Preparing for CrIS Full Spectral Resolution Radiiances in the NCEP Global Forecast System

James A. Jung¹, Andrew. Collard², Kristen Bathmana, Dave Groff², Andrew Heidinger², Mitchell Goldberg²

¹CIMSS/SEC, UW-Madison, WI ²MSIG at NOAA/NCEP/EMC, College Park, MD

Introduction

The Joint Polar Satellite System (JPSS) Program Office and NPP Science Teams improved the spectral resolution of the Cross-track Infrared Sounder (CrIS) instrument aboard the new National Polar-orbiting Partnership (NPP) satellite. This change shortened the spectral resolution and increased the channel counts for band-2 and band-3 (midwave and shortwave regions respectively). The CrIS channel counts increased from 139 to 211. These data are identified typically as CrIS Full Spectral Resolution (FSR) and CrIS-FSR is expected to be the standard CrIS resolution for NPP-1 (NOAA-20) and beyond.

To identify the two different resolutions, The National Environmental Satellite, Data, and Information Service (NESDIS) Center for Satellite Applications and Research (CSAR) reviewed the Climate processes, System Integration and Data Transformation Team (CASSIT) incorporated a new flag MIFG to the CrIS BUFR file. When the flag is set to 0 the full spectral resolution data is used for the CrIS FSR-Cloud model, Dr. C. Bishop for the Representation of meteorological data (DPRF), for anyone wanting to reproduce the quantification. The use of the CrIS-FSR BUFR template remains the same as the current CrIS BUFR template, but some of the CrIS FSR-Cloud data is in a raw form and real time, and they are available at http://ftp.star.nesdis.noaa.gov/pub/gofs/Cloud/NEL/NPCS/CrIS_FSR_BUFR/Subset.

The Environmental Modeling Center branch of the National Centers for Environmental Prediction (NCEP-EMC) and the Science and Technology Corporation (STC), in collaboration with other Numerical Weather Prediction (NWP) Centers, have developed a CrIS-FSR channel subset. This new subset is expected to be used to distribute CrIS FSR data from the Regional ATOS/Retrieval System (RARS/ERS) and Direct Broadcast Data. Recently NESDIS/STAR/CASSIT has also started to implement the CrIS FSR subset via http://ftp.star.nesdis.noaa.gov/pub/gofs/Cloud/NEL/NPCS/CrIS_FSR_BUFR/Subset.

Hyperspectral Infrared Channel Subset Modifications

NCEP has found it difficult to use all of the channels because of the large number of atmospheric channels. Which could not be used in assimilation systems, for various reasons, had to be kept throughout the assimilation process. The alternative was to develop subsets for each instrument such as the Atmospheric Infrared Sounder (AIRS) [28], AIRS 323, Atmospheric Infrared Sounder Interferometer (AIRS-IASI) [30], IASI, MIR-IASI, IASI-IR, and CrIS 399. In the past, users were constrained to assimilating one of these designated subsets or receiving all of the channels. A few years ago the Community Radiance Transient Model (CMTM) Group developed the ability to select a subset of predefined channels. This is the first step toward removing the specific channel subset constraints in the Gridpoint Statistical Interpolation (GSI) software.

The software modifications have now been incorporated into the NCEP CrIS software to take advantage of these subset-defined channel capabilities. The subset is defined to be the subset used by the GSI software. The channel list file, or "satfile", is basically ignored by the system. The channel is not counted for memory and computer time. The GSI user community now has the capability to read the full channel files (e.g., AIRS 2378, CrIS 399, FSSR 431) and to assimilate and monitor only those channels suitable to their current requirements.

Review CrIS Quality Control and Thinning Routines

The current NCEP quality control procedures and spatial thinning routines were reviewed for potential improvements in quality control and performance. The design of the CrIS instrument posed some unique challenges for this step, such as the fields of view within a field of regard along the scan line as shown in Figure 1. A post-launch change also included adding cloud information into the CrIS file, which can be used for quality control.

Two quality control procedure changes for CrIS within the GSI were updated. All Field of View (FOV) within a Field of Regard (FOR) were reviewed for potential improvements in quality control and performance. The design of the CrIS instrument posed some unique challenges for this step, such as the fields of view within a field of regard along the scan line as shown in Figure 1. A post-launch change also included adding cloud information into the CrIS file, which can be used for quality control.

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