

**THE RHODE ISLAND LONG-TERM BEACH PROFILE NETWORK:  
1986-1988 DATA**

TECHNICAL REPORT NO. 8-SRG

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## INTRODUCTION

Comprehensive studies of the beaches along the south shore of Rhode Island were conducted by Boothroyd et al., (1986), and McMaster and Friedrich (1986). These studies drew extensively upon one of the most significant geological data bases for the south shore of Rhode Island, that of the long-term beach profile network. This report presents new survey data (comparison profiles and profile volume time series graphs) bringing the long-term beach profile data base up to date as of March 1988.

The long-term beach profile network was initiated by McMaster (1961-present). Within this network data have been collected at various localities on a biweekly basis. Four of the eight transects have been monitored since 1962, the remaining 4 were established between 1975 and 1977 (Table 1). Boothroyd established a second set of 2 transect stations which have been monitored on a weekly and biweekly basis (depending on specific profile) since October 1, 1977.

Table 1. - Profile Data Sets (to mid March 1988)

<u>location (W-E)</u>	<u>start date</u>	<u>profiles</u>	<u>investigator</u>
MIS-01	Jul. 77	203	McMaster
WKG-01	Dec. 62	472	McMaster
EST-01	Dec. 62	472	McMaster
EST-02	Aug. 76	201	McMaster
CHA-BW	Jan. 77	203	McMaster
CHA-EZ	Oct. 77	595	Boothroyd
CHA-TB	Nov. 75	225	McMaster
GRH-01	Dec. 62	473	McMaster
MST-01	Dec. 62	458	McMaster
MAT-SP	Aug. 81	256	Boothroyd

Total: 3558

A significant difference in spatial resolution among the two survey data sets (Transit and Emery) appears as a result of differing methods employed in the initial gathering of topographic information. Whereas data from the oldest, and longest-running profile locations (McMaster) provide significant information regarding temporal variations in overall beach configuration, the method employed (transit and stadia surveys, with stadia locations taken primarily at slope inflections) does not resolve much spatial detail in the changing berm configurations. The modified Emery method employed in the collection of topographic data at the second set of transect localities (Boothroyd) does provide high spatial resolution of berm and beachface shape. The weekly, biweekly, and pre- and post-storm survey schedule maintained for the Emery transect locations resolves the higher frequency temporal fluctuations in berm shape as well.

An array of computer programs, originally written by Roger Greenall of ASA/Datajet (formerly at the Univ. Rhode Island Academic Computer Center) have been employed in the reduction and plotting of both types of beach survey data. Documentation for these computer programs is presented in Sea Grant technical report 9-SRG (Graves, 1988). The long-term beach profile data sets and programs are resident on the IBM mainframe computer located at the Academic Computer Center, University of Rhode Island, Tyler Hall, Kingston. A Calcomp drum plotter, located in the Plotting Room in Tyler Hall, was employed in the generation of the comparison beach profile plots and the beach profile volume time series graphs (Appendices 1 and 2).

## DISCUSSION

From statistical analyses of various aspects of the beach profile data, including eigenfunctions for profile shape changes and power spectra of the profile volume time series, Boothroyd et al., (1986) and Gibeaut (1987) identified principal and subsidiary components of the beach morphology variance, and short- (4 to 6 yr.) and long-term (10 yr.) periodicities in beach volume. Predictions based on these results were for a further decline in beach profile volume through 1987.

All beaches experienced significant depletion of the berm, and in some cases foredune erosion (see comparison profile plots in Appendix 1) as a result of the winter storms of 1986/87 (occurring at or near syzygy). With few exceptions the updated profile volume time series presented for each beach (through mid March, 1988, Appendix 2) indicate overall profile volume recovery since the winter of 1986/87.

From west to east along the coast, the response of the beaches over the last year and a half has been as follows: The Misquamicut Beach profile (MIS-01) shows a sharp drop in volume associated with the '86/86 winter storms as seen at most all the other beaches. Throughout the remainder of 1987 and into 1988, this beach exhibited a roughly sustained volume slightly less than that for 1986. The profile at Weekapaug (WKG-01) shows an increase since the '86/87 winter storms, and a roughly sustained average volume greater than that present in 1986, but less than that evident in 1985. The East Beach profiles (EST-01 and EST-02) show a fairly sharp drop in volume due to the 1986/87 winter storms, followed by recovery over the 1987 seasons to their present volume at or very nearly equal to that shown for 1985 and 1986. The CHA-BW (Breachway) profile saw an overall dramatic increase in volume after the '86/87 winter season, while exhibiting the highest variability in berm volume during rebuilding. The nearby CHA-EZ profile similarly saw a dramatic increase in volume after the '86/87 winter season, though with much less short-term variability. Its present volume (spring 1988) is higher than that ever seen on this beach segment. The Charlestown Town Beach profile (CHA-TB) recovered from the '86/87 winter storm-erosion episodes to exhibit a volume average for the year that is very nearly the same as in 1986 (greater than in 1985). The Green Hill Beach profile (GRH-01) experienced a sharp drop in volume as a result of the 1986/87 winter storms, and has remained as a low volume berm since then. The GRH-01 profile volume is at its all time lowest in a trend of (steady) decline. The Moonstone Beach profile (MST-01) showed a substantial dip in volume for the winter of 1986/87 followed by an increase in volume to very near that existing in 1986. The profile at Matunuck (MAT-SP) recovered completely from the winter storms of 1986/87 to show an overall average profile volume for 1987 that is larger than that in 1985 and 1986. Through the winter of 1987/88 and into the spring, the volume has declined however.

With the exception of the winter storms of 1987, the wave climate in Block Island and Rhode Island Sounds has been dominated by fair weather swell. We speculate that throughout this protracted period of non-storm conditions, landward asymmetry in the near bottom orbital motion (associated with the small wind waves generated within the sounds) has translated much of the upper shoreface sediment reserve to the beaches. In this way, the berm along the entire south shore has gained significant volume since 1986.

## ACKNOWLEDGMENTS

First and foremost, we thank Robert L. McMaster for his continued cooperation and sharing of transit data. Thanks are extend to Roger Greenall for his deft skill at designing the original FORTRAN programs. To James Gibeaut, whose herculean efforts resulted in the original compilation of all the pertinent data sets and appropriate programs, we owe many thanks. This report essentially is a follow-up on Gibeaut's monumental task, bringing the beach profile data base up to date as of March 1988. Steve Selden was indispensable in organizing the CHA-EZ Emery data sets and pertinent programs. Considerable thanks must also go to the numerous survey party members who assisted in the gathering of further beach profile data through March of 1988. These include, Christopher Galagan, Dave Lawson, Bill Nelson, Carol Gibson, Steve Selden, and John Peck. We much appreciate the support and patience of the entire User Services group at the Academic Computer Center, URI, and especially Charlene Yang, Hilde Gesch, Mark Oliver, Peter Rose, Christian Vye, and Janie Palm. Finally, for her equal patience, we thank Sue Ponte.

## REFERENCES

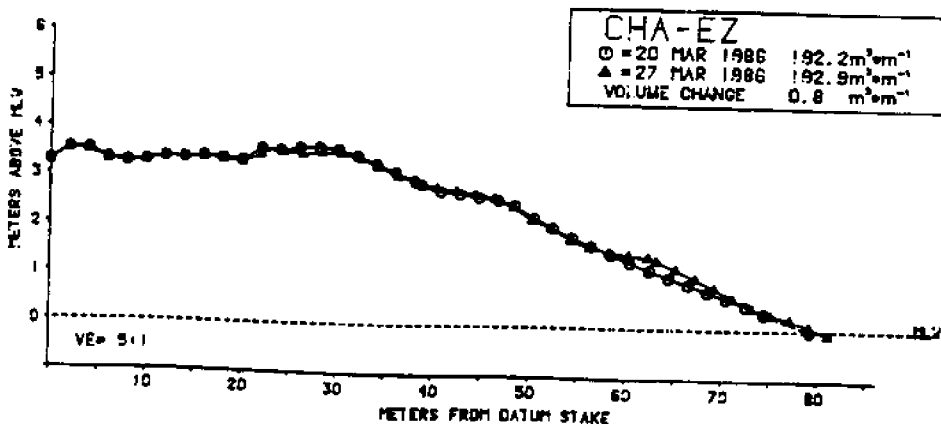
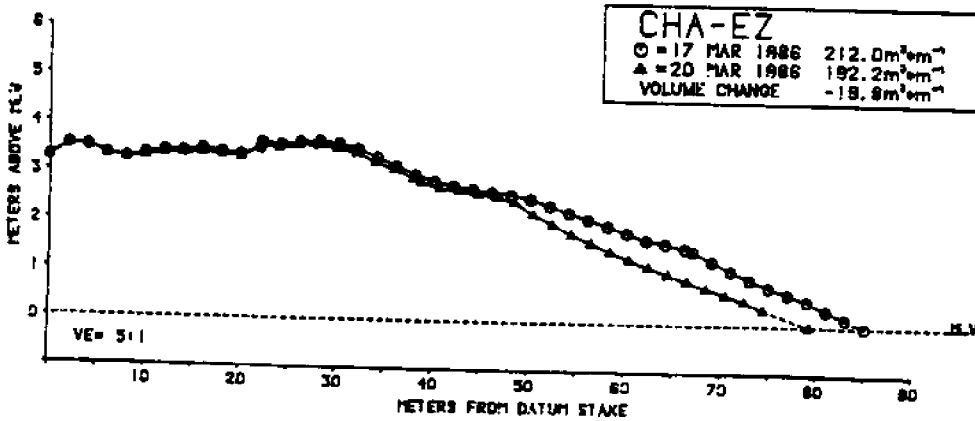
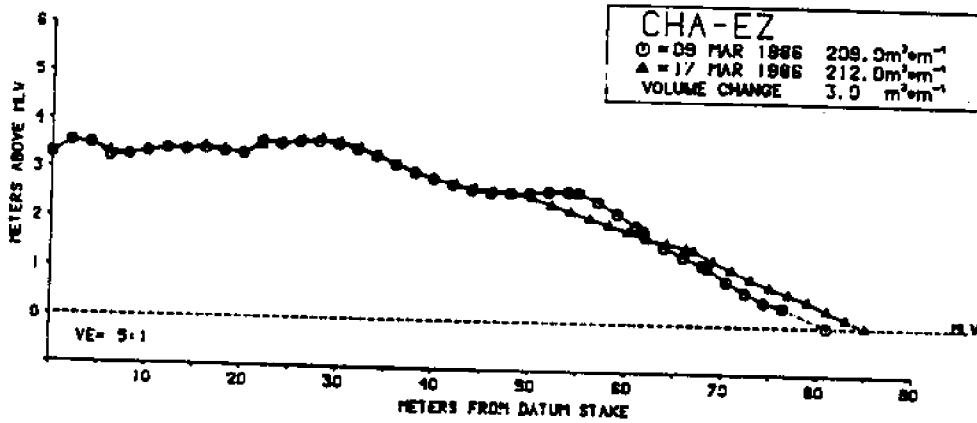
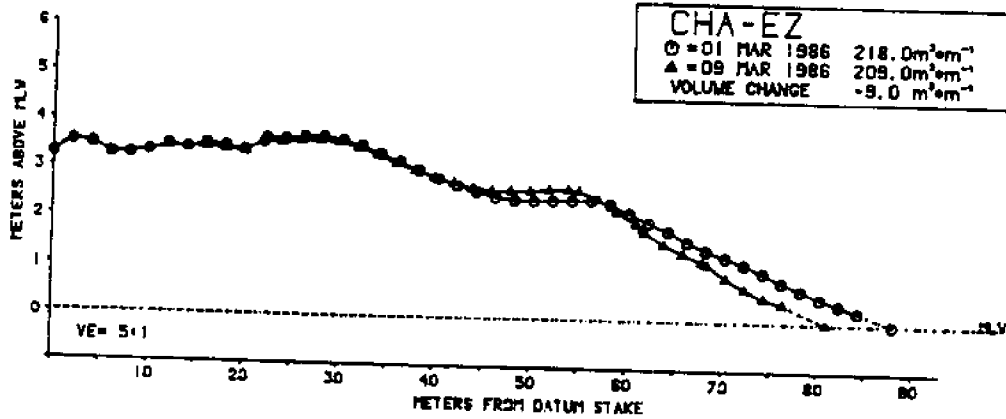
- Boothroyd, J.C., Gibeaut, J.C., Dacey, M.F., and Rosenberg, M.J., 1986, Geological aspects of shoreline management: a summary for southern Rhode Island, I. Regional depositional systems and a long-term profiling network, Vol. 1: Technical Report No. 6-SRG, University of Rhode Island Sea Grant Final Report, Contract No. NA85AA-D-SG094, Project No. R/CS-1, 104 p.
- Gibeaut, J.C., 1987, Beach sedimentation cycles (1962-1985) along a microtidal wave-dominated coast: south shore of Rhode Island, [M.S. thesis]: University of Rhode Island, 153 p.
- Graves, S.M., 1988, Documentation for computer programs used in the analysis of the long-term profile network: Technical Report No. 9-SRG, University of Rhode Island Sea Grant Final Report, Contract No. NA85AA-D-SG094, Project No. R/CS-1, 104 p.
- McMaster, R.L., (compiler) et al., 1961-present, Transit surveying of selected Block Island Sound beaches in Washington County, Rhode Island (unpub.)
- McMaster, R.L., and Friedrich, N.E., 1986, Southwestern Rhode Island beaches and shoreline processes, 1938-1984: report prepared for Coastal Resources Center, University of Rhode Island Graduate School of Oceanography, 60 p.

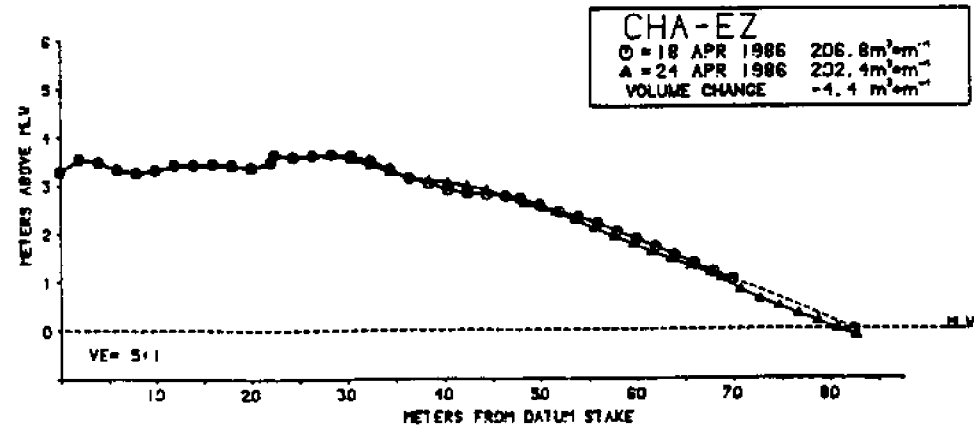
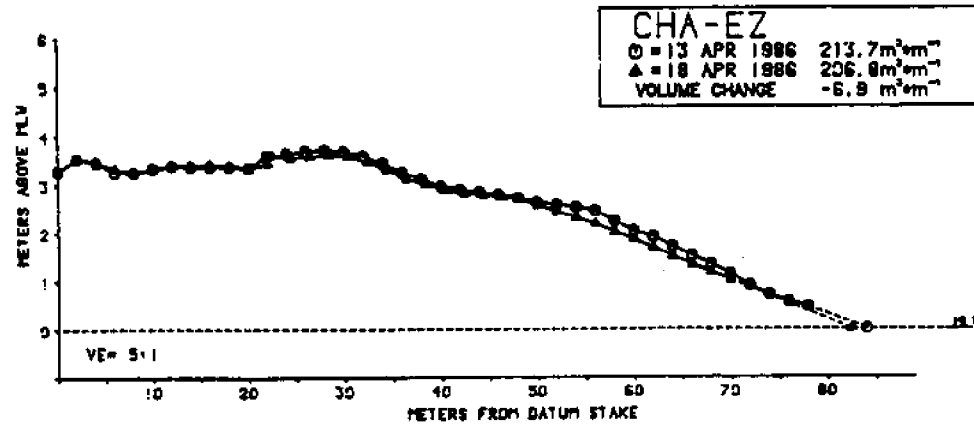
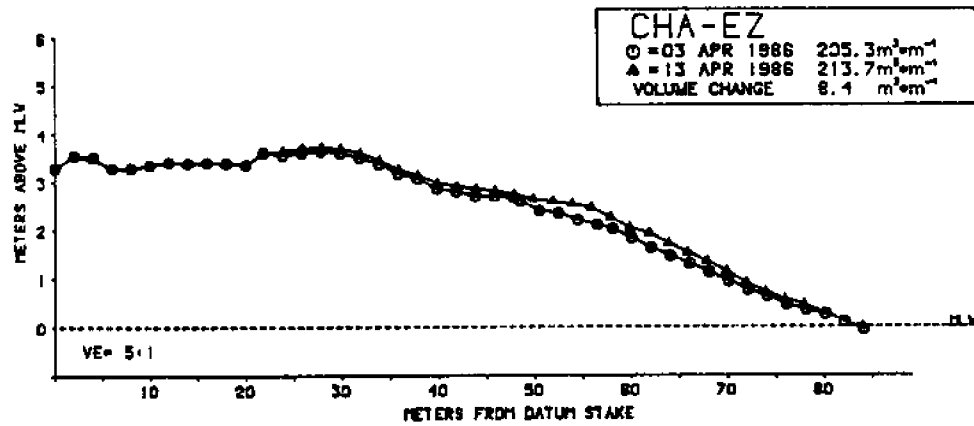
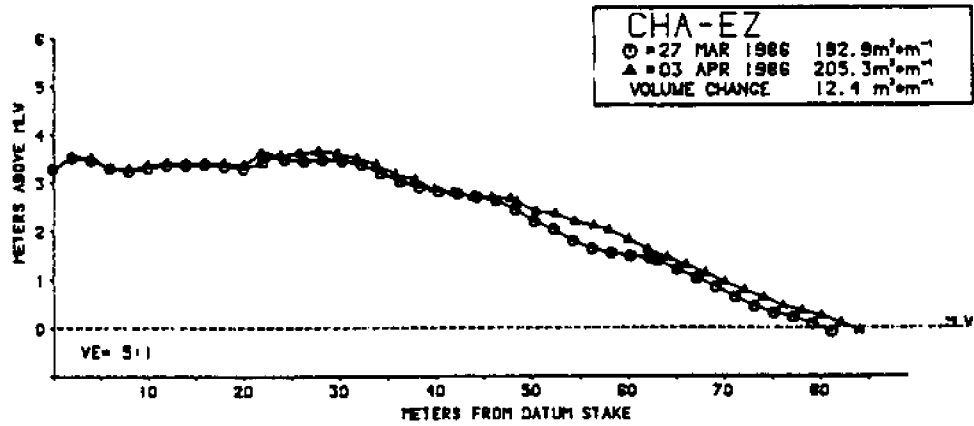
## **APPENDIX 1**

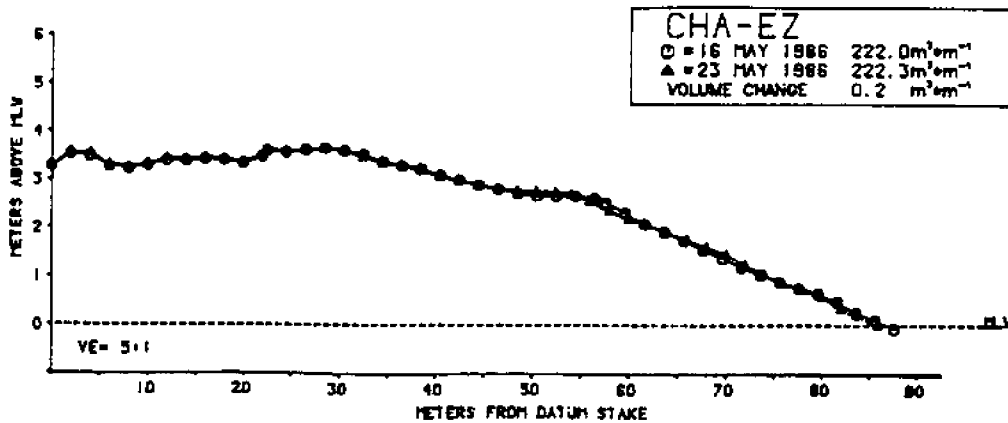
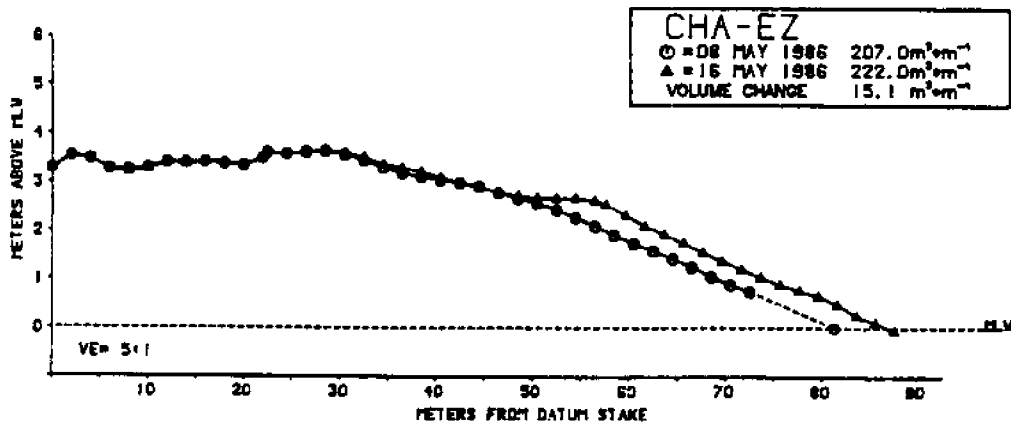
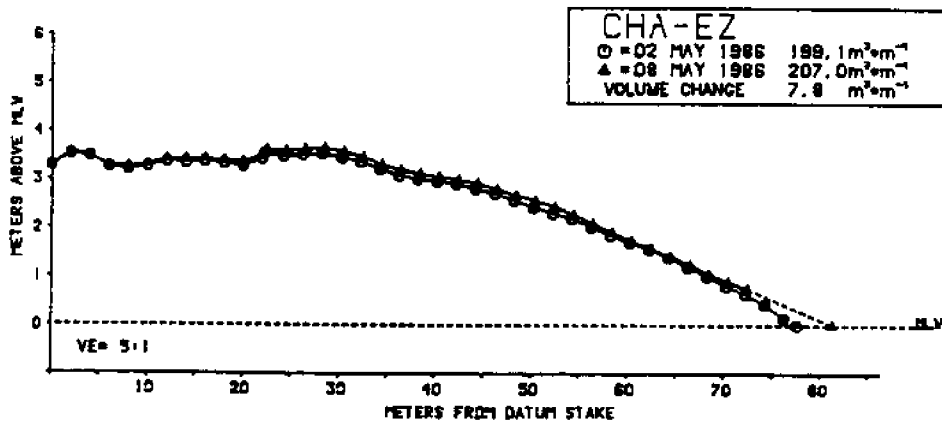
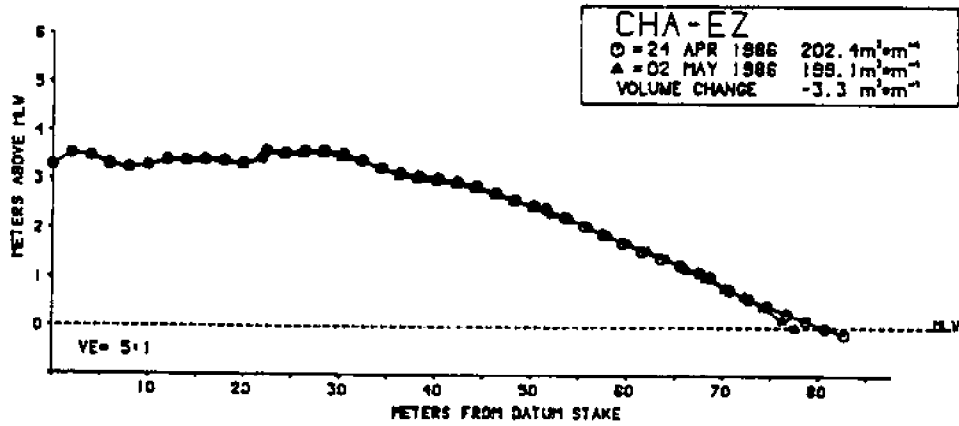
### **Comparison Profile Plots**

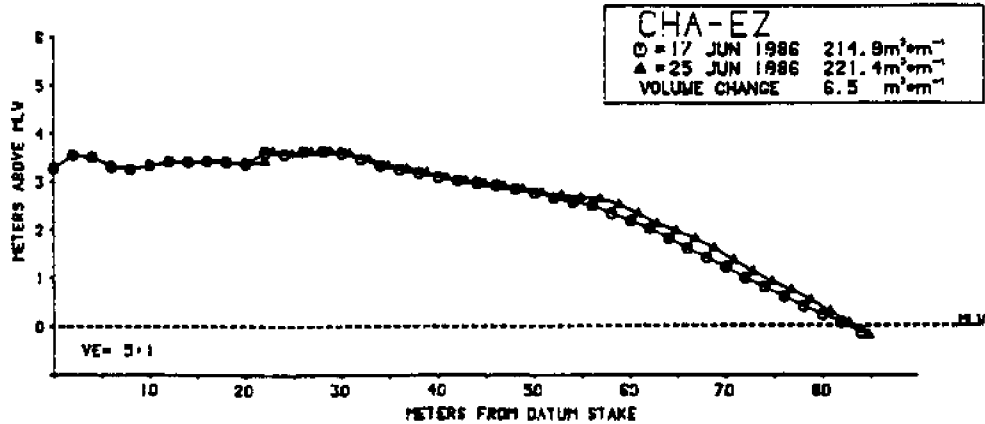
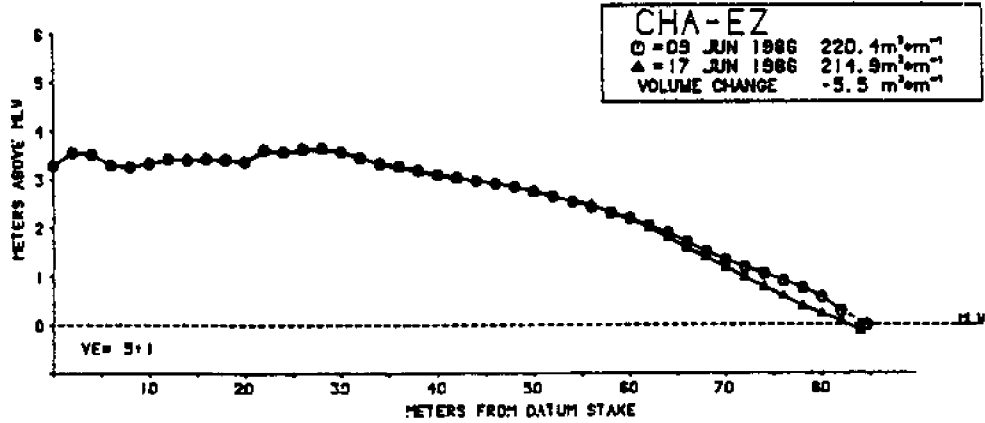
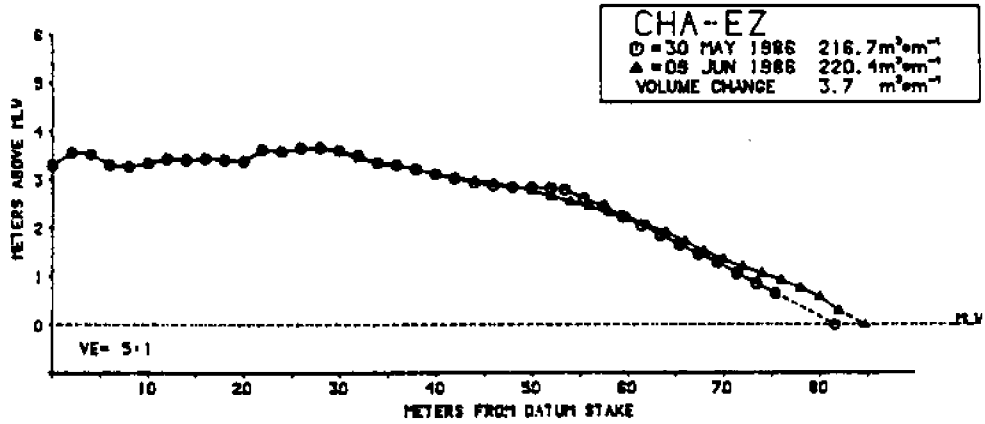
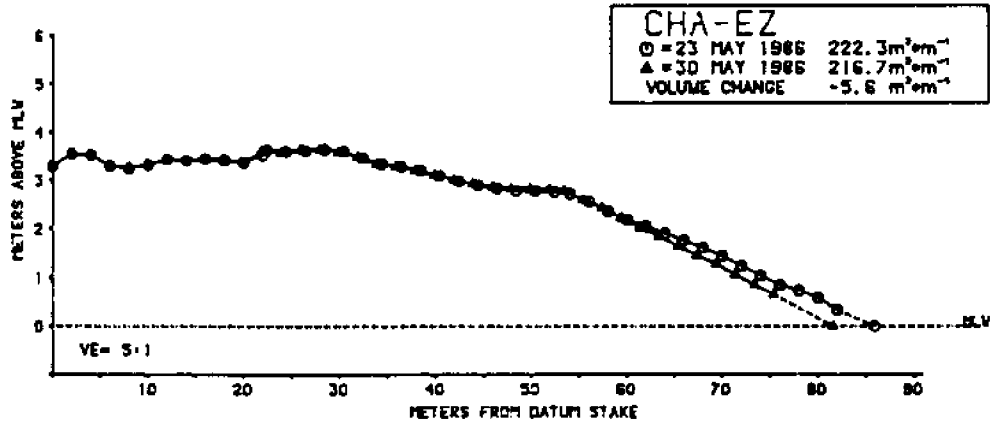
**APPENDIX 1A**  
**CHA-EZ Profile Plots**

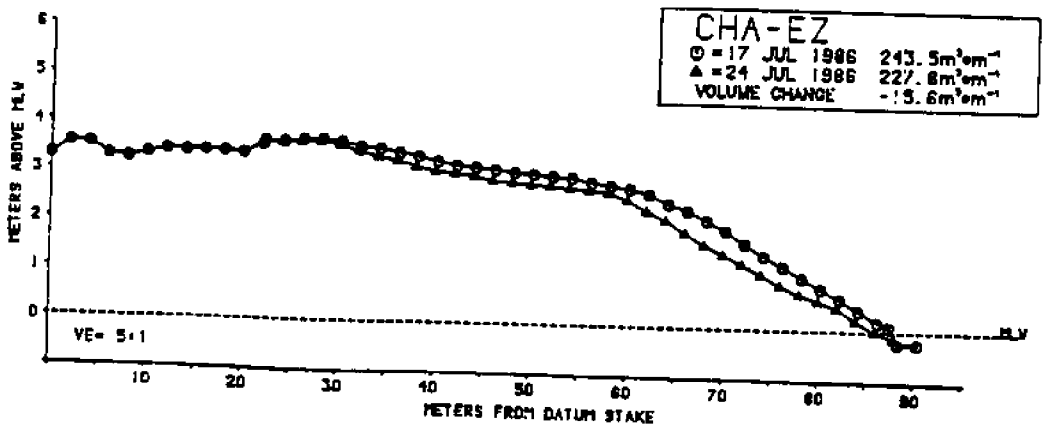
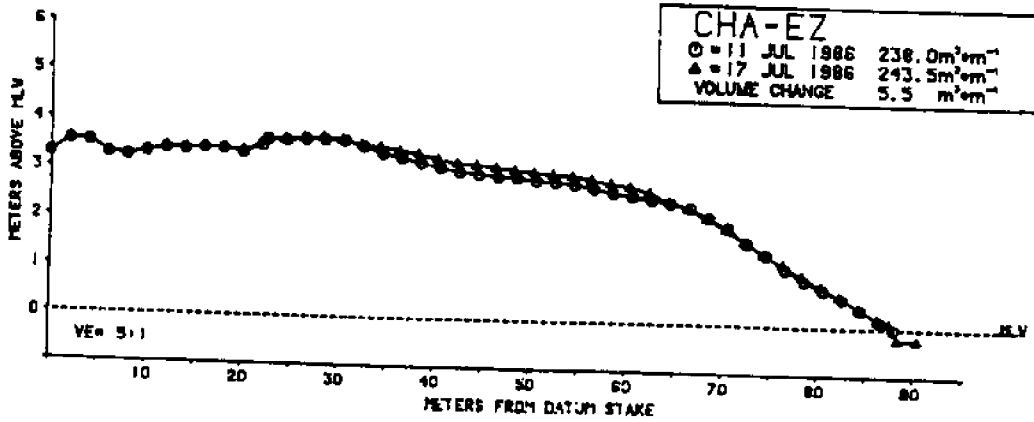
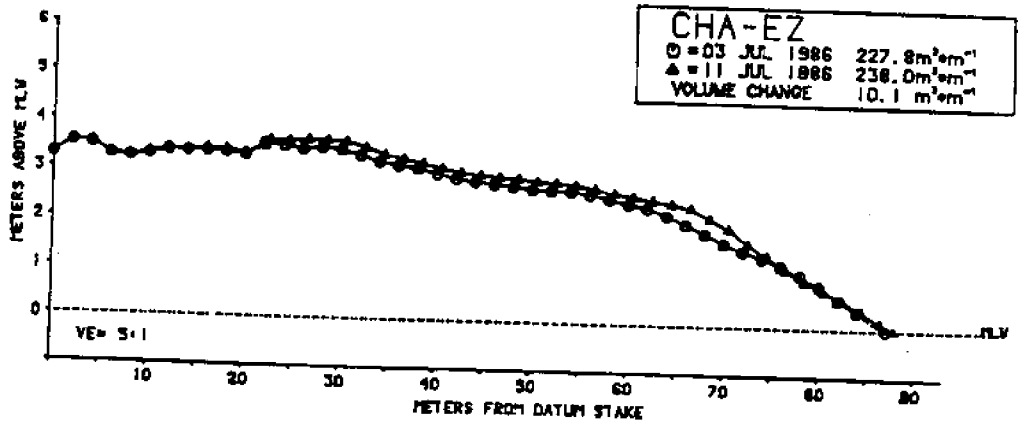
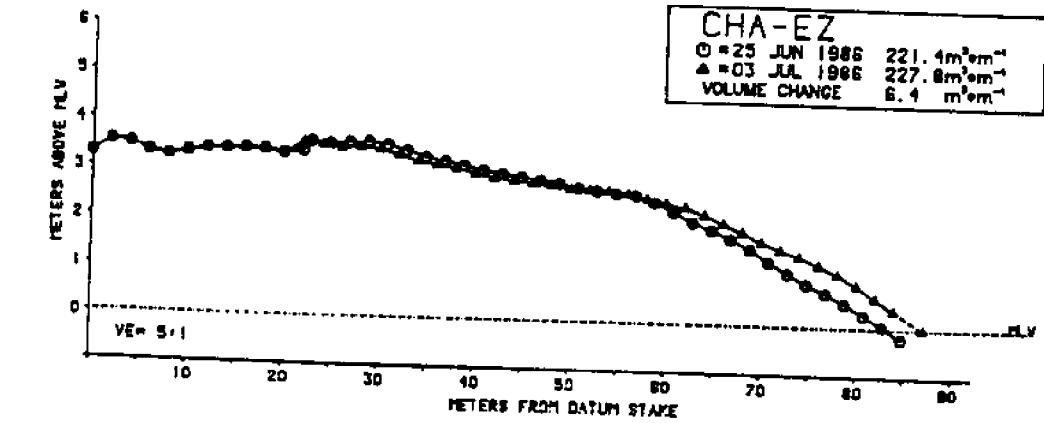


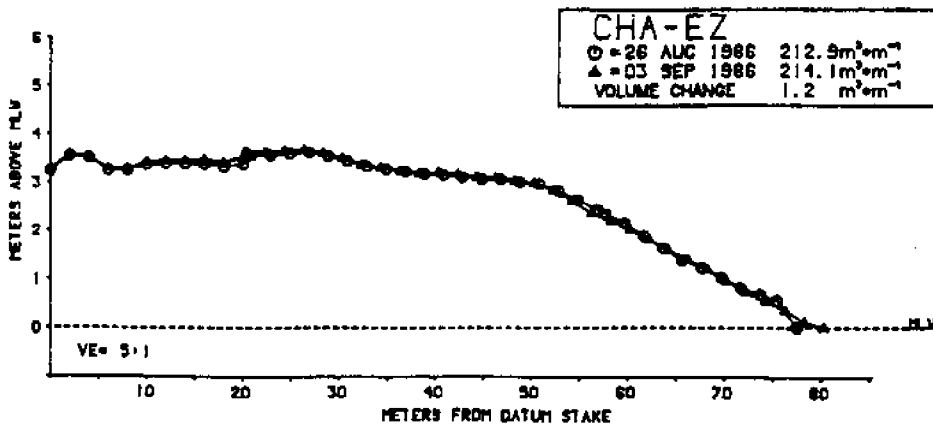
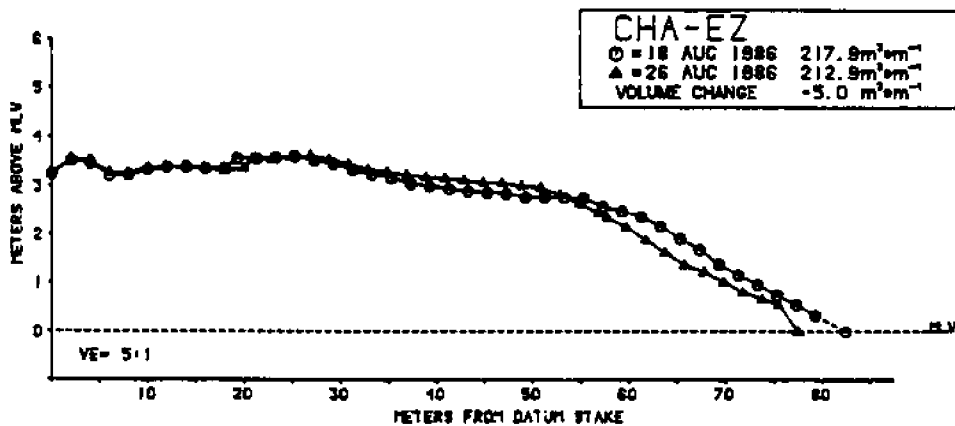
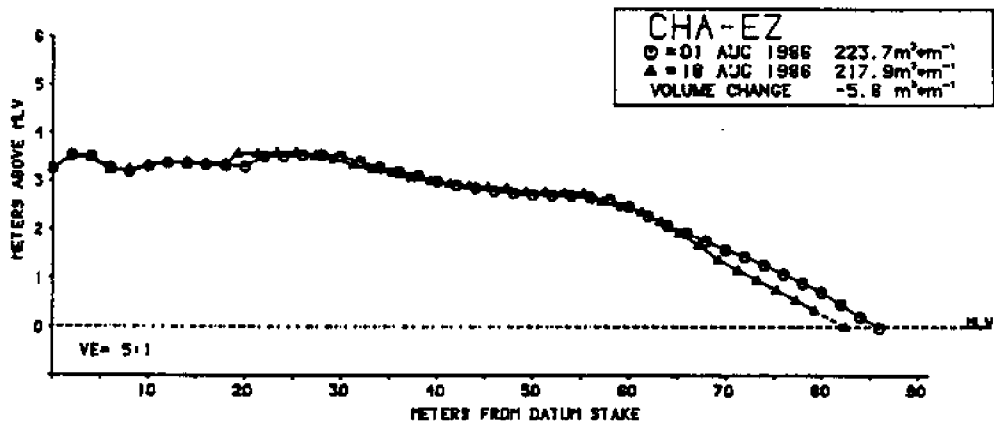
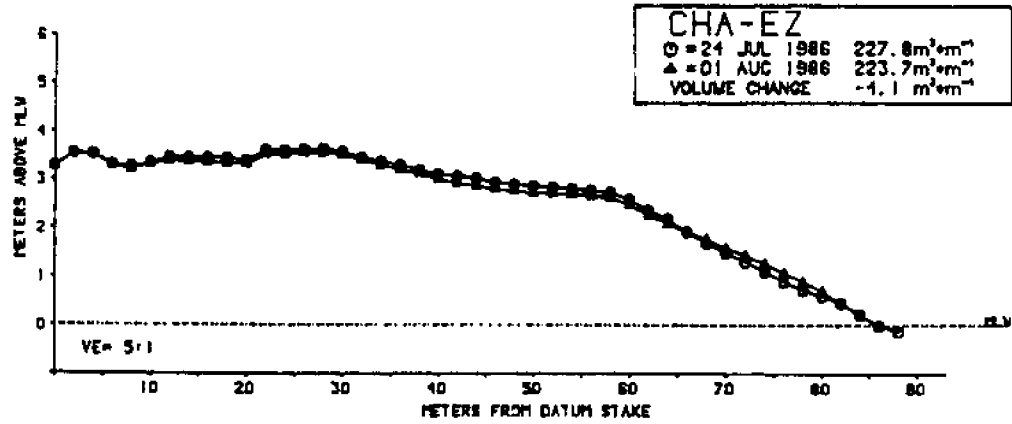


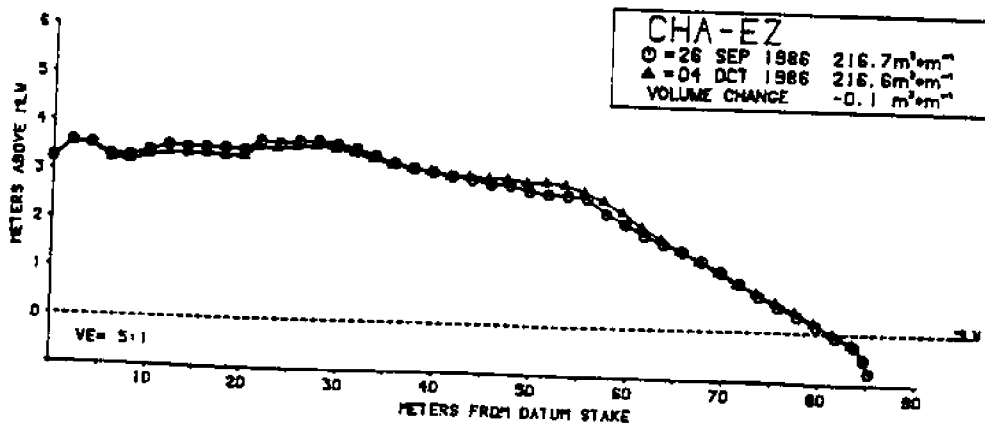
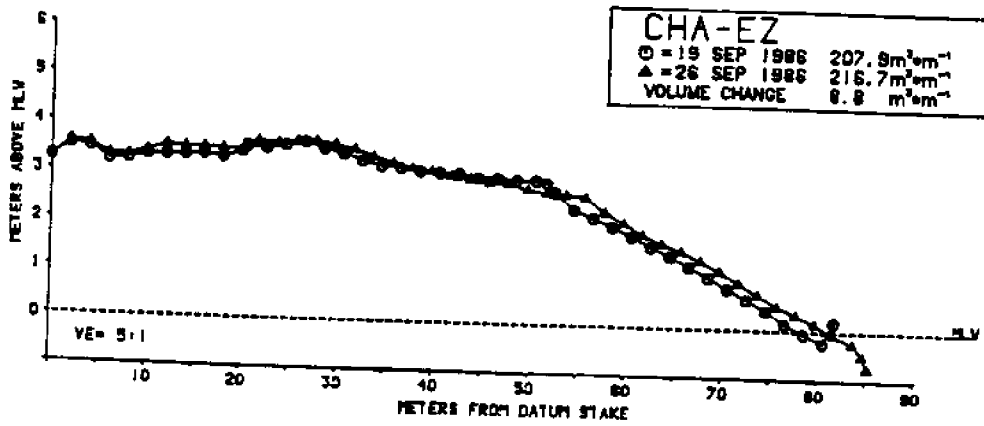
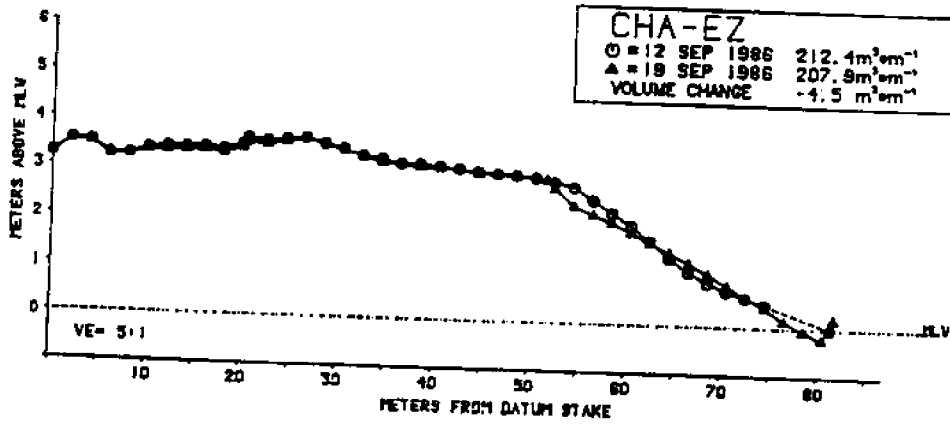
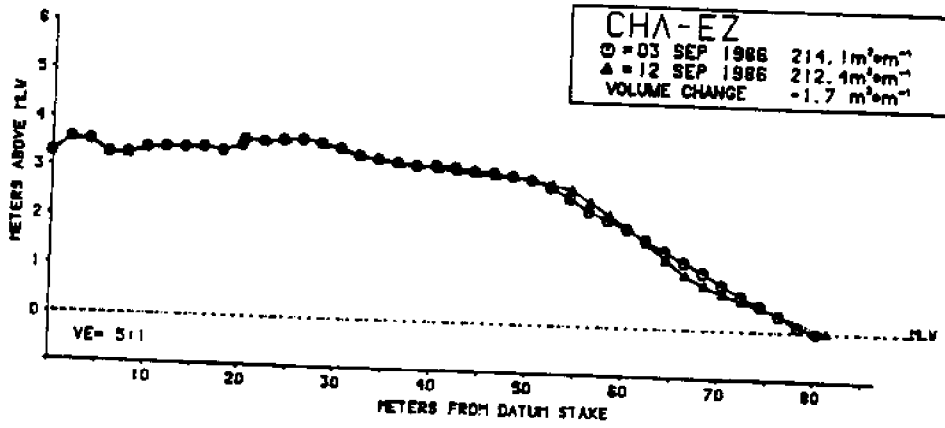


