

Florida Coastal Forcing Project

- Waves and Winds in the Nearshore -

Progress Report #10

submitted to

The Florida Department of Environmental Protection
Bureau of Beaches and Wetland Resources

and

The Beaches and Shores Resource Center

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1. Wave Gauge Network and Hindcast Database

1.1 Continued Refinement of the Permanent Test Site

In regard to the wave gauge network, effort has been devoted to 1) maintaining the wave gauge, wind instrument, and shore station in Melbourne Beach, 2) identifying and troubleshooting bio-fouling induced problems with the wave gauge, 3) refining the prototype data collection system and procedures, and 4) developing a preliminary scope of work and a cost estimate for building the envisioned FCFP measurement network. In detail:

- Following the advice of the electrician that installed the service in the shore station shed, the local electrical panel has now been grounded separately to its own grounding rod. This enabled communication with the wave gauge at only a slightly higher rate (19.2 baud), which is still unsatisfactory for downloading significant amounts of stored data.
- The Melbourne Beach wave gauge was inspected by divers on October 27. Although significant bio-fouling had occurred since it was last swapped (August 19), everything appeared to be in order. Based upon the claims of the manufacturer that the ADCP ‘sees’ through bio-fouling, and given that the cross-shelf experiment had just been started (see below), it was decided to leave well-enough alone. However, on November 7 the instrument began experiencing sporadic ‘drop-outs’ during which no acoustic data was gathered. The drop-outs began to occur more frequently, until on November 26 the gauge was swapped for a back-up. The pressure data, which continued to be collected, will be reprocessed for times when the acoustic data are missing to provide replacement significant wave height and dominant wave period. Unfortunately, directional information is unavailable during these gaps.
- The heavily bio-fouled instrument was thoroughly cleaned, and a test deployment conducted to confirm that the bio-fouling was indeed the source of the gauge problem. The test of the newly cleaned gauge was successful. From this experience,

it can be concluded that the RDI acoustic wave gauge cannot operate through a heavy layer of bio-fouling, contrary to the claim of the manufacturer.

- In consequence of the bio-fouling lesson, all of the RDI wave gauges have been treated with a special anti-fouling paint, the performance of which will be monitored over the upcoming months. If well-proven, although its application is time-consuming and expensive, anti-fouling paint will become an integral part of the maintenance program.
- During the swap of the Spessard gauge on November 26, the long neoprene umbilical was removed and the instrument's short pig-tail was connected directly to the end of the steel cable by the divers. Because batteries are no longer installed in the instrument, 'wet-connection' is practicable, and consequently the umbilical is no longer needed. This greatly simplifies the gauge-swapping procedure, and reduces the vulnerability of the underwater hardware.
- A scope of work and a preliminary budget have been developed for building additional wave & weather stations for the FCFP network, and forwarded to FDEP. In summary, each new station will cost approximately \$123,110 (including the wave gauge). Once a potential location is determined and local support affirmed, it will require 6-8 months to obtain the necessary permits and complete each installation. Any savings in cost resulting from the development of more than one new station at a time are small because the stations are to be widely separated geographically. Each location is likely to have its own peculiarities in design and installation.
- Operation and maintenance of a system of 5 stations is estimated to cost \$226,525 per year, or \$43,305 per station. Presently, the O&M for the single station at Melbourne Beach is approximately \$65,000 per year. These figures do not include the costs of periodically replacing wave gauges, cables, and other hardware.

1.2 Continuing Data Collection at the Melbourne Beach FCFP Station

Since being brought on-line on September 12, the wind instrument and its data collection system have performed flawlessly. The fact that this data stream is uninterrupted, whereas the wave gauge record has some gaps, is attributed mostly to the fact that the collection and processing of the wind data are both performed using customized data logging and control software developed by SES, as a LabView® application.

