11.4 SEAWINDS NEAR-REAL-TIME PROCESSING AT NOAA/NESDIS: PRESENT STATUS AND FUTURE PLANS

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1 INTRODUCTION

The QuikSCAT mission has recently passed the third launch anniversary and has met its design goal of operating for three years. QuikSCAT near-real-time (NRT) processing of SeaWinds data at NOAA/NESDIS has been operational since February 2000. It continues to be enhanced and maintained under the Computer Sciences Corporation's (CSC) Central Satellite Data Processing (CSDP) contract. A second SeaWinds instrument is planned for the ADEOS-II mission, scheduled for launch in December 2002. In this paper, we describe the planned ADEOS-II NRT processing system at NOAA/NESDIS and how it will be integrated into the current QuikSCAT processing environment. In addition, the current status of QuikSCAT NRT processing, including timeliness statistics and products, will be presented.

2 NOAA/NESDIS QUIKSCAT NRT PROCESSING SYSTEM

2.1 NRT Data Processing

The QuikSCAT NRT processing system at NOAA/NESDIS continues to be enhanced in collaboration with JPL and NOAA/NESDIS. Details of the NRT processing system's data flow are contained in Augenbaum, et. al. (2001, 2002) and summarized in Figures 1 and 2. Figure 1, shows the general flow of QuikSCAT data from acquisition through processing, while Figure 2, gives a detailed look at the flow of QuikSCAT data through the NRT processing system at NOAA/NESDIS. The original operational mission requirement is *to produce wind retrievals in 25 km resolution Wind Vector Cells (WVC) on an orbit-by-orbit basis within three hours of observation* and to make them available in BUFR format. This product contains both the wind retrievals along with the sigma-0 values for each wind vector cell.

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Additional products have been added to the processing stream on an operational basis and are also made available to the user community. These include a winds-only product of the primary wind retrieval, produced in a binary format at the request of the marine community, and daily ice products. We have incorporated some ice processing algorithms from Dr. David Long (BYU) into the processing stream and produce daily ice image products in several formats for regions of interest, as requested by the ice community. We currently produce daily ice image products for the Alaska, Antarctic, Arctic, North Pacific, Ross Ice Shelf, and Weddel Sea regions.

The latest 24 hours of Wind fields are available at http://wwwo2c.nesdis.noaa.gov/owinds/winds_browse_framed.htm . Archived images of older data can be found at http://manati.wwb.noaa.gov/quikscat/ .

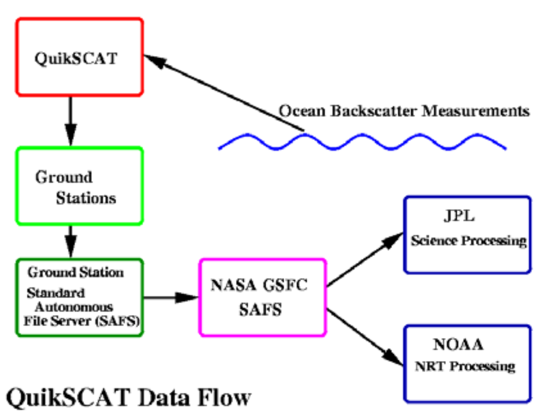

FIGURE 1. QuikSCAT Data Flow Diagram

The daily ice image products are available at http://manati.wwb.noaa.gov/cgi-bin/qscat_ice.pl In addition, the National Ice Center produces their own images from the BYU-MERS "sir" image formatted data. They are currently distributing near-real-time ice images of the northern and southern hemisphere. Their products are available at www.natice.noaa.gov/science/products/qs.html .

