P1.15 NEAR-REAL-TIME MODIS RBD FILES TO L0 FILES CONVERSION

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1. INTRODUCTION

The NOAA/NESDIS Near-Real-Time Processing System was implemented under the Computer Sciences Corporation (CSC) Central Satellite Data Processing (CSDP) contract. This system provides near-real-time environmental products to NOAA customers using the MODIS (Moderate Resolution Imaging Spectro-radiometer) data, now available from two NASA EOS satellites – TERRA and AQUA.

The first step in processing MODIS data is to convert the Rate Buffered Data (RBD) files NOAA receives from NASA's EDOS (EOS Data Operations System) to Level 0 (L0) data. In developing the subsystem for converting RBD files into the five-minute L0 data granules needed for parallel processing, we encountered some technical problems related to the way the MODIS data is transmitted to EDOS from the spacecraft contacts.

This poster session displays sample structures of the RBD files with various types of time discontinuity and bit flips and algorithms used to overcome all these irregularities.

The MODIS data flow structure largely depends on the platform, whether it is the TERRA or AQUA satellite. The difference between the two data streams is considerable and has to be taken into account.

Figure 1 shows a typical structure of a MODIS RBD file for the TERRA satellite. The number of rewinds and data volume may differ from file to file, but the structure is similar.

2. L0 REQUIRMENTS

An L0 file has a data structure similar to an RBD file. The smallest logical data set in both the L0 and RBD files consists of three parts: CCSDS Primary and Secondary headers, a MODIS header, and a data field.

Unlike an L0 file, however, each data set in an RBD file is preceded by an EDOS service header. Another difference between these two files is data volume. A NOAA-specific L0 file contains five minutes worth of observation data, while an RBD file comprises between one and twenty granules of data.

Therefore, to convert Rate Buffered Data into L0 data, we have to read five minutes worth of data from the RBD file and write it to the L0 file, dropping the EDOS service header.

This task is not as simple and straightforward as it appears due to the RBD file structure, which has various repeats and gaps in data related to instrument and communication infrastructure artifacts.

3. RBD FILE ISSUES AND ALGORITHMS

The TERRA RBD file consists of a large amount of consecutive MODIS data (practically, from 5 to 15 granules) and several granules from the rewind. Very often, we have more than one rewind in the same TERRA RBD file (see Fig.1).

The AQUA RBD file consists of some data of direct broadcast (usually, 2 or 3 granules) and a large amount of consecutive MODIS data (practically, from 5 to 15 granules) from the playback. The playback terminates with some direct broadcast data.

The following describes the most common issues with the RBD files and how we address them:

Data from tape recorder rewinds or bit flips. Some parameters (for example, the time of packet acquisition) have their consecutive values suddenly changed due to a rewind of a tape recorder or a bit flip, i.e. a sudden change of a bit value due to various technical reasons on-board the satellite. To distinguish between the two, the previous and the next packets are tested. Sometimes, it is not enough and another parameter is checked for its continuity.

Duplicate granules. We keep track of all the granules processed, and we ignore any new occurrence of the same granule: it is read in but not saved for future processing. For example, we have five duplicates for the "11:55" granule on Fig. 1.

Partial granules. As a rule, the beginning and the end of an RBD file do not fall at five-minute boundaries; therefore we have, at least, two partial granules in every RBD file. Practically, we have more

