Florida Coastal-Forcing Project

- Waves and Winds in the Nearshore -

Progress Report #6

submitted to

The Florida Department of Environmental Protection
Office of Beaches and Coastal Systems

and

The Beaches and Shores Resource Center

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(work performed October 27, 2001 to February 6, 2002)

1. Wave Gage Network

1.1 Development of the Permanent Test Site

Since the previous progress report, effort has focused on connecting the self-recording wave gauge located offshore of Spessard Holland North Beach Park to a shore station so that waves can be monitored in real time. An inordinate amount of time and energy, by both Surfbreak and the OBCS, has been devoted to acquiring the necessary permits for the wave gauge cable and the shore station shed. In brief:

- On November 30, 2001 a Field Permit was issued by the Office of beaches and Coastal Systems to allow the installation of the shore station shed seaward of the Coastal Construction Control Line.

- On January 9, 2002, a Sovereign Submerged Lands Easement was issued, establishing an easement for the wave gauge cable that is nominally 200 ft in the alongshore direction and 2000 ft in the cross-shore direction. This easement was recorded at the Brevard County Courthouse on January 11, 2002.

- A Notification of Exemption for an Environmental Resource Permit for the cable was provided by the Florida Department of Environmental Protection, Central District, on January 18, 2002. For the purposes future planning, it required nearly 3 months to receive this 'simple' exemption.

- On January 31, 2002, a Regional General Permit Verification was granted by the US Army Corps of Engineers. During review by the U.S. Fish and Wildlife Service, issues concerning sea turtles, manatees, and beach mice were raised. Because of the potential need to repair a damaged cable during turtle nesting and hatching season (February 15 – November 30), this permit requires the use of directional drilling to install a conduit under the nesting habitat.

- The shore station shed was installed on December 20, 2001.

- The security fence was installed around the shed on January 4, 2002.

- On January 31, 2002, using directional drilling, a 2-inch diameter poly-tube conduit was installed between the shed and a point nominally 100 ft seaward of the dune. Burial depth at the toe of the dune was approximately 7 ft. Minimum burial depth at the beach face was approximately 5 ft. There was absolutely no disturbance to the dune, and minimal inconvenience to park patrons. Daily inspection confirms that the conduit has thus far remained completely buried.

- Installation of underground utilities between the Park bath house and the shore station shed is scheduled for February 13, 2002.

- With the exception of a laptop computer, all components of the cable system have been purchased (e.g. armored cable, neoprene umbilical, cable grips, & power supply).

- A third RDI Workhorse Sentinel directional wave gauge was purchased in December, 2001 and delivered in January, 2002.

The next step in the process is to assemble the cable power and communication system, and to fully test it with the instrument submerged in a swimming pool. Testing will include examining gauge performance during times of power outages and communication failure.

The Spessard instrument will be swapped once more in the near future, to allow enough time for dry-land testing of the cable system. It is intended that the cable and a fresh gauge will be installed before the last self-recording gauge requires swapping (~ 33 days).

Upon successful cabling of the Spessard gauge, attention will shift to installing the data communication link from the shed to Surfbreak's office, and finally uploading it to BSRC. To complete the FCFP facility in Melbourne Beach, a directional anemometer will be installed. The instrument is to be mounted to a spar at an elevation approximately 10 m above mean sea level.

1.2 Findings from Continued Self-Record Deployment at Spessard Holland

Since its initial deployment on August 28, 2001 and first retrieval on October 3, 2001, the wave gauge at Spessard Holland has been deployed and retrieved three more times, on roughly a monthly basis. The gauge was last swapped on January 9, 2002. The data through January 9 are presented in Figures 1-6.

In October and November, five storms occurred in which the significant wave height in the nearshore exceeded 2 m, and two of these had waves greater than 3 m. In all, seven storms occurred in the fall of 2001 in which the significant height exceeded 2 m. The waves reported at NDBC #41009 during each storm were notably larger (1-2 m), as shown in the Figures.

1.3 Initial Development of the FCFP Website

Personnel from Surfbreak Engineering visited FDEP and BSRC in Tallahassee on November 13-14, 2001. During this visit the basic design of the FCFP website was established, and wave data delivered to BSRC so layout work could begin. A draft web page was quickly developed by BSRC staff, and feedback provided by Surfbreak. Additional data are being added to the site.

2. Wave Hindcast Database: Energy Loss Enigma

2.1 Acquisition of New WIS Data

As described in Progress Report #5, an investigation is underway to examine the premise that the conspicuous wave energy losses between Buoy 41009 and the nearshore gauges were not represented by earlier wave modeling with STWAVE because input spectra were synthesized from gross hindcasted parameters rather than complete directional spectra. To this end, recently developed deepwater hindcast information from the Army Corps of Engineers Wave Information Study has been obtained. These hindcast results were generated using similar wind fields as those used in the AES-40 project, but employing a different wave model (WIS versus pseudo-WAM). Most importantly, the results have been archived as complete directional spectra. The record to be examined includes Oct.-Dec., 1996, Jan.-Mar., 1997, and Jan.-Mar. 1999, selected because these time periods contain notable storms that were also documented by the Sebastian Inlet nearshore gauge. To more fully establish its capabilities and limitations, STWAVE is being set up and run for the shelf region at Sebastian Inlet, but using these less equivocal, fully directional spectra as input.

