USE OF PC GRAPHICS IN NOAA/NESDIS
OPERATIONAL SOUNDING GENERATION SYSTEMS

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1.   INTRODUCTION

NOAA/NESDIS has been producing global atmospheric temperature and moisture soundings from the TIROS Operational Vertical Sounder (TOVS) since the launch of TIROS-N in 1978. With the addition of the Special Sensor Microwave/Temperature (SSM/T) on the U.S. Air Force Defense Meteorological Satellite Program (DMSP) satellites in 1987, NOAA/NESDIS began producing 130,000 soundings every day. The sheer magnitude of the systems required to generate these data often dissuade constant quality checking. Although In-line quality control is performed in both sounding systems, isolated cases of poor quality data can be produced. These isolated cases, the desire to compare improvements to the operational system, and the need to better evaluate the sounding products prompted the development of the Off-Line Evaluation (OLE) system (Brown et. al., 1987) in 1986.

OLE is an interactive graphics display system residing on a VICOM minicomputer. A diversified system, OLE had been used extensively since its development. Unfortunately the OLE system has a long turnaround time; all data must be input to the OLE system, via 1600 bpi tapes (tape jobs are usually slow on the mainframe as well as the VICOM). While turnaround time is usually not a problem in research and development, it can be deadly in an operational environment.

The development and improvement of personal computers finally provided the means for near real-time operational interrogation of TOVS and SSM/T data. In 10 minutes, a personal computer connected to the mainframe computer by a communications board can provide the user with a graphical display which would take the OLE system at least an hour to produce under ideal conditions.

2. OVERVIEW OF THE SOUNDING DISPLAY SYSTEM

As with the OLE system, the PC based SOUNDING Display System (SONDS) uses data sets generated by the mainframe computer. These data sets are generated by user-friendly interactive programs, or they can be generated routinely for standard weekly or daily displays. Once the data sets are generated, they are downloaded, via a communications board where the SONDS network of user friendly menus enables the user to quickly display the desired plot. Depending upon the data set generated on the mainframe, the user can display vertical comparison plots, horizontal fields in color shading or contours, or processing statistics. Each of these displays have a variety of sub-menus to project many different fields. Each display subsystem will be briefly described.

3. VERTICAL AND HORIZONTAL COMPARISON PLOTS

Vertical comparison plots and horizontal color fields comprise the Sounding Interactive Evaluation (SIE) system. SIE is the first PC-based tool used in the operational environment for soundings and is the cornerstone of SONDS. The SIE vertical display subsystem uses GRAPHER, a commercial package, to provide EGA graphic plots of the statistics. The horizontal display subsystem uses the OLE

commands from the VICOM minicomputer on a high resolution graphics board developed by the Number Nine Computer Corporation.

The vertical display subsystem can display sounding-radiosonde comparisons for four data types:

    Temperature Retrieval Errors
    Thickness Errors
    Water Vapor Errors
    Virtual Temperature Errors

The actual statistics generated are Root Mean Square (RMS), Standard Deviation (SD), and mean bias. SIE has great diversity when determining the characteristics of the data sets to be compared. Data for a vertical plot can be sub-divided into any latitude range: land or sea, clear, partly cloudy, or cloudy and from 1 to 7 days.

The horizontal display system can display actual sounding data values Earth-located with geographical boundaries or pseudo-imagery displays of analyzed soundings. Currently displays can be made in Cartesian or polar projection. In addition to displaying sounding data from any of the TOVS or SSM/T data sets, NMC analysis and forecast data can also be displayed. Any parameter generated in the TOVS or SSM/T processing can be displayed in this manner.

4.   HORIZONTAL CONTOUR FIELDS

While the SIE Horizontal display system has many strong features, a system to generate contours of the sounding parameters on an EGA graphics board is also important. The Sounding Graphics System (SGS) was developed to fulfill that need. SGS uses SURFER, the companion software package to Grapher. A key advantage to using these commercial packages

is their large array of output device interfaces, a
significant savings when considering the multitude of
printers and plotters on the market.

SGS is operated under the same principle as SIE, the menus
were kept as similar as possible. SGS can contour a NMC
analysis or forecast field and post the corresponding
retrieval temperatures; time difference or cloud cover can
also be shown. As with SIE, any parameter generated by TOVS
or SSM/T can be displayed and contoured. SGS can also
contour and post the same data set. It can be configured to
compare two different satellites' retrievals instead of
comparing retrievals to NMC analysis.

5.   PROCESSING STATISTICS

Even as we work to improve studying sounding quality and
specific regions, the need to constantly track orbital
processing continues. The Sounding Processing Statistics
(SPS) system uses the Grapher package to display various
processing statistics for each orbit over a specified number
of days (currently 10 days is the default). This system is
used for monitoring and trend analysis. The most common
orbital statistics which are studied are:

                Data Delay
                Missing Data
                Number Clear, Partly Cloudy, Cloudy
                Percent Superadiabatic

While all of the parameters are available in tabular form,
the graphical display provides a better means for trend
analysis.

6. ENHANCEMENTS

As the systems in SONDS are used, new requirements arise, and thus enhancements are planned. Currently a variety of enhancements are being developed. The SIE vertical subsystem will soon be able to generate statistics from a variable longitude range as well as latitude. Features from the OLE continue to be transferred to the SIE horizontal system. The system is also being converted to an improved graphics board. The SGS system will be upgraded to capitalize on the improved version of Surfer; SGS will also have the capability to plot differencing contours. SPS will be expanded to include SSM/T and more parameters may be added (i.e., calibration of instruments). A new subsystem under development will plot radiosonde and retrieval pairs.

7. SUMMARY

NOAA/NESDIS has developed a series of personal computer-based display systems for representing products from the TOVS and SSM/T sounding systems. A powerful data display system has become a critical requirement for the operational processing of sounding data. SONDS is NOAA's response to this critical situation.