10.4 RECENT ADVANCES IN QUIKSCAT/SEAWINDS NEAR-REAL-TIME PROCESSING AT NOAA/NESDIS

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1 INTRODUCTION

QuikSCAT near real time (NRT) processing of SeaWinds data at NOAA/NESDIS has been operational since February 2000. A suite of wind retrieval and daily ice products have found widespread acceptance and are used operationally at many centers. QuikSCAT winds have recently been incorporated in the latest operational AWIPS build. With the loss of the Adeos-II satellite in November 2003, continued enhancements and maintenance of the QuikSCAT processing system is ever more critical. Recent advances in the QuikSCAT processing system include retrofitting the Adeos-II processing improvements into QuikSCAT and the development of a suite of 12.5 km wind products to complement the 25 km product. In this paper we describe the latest changes to the QuikSCAT processing system and discuss plans to transition over to ASCAT processing. These advances were made under the Computer Sciences Corporation's (CSC) Central Satellite Data Processing contract.

2 NOAA/NESDIS SEAWINDS NRT PROCESSING SYSTEM

2.1 NRT Data Processing

SeaWinds processing at NOAA/NESDIS consists of ingest and data processing of scatterometer data from the SeaWinds instruments on the QuikSCAT spacecraft.

The SeaWinds NRT processing system at NOAA/NESDIS continues to be enhanced by collaboration between JPL and NOAA/NESDIS. Details of the NRT processing system's data flow are contained in Augenbaum, et. al. (2001, 2002, 2003, and 2004) and summarized in Figures 1 and 2.

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Figure 1, shows the general flow of SeaWinds 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 was *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. The Merged Geophysical Data Record (MGDR) product contains both the wind retrievals along with the sigma-0 values (radar backscatter) for each wind vector cell.

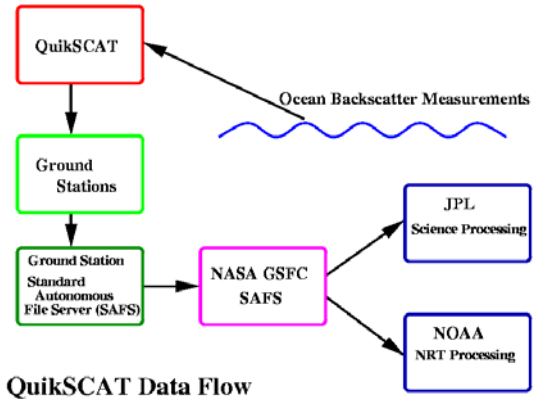

FIGURE 1. QuikSCAT Data Flow Diagram

Additional products have been added to the processing stream, on an operational basis, and are 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 based on algorithms developed by Dr. David Long (BYU).

The latest 24 hours of Wind fields are available at http://coastwatch.noaa.gov/qscat_winds_overview.html Archived images of older data can be found at http://manati.orbit.nesdis.noaa.gov/quikscat/

The daily ice image products are available at http://manati.orbit.nesdis.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

These products are available at www.natice.noaa.gov/science/products/qs.html

near-real-time ice images of the northern and southern hemisphere.

Further SeaWinds documentation is available at ftp://metroweb.nesdis.noaa.gov/pub/seawinds/