Wave data sets are processed using the manufacturer's Windows®-based software and these results are sent to the SES offices and the FDEP website. However, the wave gauge processing software experiences occasional communications errors with the computer's serial port, which can cause the Windows® system to crash. A computer crash does not typically effect the collection of wave data, but it does interrupt the stream of real-time data to the website. The missing real-time data sets can be recovered and sent to the website once the computer is re-booted. At present, a trip to the shore station is required to re-boot the system. This is not a major problem with the Spessard station due to its close proximity, but would pose some difficulty at a remote site if no local assistance were available. To alleviate this potential constraint, development of a custom Labview® application for wave data collection and remote re-boot capability will be investigated later this FY.

Wave and wind data for October 2002 are presented in Figure 1, and current data are presented in Figure 2. Concurrent data from NDBC #41009 are also presented for contrast. Conditions are unusually benign for this time of year, with a distinct lack of Northeaster activity. As might be expected, winds at 41009 tend to mimic those at the FCFP station, except when directed offshore. The nearshore current speed (Figure 2) seldom exceeds 0.1 m/s, except when the current is directed longshore (e.g. 10/9 to 10/11).

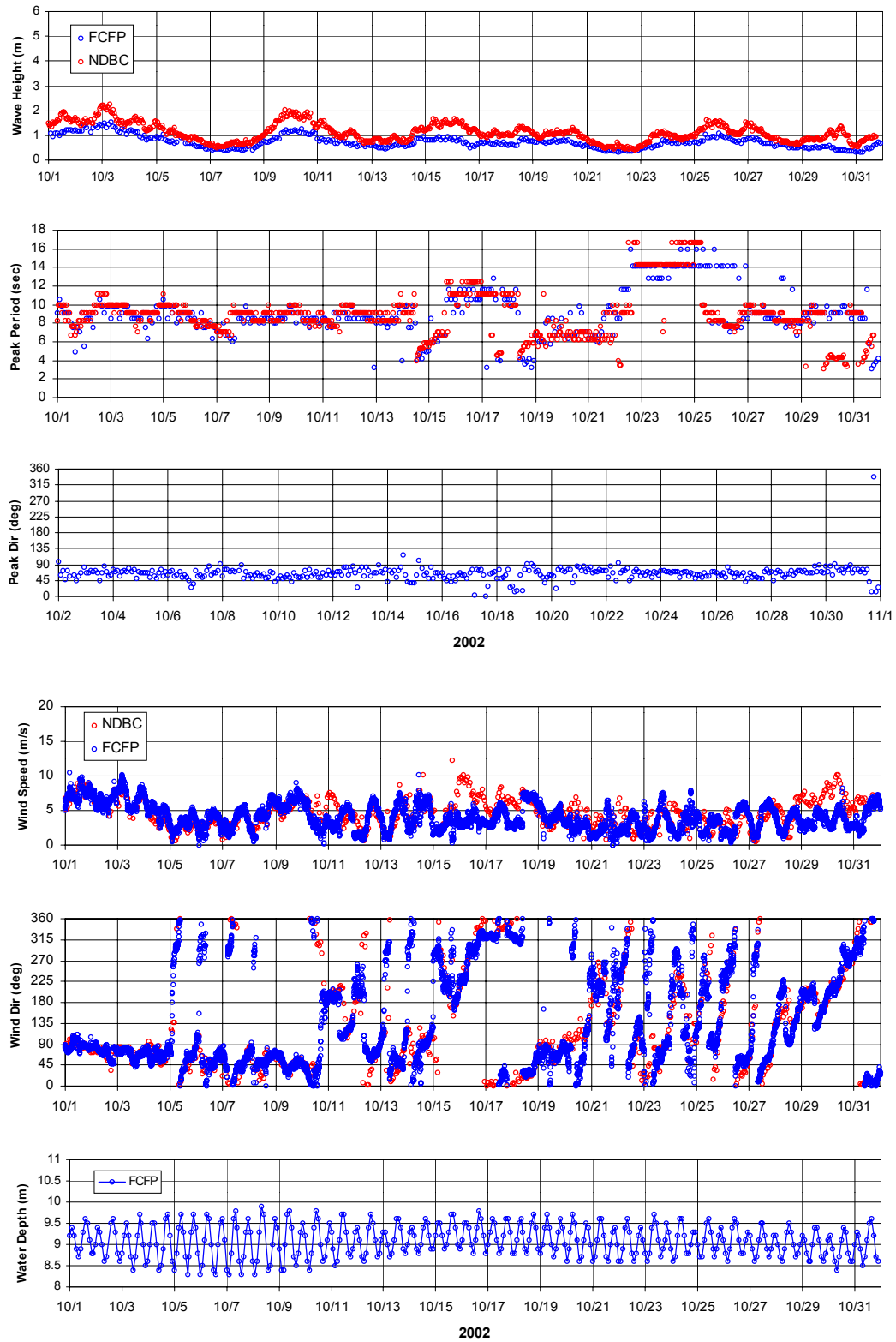


Figure 1 – Wave and wind information for October, 2002 from FCFP Melbourne Beach Station and NDBC Station off Cape Canaveral.

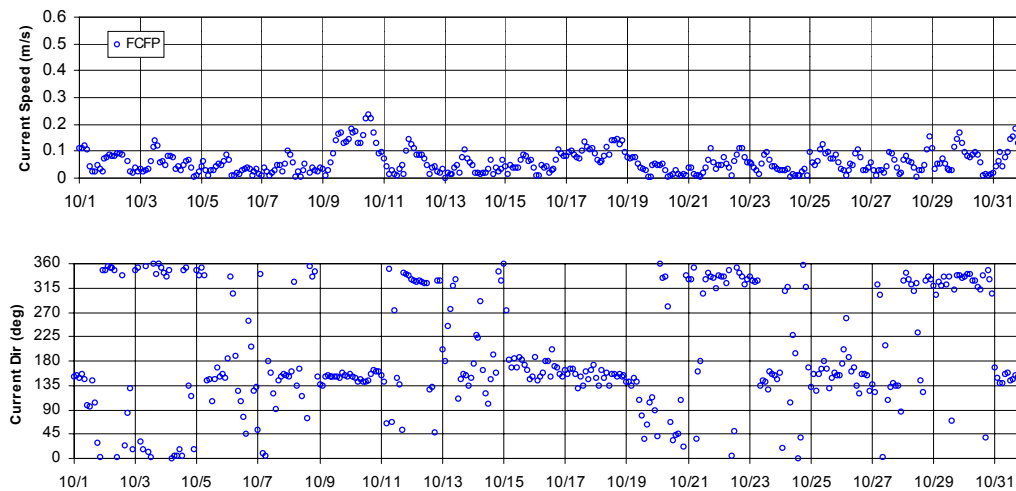


Figure 2 – Current speed and direction for October, 2002 from FCFP Melbourne Beach Station.

1.3 Approach and Scope for Development of the Nearshore Hindcast Database