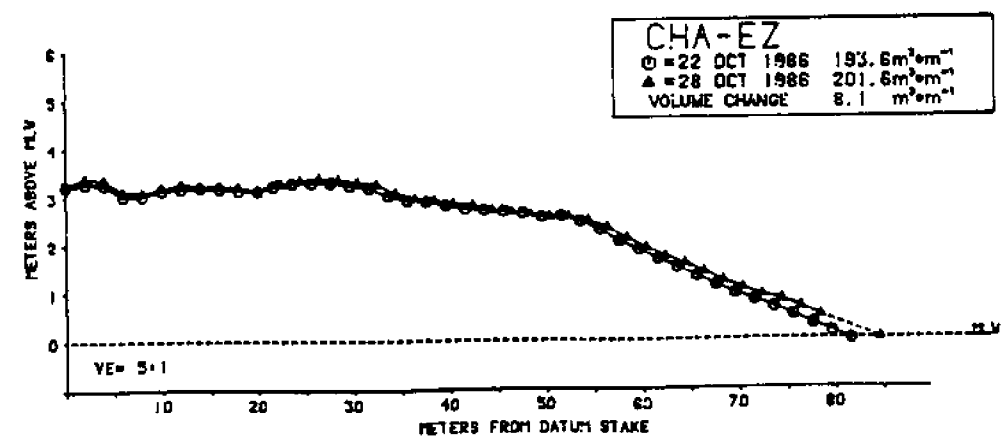
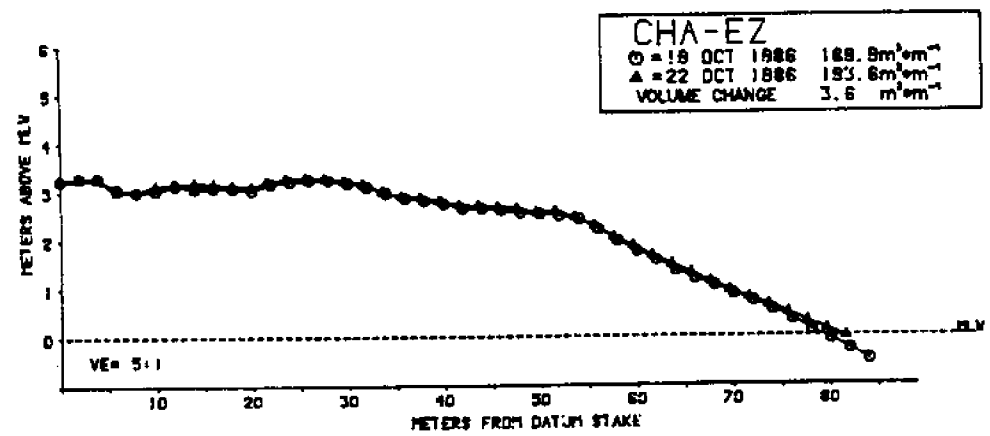
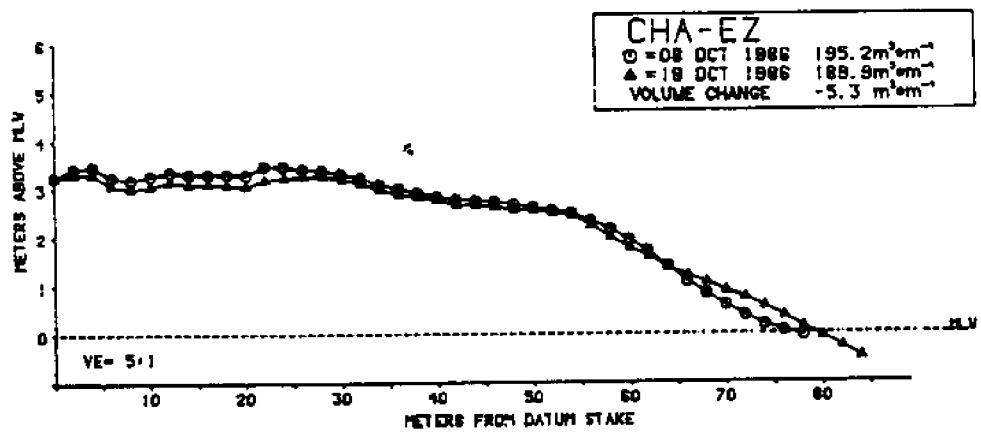
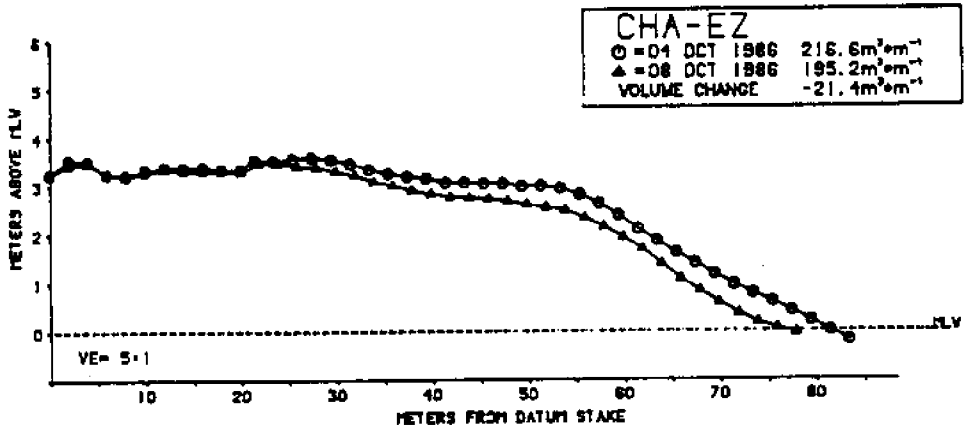




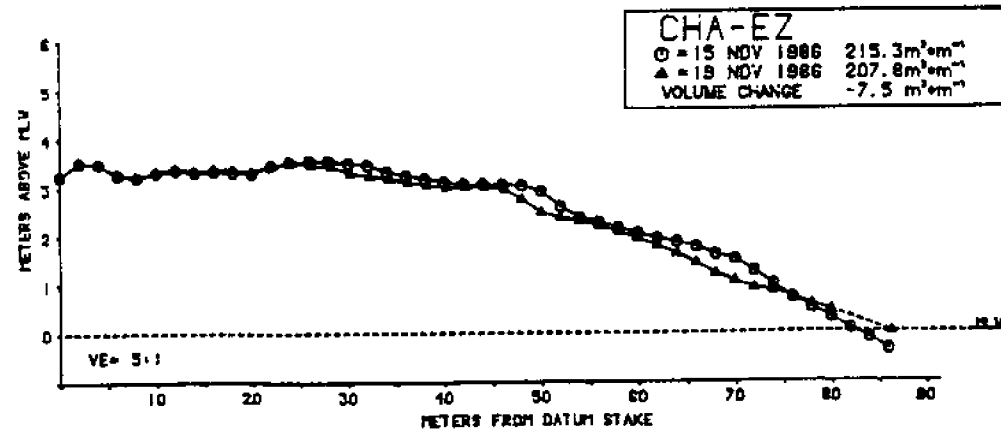
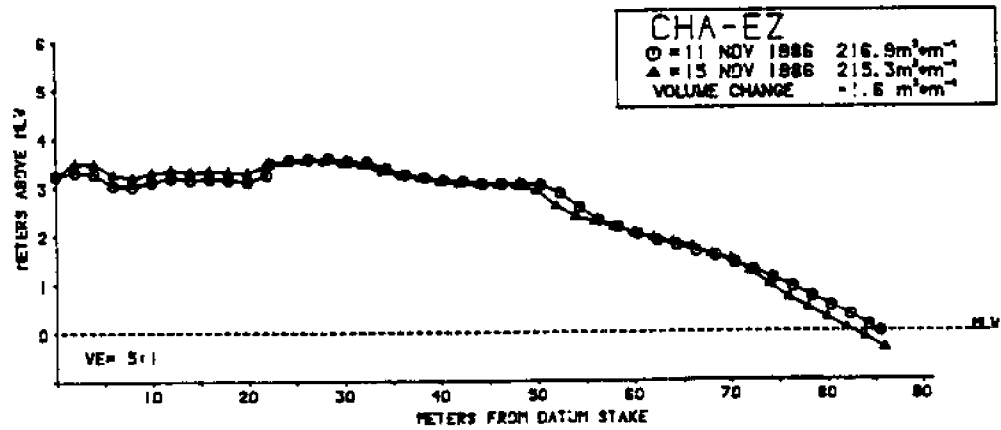
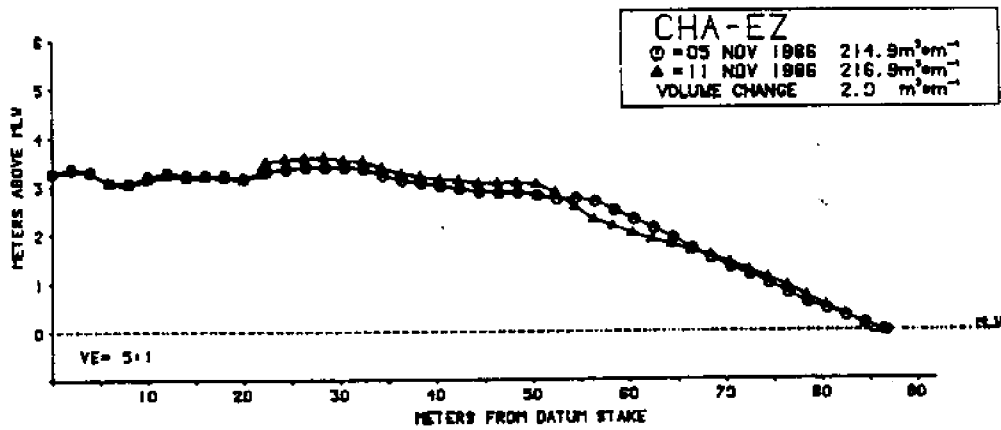
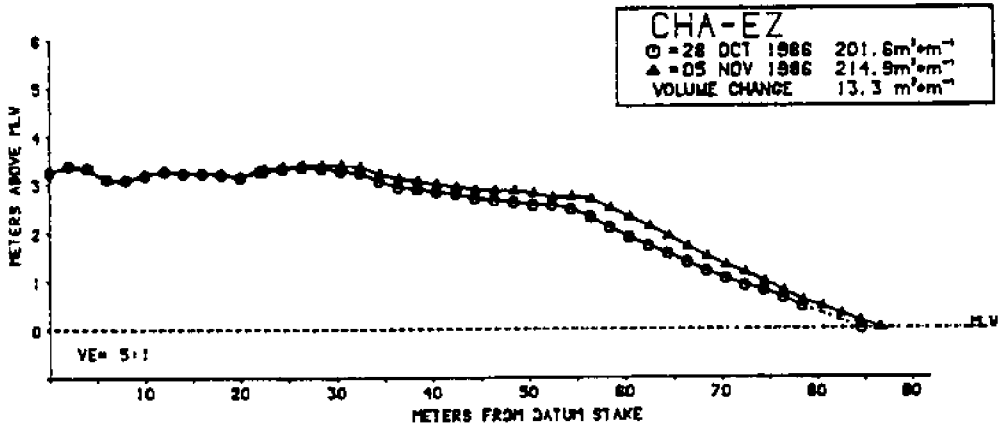


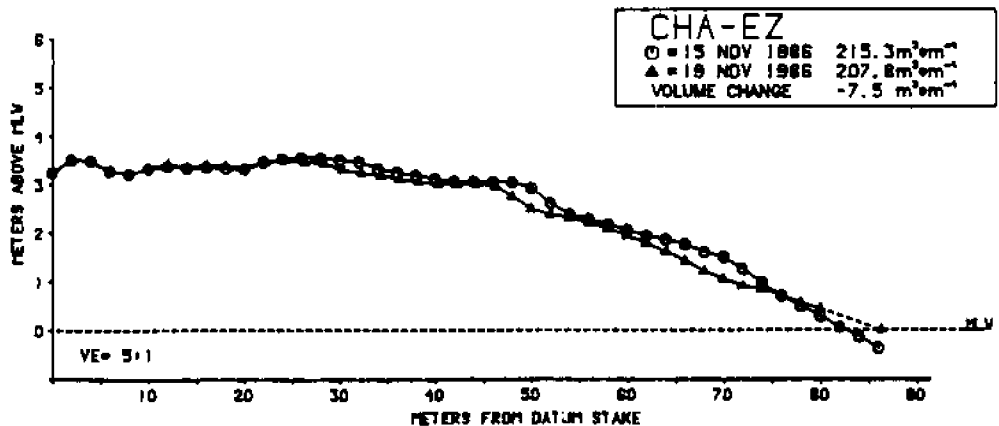
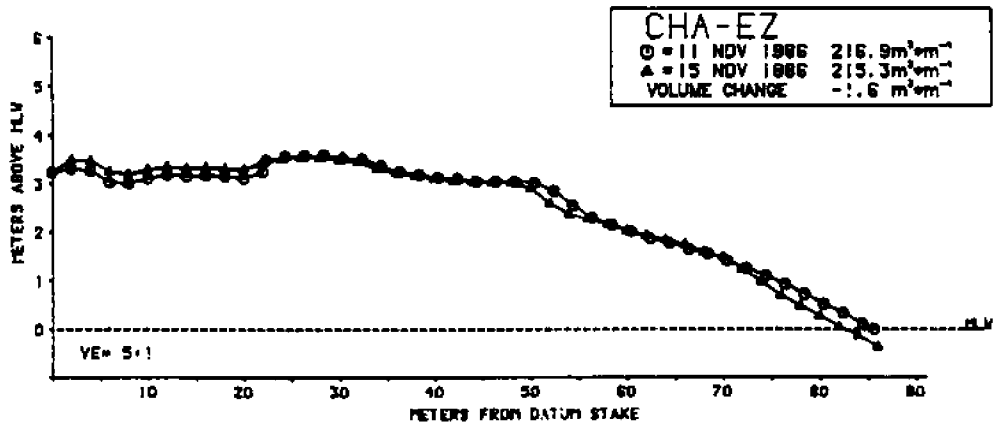
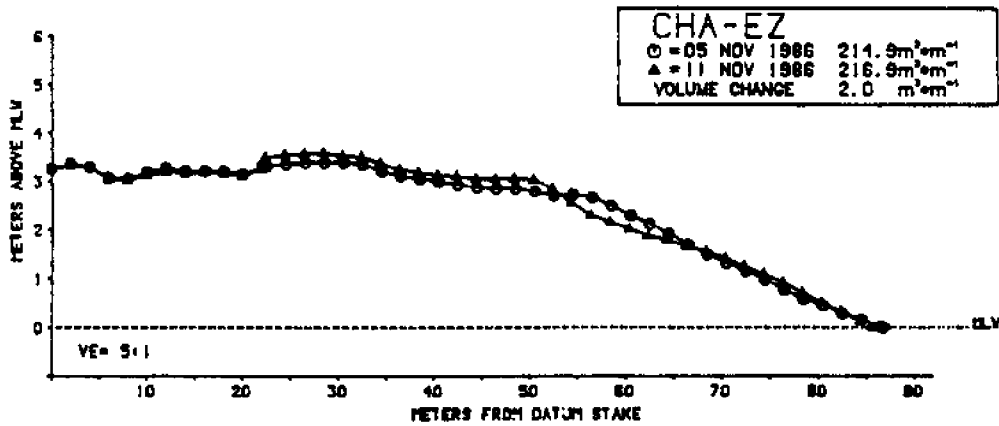
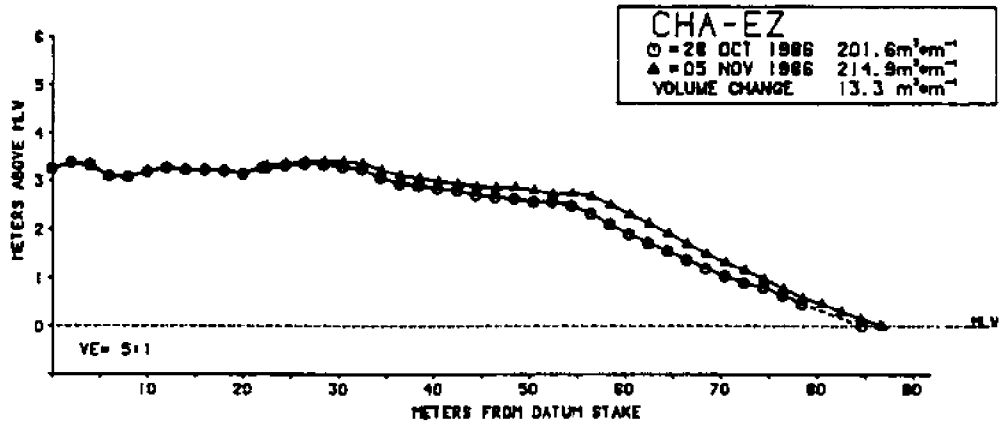


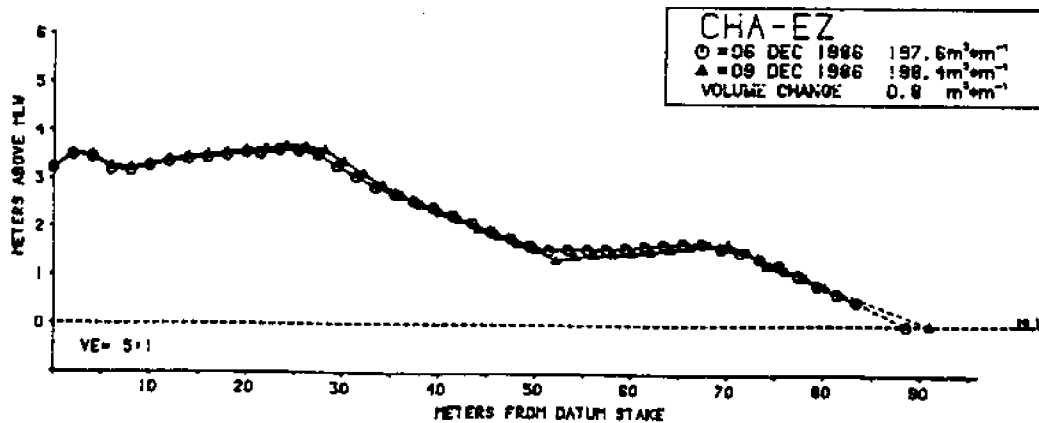
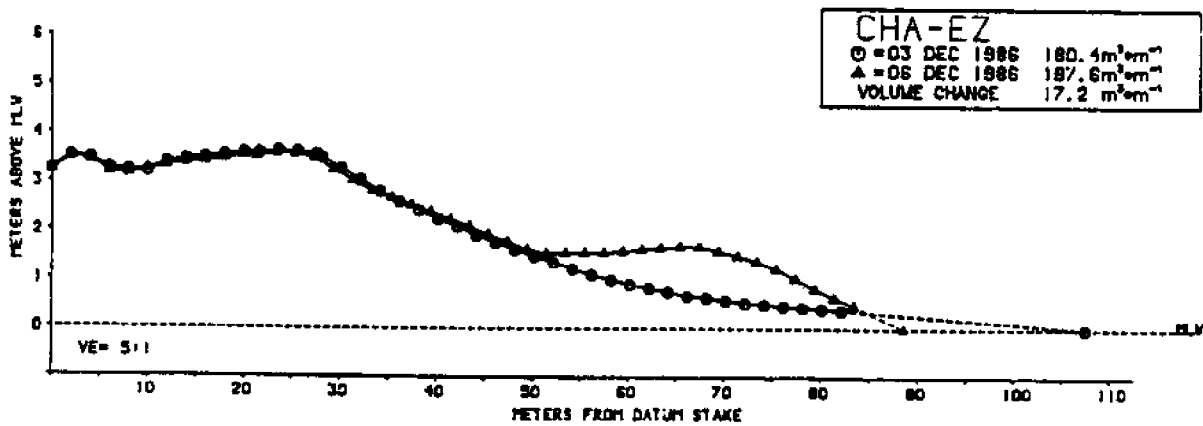
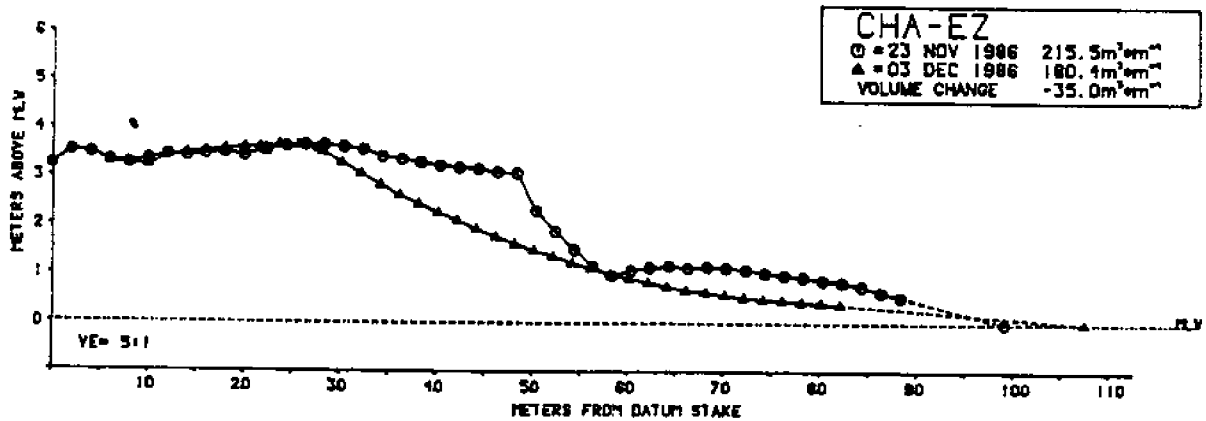
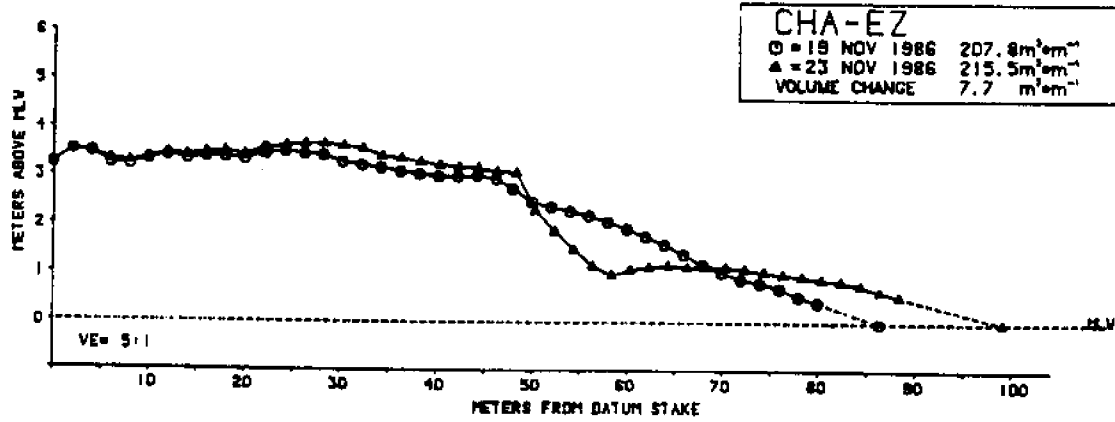


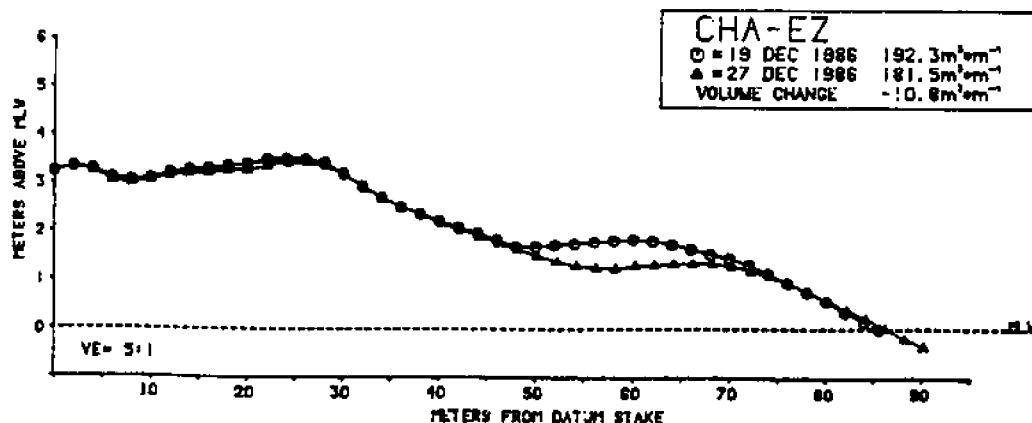
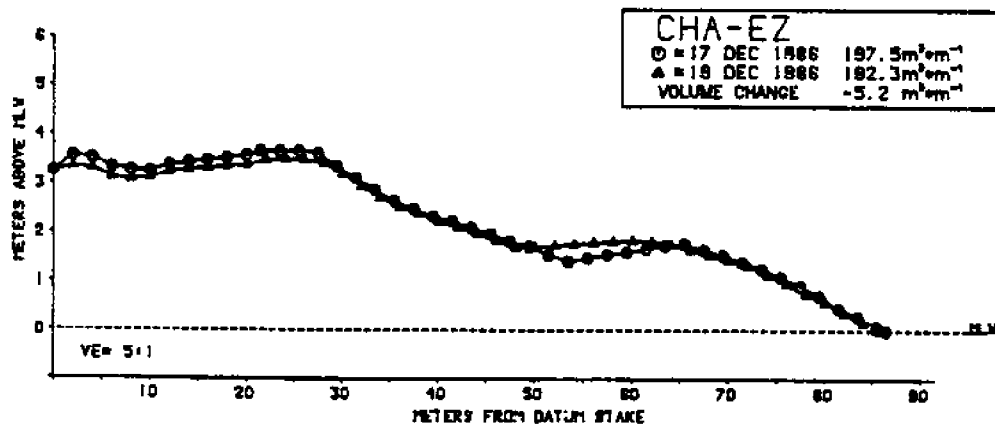
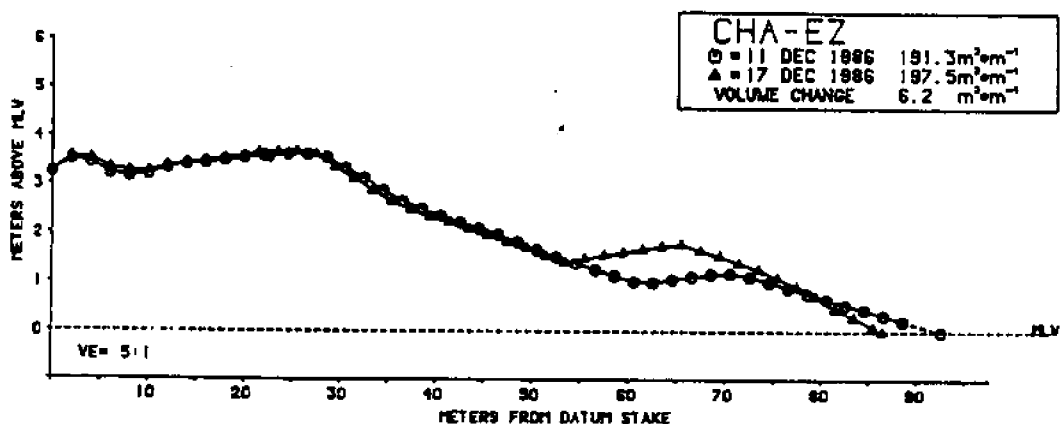
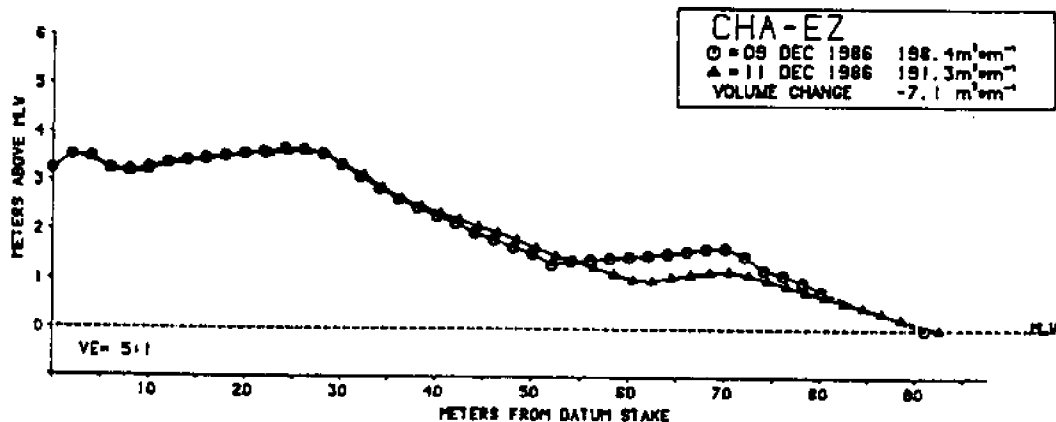


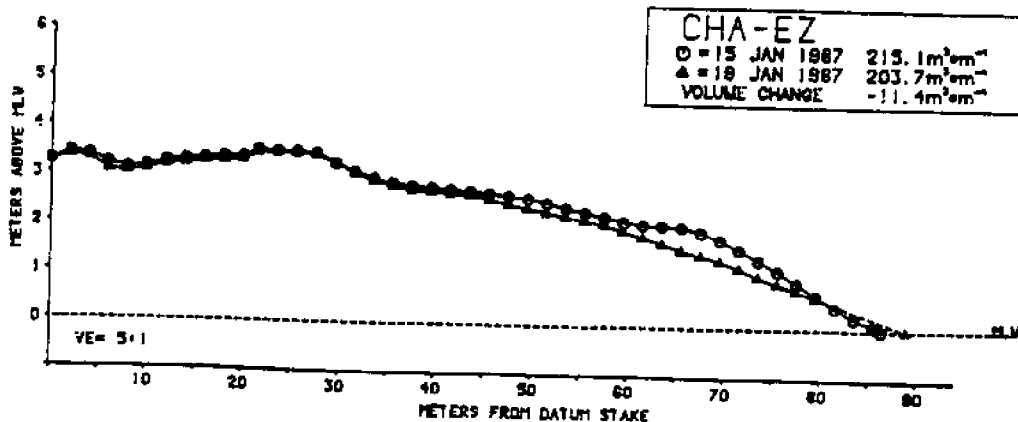
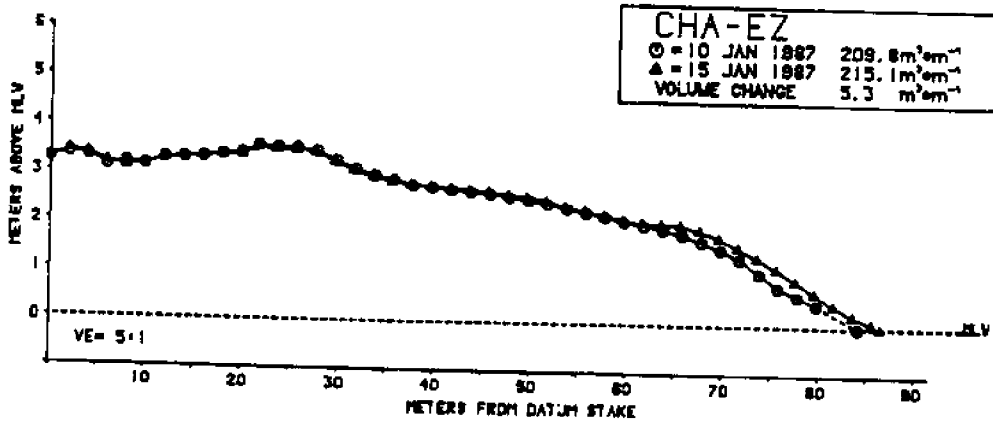
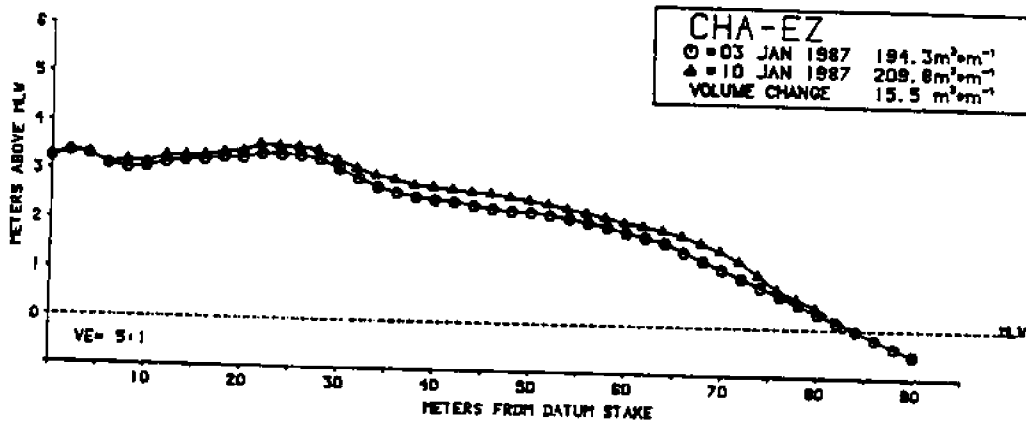
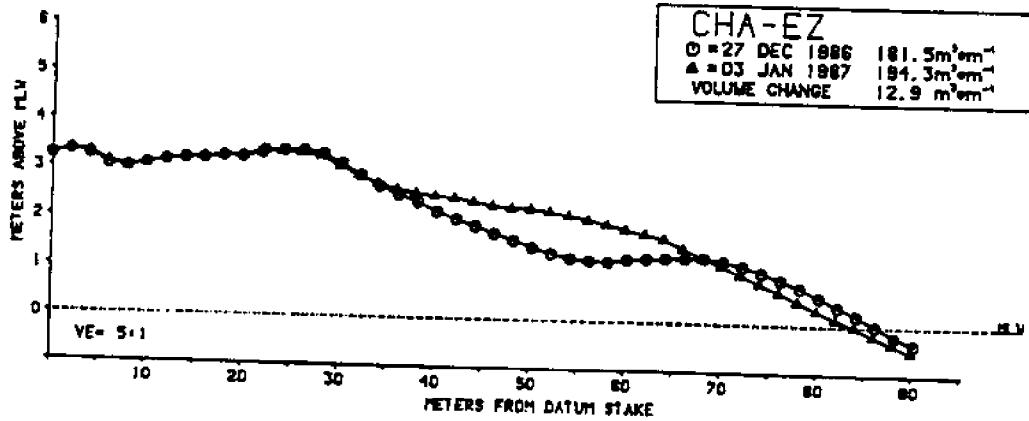


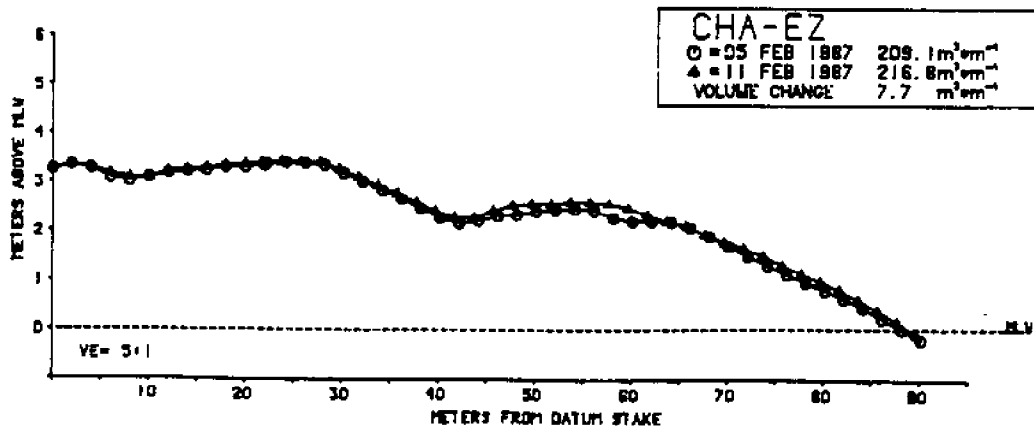
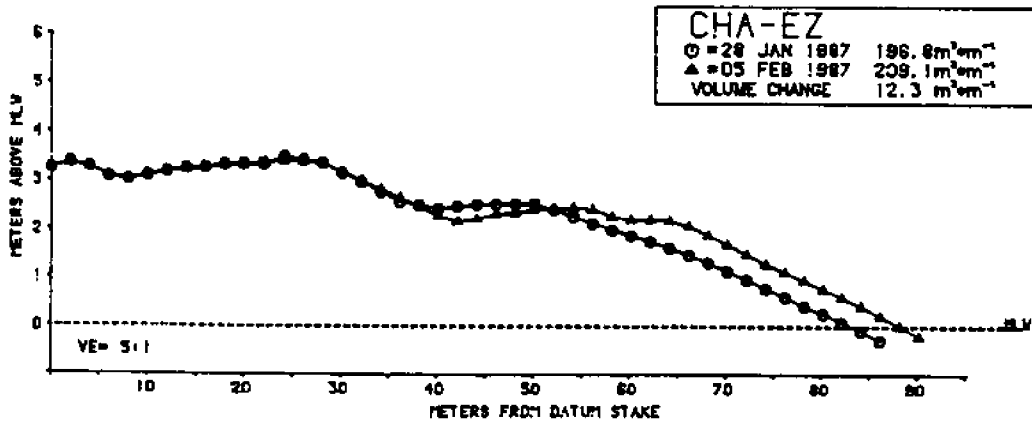
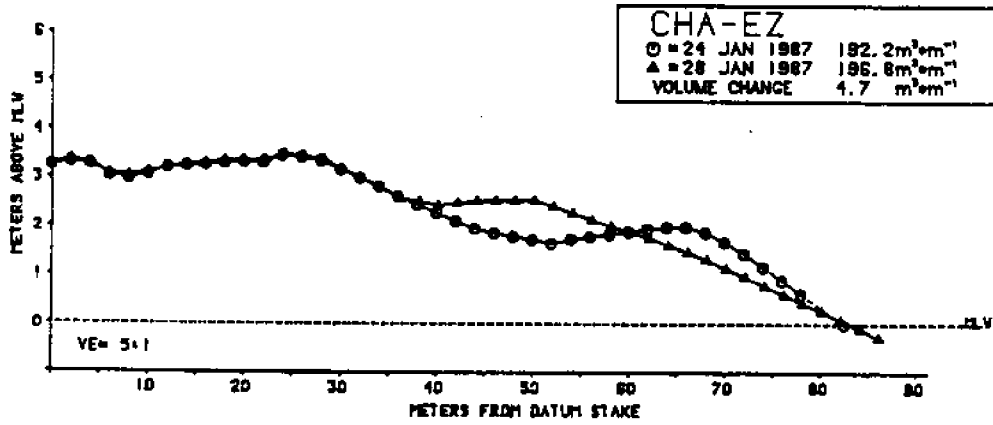
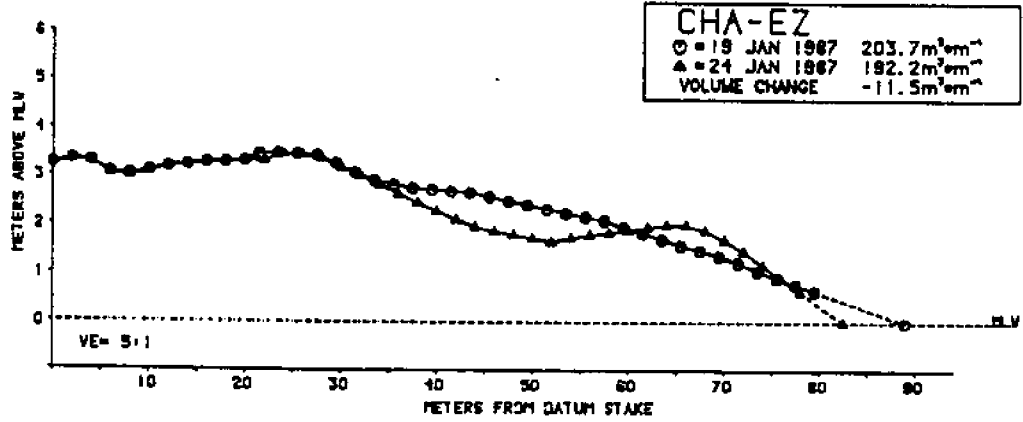


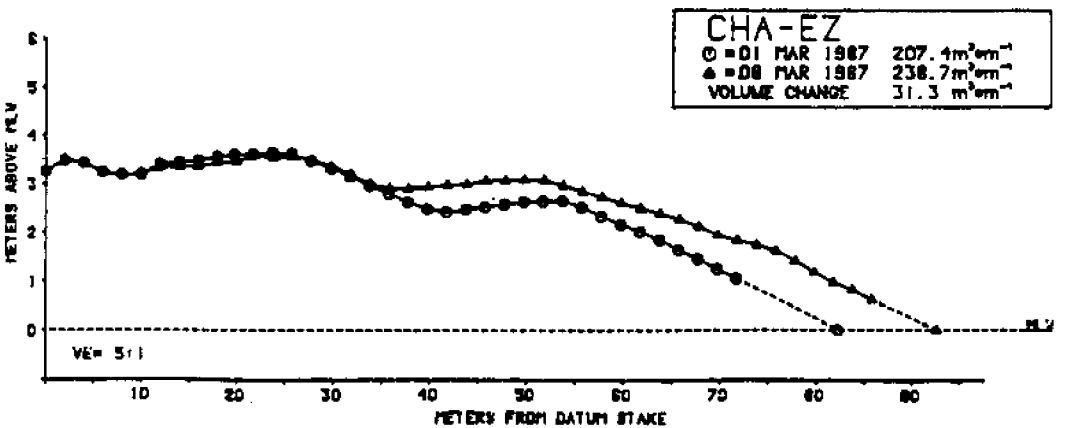
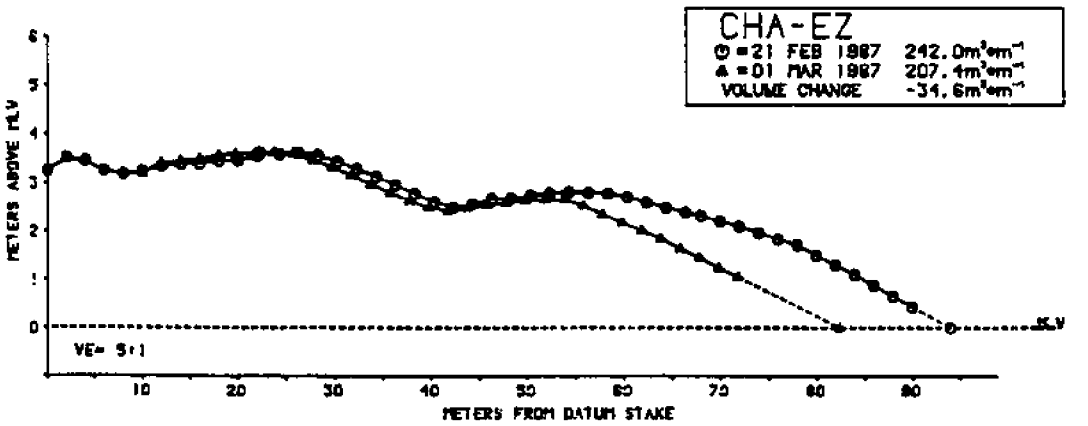
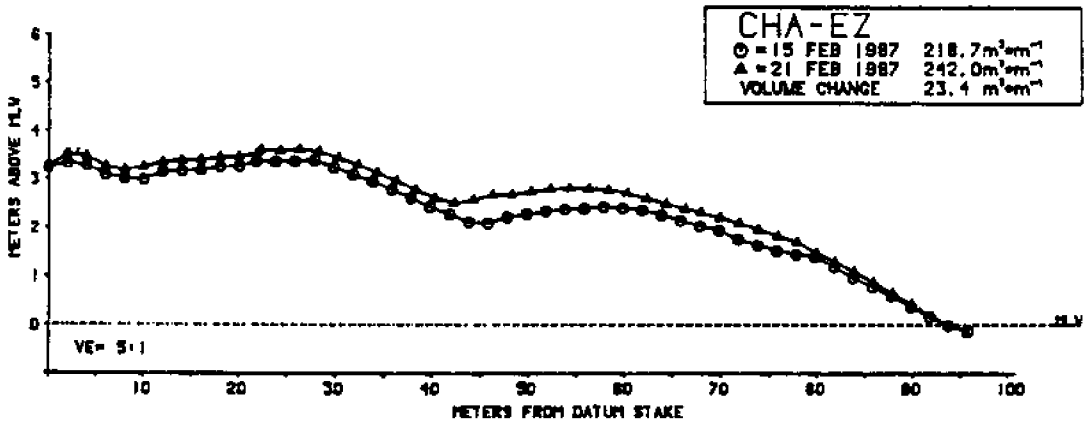
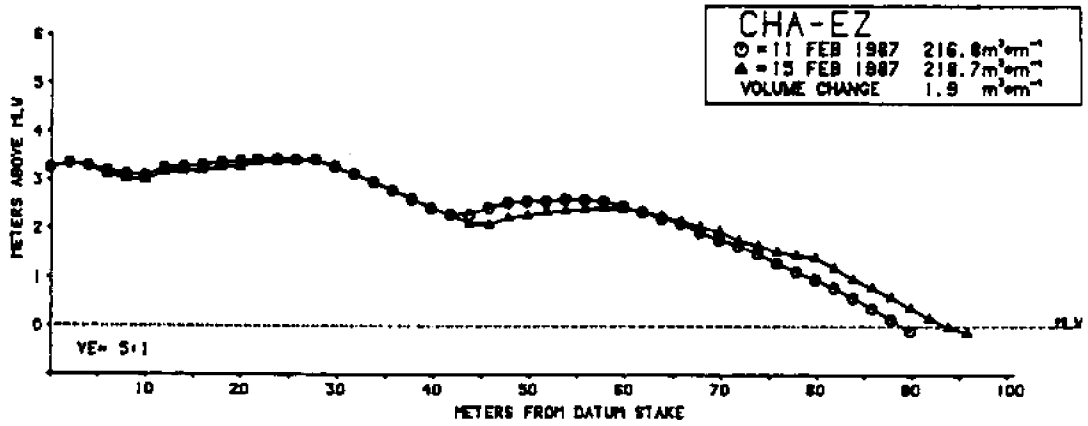


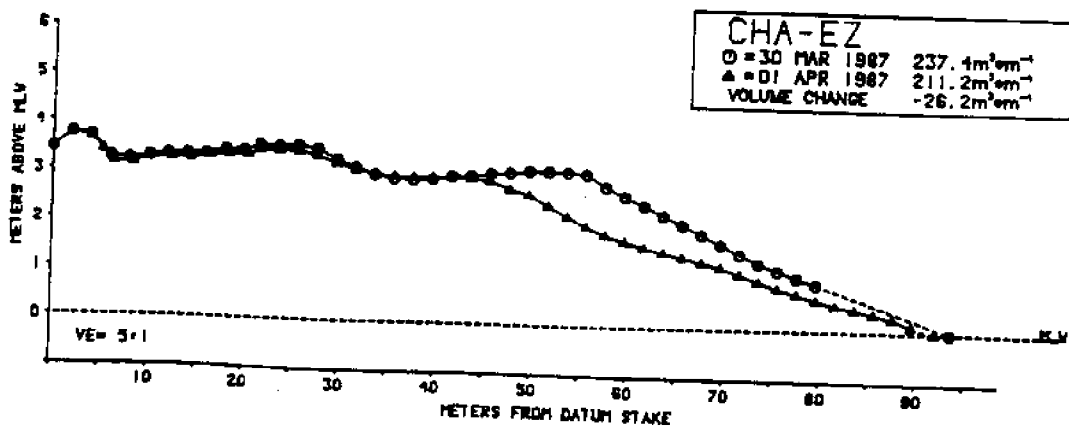
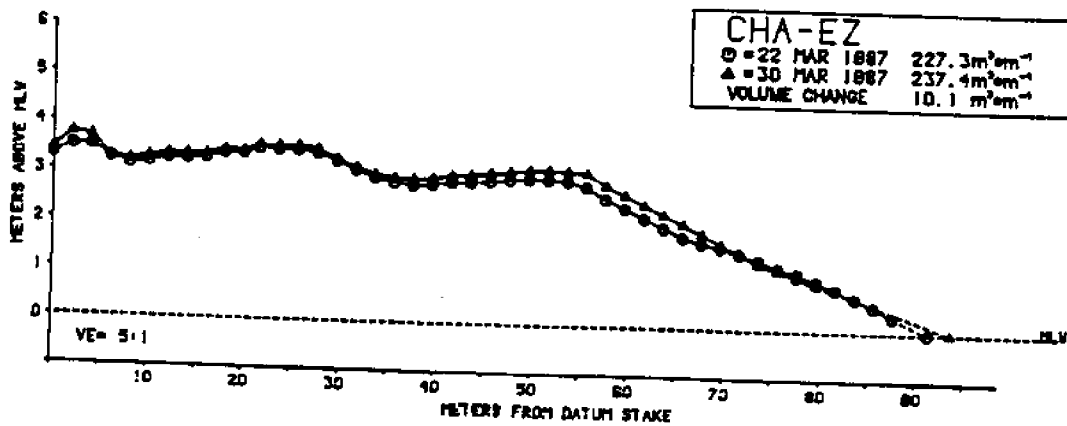
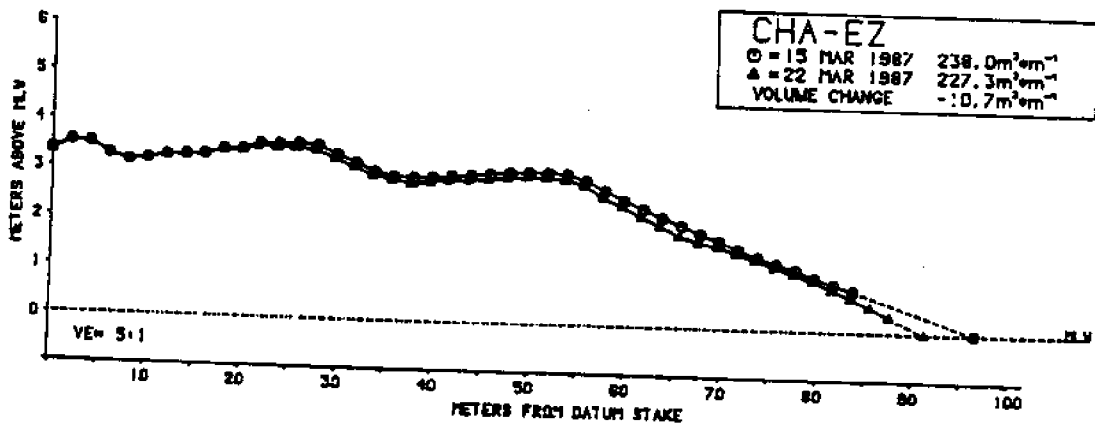
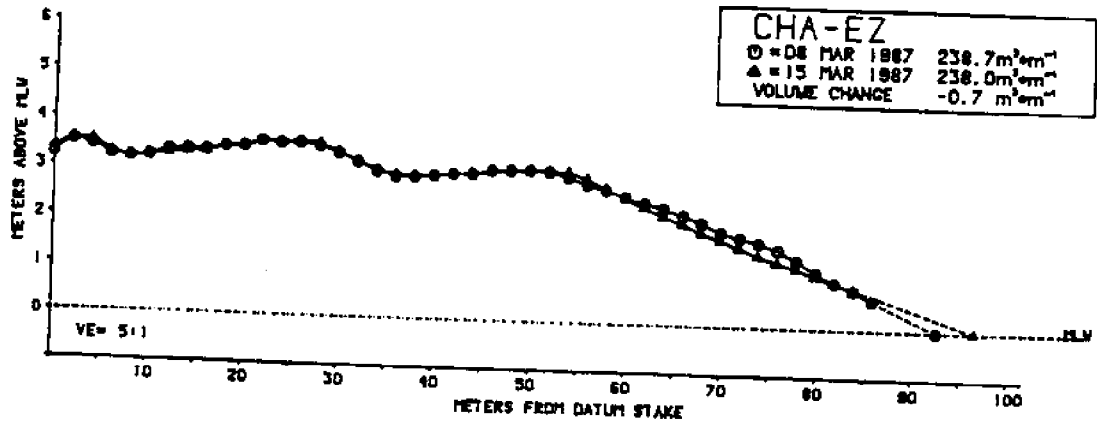