Sample data are presented in Figures 7-9. Note that in Figure 7 (lower panel) the spectral mean wave period is plotted, and in Figure 8 the vector men wave direction. These parameters display significantly better stability than peak period and peak direction (see e.g. Figure 1). Based upon this simple finding, it is recommended that mean period and direction be archived in the FCFP database.

2.2 Cross-Shelf Experiment

Planning and design work for the cross-shelf experiment has begun. Because the three submerged towers are to be deployed only for approximately three months, they will be constructed from off-the-shelf, prefabricated sections of galvanized steel antenna-tower. One brand that is readily available in several cross-sectional sizes is Rohn® T.V. Tower. Each open-frame section is ten ft long, and easily mates with adjoining pieces. Because the sections are light-weight, they might be assembled either across the gunnels

or alongside the research vessel, and then lowered to the sea floor. The outer tower will require five sections, whereas the inner towers will require only two sections each. Anti-fouling paint will be used to reduce bio-fouling and its associated drag loads.

The foundation for each tower will consist of a 10-ft long, stainless-steel spud that is jetted into the sea floor. Almost identical in design to those presently used for mounting the ADCP instruments in the nearshore, the spud is topped by a plate, to which the tower will be bolted. In erecting each structure, divers will first jet the spud into the bed, and then float the tower into an upright position using a lift bag. Guy wires may be required, particularly for the deep-water tower. These will be held by helical anchors. Design work and fabrication are slated to be completed this spring, with ocean-testing of the tower system to be conducted in June and July. The foundation spuds will be installed in July and August. The towers will be temporarily erected to check their fit and performance, but then lowered again and left resting on the bottom. With preparations complete, in mid-September the towers will be lifted upright again, and the self-recording instruments deployed. It is envisioned that the gauges will be checked one week later and, if all is well, checked on a monthly basis thereafter. Final retrieval is slated for mid-December.

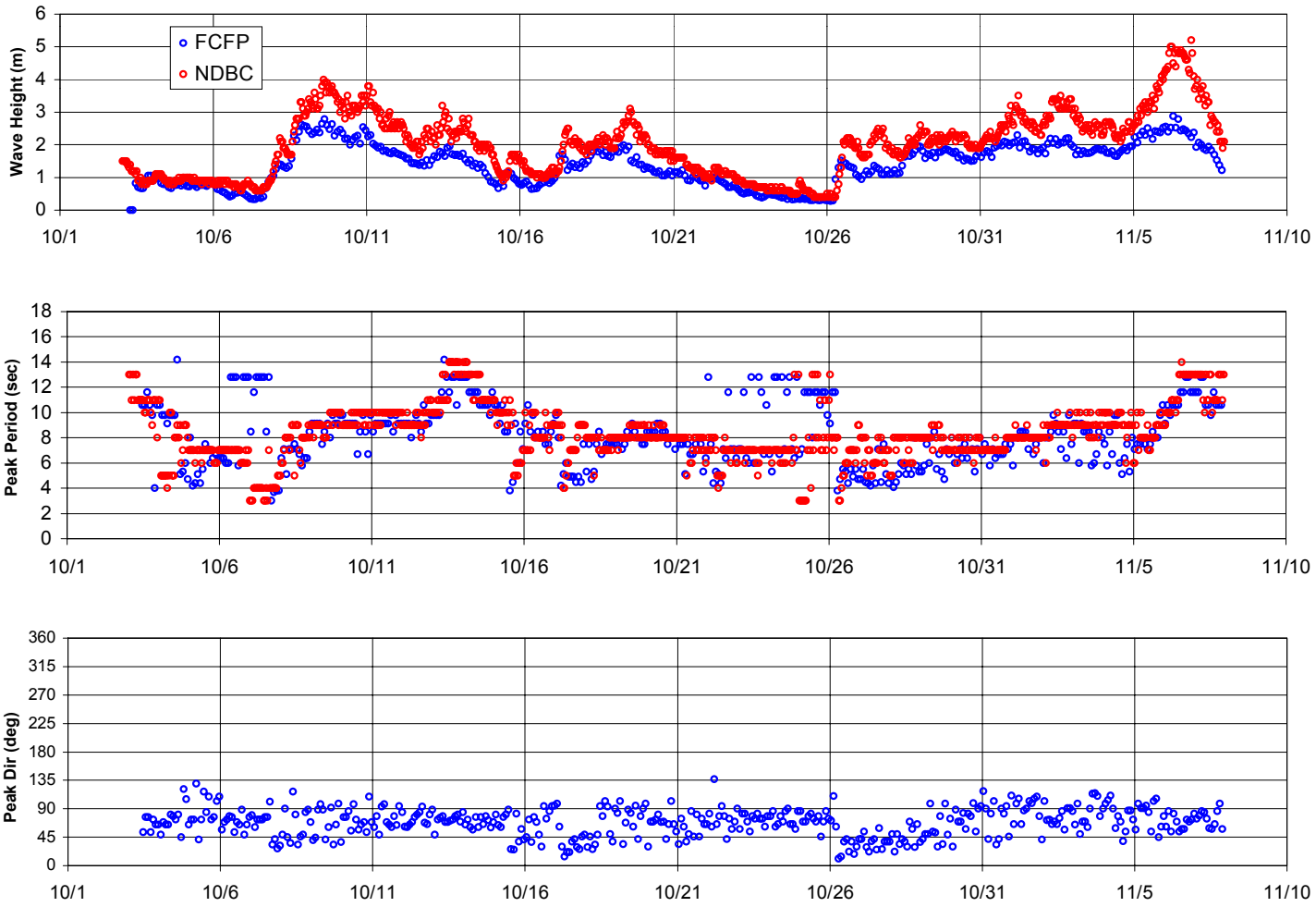

Figure 1 – Wave data from Melbourne Beach gauge for October 3 – November 7, 2001. Data from NDBC 41009 shown for comparison.

