OC4213 – NEARSHORE AND WAVE PROCESSES

LAB #3 – Surf-Zone Wave and Current Observations

February 23, 2012

I. INTRO-DUCTION/BACKGROUND

In this weeks lab students will be examining some nearshore current and wave data from the DUCK94 experiment. The purpose of this lab is to relate the observed cross and alongshore currents in and around the surf zone with offshore wave conditions. Students will examine current data from several different wave regimes and discuss how the observed current data varies under the different wave conditions.

Four different wave regimes have been selected for the students to examine. These include times when the waves were arriving from nearly directly offshore to times when they were coming in to the beach at a more oblique angle either from the north or the south. Significant wave height ranged from approximately 1 to 3 meters during these different events. Table 1 contains a summary of the offshore wave conditions during the different times to be examined.

II. DATA

The data for this lab consist of mean cross-shore and alongshore velocity data collected across the surf zone during the DUCK94 experiment. These data were collected in depths ranging from several cm to approximately 8 m. Data were initially collected at 2 hz. For the purpose of this lab the currents have been averaged over three hours. The sensor locations and cross-shore bathymetry are shown in figure 1. Note that the x-axis in this figure is a log axis to expand the cross shore scale. The offshore wave conditions are listed in table 1. These data are from a site in approximately 8m water depth.

For each of the four times to be examined there is a matlab "*.mat" file which contains the cross and alongshore currents as well as the significant wave height at the different cross-shore locations. These data can be accessed through the course web site: www.oc.nps.navy.mil/wavelab/courses/oc4213. Follow the links to **lab3data**. Data file names are **090413_uv.mat, 092307_uv.mat,** etc. where the beginning of the file name represents the month, day, and hour at the start of the averaging interval. The variables contained in each file are:

u_vel – cross shore velocity (m/s). Positive is onshore.
v_vel – alongshore velocity (m/s). Positive is southerly flow.
hs_dat – significant wave height (m)
u_dist – cross shore distance (m) for the u_vel data.
v_dist – cross shore distance (m) for the v_vel data.

hs_dist – cross shore distance (m) for the hs_dat data.
u_inst – instrument number for the u_vel data.
v_inst – instrument number for the v_vel data.
hs_inst – instrument number for the hs_dat data.

III. LAB TASKS

Each student is responsible for producing the following for this lab:

1) Create plots of the significant wave height, and alongshore and cross-shore velocities vs. distance offshore for **each** of the four times to be examined.

2) Calculate the mean cross-shore and alongshore current velocities for each of the times to be examined.

3) Create a table that contains four rows (one for each time) and the following information in the columns: Time, Offshore Hs, Offshore Mean Direction, Mean Cross-shore velocity, Mean Alongshore velocity, and starting and ending location of the surf zone. Estimate the surf zone location by examining the plots created in step 1. The surf zone can be estimated to be in the area where there is the quickest decrease in significant wave height. **Note:** Ignore changes in significant wave height closer than 50m to shore when determining surf zone location.

4) From the table created for part 3 create plots of; 1) mean cross shore and alongshore velocity vs. offshore significant wave height and 2) mean cross shore and alongshore velocity vs. offshore wave direction.

5) Answer the following questions;

1. Based on the plots created in part 4 how do the longshore and cross-shore currents relate to the direction and size of the offshore wave field?
2. From your estimates of surf zone location how does the surf zone width relate to the offshore wave conditions?
3. Where are the maximum currents? Is there a correlation with the location of the surf zone?

SPECIFIC PROCEDURES

The specific procedures needed to accomplish these tasks can be broken down as follows:

1) Copy the four different "*.mat" files from the web site into your working directory.

2) Start matlab.

3) Load **the first** of the data files into the matlab environment using the load

command.

- Example: **load '090413_uv'.**

4) Create the plots of significant wave height, and alongshore and cross shore currents.

- Example: **plot(v_dist,v_vel,'x-',u_dist,u_vel,'o-',hs_dist,hs_dat,'+-').**

This command would plot the alongshore velocity with the symbol x, the cross shore velocity with the symbol o, and the significant wave height with the symbol +.

5) Calculate the mean cross shore and alongshore current velocities using the matlab function **nanmean**.

6) Fill in the table for task 3 with the appropriate data for this data set (time).

7) Repeat steps 3 thru 6 for each of the three remaining data sets.

8) Create the plots for task 4 and answer the questions in task 5. Turn in plots, the table created for task 3, the answers to all questions and any matlab m-files you create.

Make sure all plots are clearly labeled and contain legends if necessary. If printing in black and white use alternate line styles to identify the different data.

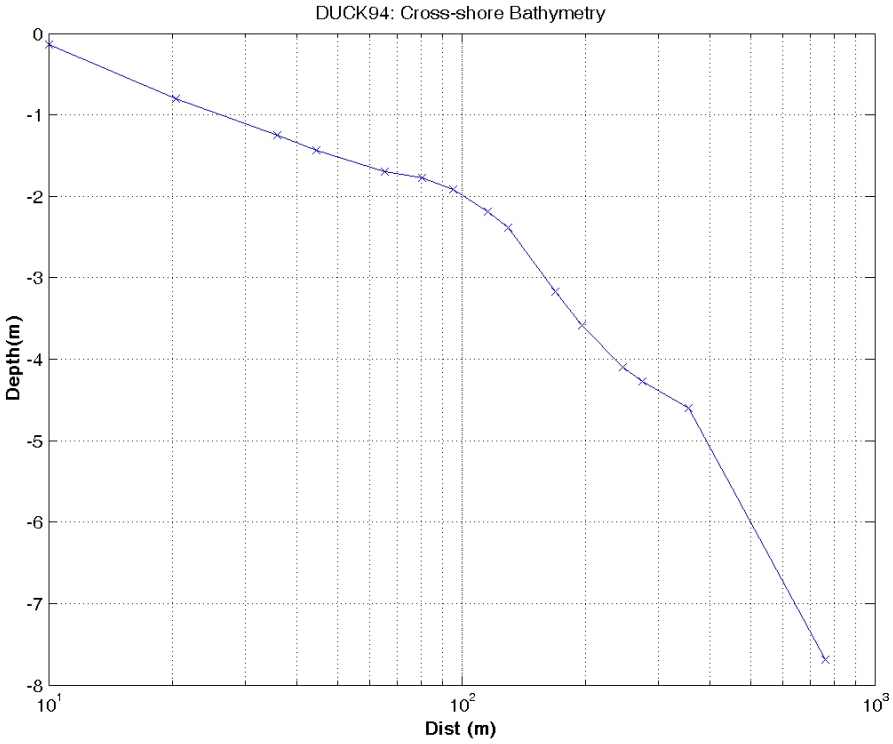

Figure 1 – Cross shore bathymetry and sensor locations for data of this lab.

Table 1 – Summary of offshore wave conditions during the times to be examined. Wave direction is relative to shore normal, i.e. a direction of 0 means the waves are coming from directly offshore. Positive directions mean waves are coming from north of shore normal and negative directions mean the waves are coming from south of shore normal

Date/Time	Significant Wave Height (m)	Wave Direction (deg. from)	Wave Period (s)
0904:1300	2.8	-4	9.7
0923:0700	1.0	-38	8.2
1012:1300	2.3	12	7.0
1026:1600	1.8	24	6.6