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Introduction

The OMPS Total Column (TC) and Nadir Profiler (NP) SDR algorithms have been significantly modified to improve the algorithm's performance and flexibility. The sensor characterization databases have been developed and used to derive the Look-Up Tables (LUT) for the SDR algorithms. With the updated SDR algorithms, the SDR product generation will be driven by the various sample tables that control the calibration data collection and the onboard EV data processing. New test data based on the latest sensor test results was generated to verify the SDR algorithm software implementation and its functional performance.

OMPS SDR Algorithm Improvements

Algorithm Development History

- The OMPS TC and NP SDR algorithms were originally developed by Raytheon ITSS and went through a series of Risk Reduction Reviews and the algorithm CDR (2002)
- NGST hosted the algorithms, performed initial tests to evaluate the algorithms functional and performance maturity, and fixed a number of software coding errors uncovered during the testing (2006)
- NGST recently completed major improvements to both SDR algorithms to address a number of algorithm deficiencies
 - Sensor data type, size and structure have evolved from the assumptions based on which the algorithms were developed
 - Lack of flexibility to accommodate possible on-orbit adjustment to the spatial and spectral ranges and locations of earth view and calibration data that may be necessary to meet the OMPS SDR and EDR product performance requirements
 - Algorithm LUTs of sensor parameters and coefficients need to be updated to reflect the sensor's true performance which are measured and characterized in the Sensor Characterization Databases (SCDB)
 - The science implementation is out-of-date and no longer consistent with the sensor operation in some modules (bias, dark removal, linearity, flat field, calibration, geolocation)

Improved Algorithm Flexibility

- All EV and calibration data processing driven by sample tables
 - Macrotable: EV macropixel location and bin size
 - EV_sampletable: bad pixel table, actual macropixel location and bin size
 - SC_sampletable: solar data location, size, and structure
 - EV_sampletable: lamp data location, size and structure
- Added sufficient flexibility to handle possible variations of the operational data in size and structure
 - Solar: binned smear, bias or no bias, any spatial/spectral dimension
 - Dark: FF
 - Lamp: bias/no bias, binned smear or no smear, any pixel location
 - Earth view: any spatial/spectral dimension, any spatial bin size
- Data type automatically identified from RDR header information

Improved Algorithm Science

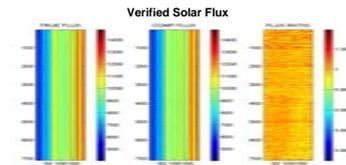
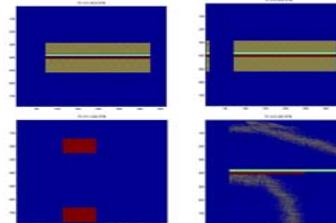
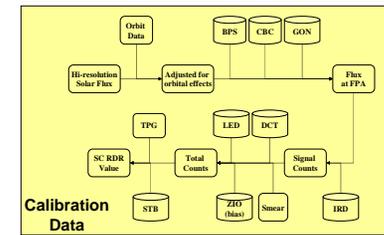
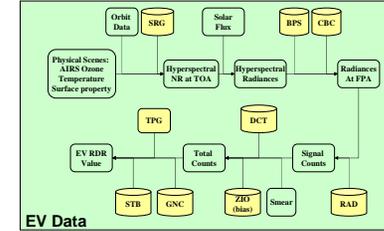
- Linearity table generation and nonlinearity correction
 - Same approach used by sensor vendor; table-based nonlinearity correction
- Bias correction
 - Computed from dark; after linearity correction; scaled by image co-adds
- Geolocation
 - Consistent definition of look angles; computation of macropixel LOS
 - Gain correction (Flat-field table generation)
 - Computed from radiance calibration coefficients and sensor through-put degradation factor
- Radiance calibration
 - Applied prelaunch radiance calibration coefficients
- Sun-earth distance correction
 - Added module to calculate sun-earth distance to adjust solar flux values
- Solar data processing
 - Modified to deal with solar image overlap regions; matching irradiance calibration coefficients and geometry correction coefficients to solar data
- Bad-pixel identification and table generation
 - Based on dark values; table generated and combined with EV sampletable in offline process
- Climatology databases
 - Updated and fixed errors in climatology databases; TOMS V8 climatology
- SDR match-up
 - Added functionality to automatically select channels used for EDR generation