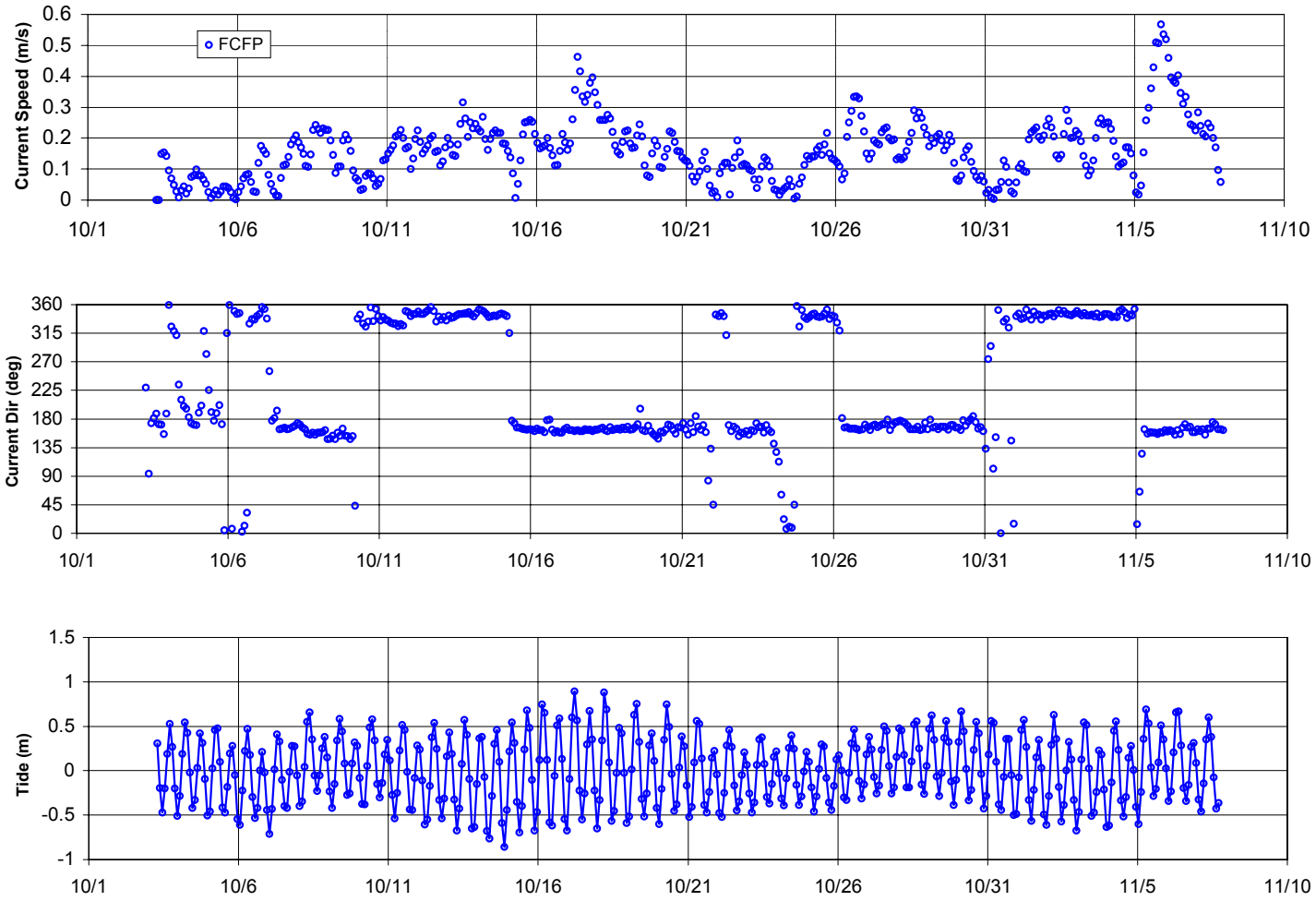

Figure 2 – Current and tide data from Melbourne Beach gauge for October 3 – November 7, 2001.

