

Enterprise Plan for Algorithm Development and Integration to Operations

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Slides from the following people were used:

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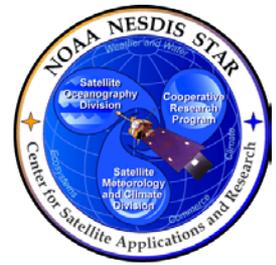
Jaime Daniels and Lihang Zhou

NOAA/NESDIS, Center for Satellite Applications and Research (STAR)

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Look towards the future



- Little or no monies are available to maintain older operational satellite science algorithms as GOES-R and JPSS systems are developed and become operational
- OSPO is looking to retire products and product systems as new products become operational
- OSGS is moving towards one Ground Enterprise ARchitecture System (GEARS) where the algorithms become services

Current Algorithm Problem



- Multiple versions or type of algorithms for similar products are run in operations
- Multiple versions of algorithms are running in different systems on different hardware within OSPO

Solution

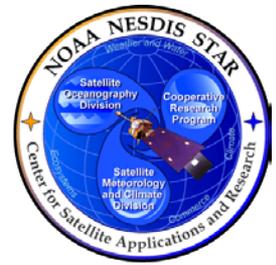


- Develop Enterprise Algorithms
- Implement Enterprise Algorithms within common system within OSPO
 - Eventually the GEARS system

Enterprise Algorithm Definition

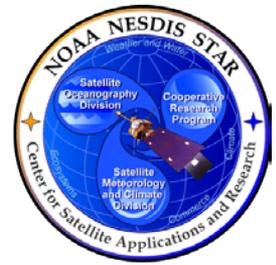


- An enterprise algorithm is algorithm that uses the same scientific methodology and software base to create the same classification of product from differing input data (satellite, in-situ or ancillary)



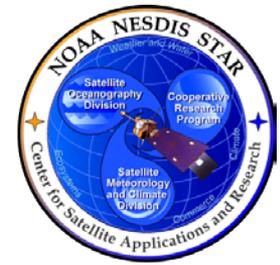
Motivation – Users

- Brings continuity of NOAA products between current and future NOAA operational satellites
- Supports the NWS Office of Science and Technology's implementation strategy of multi-sensor algorithms and products



Motivation – NESDIS

- Enterprise Algorithms have the following advantages:
 - Continuity of NOAA products between current and future NOAA operational satellites
 - Cost effective processing for NOAA products
 - Maintenance of fewer algorithms and systems within operations
 - One transition of the algorithm service to the GEARS system



Algorithms



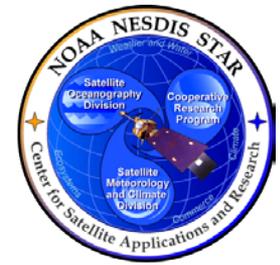
Types of Algorithms

- Individual – One algorithm suite per program per instrument (stovepipes)
- Linked – Algorithms that are developed for one instrument and may be dependent upon other products from that instrument (JPSS and GOES-R)
- Individual Enterprise Algorithm Suite – Algorithms that run on multiple instruments within one system
- Complex Enterprise Algorithm Suite – Algorithms that run on multiple instruments that have been designed to be transitioned to GEARS



Individual Algorithms

- Independent software base
- Minimal software reuse – algorithm team must develop data readers and writers for the instrument used
- Project only hardware – may or may not be shared with other instrument algorithms
- Medium development cost
- High maintenance cost



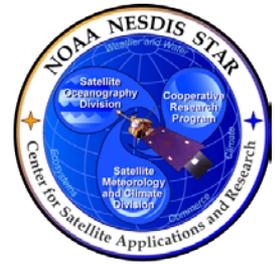
Linked Algorithms

- New system for new algorithm suite
- Products are linked together – product precedence
- Coordinated product development
- Project does not care about other satellites and/or instruments – requirements outside the project have no weight
- High cost
- System complexity determines maintenance cost



