DEVELOPMENT OF LEVEL 2 CALIBRATION AND VALIDATION PLANS FOR GOES-R; WHAT IS A RIMP?

Thomas J Kopp, Leslie O Belsma, Andrew K Mollner, Ziping Sun, Frank De Luccia

The Aerospace Corporation, El Segundo, CA

Calibration and Validation (Cal/Val) plans for Geostationary Operational Environmental Satellite version R (GOES-R) Level 2 (L2) products were documented via Resource, Implementation, and Model Management Plans (RIPMs) for all of the official L2 products required from the GOES-R Advanced Baseline Imager (ABI). In 2015 the GOES-R Advanced Baseline Imager L2 Validation Plan (L2VP) was established and RIPMs for all L2 products from GOES-R ABI for User Readiness and Product Evaluation, 97: 245-261.

Validation Overview

Each L2 RIMP contained the following required content: Validation Overview, Schedule of Events, Roles and Responsibilities, Tools, Analysis Methods, Output Artifacts, Pre-Launch, References, Appendices: Validation Events, Validation Reference Data, List of Tools, Acronyms.

Contents

Cloud and Moisture Imagery

Cloud and Moisture Imagery (CM) was a special case, and followed the L1B schedule. Anticipation for GOES-R Imagery is high, and numerous pre-launch efforts have focused on being able to exploit this imagery as soon as it becomes available. Similar ideas were employed for land and aerosol products, though for these products each individual product retained its own RIMP. Since those algorithms did not run in a chain, it was appropriate to retain individual RIPMs. Volcanic ash was a more difficult case, since ash events vary widely over large time scales, and there is no guarantee of a significant ash event during the official Cal/Val period. The RIMP accounts for this possibility and the RIMP includes options to quantitatively show volcanic ash product performance even if no significant event occurs. Each RIMP had to account for unexpected product discrepancies, which are depicted in the figure below.

Clear Sky Mask (CSM)

The CSM is an exceptional challenge since it is impacted numerous L2 products. Such challenges with cloud mask verification have occurred with other programs such as the Suomi National Polar-orbiting Partnership (SNPP) and described in Kopp at al [2]. The figure above shows the overall L2 validation schedule, and the completion data for the CSM. The CSM schedule had to account for all downstream dependencies, since all of the L2 products had to meet the schedule reflected in Figure 1. None of the dependent L2 products could finish verification before the CSM was complete and an acceptable CSM. Therefore the CSM completion date was an important validation parameter. Each dependent product impacted the CSM completion dates, and likewise were written to correspond with the expected availability, and accuracy, of the CSM. Therefore the resulting L2 RIMPs are properly correlated with CSM progress and planning.

Conclusions

GOES-R, now GOES-16, successfully launched on 19 November 2016. GOES-16 reached its testing position on 5 December and validation procedures have passed the beta stage. The L2 RIPMs successfully guided the validation process through the beta validation on time, and they continue to be the foundation from which GOES-16 is accomplishing the L1 validation process. Referenced

Although each L2 RIMP followed the same format, additional considerations were necessary for Derived Motion Winds (DMW) and Hurricane Intensity Estimation (HIE). In the case of DMW, it contained more than triple the number of PLPTs compared to any other L2 product. This proved successful, and only after extensive discussion was a consolidation approach agreed to by all parties. The result retained all of the necessary and applicable PLPTs while avoiding an unacceptably lengthy and repetitive RIMP. For HIE the challenge was in describing correct quantitative criteria for what is an estimate by design. Nevertheless quantitative values were present in requirement documents and were incorporated into the HIE RIMP to provide an effective standard by which the various stages of validation may be met.

Introduction

Approach

The creation of the L2 RIPMs was a complex and dynamic process. The suite of L2 products required 14 separate L2 RIPMs guided by 6 lead authors who interacted with 12 different science leads from Satellite Applications and Research (STAR) along with GOES-R program personal. Each L2 RIMP had to accommodate a fixed GOES-R validation schedule and GOES-R requirements. Furthermore there were conflicting documents on exactly what the standards were for validation, and hurdles of pre-existing Post Launch Product Tests (PLPTs) that were also to be addressed within the RIPMs. The L2 RIPMs were standardized to ensure critical content such as the appropriate criteria for each stage, tools, schedule, processes, and the description of pre-existing Validation Events (VEs) were handled in a consistent manner. Initial efforts determined the scope of the documents, and afterwards organized, coordinated, and developed the L2 RIPMs. Dependencies were identified between the Functional and Performance Specification (FPS) and the Product User’s Guide (PUG), and measures to be used to validate each product were successfully established. Risks were identified throughout the development of the RIPMs and passed forward to the appropriate review boards. Interactions between the L2 products C-Vel efforts had to be accounted for, especially in the case of the Clear Sky Mask (CSM), which is a necessary input to many L2 products. The CSM coordination and development took particular care.

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Cloud and Moisture Imagery

Cloud and Moisture Imagery (CM) was a special case, and followed the L1B schedule. Anticipation for GOES-R Imagery is high, and numerous pre-launch efforts have focused on being able to exploit this imagery as soon as it becomes available (e.g. Greenwald et al [1]). The CSM coordination and development took particular care. Nevertheless quantitative values were present in requirement documents and were incorporated into the HIE RIMP to provide an effective standard by which the various stages of validation may be met.

Logistics for the remaining L2 RIPMs

Similar ideas were employed for land and aerosol products, though for these products each individual product retained its own RIMP. Since those algorithms did not run in a chain, it was appropriate to retain individual RIPMs. Volcanic ash was a more difficult case, since ash events vary widely over large time scales, and there is no guarantee of a significant ash event during the official Cal/Val period. The RIMP accounts for this possibility and the RIMP includes options to quantitatively show volcanic ash product performance even if no significant event occurs. Each RIMP had to account for unexpected product discrepancies, which are depicted in the figure below.

Figure above

Simple schematic of the cloud product algorithm chain for GOES-R. The associated cloud RIPMs are below the algorithm product, and the products were combined consistent with the algorithms that produced them.