Geostationary Operational Environmental Satellite (GOES) – R Series

ABI L2+ Legacy Vertical Temperature Profile and Legacy Vertical Moisture Profile Beta, Provisional and Full Validation Readiness, Implementation and Management Plan (RIMP)

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ABI L2+ Legacy Vertical Temperature and Moisture Profiles
Beta, Provisional and Full Validation
Readiness, Implementation and Management Plan (RIMP)

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Preface

The evolving calibration and validation (cal/val) maturity of Geostationary Operational Environmental Satellite R-Series (GOES-R) products throughout the beginning of the mission is described by three levels: Beta, Provisional, and Full validation. The Flight Project is responsible for producing the Level 1b (L1b) products according to the Level III requirement documents. Once Beta Maturity of the L1b products is achieved, the Level 2+ (L2+) will begin analysis towards Beta maturity. Further levels of maturity (Provisional and Full validation) require additional and often long-term activities. A detailed description of the three product maturity levels is given in Figure 1, but brief descriptions of the three maturity levels are:

Beta: the product is minimally validated and may still contain significant errors; based on product quick looks using the initial calibration parameters.
Provisional: product performance has been demonstrated through a large, but still (seasonally or otherwise) limited, number of independent measurements. The analysis is sufficient for limited qualitative determinations of product fitness-for-purpose, and the product is potentially ready for testing operational use.
Full: product performance has been demonstrated over a large and wide range of representative conditions, with comprehensive documentation of product performance, including known anomalies and their remediation strategies. Products are ready for operational use.

Assessment and declaration of maturity levels is performed during Peer Stakeholder–Product Validation Reviews (PS-PVRs). At each PS-PVR, the status of products will be presented by members of the cal/val science teams. For L2+ products, Beta maturity PS-PVRs are held in close proximity with and prior to Operations Handover. The review panel at the PS-PVRs will include the GOES-R Operational Readiness Working Group (GORWG), GOES-R Program System Engineering (PSE), NOAA Office of Satellite and Product Operations (OSPO), and GOES-R Product Readiness and Operations (PRO). The Readiness, Implementation, and Management Plans (RIMPs) have been created to document the analysis techniques, methodology, duration, tools, data, resources, staffing, and schedule of the Post-Launch Product Tests (PLPTs) to be used by the cal/val science teams to demonstrate the different levels of product maturity. The primary purpose of the RIMPs is to act as a planning resource for the cal/val teams as they prepare for Launch. Additionally, the RIMPs can be used by other members of the GOES-R Program to prepare for cal/val activities, to assess the suitability of the cal/val test plans, and to understand the data and resource requirements the science teams have. Cal/val testing is likely to reveal necessary algorithm changes to evolve the product quality through the maturity levels. The Algorithm Change Management Plan (ACMP) will be used to track and implement these algorithm changes.

The introspection necessary to create these RIMPs has led to extensive consultations between the cal/val teams and other groups within the GOES-R Program, including the Flight Project, the Ground Segment, and a team of experts from The Aerospace Corporation under contract from GOES-R PSE to help improve the cal/val mission. Figure 2 below describes the responsibilities and accountability of each of the main parties involved in the creation of the RIMPs. This delineation is required because GOES-R operations are to be handed over from the GOES-R Program to NOAA OSPO at the end of the PLT period, yet the process of validating product maturity will continue. This changing nature of accountability during the process must be acknowledged. Accountability of the RIMPs changes at Operations Handover from NASA to NOAA and is aligned with the level of each RIMPs' validation maturity objective. Accountability determines which organization owns documentation, process, and procedures. Responsibility determines which organization creates, executes, and maintains specific activities.

GOES-R Product (L1b and L2+) Maturity Levels

Beta Validation

Preparation Activities
- Initial calibration applied (L1b).
- Rapid changes in product input tables, and possibly product algorithms, can be expected.
- Product quick looks and initial comparisons with ground truth data (if any) are not adequate to determine product quality.
- Anomalies may be found in the product and the resolution strategy may not exist.

End state
- Products are made available to users to gain familiarity with data formats and parameters.
- Product has been minimally validated and may still contain significant errors.
- Product is not optimized for operational use.

Provisional Validation

Preparation Activities
- Validation and quality assurance (QA) activities are ongoing, and the general research community is now encouraged to participate.
- Severe algorithm anomalies are identified and under analysis. Solutions to anomalies are in development and testing.
- Incremental product improvements may still be occurring.
- Users are engaged in the Customer Forums (L2+ products only), and user feedback is assessed.

End state
- Product performance (L1b or L2+) has been demonstrated through analysis of a small number of independent measurements obtained from selected locations, periods, and associated ground-truth/field program efforts.
- Product analysis are sufficient to communicate product performance to users relative to expectations.
- Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community.
- Testing has been fully documented.
- Product ready for operational use and for use in comprehensive calibration/validation activities and product optimization.

Full Validation

Preparation Activities
- Validation, QA, and anomaly resolution activities are ongoing.
- Incremental product improvements may still be occurring.
- Users are engaged and user feedback is assessed.

End state
- Product performance for all products is defined and documented over a wide range of representative conditions via ongoing ground-truth and validation efforts.
- Products are operationally optimized, as necessary, considering mission parameters of cost, schedule, and technical competence as compared to user expectations.
- All known product anomalies are documented and shared with the user community.
- Product is operational.

Figure 1. GOES-R product maturity levels.

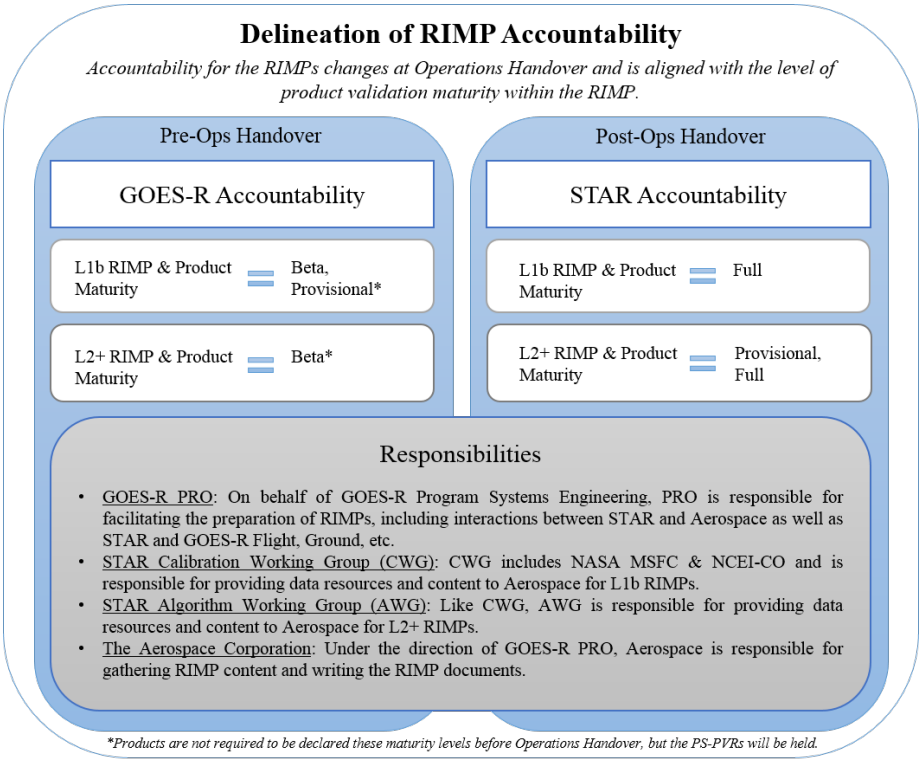

Figure 2. Delineation of accountability between GOES-R and STAR.