Previous modeling efforts with STWAVE, from which the importance of bed-induced energy losses as well as the importance of local calibration was recognized, has helped to establish the general approach to be followed in developing the nearshore wave hindcast database for Florida. A scope of work and a preliminary budget have subsequently been developed, and have been forwarded to FDEP. This effort includes start-up work on the STWAVE⁺ model, calibration and ground-truthing of the model results in each of Florida's four coastal regions, and final production runs and archiving. Total cost is nominally \$775,000, and would require nominally 4 years to complete.

2. Canaveral Cross-Shelf Experiment

The Canaveral cross-shelf wave transformation experiment is up-and-running. The first deployment and retrieval of instruments from the three offshore towers has been successfully completed, the instruments and towers serviced, and the instruments re-deployed. It is anticipated that the instruments will be retrieved again in mid-January. In detail:

- The Liberty Tripod (73 ft depth) was successfully erected on October 8.
- On October 13 the Tug Tower (62 ft depth) was inspected and found to be in good order. The Rock Reef Tower (57 ft) was completed.
- On October 27, gauges were deployed at the Liberty and Tug towers, and the Spessard gauge was inspected.
- A gauge was deployed at the Rock Reef tower on November 5.
- On November 25, all three instruments were retrieved from the towers. Data collection was successful, and the raw data have been processed. Results are presented in Figures 3, 4, and 5.
- On December 12, damage to the Liberty tripod inflicted by storm swell was discovered, the tripod was repaired, and a gauge deployed. The Tug tower was also inspected and minor repairs made on that day, but the weather turned foul before a gauge could safely be deployed.
- A gauge was deployed at the Tug tower on December 16. The Liberty and Tug instruments will be retrieved in mid January.

