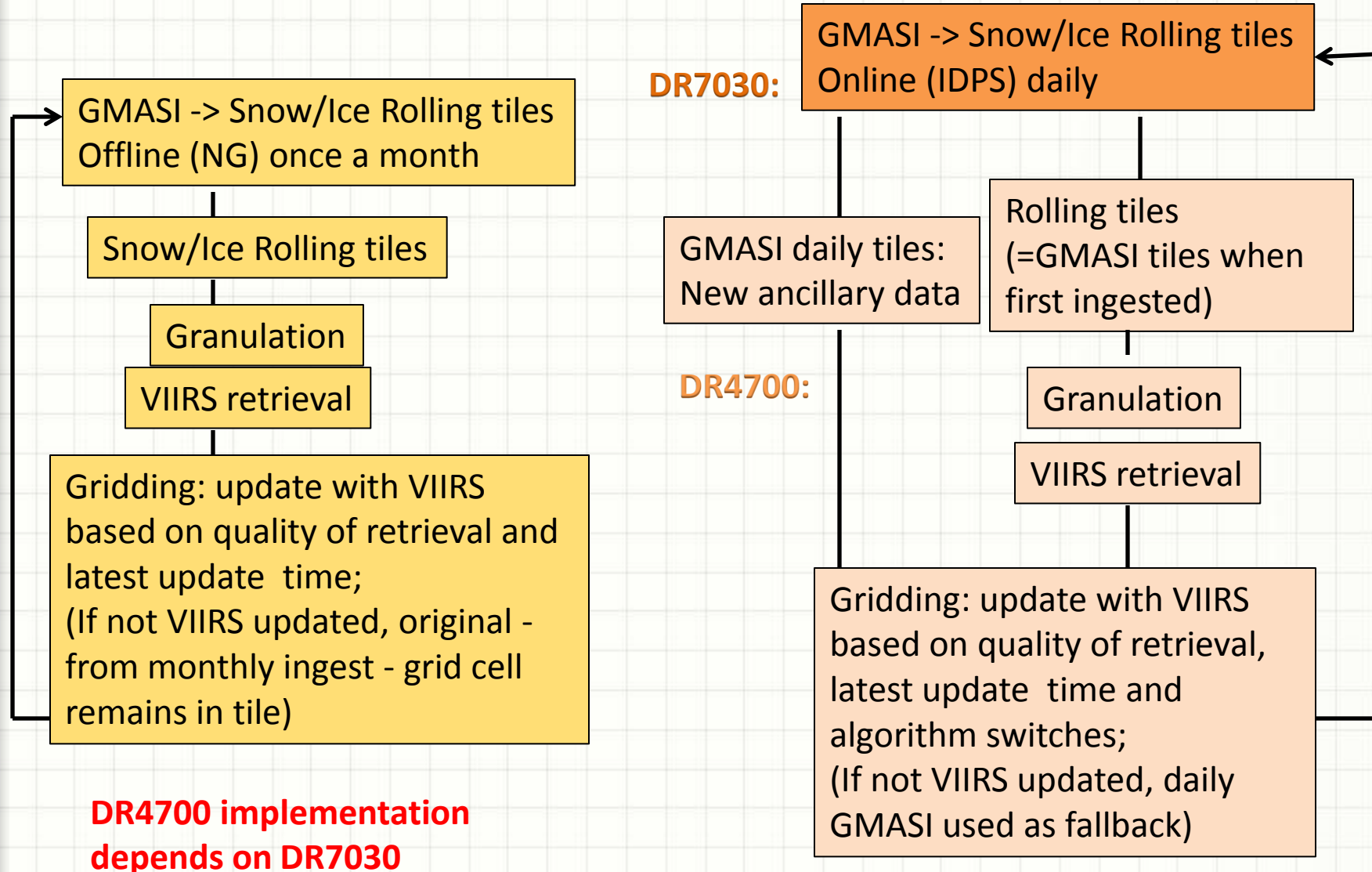
## Example:

- a) After generating SDRs, focus on cloud mask
- b) Check for any LUT changes. The PCT file VIIRS-CM-IP-AC\_npp\_20130815000000Z\_20130924000000Z was updated in August 2013 and use this file for Cloud Mask run instead of whatever was used on April 23, 2013.
- c) Then check for any Aerosol LUT updates in ADL MX8.3
- d) VIIRS-AOT-LUT is changed from MX8.1 version and use this new LUT for the Golden Day instead of the actual version of VIIRS-AOT-LUT that was used for April 23, 2013 IDPS run.