1. Legacy Vertical Temperature Profile and Legacy Vertical Moisture Profile Validation Overview

This Readiness, Implementation, and Management Plan (RIMP) covers all validation stages of the GOES-R Advanced Baseline Imager (ABI) Legacy Vertical Temperature (LVT) Profile and Legacy Vertical Moisture (LVM) Profile Level 2 products. There are three stages in the validation process, Beta, Provisional, and Full. Each stage is characterized by PLPTs, which guide the overall validation process. The RIMP includes a summary of the methods and tools employed to prove the LVT and LVM have met a given validation stage. Feedback from the NWS will be provided through the PS-PVR process. Other forums are being considered, but are TBD at this time. Appendices are included that present more detail on each applicable PLPT and detail on the different data sets and tools employed in the LVT and LVM validation processes. The LVT/LVM validation effort has no identified need for data from a North/South (N/S) scan or for a specific mesoscale scene. Data from field campaigns is not required for LVT/LVM validation, but high spectral IR measurements, such as from the Scanning High-resolution Interferometer Sounder, and radiosondes from field campaigns would be used if available.

The LVT and LVM products each have eight PLPTs with identified success criteria for Beta maturity. Five of these tests are intended to verify that various products are generated at the required cadence (see Table 1). The other three PLPTs associated with Beta maturity are an initial assessment of the accuracy and precision of the FD, CONUS, and mesoscale data products when the sensor is in Mode 3.[1] PLPTs that support Beta maturity are listed below; details are in Appendix A.

Beta PLPTs associated with inspection of LVT and LVM products to ensure data are produced at the specified cadence in each mode will be the responsibility of OSPO personnel. Any failures will be reported to the product analyst described in Section 3 and Appendix A. In parallel, the product analyst will perform checks that the data outputs are within the expected range and begin initial quantitative assessments of LVT and LVM quality, including quantitative comparisons between the LVT and LVM profiles and various truth data sources, to validate the reasonableness of the data products. A primary source of truth data for Beta validation will be Numerical Weather Prediction (NWP) short-term forecasts used to initialize the LVT and LVM algorithms. While not an independent source of truth data or as high accuracy as other sources of truth data, NWP will be available for comparison with every LVT and LVM output and will be sufficient to assess the reasonableness of the data products. Comparisons will also be made to additional independent sources of truth data, including conventional radiosondes within GOES-R coverage.[2]

- **ABI-FD-LVT01:** verify that LVT generated at the required cadence for FD for cloud-free areas while in ABI Mode 3 fall within the expected measurement range.
- **ABI-CONUS-LVT02:** verify that LVT generated at the required cadence for CONUS for cloud-free areas while in ABI Mode 3 fall within the expected measurement range.
- **ABI-MESO-LVT03:** verify that LVT generated at the required cadence for mesoscale for cloud-free areas while in ABI Mode 3 fall within the expected measurement range.
- **ABI-FD-LVT04:** verify that LVT generated at the required cadence for FD for cloud-free areas while in ABI Mode 4 fall within the expected measurement range.
- **ABI-CONUS-LVT05:** verify that LVT generated at the required cadence for CONUS for cloud-free areas while in ABI Mode 4 fall within the expected measurement range.
- **ABI-FD-LVT06:** assess the accuracy of LVT generated for FD in ABI Mode 3 and 4 for a very limited (i.e., not seasonally representative) number of independent measurements to convey an initial characterization of product accuracy to the user community.

- **ABI-CONUS-LVT07:** assess the accuracy of LVT generated for CONUS in ABI Mode 3 for a very limited (i.e., not seasonally representative) number of independent measurements to convey an initial characterization of product accuracy to the user community.
- **ABI-MESO-LVT08:** assess the accuracy of LVT generated for mesoscale in ABI Mode 3 for a very limited (i.e., not seasonally representative) number of independent measurements to convey an initial characterization of product accuracy to the user community.
- **ABI-FD-LVM01:** verify that LVM generated at the required cadence for FD for cloud-free areas while in ABI Mode 3 fall within the expected measurement range.
- **ABI-CONUS-LVM02:** verify that LVM generated at the required cadence for CONUS for cloud-free areas while in ABI Mode 3 fall within the expected measurement range.
- **ABI-MESO-LVM03:** verify that LVM generated at the required cadence for mesoscale for cloud-free areas while in ABI Mode 3 fall within the expected measurement range.
- **ABI-FD-LVM04:** verify that LVM generated at the required cadence for FD for cloud-free areas while in ABI Mode 4 fall within the expected measurement range.
- **ABI-CONUS-LVM05:** verify that LVM generated at the required cadence for CONUS for cloud-free areas while in ABI Mode 4 fall within the expected measurement range.
- **ABI-FD-LVM06:** assess the accuracy of LVM generated for FD in ABI Mode 3 and 4 for a very limited (i.e., not seasonally representative) number of independent measurements to convey an initial characterization of product accuracy to the user community.
- **ABI-CONUS-LVM07:** assess the accuracy of LVM generated for CONUS in ABI Mode 3 for a very limited (i.e., not seasonally representative) number of independent measurements to convey an initial characterization of product accuracy to the user community.
- **ABI-MESO-LVM08:** assess the accuracy of LVM generated for mesoscale in ABI Mode 3 for a very limited (i.e., not seasonally representative) number of independent measurements to convey an initial characterization of product accuracy to the user community.

The following Table identifies the frequency of each scan type for Modes 3 and 4. It includes the required cadence of the LVT and LVM products as defined by both the GOES-R Functional and Performance Specification (F&PS)[7] and the Product User's Guide (PUG)[10]. The PUG is a forward-looking document and may not match the F&PS. The LVT/LVM team will validate to whatever cadence the products are derived.

** There is no CONUS scan type for Mode 4, but there are required products over the CONUS that are derived from the FD output*

Mode	Mode 3			Mode 4		
Scan Type	FD	CONUS	Mesoscale	FD	CONUS	Mesoscale
Scan Freq	15 min	5 min	30 sec	5 min	5 min*	N/A
F&PS	60 min	30 min	5 min	60 min	30 min	N/A
PUG	15 min	5 min	5 min	5 min	5 min	N/A

Table 1. Legacy Vertical Temperature and Moisture documented product and verification cadences

Six additional PLPTs have been defined to attain Provisional maturity. PLPTs that support Provisional maturity are listed below; details are in Appendix A.

- **ABI-FD-LVT09:** assess the accuracy and precision of LVT generated for FD in ABI Mode 3 and 4 for an extended period that includes some but not all seasonal variability, to facilitate user decision on operational readiness.
- **ABI-CONUS-LVT10:** assess the accuracy and precision of LVT generated for CONUS in ABI Mode 3 for an extended period that includes some but not all seasonal variability, to facilitate user decision on operational readiness.