- Because of the bio-fouling problem at Spessard , a fourth wave gauge was not available in time to be re-deployed on the Rock Reef tower. However, it will be deployed for the third data collection.

The remainder of the fiscal year will be devoted to 1) completion of the cross-shelf experiment and processing of the raw data, 2) preliminary analysis and wave-transformation modeling using measured directional wave spectra as input, and 3) addressing the software-crash problems and data communication issues at the Spessard station.

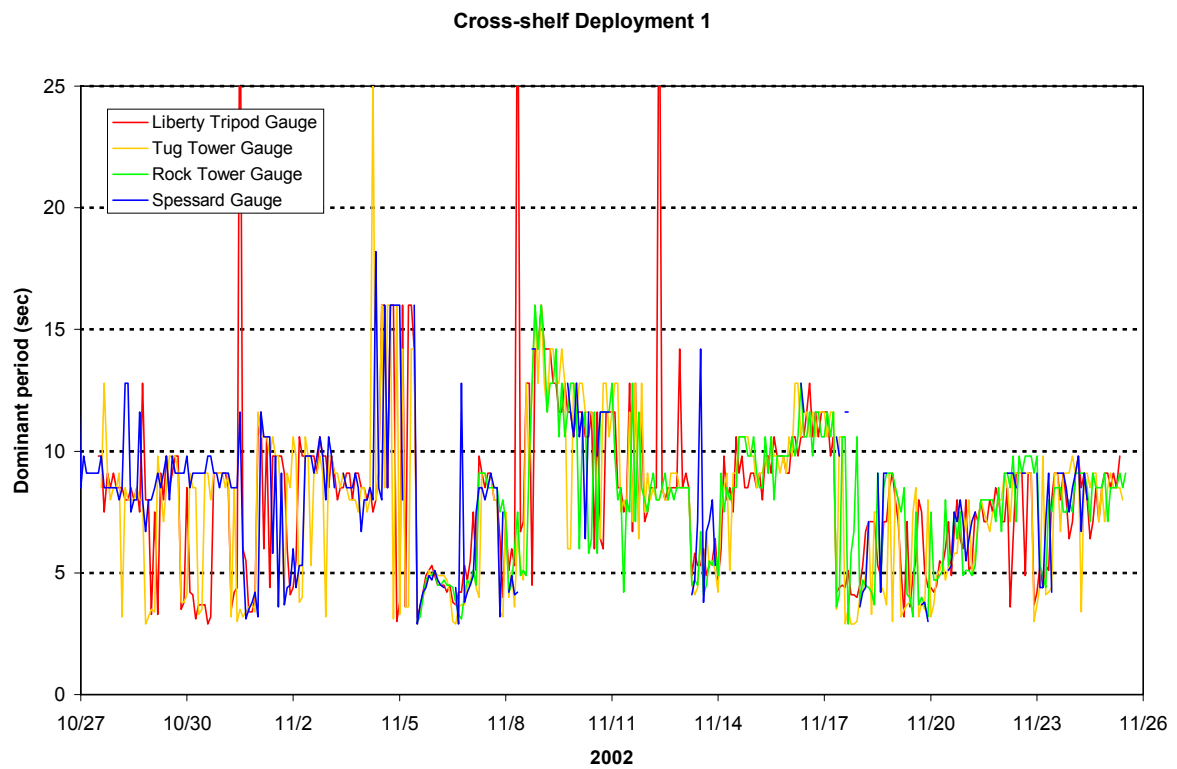
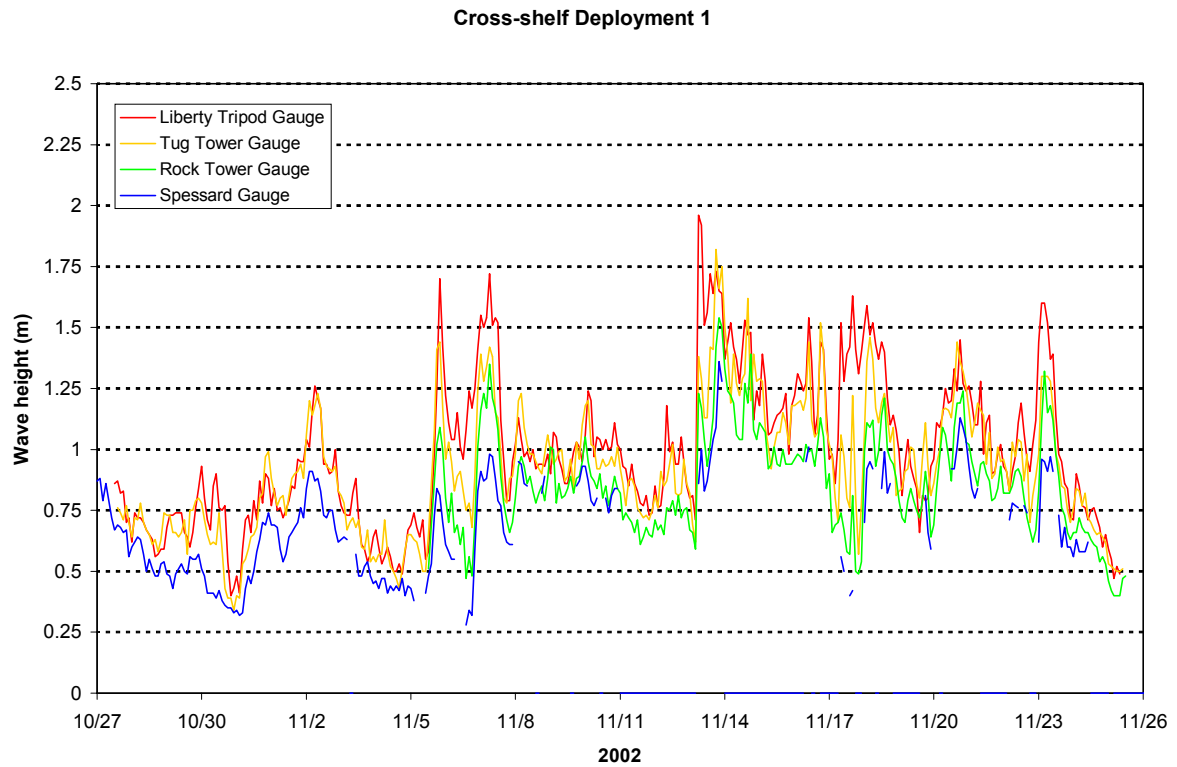