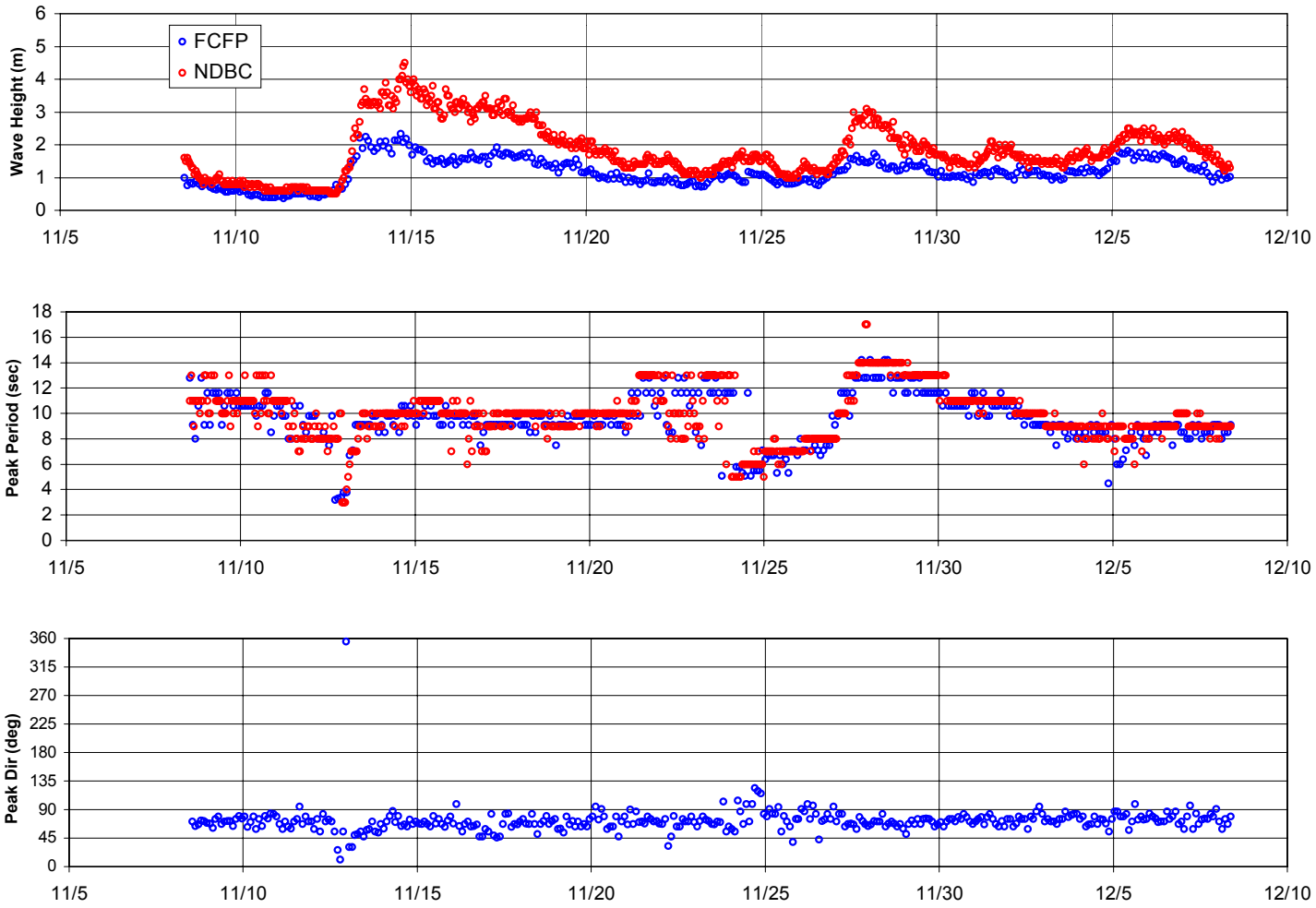

Figure 3 – Wave data from Melbourne Beach gauge for November 7 – December 8, 2001. Data from NDBC 41009 shown for comparison.