❑ **Step 8:** Build ADL and Run the Executables to generate Product Data

# Testing & Troubleshooting Examples

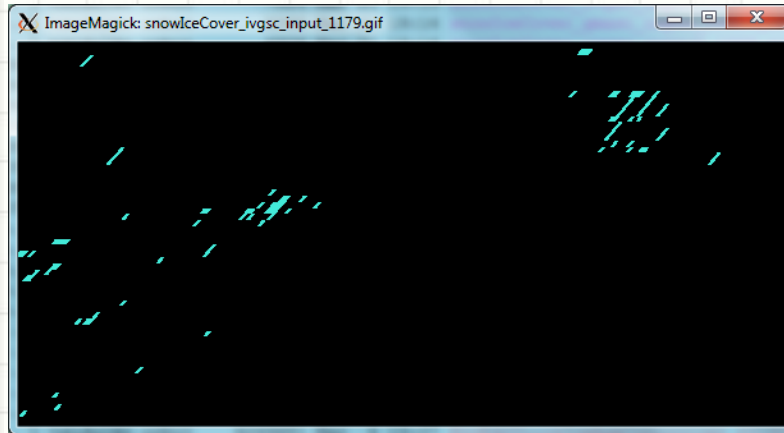
## Snow/Ice Rolling tiles in current and proposed systems



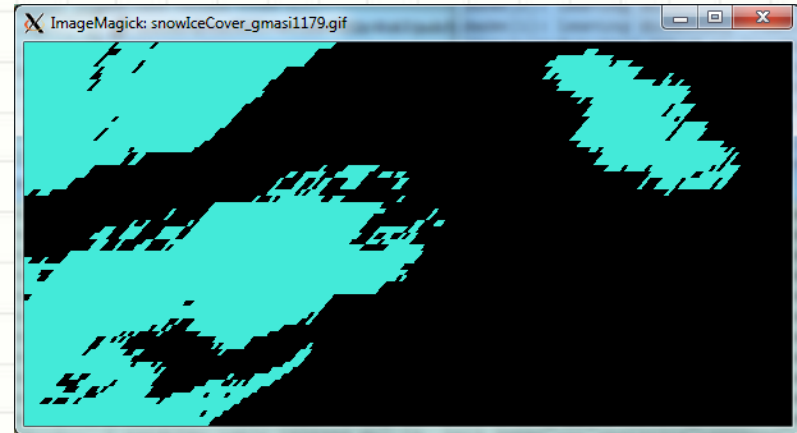
# Testing and Troubleshooting Examples

Example for updated run: VIIRS snow cover gridding ON and VIIRS sea ice gridding ON

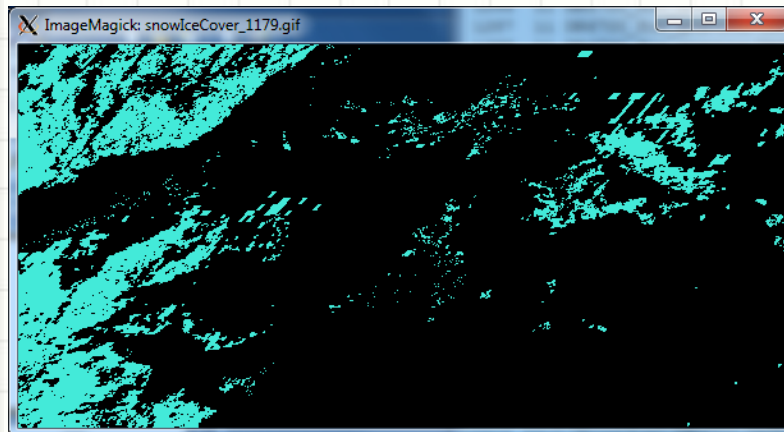
Input Snow/Ice Rolling tile (Nov 15, 2012)