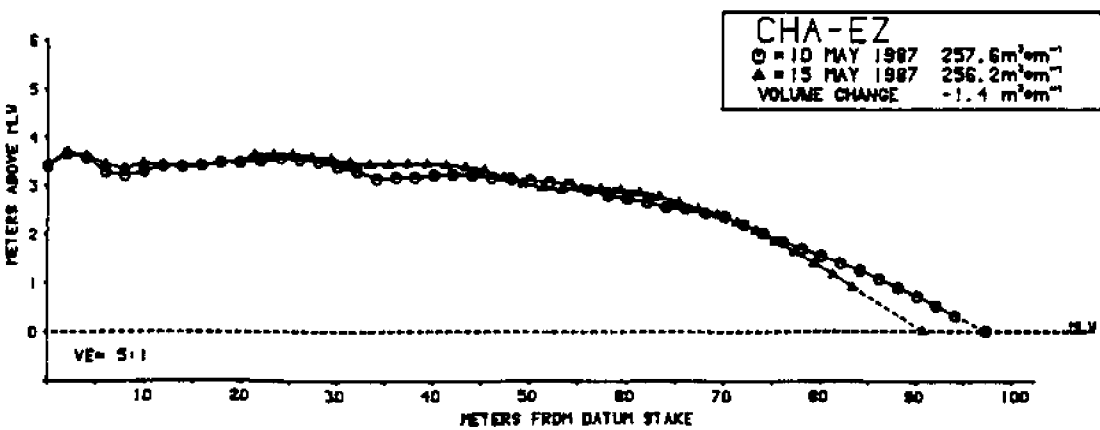
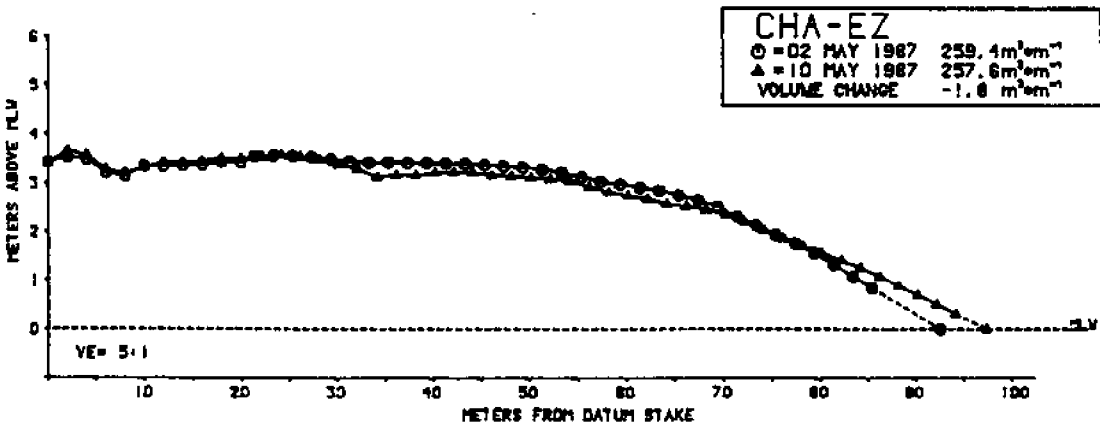
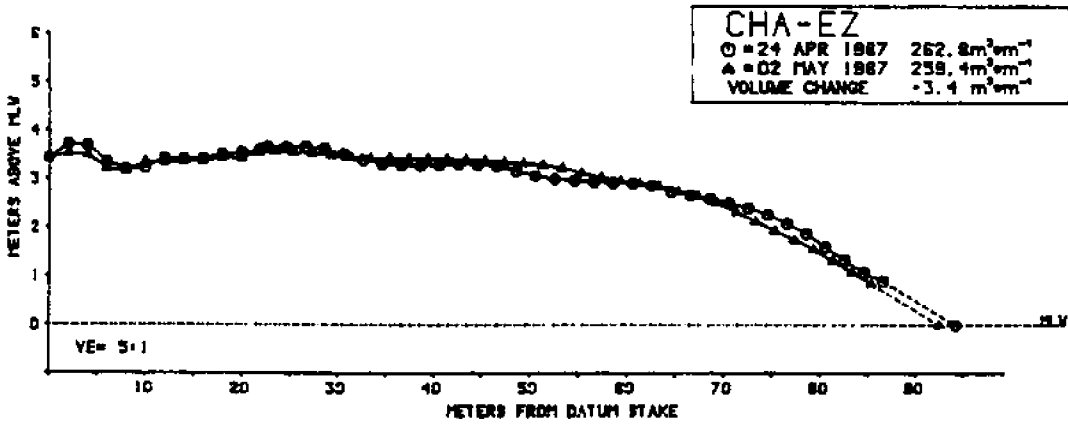
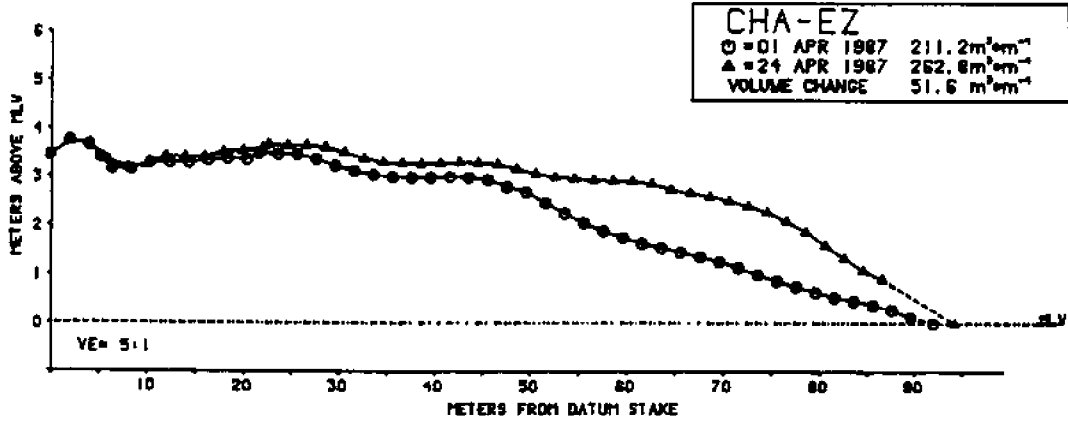


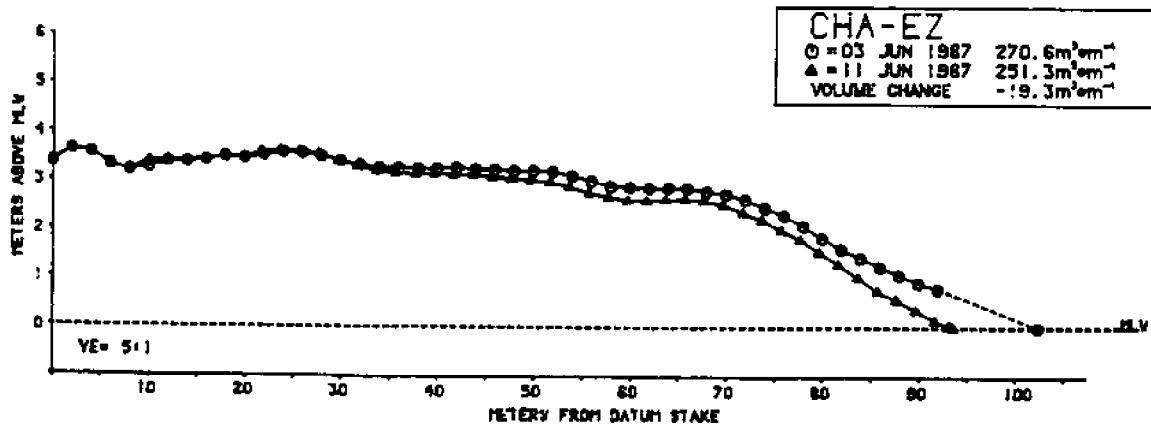
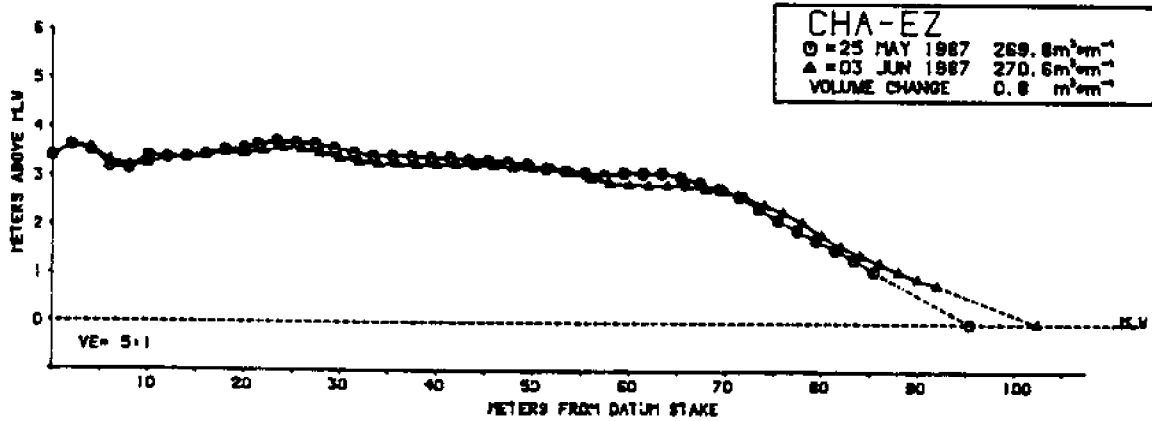
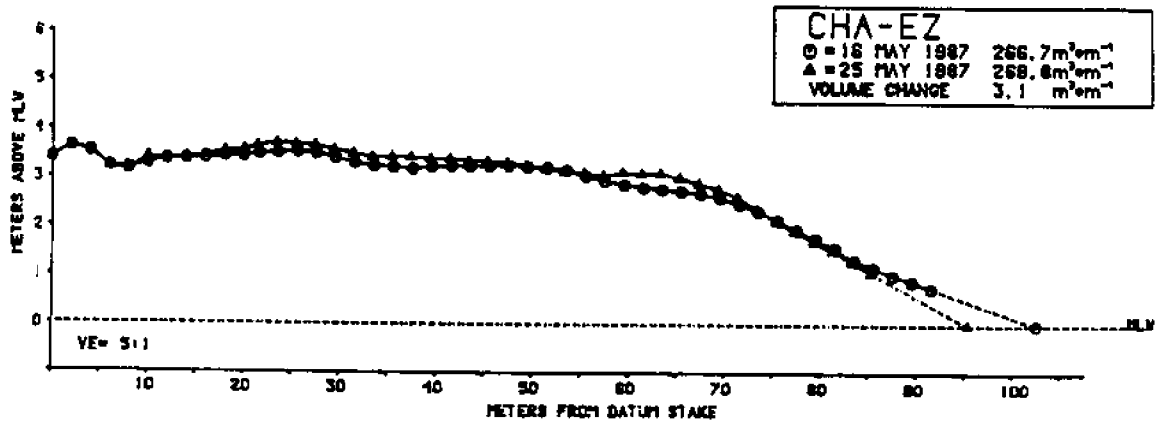
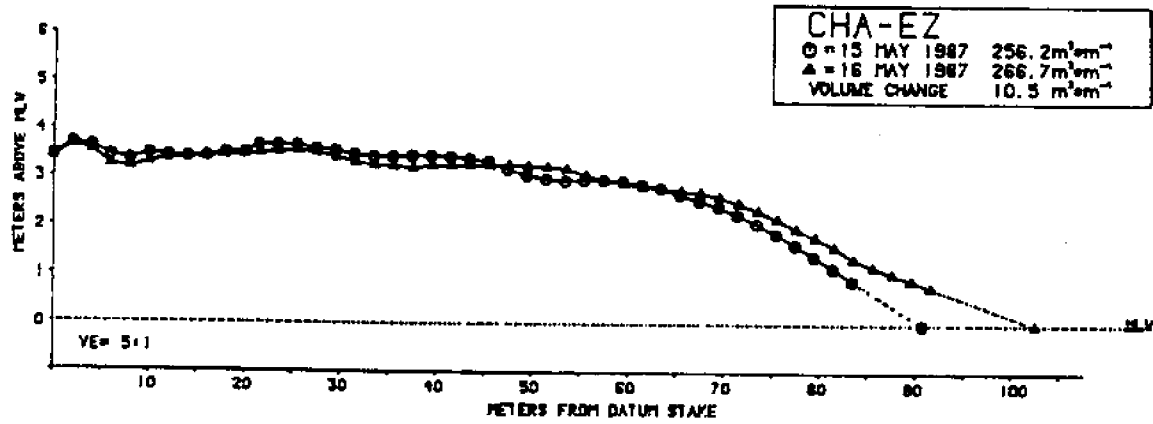


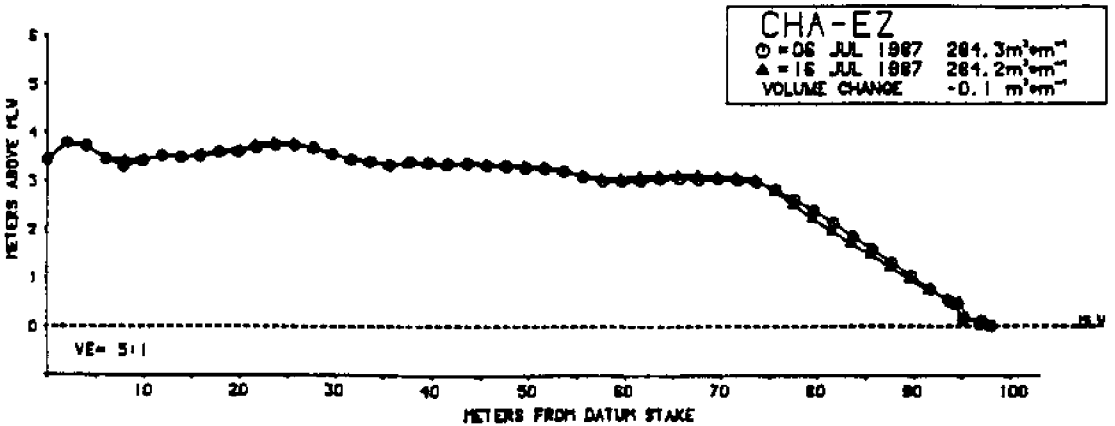
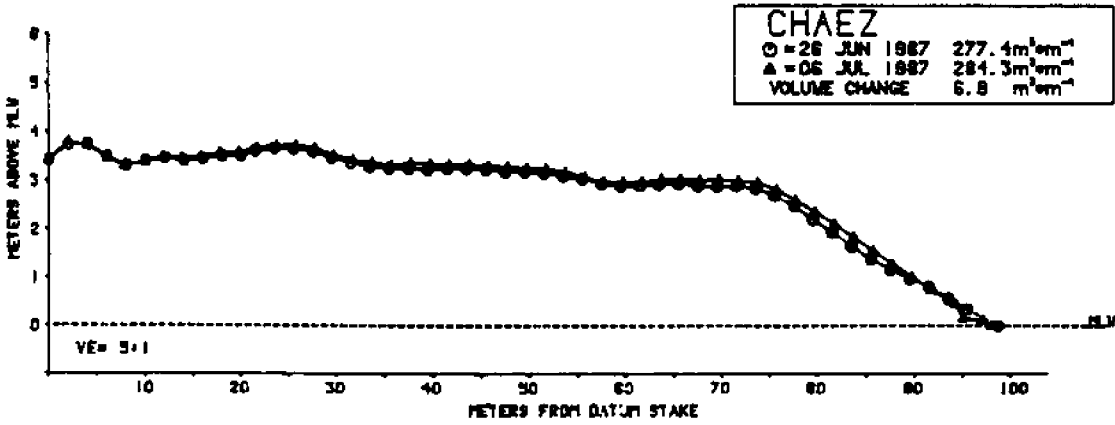
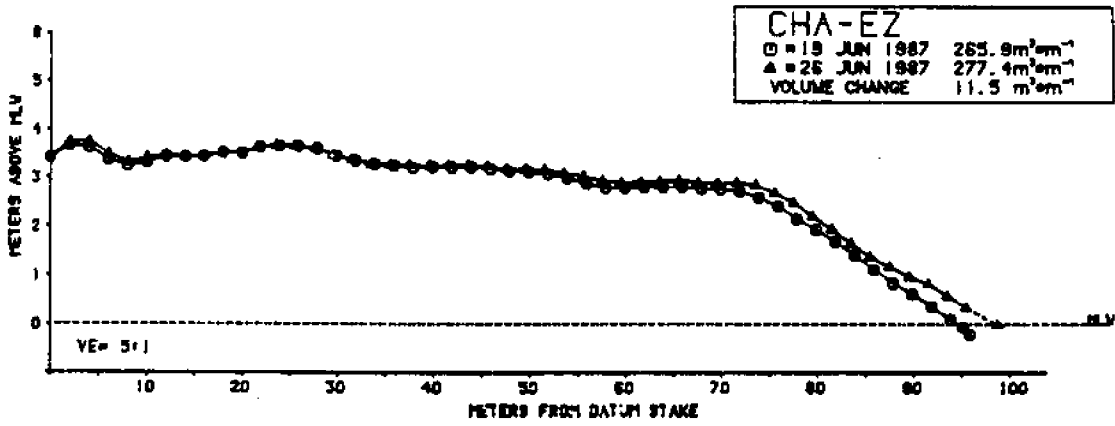
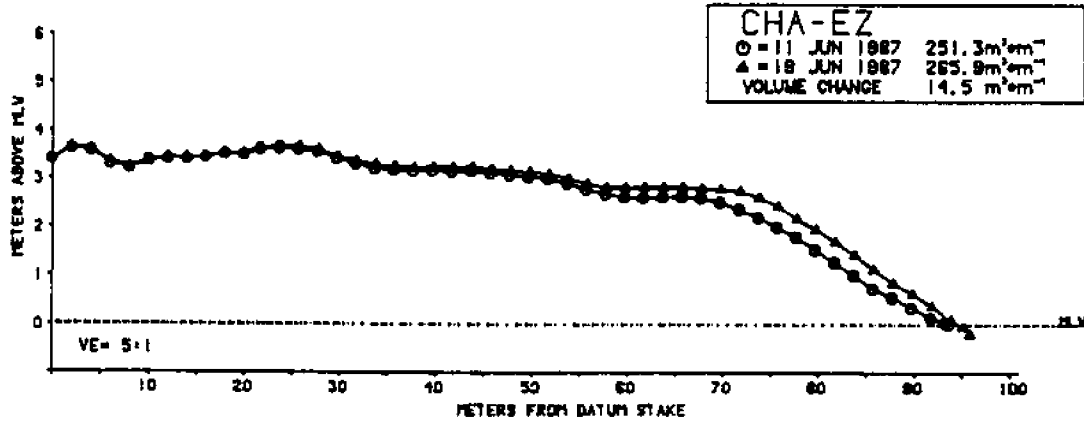


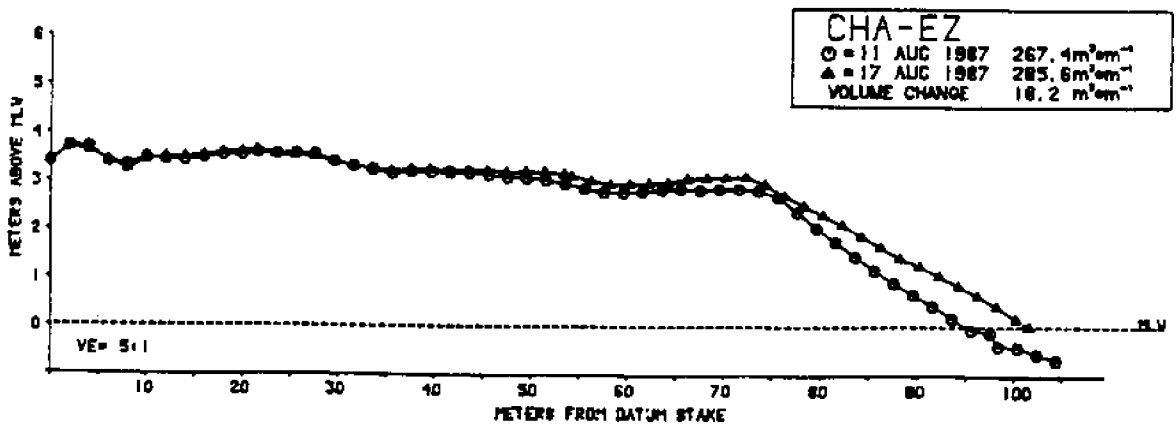
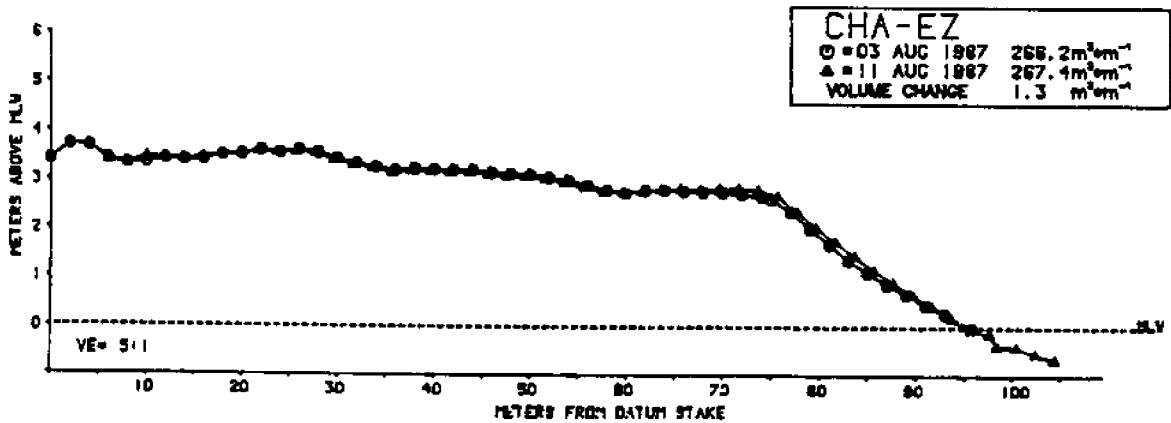
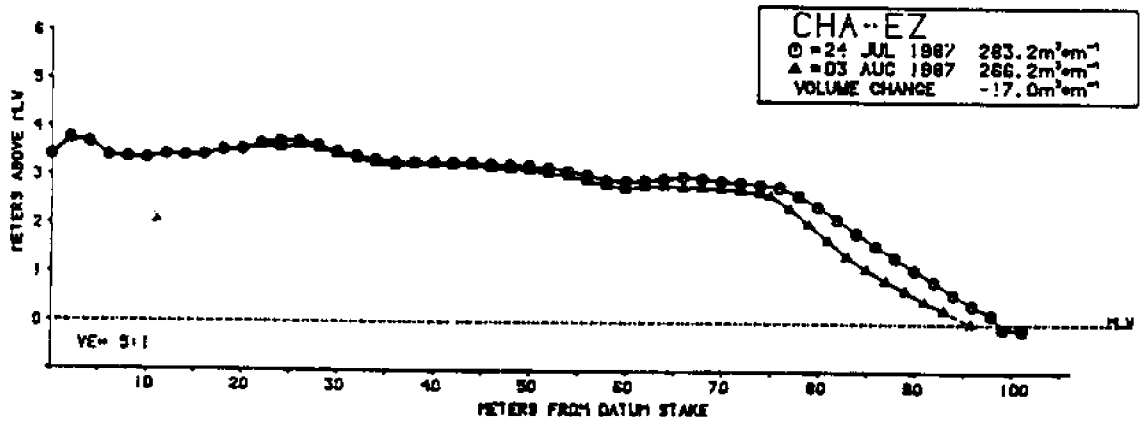
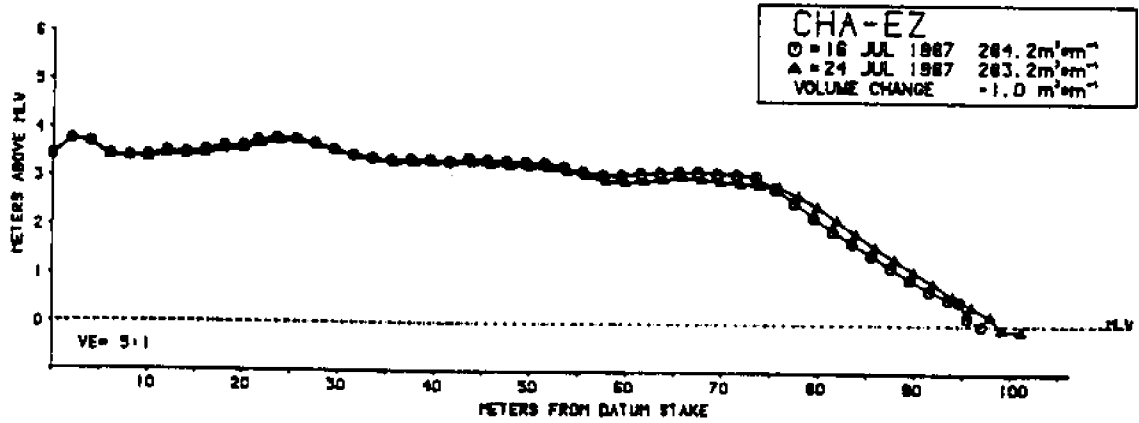


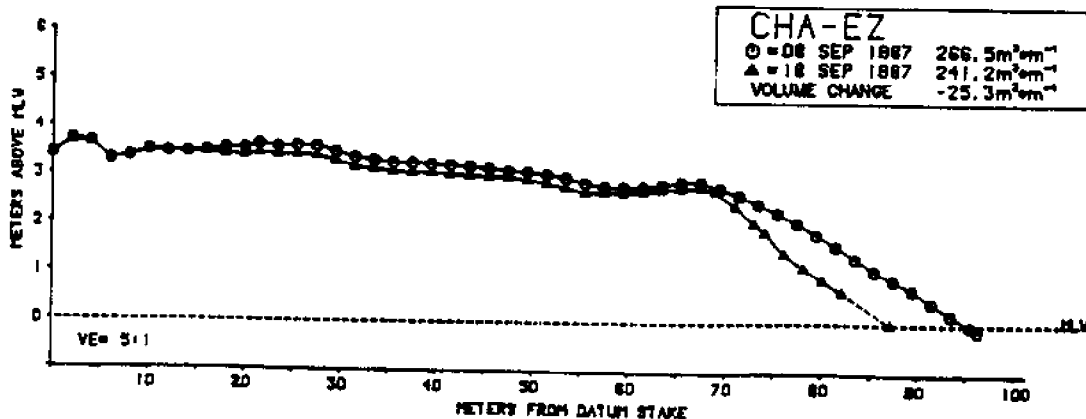
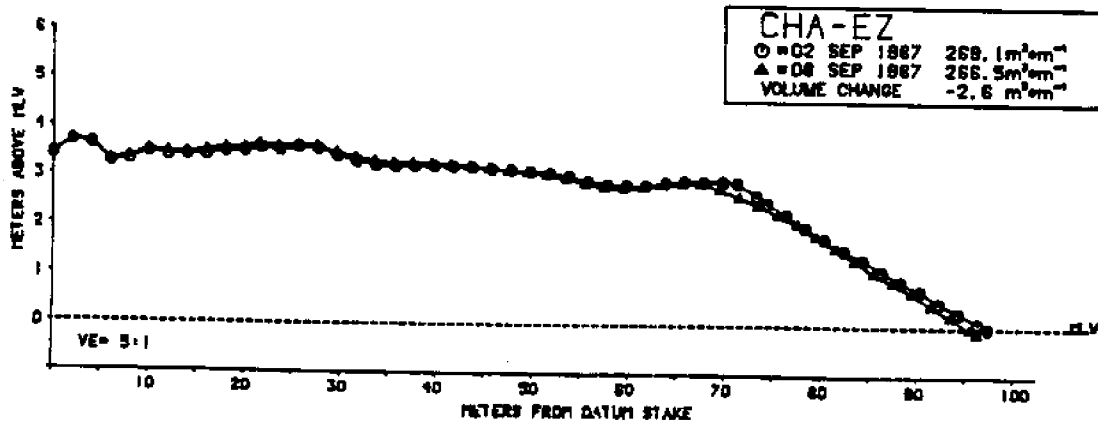
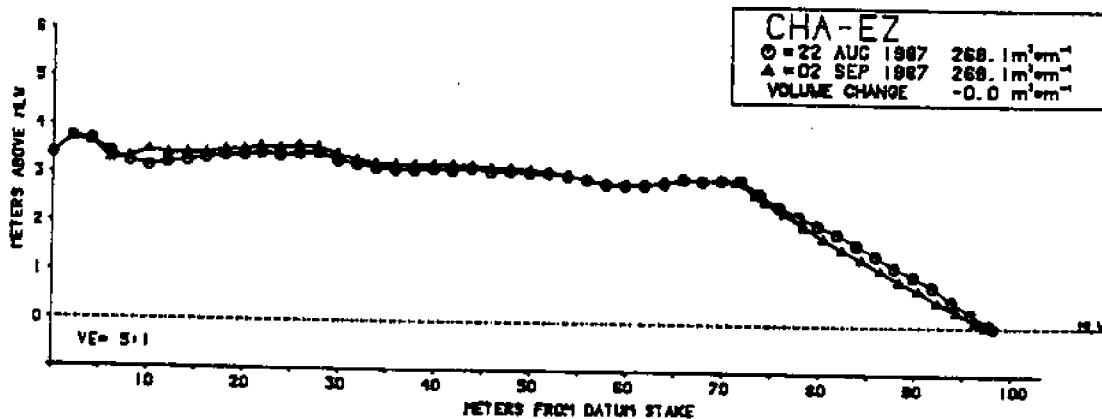
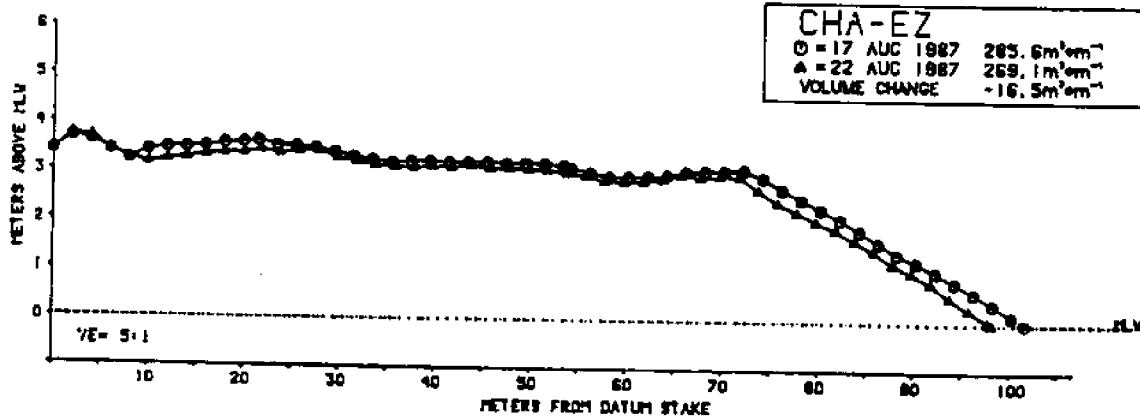


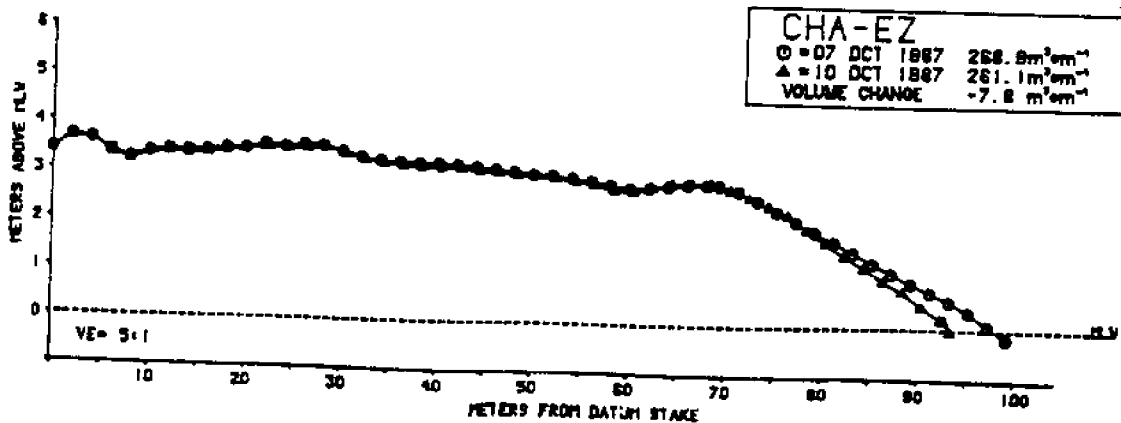
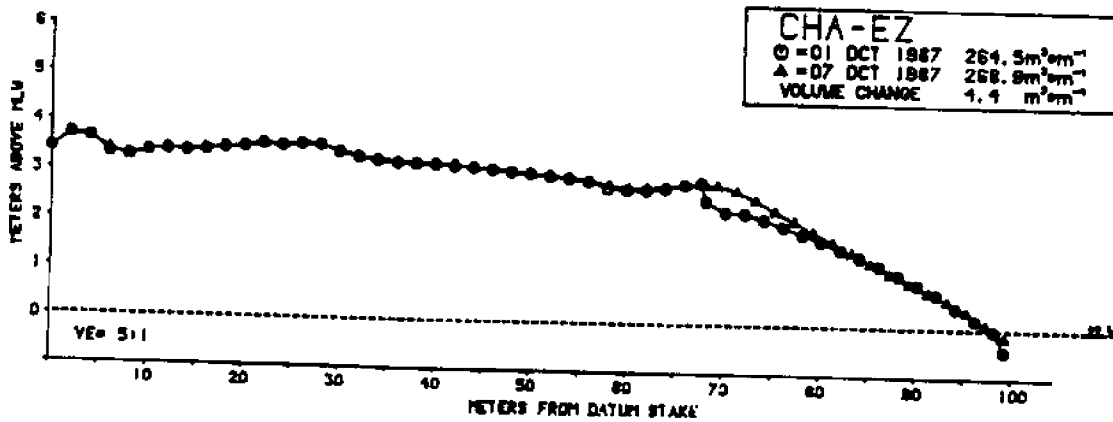
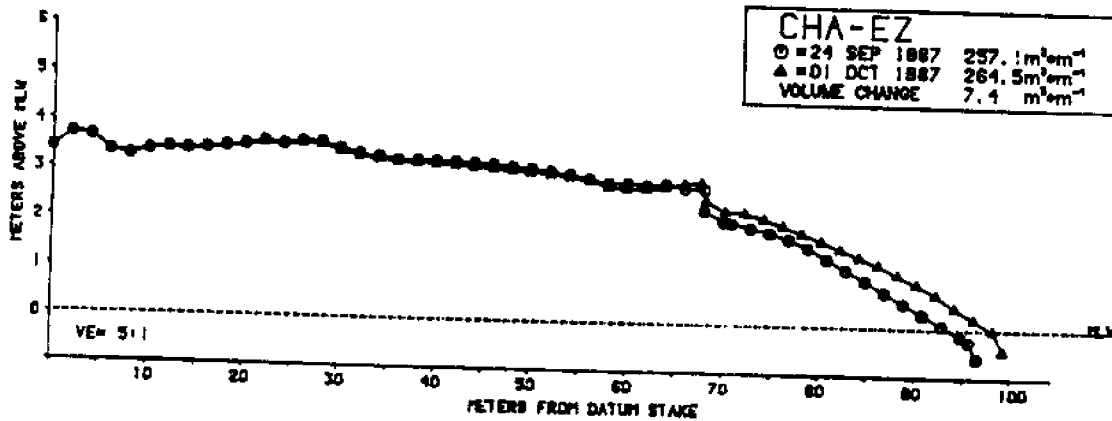
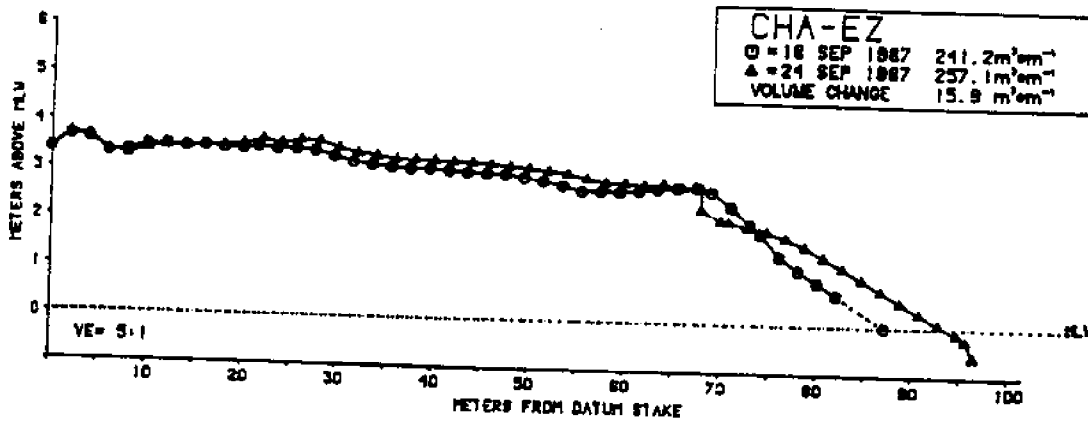


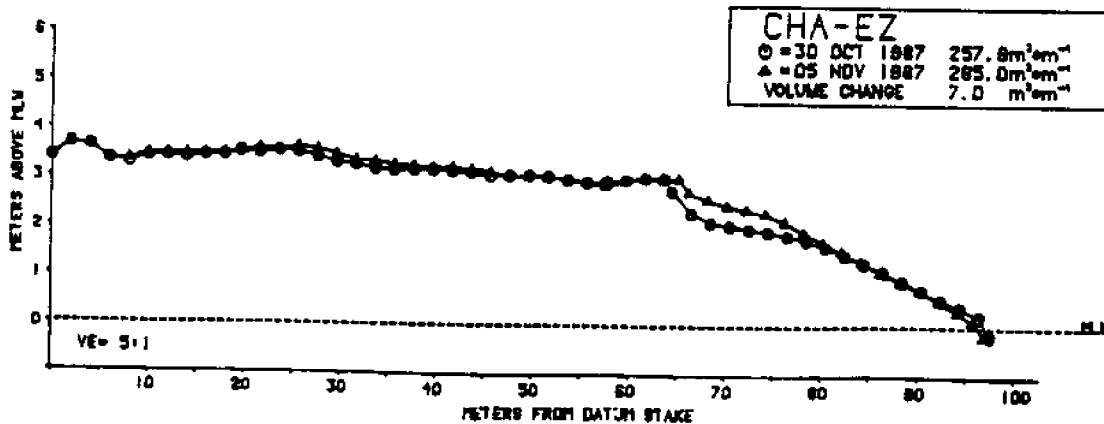
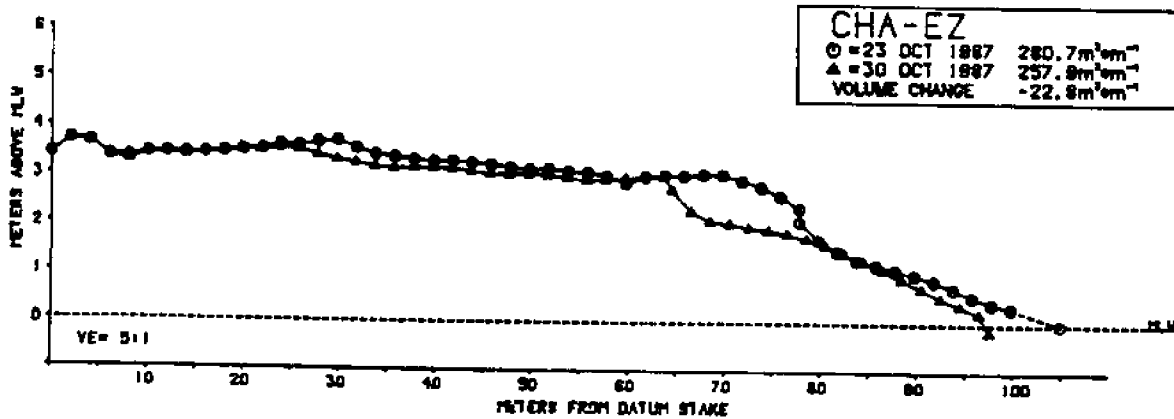
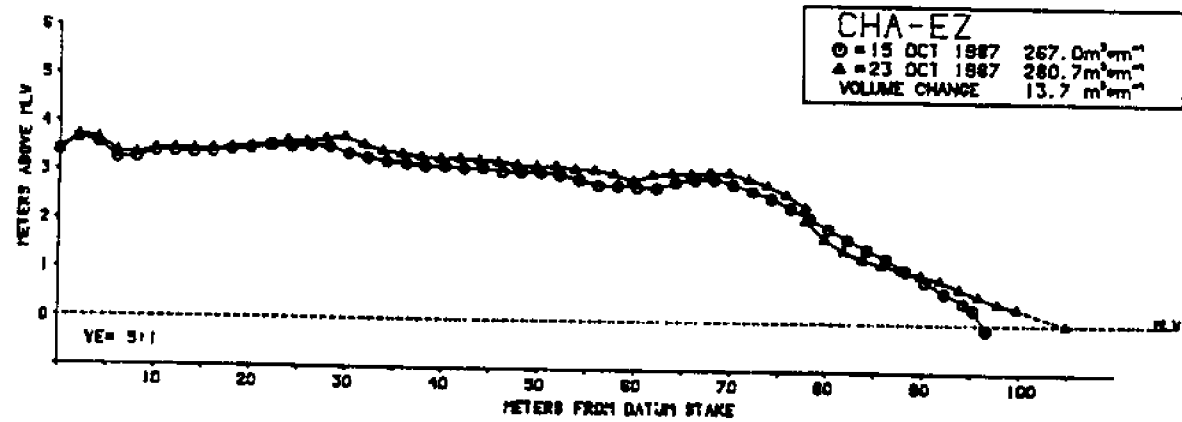
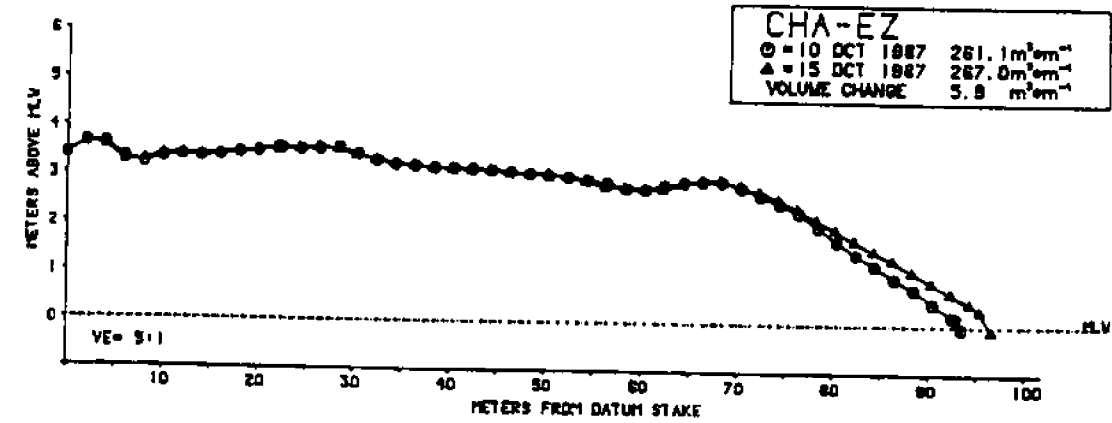


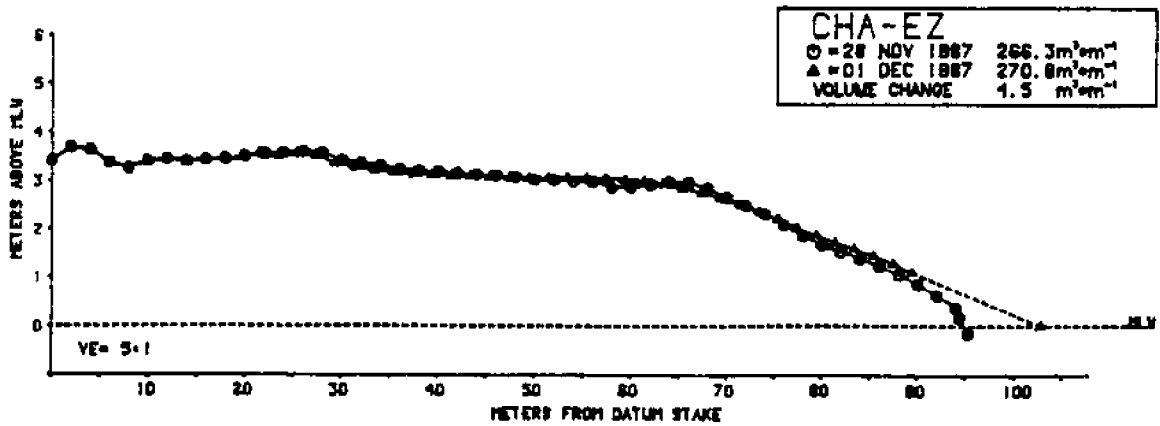
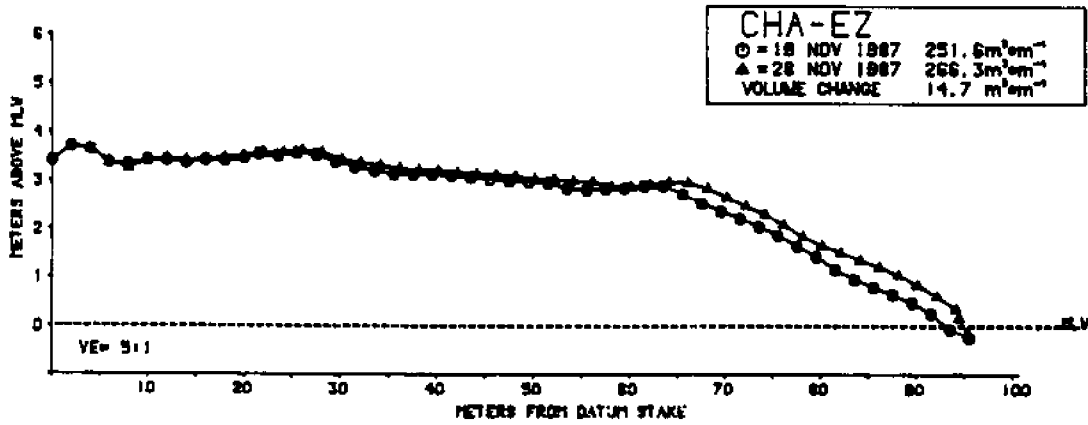
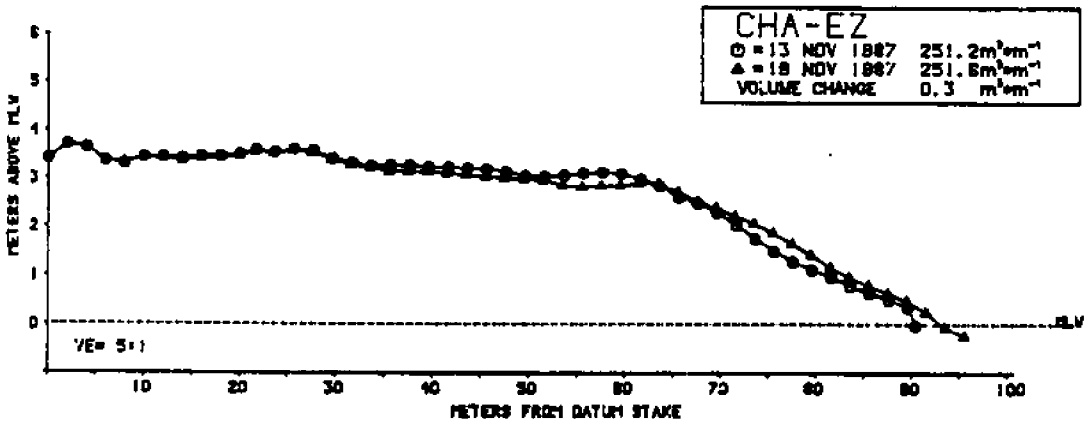
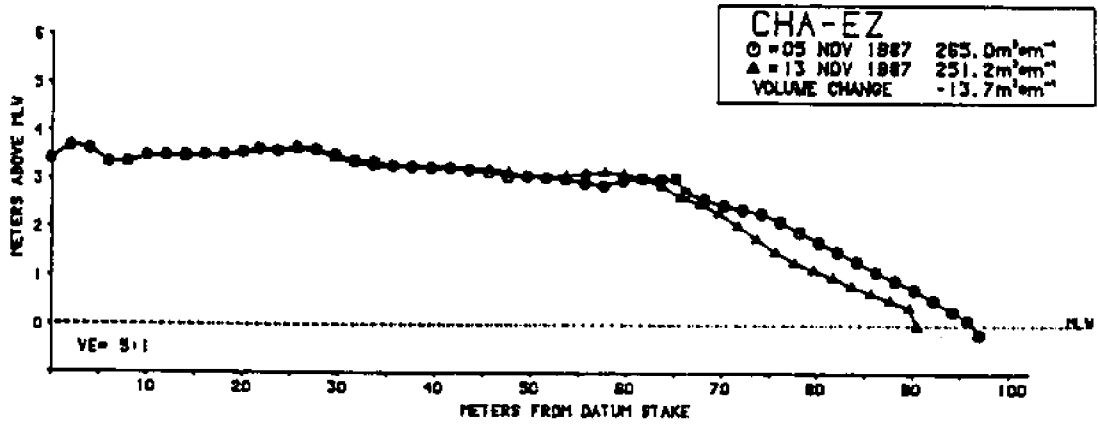