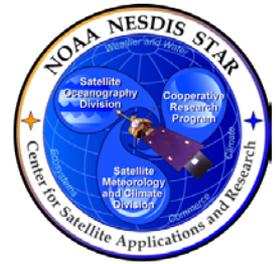
Individual Enterprise Algorithm Suites

Individual Enterprise Algorithm Suites



- Individual Enterprise Algorithm Suite is a program that has been developed by a science team to create their suite of products for multiple satellites
 - AVHRR Clear-Sky Processor for Oceans (ACSP0) – SST for polar satellites, currently being updated to process AHI data
 - Microwave Integrated Retrieval System (MiRS) – Microwave product suite for most microwave instruments
 - NESDIS Unique CrIS and ATMS Product System (NUCAPS) – Sounding product suite created using AIRS, IASI and CrIS hyperspectral sounding data

Software

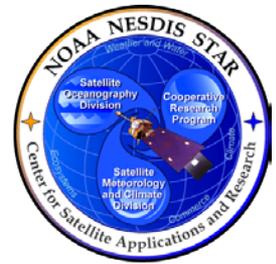


- Algorithm methodology and software is reused for multiple instruments
- Reduced algorithm development time
- Algorithms and software may not have been designed to be transitioned into a service base system

Issues:

Run in Multiple Systems

- The Enterprise Algorithm Suites are currently run in multiple processing systems within OSPO
- Different versions of the suites are run in each of the processing systems
- Regression tests may not be conducted – deliveries for each instrument individually





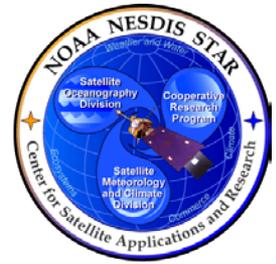
Steps Towards GEARS

- Consolidate Enterprise Algorithm Suites onto one or two processing system within OSPO
- Remove versionitis by conducting regression tests for the products
- Minimize software deliveries by updating algorithm for multiple satellites at once
- Evaluate algorithm implementation and work with STAR development team to create GEARS like algorithm service interfaces



Complex Enterprise Algorithm Suite

Complex Enterprise Algorithm Suite



- STAR Enterprise Processing Framework
- Overall program that keeps common data in memory
 - Individual algorithm teams create their own subroutines to plug into the program
 - Algorithm teams are dependent upon products from other algorithm teams
- Redundancy removed that is common amongst algorithms



More Enterprise Algorithms

- Work is being conducted to modify NOAA Heritage Cloud, Cryosphere, Volcanic Ash, and Aerosol algorithms to work on VIIRS data
- For most products, the heritage algorithm is the GOES-R algorithm.
- This will bring scientific consistency between the GOES-R products and VIIRS products

VIIRS and GOES-R Cloud Products



- Cloud Mask
- Cloud Top Phase
- Cloud Type
- Cloud Top Height
- Cloud Cover Layers
- Cloud Top Temperature
- Cloud Top Pressure
- Cloud Optical Depth
- Cloud Particle Size Distribution
- Cloud Liquid Water
- Cloud Ice Water Path

(All GOES-R heritage)

VIIRS and GOES-R Aerosol Products

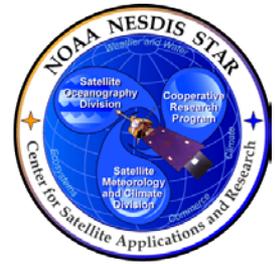


- Aerosol Detection
- Aerosol Optical Depth
- Aerosol Particle Size

- Volcanic Ash Mass Loading
- Volcanic Ash Height

(All GOES-R heritage)

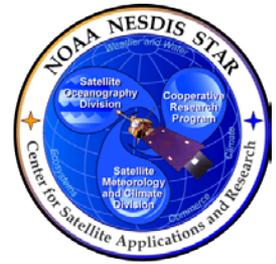
VIIRS and GOES-R Cryosphere Products



- Binary Snow Cover
- Fractional Snow Cover
- Ice Concentration and Cover
- Ice Surface Temperature
- Ice Thickness / Age

(Ice products have GOES-R heritage,
Snow products have operational
heritage)

Cloud and Wind Enterprise Algorithms



- Cloud algorithms from AVHRR and GOES are being migrated to a common software base (the SAPF) in operations
- Derived Motion Winds algorithms from AVHRR and MODIS are being migrated to a common software base (the SAPF) in operations
- All cloud and wind products in operations will be consolidated when these projects are complete



Transition to Enterprise Algorithms

STAR ASSISTT



- The Algorithm Scientific Software Integration and System Transition Team (ASSISTT) designs and develops algorithm processing suites/systems that are transitioned to OSPO
- Once these satellite suites/systems are transitioned to operations, STAR works in coordination with OSPO to maintain the science within these systems.
- ASSISTT specializes in this end to end process (design, development, transition to operations, and maintenance) for algorithm processing systems and their products.

