

RADARSAT-1 AND -2 GOVERNMENT CALIBRATION ACTIVITIES

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1. INTRODUCTION

This paper examines the calibration activities assumed by the Canadian government within the RADARSAT program, from RADARSAT-1 commissioning in 1996 to the current period, more than one year into the RADARSAT-2 mission. Design, deployment and implementation of the RADARSAT-1 calibration plan and ground system are reviewed in the context of successor missions, more specifically RADARSAT-2. RADARSAT-1 calibration and image quality measurements covering the entire thirteen-year experience in calibration operations and maintenance of the RADARSAT-1 mission are presented, as well as Government calibration monitoring activities and results for RADARSAT-2.

2. THE GOVERNMENT CALIBRATION OPERATIONS

Property of the Canadian government, RADARSAT-1 has a calibration system operated at the satellite operations facility of the Canadian Space Agency (CSA) headquarters located in Longueuil, Canada [1]. The Canadian Data Processing Facility (CDPF), operated by MacDonald Dettwiler and Associates Ltd (MDA), has remained the reference processing facility for RADARSAT-1 data quality control since the start of the Maintenance Phase in Feb. 1997. Previous reports of the RADARSAT-1 calibration performance at various mission stages since launch can be found [2-7].

The RADARSAT-2 operations undergo a different mission model. Privately owned by MDA and developed in partnership with the CSA, the RADARSAT-2 SAR system has increased capabilities and larger range of imaging options including selectable polarization. While the RADARSAT-2 SAR calibration is maintained by MDA, the Canadian Government has an image quality assurance mandate coordinated by the CSA, with the participation of the Canada Centre for Remote Sensing (CCRS), the Department of National Defence, and other Canadian Government Departments.

3. RADARSAT-1 CALIBRATION OPERATIONS

The long-term performance and outstanding stability of the RADARSAT-1 SAR instrument is best visualized through in-orbit data records obtained from the monitoring of its radiometric calibration and its image quality, respectively. In effect, the RADARSAT-1 calibration plan was designed with an emphasis on in-flight validation of antenna beam patterns and quality measurements of SAR imagery, performed at fixed sampling periods. Calibration datatakes were compared against a set of specifications defined from pre-flight patterns and system analysis performed at the design phase. More direct internal calibration measurements are also performed regularly since 1999, showing no indication of trends affecting the linearity of the receiver.

Measurements of elevation beam patterns consistently relied on a specific area of the Amazon rainforest, and more than 1500 patterns were extracted at this site so far, at a rate of 10 patterns per 24-day cycle. Image quality measurements such as SAR

impulse response and location error relied on the use of four precision transponders deployed across the Canadian territory. Overall, long-term usage of transponders and Amazon has been instrumental in monitoring the RADARSAT-1 SAR system, while providing lessons learned for the more complex RADARSAT-2.

4. RADARSAT-2 IMAGE QUALITY ASSURANCE ACTIVITIES

The second part of this communication presents some of the RADARSAT-2 image quality and calibration assurance activities undertaken by the Canadian Government. The Canadian Government, through supporting the development of RADARSAT-2, and as a prime data user, has a role in verifying that SAR sensor data fully meets the agreed specifications of products, including quality parameters. To that end, a Government Working Group on Image Quality (GWGIQ) was formed from representatives of key government departments to independently validate the RADARSAT-2 SAR sensing performance, as well as to investigate other government image quality requirements that extend data usage beyond those conceived at launch. Inherent to the mission of the GWGIQ is the ongoing collaboration with MDA to optimize the benefits of the investment through continuing development of products and services. Independent assessment of data products for RADARSAT-2 is being made using an upgraded RADARSAT-1 transponder, the Amazon, and other sites under study in Antarctica and Central Africa. So far, results from basic product validation indicate radiometric and point target specifications are well met, and image quality is excellent, as well as noise performance [8].

5. REFERENCES

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