Figure 3 – Significant wave height and dominant wave period during the first cross-shelf deployment, October 27 to November 26, 2002.

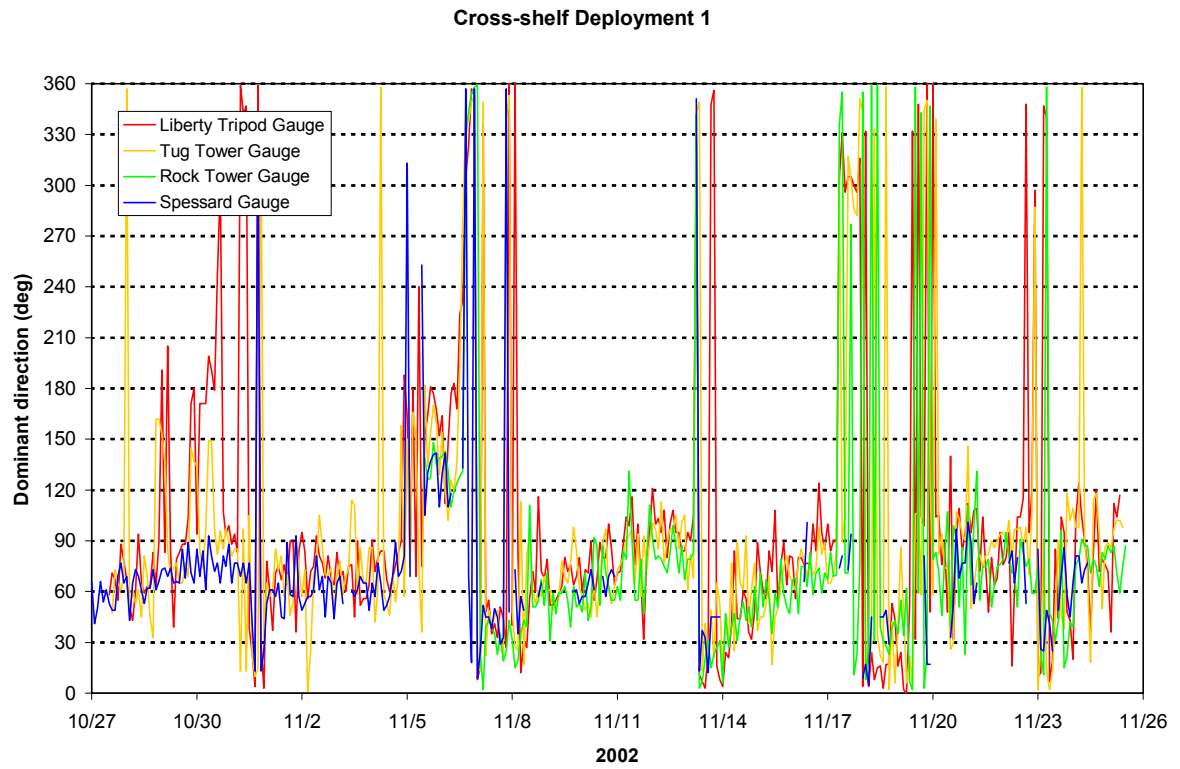


Figure 4 – Dominant wave direction during the first cross-shelf deployment, October 27 to November 26, 2002.