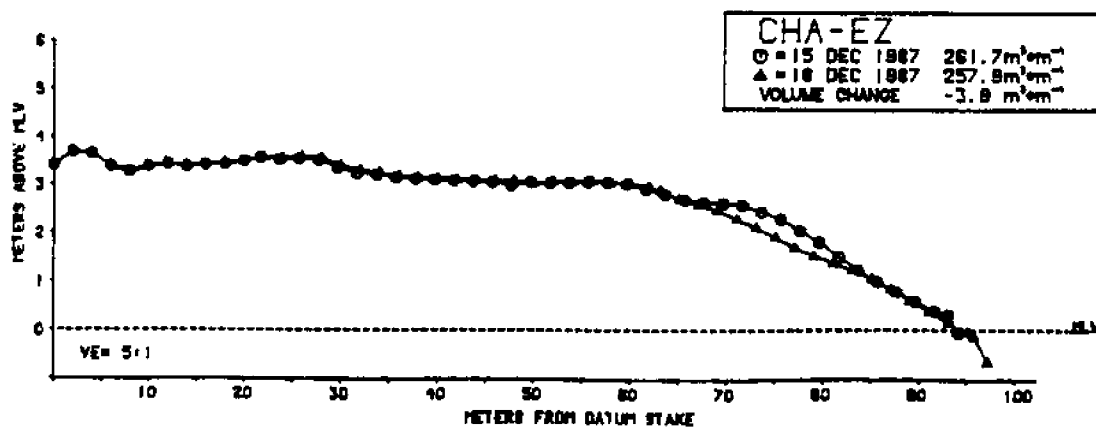
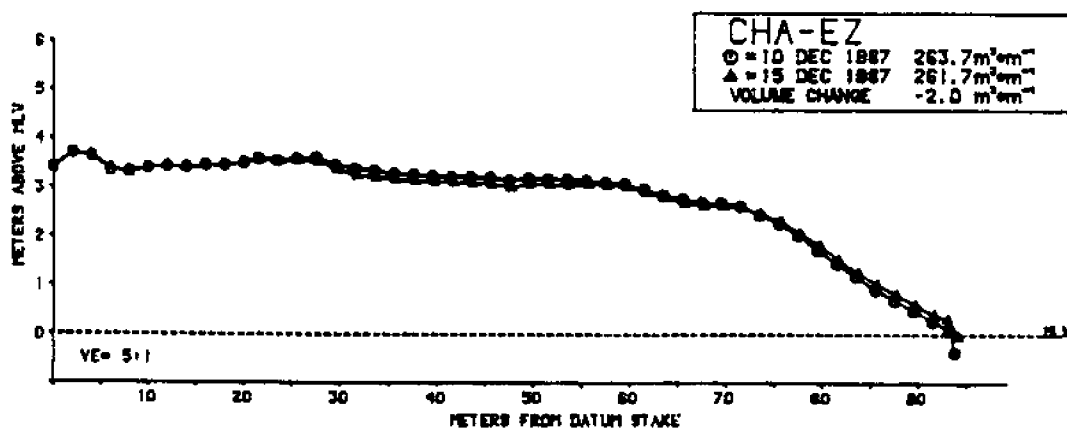
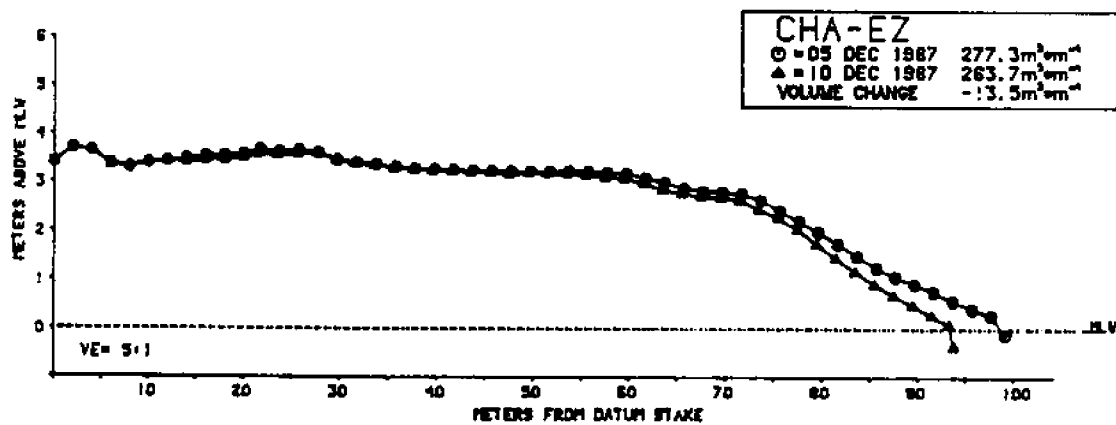
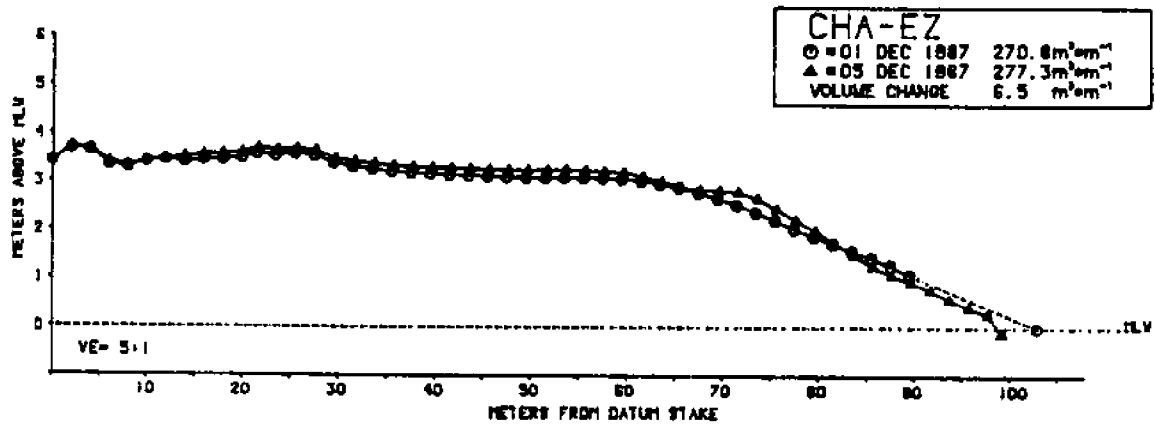


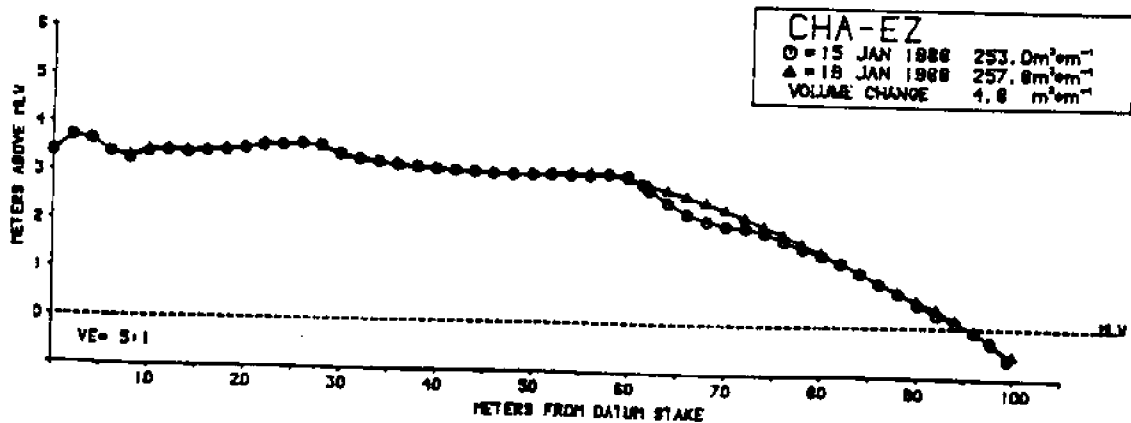
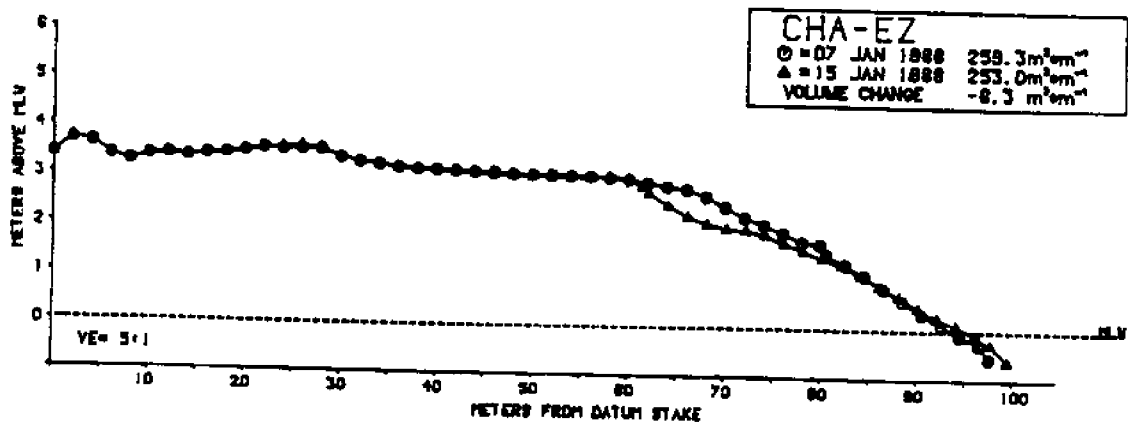
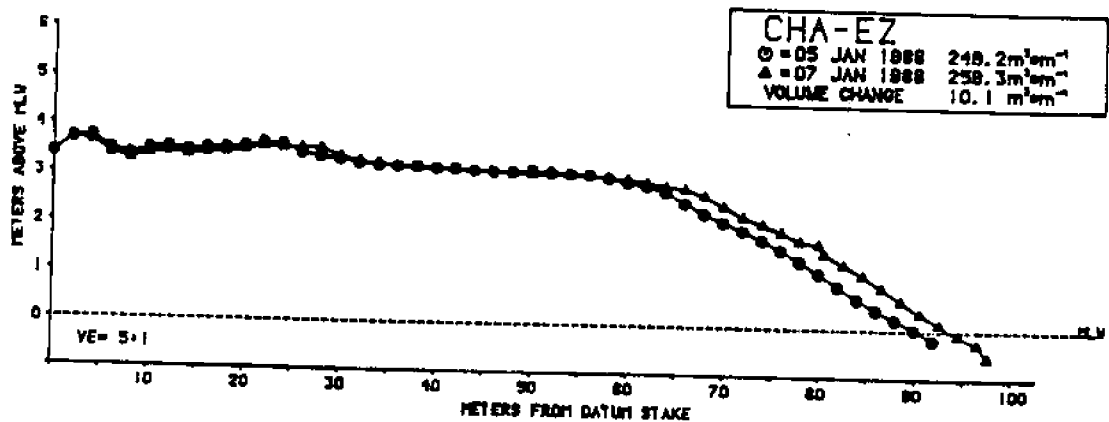
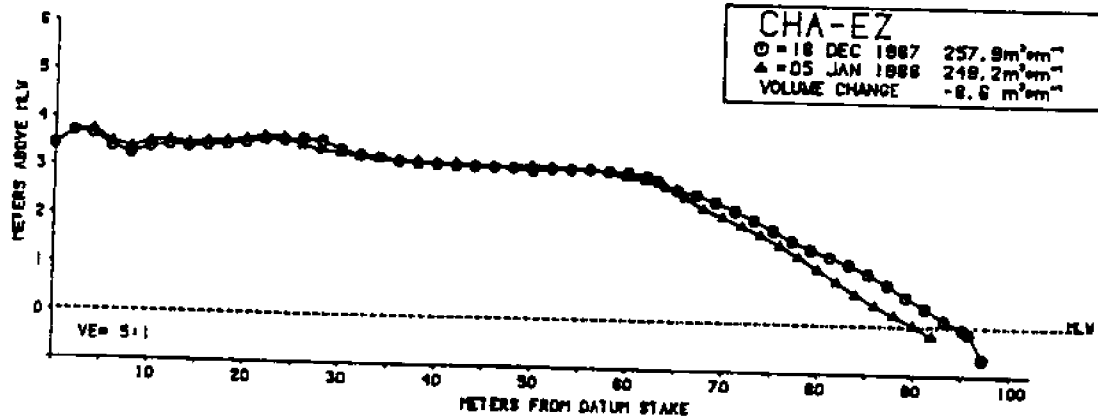


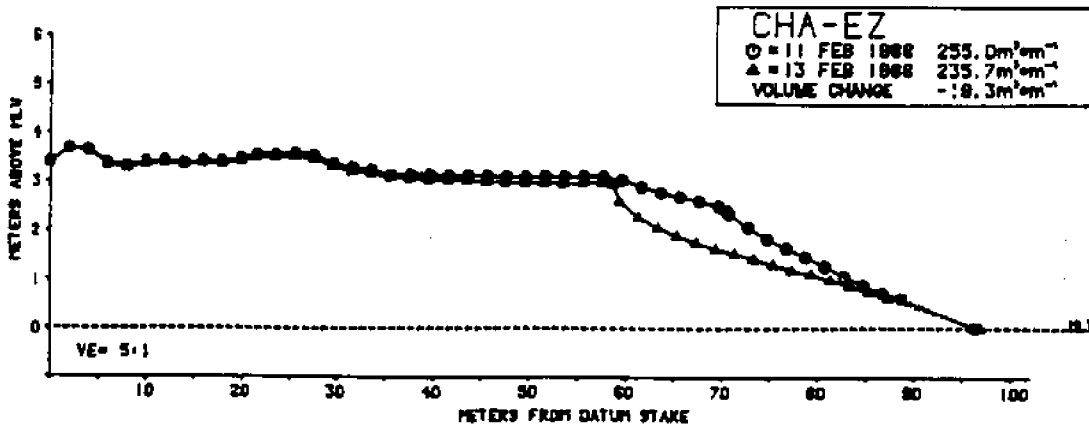
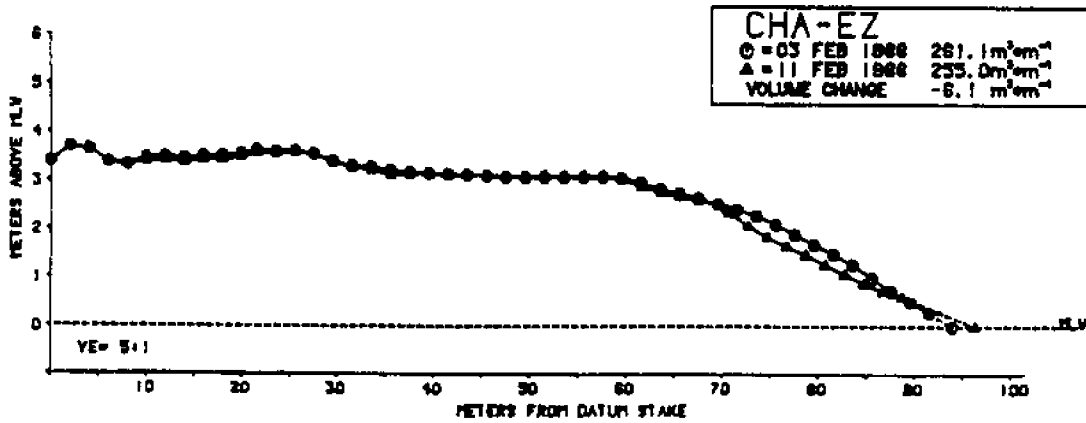
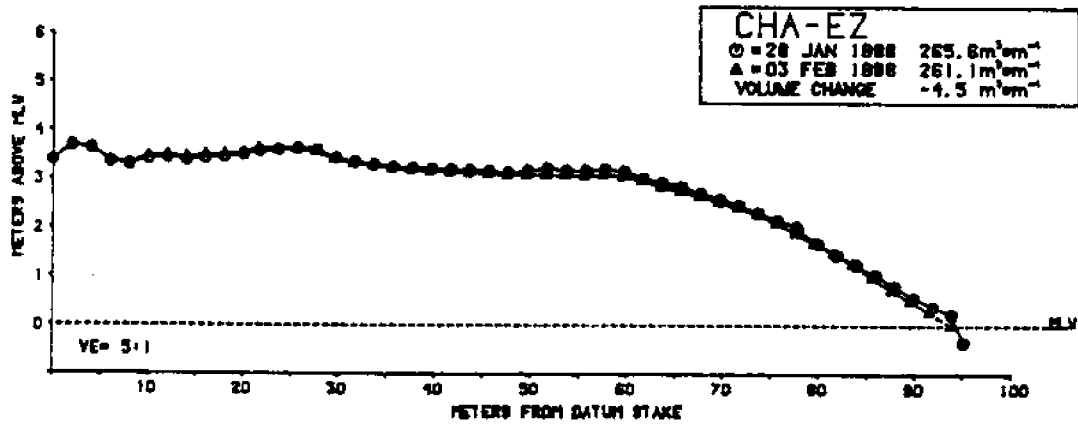
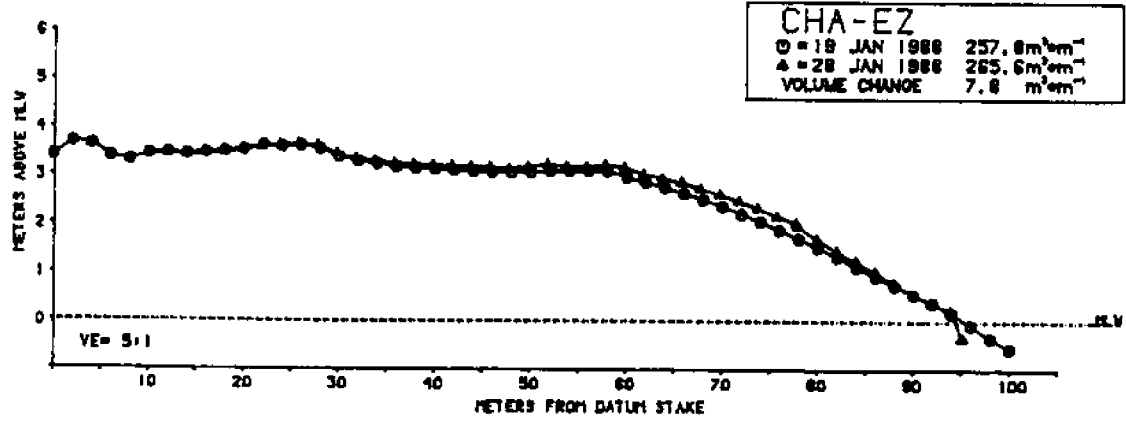


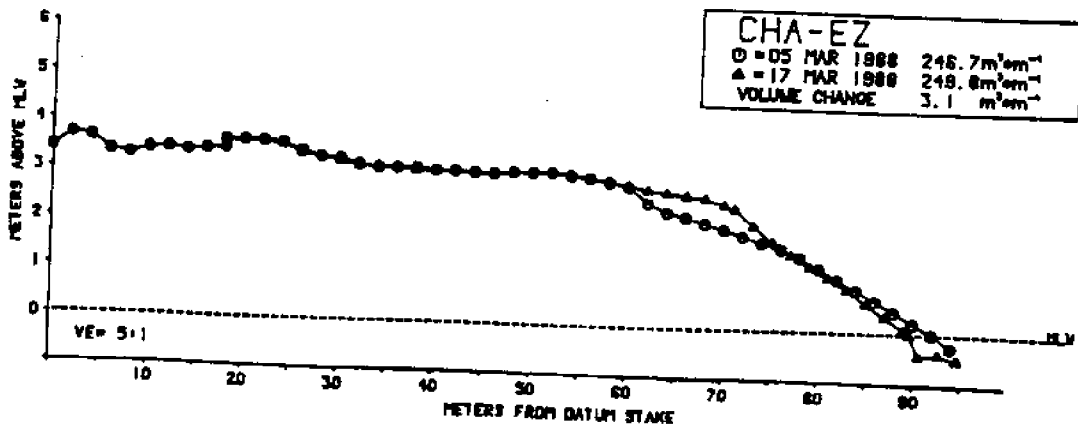
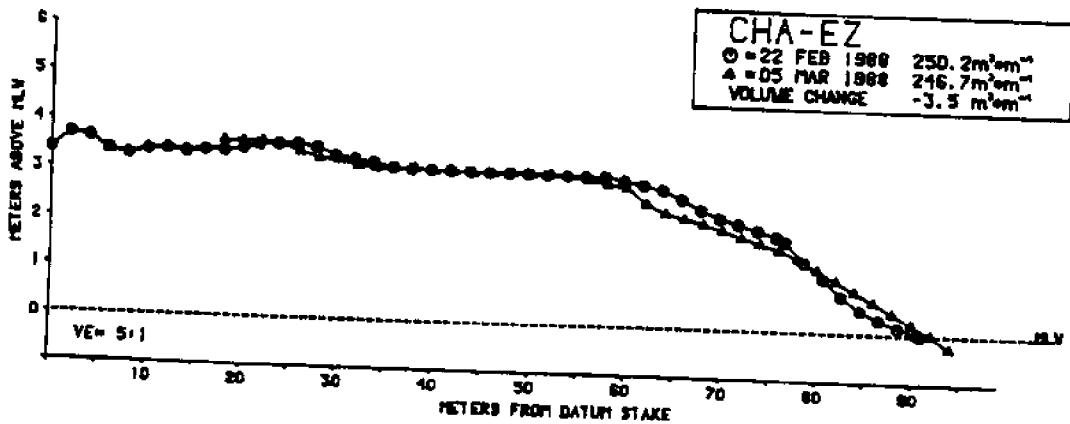
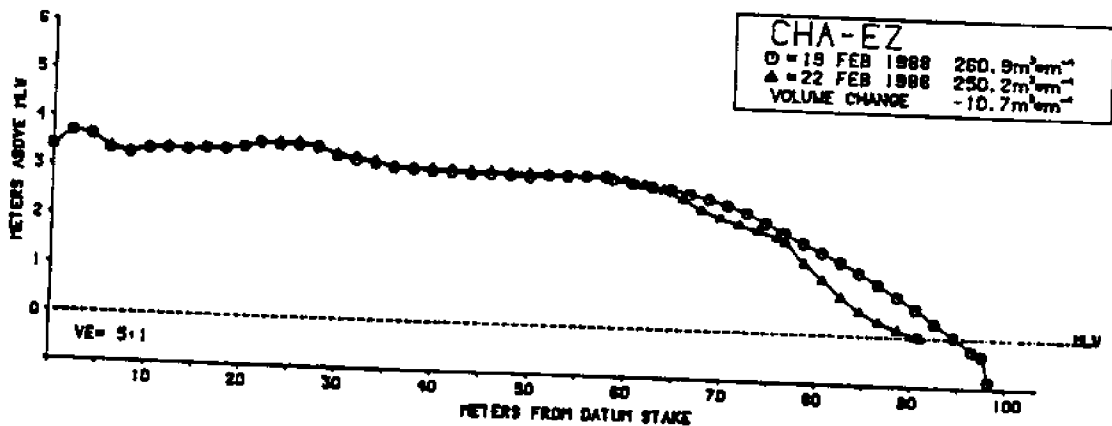
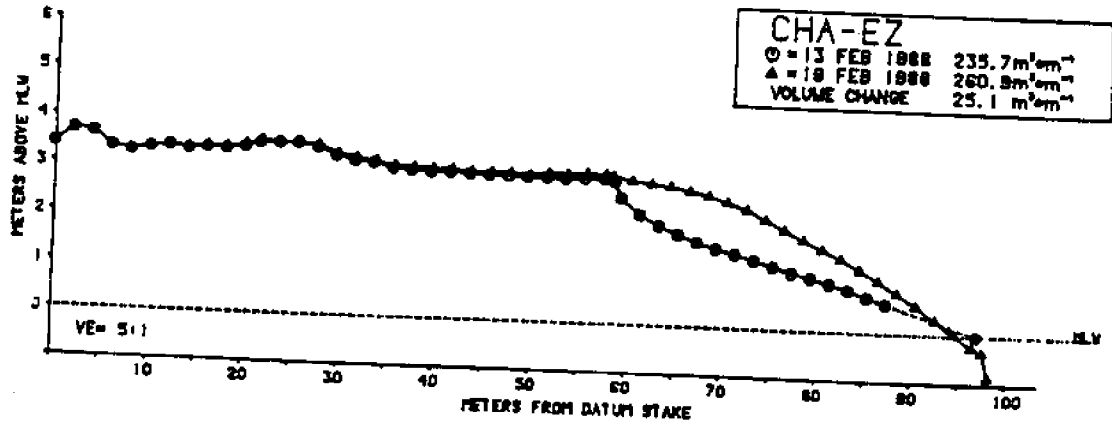


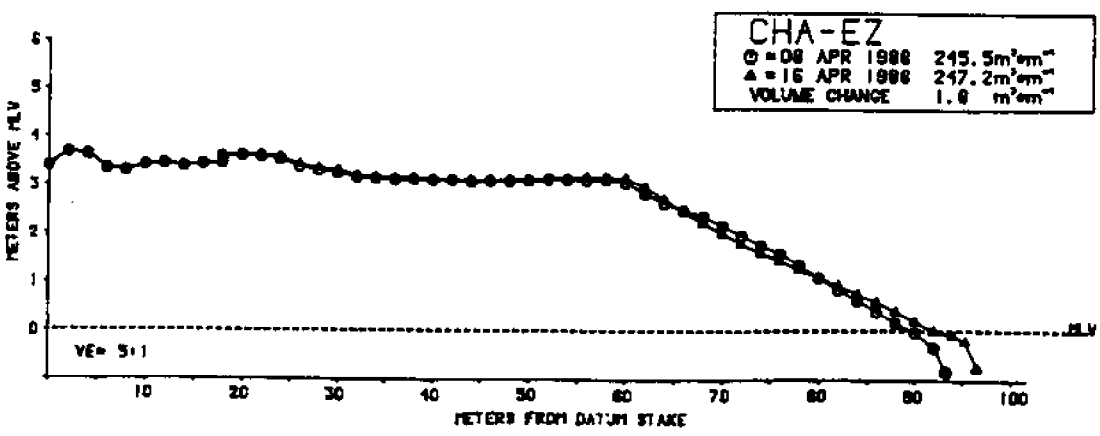
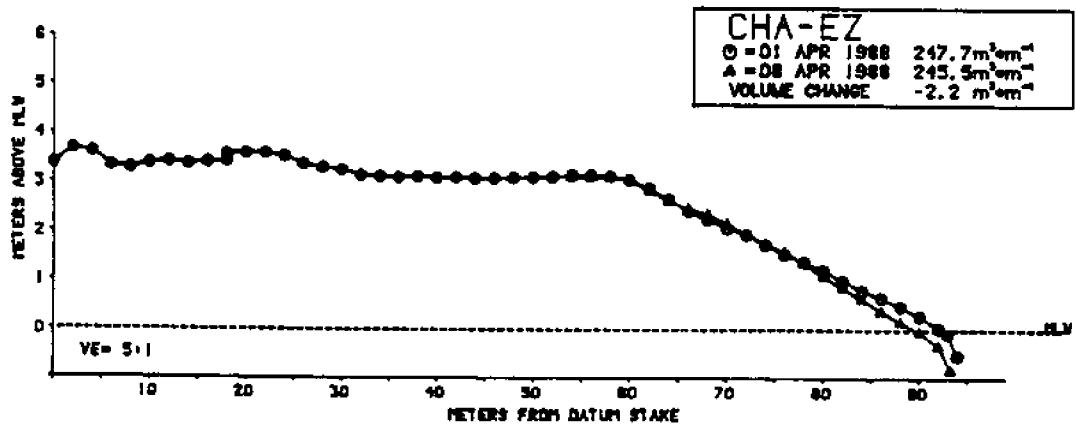
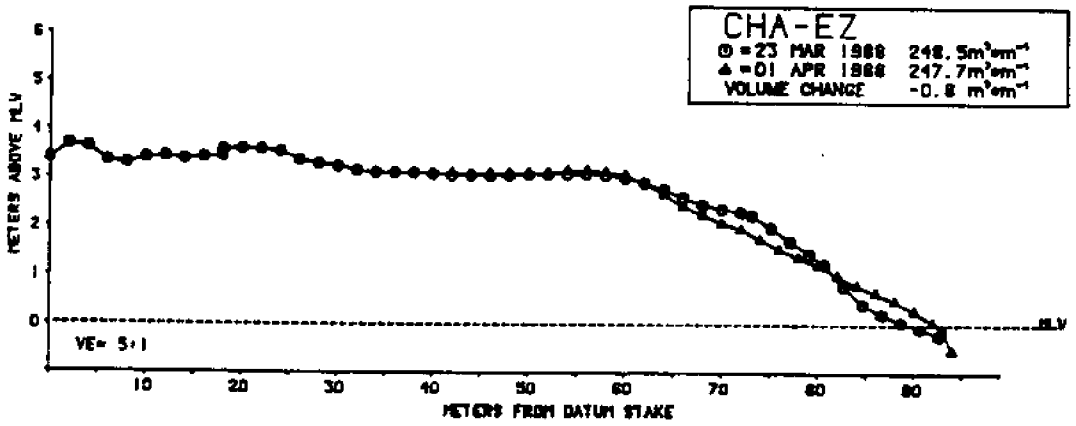
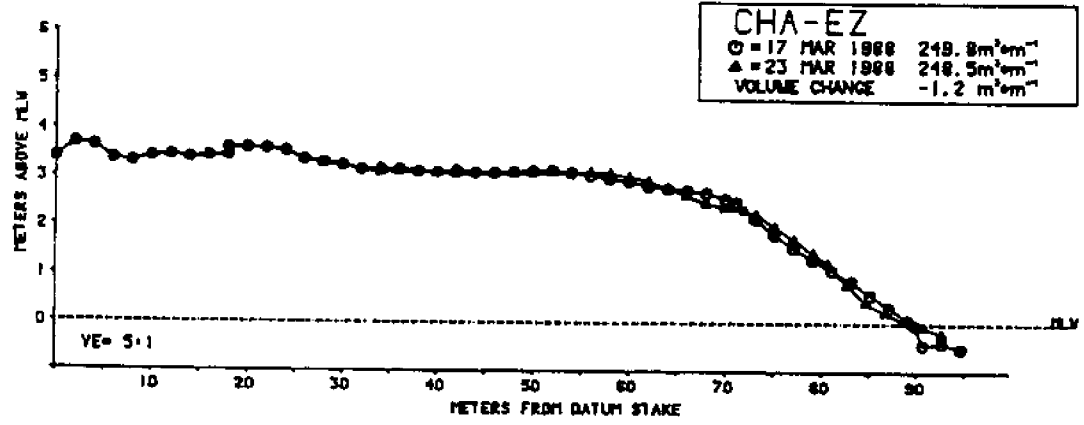






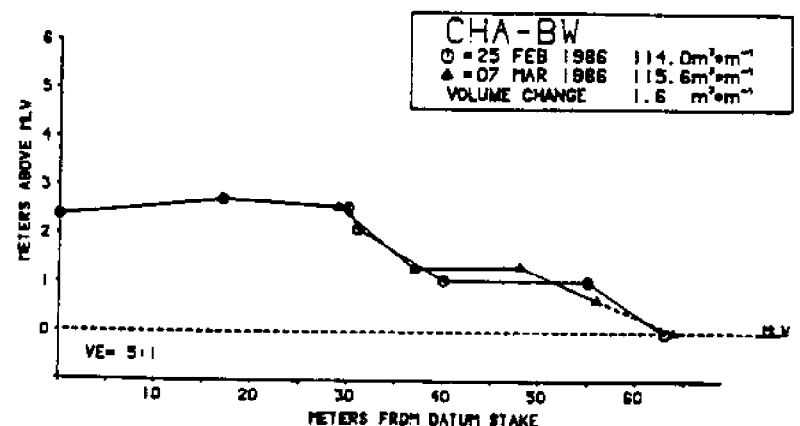
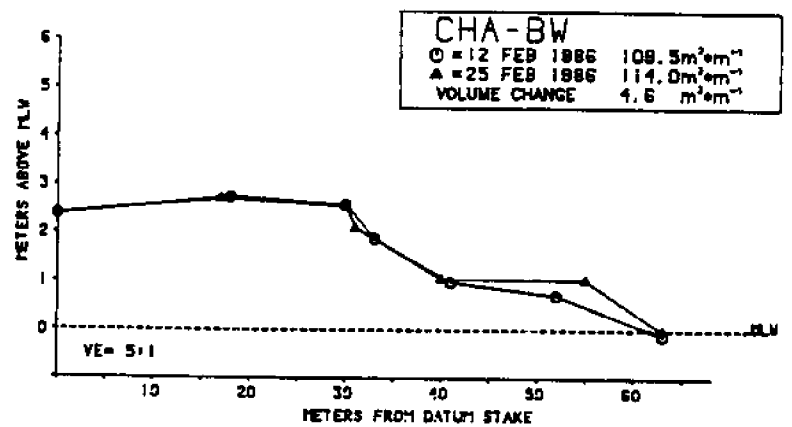
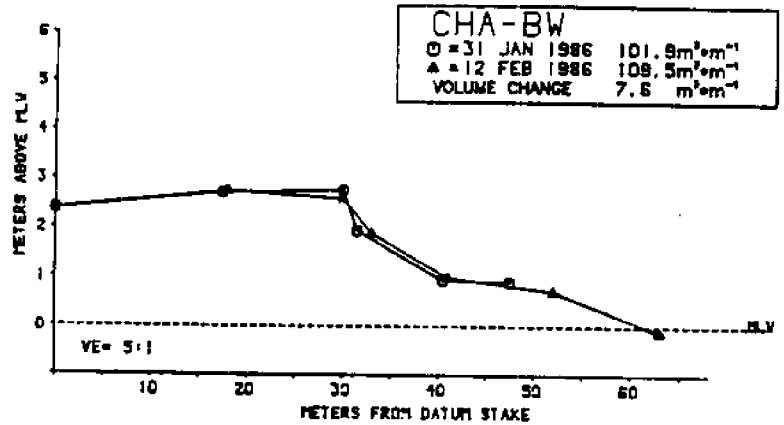
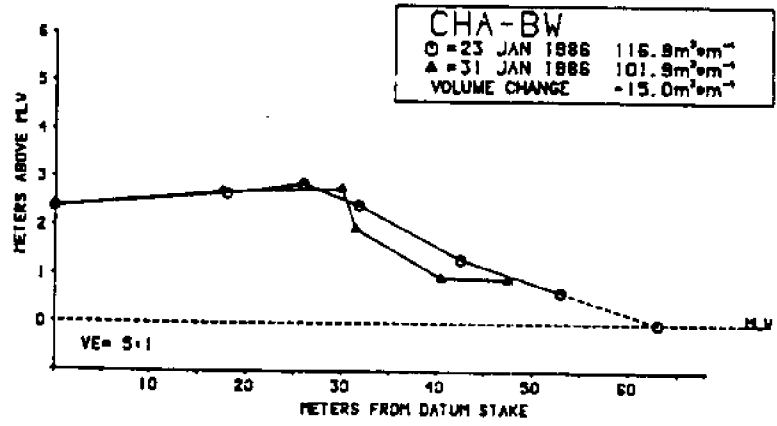


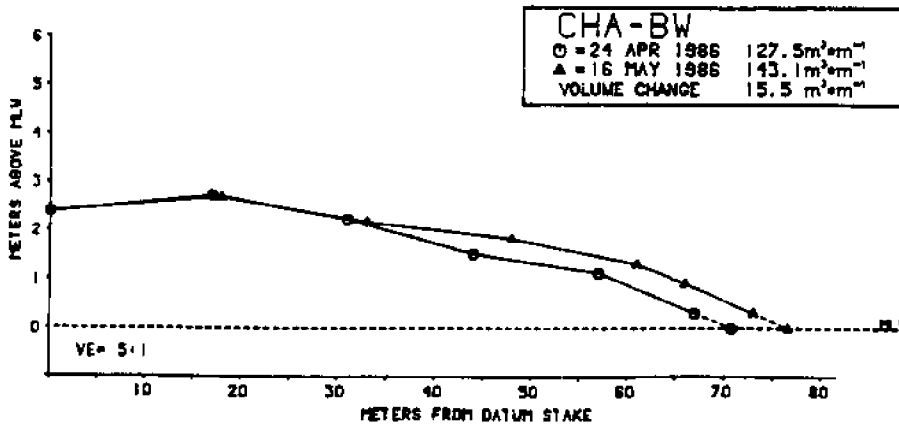
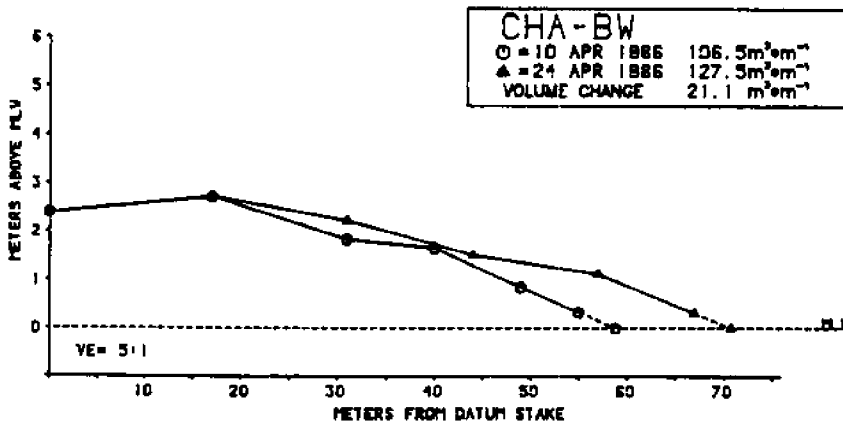
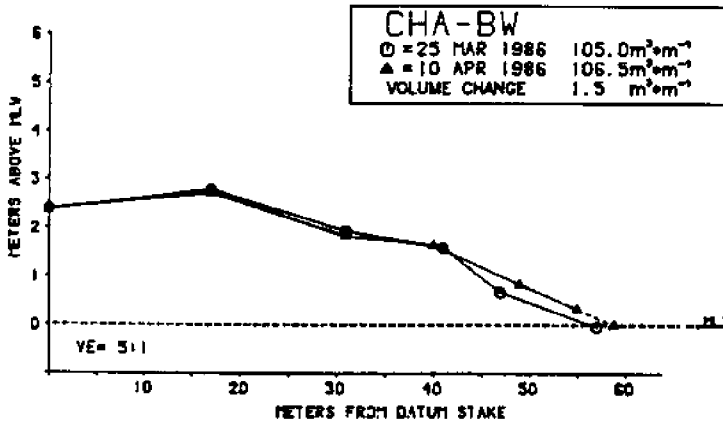
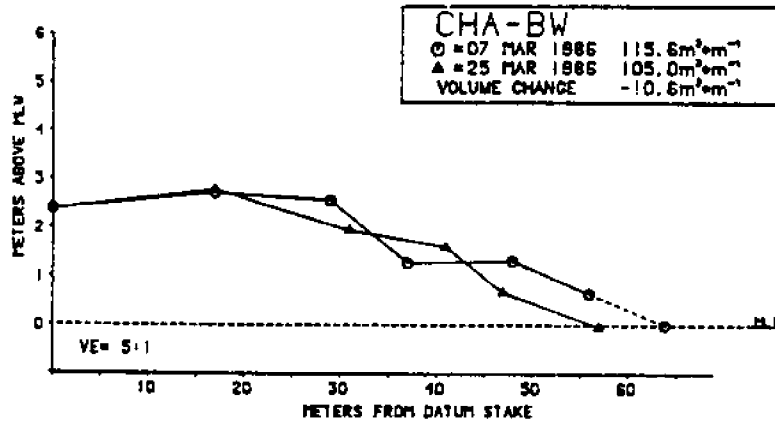




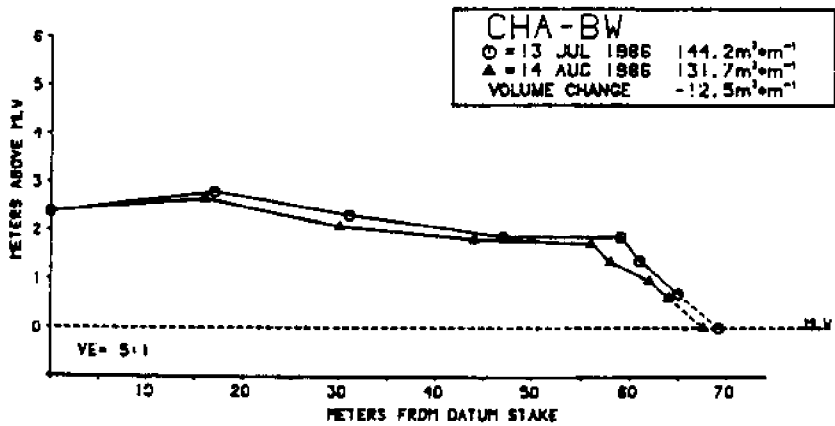
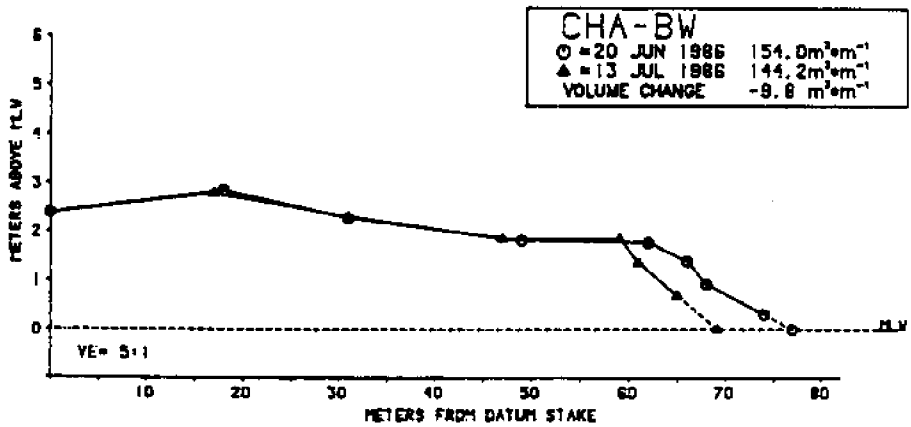
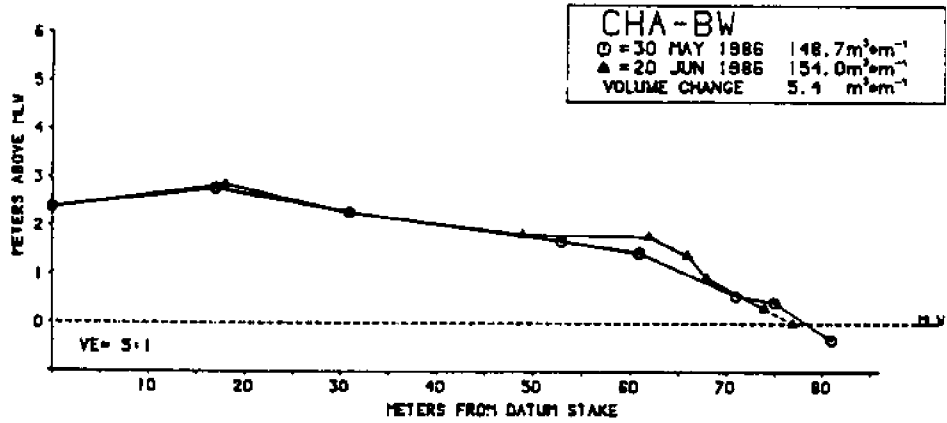
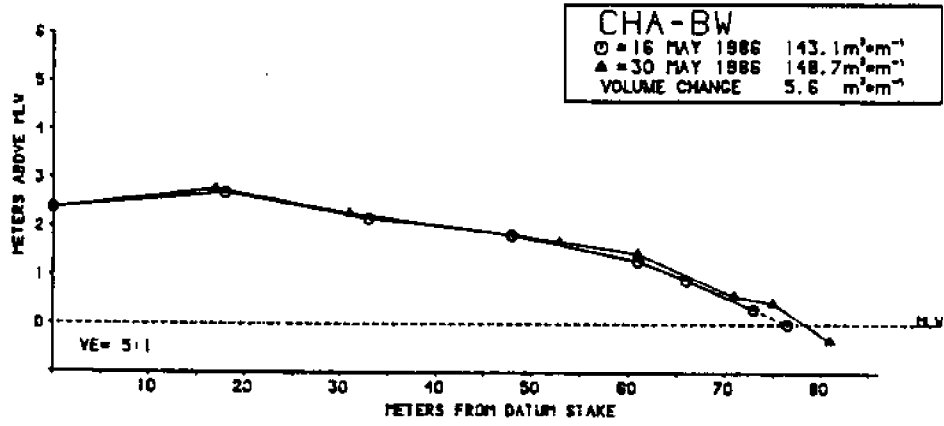
**APPENDIX 1B**