- **ABI-MESO-LVT11:** assess the accuracy and precision of LVT generated for mesoscale in ABI Mode 3 for an extended period that includes some but not all seasonal variability, to facilitate user decision on operational readiness.
- **ABI-FD-LVM09:** assess the accuracy and precision of LVM generated for FD in ABI Mode 3 and 4 for an extended period that includes some but not all seasonal variability, to facilitate user decision on operational readiness.
- **ABI-CONUS-LVM10:** assess the accuracy and precision of LVM generated for CONUS in ABI Mode 3 for an extended period that includes some but not all seasonal variability, to facilitate user decision on operational readiness.
- **ABI-MESO-LVM11:** assess the accuracy and precision of LVM generated for mesoscale in ABI Mode 3 for an extended period that includes some but not all seasonal variability, to facilitate user decision on operational readiness.

Provisional PLPTs for LVT and LVM will involve quantitative comparisons between the data products and various truth data sources, to provide an initial statistical assessment of data accuracy and precision. NWP short-term forecasts used to initialize the LVT and LVM algorithms will continue to be used, although these are not truly independent data sets. For Provisional maturity, a greater emphasis will be placed on comparisons to conventional NWS radiosondes within GOES-R coverage as an independent source of ground truth.

Six additional PLPTs have been defined to attain Full maturity. The PLPTs that support Full maturity are listed below; details are in Appendix A.

- **ABI-FD-LVT12:** assess the accuracy and precision of LVT generated for FD in ABI Mode 3 and 4 for an extended period of at least one year that includes seasonal variability, to facilitate user decision on operational readiness.
- **ABI-CONUS-LVT13:** assess the accuracy and precision of LVT generated for CONUS in ABI Mode 3 for an extended period of at least one year that includes seasonal variability, to facilitate user decision on operational readiness.
- **ABI-MESO-LVT14:** assess the accuracy and precision of LVT generated for mesoscale in ABI Mode 3 for an extended period of at least one year that includes seasonal variability, to facilitate user decision on operational readiness.
- **ABI-FD-LVM12:** assess the accuracy and precision of LVM generated for FD in ABI Mode 3 and 4 for an extended period of at least one year that includes seasonal variability, to facilitate user decision on operational readiness.
- **ABI-CONUS-LVM13:** assess the accuracy and precision of LVM generated for CONUS in ABI Mode 3 for an extended period of at least one year that includes seasonal variability, to facilitate user decision on operational readiness.
- **ABI-MESO-LVM14:** assess the accuracy and precision of LVM generated for mesoscale in ABI Mode 3 for an extended period of at least one year that includes seasonal variability, to facilitate user decision on operational readiness.

Full PLPTs for LVT and LVM will involve quantitative comparisons between the LVT and LVM data products and various truth data sources over an extended period of time, to provide a statistical assessment of data accuracy and precision. NWP short-term forecasts used to initialize the LVT/LVM algorithms and conventional NWS radiosondes within GOES-R coverage will continue to be used. Additional sources of ground truth, such as radiosondes from Atmospheric Radiation Measurement (ARM) sites and European Centre for Medium-Range Weather Forecasts (ECMWF) analysis will also be used.

The validation processes and procedures, monitoring and analysis methods, tools, and expected output artifacts are described in the following sections. The details of each PLPT test are contained in Appendix A and of each reference data set in Appendix B. The details of any tools used in the validation process are in Appendix C.

2. Schedule of Events

Figure 3 shows the GOES-R validation schedule. System Performance Operation Test (SPOT) begins 44 days after launch when ABI L1b and the L2 Cloud and Moisture Imagery (CMI) Key Performance Beta evaluation begins and should be declared Beta maturity by L+87. One day later, the GOES Rebroadcast (GRB) will be populated with that data. The L2 product must reach Beta maturity by Handover at L+197, the same time that ABI L1b and CMI must reach Provisional. Given that L2 Beta tests require at least 6 weeks, L2 Beta testing must get underway by L+155, but can begin as soon as the ABI L1b and CMI reach Beta (L+87).

The GOES-R Operations phase begins after handover, marking the start of a 12 month Extended Validation period for ABI L1b and CMI, which is coincident with the start of the 6 month L2 Provisional evaluation, followed by another nine month period for the L2 products to reach Full maturity, 15 months after Handover. LVT and LVM validations are expected to require the entire allocated period.

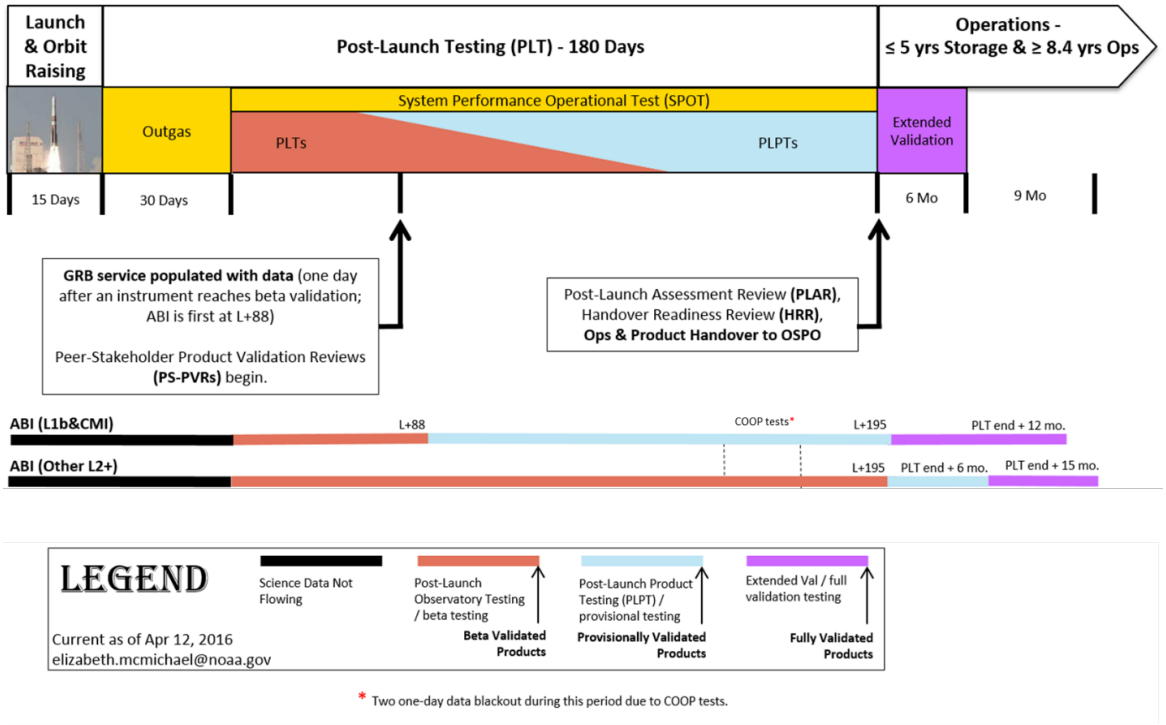

Figure 3. Schedule of events.

All Beta LVT and LVM PLPTs will commence at the start of PLPT period and progress in parallel. The verification of product generation PLPTs are scheduled for 1 week, while the assessment of product accuracy and precision tests are scheduled for 5 weeks. All Beta maturity PLPTs for LVT and LVM are scheduled to start simultaneously. Quality assessments by the product analyst, as described in Section 1, will continue over the first five weeks of the PLPT period. Comparisons will be made on an ongoing basis with summaries made approximately weekly, so as to identify unreasonable data products as early in PLPT as possible. Provisional LVT and LVM PLPTs are planned to begin at the end of the PLPT period, immediately after the Beta maturity has been obtained, and they are planned to last 24 weeks. Finally, Full PLPTs for LVT and LVM will be carried out immediately after the Provisional stage for another 36 weeks.