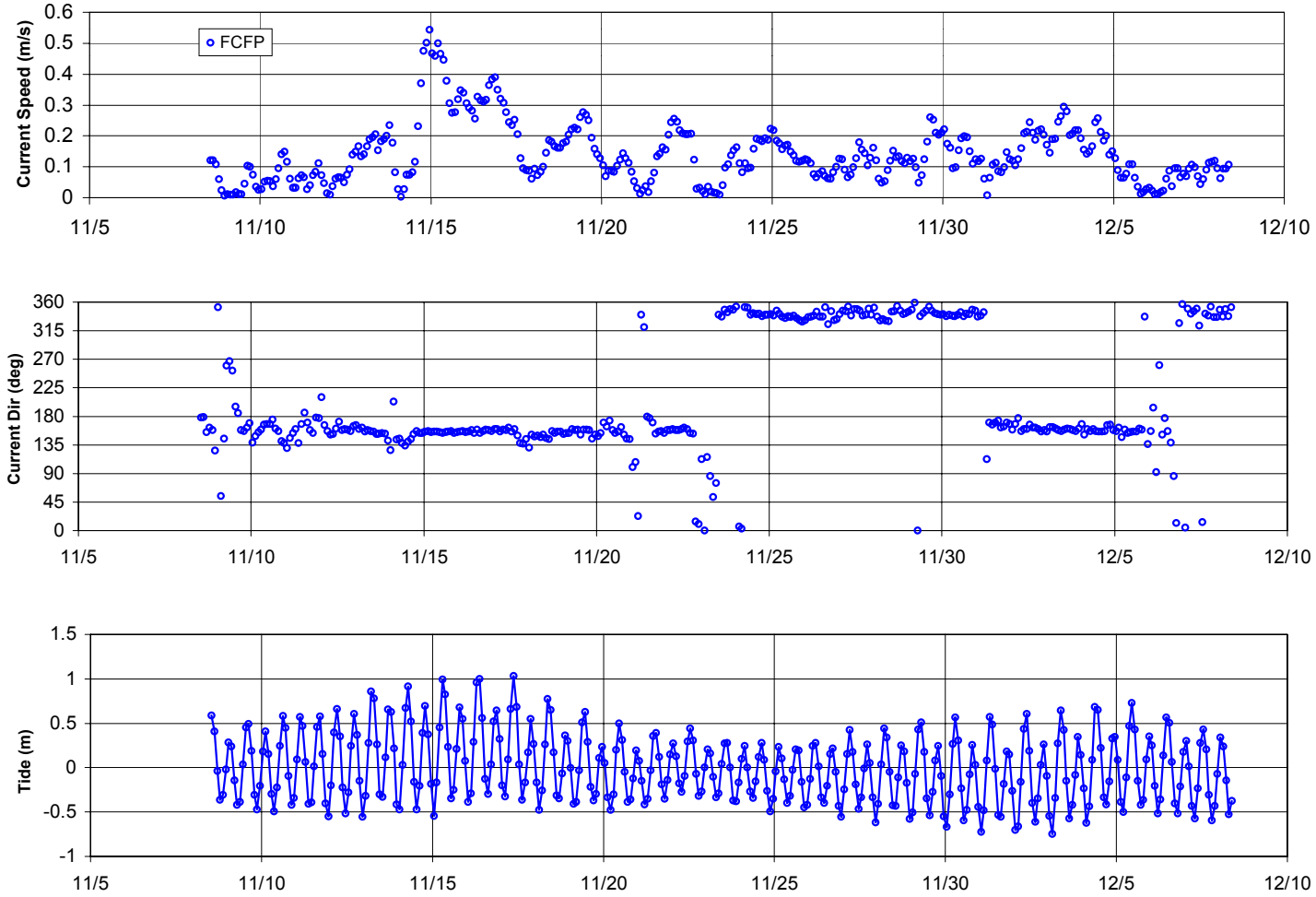

Figure 4 – Current and tide data from Melbourne Beach gauge for November 7 – December 8, 2001.

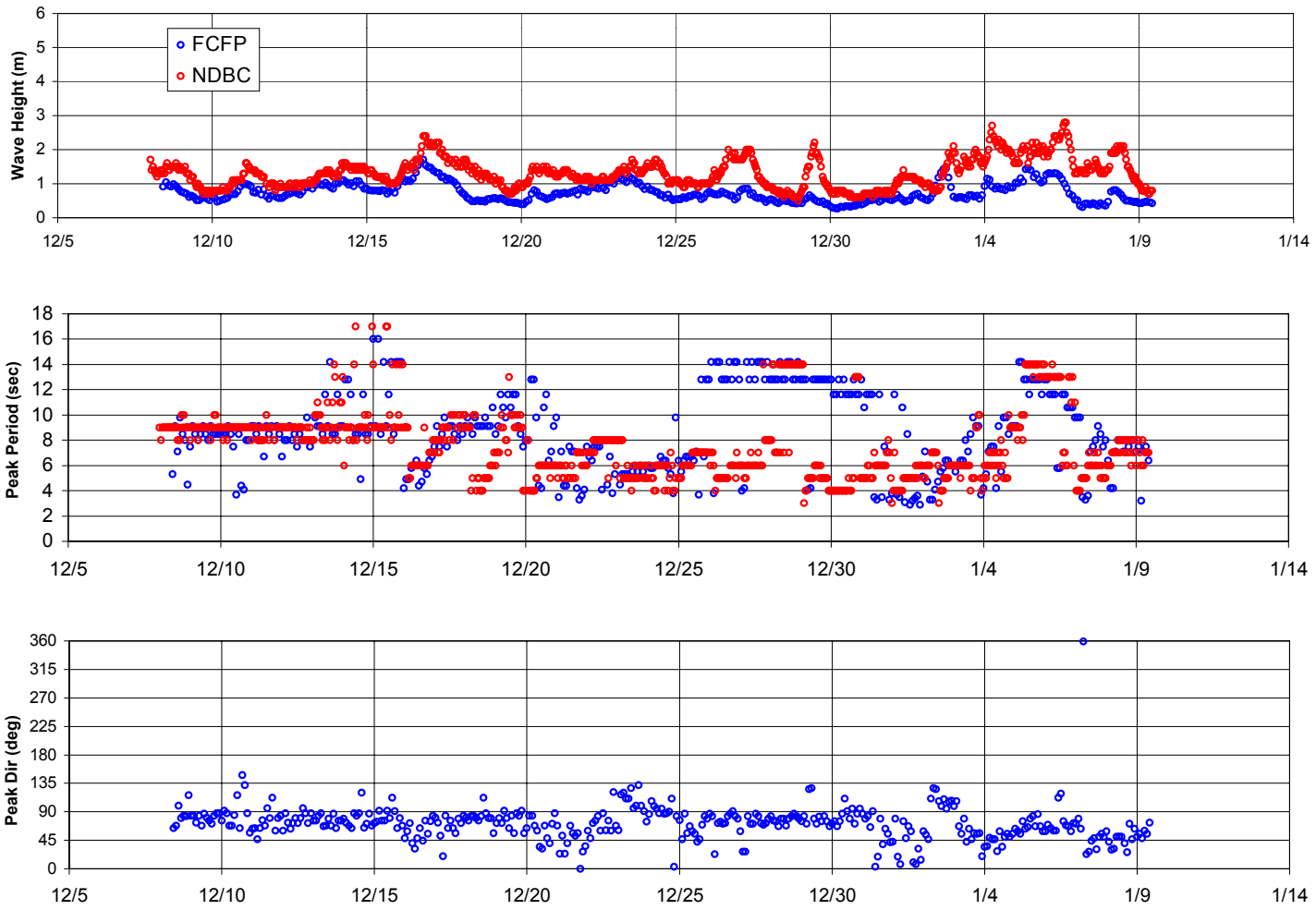

Figure 5 – Wave data from Melbourne Beach gauge for December 8, 2001 – January 9, 2002. Data from NDBC 41009 shown for comparison.