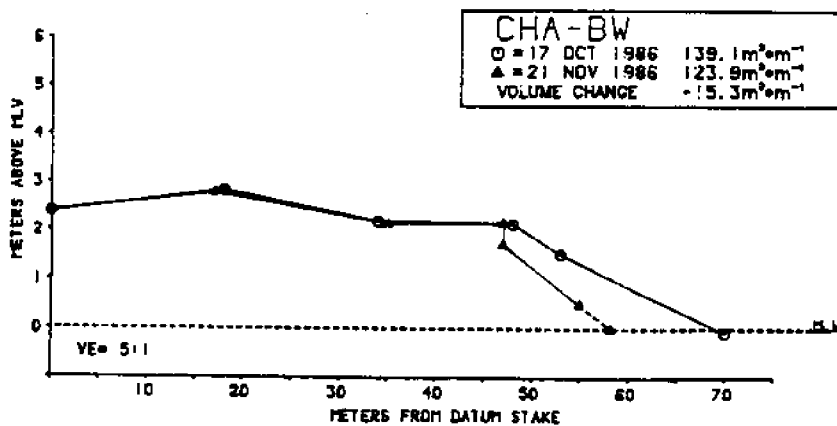
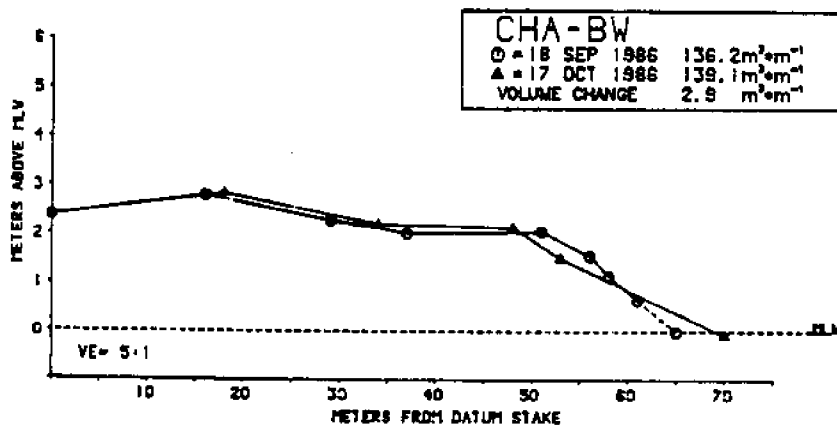
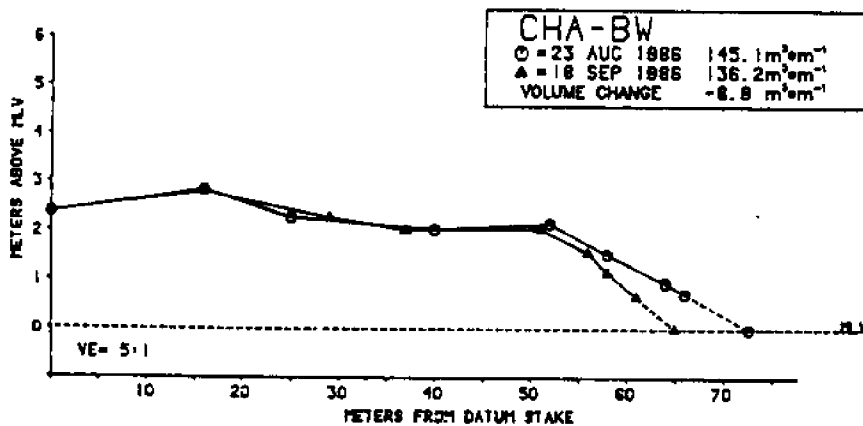
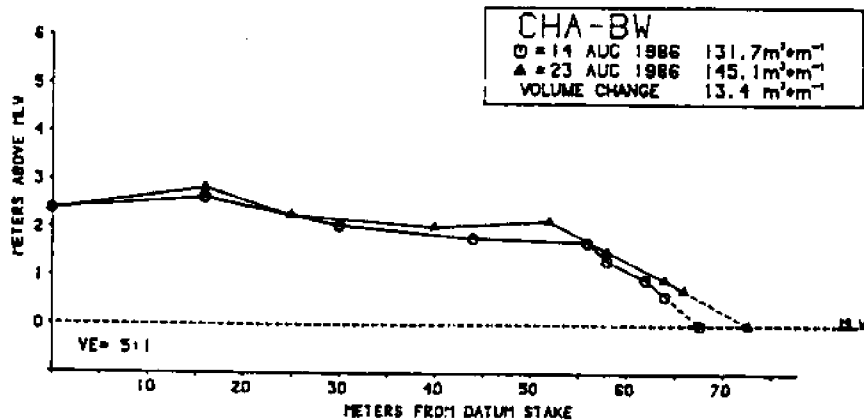
**CHA-BW Profile Plots**

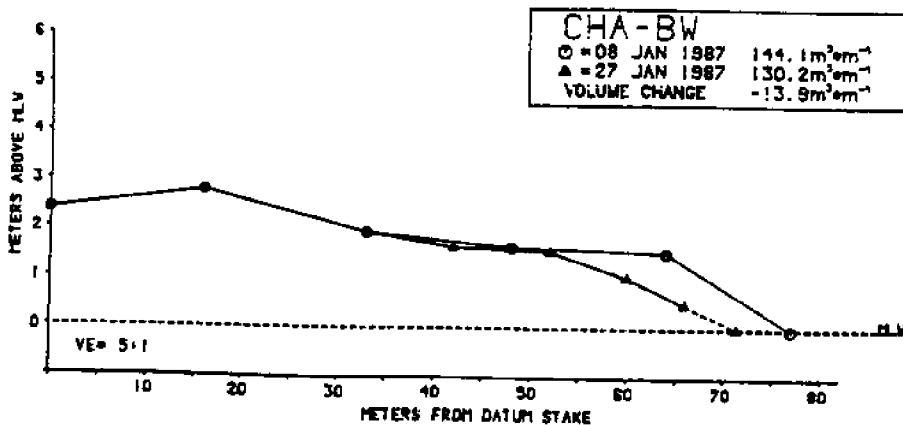
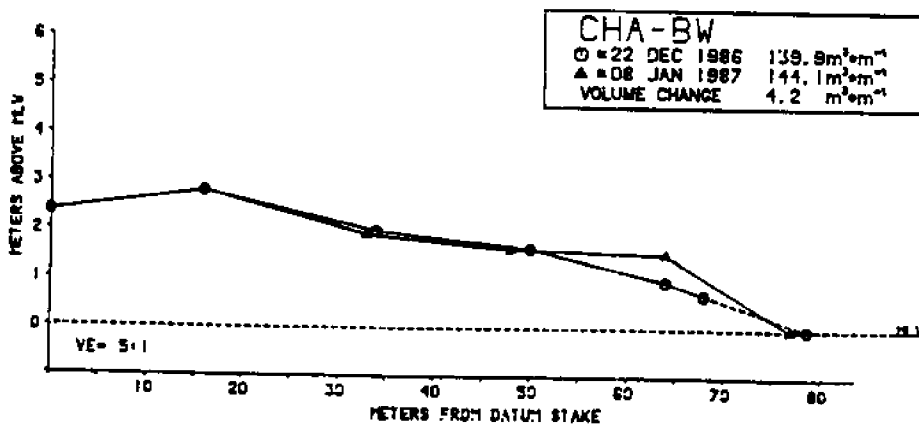
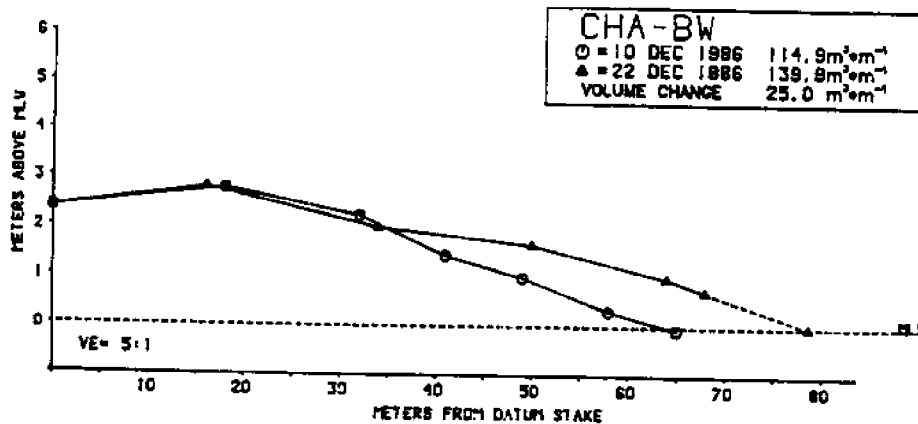
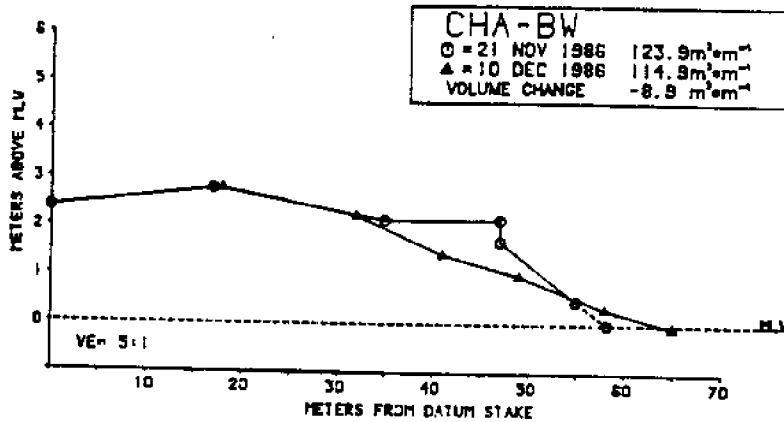


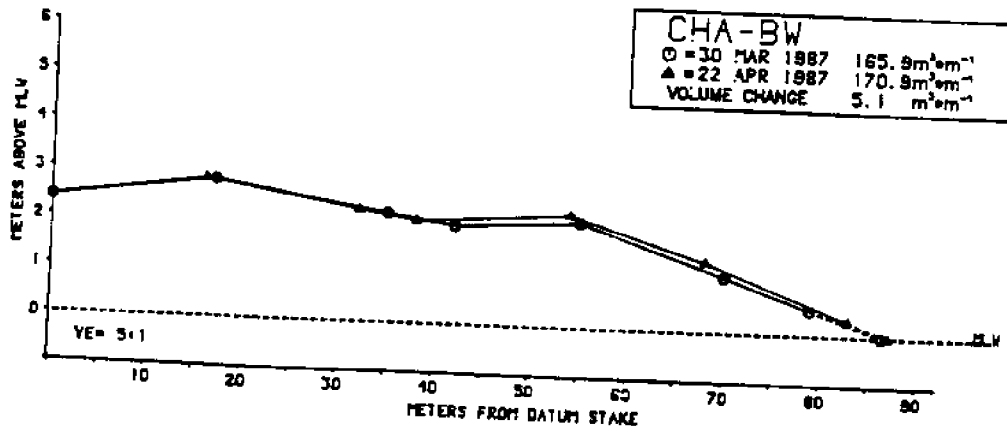
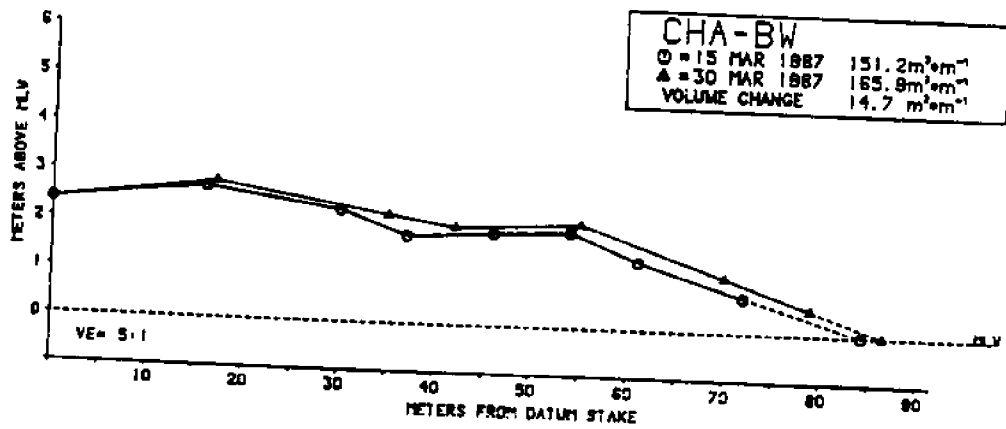
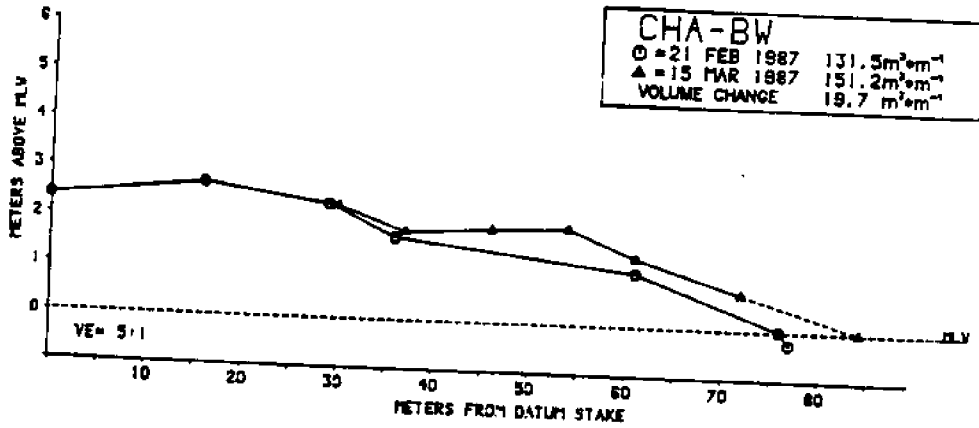
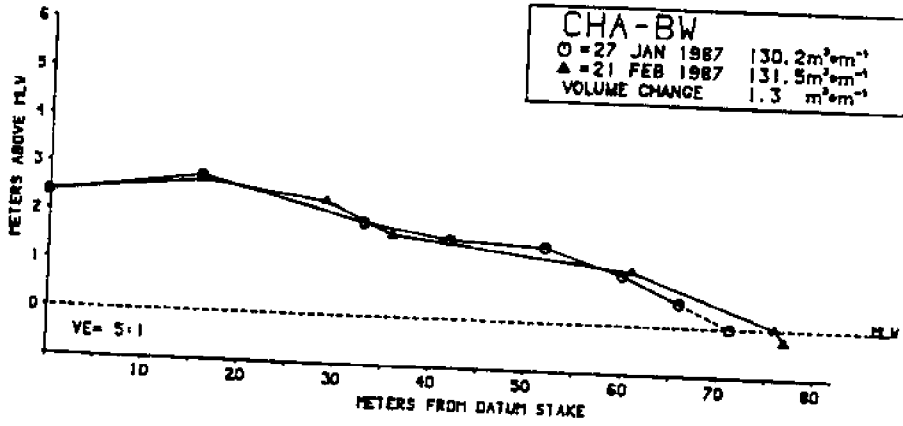


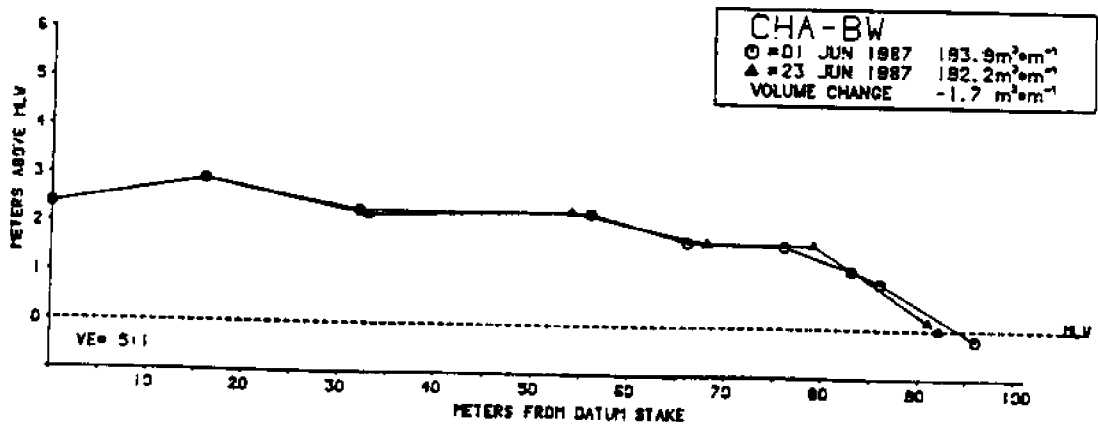
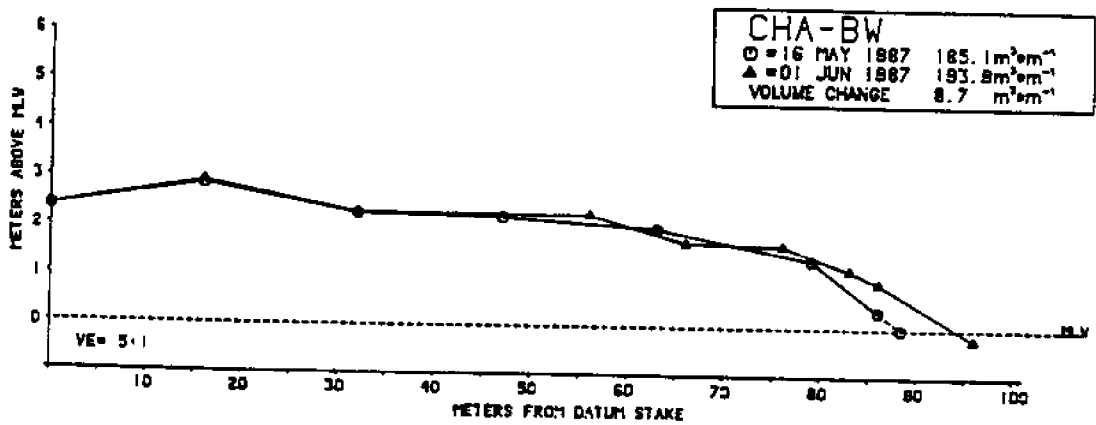
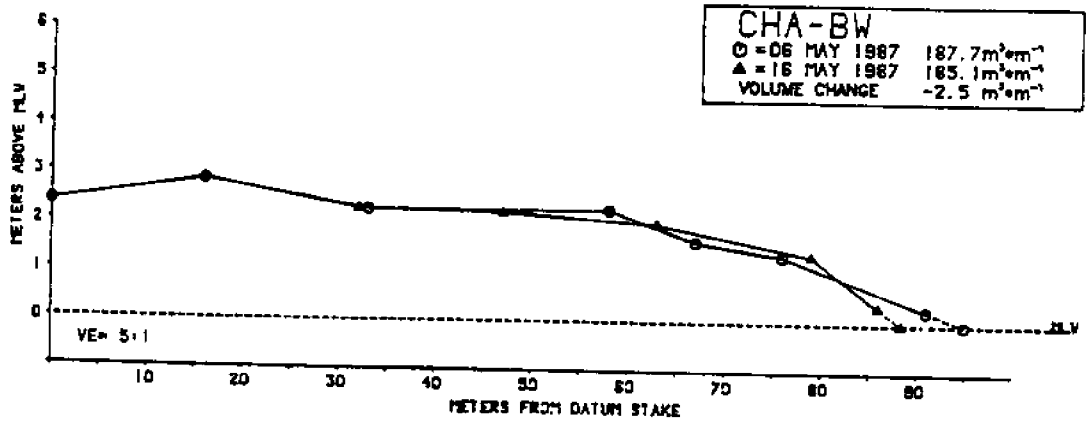
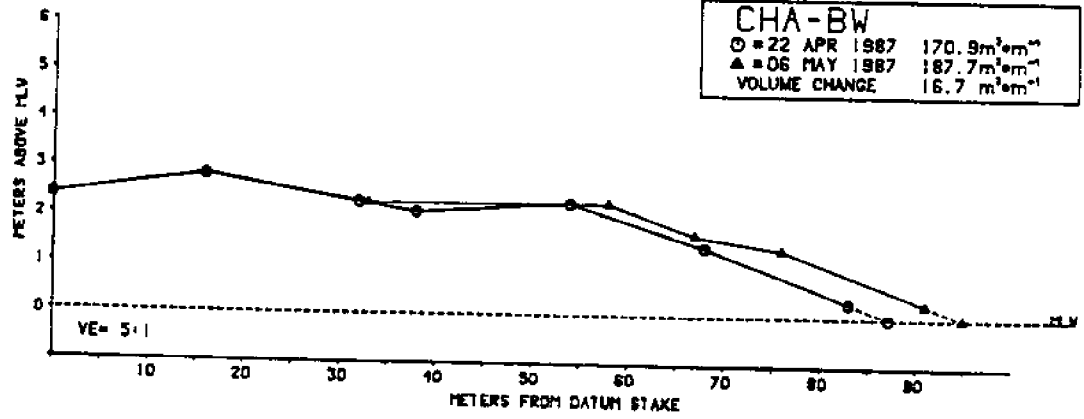


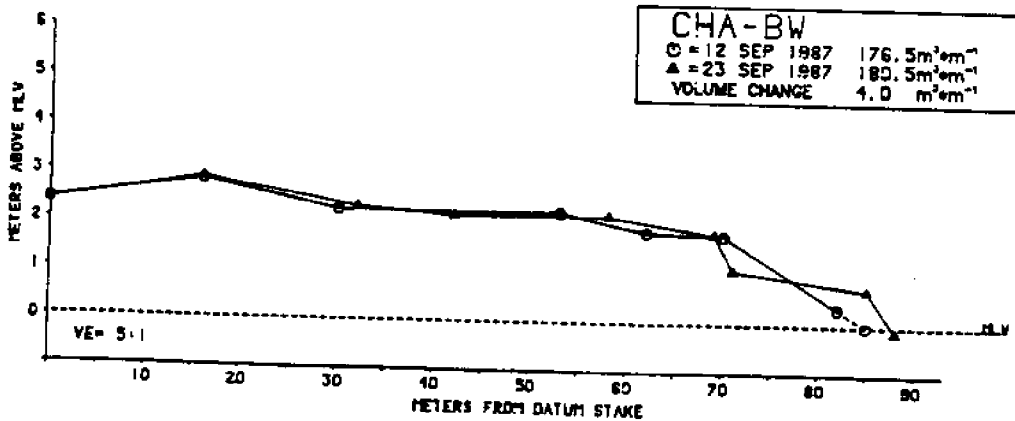
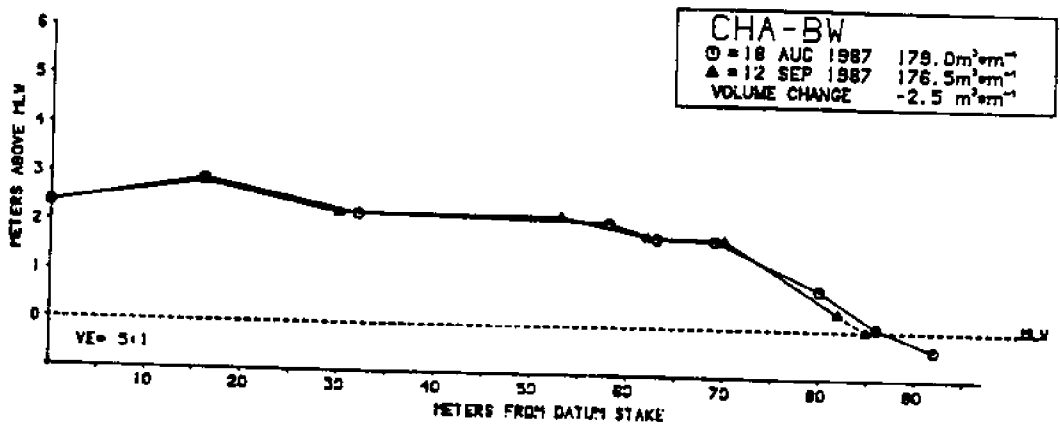
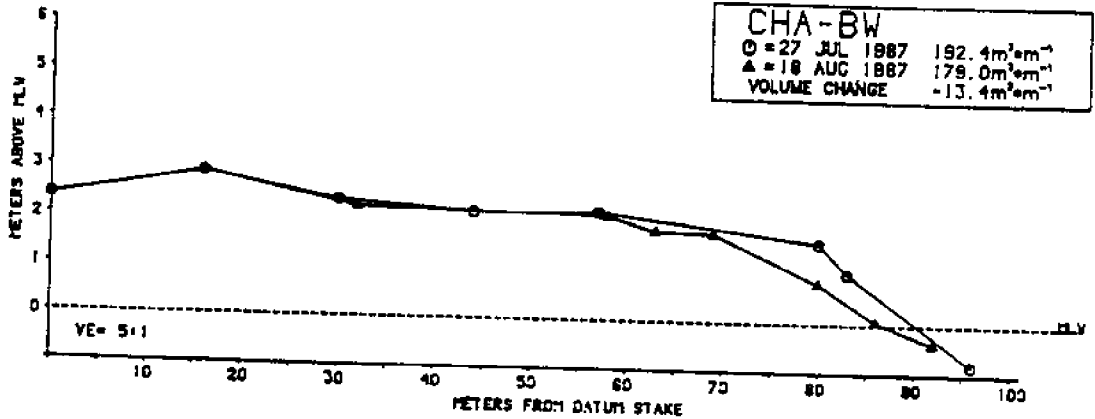
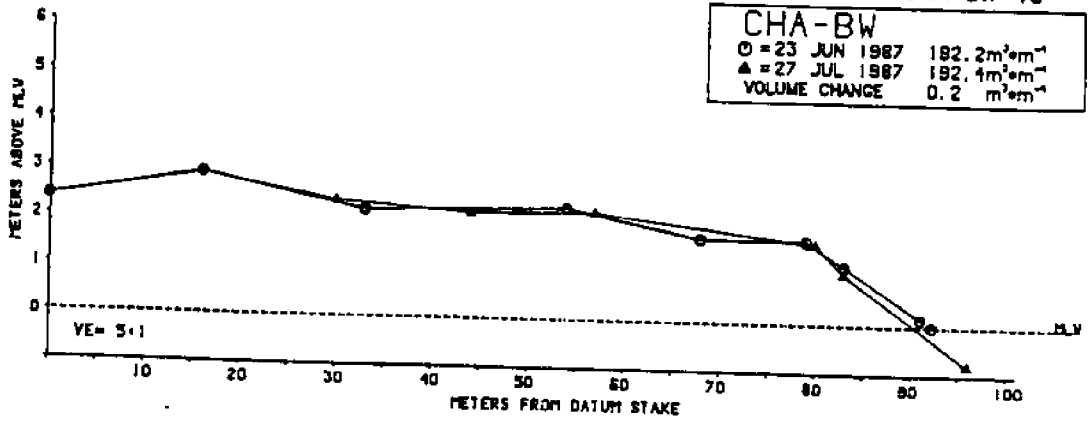


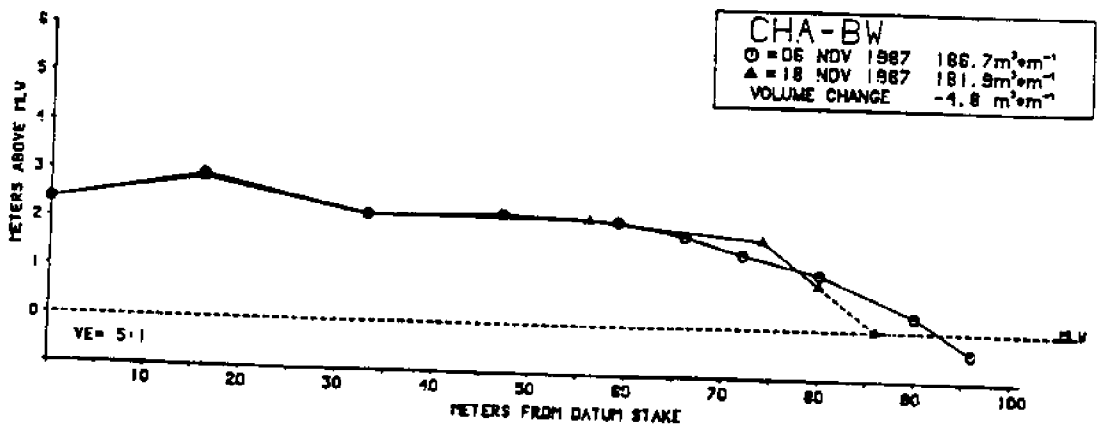
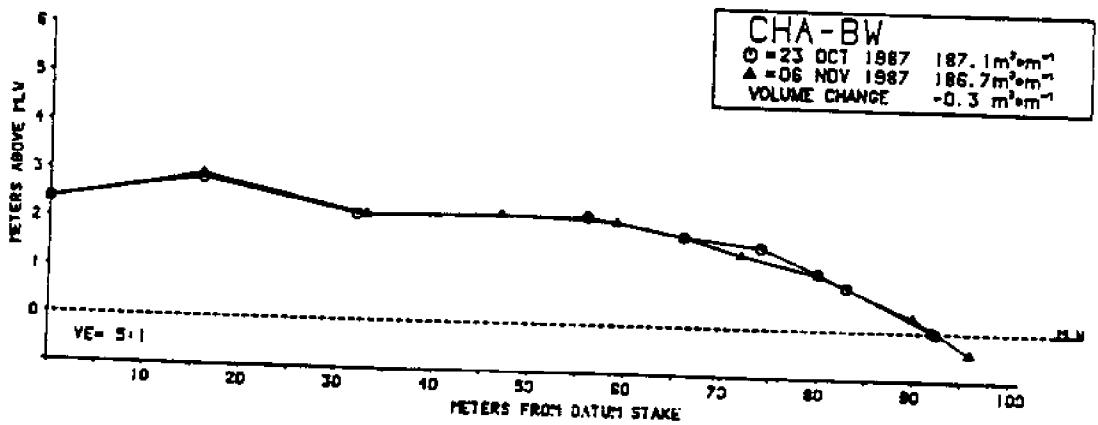
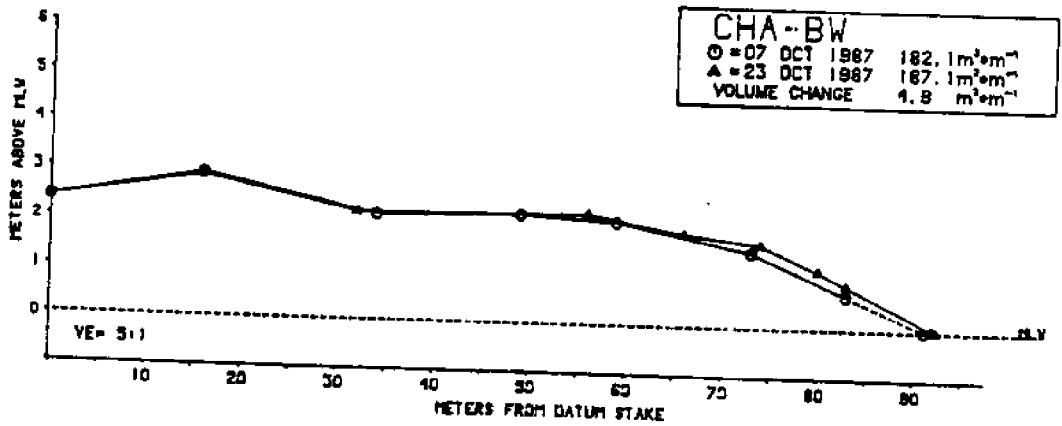
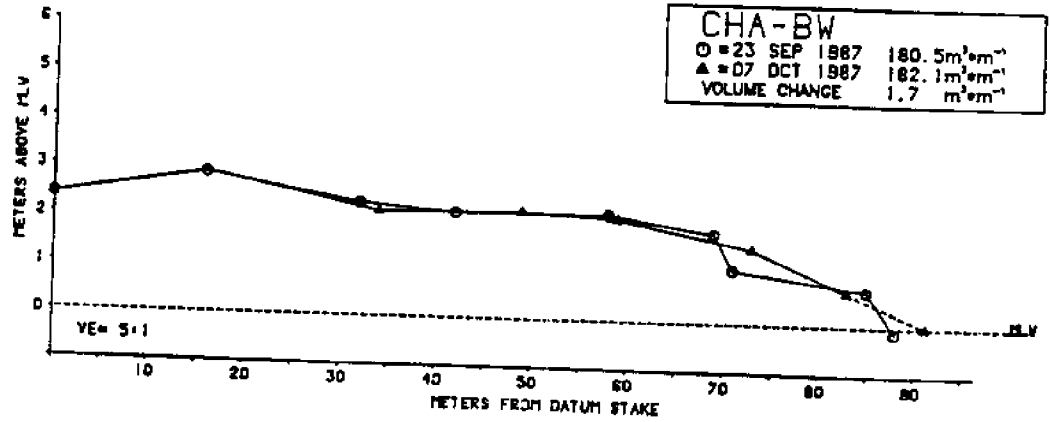


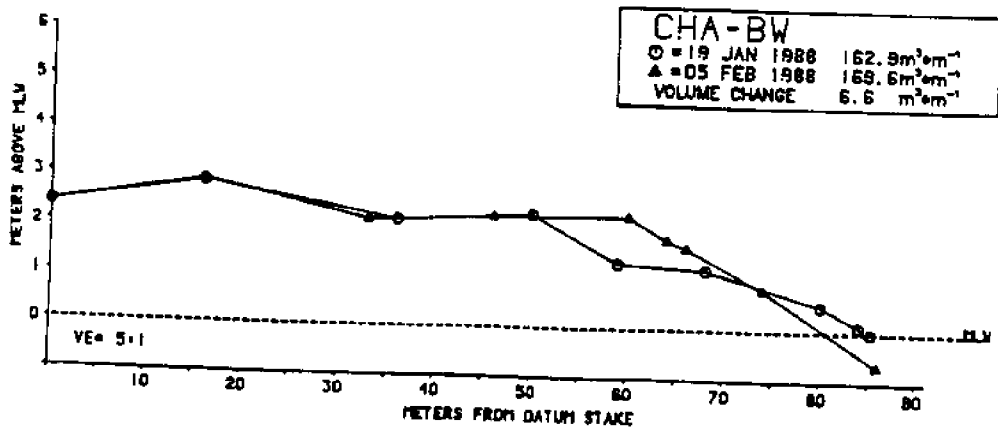
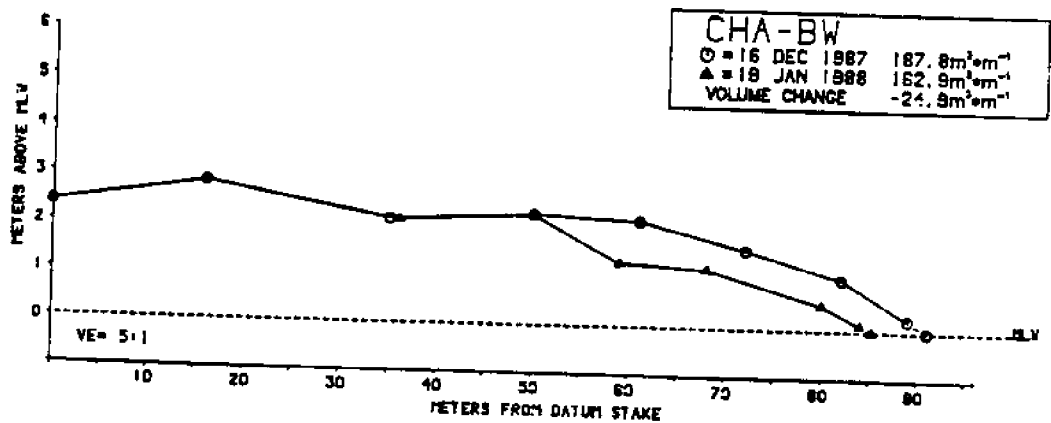
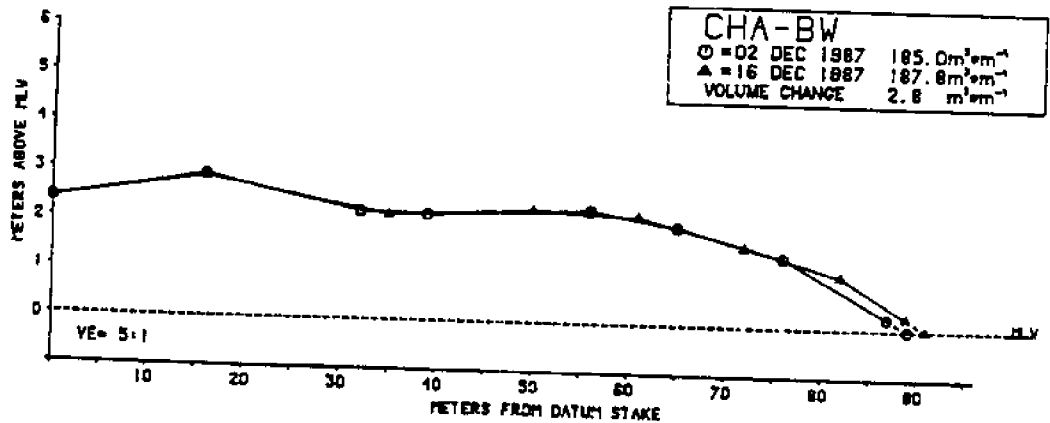
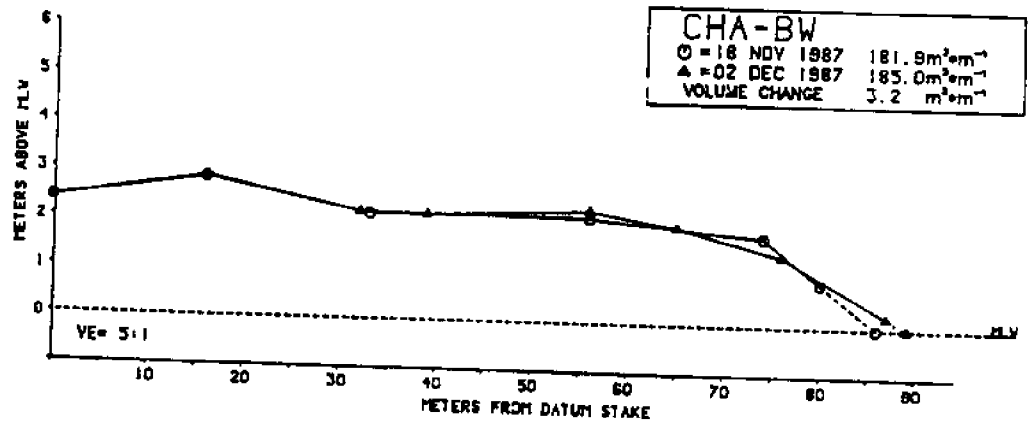




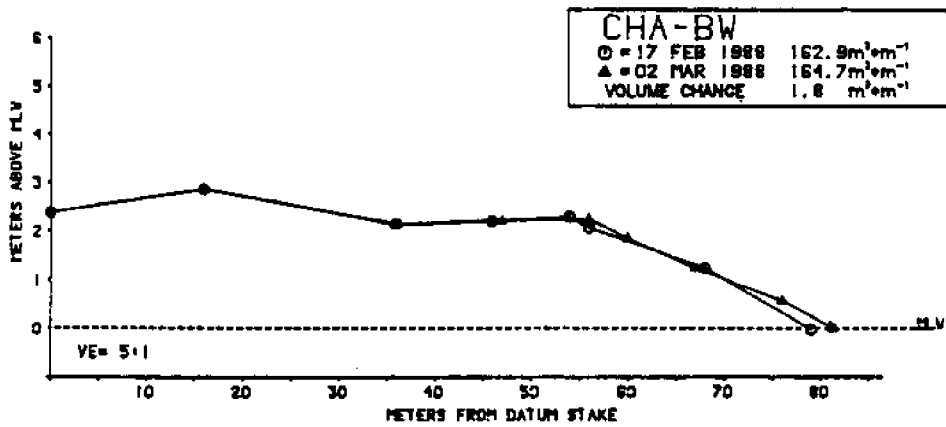
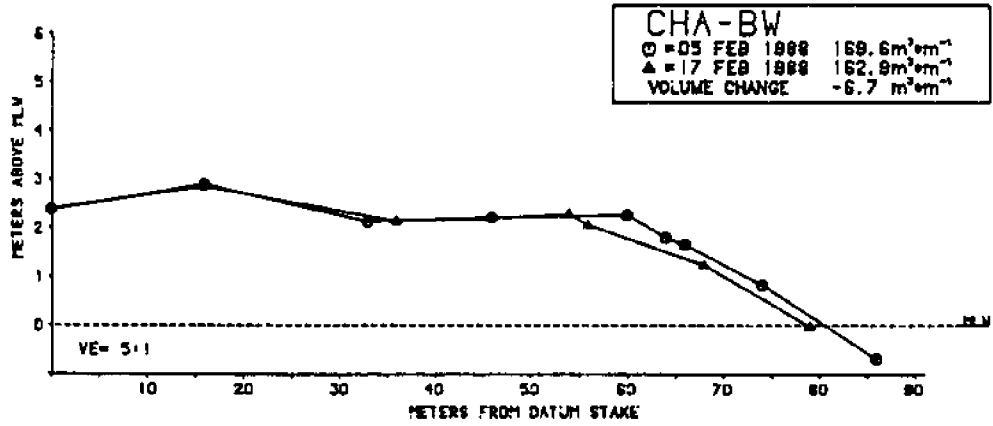




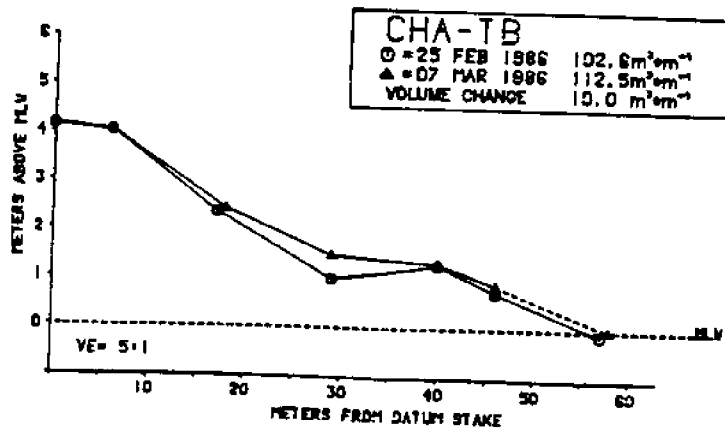
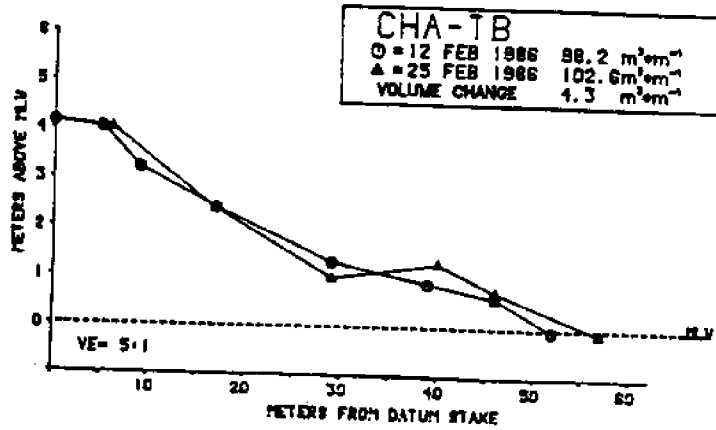
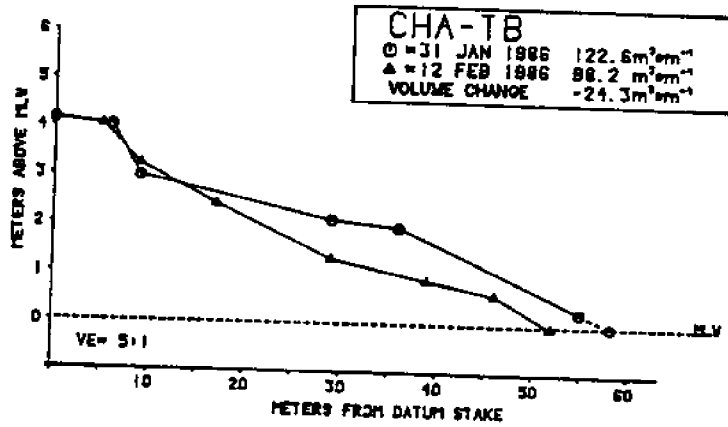
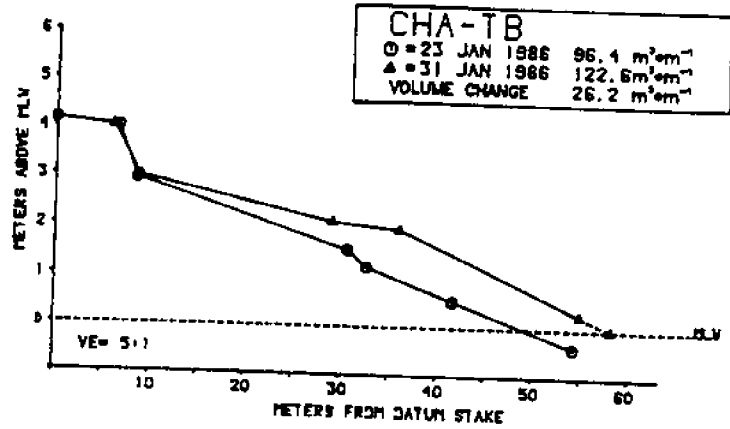


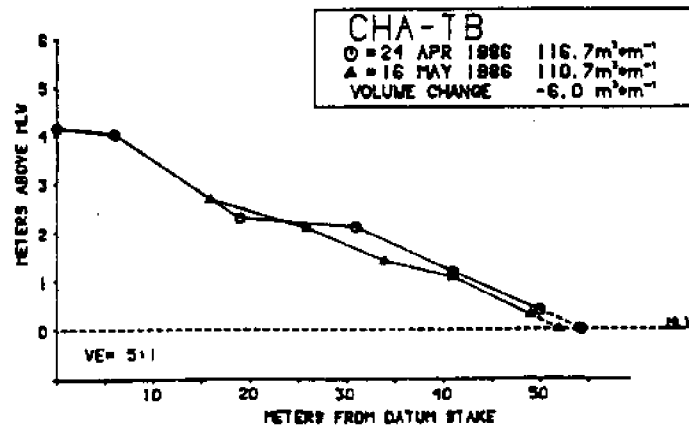
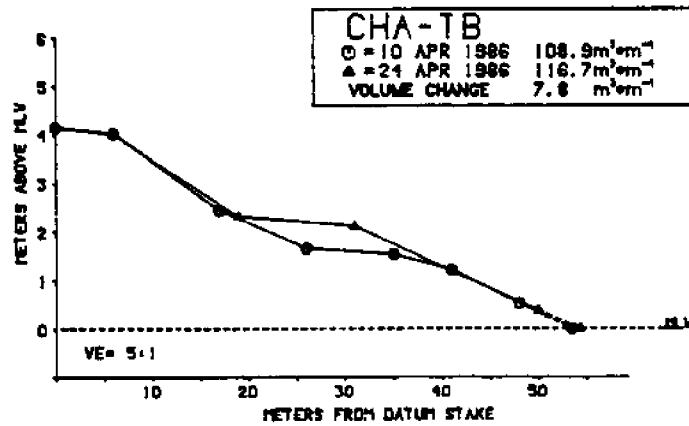
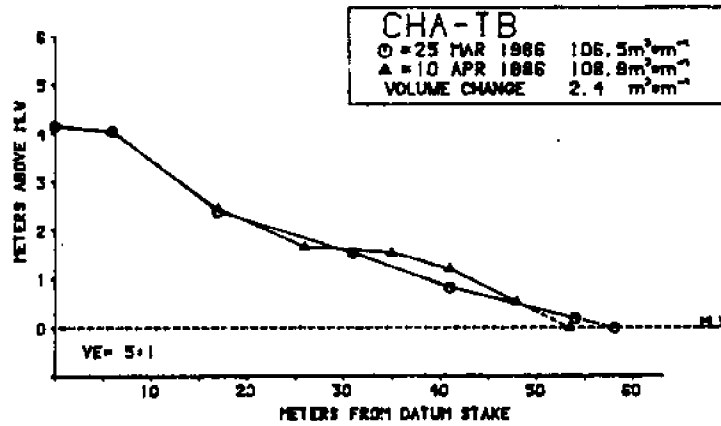
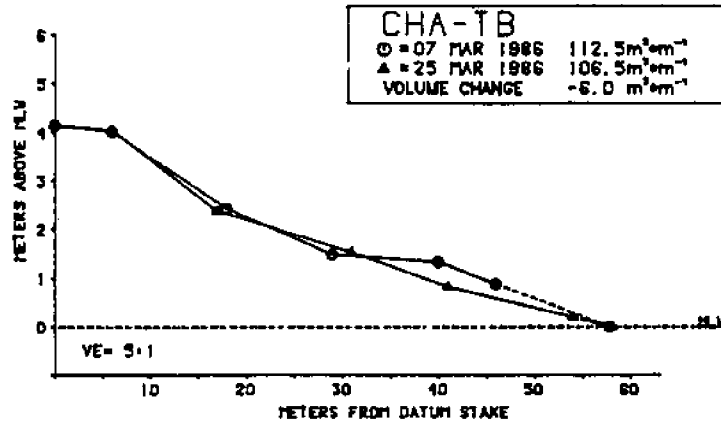