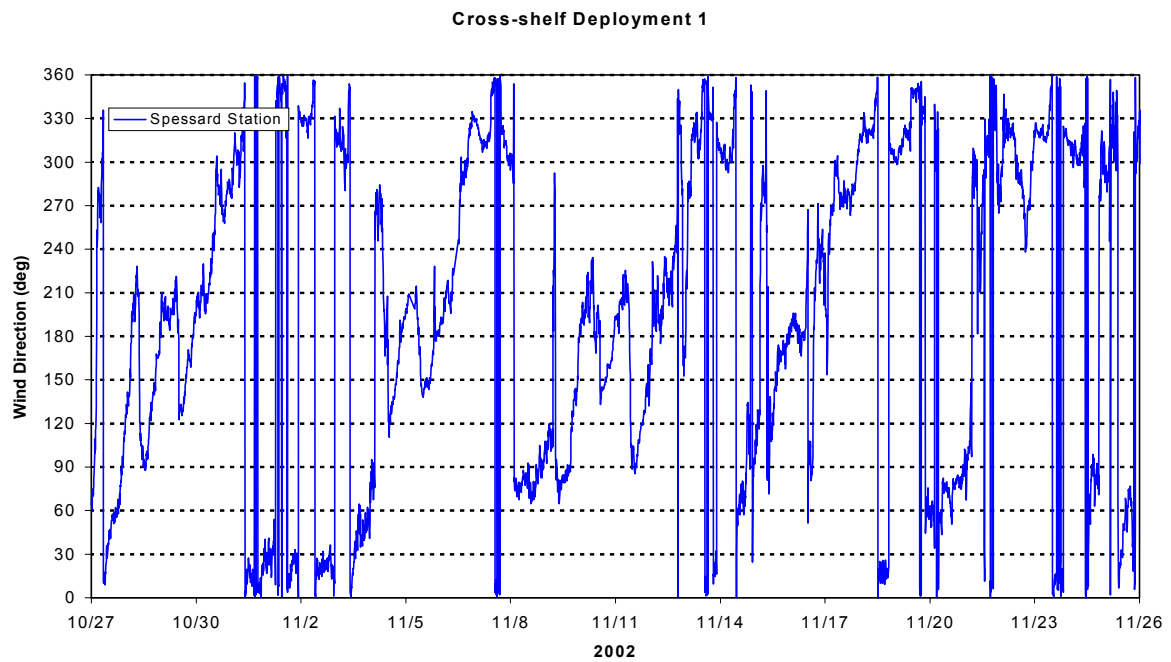
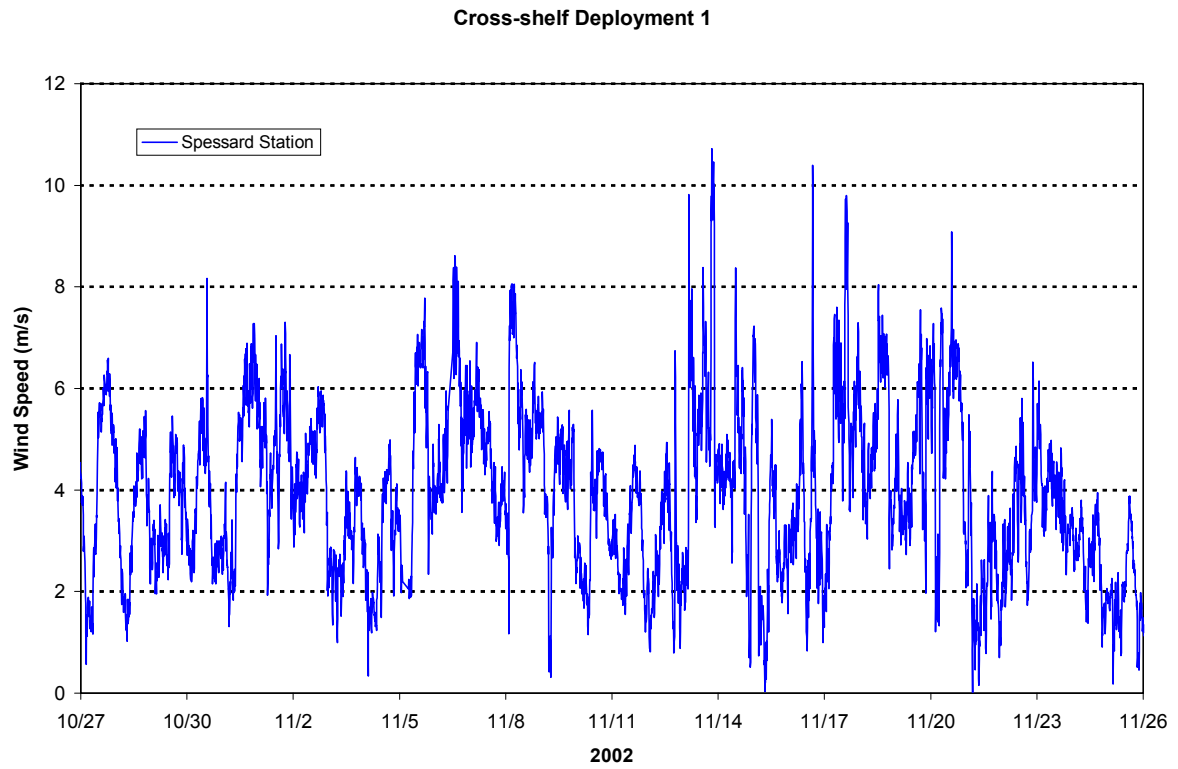


Figure 5 – Wind speed and direction at the Spessard station during the first cross-shelf deployment, October 27 to November 26, 2002.