

# S-NPP CrIS Gap Channels Prediction, Validation and Application

Hui Xu<sup>1</sup>, Yong Chen<sup>1</sup>, Likun Wang<sup>1</sup>, Changyong Cao<sup>2</sup>

<sup>1</sup>Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD, USA

<sup>2</sup>NOAA/NESDIS/Center for Satellite Applications and Research, College Park, MD, USA

## Abstract

CrIS (Cross-track Infrared Sounder) is a hyperspectral infrared sounder mainly for providing atmospheric temperature and moisture profiles to improve weather forecast. It is a Michelson interferometer with 2211 (Full Resolution) channels over three wavelength ranges: long-wave infrared (650-1095  $\text{cm}^{-1}$ ), middle-wave infrared (1210-1750  $\text{cm}^{-1}$ ), and short-wave infrared (2155-2550  $\text{cm}^{-1}$ ). Due to its excellent performance, CrIS radiance is also used as an infrared reference to check calibration accuracy of AVHRR/ABI on GOES, VIIRS on NPP, AHI on HIMAWARI, and other imagers under the GSICS (Global Space-based Inter-Calibration System) framework. However, there are spectral gaps among CrIS three bands, which may impact the capability and comparison accuracy of inter-comparison between CrIS and other instruments. To fill up the spectra gaps, this paper develops a new method to predict the CrIS unmeasured channels based on a Full-CrIS (650-2550  $\text{cm}^{-1}$  with 0.625  $\text{cm}^{-1}$  resolution) spectrum derived from IASI (Infrared Atmospheric Sounding Interferometer) observation. A large Full-CrIS spectra training dataset was first built based on the spectra selected from different seasons to represent different atmospheric and surface conditions. Then, a Principle Component Regression (PCR) method is developed to derive the prediction coefficient matrix between CrIS measured and gap channel spectrum. Finally, the predicted CrIS gap channel radiances are compared with other hyper-spectral infrared sounders (such as AIRS and IASI) based on the Simultaneous Nadir Overpass (SNO) events to check their accuracy. The comparison results demonstrate that the CrIS gap channel radiances can be successfully predicted with high accuracy for the inter-comparison purpose by using the current measured CrIS spectral information. The inter-comparison results with broadband channels also suggest that the predicted CrIS gap channels radiances will greatly improve the inter-comparison results and can be used in GSICS in the future.

**Key words:** S-NPP CrIS, Spectrum Gap, Prediction, Inter-Comparison