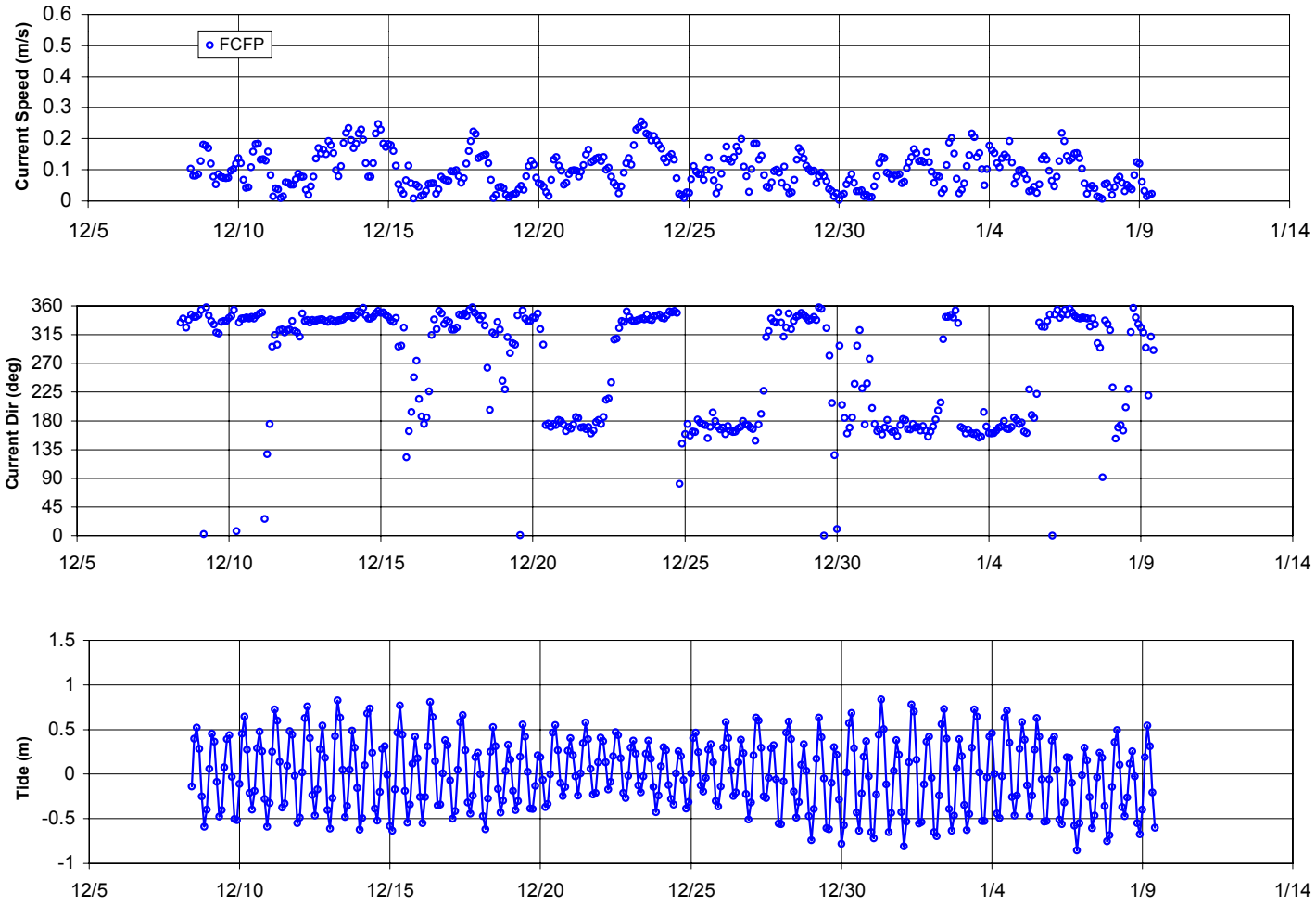

Figure 6 – Current and tide data from Melbourne Beach gauge for December 8, 2001 – January 9, 2002.