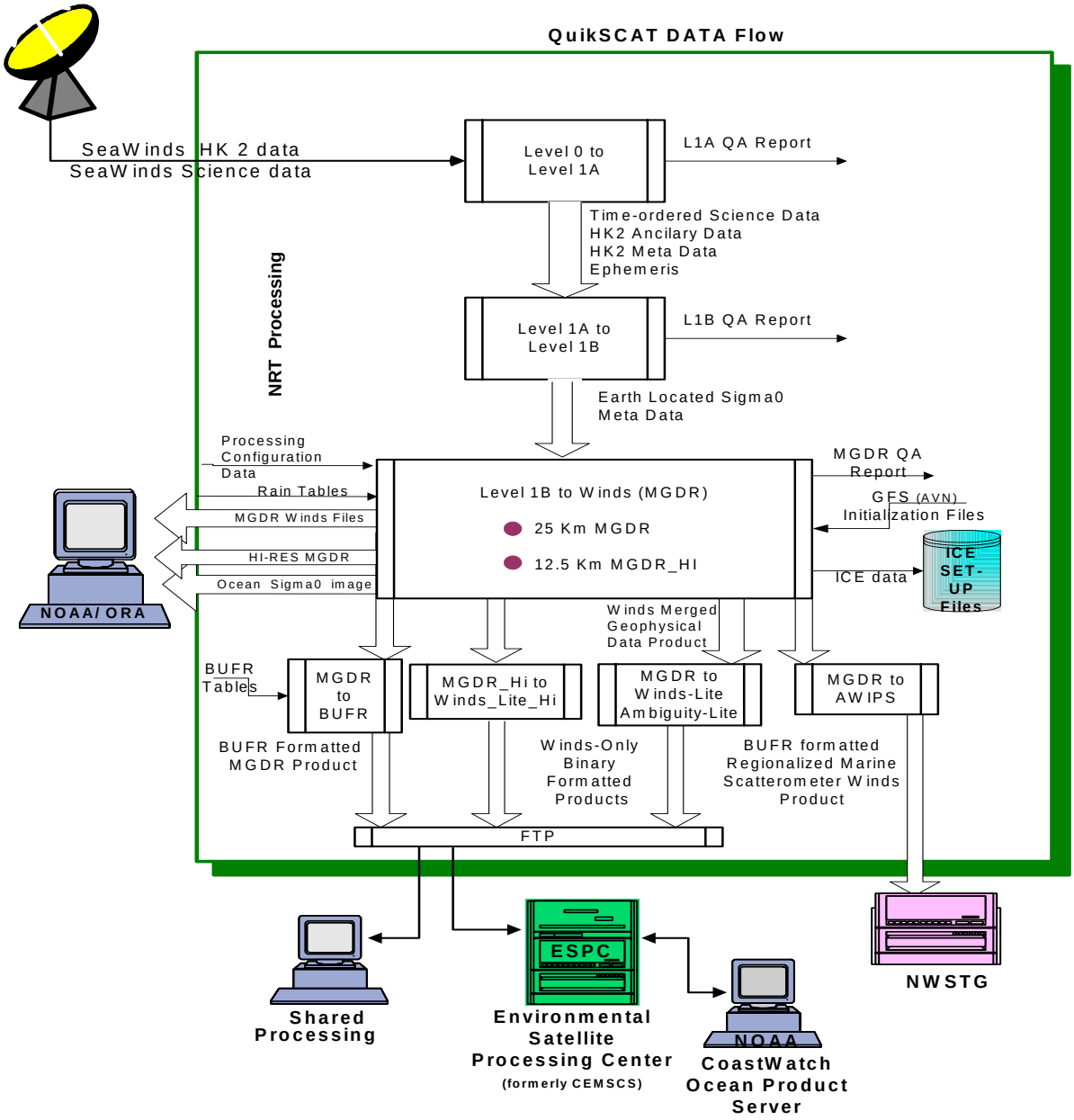

FIGURE 2. QuikSCAT Processing Flow Diagram

2.2 High-resolution SeaWinds QuikSCAT Products

Additionally, several high-resolution products have been added to the product stream and are produced after the main BUFR product is generated and made available. These products take longer to generate and are done after the BUFR product satisfies the operational requirement of being made available within 180 minutes of observation. The high-resolution products include a 12.5 km resolution wind retrieval and an Ocean Sigma-0 image. A binary formatted product containing the primary wind vector

retrieval at 12.5 km resolution was made publicly available this year. It is similar to the 25 km wind_lite product that has been available almost from the beginning of operations. Both, the 12.5 and 25 km, winds products have been incorporated into the NAWIPS package. Figure 3. and 4. displays a screen shots of Hurricane Frances from September 01 2004 with 25 and 12.5 km resolution. Note that the 12.5km image depicts the wind field superimposed over a satellite image. (These images are courtesy of NESDIS/ORA and The NCEP Ocean Prediction Center) The 12.5 km wind retrieval is also available at http://manati.orbit.nesdis.noaa.gov/hires/ Daily Sigma-0 images for regions of storm activity are available at http://manati.orbit.nesdis.noaa.gov/cgi-bin/qscat_storm.pl

2.3 Ambiguity-lite product

In the past, a 25 km winds-lite product was made available in binary format that only contained the primary winds solution vector along with a few additioanl fields such as the rain flag and quality flag. This year a new ambiguity-lite product was put into productiion. This product is similar in structure and format to the winds-lite product but includes all 4 wind retreival solutions. Each ambiguity wind retrieval is put in a separate file, structurally identical to the winds-lite product. In Figure 5. we display a screen shot of the ambiguity fields from a NAWIPS screen (courtesy of the NWS/NCEP Tropical Prediction Center).

