INITIAL PROCESSING OF TOVS DATA BY USING MICROCOMPUTER MERA-60

Leslaw Baranski
Krzysztof Rosemski
Institute of Meteorology and Water Management
Krakow, Poland

1. INTRODUCTION

In 1984 at the Institute of Meteorology and Water Management in Krakow, the information system support on the microcomputer MERA-60 (with DEC software) was completed and put into operation for retrieval of the vertical temperature and moisture profiles.

Computing power of the microcomputer limited our calculations to one atmospheric sounding only for a selected area. Processing of the TOVS data will be done in two stages. The first stage is the initial data processing. The hardware and software supporting this stage was completed in 1984. Initial processing of TOVS data include all the information transmitted by the Direct Sounder Broadcast system during one satellite pass extending to the radio horizon of the Krakow TIP receiving station. The main goal of the initial processing is as follows:

- reception of the TOVS data,
- extraction and reorganization of HIRS, MSU data for a selected area,
- detection and elimination of transmission errors,
- formation of a file of the calibration coefficients, and
- formation of files containing the auxiliary data for improvement of subsequent processing.

The second processing stage (planned to be finished in 1985) involves selection of the HIRS and MSU data nearest to a selected geographical point. The temperature and moisture profile computed above this point is the final result of the second processing stage.

A summary of the processing software is presented below.

2. CONTROL OF RECEIVING TOVS DATA

The macroassembler program was completed for registration of the raw TIP data on the magnetic tape. This program is also used for providing the input data into the automatic tracking antenna device. This data specifies the instantaneous positions of antenna (in azimuth and elevation). The antenna position is calculated every 20 seconds, just before beginning of the transmission by using data contained in the APT Predict Bulletin.

3. EXTRACTION AND DECOMPOSITION OF TOVS DATA

A macroassembler program was written for decomposition of succeeding TIP minor frames and extraction of HIRS, MSU and organization data important for future processing. Those data are recorded on a magnetic

disk with a format which makes it easy for identification and future processing on FORTRAN level. This program also controls the parity of the frames and meritorical correctness of the received TOVS data (numeration of frames and elements). The frames with erroneous numeration are not registered.

4. EXTRACTION OF THE PRINCIPAL INFORMATION OF TOVS DATA TRANSMISSION

The TIP data transmission is not continuous; breaks due to disturbances are observed. Those disturbances are especially frequent during the beginning and the end of transmission and for low satellite orbits. It has been observed that for elevation angles above 5 degrees, the received data are useful for future processing. Errors in receiving and registering the data are also observed. The time values of TIP major frames and numeration are very important for geographical location and for MSU data identification.

In this regard, it was necessary to develop auxiliary program to deliver information of transmission and detected errors as well as reading and correcting of TIP major frames times. This program and also the next programs are written in FORTRAN-IV language.

5. FORMATTING THE MSU DATA

MSU data in contrast to HIRS data are unequally distributed in TIP minor frames. For efficiency of programs using MSU data it is convenient to assemble these data in records which contain all data from a single MSU line. The time of TIP minor frame is used to identify the MSU words. The program also calculates start times of MSU lines.

6. CALIBRATION OF TOVS DATA

The relationship between instrument counts and radiance (or brightness temperature) can be written in the form:

$$R_H = G_H N_H + I_H \quad \text{for HIRS} \tag{1}$$

$$T_M = G_M f(N_M) + I_M \quad \text{for MSU} \tag{2}$$

where: R_H - the radiance measured in a HIRS channel
N_H - HIRS output counts
T_M - brightness temperature for a MSU channel
N_M - MSU output counts
G_H, I_H - calibration coefficients for HIRS
G_M, I_M - calibration coefficients for MSU
f - function of nonlinearity correction for MSU

Calibration coefficients are calculated according to the algorithm published by L. Lauritson et al. (1979). During initial processing, the radiances (brightness temperatures) are not calculated for all HIRS and MSU IFOVs, because determination of the single temperature profile only requires the radiometric data from the surrounding area of the sounding point.

Calculation of the brightness temperatures for HIRS and MSU channels will be performed in the second stage of the processing. It was assumed that the necessary coefficients will be calculated for each transmission.

7. GEOGRAPHICAL LOCATION OF TOVS MEASUREMENTS

The radiometric data from these IFOVs nearest to the selected area center are necessary for determination of the temperature and moisture profile over this area. Hence, it is necessary to find such an IFOV which is located as near as possible from considered earth point. The method of finding this field by locating all IFOVs seems to be too expensive, because calculation is complex and the processor is slow. Therefore, a method of searching succeeding areas composed of five HIRS lines was applied for finding the desired point in the HIRS area. An approximate searching method is used for finding the number of line and element situated as near as possible from this point.

8. CONCLUSION

In the Institute of Meteorology and Water Management in Poland, the receiving station for DSB TIP data and microcomputer support system was completed. This instrumentation is designed for preprocessing of TOVS data and vertical sounding calculations. At the end of 1984, the software for initial processing was completed. The retrieval of the first temperature and moisture profile is planned in 1985 from the NOAA-9 satellite, after obtaining the appropriate coefficients from NESDIS.

The Technical Proceedings of
The Second International TOVS Study Conference

Igls, Austria

February 18 - 22, 1985

Edited by

W. P. Menzel

Cooperative Institute for Meteorological Satellite Studies
Space Science and Engineering Center
University of Wisconsin
1225 West Dayton Street
Madison, Wisconsin 53706
(608)262-0544

September 1985