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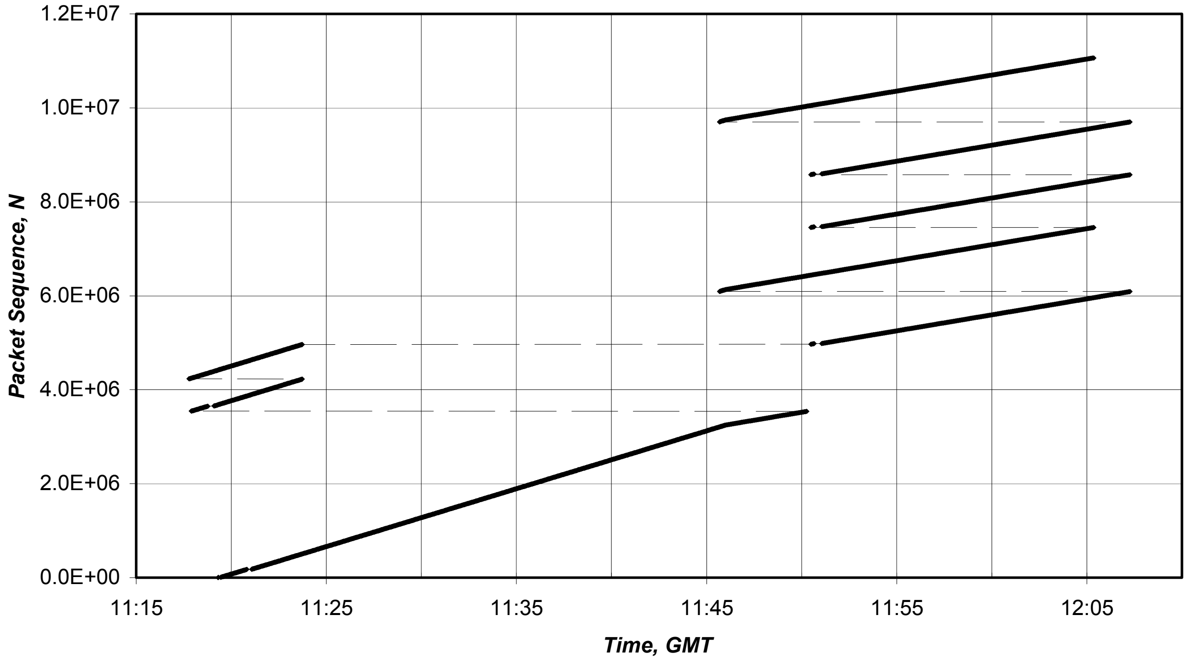

***Figure 1**. Sequence Packet Number versus Time of Packet Acquisition.*

This is an example of a scatter chart of a TERRA MODIS RBD file (R0420064EDO0205716171300.RBD). Dashed lines connect points corresponding to two consecutive packets in the RBD file. Points representing a sequential number of a packet in the RBD file and its time of acquisition form solid-looking lines. The two lowest lines are from direct playback. The rest of the lines are from the playbacks after rewinding of the onboard tape recorder. The missing packets and bit flips are invisible on the chart due to the scale limitations. A partial granule before a granule boundary forms a "tail-part" of a granule. A partial granule after a granule boundary forms a "nose-part" of a granule. Such "noses" and "tails" are used to further produce whole granules.

partial granules per a file than just two, because of rewinds and/or missing packets. Also we have partial granules fragmented within the same or separate file (see Fig.1). Every partial granule is stored in a file and waits for another part of a granule to arrive. Then the two partial granules are "stitched up" in one entire granule.

Gap inside a granule. If a rewind does not cover a gap between two consecutive files, a granule combined from two parts has a gap. Sometimes, several packets or even entire consecutive scans are lost due to reasons other than rewinds. We retain such granules for further processing, because it is up to a customer or an application to decide whether to use such a gapped granule or not.

Packets of the same scan repeated several times in a row. The ground-satellite interaction is an ongoing process. This repetition is an example of what can occur in the course of events. The RBD data began to come from TERRA in an unusual and unpredictable mode: packets of the same scan were repeated several times in a row. As a result, we lost a lot of data before the problem was identified and the program was modified to accommodate the changes in the input data.

4. CONCLUSIONS

A new program converting MODIS RBD files to five-minute L0 data granules has been created. The number of missing granules extracted from the RBD data stream was decreased from about 10% per day to about 0.03%, i.e. one five-minute granule per ten days. The reason we are not extracting 100% of the available data is due to bit flips or missing packets at the beginning of scans. Theoretically, it is possible to extract 100% of the available granules, but it will result in an undesired increase of the processing time.

A copy of this poster session is located at http://www.osdpd.noaa.gov/MODIS/AMS/.