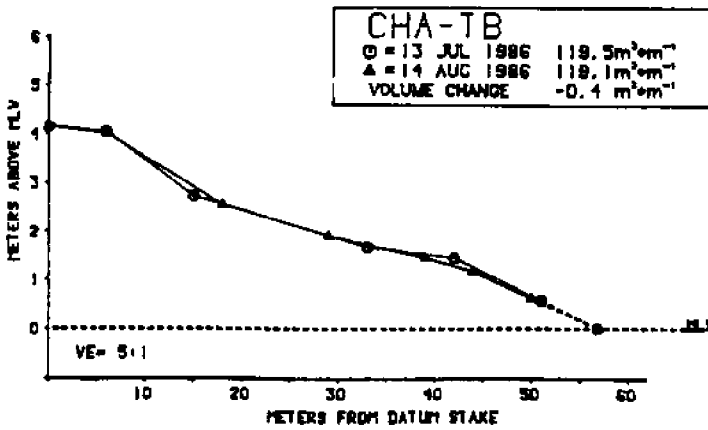
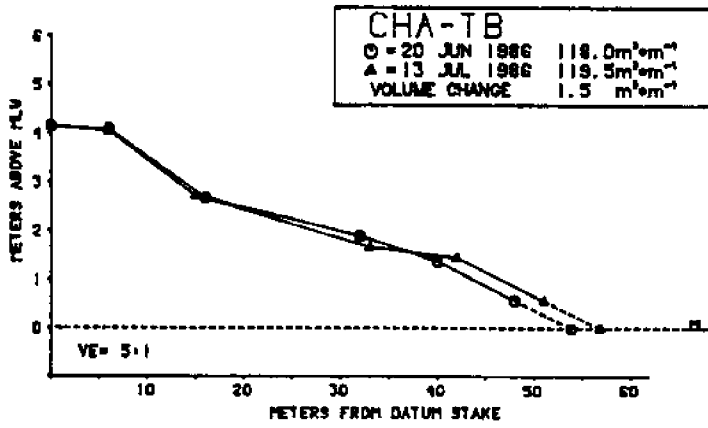
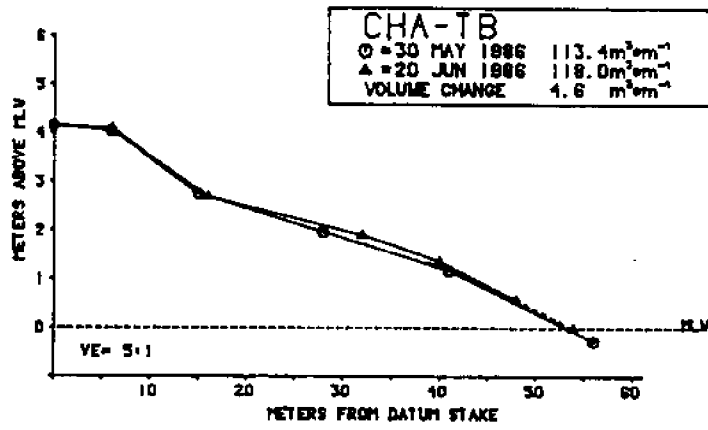
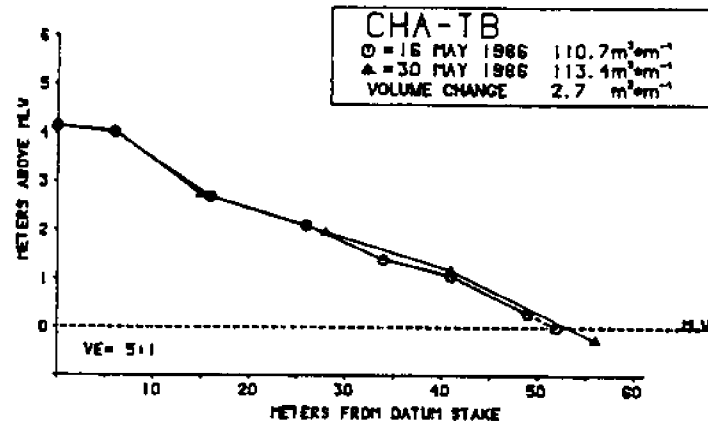


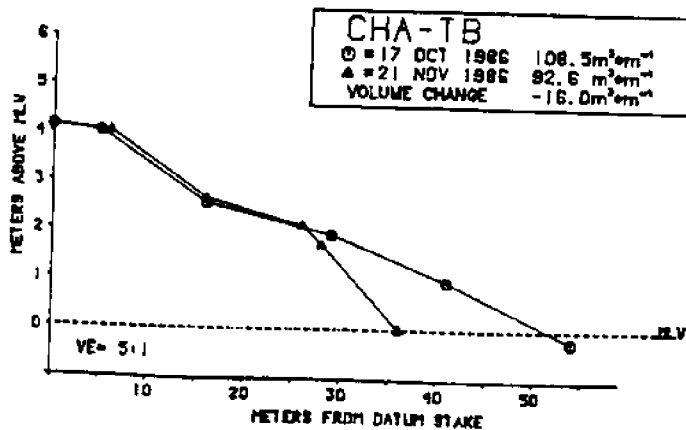
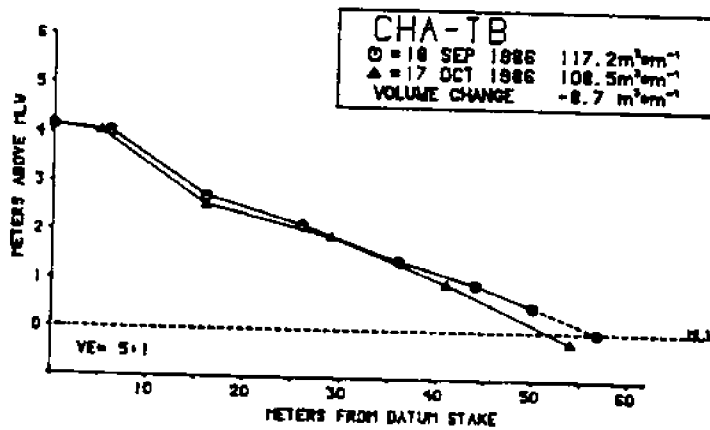
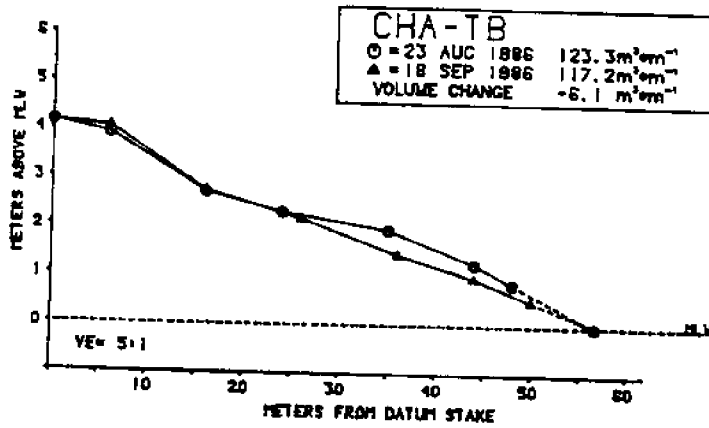
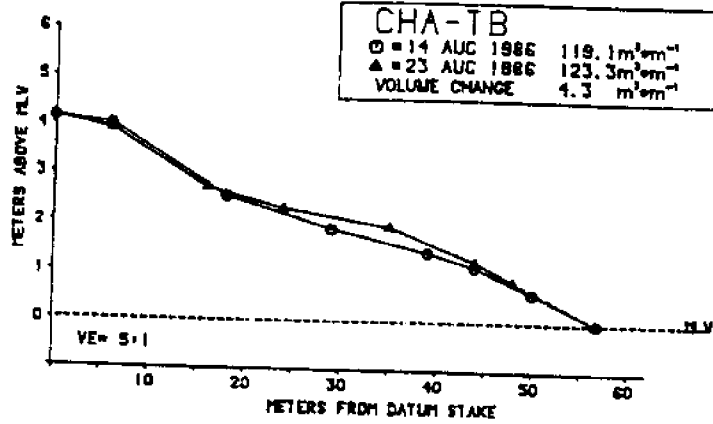


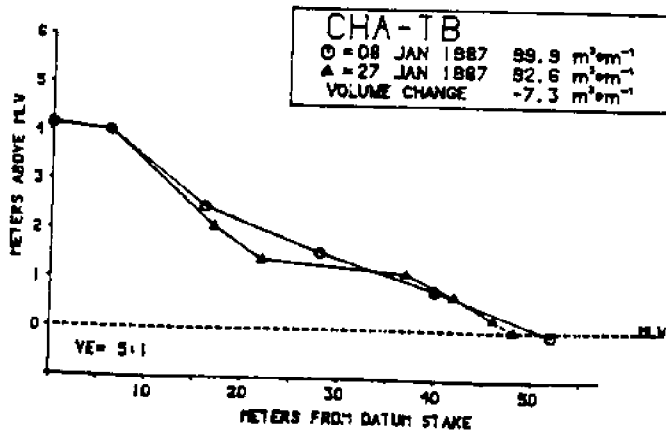
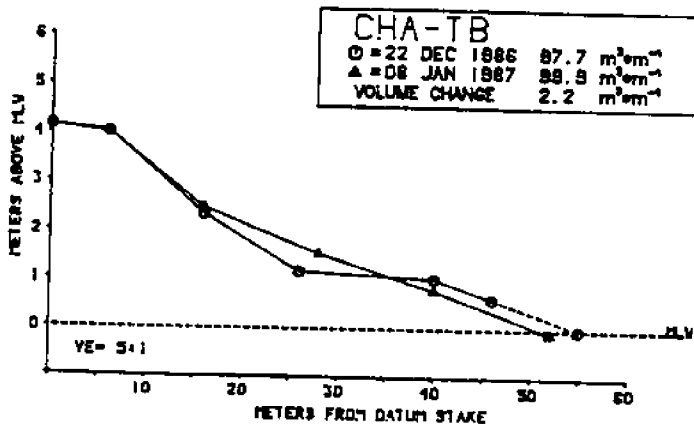
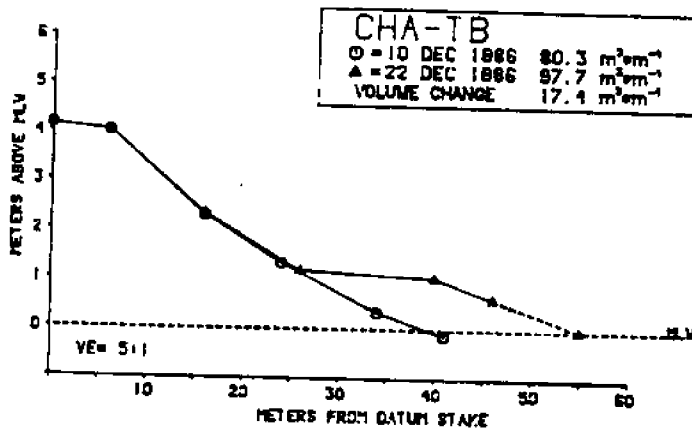
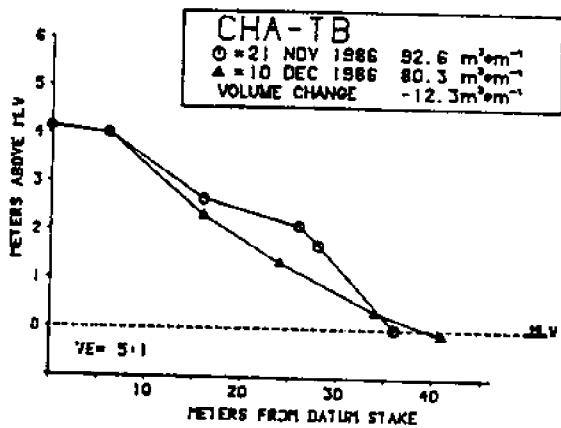
**APPENDIX 1C**  
**CHA-TB Profile Plots**

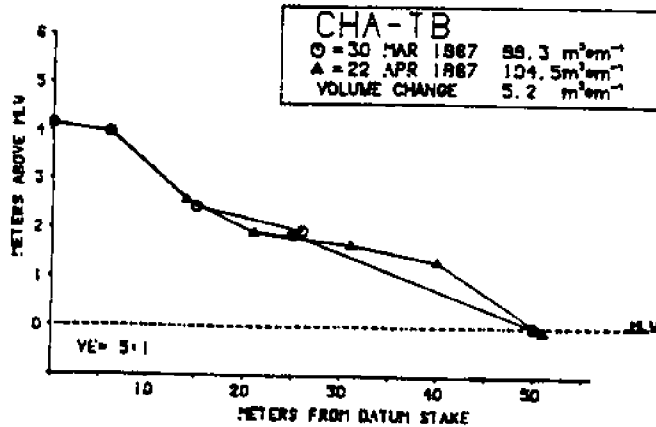
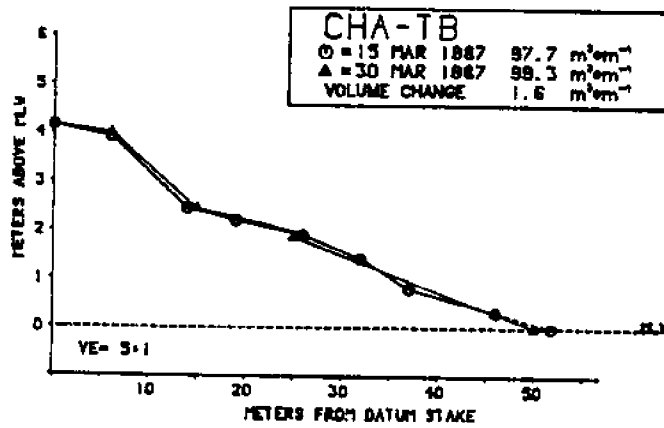
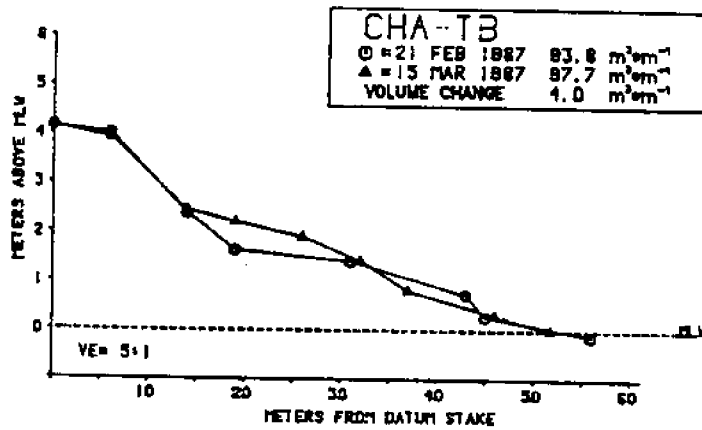
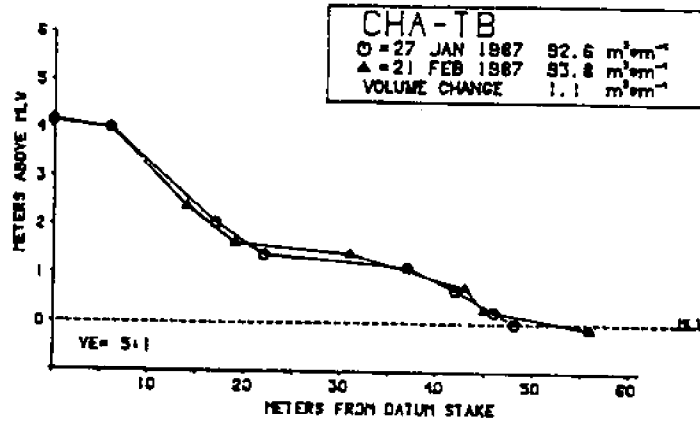




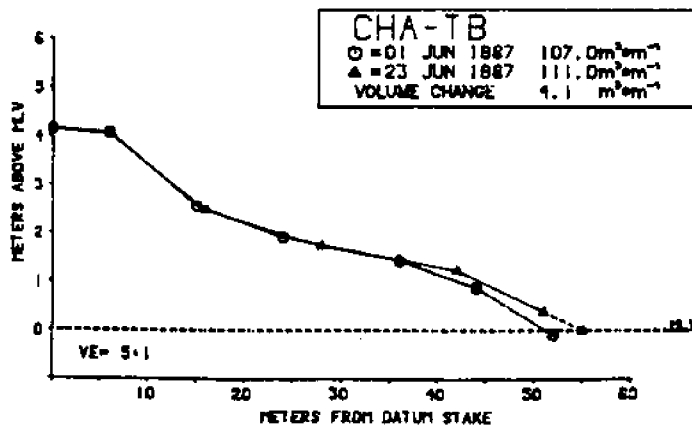
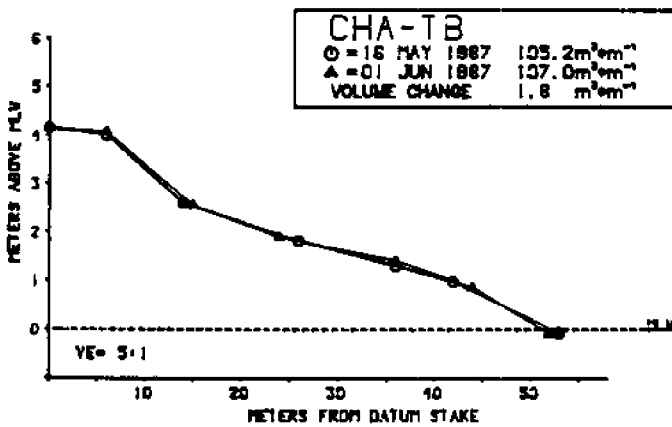
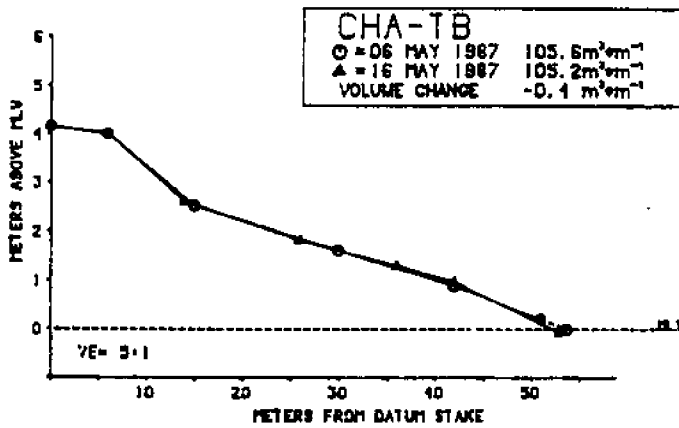
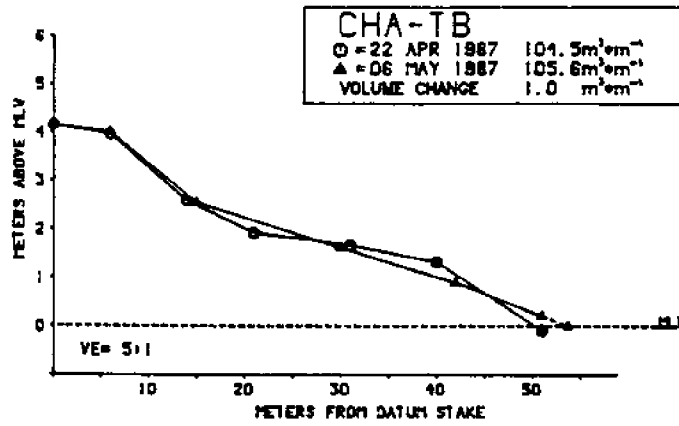


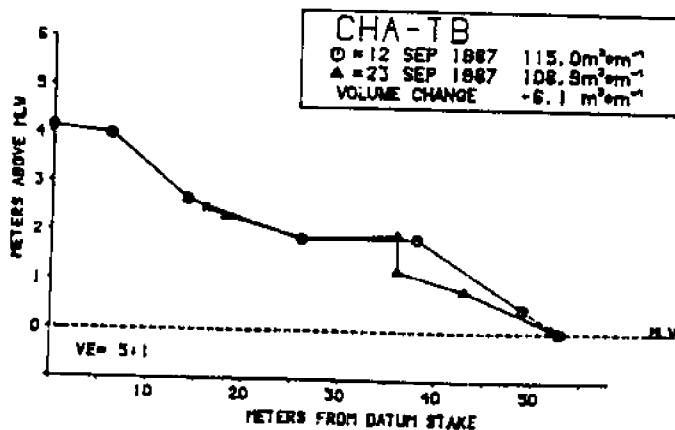
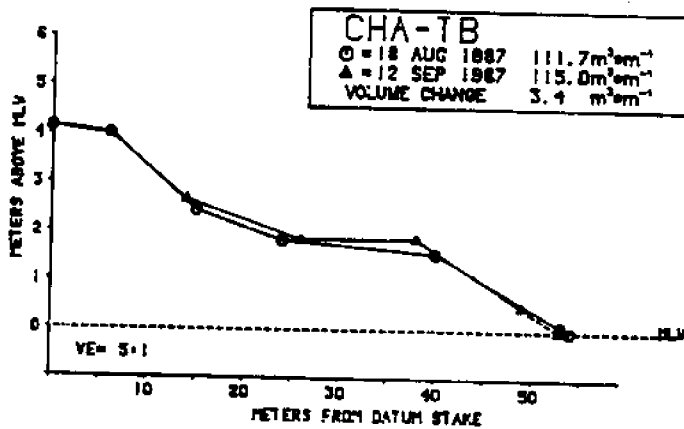
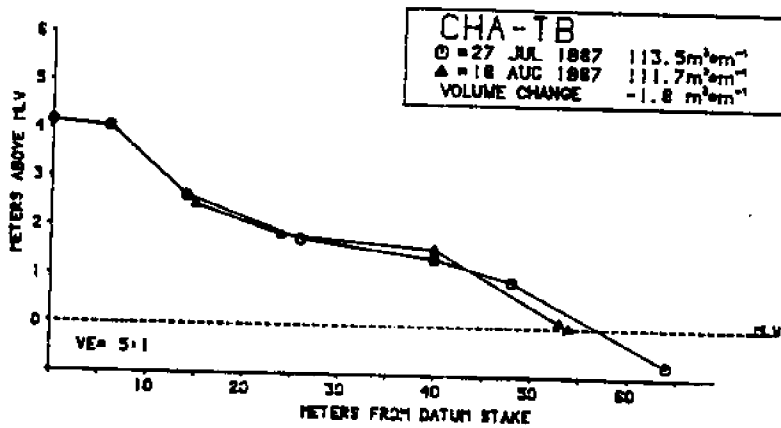
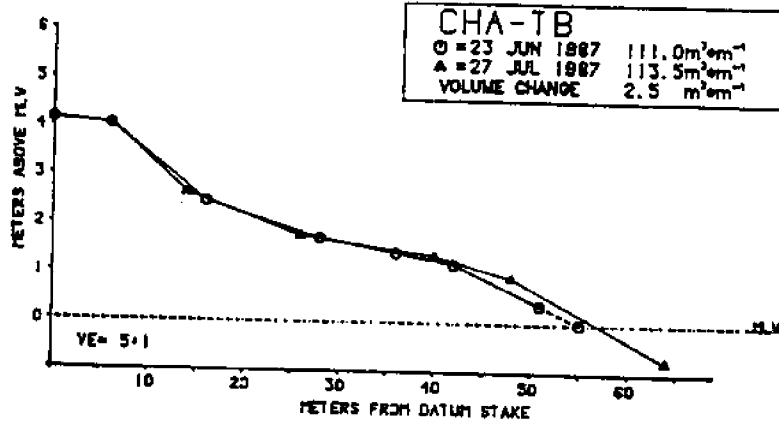


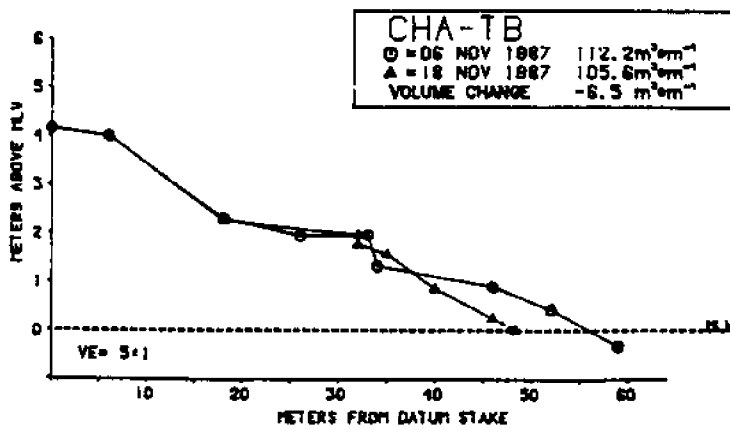
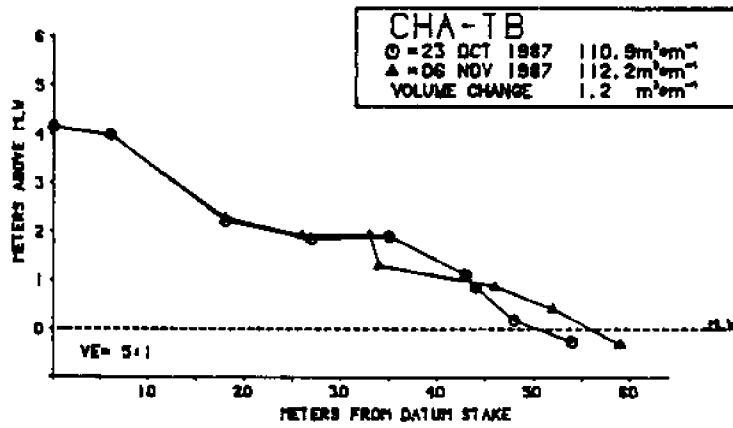
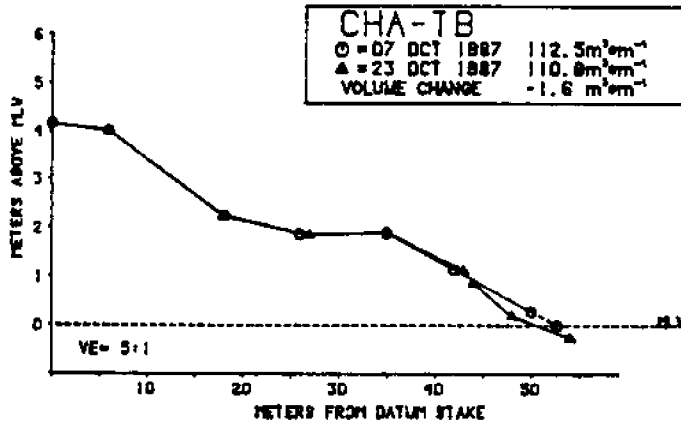
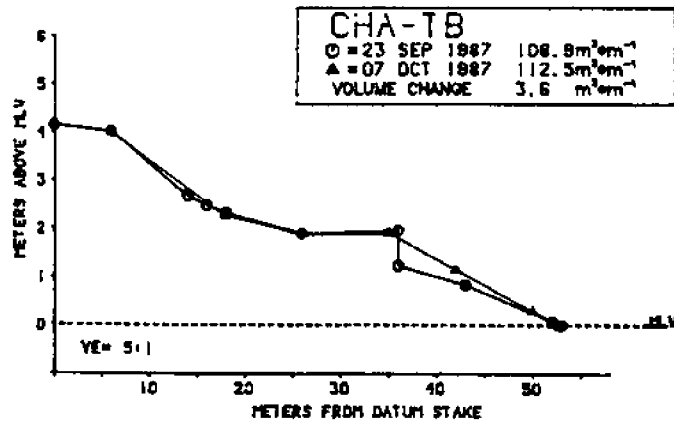


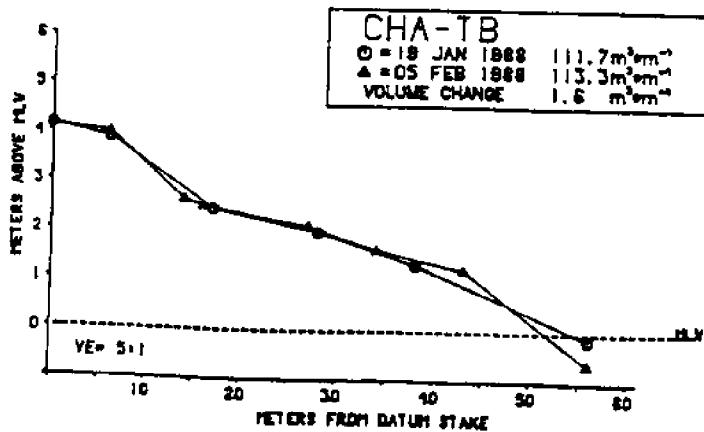
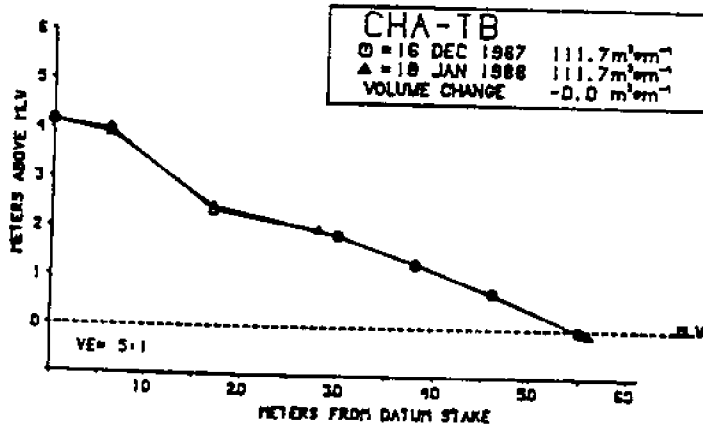
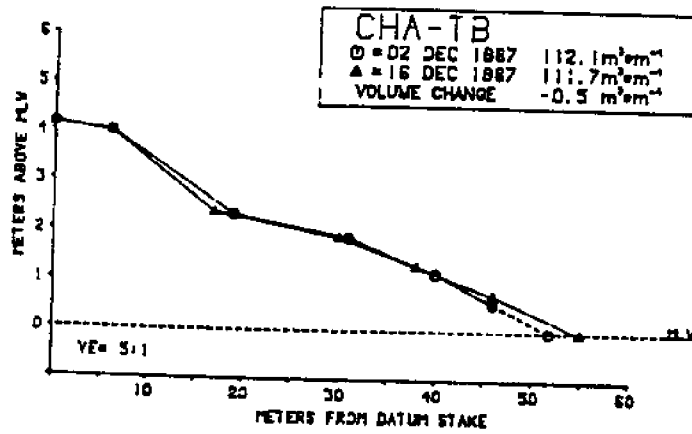
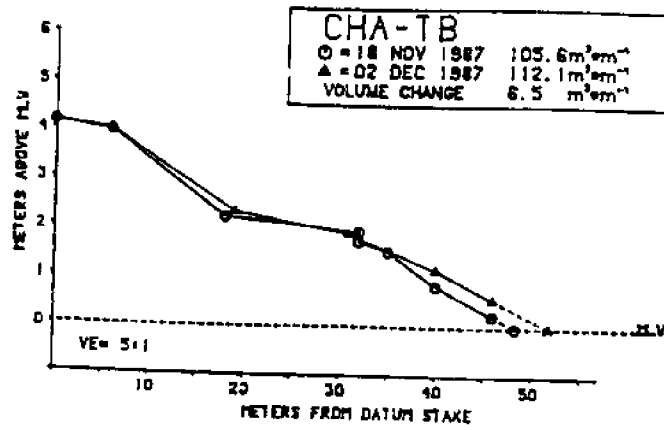


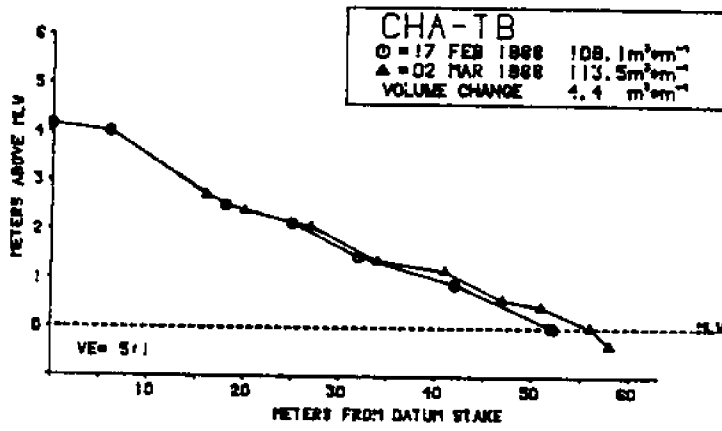
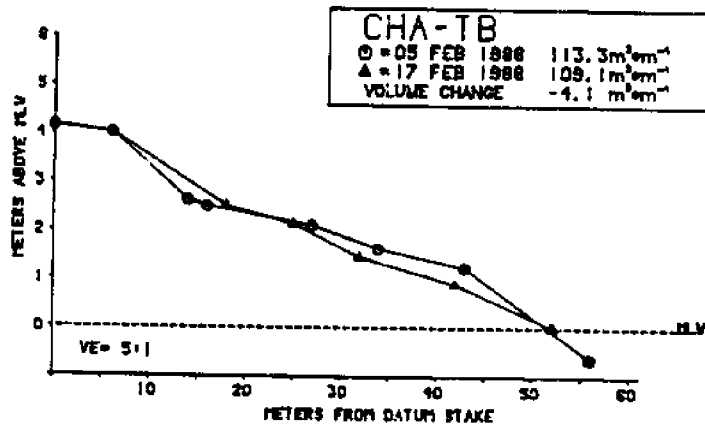






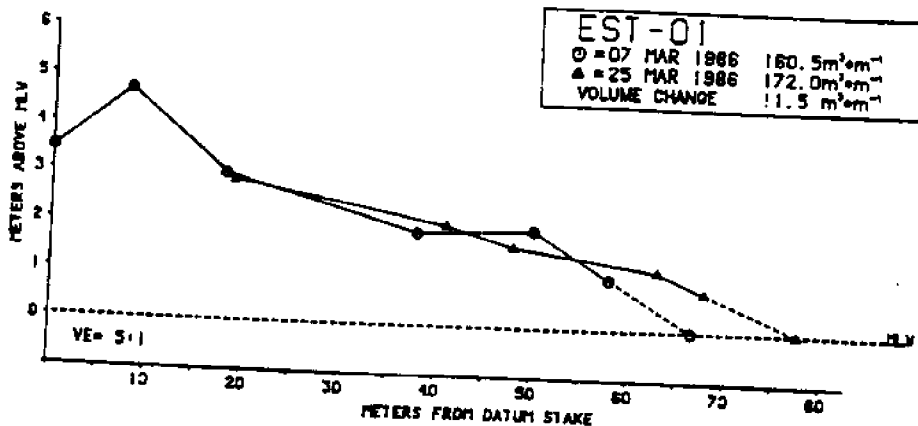
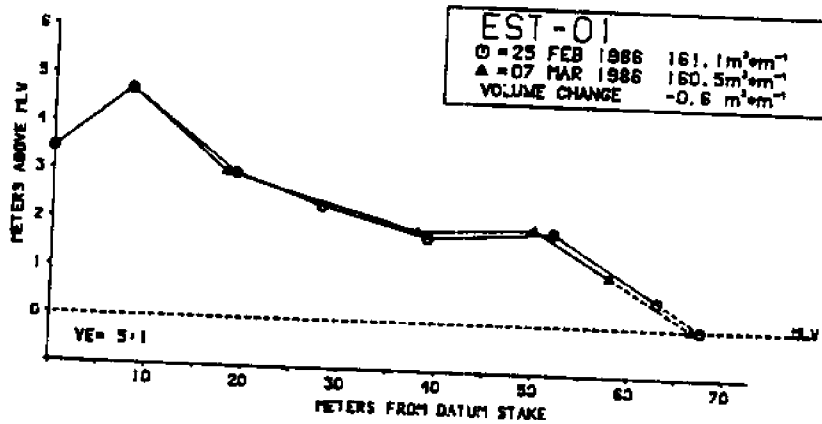
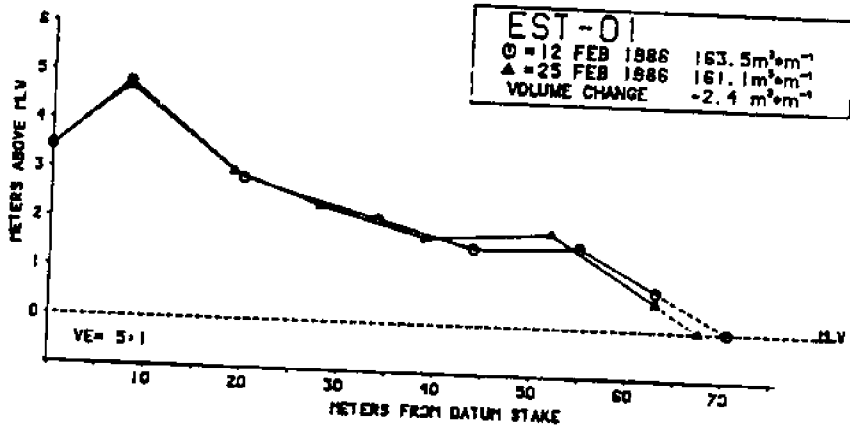
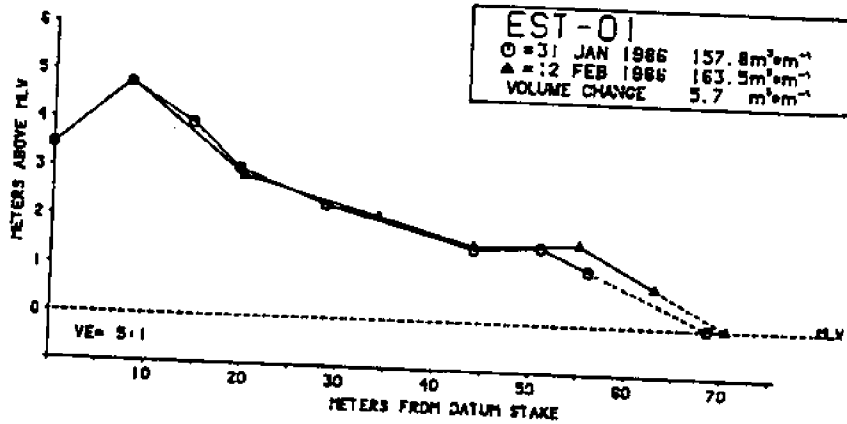


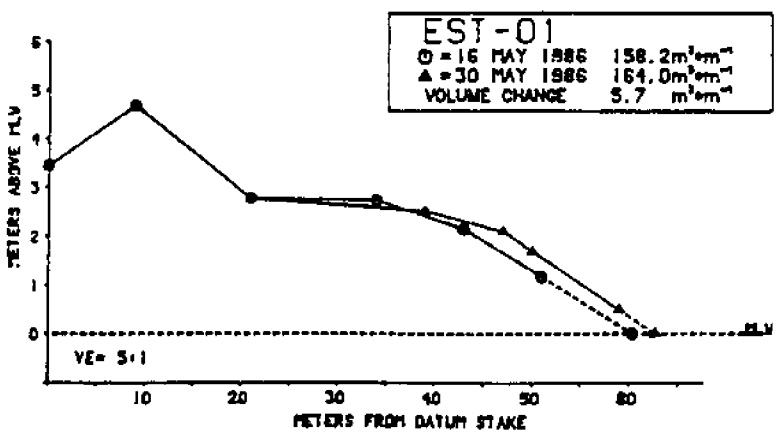
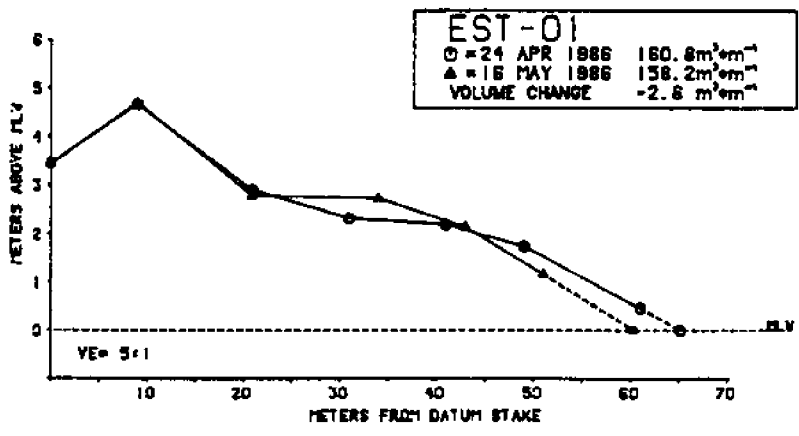
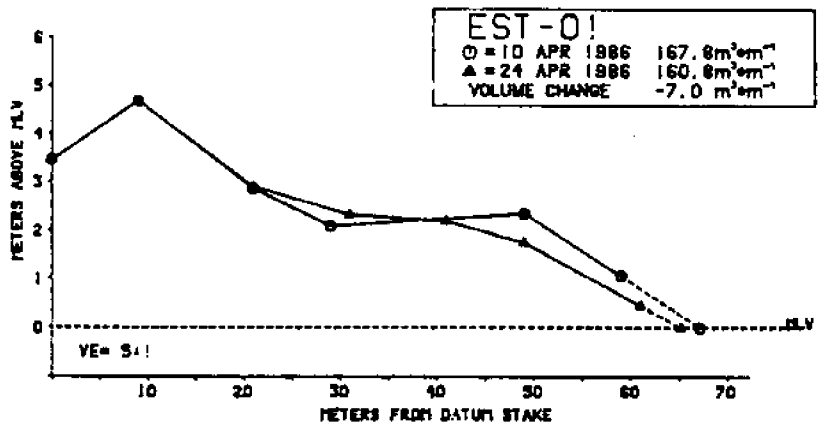
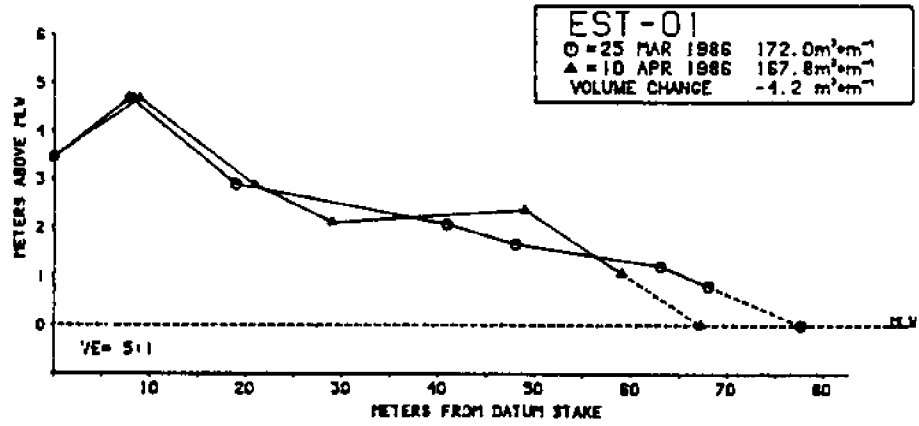




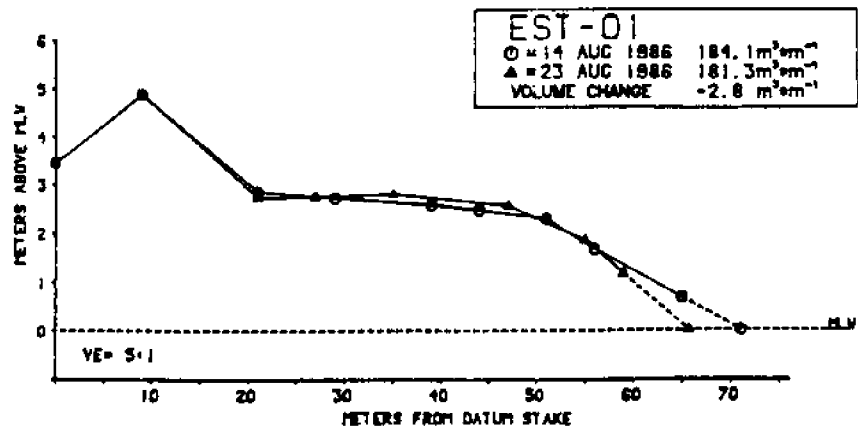
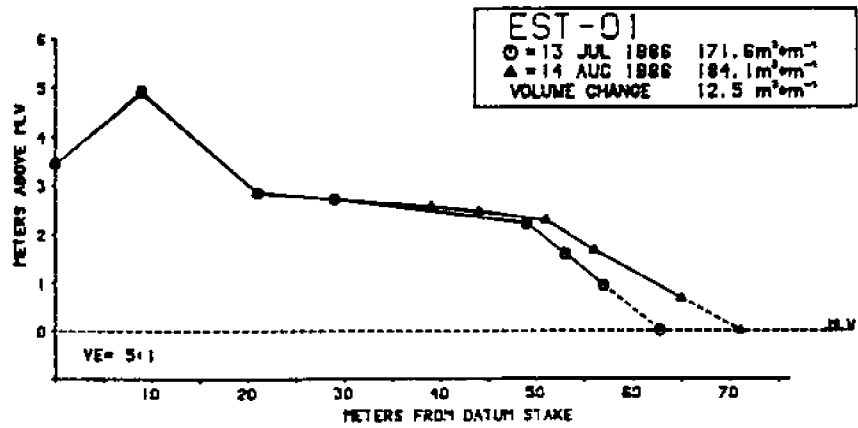
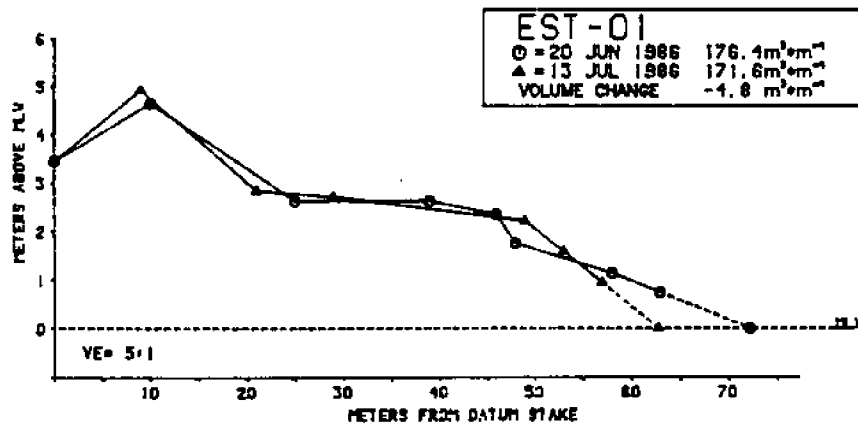
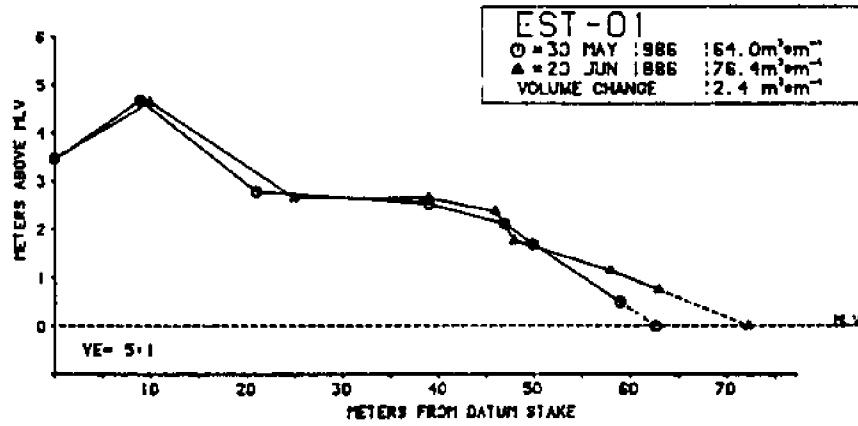
**APPENDIX 1D**