2.4 Algorithmic Upgrades

During this past year the SeaWinds/QuikSCAT processing was upgraded to v2.4.1. This build is a "retrofit" of the SeaWinds/AdeosII processing improvements into QuikSCAT and includes a number of significant improvements into the SeaWinds/QuikSCAT processing. These improvements include selecting the "best 8" rather than the "center 8" slices in the radar return and the use of "echo tracking" to improve the reported attitude knowledge. These improvements have minimal, if any, impact on the current data, but, as the spacecraft ages and the pointing deteriorates, this should maintain the high quality of the data substantially. Additionally, the L1B processing has been optimized and runs faster than the older QuikSCAT L1B processor. The execution time of the L1B, for similarly sized files, went from 21 minutes to 15 minutes for adjacent passes. Also, with this change, when/if JPL improves the MUDH rain flagging based on their AMSR work, the NOAA version will be ready for the drop-in. With this upgrade, NOAA's ability to meet the three hour latency requirement with an 85% success rate has significantly improved since we need to process the data and make the BUFR product available within 30 minutes after we receive the data in order for NOAA to meet the overall three hour time limit.

3 ASCAT PREPARATIONS

With the launch of ASCAT aboard METOP scheduled for December 2005 we have begun planning for the transition from QuikSCAT to ASCAT to meet the needs for near-real-time scatterometer based wind products. At present we are identifying the hardware and software platforms necessary to integrate the ASCAT processing system into the NOAA/NESDIS environment.

ASCAT is functionally the same as SeaWinds, but significantly different from a hardware perspective. SeaWinds is a conical scanning RADAR at 13.4 GHz (KU Band)) with two polarizations and two incidence angles which sweep out earth coverage in a circle centered under the satellite. At this frequency, SeaWinds is susceptible to rain interference. ASCAT is a "stick" scat design, with 6 antennas, 3 pairs of 2, at 5.255GHz (C-Band). At this frequency, ASCAT is much less susceptible to rain interference. The first pair is perpendicular to the mid point of the spacecraft, with the 2nd and 3rd pairs are +/- 45 degrees of broadside to make measurements of the same ground track.

The Level 1B processing scheme between SeaWinds and ASCAT which creates the wind vector cells is significantly different, due to the differences in observational geometry. Additionally, ASCAT provides a product resolution of 50km and SeaWinds product resolutions are 25km and 12.5km. The ASCAT product is divided into two 500KM swaths on either side of a 300KM nadir gap, again at 50km resolution. The SeaWinds products are a continuous 1800KM swath with resolutions of 25KM or 12.5KM. Our goal in ASCAT development is to provide an initial product with a ground resolution of 25KM to minimize differences with SeaWinds. Further information can be found at http://www.esa.int/export/esaME/ascat.html .

4 CONCLUSIONS

QuikSCAT near-real-time processing has been operational since February 2000 and continues to meet NOAA's mission requirements of near-real-time data processing within 180 minutes of observation 85% of the time. Over the past year, the system has been enhanced to include additional products that our customers have requested. We are presently developing plans to build a similar ASCAT processing system at NOAA/NESDIS to make a near-real-time suite of ASCAT wind products available when ASCAT scatterometer data becomes available in 2006.