3. Roles and Responsibilities

3.1 Primary Point of Contact

The primary point-of-contact (POC) for managing the LVT/LVM validation effort and coordinating algorithm updates is Tim Schmit, with Jun Li (CIMSS) as secondary POC.

3.2 GOES-R Point of Contact

The primary POC at GOES-R for the LVT/LVM validation effort is Wayne MacKenzie.

3.3 Test Analyst/Engineer

The test analyst for all LVT/LVM PLPTs is Zhenglong Li. If Zhenglong Li is unavailable during PLPT, the primary backup analyst is Yong-Keun Lee.

3.4 GOES-R Feedback

Formal feedback to the GOES-R Program regarding the LVT/LVM validation effort will be provided by Tim Schmit.

3.5 Level of Effort

During the Beta validation effort, the first five of each of the LVT and LVM PLPTs are each budgeted 0.08 Full-Time Equivalent (FTE) (0.08 person-weeks), for a total of 0.8 FTE (0.8 person-weeks) split evenly between LVT and LVM. The remaining three of each of the LVT and LVM PLPTs, to be worked in parallel over the first five weeks, are each budgeted 0.13 FTE (0.65 person-weeks), for a total of 0.78 FTE (3.9 person-weeks).[1]

The LVT and LVM Provisional PLPTs should each be budgeted for 0.4 FTE (0.4 person-weeks) per week. Therefore the total commitment for the analyst during the Provisional stage is 0.8 FTE (0.8 person-weeks) per week, for a total of 19.2 FTE (19.2 person-weeks).

The LVT and LVM Full PLPTs should each be budgeted for 0.4 FTE (0.4 person-weeks) per week. Therefore the total commitment for the analyst during the Full stage is 0.8 FTE (0.8 person-weeks) per week, for a total of 28.8 FTE (28.8 person-weeks).

4. Tools

The LVT and LVM validation efforts utilizes a set of tools that fall into two categories: colocation tools and statistical analysis tools. The colocation tools compare Latitude, Longitude and time between LVT and LVM data and "truth" data sets to establish matched pairs of data for comparison. The statistical analysis tool will calculate bias, standard deviation, and RMS error between truth data sets and collocated ABI LVT and LVM products as well as visualization tools for such comparisons. The specifics of these tool sets are described in Appendix C.

5. Analysis Methods

The following methods will be utilized to evaluate and validate the LVT and LVM. Only the first two of the listed tools are likely to be used during Beta validation of the LVT and LVM data products. The other tools will be required for later stages of product validation. Similarly, the only datasets used during Beta validation will be NWP forecast used in the LAP retrieval, radiosondes (conventional), and ABI IR brightness temperatures.

3.1 Method 1: Routine Analysis[4]

- **Capabilities:** monitoring the quality of atmospheric temperature and moisture profiles in near-real time.
- **Datasets Used:** NWP forecast used in the Legacy Atmospheric Profile (LAP) retrieval, radiosondes (conventional), and ABI infrared (IR) brightness temperatures.
- **Visualization and Software Tools:**
  - Animation of retrieval (RTVL) images for the selected levels (LVT and LVM).
  - Animation of forecast (FCST) images for the selected levels (LVT and LVM).
  - Animation of difference (RTVL – FCST) images for the selected levels (LVT and LVM).
  - Statistics of retrievals against conventional radiosondes.
  - Monitor product quality.

3.2 Method 2: Deep-Dive Validation Tools[4]

- **Capabilities:** monitor anomalies of any GOES-R LAP product and identify the cause. Quantify the error/uncertainty of GOES-R LAP products for better applications.
- **Datasets Used:** radiosondes (conventional) and ABI IR brightness temperatures.
- **Visualization and Software Tools:**
  - Full and/or zoomed difference (LVT and LVM) between RTVLs and FCSTs images.
  - Full and/or zoomed (LVT and LVM) RTVL images.
  - Full and/or zoomed (LVT and LVM) FCST images.
  - Vertical (temperature and water vapor) profiles can be shown where both ground truth and retrieval are available.

Note that this method is not used during the Beta PLPT efforts.

3.3 Method 3: Long-term Performance Analysis

- **Capabilities:** monitor the quality of atmospheric temperature and moisture profiles.
- **Datasets used:** LAP retrieval, radiosondes (ARM site), and ECMWF analysis.
- **Visualization and Software Tools:**
  - Statistics of retrievals against ARM site radiosondes.
  - Statistics of retrievals against ECMWF analysis.

Note that this method is not used during the Beta PLPT efforts.

6. Output Artifacts

6.1 Beta Maturity Artifacts

The success criterion for Beta is the successful characterization of product accuracy and precision regardless of scene type or season. At the completion of the Beta phase, a report will be prepared and presented detailing the methods used and the results in terms of mean (accuracy), standard deviation (precision), and root mean square (RMS). Minimum and maximum values and probability distribution will be reported.

At the end of the first week of PLPT, the results from the range testing will be summarized in a report that will be made available for review by the Program. During the weeks 2-6 of PLPT the validation results from the analysis methods in Section 5 will be made available in the web-based display.

6.1.1 These tests of priority 1 all must pass in order to achieve Beta maturity:

- ABI-FD-LVT01
- ABI-CONUS-LVT02
- ABI-MESO-LVT03
- ABI-FD-LVT04
- ABI-CONUS-LVT05
- ABI-FD-LVT06
- ABI-CONUS-LVT07
- ABI-MESO-LVT08
- ABI-FD-LVM01
- ABI-CONUS-LVM02
- ABI-MESO-LVM03
- ABI-FD-LVM04
- ABI-CONUS-LVM05
- ABI-FD-LVM06
- ABI-CONUS-LVM07
- ABI-MESO-LVM08

6.1.2 The LVT and LVM Beta maturity validation effort does not include any tests of priority 2.

6.2 Provisional Maturity Artifacts

The success criteria for the Provisional PLPTs are: 1. the product, generated over a large and wide range of representative (except seasonally representative) conditions for all required frequencies (see Table 1) has been assessed sufficiently to characterize its accuracy and precision as well as the product limitations. Accuracy and precision have been compared to requirements for each product described in Appendix A; 2. Potential fixes and improvements needed to satisfy the Functional and Performance Specification (F&PS) have been identified; 3. Necessary fixes to the ABI sensor performance for the LVT and LVM products to be ready for operational use have been established; and 4. Necessary fixes to the LVT and LVM algorithms for the products to be ready for operational use have been established.

At the completion of the Provisional analysis, a report will be prepared and presented detailing the methods used and the results in terms of mean (accuracy), standard deviation (precision), and RMS. Minimum and maximum values and probability distribution will be reported for LVT and LVM.

Results will be presented showing dependencies on diurnal cycle and region (e.g., east or west CONUS).