Further documentation is available at ftp://ftposdpd.noaa.gov/pub/seawinds/

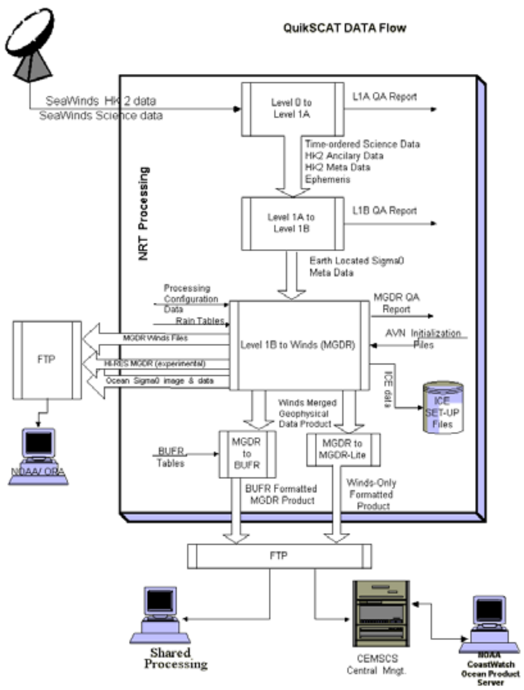

FIGURE 2. QuikSCAT Processing Flow Diagram

2.2 Research Products

In addition to the operational and validated products described above, the L1B intermediate product is used to generate additional experimental products. These products, which are being evaluated for their future use, are not yet publicly available. However, they are delivered to Dr. Paul Chang (NOAA/ORA) where they are being studied. The two research products that we are currently generating are a high-resolution wind retrieval with 12.5 km resolution and an Ocean Sigma-0 image. The Ocean Sigma-0 image is based on image processing algorithms developed by Dr. David Long of the BYU Microwave Earth Remote Sensing (MERS) Laboratory (www.mers.byu.edu/Seawinds-1.html). The NRT processing system produces high-resolution (on a 2.5 km swath based grid) Normalized Radar Cross Section (NRCS) or Sigma-0 images using AVE resolution enhancement and also gif formatted images on an orbit-by-orbit basis. Currently, only the vertically polarized, forward look measurement from QuikSCAT is produced. The idea here is that looking at the scatterometer data in this way, rather than the calculated wind retrievals, might provide additional uses for QuikSCAT data. Figure 3, shows a comparison of the 12.5 km winds vs. the 25 km wind field for a sample region, while Figure 4, displays a comparison of the wind field and the Ocean Sigma-0 image for Storm Gabrielle off the Florida coast on 09/17/01. Daily Sigma-0 images for regions of storm activity are available at http://manati.wwb.noaa.gov/cgi-bin/qscat_storm.pl

2.3 Hardware Configuration

The current processing environment consists of similarly configured, multi-processor SUN Enterprise 4500 processing servers known as Zephir and Boreas. Zephir serves as the primary processing server for QuikSCAT processing, with Boreas available as a “hot” backup and development machine. Recently, both machines underwent significant upgrades in CPU, memory, and disk capacity. The most significant upgrade was the replacement of the 4 300 MHz CPUs with 6 400 MHz CPUs on each machine. Consistent with the CPU speed increase, the processing time was reduced by about 20%.

In addition, a third SUN Enterprise server, designated Aeolus, is currently being configured to handle the Seawinds processing for the ADEOS-II data stream. The new configuration will consist of one primary processing server each for QuikSCAT and ADEOS-II data stream with Boreas functioning as the “hot” backup for both QuikSCAT and ADEOS-II. Each of the three machines was configured the same so that any machine can handle either QuikSCAT and/or ADEOS-II processing if the need should arise.

2.4 Performance Metrics

Monthly latency and processing statistics have been tracked at NOAA since QuikSCAT went operational. Since the ground network is required to get the data to NOAA within 150 minutes of observation, that leaves only 30 minutes for the processing, in order to meet the three hour mission requirement. In reality, the processing of one orbit of data takes over an hour; so what was done from the outset was to split the incoming orbit and process each part in parallel, thereby shortening the processing time. Prior to the processor upgrade in June 2002, the processing averaged between 30 and 45 minutes per orbit.