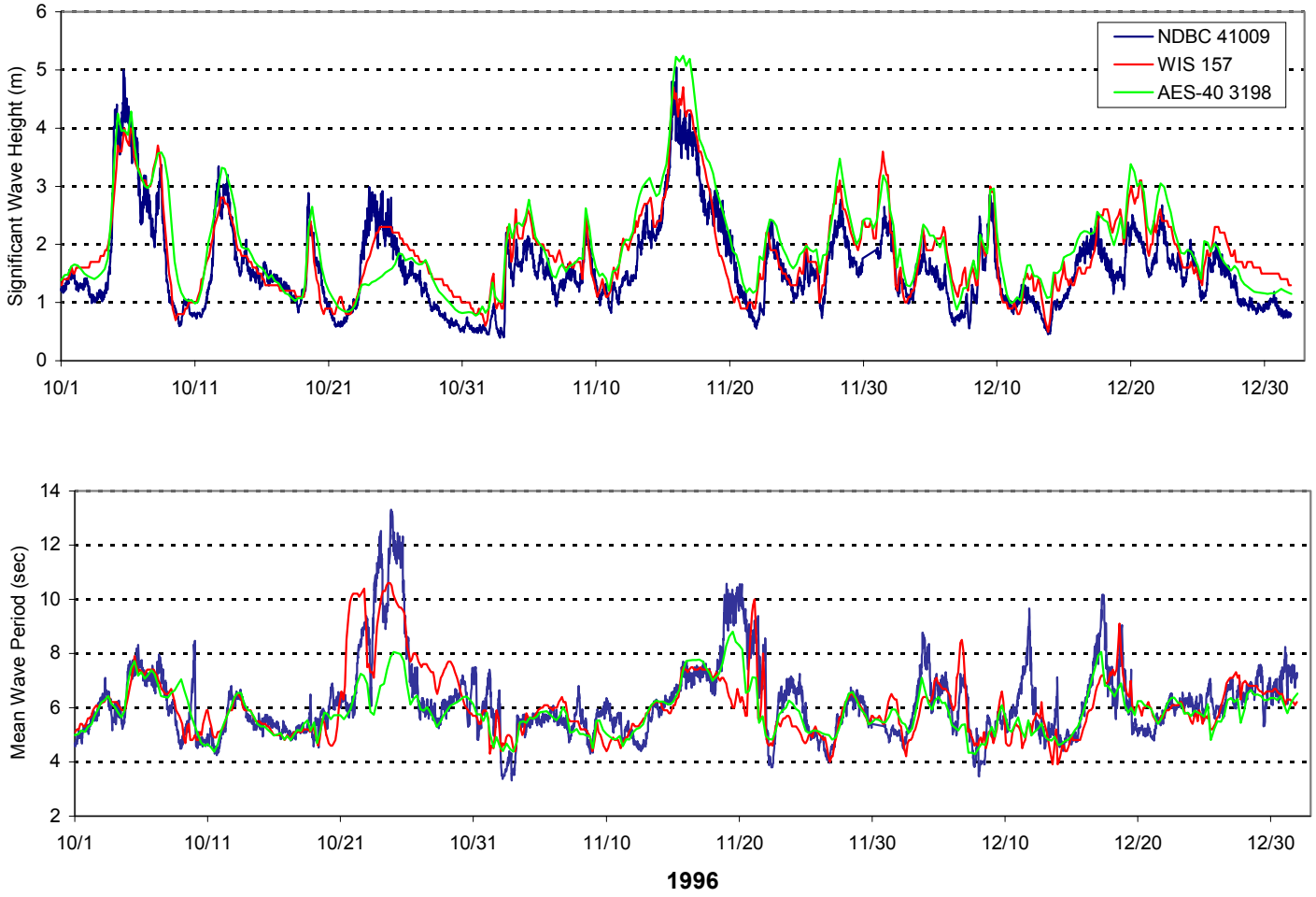

Figure 7 – Sample comparison of NDBC 41009 wave height and period data to WIS and AES-40 hindcast.