6.2.1 These tests of priority 1 all must pass in order to achieve Provisional maturity:

- ABI-FD-LVT09
- ABI-CONUS-LVT10
- ABI-MESO-LVT11
- ABI-FD-LVM09
- ABI-CONUS-LVM10
- ABI-MESO-LVM11

6.2.2 The LVT and LVM Provisional maturity validation effort does not include any tests of priority 2.

6.3 Full Maturity Artifacts

The success criteria for the Full PLPTs are that the LVT and LVM products meet accuracy and precision specifications for a large and wide range of representative conditions (i.e., seasonal) over a period of at least a year for all required frequencies (see Table 1). Accuracy and precision specifications for each product are described in Appendix A.

At the completion of the Full analysis, a report will be prepared and presented detailing the methods used and the results in terms of mean (accuracy), standard deviation (precision), and root mean square, minimum and maximum values, and probability distribution will be reported for LVT and LVM. Results will be presented showing dependencies on diurnal cycle, region (e.g., east or west CONUS or ocean), and season.

6.3.1 These tests of priority 1 all must pass in order to achieve Full maturity:

- ABI-FD-LVT12
- ABI-CONUS-LVT13
- ABI-MESO-LVT14
- ABI-FD-LVM12
- ABI-CONUS-LVM13
- ABI-MESO-LVM14

6.3.2 The LVT and LVM Full maturity effort does not include any tests of priority 2.

6.4 Key Artifacts

Key artifacts for the LVT and LVM validation effort are reports generated at the end of each validation stage.

6.5 More Output Artifacts

None.

6.6 Delivery Schedule

The delivery schedule of artifacts for the LVT and LVM validation effort is tied to the schedule for completing beta, provisional, and full validation as given in section 2. The generation of reports will the responsibility of the Test Lead, working in conjunction with the Test Analyst.

7. Pre-launch

Software tools that will be utilized throughout the LVT and LVM validation effort are 90% complete. All validation tools have been developed and web tools are now available at http://soundingval.ssec.wisc.edu/. Testing of colocation and analysis tools with GOES-R proxy data, Southern Great Plains (SGP) radiosonde data, CONUS standard radiosonde sites, and archived Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) data from 2011 have been successfully completed.[5] Data Operations Exercises (DOEs) 1, 2, and 3 data have been provided and the LVT and LVM team has responded with comments. Additional data from DOE 4 are anticipated by the end of September 2016. Remaining tests of the tools require routine files to be produced and run through the system, staged and accessed by the PDS in real time. Future test data must contain forecast vertical temperature/moisture profiles which are needed in the GOES-R ABI LAP validation tool. Software tools are expected to be fully tested by October 2016.

8. References

The references listed below were used to generate this document, augmented with written and/or verbal feedback with the STAR product team. Superscripts are invoked within the text of this document to indicate a reference that can provide additional detail for the reader.

[1] PLPT_VE_List_L2_v1_0_20141022.xlsx.
[2] CalValPlan_Vol2_L2_v1-1-draft-redlines_inc-ERB_comments_v2a - Clean - BobEdits.docx.
[3] Derived_LAP_TPW_Stability_Validation_Table_v2_rico.docx.
[4] GOES-R_LAP_Validation_final_final.ppt.
[5] GOES-R_ABI_Validation_Tools_LAP_v1.3.docx.
[6] GOESR-CVCT-PLPT_BriefingToNOAA-IAC_2015-02-03_FINAL.pptx – Shortcut.
[7] GOES-R_GS_FPS.pdf.
[8] GOES-R_Field_Campaign_Plan_IAC_bds.pptx.
[9] MRD_v3_17.pdf.
[10] SE-16_CGS_7035538_PUG_V5_L2_RevD.pdf.

A. Appendix A: Validation Events

A.1 PLPT Events that Support Beta Maturity

A.1.1 Event Name: ABI-FD_LVT01

Objective: Verify that product is generated at the required cadence for FD.
Start Time: Start of the PLPT period.
Duration: 1 week.
ABI Mode: Mode 3.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Beta Success Criteria: Range assessment results reported. Analyst will inspect products to assess whether LVT product is generated at the required cadence (see Table 1) for FD and falls within expected range (180 – 320 K).[7,9] The monitoring of the product generation cadence will primarily be the responsibility of OSPO (not the test analyst) and the results conveyed to the test analyst. If there are issues with data products not being produced on time or falling outside expected values, a root cause and path forward should be identified prior to Beta being achieved.
Dependencies: Any issues with data access to LVT products will directly impact the schedule of LVT validation activities. Analyst requires access to near-real-time data through PDA.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li; 0.08 FTE; 0.08 person weeks.
Comparison/Reference Data: None.
Monitoring & Analysis Method: Product inspection.

A.1.2 Event Name: ABI-CONUS_LVT02

Same as ABI-FD_LVT01 except for:
Objective: Verify that product is generated at the required cadence for CONUS.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.
Beta Success Criteria: Range assessment results reported. Analyst will inspect products to assess whether LVT product is generated at the required cadence (see Table 1) for CONUS and falls within expected range (180 – 320 K).[7,9] The monitoring of the product generation cadence will primarily be the responsibility of OSPO (not the test analyst) and the results conveyed to the test analyst. If there are issues with data products not being produced on time or falling outside expected values, a root cause and path forward should be identified prior to Beta being achieved.

A.1.3 Event Name: ABI-MESO_LVT03

Same as ABI-FD_LVT01 except for:
Objective: Verify that product is generated at the required cadence for mesoscale.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.
Beta Success Criteria: Range assessment results reported. Analyst will inspect products to assess whether LVT product is generated at the required cadence (every 5 min) for mesoscale and falls within expected range (180 – 320 K).[7,9] The monitoring of the product generation cadence will primarily be the responsibility of OSPO (not the test analyst) and the results conveyed to the test analyst. If there are issues with data products not being produced on time or falling outside expected values, a root cause and path forward should be identified prior to Beta validation being achieved.

A.1.4 Event Name: ABI-FD_LVT04

Same as ABI-FD_LVT01 except for:
ABI Mode: Mode 4.

A.1.5 Event Name: ABI-CONUS_LVT05

Same as ABI-CONUS_LVT02 except for:
ABI Mode: Mode 4.

A.1.6 Event Name: ABI-FD_LVT06

Objective: Assess accuracy and precision of FD product.
Start Time: Start of the PLPT period.
Duration: 5 weeks.
ABI Mode: Modes 3 and 4.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Beta Success Criteria: Quantitatively assess performance with limited set of data. Identify issues with LVT product. Document performance and issue in the Beta report.
Dependencies: Any issues with data access to LVT products will directly impact the schedule of LVT validation activities. Analyst requires access to near-real time data through Product Distribution and Access (PDA). Any issues with access to Global Forecast System profiles of temperature will also impact LVT accuracy and precision validation activities.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li (primary), 0.13 FTE, 0.65 Person weeks; Yong-Keun Lee (backup).
Comparison/Reference Data: NWP inputs to algorithm, NWS radiosondes, and GOES Sounder Vertical Temperature Profiles over CONUS.[1]
Monitoring & Analysis Method: Colocation tools and statistical analysis tools. Colocation tools will extract LVT data matched in time and space with ground truth data. Statistical analysis tools will calculate accuracy and precision metrics relative to ground truth data.

A.1.7 Event Name: ABI-CONUS_LVT07

Same as ABI-FD_LVT06 except for:
Objective: Assess accuracy and precision of CONUS product.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.
ABI Mode: Mode 3.