The monthly data for the last year shows that, on average, NOAA has received the data within 150 minutes of observation 85% of the time. This meets the requirement for the ground network. Since the CPU upgrade in June 2002, the NOAA-only processing times of less than 30 minutes have increased to approximately 90%, up from an average of 20%. For the first time, beginning with the use of the upgraded CPUs, the end-to-end (observation to product available) processing times have been less than 180 minutes, 90% of the time. Figure 5, displays the processing times for each orbit processed for the time period covering February 5th through September 16, 2002. Note the sharp drop in processing time to below 30 minutes from mid June on, except for a brief period in August where network issues effected the processing.

3 ADEOS-II PROCESSING

One of the most anticipated changes for the Seawinds processing system is the launch of a second Seawinds instrument on the ADEOS-II spacecraft, scheduled for December 2002. The result of this will be a second QuikSCAT data stream to be processed in near-real-time.

NOAA's ADEOS-II processing requirement is similar to that of QuikSCAT, *to make wind retrieval products available within three hours of observation*. Over the past year, NOAA has participated in ground network communication tests, as well as set up a dedicated processing server, Aeolus, to handle the ADEOS-II processing requirements. The overall SeaWinds on ADEOS-II data flow is shown in Figure 6. The core processing software is being developed by JPL and is similar to the QuikSCAT software. We will produce MGDR, MGDR-lite, MGDR_HI, Ice and Ocean Sigma0 products similar to QuikSCAT.

The main difference in the two processing systems is the way that the ingest is handled. With QuikSCAT, both HK2 telemetry and science data files come from the NASA ground network (NGN) to CSAFS at NASA/Goddard where it is then pushed directly to the NOAA processing servers. For ADEOS-II, the science files come from either the NGN or directly from NASDA servers to an ADEOS file server at NOAA/NESDIS where it is then pushed to the processing server. The telemetry data doesn't come on an orbit basis as it does with QuikSCAT. Instead we will get a daily Mission Operation Interface File (MOIF) from which the telemetry information will be available. Unlike QuikSCAT, we will know in advance when a particular orbit of data is scheduled to arrive.

At present, a prelaunch build of the processing software is running on Boreas, the development machine. A conversion routine is in place to convert QuikSCAT data to ADEOS-II format in order to process simulated ADEOS-II data on a routine basis.

4 CONCLUSIONS

QuikSCAT near-real-time processing of SeaWinds data at NOAA/NESDIS has been operational since February 2000. For the first time, recent hardware upgrades have allowed NOAA to meet its mission requirements of near-real-time data processing within 180 minutes of observation 85% of the time. Additionally, new ice products and security enhancements have been incorporated into the processing system without impacting its operational performance.

ADEOS-II development and testing is taking place in order to support the ADEOS-II mission from launch, currently planned for December 2002, and subsequent CAL/VAL period through operational processing.