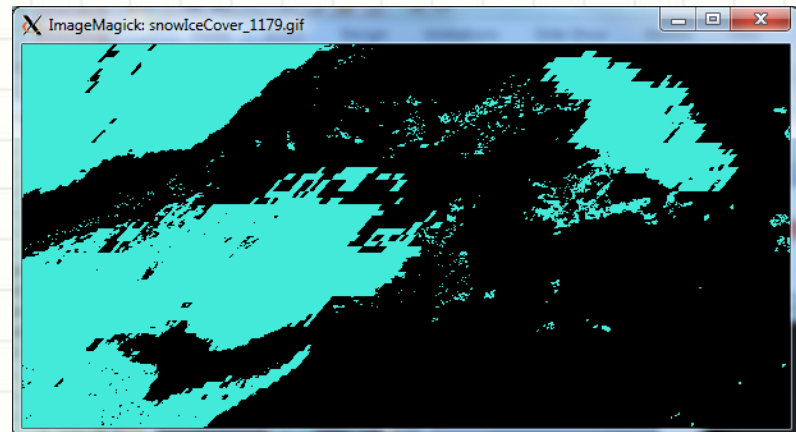
Input GMAI tile (Dec 16, 2012)



Baseline: Output Snow/Ice Rolling tile



Updated: Output Snow/Ice Rolling tile



**Tile 1179: Canada (South East of Hudson Bay)**



# Sensitivity Tests

Green – old ice

Blue – new ice

Baseline: no  
changes

$SWR = SWR * 0.7$  and  
 $Albedo = \text{const} = 0.8$

SWR = Shortwave Radiation

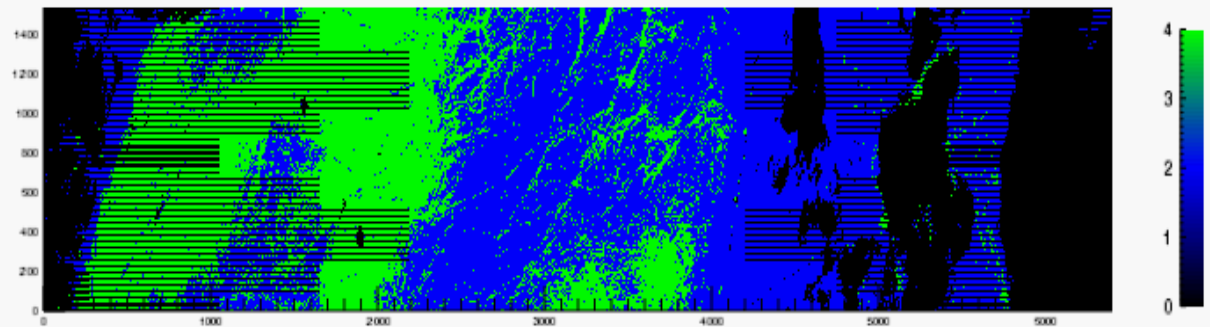
$Albedo = 0.8$

$Temp = Temp - 2$

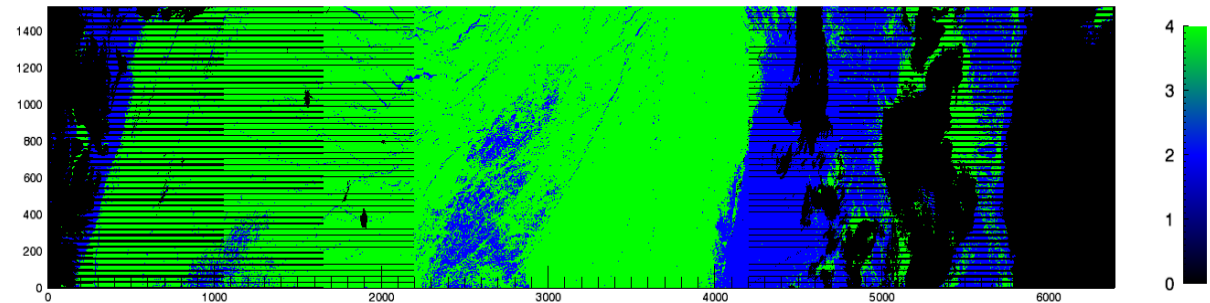
$Sh = Sh - 0.0002$

Sh – Specific Humidity

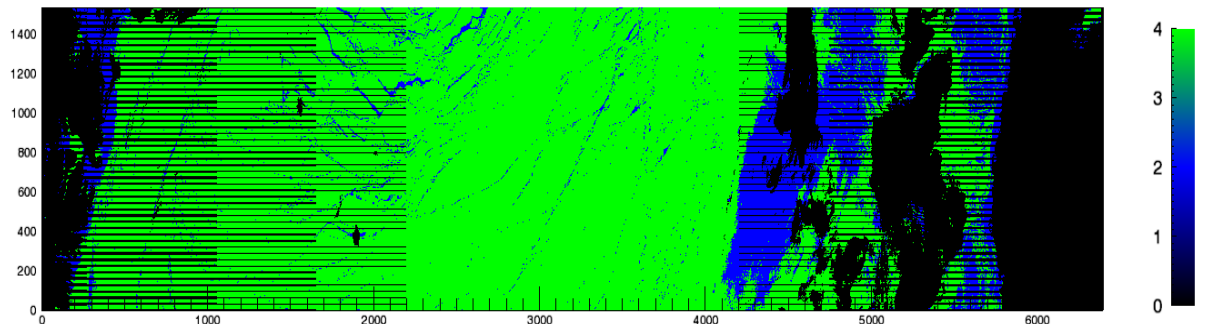
TEMP ICE TYPE



TEMP ICE TYPE



TEMP ICE TYPE



Change in classification with relatively small (realistic) perturbations in energy balance terms and ancillary data (granules near terminator zone)

# Testing & Troubleshooting Summary

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# Communication with DPES

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- We communicate with DPES if we find any discrepancy in ADL version matching the description of the update in release notes etc.
- We verify with them if some LUTs have a description that slightly differs somewhere in the name.  
**Example:** CrIMSS case where 4 of the LUT files had a different end date description in the file
- We communicate with them constantly during change request package submission process for them to check the package, then we verify the functional test results, regression test results, help in AERB review process if any reviewer has any doubts etc.

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# Quality Check

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## ADL Version Check