A.1.8 Event Name: ABI-MESO_LVT08

Same as ABI-FD_LVT06 except for:
Objective: Assess accuracy and precision of mesoscale product.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.
ABI Mode: Mode 3.

A.1.9 Event Name: ABI-FD_LVM01

Objective: Verify that product is generated at required cadence for FD.
Start Time: Start of the PLPT period.
Duration: 1 week.
ABI Mode: Mode 3.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD every hour.
Beta Success Criteria: Range assessment results reported. Analyst will inspect products to assess whether LVM product is generated at required cadence (see Table 1) for FD and falls within expected range (0 – 100 %).[7,9] The monitoring of the product generation cadence will primarily be the responsibility of OSPO (not the test analyst) and the results conveyed to the test analyst. If there are issues with data products not being produced on time or falling outside expected values, a root cause and path forward should be identified prior to Beta validation being achieved.
Dependencies: Any issues with data access to LVM products will directly impact the schedule of LVM validation activities. Analyst requires access to near-real time data through PDA.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li; 0.08 FTE; 0.08 Person weeks.

Comparison/Reference Data: None.
Monitoring & Analysis Method: Product inspection.

A.1.10 Event Name: ABI-CONUS_LVM02

Same as ABI-FD_LVM01 except for:
Objective: Verify that product is generated at required cadence for CONUS.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS every 30 min.
Beta Success Criteria: Range assessment results reported. Analyst will inspect products to assess whether LVM product is generated at required cadence (see Table 1) for CONUS and falls within expected range (0 – 100 %).[7,9] The monitoring of the product generation cadence will primarily be the responsibility of OSPO (not the test analyst) and the results conveyed to the test analyst. If there are issues with data products not being produced on time or falling outside expected values, a root cause and path forward should be identified prior to Beta validation being achieved.

A.1.11 Event Name: ABI-MESO_LVM03

Same as ABI-FD_LVM01 except for:
Objective: Verify that product is generated at required cadence for mesoscale.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale every 5 min.
Beta Success Criteria: Range assessment results reported. Analyst will inspect products to assess whether LVM product is generated at required cadence (5 min) for mesoscale and falls within expected range (0 – 100 %).[7,9] The monitoring of the product generation cadence will primarily be the responsibility of OSPO (not the test analyst) and the results conveyed to the test analyst. If there are issues with data products not being produced on time or falling outside expected values, a root cause and path forward should be identified prior to Beta validation being achieved.

A.1.12 Event Name: ABI-CFD_LVM04

Same as ABI-FD_LVM01 except for:
ABI Mode: Mode 4.

A.1.13 Event Name: ABI-CONUS_LVM05

Same as ABI-CONUS_LVM02 except for:
ABI Mode: Mode 4.

A.1.14 Event Name: ABI-FD_LVM06

Objective: Assess accuracy and precision of FD product.
Start Time: Start of the PLPT period.
Duration: 5 weeks.
ABI Mode: Modes 3 and 4.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Beta Success Criteria: Quantitatively assess performance with limited set of data. Identify issues with LVM product. Document performance and issue in the Beta report.
Dependencies: Any issues with data access to LVM products will directly impact the schedule of LVM validation activities. Analyst requires access to near-real time data through PDA. Any issues with access to Global Forecast System profiles of moisture will also impact LVM accuracy and precision validation activities.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li (primary), 0.13 FTE, 0.65 Person weeks; Yong-Keun Lee (backup).
Comparison/Reference Data: NWP inputs to algorithm, NWS radiosondes, and GOES Sounder Vertical Moisture Profiles over CONUS.

Monitoring & Analysis Method: Colocation tools and statistical analysis tools. Colocation tools will extract LVM data matched in time and space with ground truth data. Statistical analysis tools will calculate accuracy and precision metrics relative to ground truth data.

A.1.15 Event Name: ABI-CONUS_LVM07

Same as ABI-FD_LVM06 except for:
Objective: Assess accuracy and precision of CONUS product.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.
ABI Mode: Mode 3.

A.1.16 Event Name: ABI-MESO_LVM08

Same as ABI-FD_LVM06 except for:
Objective: Assess accuracy and precision of mesoscale product.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.
ABI Mode: Mode 3.

A.2 PLPT Events that Support Provisional Maturity

A.2.1 Event Name: ABI-FD_LVT09

Objective: Assess accuracy and precision of FD products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
Start Time: At completion of Beta analysis & start of operational phase.
Duration: 24 weeks.
ABI Mode: Modes 3 and 4.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Provisional Success Criteria:

- Accuracy and precision determined over a large and wide range of representative conditions for all required modes. Accuracy and precision requirements do not have to be met to attain Provisional status, however, if they do not do so, the reasons behind not meeting these requirements must be documented.
  - Accuracy[7,9]: 1 K below 400 hPa and above boundary layer.
  - Precision[7,9]: 2 K below 400 hPa and above boundary layer.
  - Horizontal Resolution[7,9]: 10 km.
  - Mapping Accuracy[7,9]: 5 km.
- Remediation strategies are in place for known issues.
- Impacts from challenges with upstream dependencies are documented.
- Feedback from the primary user (NWS) is documented.
- Product is ready for potential operational use (user decision) and for use in scientific publications.

Dependencies: Any issues with data access to LVT products will directly impact the schedule of LVT validation activities. Analyst requires access to near-real time data through PDA. Any issues with access to Global Forecast System profiles of temperature will also impact LVT accuracy and precision validation activities.
PLPT Lead: Tim Schmit.
PLPT Analyst: Yong-Keun Lee (primary), 0.13 FTE, 3.2 person-weeks; Zhenglong Li (backup).
Comparison/Reference Data: NWP inputs to algorithm, NWS radiosondes, and GOES Sounder Vertical Temperature Profiles over CONUS.[1]
Monitoring & Analysis Method: Colocation tools and statistical analysis tools. Colocation tools will extract LVT data matched in time and space with reference “truth” data. Statistical analysis tools will calculate accuracy and precision metrics relative to reference data.

A.2.2 Event Name: ABI-CONUS_LVT10

Same as ABI-FD_LVT09 except for:
Objective: Assess accuracy and precision of CONUS products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.
ABI Mode: Mode 3.

A.2.3 Event Name: ABI-MESO_LVT11

Same as ABI-FD_LVT09 except for:
Objective: Assess accuracy and precision of mesoscale products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.
ABI Mode: Mode 3.

A.2.4 Event Name: ABI-FD_LVM09

Objective: Assess accuracy and precision of FD products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
Start Time: At completion of Beta & start of operational phase.
Duration: 24 weeks.
ABI Mode: Modes 3 and 4.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Provisional Success Criteria:

- Accuracy and precision determined over a large and wide range of representative conditions for all required modes. Accuracy and precision requirements do not have to be met to attain Provisional status, however, if they do not do so, the reasons behind not meeting these requirements must be documented.
    - Accuracy[7,9]: Sfc-500 mb: 18% relative humidity; 500-300 mb: 18% relative humidity; 300-100 mb: 20% relative humidity.
    - Precision[7,9]: Sfc-500 mb: 18% relative humidity; 500-300 mb: 18% relative humidity; 300-100 mb: 20% relative humidity.
    - Horizontal Resolution[7,9]: 10 km.
    - Mapping Accuracy[7,9]: 5 km.
- Remediation strategies are in place for known issues.
- Impacts from challenges with upstream dependencies are documented.
- Feedback from the primary user (NWS) is documented.
- Product is ready for potential operational use (user decision) and for use in scientific publications.