5 REFERENCES

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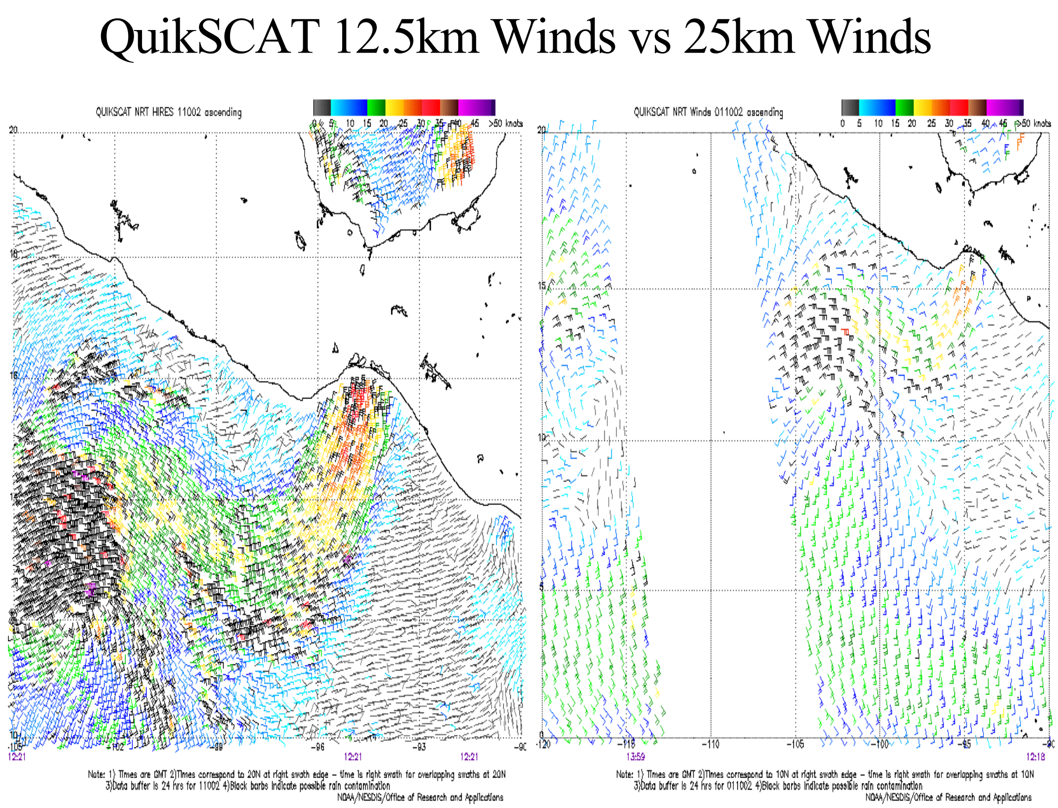