5 REFERENCES

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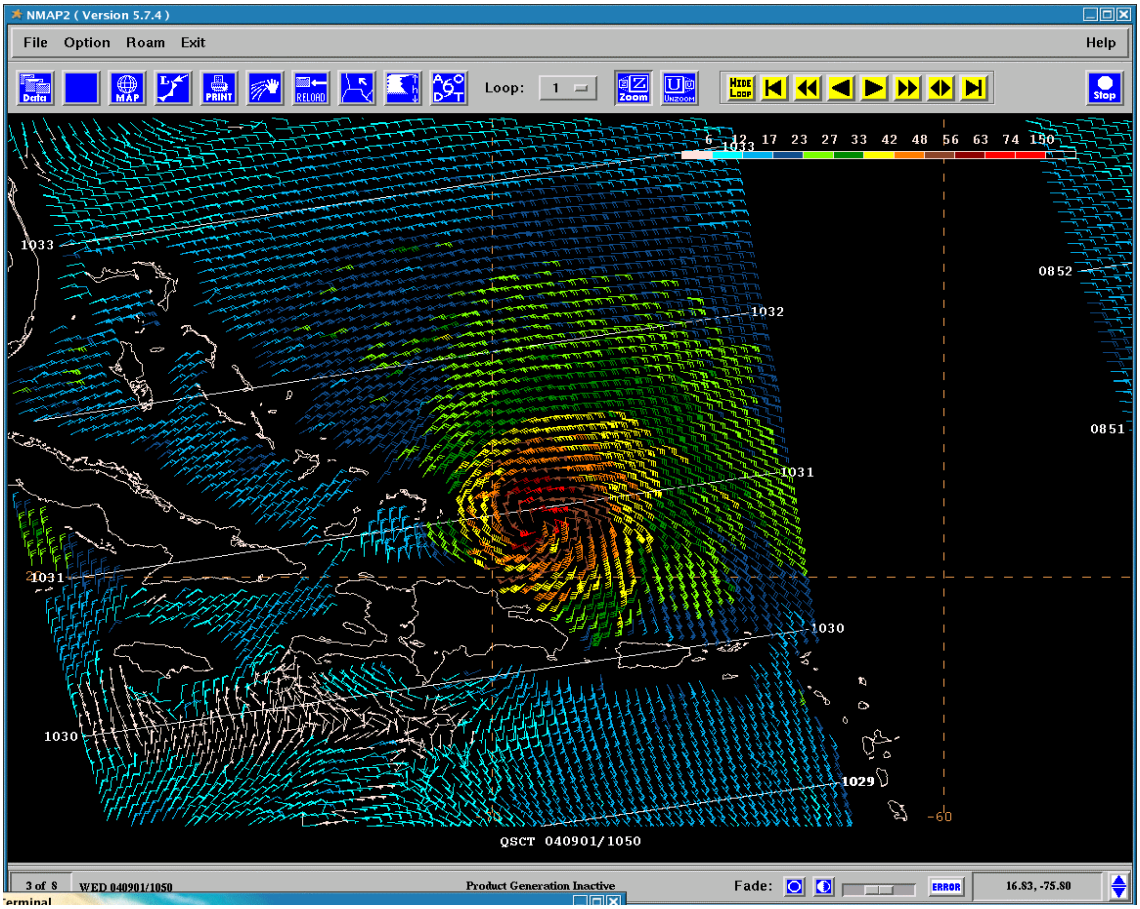

FIGURE 3. Screenshot of an NAWIPS display with 25 km QuikSCAT winds data for Hurricane Frances – September 01 2004