When we get a new ADL version, we build and use the executables to run a few sample SDR and EDR cases and compare the results with IDPS results.

For Example, MX8.1/8.2 became effective on February 20, 2014 and MX 8.3 became effective in operations on March 18, 2014.

- We take a day, say February 25 and retrieve IDPS data.
- Use the metadata to get information about input files.
- Use compatible input files to run them in compatible ADL 4.1/4.2 framework in our system.
- Then run for ATMS SDR, VIIRS SDR, VIIRS CM, OMPS TC SDR etc. and compare with IDPS results.

# Quality Check

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## Science Check

Constant Communication with the Science Team for Verification of the Results and DPES for Integration

### Examples:

For CrIMSS EDR, I worked with Mike Wilson and Chris Barnett continuously throughout the submission of the change request, AERB Review and final integration.

For OMPS EDR, I worked with Larry, Trevor and Maria throughout the preparation and submission of the change request, functional test and regression test verification and final integration.

# Quality Check (Continued)

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## Document Check

We also review documents from time to time to track failures, strange behavior of results etc. to support the science teams.

- ATBD documents
- OAD documents
- Other presentations made by science team members
- Publications by the corresponding science team members.
- Requirement documents
- CDR and Other related documents.

# Quality Check (Continued)

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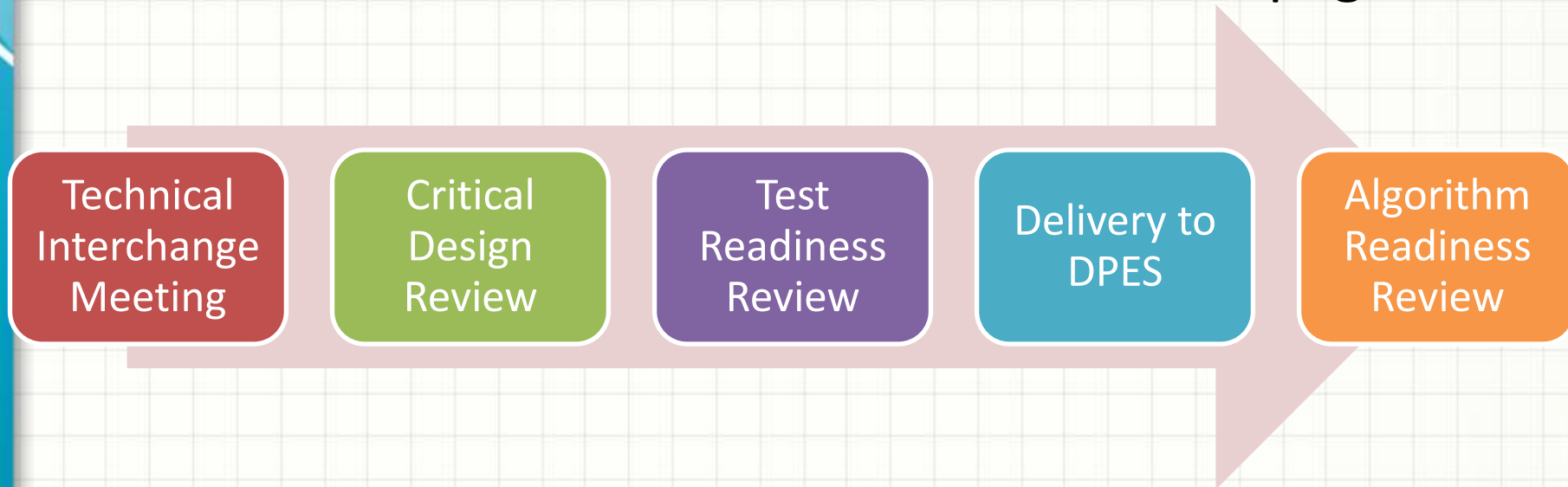
## Algorithm Package Check