Figure 3. Comparison of 12.5 km Winds vs. 25 km Winds

Storm GABRIELLE off of Florida Coast

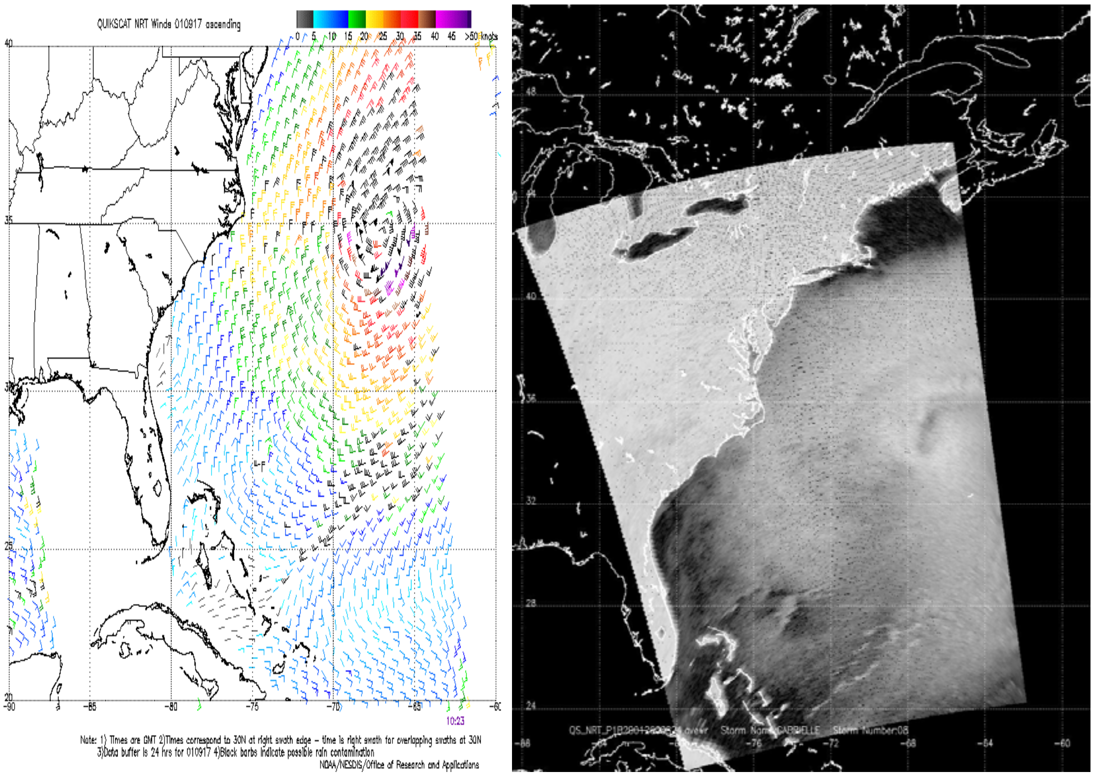

Figure 4. Comparison of Wind Field vs. Sigma-0 image