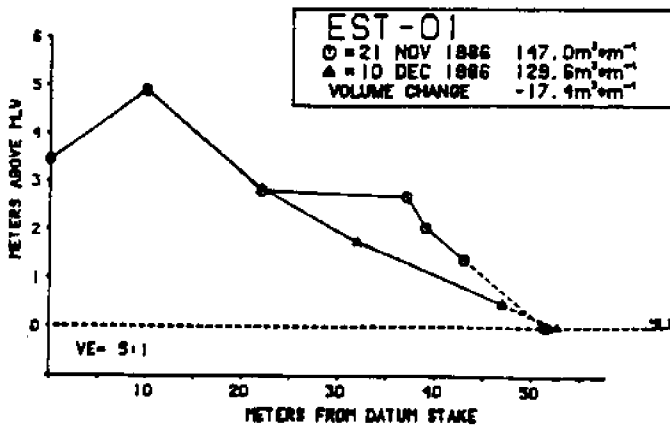
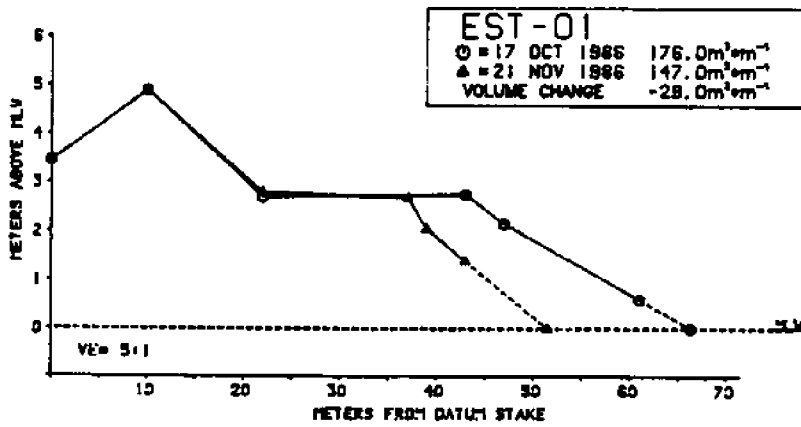
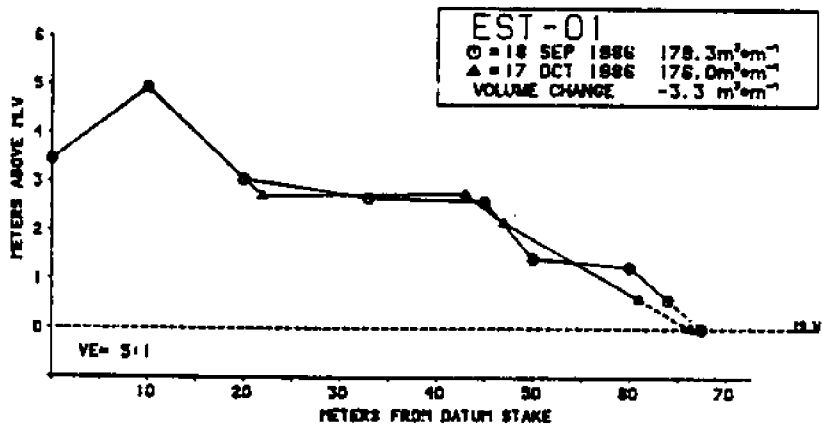
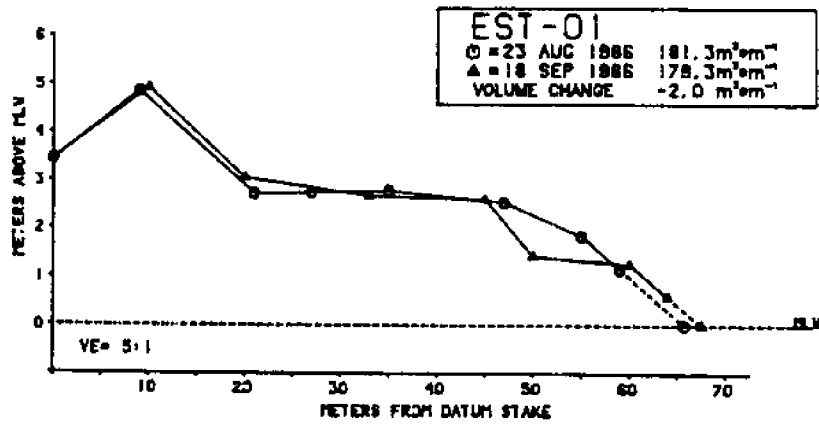
**EST-01 Profile Plots**





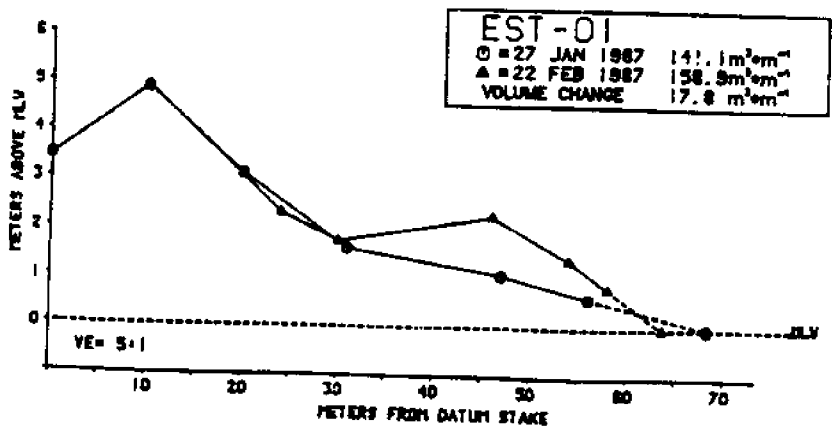
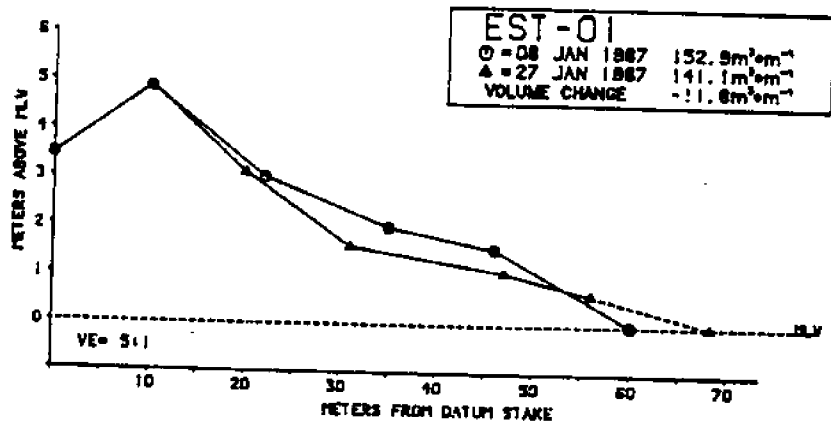
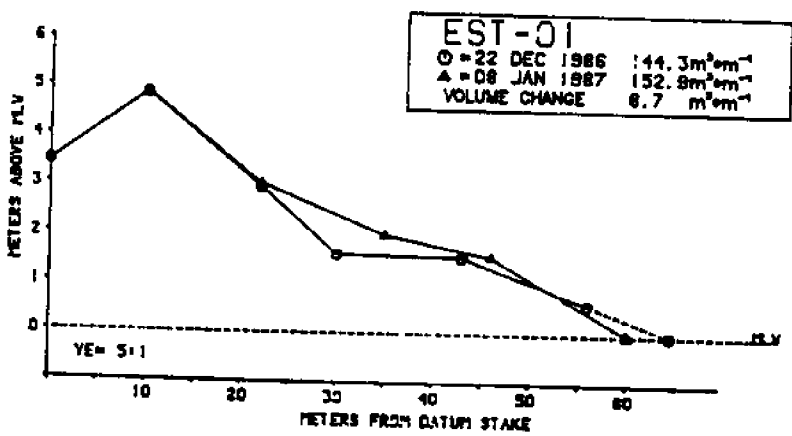
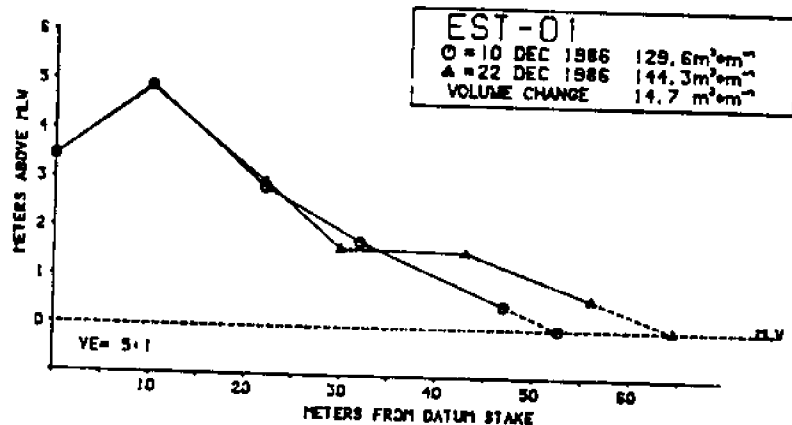


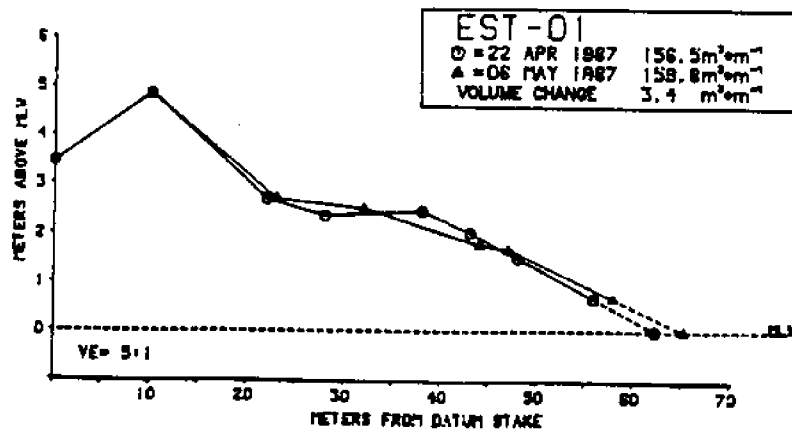
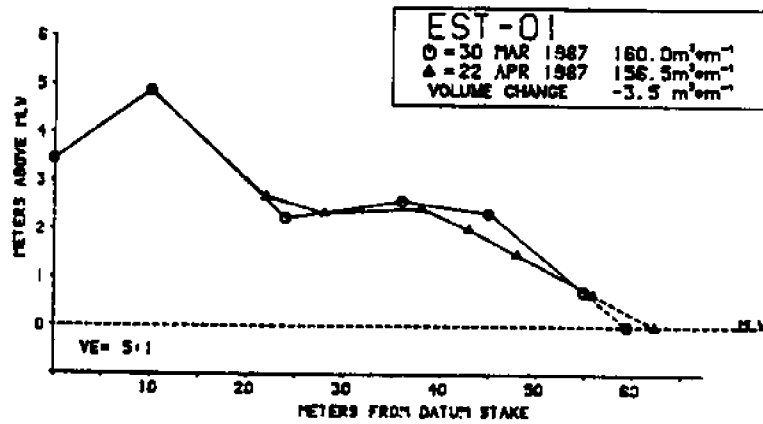
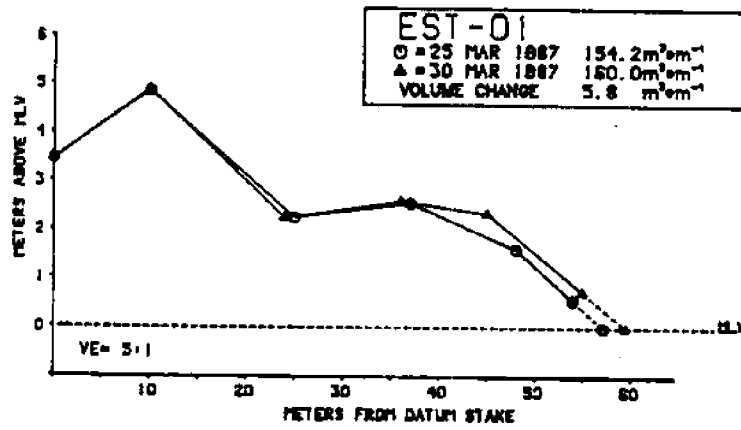
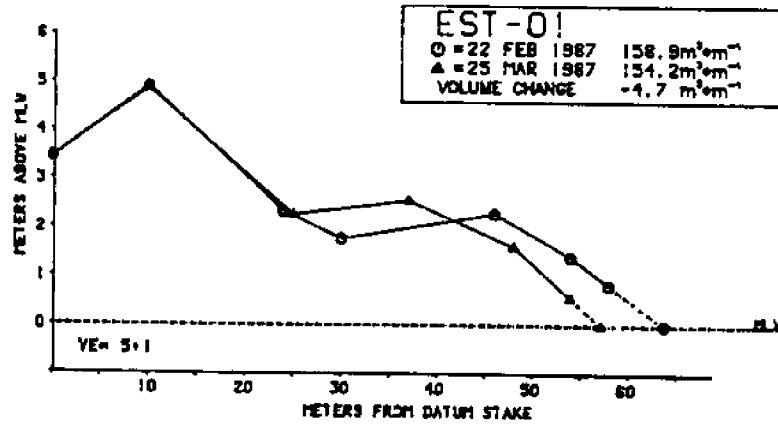


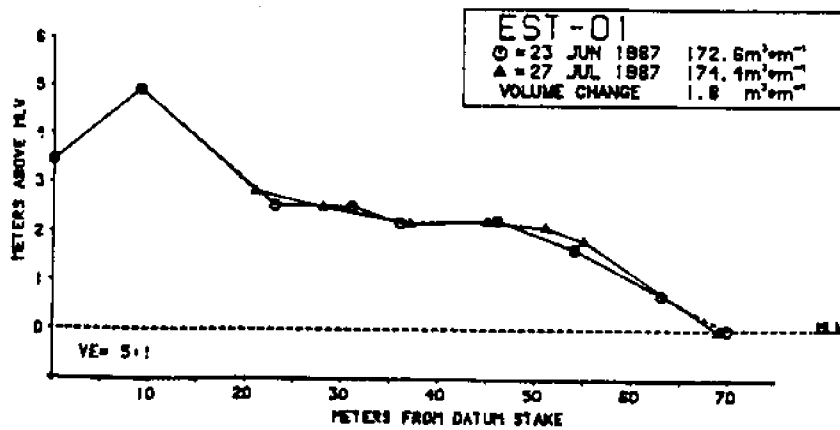
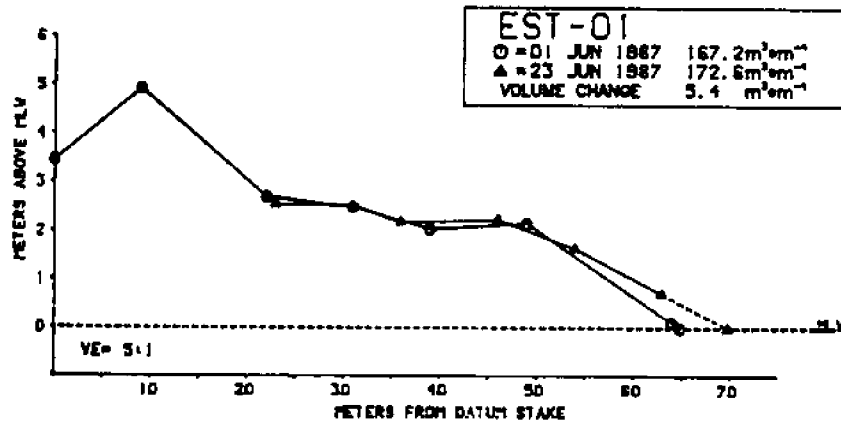
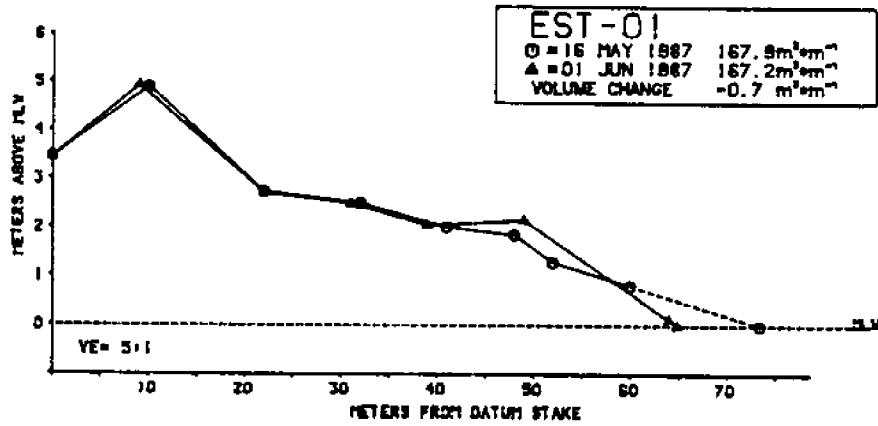
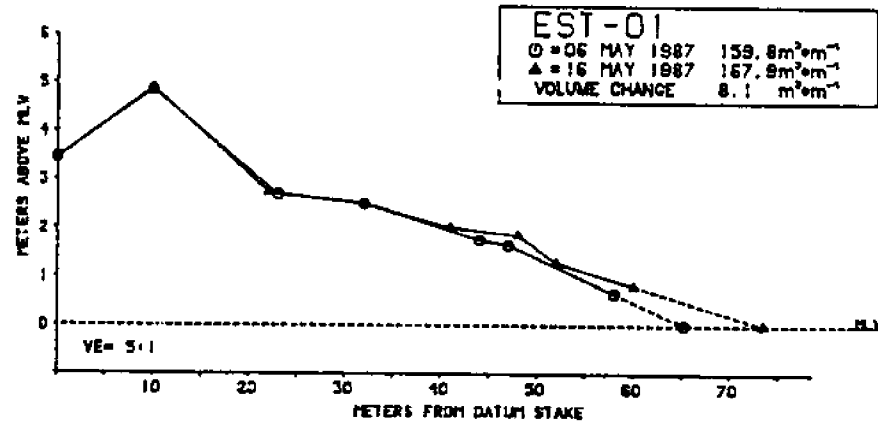


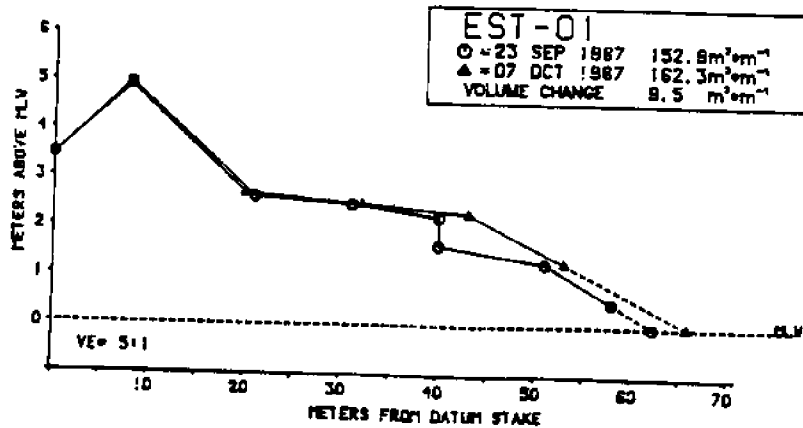
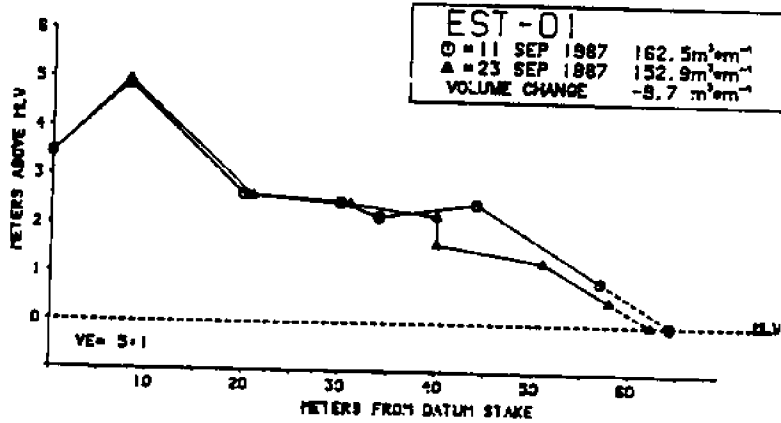
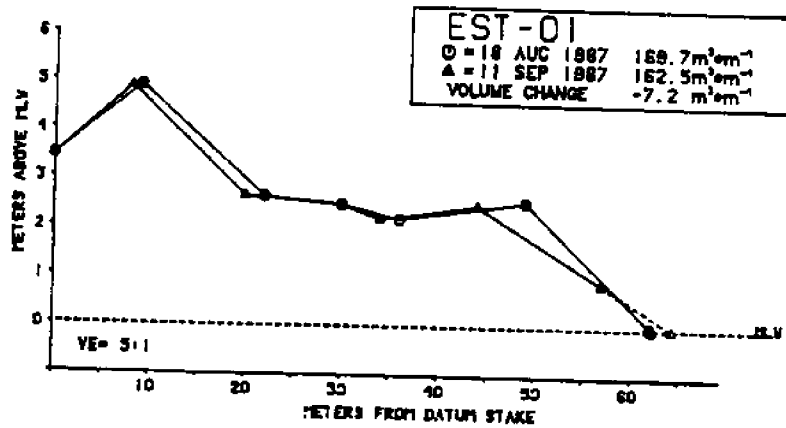
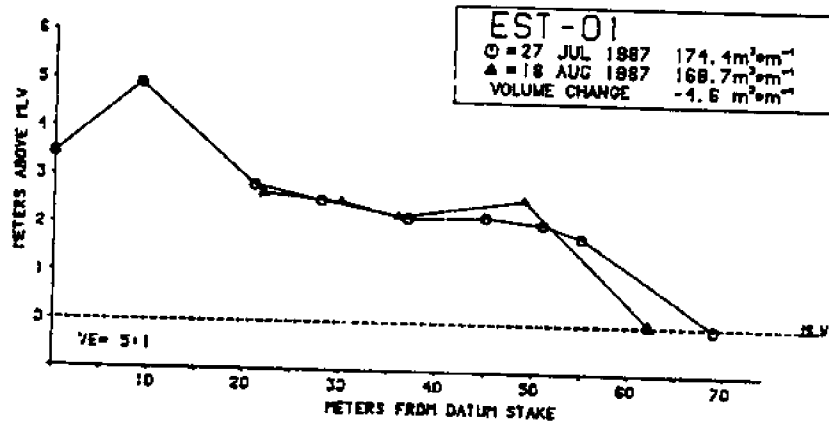
## **APPENDIX 2**

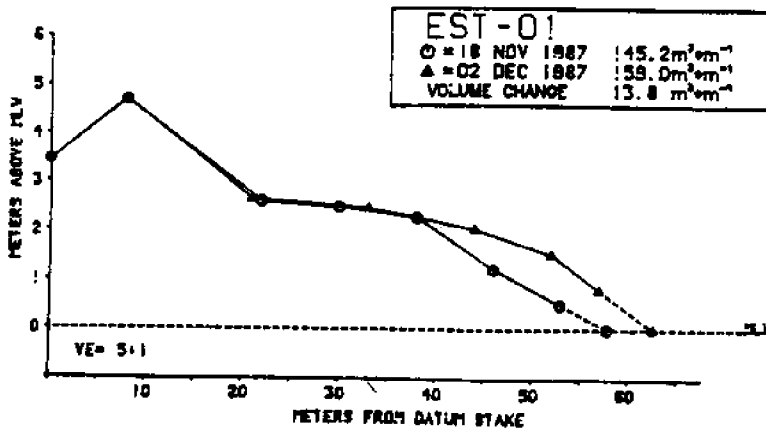
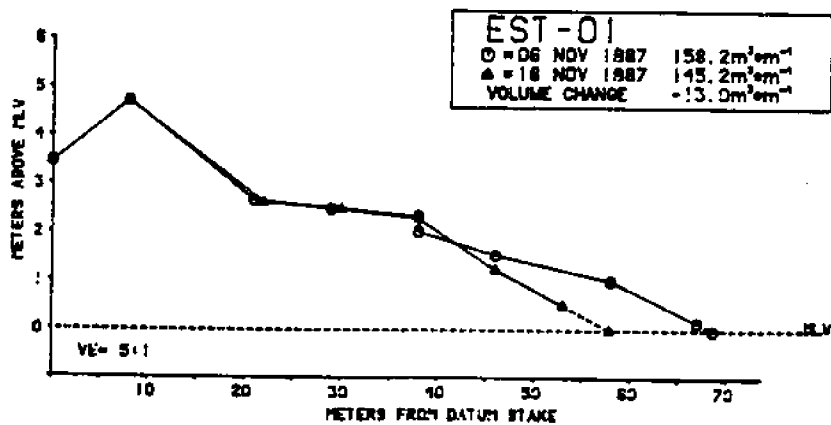
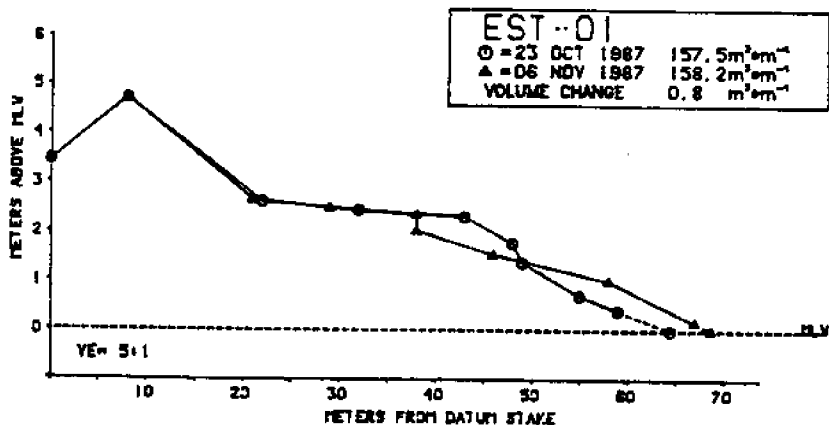
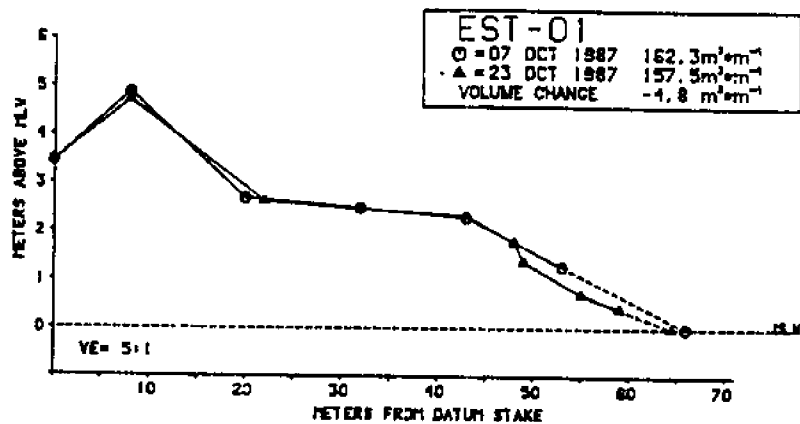
### **Profile Volume Time Series Graphs**



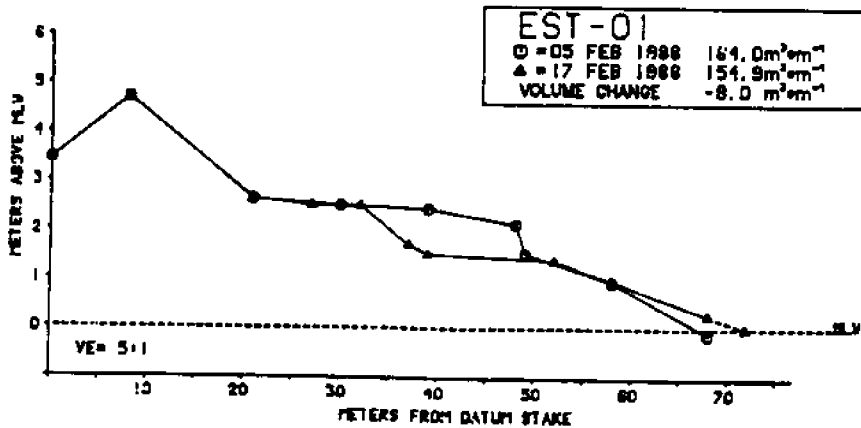
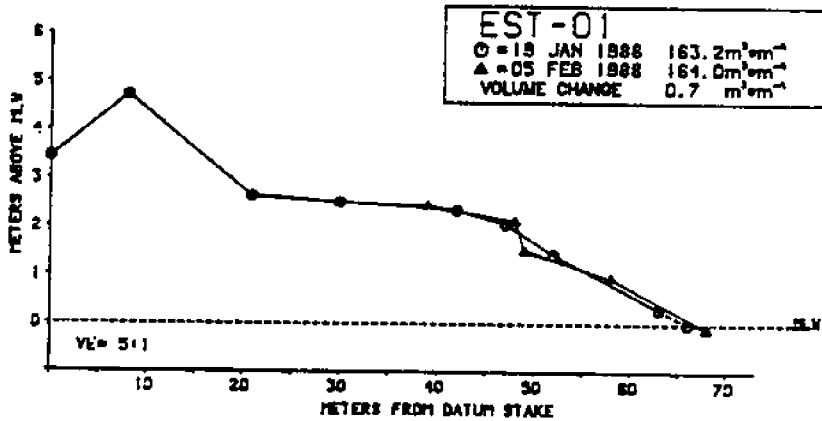
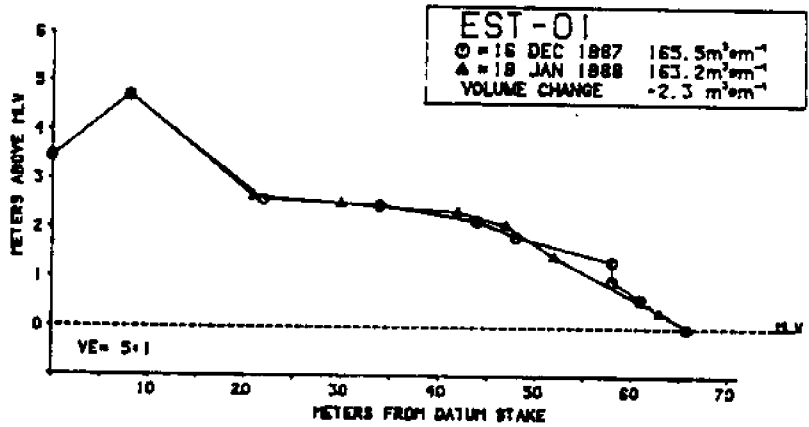
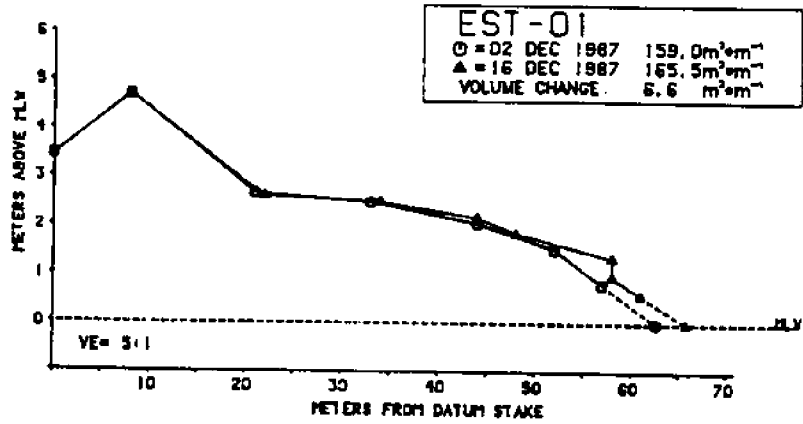


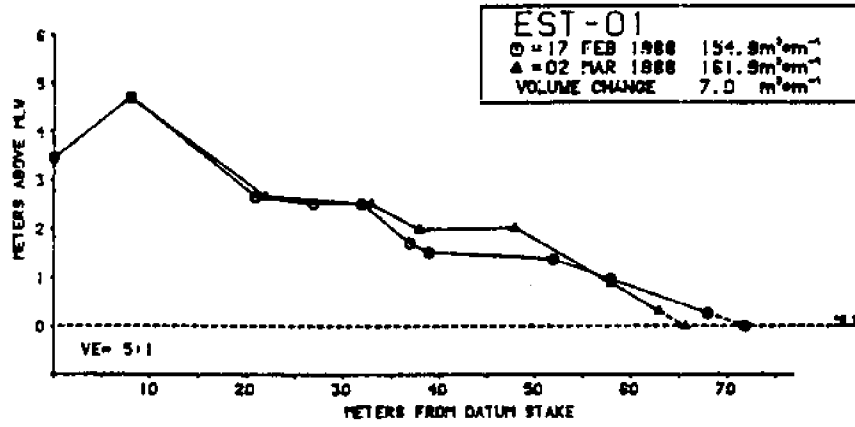






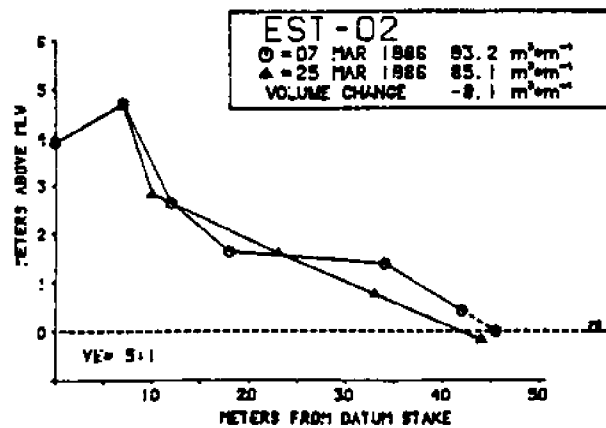
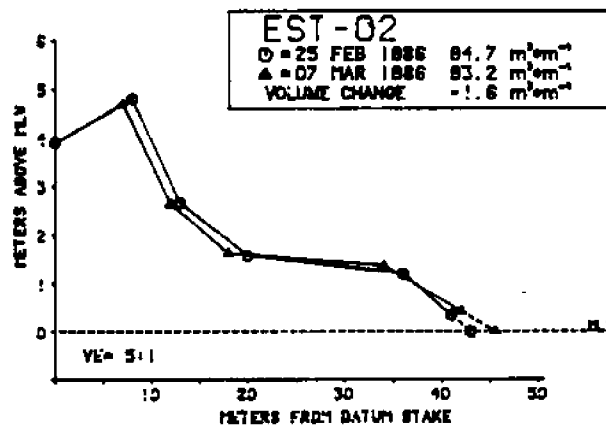
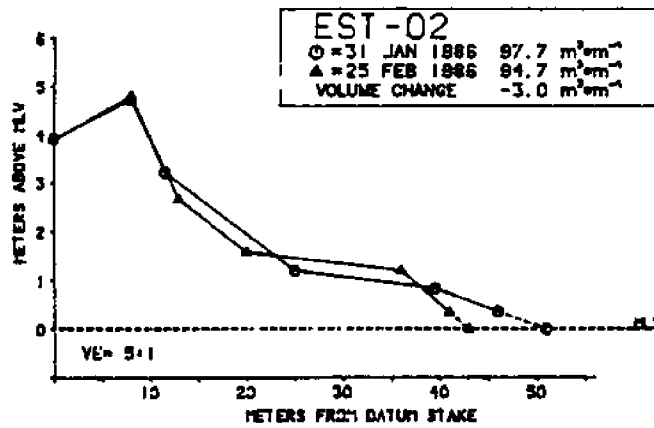
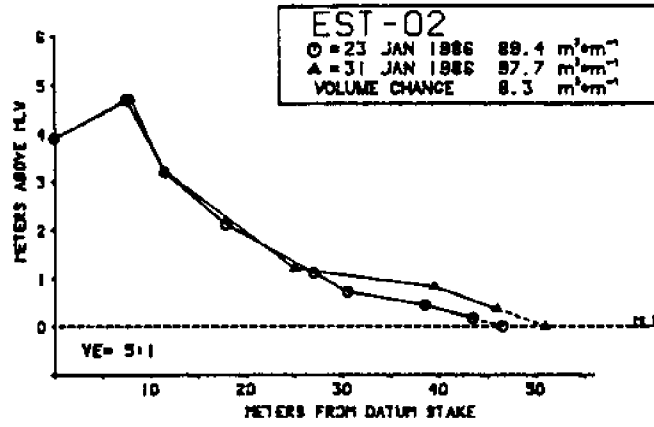


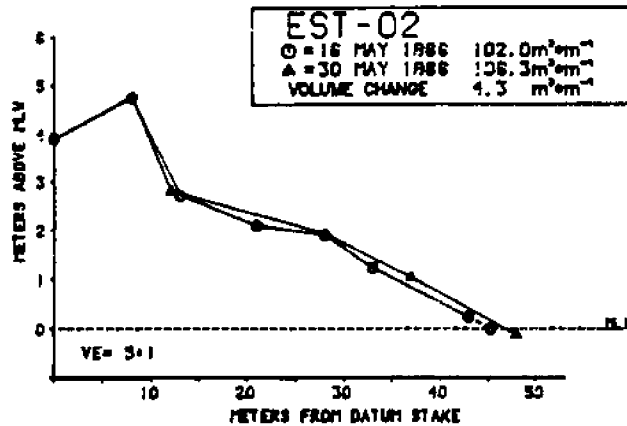
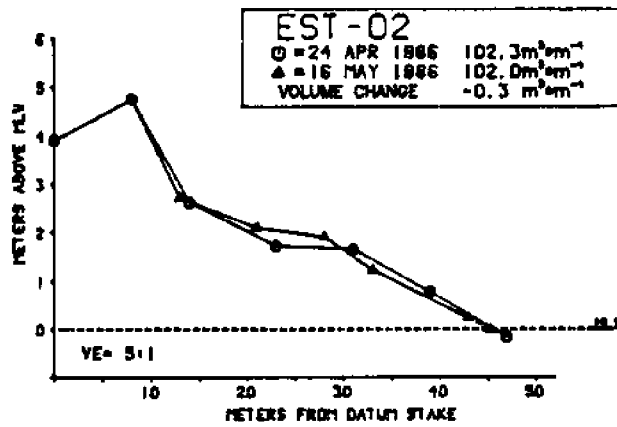
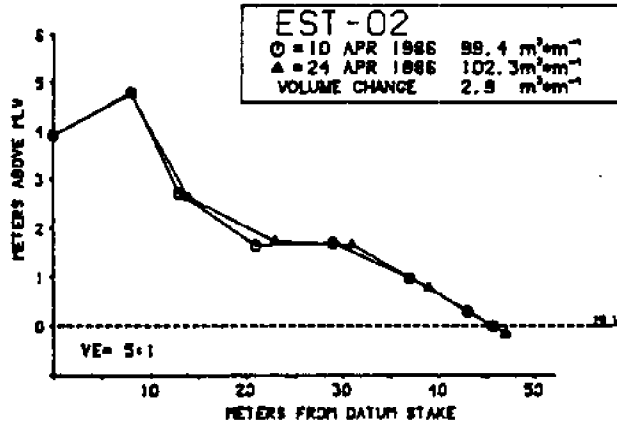
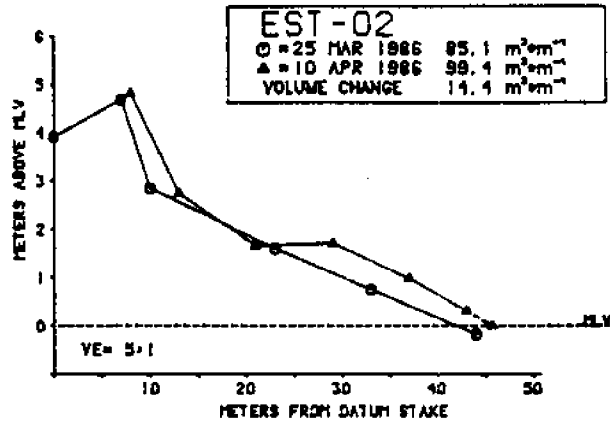


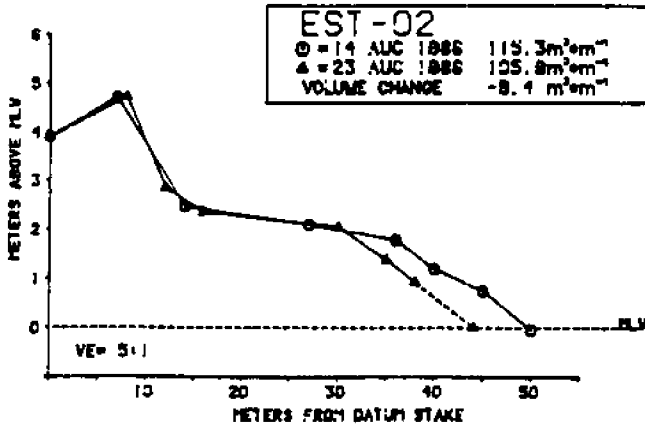
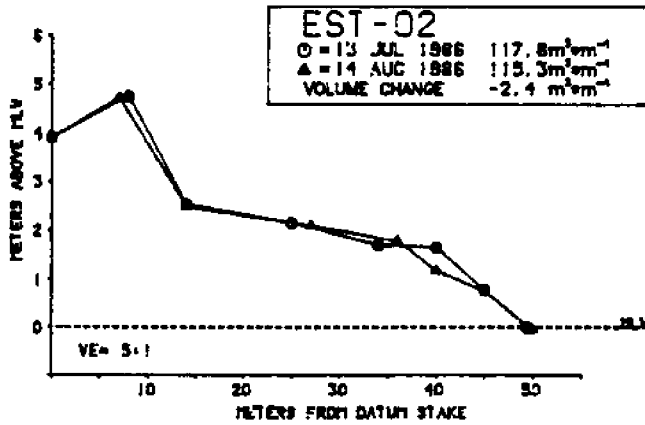
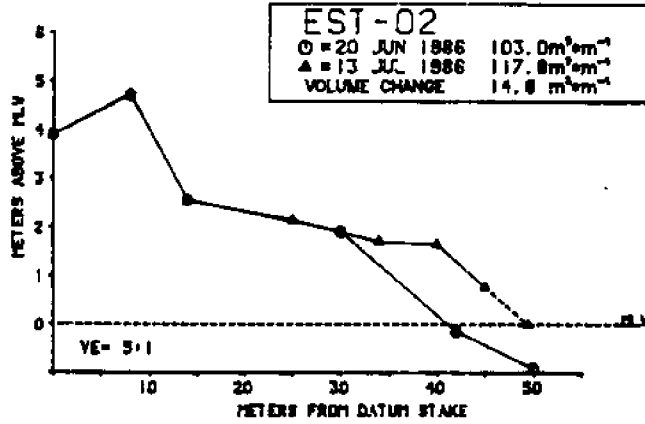
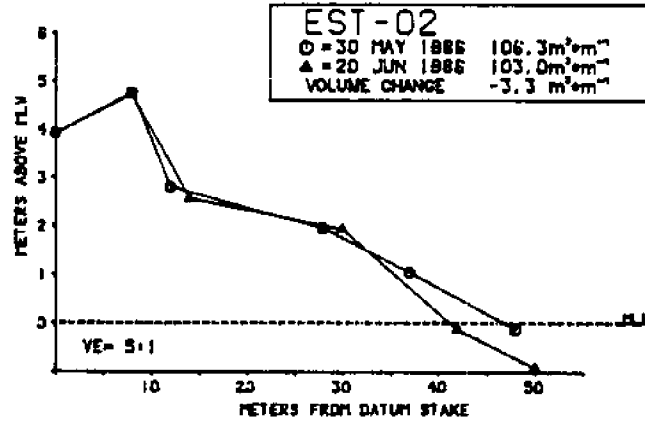


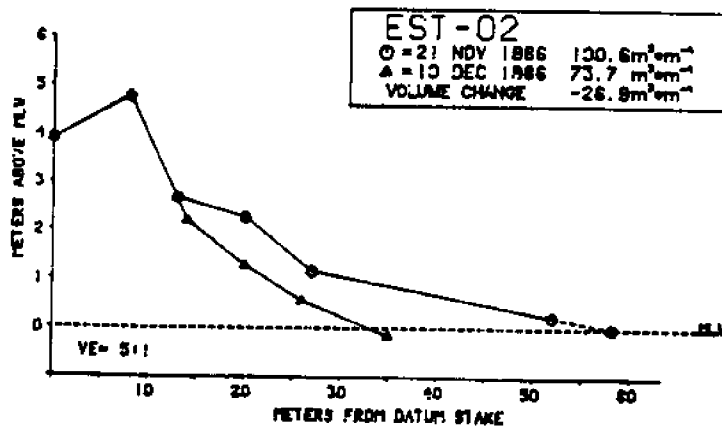
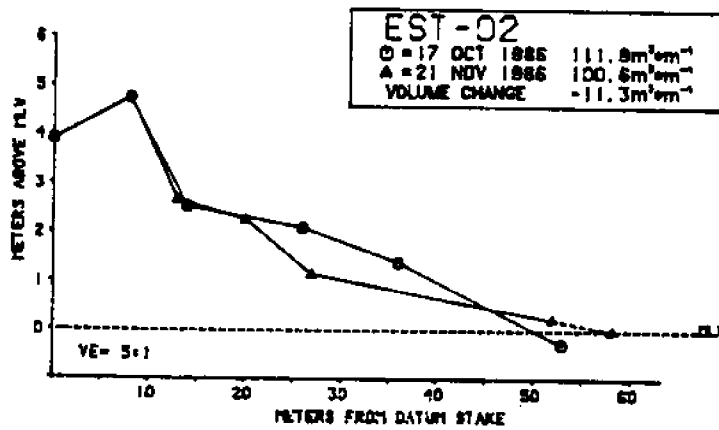
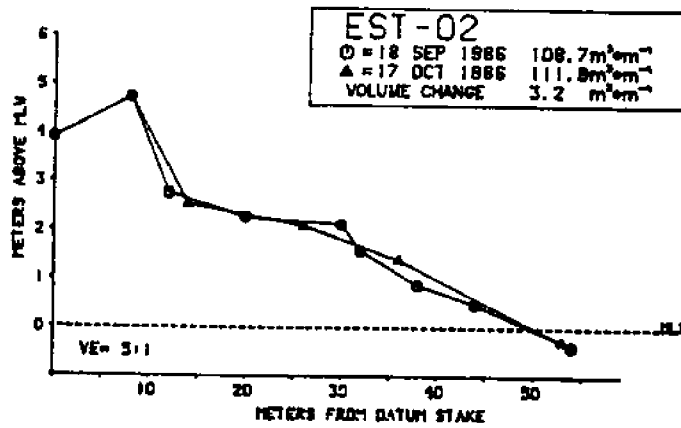
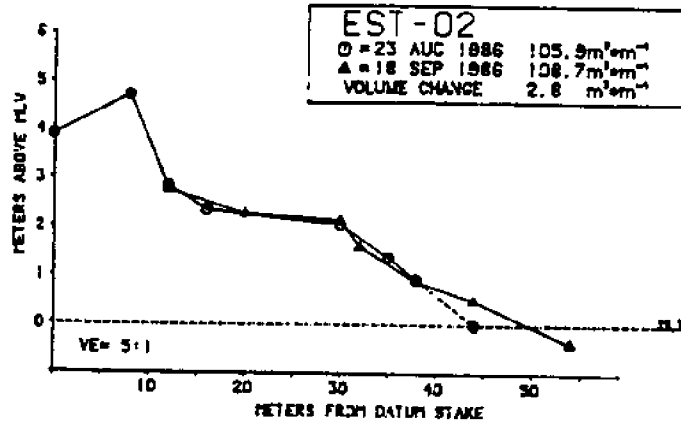
**APPENDIX 1E**

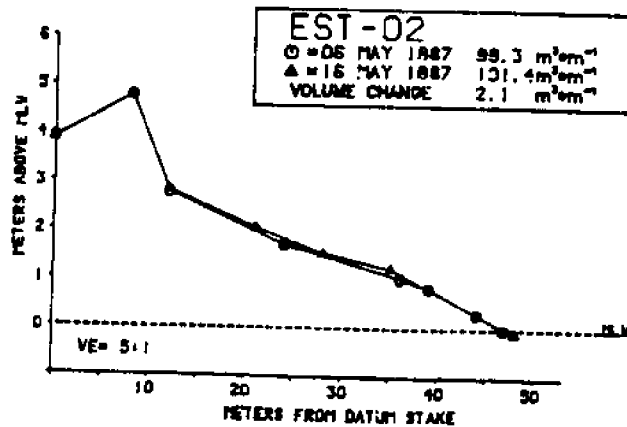
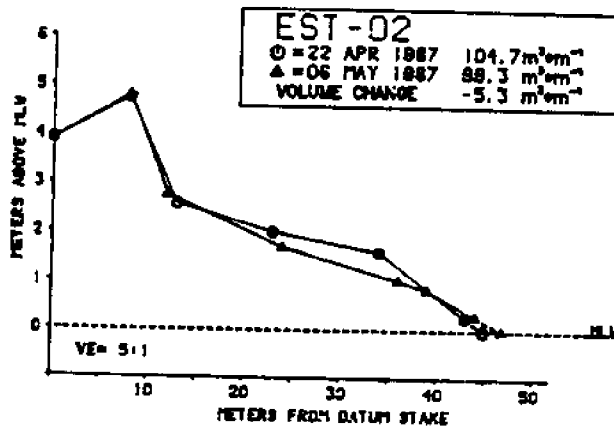
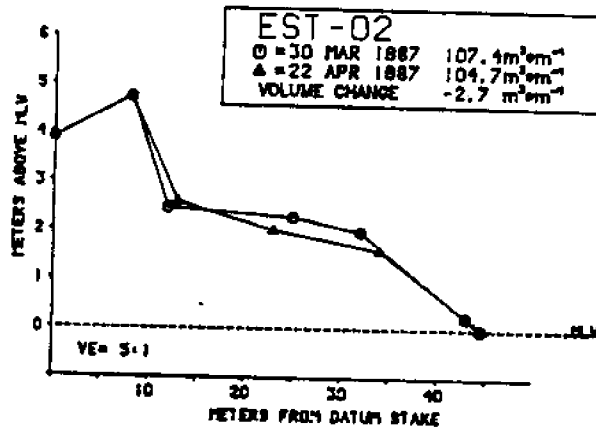
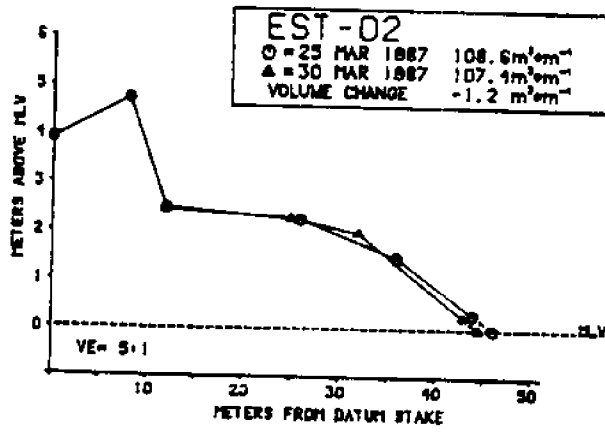
**EST-02 Profile Plots**



