PRE-LAUNCH VIIRS, CRIS, AND ATMS PROXY DATASETS FOR NPP VALIDATION

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1. INTRODUCTION

In order to facilitate preparation for the upcoming launch of the National NPOESS Preparatory Project (NPP), the NPOESS Integrated Program Office (IPO) has developed a set of software tools for the generation of proxy Sensor Data Records for the VIIRS, CrIS, and ATMS instruments. Proxy data files are produced in HDF5 and conform to the standards described in the NPOESS IDPS Data Format Control Book. The IPO is routinely producing and making available for test activities, a "live" data stream using the Government Resource for Algorithm Verification, Independent Testing, and Evaluation (GRAVITE) computing facility.

2. BENEFITS OF PROXY DATA

The current test scenes used in NPP testing, including ground system interface testing are either instrument data from ground test or synthetic, based on instrument models. In both radiances are not realistic as compared with the data that will eventually flow from the operational observatory. With instrument test data, the scene is limited to the emissivity sources present in the test environment and with modeled cases cloud and surface emissivity simulations are only crudely realistic. Variability is limited by the computational demands of generating simulated data and the resulting scenes mostly represent ideal data. A proxy is a "stand-in or substitution", and a proxy source, in our definition is a source of real data used as a stand in for the eventual source. Proxies are similar operating environmental sensors, in similar Earth orbit to the NPP instruments. Proxies provide a number of advantages, including real scenes, with variability and structure that is impossible to realistically simulate. The proxy sources experience real atmospheric effects, real variability in surface emissivity and real artifacts such as clouds or glints or surface roughness. Proxy data cannot be used to understand in idiosyncrasies of instrument design, but they can be used to identify areas of deficiencies in algorithm processing especially beyond the sensor data record level. Proxy data streams, because they exhibit the variability of real world scenes and the vagaries of real world handling can be used to test operational code robustness and check error-handling capability.

Terra, Aqua and MetOp observatories are used as proxy for the corresponding NPP observatory instruments and the data are transformed to mimic NPP SDRs and formatted according to the mission HDF5-NPOESS standard. Data are retrieved from near-real time sources and are transformed, within a few hours to provide a flow of data with volume and data complexity similar to the expected operational NPP observatory. There is no attempt to simulate the NPP orbit, but rather the proxies are treated as if they were NPP instruments flying on the proxy observatories. GRAVITE maintains a 30-day rolling store of the resulting products and makes them available for use and distribution to the Cal/Val team and to the IPO team. The data is useful for system and algorithm stress testing, and will provide products range and complexity that approximate the expected data but they will not provide scientifically valid products.

3. VIIRS PROXY FROM MODIS

Our VIIRS proxy begins with Level 0 (L0) data flows via the Near Real Time Processing Effort (NRTPE) portal that provides NASA's MODerate resolution Imaging Spectroradiometer (MODIS) data at 2-4 hr latency worldwide. The five-minute native MODIS granules are "cut" into 48- scan pieces to emulate the VIIRS native granule size. The VIIRS-sized MODIS L0 granules are then processed to L1B using the standard NASA L1B processor producing 48-scan MODIS L1B files. These files are then transformed into a VIIR proxy using software adapted from NASA GSFC Land PEATE version of "SDRGen". With SDRGen, VIIRS spectral bands are proxied by nearest MODIS band. Simple band substitution is performed with no special processing to remove artifacts such as striping. Because the MODIS has a different number of detectors in each swath scan than VIIRS and the VIIRS scan has more pixels across track than MODIS. Pixels values are piecewise interpolated to simulate the 16 detector VIIRS swath scan including the effects of VIIRS pixel aggregation. Geolocation is bilinearly interpolated for each of the VIIRS resolution scales, Moderate, Imagery, and Day/Night. SDRGen also simulates VIIRS bow-tie deletion [1]. Finally, the proxy is encoded into the HDF5 format that is the standard output of NPOESS SDR processing. The Radiance and Brightness Temperatures are scaled by VIIRS factors and cast to integer and quality flags present in the MODIS product are re-encoded as their equivalent VIIRS flags.

4. CRIS PROXY FROM IASI

Our CrIS proxy process was developed by Xu Liu at NASA LaRC. It is a mathematical conversion using a forward and reverse Fast Fourier Transform (FFT). An algorithm theoretical basis for the mathematical transformation is available. First a FFT is performed on the IASI Level 1C spectra to generate interferograms. The IASI interferograms are then apodized and truncated to approximate CrIS interferograms. An inverse FFT is applied to generate proxy CrIS spectra. Then interpolation is performed. The IASI instrument has 3 spectral bands and each spectral band has 4 pixels within the AMSU field of views (FOV). The CrIS instrument has 3

spectral bands and each spectral band has 9 FOV within a 45 km field of regard (FOR). A spatial linear interpolation converts the four IASI pixels to nine CrIS pixels [2]. A final process writes an HDF5 output file.

5. ATMS PROXY FROM AMSU-A/MHS

Our ATMS proxy process was developed by William Blackwell at MIT Lincoln Lab. The process is also a mathematical conversion and an ATBD available. The manuscript is presently under peer review by IEEE GRSL [3]. The code is implemented in MATLAB and runs as a binary executable. The proxy result is stored in HDF5 in the NPOESS format.

6. REFERENCES

[1] Wolfe, R. *Re: Proxy Data [Electronic message]*. NASA Goddard Space Flight Center. Greenbelt MD. November 11, 2009.

[2] Liu, X. *Re: Proxy Data [Electronic message]*. NASA Langley Research Center. Hampton VA. November 2, 2009.

[3] Blackwell, W. *Re: Proxy Data [Electronic message]*. MIT Lincoln Labs. November 2, 2009.