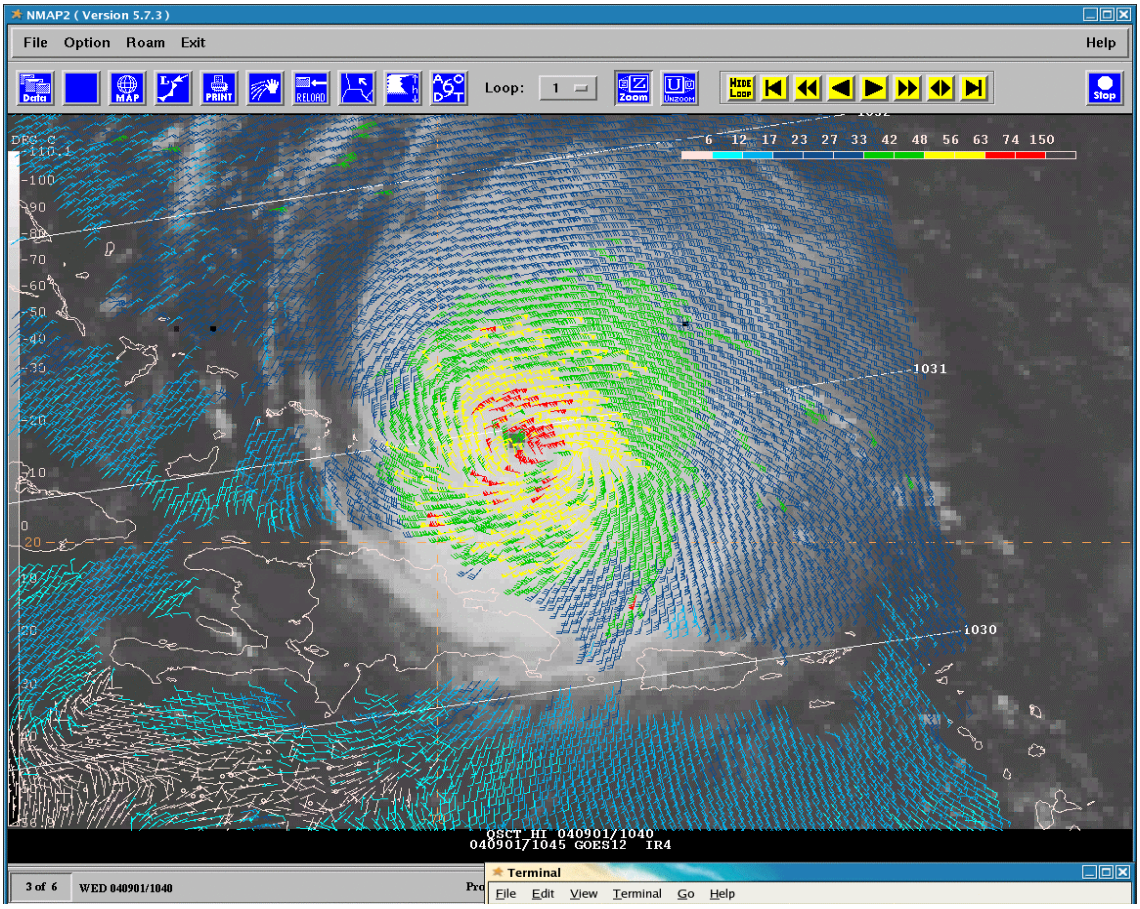

FIGURE 4. Screenshot of an NAWIPS display with 12.5 km QuikSCAT winds data for Hurricane Frances – September 01 2004

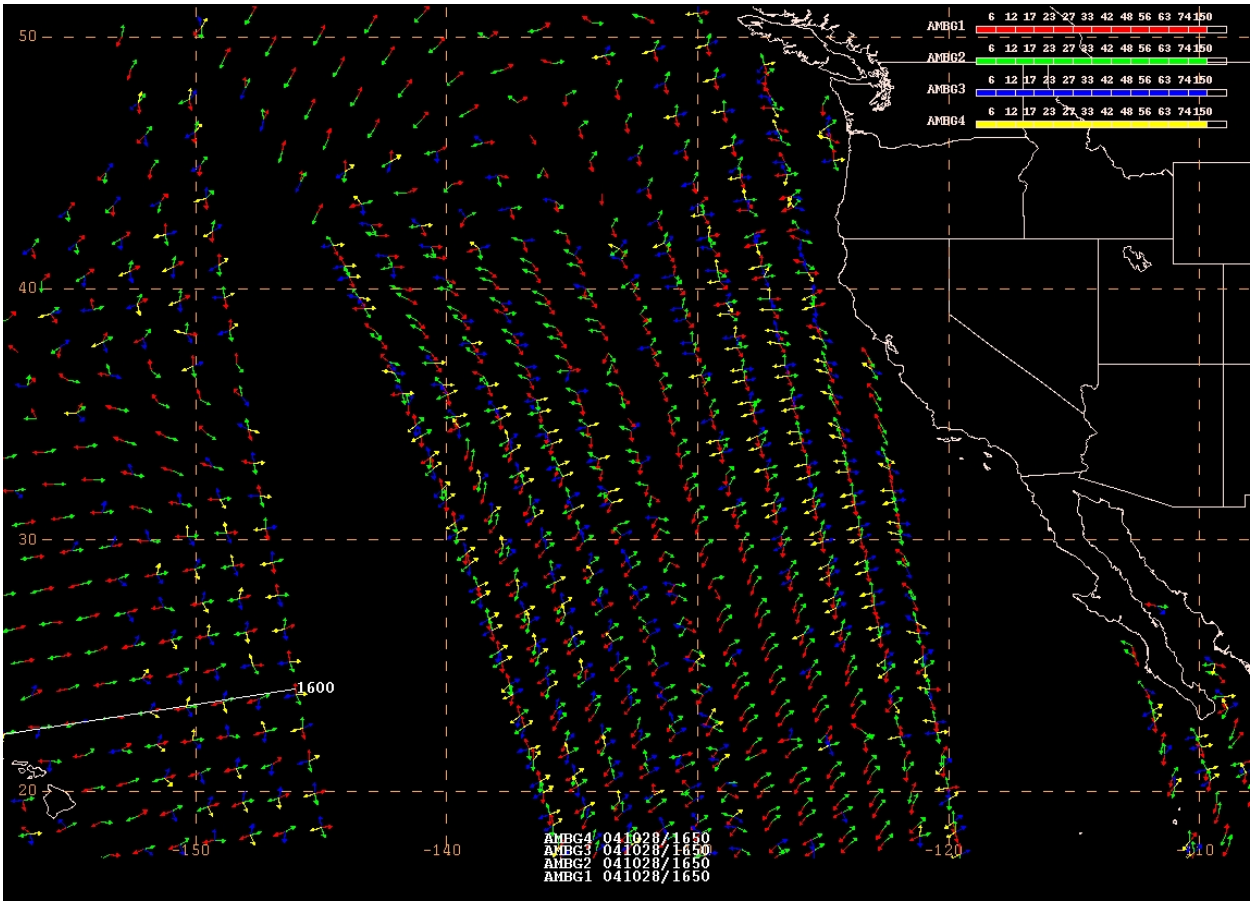

FIGURE 5. Sample screenshot of an NAWIPS display of the ambiguity fields