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NOAA Instruments Characterization of the Imager and Sounder Instruments in Polar and Geostationary Orbit

Summary of the Working Paper

CGMS-36 called on members for Action (36.13) “to make available the instrument characterisation of their imaging and sounding instruments”. This paper is the initial response from NOAA to that call.

NOAA Instruments Characterization of the Imager and Sounder Instruments in Polar and Geostationary Orbit

1 INTRODUCTION

Instrument characteristics, such as spectral response function, noise, stability, are vital for users of data from the instrument. In view of its importance, CGMS-36 called upon all members (**Action 36.13**)

- **To make available the instrument characterisation of their imaging and sounding instruments in polar and geostationary orbit, in particular the spectral response functions. This should include both the currently operational as well as all previous instruments. It is sufficient to make available the web link where the instrument characterisation data can be found.**

In response to that call for action, NOAA prepared this document to provide the characteristics of its satellite instruments, on its Polar-orbiting Operational Environmental Satellites (POES) and Geostationary Operational Environmental Satellite (GOES), which are currently operational or were operational in the past.

2 POES

Characteristics for POES instruments have been summarized by T. Kleespies at http://www.star.nesdis.noaa.gov/smcd/spb/calibration/page_of_pages.html, which provides links to sites separately maintained by instrument scientists.

2.1. POES AVHRR (Advanced Very High Resolution Radiometer)

All the AVHRR spectral response functions from TIROS-N through Metop-B are available at this summary webpage through the link of AVHRR Instrument Response Functions for All Satellites at http://www.star.nesdis.noaa.gov/smcd/spb/fwu/solar_cal/spec_resp_func/index.htm. This summary webpage also provides the links for the parameters needed to calculate the calibrated reflectance or radiance from instrument scan count. These parameters are well documented at the NOAA KLM+ User's Guide (<http://www.ncdc.noaa.gov/oa/pod-guide/ncdc/docs/intro.htm>). The instrument characteristics for the solar reflectance channels includes the pre-launch calibration coefficients, in-band extraterrestrial solar irradiance, equivalent width, and effective central wavelength for the AVHRR/3 onboard NOAA-15 through Metop-A. A link to the post-launch calibration coefficients for NOAA-14 can also be found at this webpage. Yet the post-launch calibration coefficients for AVHRR/3 since May 2004 are available at http://www.star.nesdis.noaa.gov/smcd/spb/fwu/solar_cal/Op_Cal_AVHRR/Op_Cal_AVHRR.html which is routinely maintained and updated monthly. The instrument characteristics for the IR channels include the PRT count to temperature conversion coefficients, PRT weighting factors, central wave number, band correction coefficients, space



radiance and nonlinear radiance correction coefficients for each AVHRR/3 IR channel at NOAA-15 through Metop-A.

2.2. POES HIRS (High Resolution Infrared Radiation Sounder)

HIRS instrument response functions from NOAA-9 through NOAA-19 and Metop-A are all available through the link provided at the POES instrument characteristics webpage (<http://www.star.nesdis.noaa.gov/smcd/spb/calibration/hirs/hirssrf.html>). Similar to the AVHRR IR instrument, the HIRS instrument characteristics available through the links at this webpage include the PRT count to temperature coefficients, central wave numbers, band correction coefficients, channel 20 slope and intercept, and secondary telescope temperature coefficients for HIRS/3 at NOAA-15 through Metop-A. These calibration parameters are linked to the corresponding webpages at the NOAA KLM+ User's Guide.

2.3. POES AMSU-A (Advanced Microwave Sounding Unit-A) and AMSU-B (Advanced Microwave Sounding Unit-B)

The POES instrument characteristics webpage provides the central frequency, central wave number and 1/F frequencies information for AMSU-A and AMSU-B onboard NOAA-15 and 16, and AMSU-A1 and -A2 at NOAA-18 and Metop-A. It also includes the PRT count conversion to temperature coefficients for AMSU-A and -B at NOAA-15/16, AMSU-A1 and -A2 at NOAA-18 and Metop-B, the bias correction for AMSU-B at NOAA-15 and -17. All these instrument characteristics are correspondingly linked to the NOAA KLM+ User's Guide for

2.4. MHS (Microwave Humidity Sounder)

The summary of POES instrument characteristics webpage also provides the links to the NOAA-18 and Metop-A MHS channel IR characteristics and the PRT count to temperature conversion coefficients. These linked instrument characteristics are documented at NOAA KLM+ Users's Guide website.

3. GOES

The spectral response functions and calibration coefficients of GOES 8-12 Sounder/Imager are available at http://www.star.nesdis.noaa.gov/smcd/spb/fwu/solar_cal/GOES_Instr_Char.html

3.1. Imager

Two sets of GOES Imager spectral response functions, which are of the same origin, are linked at this GOES instrument characteristics webpage. The packed ones are linked to NOAA Office of Satellite Operation and should be authentic. But the users need to uncompress the package and some simple analyses (e.g., average the measured SRFs among the detectors for each channel) may be needed before application. Another source of the SRF is from the SSEC at the University of Wisconsin at Madison. The SSEC version is believed to average over each detector SRF. Compared to the NOAA OSO version, this SSEC source is in ASCII format and thus more user-friendly. Yet it may need some independent verification.

The GOES instrument characteristics webpage also provide the links to the conversion coefficients of GVAR count to scene radiance for the infrared channels at GOES-8 through 14 Imager, pre-launch and post-launch calibration coefficients for the visible channels at GOES 8 through 12. The GOES Imager IR instrument characteristics parameters include Imager scaling coefficients, the central wave number, band correction coefficients in both first and second-order polynomial functions for each IR channel. Historical measurement and the later revisions of GOES-13 Imager channel 6 (13.3 μ m) are also provided at this webpage.

3.2. Sounder

Currently this GOES instrument characteristics webpage contains the GOES-8 through 14 Sounder spectral response function data provided at NOAA OSO. Like the GOES Imager SRF, these Sounder SRFs are more authentic compared to the other sources. Other GOES Sounder instrument characteristics available in this webpage includes the central wave number and band correction coefficients for the GOES-8 through 14. The GOES-8 through 12 Imager and Sounder look-up tables of radiance, brightness temperature vs. GVAR counts are also available through the GVAR conversion link at this webpage.

4. Summary

Instrument characteristics are important for proper interpretation and utilization of instrument measurements. NOAA/NESDIS supports the effort by CGMS to make such fundamental information widely and readily available, of all operational meteorological satellites and for the international community. As an initial step, this paper provides links to those information of NOAA satellite instruments, GEO and LEO, imaging and sounding, current and past, and from visible to microwave. NOAA/NESDIS is committed to maintain such information accurate, current, and continuously available, and encourages a repository of such information from all agencies.