P1.13 NOAA POLAR INSTRUMENT DATA PROCESSING FOR LEVEL 1B DATA USERS

Arlington R. Morgan*
Computer Sciences Corporation, Suitland, MD

Emily D. Harrod
NOAA/NESDIS, Suitland, MD

1. INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA)/National Environment Satellite Data and Information Service (NESDIS)/Office of Satellite Data Processing and Distribution (OSDPD)/Information Processing Division (IPD) receives and formats raw spacecraft instrument data from the TIROS series of Polar-orbiting Operational Environmental Satellites (POES) into user-friendly Level 1B formats for distribution to the NOAA polar data user community. The Pre-Product Processing (PPP) system is used to create and monitor the quality of the 1B data sets produced from ingested raw polar satellite data. The PPP subsystems that process the ingested polar spacecraft data perform the following functions:

(i) **Calibration**—maintains a spacecraft-specific database for each POES

(ii) **Earth Location**—provides the POES spacecraft geolocation information that is included in the Level 1B data

(iii) **Polar Data Preprocessing (PDP)** — executes the algorithms for calibrating, Earth locating, quality checking, and formatting the ingested polar satellite data

(iv) **Quality Control (QC) Monitoring System**—performs quality checks, produces trending plots, and is used to analyze and evaluate the Level 1B data.

This poster session will display examples of the NOAA polar instrument data processing, quality control monitoring and trending analysis, and sample products generated by 1B users such as Sea Surface Temperature, Vegetation Index, Soundings Moisture Profiles, Ozone, Aerosol, and Radiation Budget. The goal of IPD is to provide the polar data user community with timely, accurate, and complete Level 1B data.

2. NOAA POLAR INSTRUMENT DATA 1B PROCESSING

2.1 *Polar Instruments Data Types*

The PDP processors create Level 1B formats from the ingested POES raw satellite Level 1A data sets. These processors generate and distribute the following thirteen 1B data types:

AMSU-A — Advanced Microwave Sounding Unit – A[1]
AMSU-B — Advanced Microwave Sounding Unit – B[1]
DCS — Data Collection System
GAC — Global Area Coverage Advanced Very High-Resolution Radiometer (AVHRR)
HIRS — High-Resolution Infrared Radiation Sounder
HRPT — High-Resolution Picture Transmission AVHRR
LAC — Local Area Coverage AVHRR (recorded)
MSU — Microwave Sounding Unit[1]
SAR — Search and Rescue
SBUV — Solar Backscatter Ultraviolet Radiometer
SEM — Space Environment Monitor
SSU — Stratospheric Sounding Unit
TIP — TIROS Information Processor

2.2 *IPD Data Processing and Distribution*

Operation of the various NOAA polar satellite Level 1B data processing systems is principally the responsibility of IPD. IPD receives data from the Satellite Operations and Control Center (SOCC) and processes it into Level 1A and 1B data in the Central Environmental Satellite Computer System (CEMSCS). The CEMSCS has ingest and preprocessing systems for NOAA polar, NOAA geostationary, and some non-NOAA satellites. The PDP operation consists of components such as pre-launch activities, ingest 1A processing, 1B processing, calibration, navigation, product generation, and archive. The software systems that are implemented, operated, and maintained are in the following functional categories: Ingest (Level 1A), satellite data set processing (Preprocessing Level 1B), product processing, archiving, QC monitoring, navigation and Earth location, data communications, calibration (pre- and post-launch), and shared processing. The 1B data sets are made available to the User community via direct access to the CEMSCS, File Transfer Protocol (FTP), and the Satellite Active Archive (SAA) system. The diagram in Figure 1 titled NOAA-KLM Preprocessor is an illustration of the NOAA-KLM instrument data processing flow to create the level 1B data from the raw instrument data.