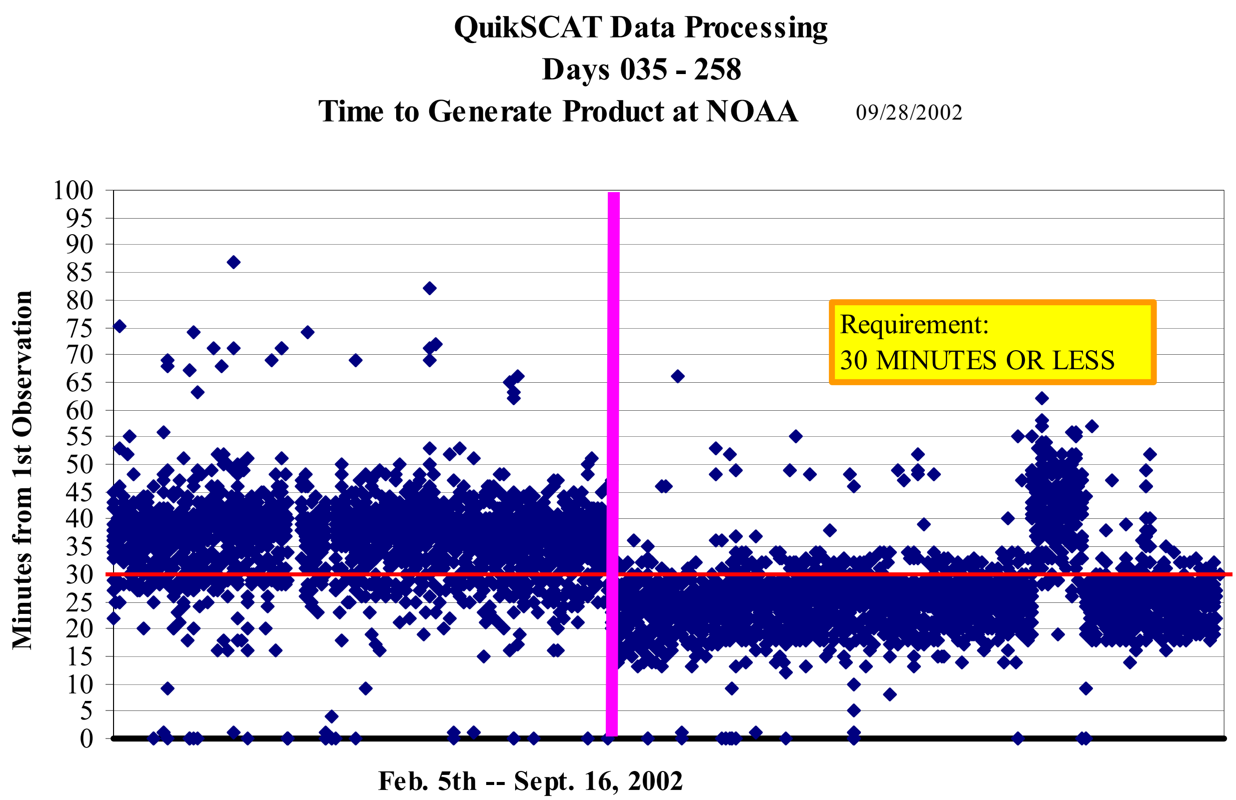

Figure 5. Processing Time for NOAA Generated Wind Products

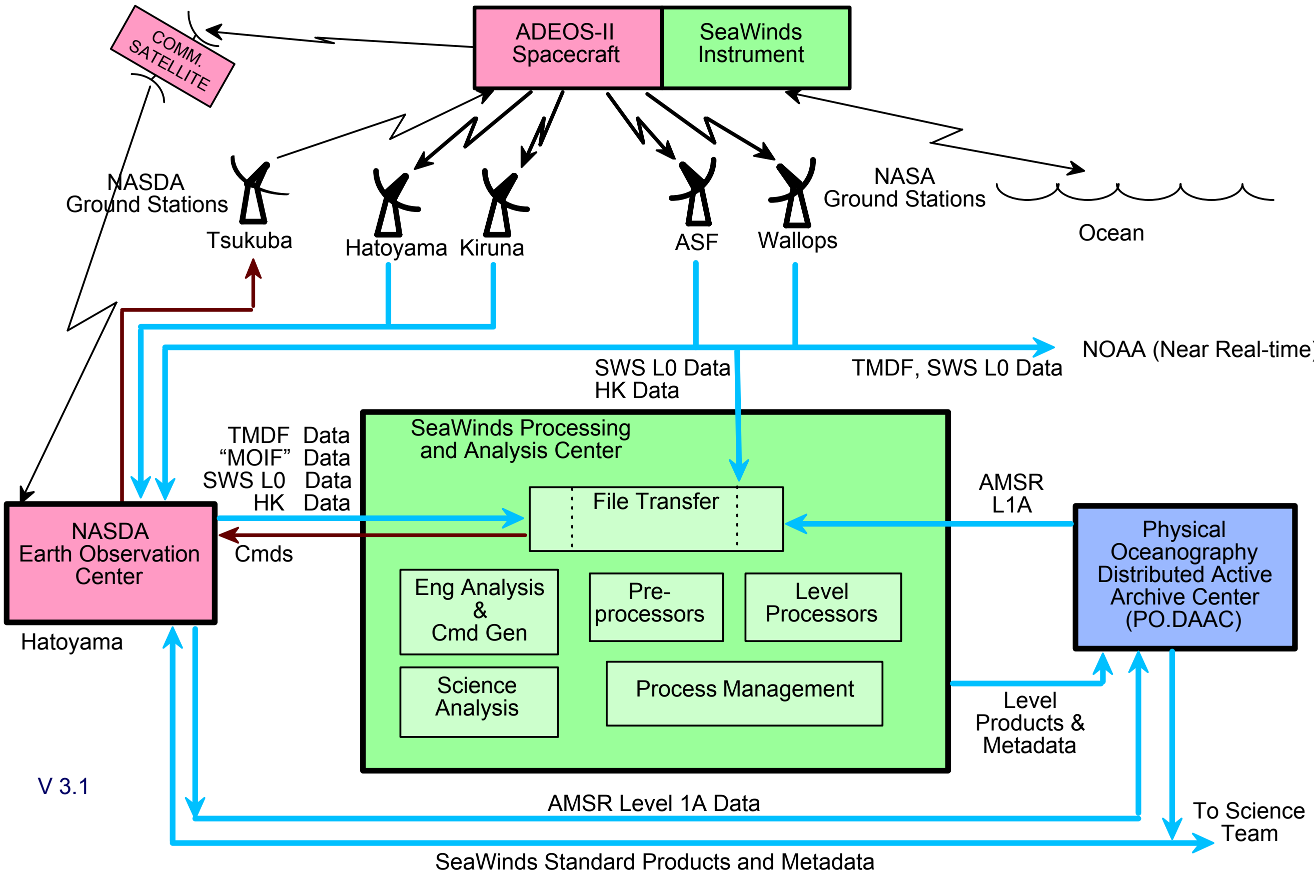

Figure 6. Data Flow for ADEOS-II Processing