- ATBD Documents
- OAD Documents
- Test Data Sets
- Updated Software
- Baseline and Updated Results
- DPE Processing Request Form
- Algorithm LUT PCT or Algorithm Delivery Checklist
- Update Delivery Report
- Any Other Supporting Documents

# Life Cycle Reviews for J1 Algorithms

STAR AIT Review Process for J1 is based on the Capability Maturity Model Integration Process.

- Shows that we understand requirements
- Shows we can develop algorithms to meet requirements.
- Ensures all stakeholders are on the same page





# Life Cycle Reviews for J1 Algorithms

## TIM

- Candidate algorithm design is discussed to ensure it meets all scientific and operational requirements

## CDR

- STAR AIT and science team describe the chosen algorithm, showing that it will meet requirements
- Implementation Concept and Software Architecture are discussed, so that all changes to input/output structure are known

## TRR

- Show that the algorithm, within the operational framework, meets coding standards and science expectations
- Establish datasets that will be used to show that the algorithm will meet requirements

## DTD

- The algorithm is delivered to DPES for implementation into G-ADA.

## ARR

- Describe tests that show the algorithm will be ready for delivery to CGS Contractor.

# AIT Capabilities: How Much Data We Can Process?

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- We have provided OMPS EDR data for TC. TC EDR needed CrIMSS EDR and VIIRS EDR as inputs. It took almost a week for one day of TC EDR generation.
- It took only 4 days for one day of OMPS NP EDR generation.
- For Aerosol EDR for one day with two scenarios, took one week to process.

# AIT Capabilities: How Much Data We Can Process?

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- ❖ STAR AIT will be implementing a HTCondor cluster to be used across projects
- ❖ AIT is in the process of buying a few JPSS machines to add to a cluster.
- ❖ AIT personnel will manage the cluster.
- ❖ JPSS storage capabilities will be added in the future.
- ❖ Currently, AIT can only generate one day worth of data in five to seven days if we have an average system load and no other system mishaps. This is expected to be improved with the implementation of the HTCondor cluster.

# AIT Work Examples

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- ☐ Land surface albedo LUT updating
- ☐ Adjust Quality Flag for Thin Cirrus in Land Surface Temperature (LST) and Update LUT
- ☐ Add Quality Check for ActiveFire
- ☐ Equation Modification for Sea Surface Temperature and Evaluating Downstream Impact
- ☐ Roll Back LST LUT from Provisional to Beta Version
- ☐ New Rain Algorithm for CrIMSS
- ☐ Wavelength Shift for OMPS, submit CRP
- ☐ New Ozone Mixing Fraction for OMPS, submit CRP
- ☐ Implementing NOAA Global Multisensor Automated Snow/Ice Map (GMAI) Tile

# AIT Work Examples

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- ❑ PCT file update for CrIS SDR
- ❑ Troubleshooting, testing and change request package submission for ATMS SDR
- ❑ Provide one day of test data to OMPS team with 4 DR updates, 2 for TC and 2 for NP
- ❑ Helping in OMPS Darks production transfer to GRAVITE
- ❑ Conducting sensitivity tests for Ice Age algorithm
- ❑ Submit change request package for OMPS BIAS table replacement for TC and NP



# Summary

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## Accuracy of Algorithms -> Product Accuracy

### STAR AIT ROLES:

#### ❖ Testing and Troubleshooting

- Facilitates Structured Tests
- Performs Emulation Experiments with Chain Run Tests
- Performs Code Updates, Tests and Delivery
- Facilitates Review Process
- Produces Product Test Data

#### ❖ Communication Facilitation

#### ❖ Quality Check: Algorithm Check, Science Check & Documentation Check



QUESTIONS?

*Thank  
You*