Dependencies: Any issues with data access to LVM products will directly impact the schedule of LVM validation activities. Analyst requires access to near-real time data through PDA. Any issues with access to Global Forecast System profiles of moisture will also impact LVM accuracy and precision validation activities.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li (primary), 0.13 FTE, 3.2 person-weeks; Yong-Keun Lee (backup).
Comparison/Reference Data: NWP inputs to algorithm, NWS radiosondes, ARM site radiosondes, ECMWF analysis, and GOES Sounder Vertical Temperature Profiles over CONUS.[1]

Monitoring & Analysis Method: Colocation tools and statistical analysis tools. Colocation tools will extract LVM data matched in time and space with reference "truth" data. Statistical analysis tools will calculate accuracy and precision metrics relative to reference data.

A.2.5 Event Name: ABI-CONUS_LVM10

Same as ABI-FD_LVM09 except for:
Objective: Assess accuracy and precision of CONUS products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.
ABI Mode: Mode 3.

A.2.6 Event Name: ABI-MESO_LVM11

Same as ABI-FD_LVM09 except for:
Objective: Assess accuracy and precision of mesoscale products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.
ABI Mode: Mode 3.

A.3 PLPT Events that Support Full Maturity

A.3.1 Event Name: ABI-FD_LVT12

Objective: Assess accuracy and precision of FD products for an adequate number of independent measurements to characterize accuracy and precision over a range of conditions, including seasonal variability.
Start Time: At completion of Provisional analysis.
Duration: 36 weeks.
ABI Mode: Modes 3 and 4.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Full Success Criteria:

- Accuracy and precision determined over a large and wide range of representative, conditions, including seasonal, over a period of at least a year for all required frequencies. Accuracy and precision requirements should be met to attain Full maturity status. However, if they do not do so, the reasons behind not meeting these requirements must be documented and remediation strategies must be in place for known issues.
    - Accuracy[7,9]: 1 K below 400 hPa and above boundary layer.
    - Precision[7,9]: 2 K below 400 hPa and above boundary layer.
    - Horizontal Resolution[7,9]: 10 km.
    - Mapping Accuracy[7,9]: 5 km.

Dependencies: Any issues with data access to LVT products will directly impact the schedule of LVT validation activities. Analyst requires access to near-real time data through PDA. Any issues with access to Global Forecast System profiles of temperature will also impact LVT accuracy and precision validation activities.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li (primary), 0.13 FTE, 4.8 person-weeks; Yong-Keun Lee (backup).
Comparison/Reference Data: NWP inputs to algorithm, NWS radiosondes, ARM site radiosondes, ECMWF short-term forecasts, and GOES Sounder Vertical Temperature Profiles over CONUS.[1]

Monitoring & Analysis Method: Colocation tools and statistical analysis tools. Colocation tools will extract LVT data matched in time and space with reference "truth" data. Statistical analysis tools will calculate accuracy and precision metrics relative to reference data.

A.3.2 Event Name: ABI-CONUS_LVT13

Same as ABI-FD_LVT12 except for:
Objective: Assess accuracy and precision of CONUS products for an adequate number of independent measurements to characterize accuracy and precision over a range of conditions, including seasonal variability.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.
ABI Mode: Mode 3.

A.3.3 Event Name: ABI-MESO_LVT14

Same as ABI-FD_LVT12 except for:
Objective: Assess accuracy and precision of mesoscale products for an adequate number of independent measurements to characterize accuracy and precision over a range of conditions, including seasonal variability.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.
ABI Mode: Mode 3.

A.3.4 Event Name: ABI-FD_LVM12

Objective: Assess accuracy and precision of FD products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.
Start Time: At completion of Provisional analysis.
Duration: 36 weeks.
ABI Mode: Modes 3 and 4.
GOES-R Data Type(s): ABI L1b products for Bands 8-16 for FD.
Full Success Criteria:

- Accuracy and precision determined over a large and wide range of representative, conditions, including seasonal, over a period of at least a year for all required frequencies. Accuracy and precision requirements should be met to attain Full maturity status. However, if they do not do so, the reasons behind not meeting these requirements must be documented and remediation strategies must be in place for known issues.
    - Accuracy[7,9]: Sfc-500 mb: 18% relative humidity; 500-300 mb: 18% relative humidity; 300-100 mb: 20% relative humidity.
    - Precision[7,9]: Sfc-500 mb: 18% relative humidity; 500-300 mb: 18% relative humidity; 300-100 mb: 20% relative humidity.
    - Horizontal Resolution[7,9]: 10 km.
    - Mapping Accuracy[7,9]: 5 km.

Dependencies: Any issues with data access to LVM products will directly impact the schedule of LVM validation activities. Analyst requires access to near-real time data through PDA. Any issues with access to Global Forecast System profiles of moisture will also impact LVM accuracy and precision validation activities.
PLPT Lead: Tim Schmit.
PLPT Analyst: Zhenglong Li (primary), 0.13 FTE, 4.8 person-weeks; Yong-Keun Lee (backup).
Comparison/Reference Data: NWP inputs to algorithm, NWS radiosondes, ARM site radiosondes, ECMWF short-term forecasts, and GOES Sounder Vertical Temperature Profiles over CONUS.[1]

Monitoring & Analysis Method: Colocation tools and statistical analysis tools. Colocation tools will extract LVM data matched in time and space with reference "truth" data. Statistical analysis tools will calculate accuracy and precision metrics relative to reference data.

A.3.5 Event Name: ABI-CONUS_LVM13

Same as ABI-FD_LVM12 except for:

Objective: Assess accuracy and precision of CONUS products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.

GOES-R Data Type(s): ABI L1b products for Bands 8-16 for CONUS.

ABI Mode: Mode 3.

A.3.6 Event Name: ABI-MESO_LVM14

Same as ABI-FD_LVM12 except for:

Objective: Assess accuracy and precision of mesoscale products for an adequate number of independent measurements to characterize accuracy and precision adequately for the user to determine if the product is ready for operational use.

GOES-R Data Type(s): ABI L1b products for Bands 8-16 for mesoscale.

ABI Mode: Mode 3.

B. Appendix B: GOES-R and Validation Reference Data

B.1 Data Set #1: Global Forecast System (GFS) Products[3]

Description: Vertical profiles of temperature and water vapor calculated four times daily. Short-term NWP input is used to initialize ABI LVT/LVM generation, and therefore will be available for every LVT/LVM product generated. While not a truly independent source of "truth" data, should be sufficient to assess the reasonableness of the LVT/LVM products.
Storage Location: National Centers for Environmental Prediction (NCEP).
Access Process: ftp.ncep.noaa.gov.
POC: N/A.
Spatial Coverage: FD coverage.
Temporal Coverage: 00, 06, 12, and 18 UTC daily.
Contingency: N/A (cannot produce LVT/LVM products without GFS Forecast products).