Satellite Algorithm Integration for Common Ground System



Tasks

Transition Algorithms and Processing Systems to Operations

- Lead Process Lifecycle Reviews
- Provide scientists with software development guidance
- Integrate algorithms into processing systems
- Perform unit, regression and system tests
- Package and deliver algorithms/systems to OSPO
- Requirements development and tracing
- Configuration Management
- Risk Management
- Implementation of one program to create all satellite products
- Implementation of a hardware cluster for algorithm testing and reprocessing

Projects

Supported by ASSISTT

- GOES-R
- JPSS
- NDE (Six projects)
- Himawari-8
- GCOM (AMSR-2 Instrument)
- GOES Clouds, Winds, Fog, Land Surface Temperature, and Radiation Budget
- AVHRR Clouds and Volcanic Ash
- Product Tailoring
- Product Monitoring
- Direct Broadcast
- OSGS Algorithm Prototype

Enterprise

Implementation of the STAR Enterprise Algorithms *

- Winds – GOES-R ABI, Himawari-8, S-NPP VIIRS, GOES, AVHRR, SEVIRI, MODIS
- Cloud Products – GOES-R ABI, Himawari-8, S-NPP VIIRS, GOES, AVHRR, SEVIRI, MODIS, MTSAT
- Volcanic Ash – GOES-R ABI, Himawari-8, S-NPP VIIRS, AVHRR
- Cryosphere Ice Products – GOES-R ABI, Himawari-8, S-NPP VIIRS
- Aerosol Detection – GOES-R ABI, Himawari-8, S-NPP VIIRS
- Aerosol Optical Depth – GOES-R ABI, Himawari-8, S-NPP VIIRS



Steps towards GEARS

Transition Steps for Algorithms to GEARS



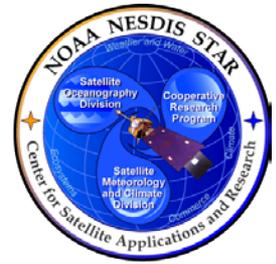
- Create Enterprise Algorithms
- Implement Enterprise Algorithms into a common system(s)
- Migrate common system Enterprise Algorithms to GEARS system



Motivation – OSGS

- Enterprise Algorithms have the following advantages for a GEARS implementation:
 - Development cost reduction
 - One transition of the algorithm to the GEARS system
 - Enables easier transition to algorithms a service

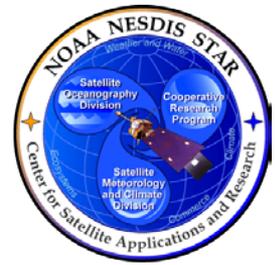
Summary



- Enterprise algorithms are a logical step in the transition to the GEARS system
 - Consolidation of science
 - Consolidation of systems
 - Minimization of operational software to maintain
- Goal is for these enterprise algorithms to become GEARS services



Backup Slides



ASSISTT – Enterprise Algorithms

- Winds – GOES–R ABI, Himawari–8, S–NPP VIIRS, GOES, AVHRR, SEVIRI, MODIS
- Cloud Products – GOES–R ABI, Himawari–8, S–NPP VIIRS, GOES, AVHRR, SEVIRI, MODIS, MTSAT
- Volcanic Ash – GOES–R ABI, Himawari–8, S–NPP VIIRS, AVHRR
- Cryosphere Ice Products – GOES–R ABI, Himawari–8, S–NPP VIIRS
- Aerosol Detection – GOES–R ABI, Himawari–8, S–NPP VIIRS
- Aerosol Optical Depth – GOES–R ABI, Himawari–8, S–NPP VIIRS