* *Corresponding author address:* Arlington R. Morgan, NOAA/NESDIS, FB#4, Rm. 0303, E/SP13; 4401 Suitland Road, Suitland, MD 20746-4303; e-mail: Arlington.Morgan@noaa.gov

[1] MSU and SSU sounding instruments were replaced with AMSU-A and B instruments on the NOAA KLM series (NOAA-15, NOAA-16, NOAA-17).

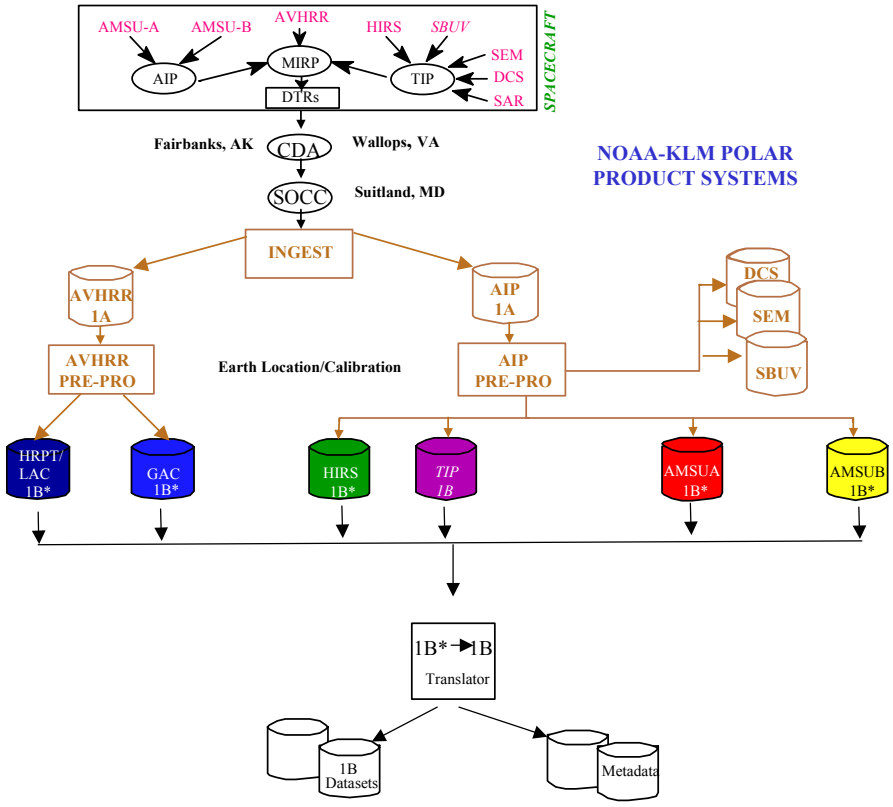

Figure 1. NOAA-KLM Preprocessor

3. CUSTOMER UTILIZATION OF LEVEL 1B DATA

The following products are generated from the NOAA/NESDIS Level 1B data. The diagram in Figure 2 titled Level 1B Products is a representation of the various products derived from the NOAA Polar instruments 1B data. For details on these products, go to the Products Systems Branch (PSB) website provided in the summary.

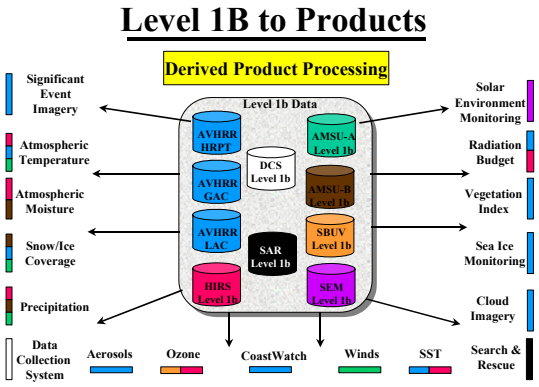

Figure 2. Level 1B to Products Diagram

A. **Sea Surface Temperature (SST) Products:** NOAA/NESDIS produces and archives two types of SST products; gridded products and geographically organized retrievals. The SST products include SST anomalies, contour charts, and analyzed fields. Also provided are maps of current sea surface temperatures, ocean surface winds, hot spots, and degree heating weeks. These are useful for monitoring coral bleaching at various sites around the globe.