B.2 Data Set #2: Conventional (NWS) Radiosonde Oobservations[3]

Description: Vertical profiles of temperature, pressure, and water vapor collected from a distributed network of CONUS locations at 00 UTC and 12 UTC daily.
Storage Location: NOAA.
Access Process: OSPO Man-computer Interactive Data Access System (McIDAS) Abstract Data Distribution Environment (ADDE) server NCEP prep Binary Universal Form for the Representation of meteorological data (BUFR) files (ftp .ncep.noaa.gov).
POC: N/A.
Spatial Coverage: Network distributed fairly evenly over CONUS. Colocation and analysis tools testing used 57 locations in eastern CONUS.[5]
Temporal Coverage: 00 UTC and 12 UTC daily.
Contingency: GFS Forecast.

B.3 Data Set #3: SGP ARM Site Radiosondes

Description: Vertical profiles of temperature, pressure, and water vapor collected from the ARM-Cloud and Radiation Testbed (CART) site at SGP (CONUS) location every six hours. The quality of the RAOB data from SGP has been shown to be of higher quality than conventional RAOB.[5] Instability indices will be derived from the vertical profiles.
Storage Location: ARM-CART at SGP.
Access Process: Data available for download.
POC: N/A.
Spatial Coverage: Latitude 36.61º N and longitude 97.47° W.
Temporal Coverage: Once every 6 hours.
Contingency if not available: Conventional (NWS) radiosonde observations or ECMWF forecasts.

B.4 Data Set #4: ECMWF Analyses

Description: Forecasts of temperature, pressure, and water vapor calculated by the ECMWF.
Storage Location: ECMWF.
Access Process: Ordered as needed.
POC: The CIMSS POC for obtaining ECMWF data is Kevin Baggett..
Spatial Coverage: Calculations performed globally at grid points.
Temporal Coverage: 00 UTC to 24 UTC daily at 6 hour intervals.
Contingency if Not Available: GFS forecast or radiosonde observations.

C. Appendix C: Tools

C.1 Tool Set #1: Colocation Tools[5]

Location: Cooperative Institute for Meteorological Satellite Studies (CIMSS).
Description: MATLAB tools to compile ABI LAP temperature and moisture profile data that meets matchup criteria with ground truth data sets. Designed to run on MATLAB software version 7.10.0.499 (R2010a) on 64 bit Linux machine. Should work on newer versions as well.
Developer: Yong-Keun Lee (Tim Schmit, Jun Li, Zhenglong Li co-authors on Reference [5]).
Development Schedule: 90% complete. All validation tools have been developed and web tools are now available at http://soundingval.ssec.wisc.edu/.
Tools are internal to STAR and shared within the team. No handover plan is required.
Data Dependencies: ABI Legacy Vertical Temperature Profile products. ABI Legacy Vertical Moisture Profile products. Latitude, Longitude, and time of reference ("truth") data sets.
Testing Accomplished or Planned: Testing of colocation tools performed with GOES data and RAOB data collected between April 7, 2010 and March 26, 2011. Data Operations Exercises (DOEs) 1, 2, and 3 data have been provided and the LVT and LVM team has responded with comments. Additional data from DOE 4 are anticipated by the end of September 2016. Remaining tests of the tools require routine files to be produced and run through the system, staged and accessed by the PDS in real time. Future test data must contain forecast vertical temperature/moisture profiles which are needed in the GOES-R ABI LAP validation tool. Software tools are expected to be fully tested by October 2016.
POC: Yong-Keun Lee and Zhenglong Li.

C.2 Tool Set #2: Statistical Analysis Tools[5]

Location: CIMSS.
Description: MATLAB tools to calculate bias, standard deviation, and RMS error between reference truth data sets and collocated ABI temperature/moisture profiles as well as visualization tools for such comparisons. Designed to run on MATLAB software version 7.10.0.499 (R2010a) on 64 bit Linux machine.
Developer: Yong-Keun Lee (Tim Schmit, Jun Li, Zhenglong Li co-authors on Reference [5]).
Development Schedule: 90% Complete. All validation tools have been developed and web tools are now available at http://soundingval.ssec.wisc.edu/.
Tools are internal to STAR and shared within the team. No handover plan is required.
Data Dependencies: Reference data will be NWP inputs to the LAP retrievals, RAOB data from 57 NWS conventional RAOB sites (twice daily), and ABI LAP retrieval products temporally and spatially matched for each of these sites by the colocation tools.
Testing Accomplished or Planned: Testing of statistical analysis tools performed with GOES data and RAOB data collected between April 7, 2010 and March 26, 2011. Data Operations Exercises (DOEs) 1, 2, and 3 data have been provided and the LVT and LVM team has responded with comments. Additional data from DOE 4 are anticipated by the end of September 2016. Remaining tests of the tools require routine files to be produced and run through the system, staged and accessed by the PDS in real time. Future test data must contain forecast vertical temperature/moisture profiles which are needed in the GOES-R ABI LAP validation tool. Software tools are expected to be fully tested by October 2016.
POC: Yong-Keun Lee and Zhenglong Li.

D. Appendix D: Acronym List

Acronym	Definition
ABI	Advanced Baseline Imager
ACMP	Algorithm Change Management Plan
AMSR-E	Advanced Microwave Scanning Radiometer - Earth Observing System
ARM	Atmospheric Radiation Measurement
AWG	Algorithm Working Group
BUFR	Binary Universal Form for the Representation of meteorological data
Cal/Val	Calibration and Validation
CAPE	Convective Available Potential Energy
CART	Cloud and Radiation Testbed
CCR	Configuration Change Request
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CMI	Cloud and Moisture Imagery
CONUS	Continental United States
CVCT	Cal/Val Coordination Team
CWG	Calibration Working Group
DOE	Data Operations Exercise
DSI	Derived Stability Index
ECMWF	European Centre for Medium-Range Weather Forecasts
ERB	Engineering Review Board
F&PS	GOES-R Functional and Performance Specification
FCST	Forecast
FD	Full Disk
FTE	Full-Time Equivalent
GFS	Global Forecast System
GOES	Geostationary Operational Environmental Satellite
GOES-R	GOES R-Series
GORWG	GOES-R Series Operational Requirements Working Group
GRB	GOES Rebroadcast
IR	Infrared
KI	K Index
L1b	Level 1b
L2	Level 2
LAP	Legacy Atmospheric Profile
LI	Lift Index
LVM	Legacy Vertical Moisture Profile
LVT	Legacy Vertical Temperature Profile
McIDAS	Man-computer Interactive Data Access System
McIDAS ADDE	McIDAS Abstract Data Distribution Environment

Acronym	Definition
MOST	Mission Operations Support Team
MRD	Mission Requirements Document
MSFC	Marshall Space Flight Center
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NCEI	National Centers for Environmental Information
NCEI-CO	NCEI - Colorado
NCEP	National Centers for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
NWS	National Weather Service
OSPO	Office of Satellite and Product Operations
PDA	Product Distribution and Access
PLPT	Post-Launch Product Test
PLT	Post-Launch Test
POC	Point of Contact
PRO	Product Readiness and Operations
PSE	Program System Engineering
PS-PVR	Peer Stakeholder-Product Validation Review
PUG	Product User's Guide
QA	Quality Assurance
RAOB	Radiosonde Observation
RIMP	Readiness, Implementation and Management Plan
RMS	Root Mean Square
RTVL	Retrieval
SGP	Southern Great Plains
SI	Showalter Index
SPOT	System Performance Operational Test
STAR	Center for Satellite Applications and Research
TBD	To Be Determined
TPW	Total Precipitable Water
TT	Total Index
UTC	Universal Time Coordinated
VE	Validation Events