Algorithms Ready for Operationalization

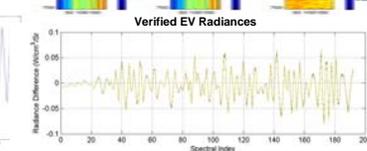
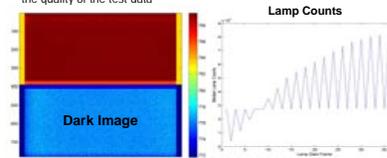
- Algorithm software code was updated based on the operational scenarios of the real OMPS sensors
- Algorithm software contains all essential science functionality for operational data processing
- Algorithm has additional flexibility to handle possible on-orbit data variations in type, size and dimension
- Algorithm has been thoroughly tested with variable and high fidelity test data

Test Data Generation and Verification

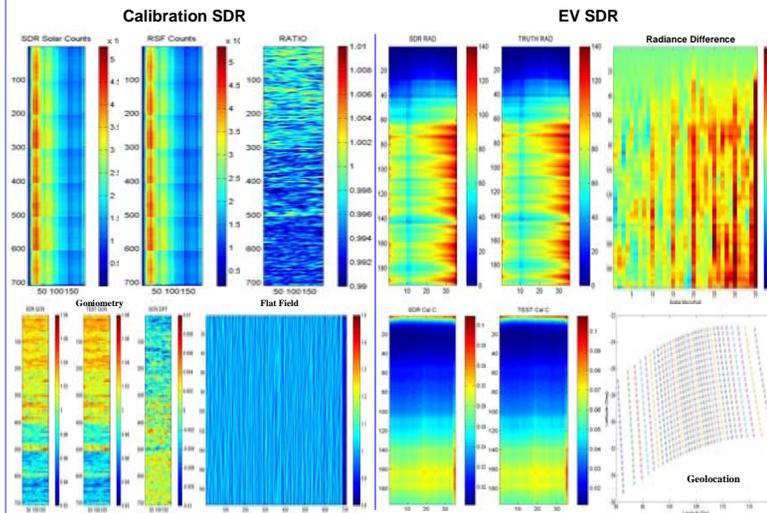
- The OMPS test data were generated using the latest sensor characterization databases (including sampletables)
- The test data have structure and contents that are similar to the operational data to allow for verification of the algorithms' real' functional performance
- In addition, two sets of test data were generated using different sampletables to verify the SDR algorithm's flexibility in handling variable data sizes
- TC test datasets
 - V11: 7328 EV MP: No bias in solar; No bias/smear in lamp data
 - V12: 7448 EV MP: With bias in solar; With bias and smear in lamp data
- NP test datasets
 - V08: No bias in solar data; No bias/smear in Lamp data
 - V09: With bias in solar data; With bias and smear in lamp data



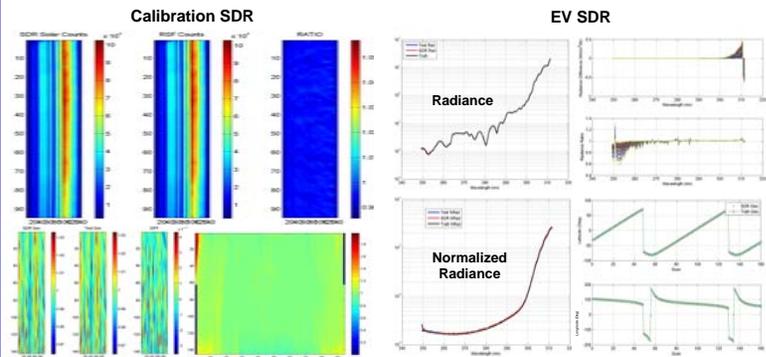
- Test data was independently verified to have the correct data structure, engineering data, and science data
- A simplified calibration algorithm (test code) was written to verify the content of the test data
- The test data was processed using the test code to compute the solar flux and EV radiances which are then compared to the truth to assess the quality of the test data



TC SDR Algorithm Test Results



NP SDR Algorithm Test Results



Conclusions

- The OMPS TC and NP SDR Algorithms have been significantly improved to have the complete functionality and correct science consistent with the OMPS sensors on-orbit operation and are ready for operational implementation
- The algorithms have additional flexibility to accommodate possible operational data changes in size and structure to meet the calval team and the user community's needs
- The updated science code has been successfully tested for functional performance with the high fidelity test data that was simulated based on the OMPS sensor characterization testing results