B. **Mapped Global Area Coverage (GAC) Products:** The mapped GAC products comprise mapped mosaics displayed on polar stereographic and Mercator map projections, with both forms available on digital media. The mapped mosaics consist of daytime visible (VIS) and infrared (IR), and nighttime IR imagery. NESDIS/IPD also produces an operational mapped GAC product, which is known as the *Global Vegetation Index Product*. This product provides a means of monitoring the density and vigor of green vegetation over the growing areas of the Earth.

C. **Radiation Budget Products:** The Radiation Budget products include daily and monthly mean global maps of outgoing longwave (infrared) radiation and absorbed and available incoming shortwave (solar) radiation.

This data is frequently used to study global climate changes.

D. **Sounding Products:** A sounding is a vertical atmospheric temperature or moisture profile derived from radiance measurements. NESDIS currently has the capability of producing a maximum of 3,175,000 soundings every 24 hours from three operational spacecraft. ATOVS, from NOAA-15 or 16, generates retrievals with a 60 km resolution (40 km at nadir). AMSU-B, from NOAA-15 or 16, generates retrievals with a 15 km resolution and 15 km spacing between retrievals. The data is sampled to reduce the data volume by half.

E. **Coast Watch Products:** The Coast Watch program provides high-resolution (1km/4km) satellite data and derived products (including sea surface temperature) for coastal regions. This data helps meteorologists predict weather, fishermen locate fish, and scientists track oil spills and red tide events.

F. **Snow and Ice Products:** Meteorologists and climatologists are interested in short-term and long-term observations of snow and ice cover because of its affect on weather forecasting and climatic processes. Since 1966, NOAA/NESDIS snow and ice analysts have been creating weekly maps showing the extent of snow cover for the Northern Hemisphere.

G. **Ozone (SBUV/2) Products:** The Ozone products are generated from the SBUV/2 (Solar Backscattered Ultraviolet Radiometer/Version 2). The SBUV/2 is a non-scanning, nadir-viewing instrument designed to measure scene radiance in the spectral region from 160 to 400 nm. SBUV data is used to determine the vertical distribution and total ozone of the atmosphere, as well as solar spectral irradiance.

   The SBUV/2 sensor data consists of radiance and irradiance measurements taken in both the discrete mode (12 wavelengths) and the sweep mode (1680 wavelengths) at approximately 2 Angstrom intervals.

H. **Aerosol Optical Thickness Products:** The aerosol products are produced from NOAA-16 AVHRR data on a weekly basis. The primary products are a global 1-degree map of aerosol optical thickness (AOT), based on a composite of 1 week's worth of data, and the monthly mean product. Also, there are contour plots of weekly composites and monthly means.

4. SUMMARY

The IPD is making every effort to provide quality Level 1B data to the user community in fulfillment of the NOAA/NESDIS mission “to provide and ensure timely access to global environmental data from satellites….” Enhancements to improve the efficiency and accuracy of the Level 1B generation process and the product itself are planned to support future missions (such as NOAA-N, and MetOp). Users interested in getting more information on the Level 1B process, products, and updates should check the following websites:

http://www.osdpd.noaa.gov/ — general information on the IPD

http://www.osdpd.noaa.gov/PSB/PSB.html — information on the products produced by PSB

http://www.osdpd.noaa.gov/PSB/PPP/PPP.html — information on the Level 1B calibration, Earth location, QC, and instrument trending.

Those users interested in archived Level 1B data may consult the NOAA Satellite Active Archive (SAA) website, http://www.saa.noaa.gov/. The mission of the SAA is to provide electronic distribution of data and derived data products from U.S. POES.

5. REFERENCES

NOAA/NESDIS/OSDPD website, http://www.osdpd.noaa.gov/**.** *NOAA KLM User's Guide,* May 1999 version, http://www2.ncdc.noaa.gov/docs/klm/index.htm