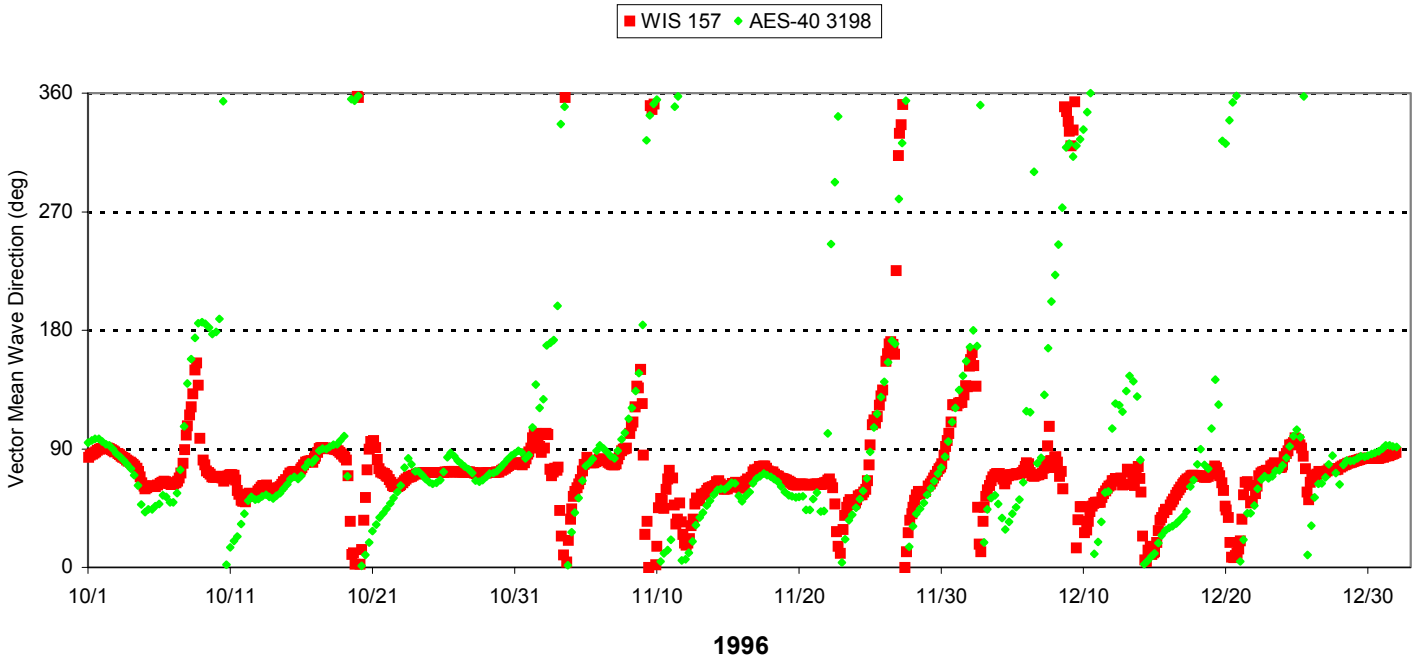

Figure 8 – Sample comparison of wave direction from WIS and AES-40 hindcast.

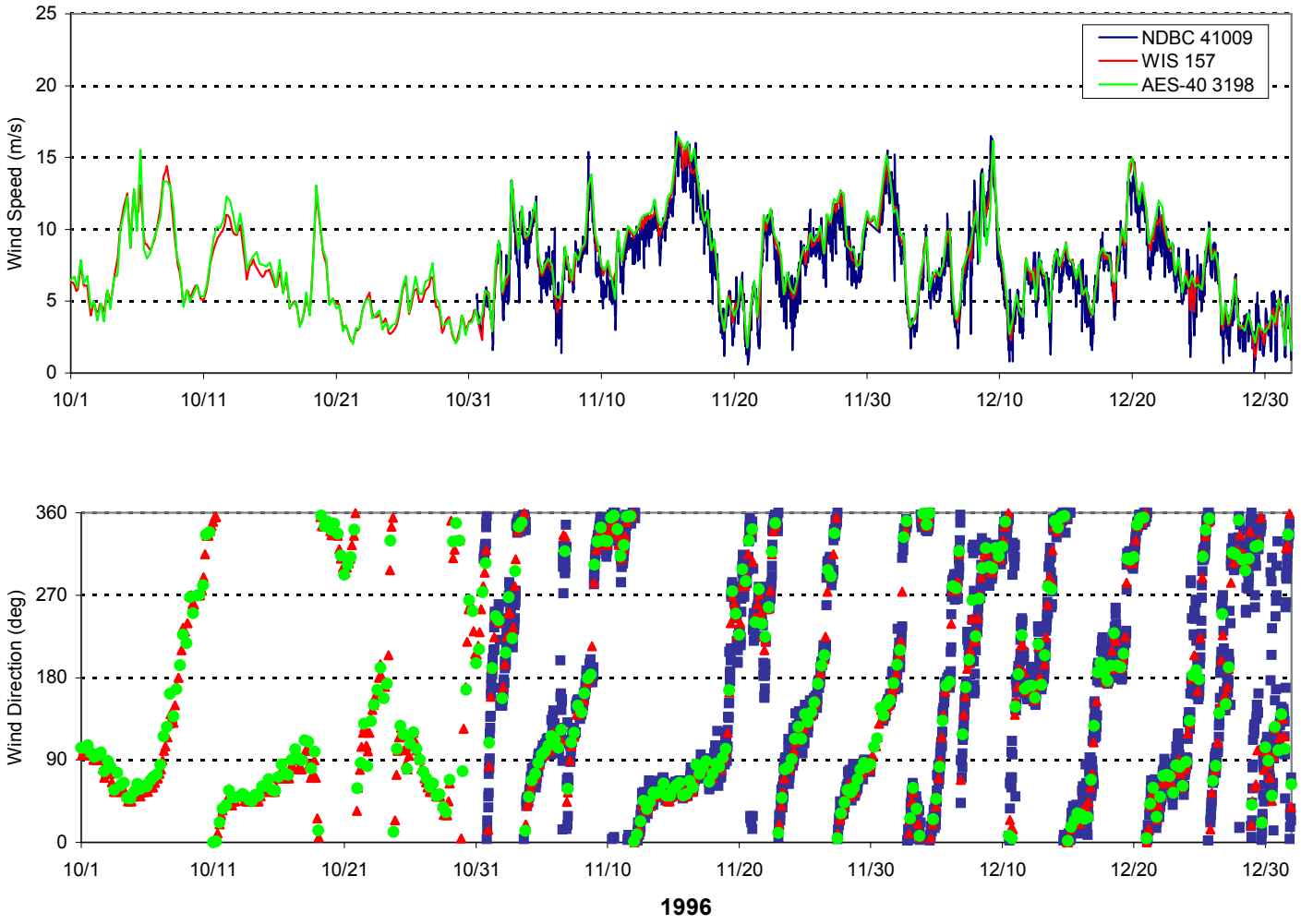

Figure 9 – Sample comparison of wind speed and direction data from NDBC 41009 to WIS and AES-40 hindcast.