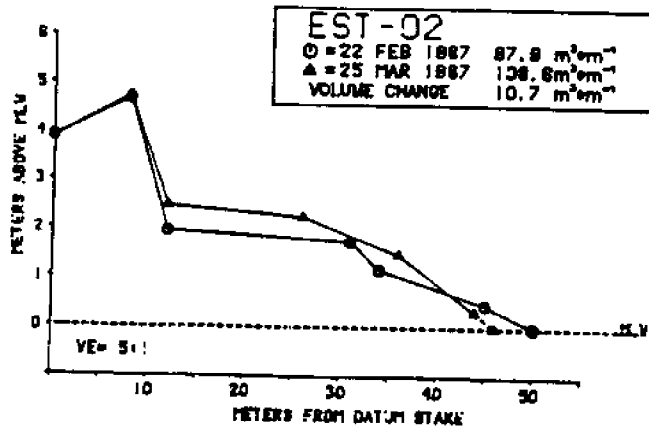
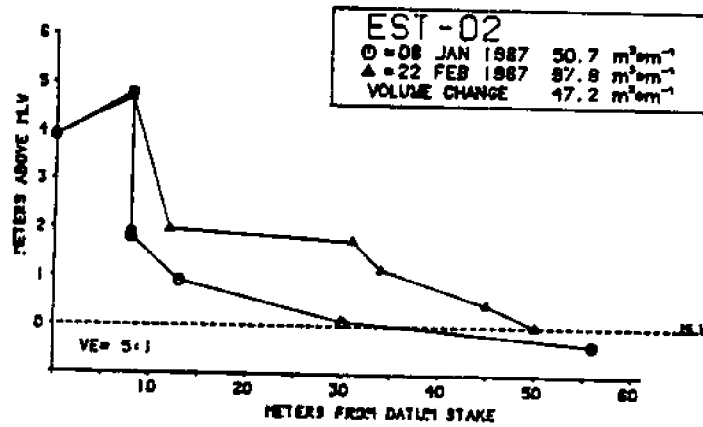
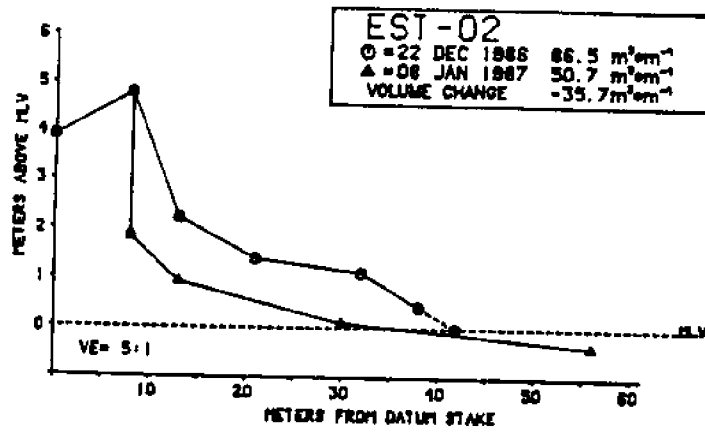
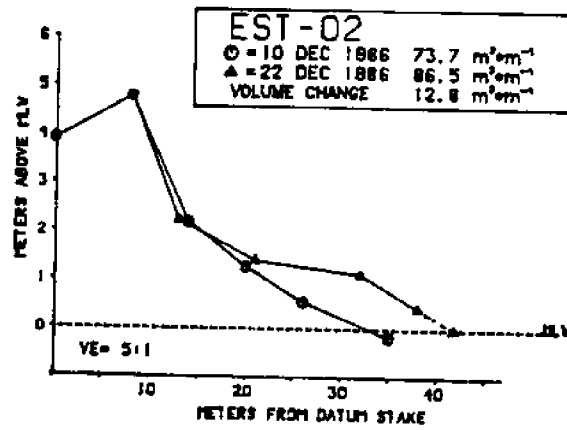


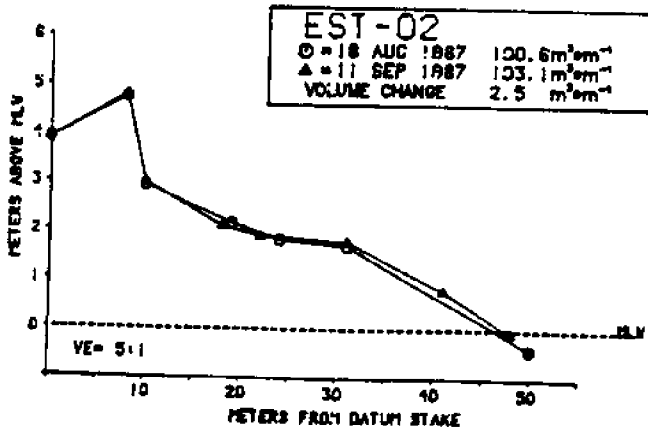
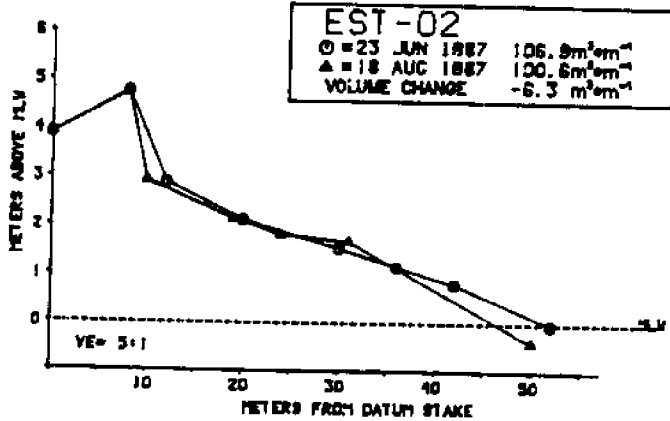
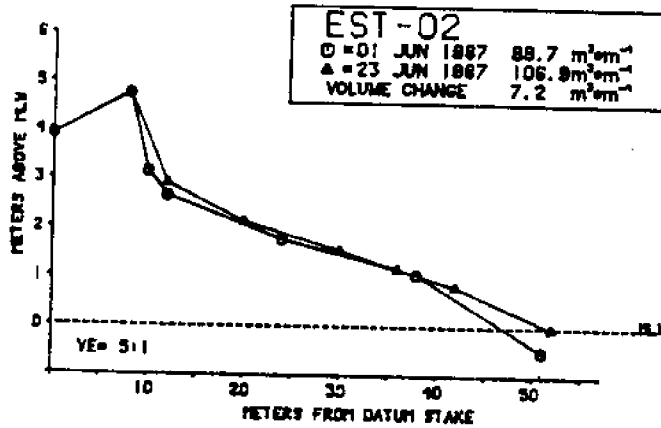
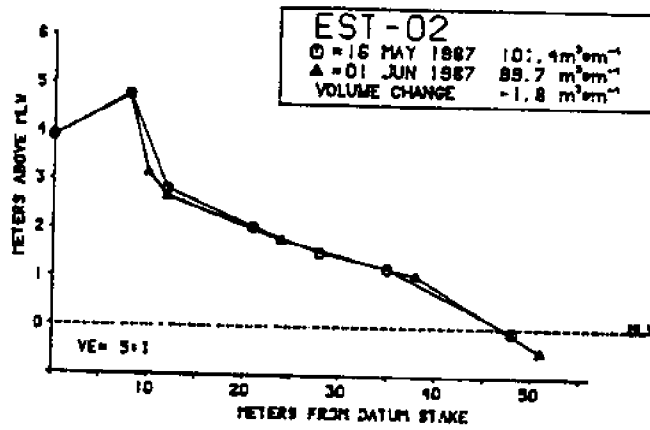


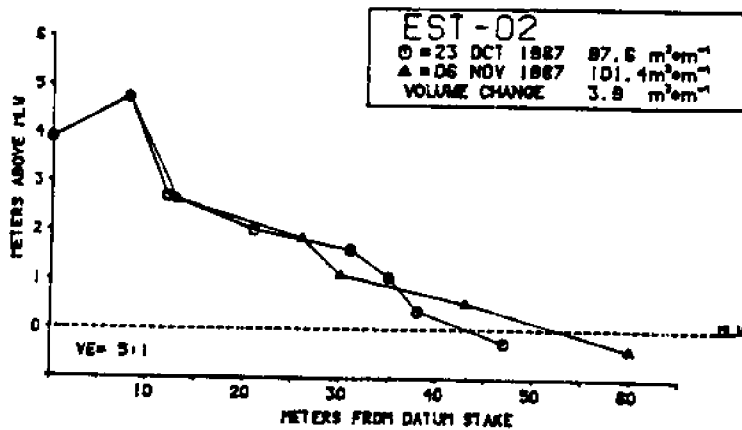
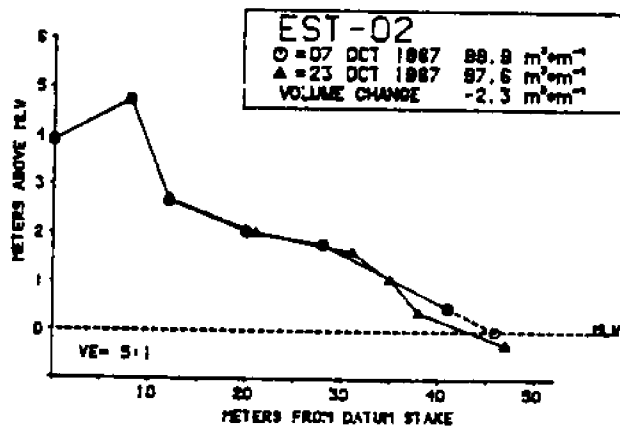
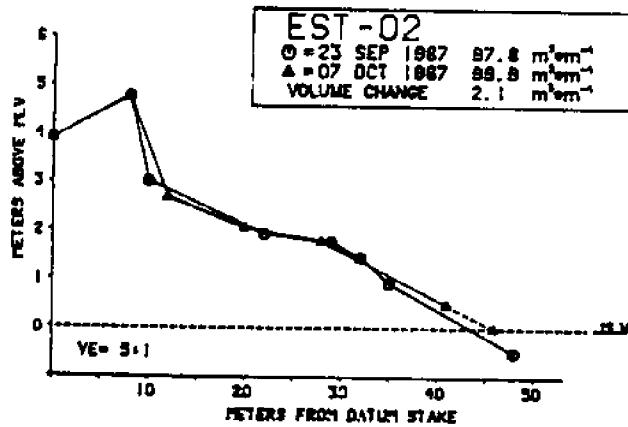
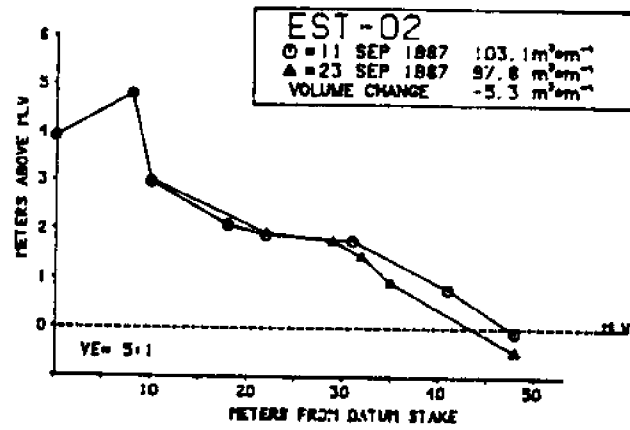


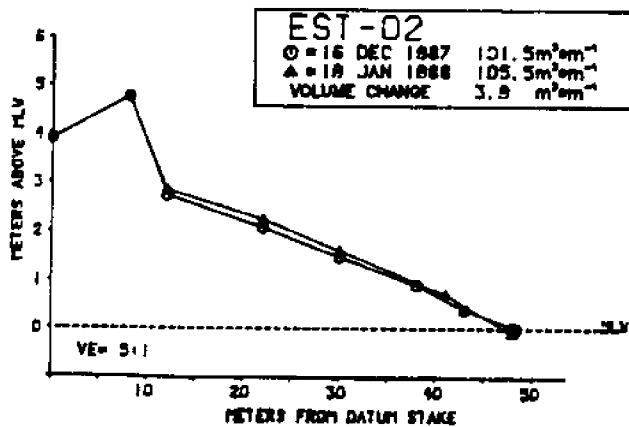
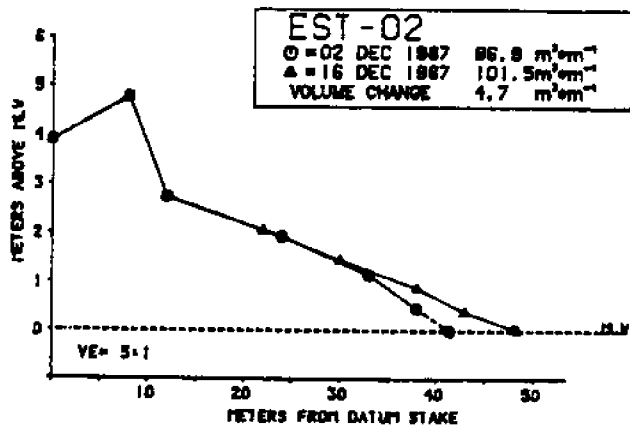
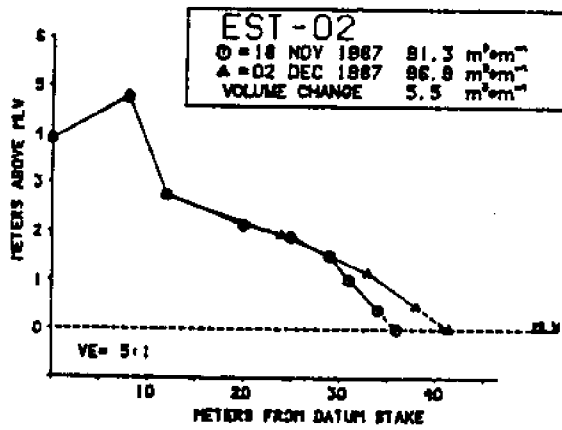
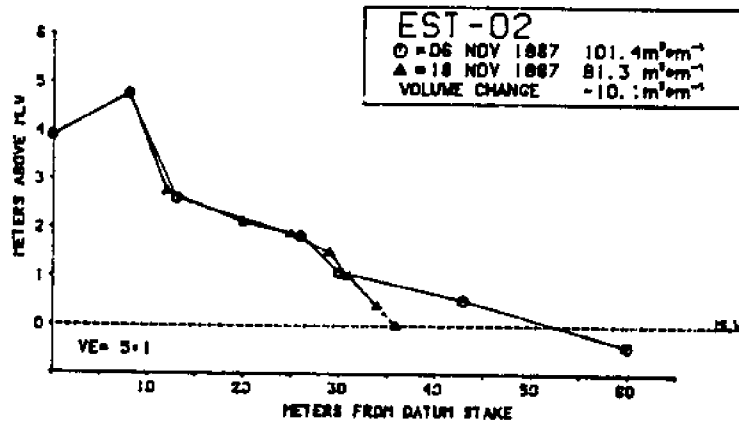


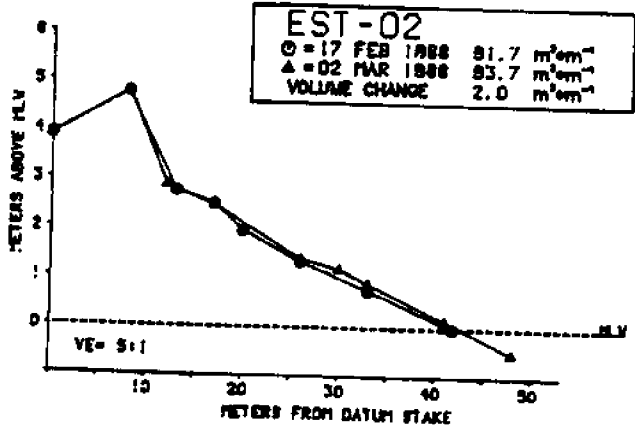
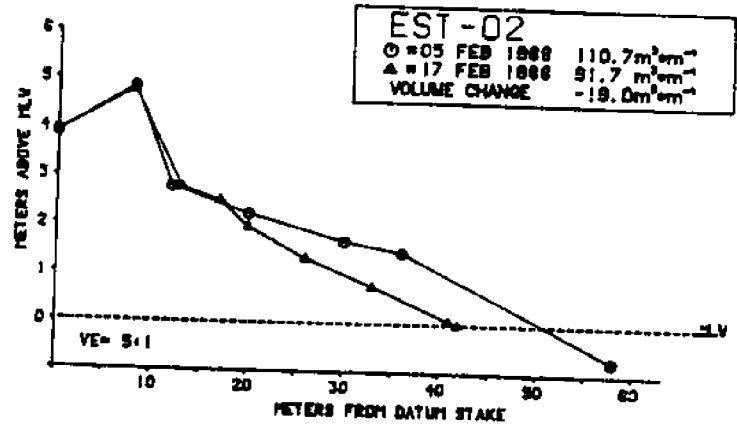
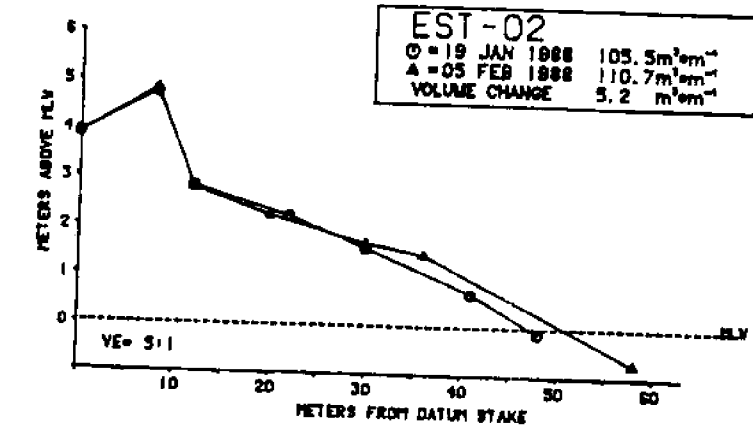






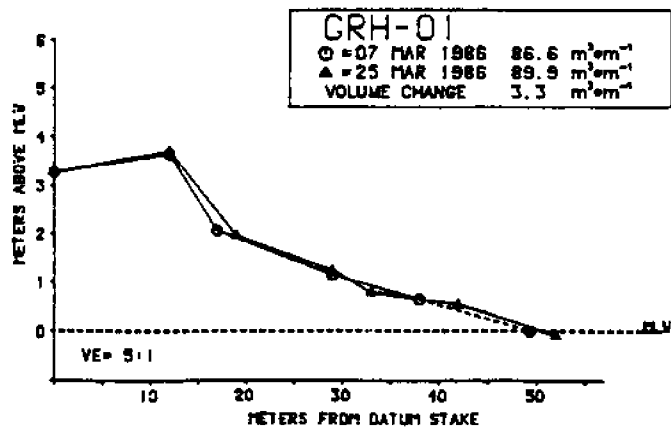
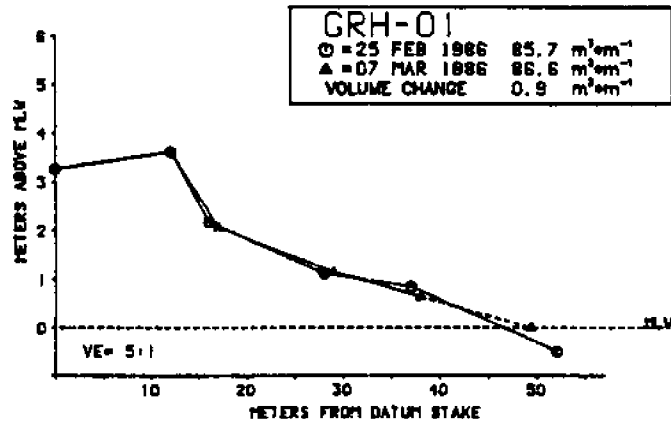
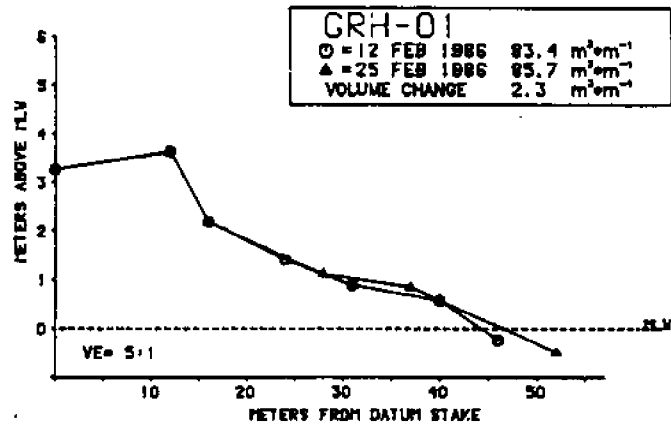
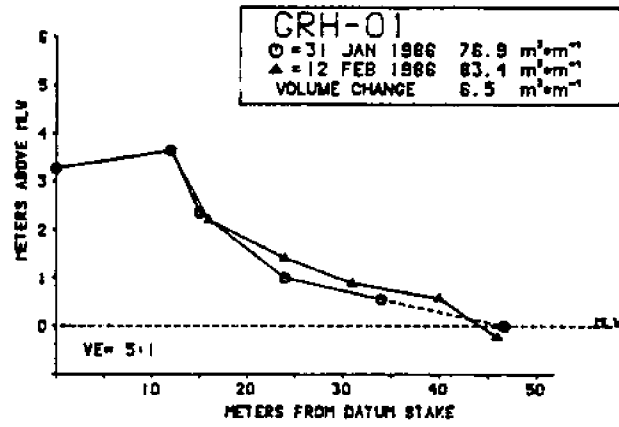


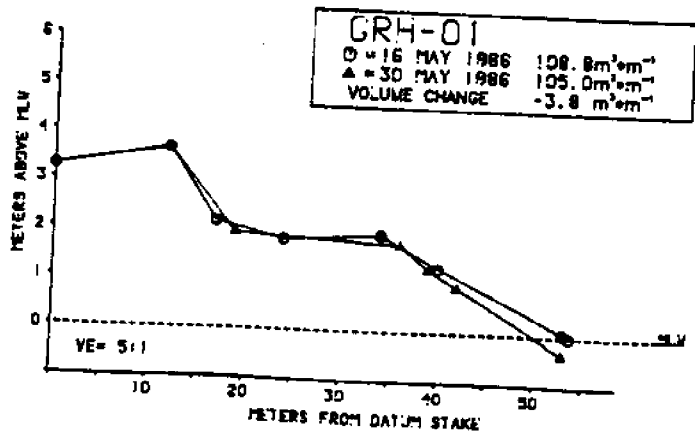
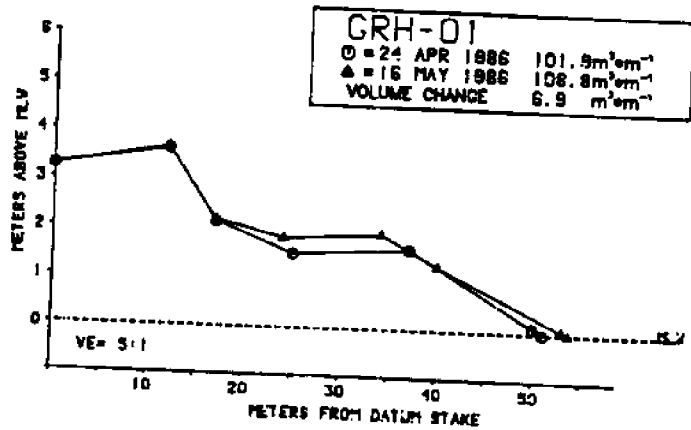
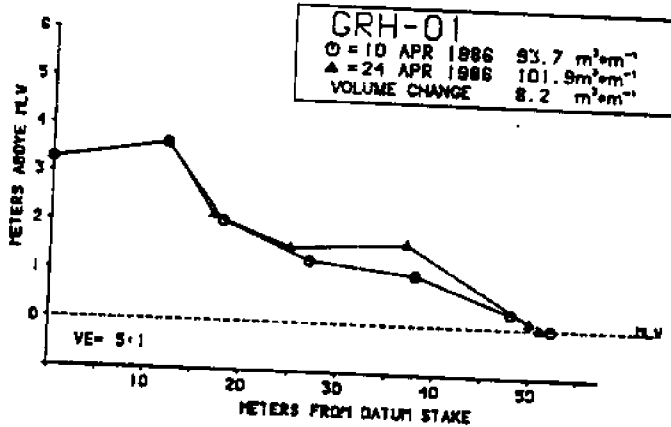
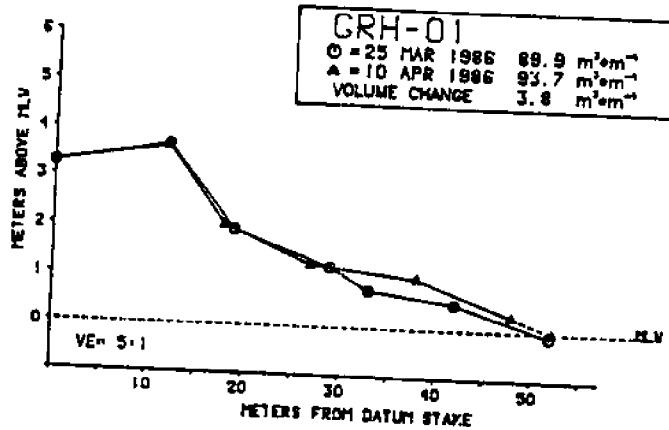




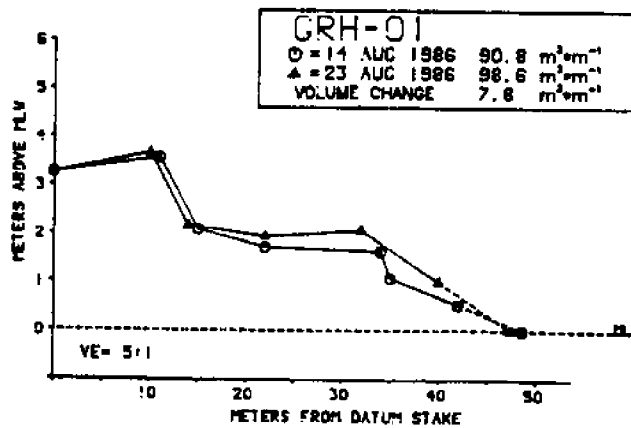
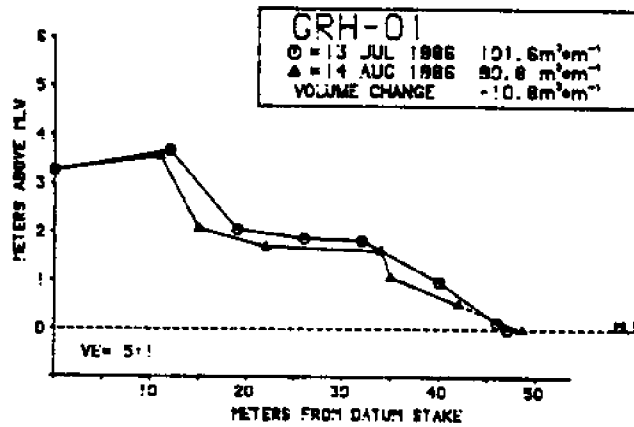
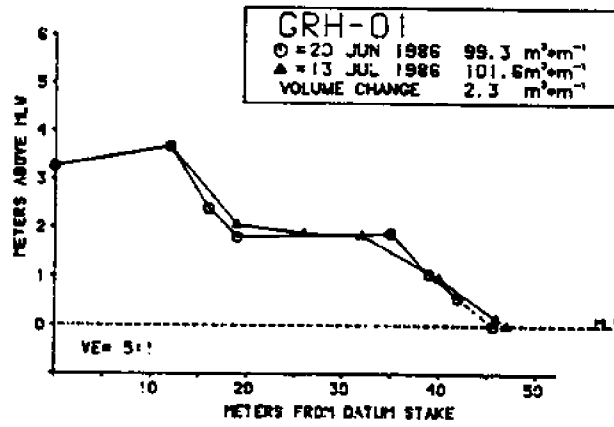
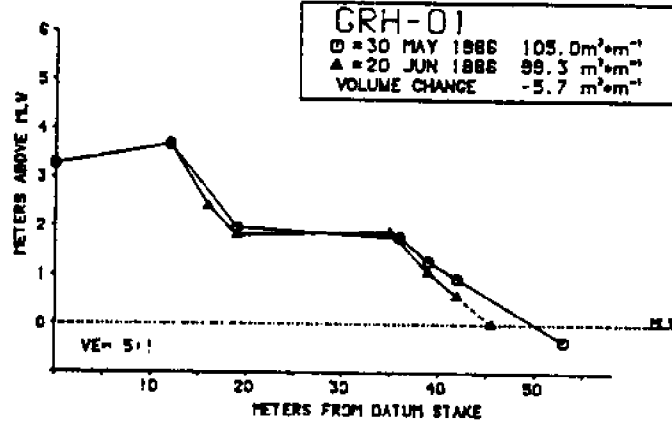
**APPENDIX 1F**

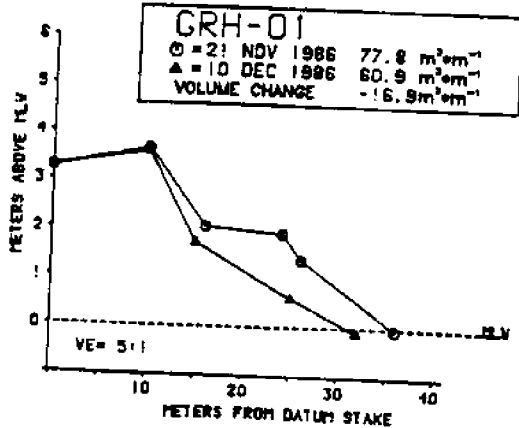
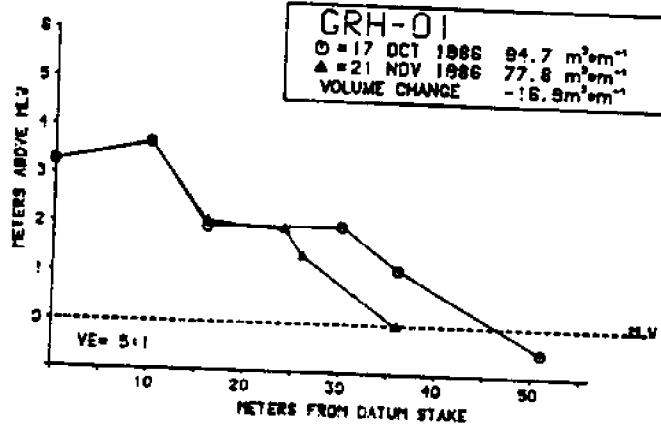
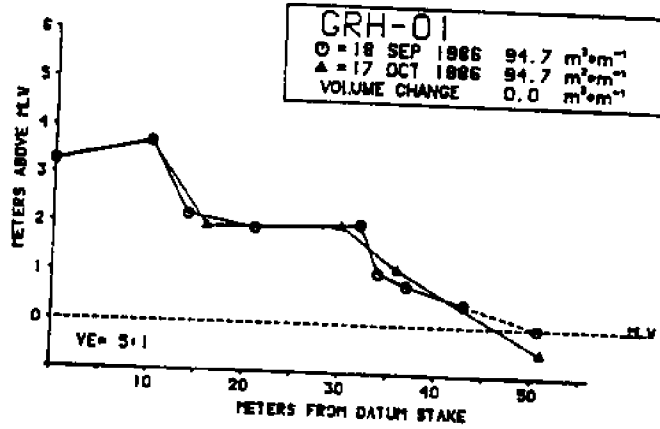
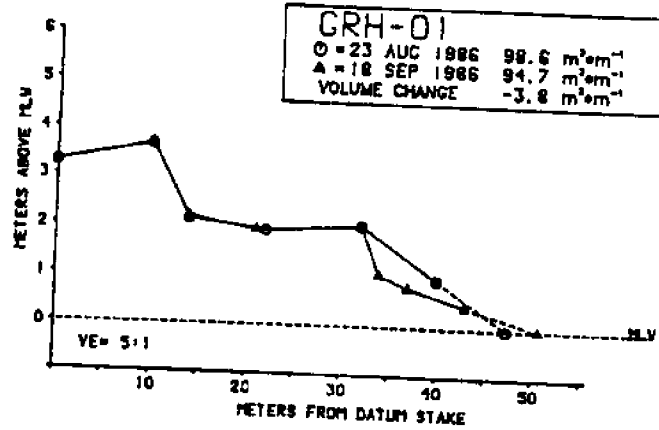
**GRH-01 Profile Plots**

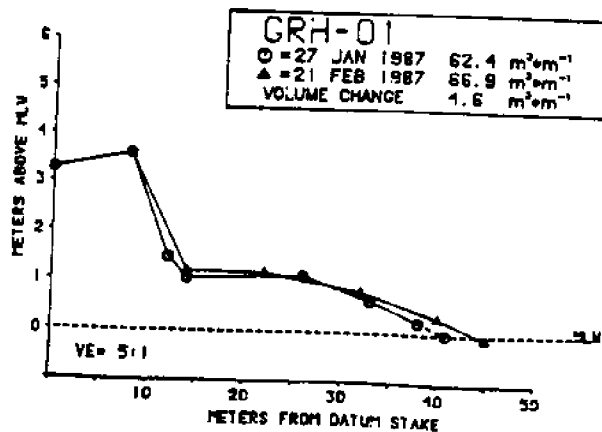
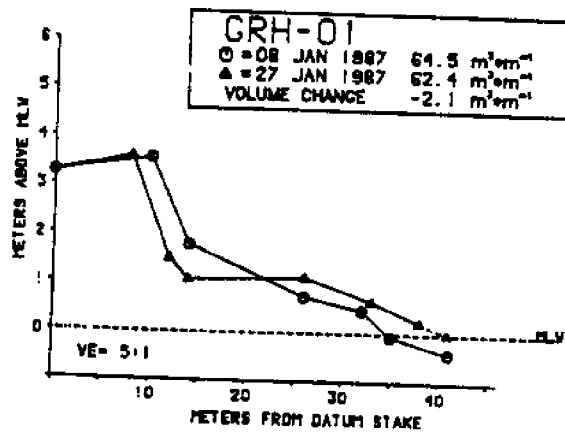
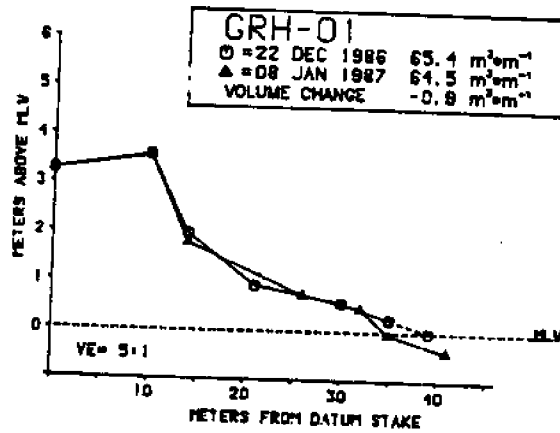
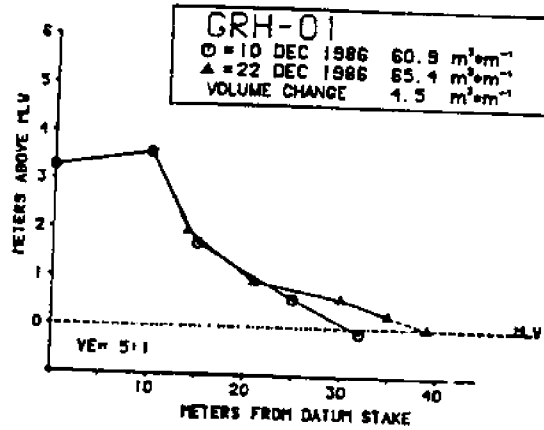


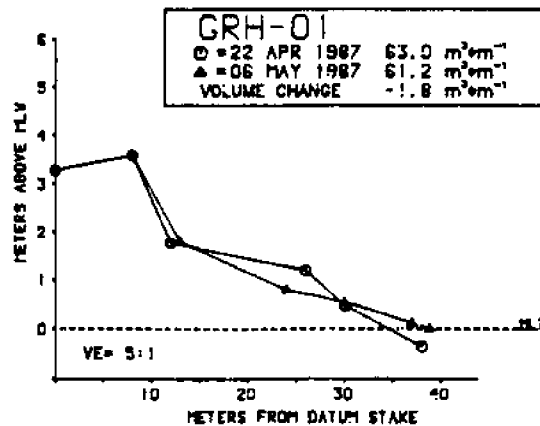
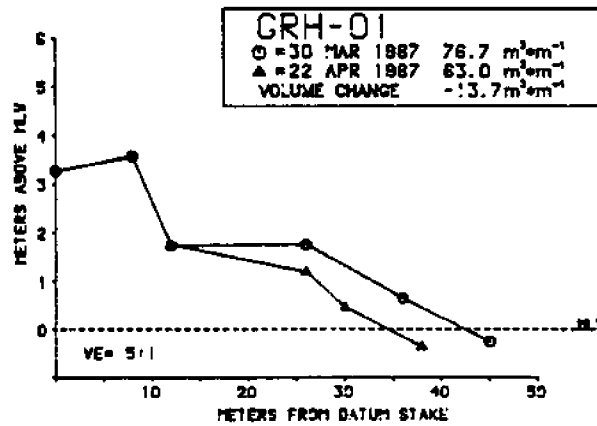
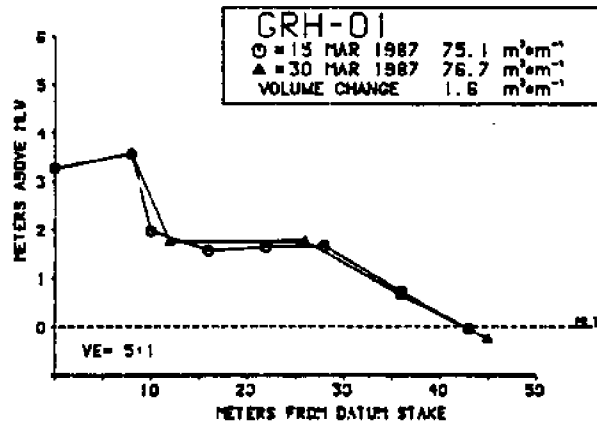
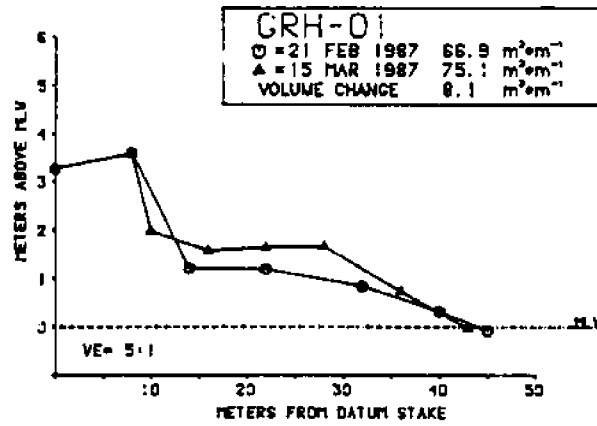


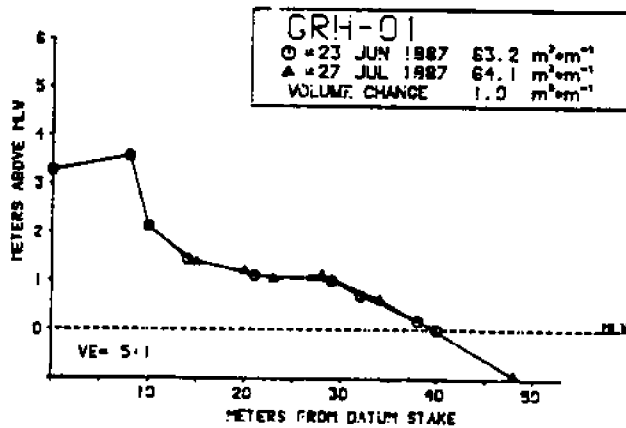
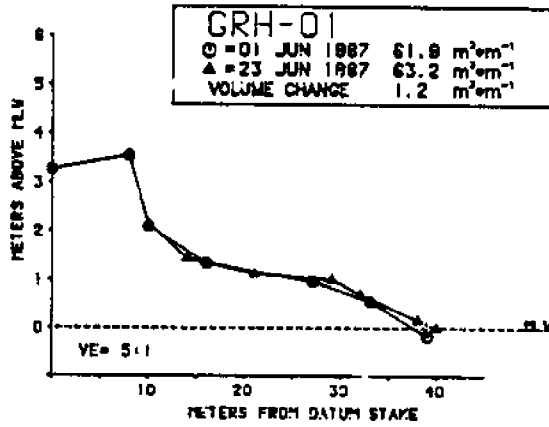
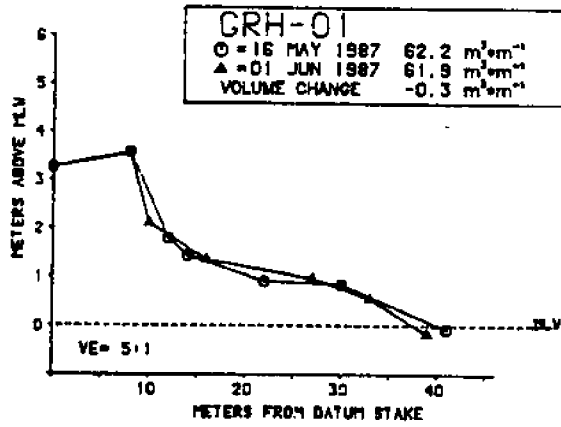
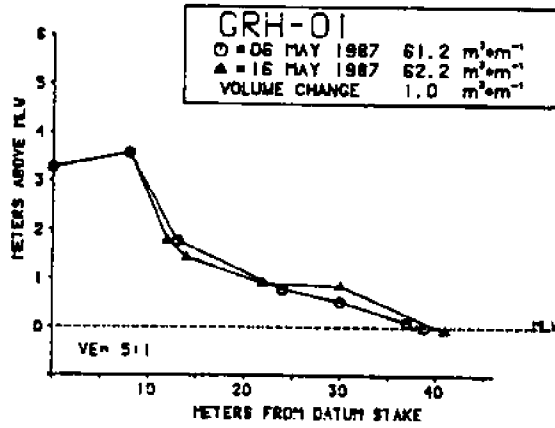


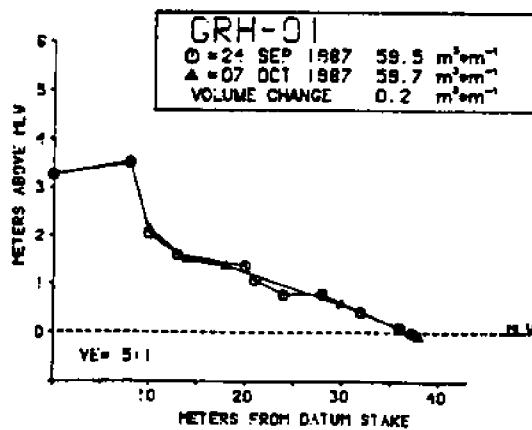
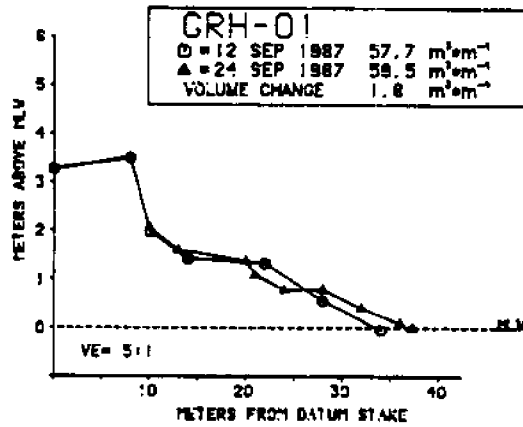
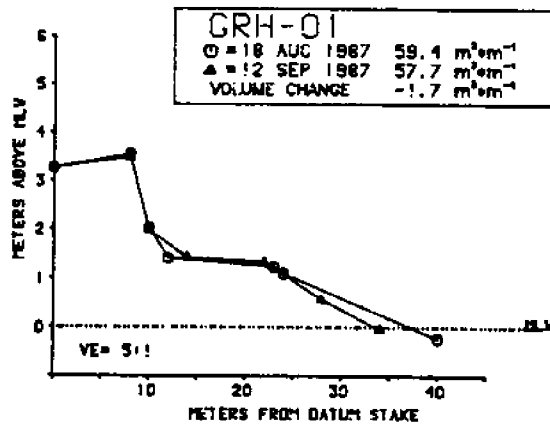
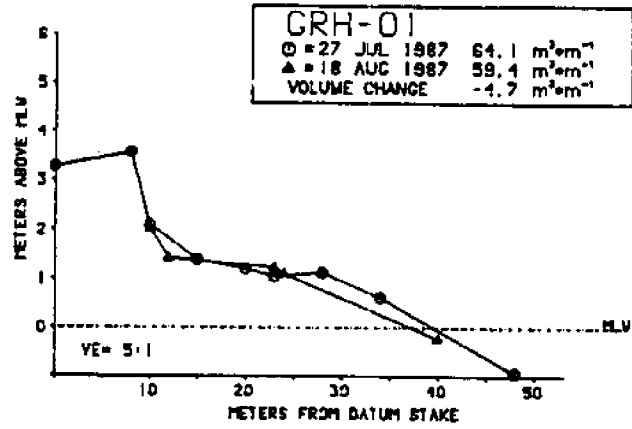


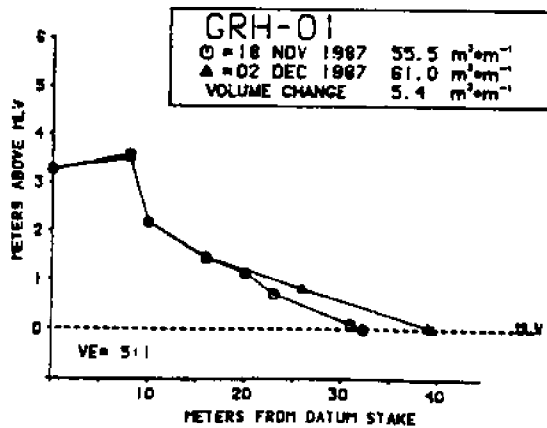
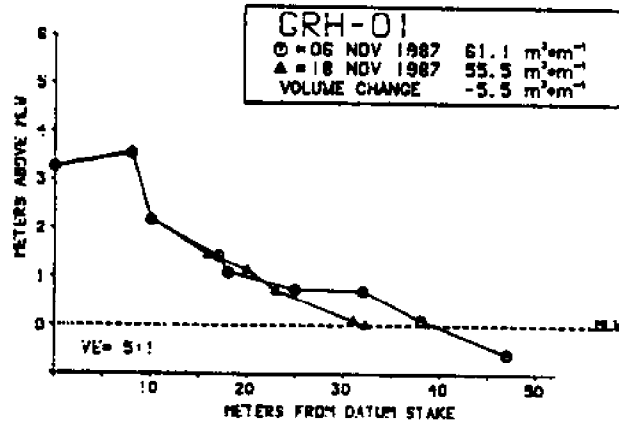
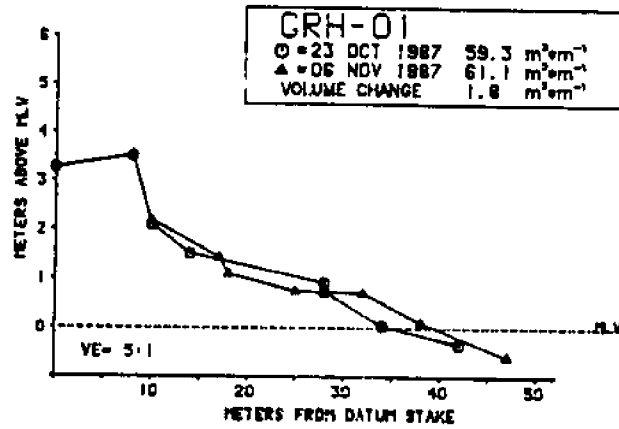
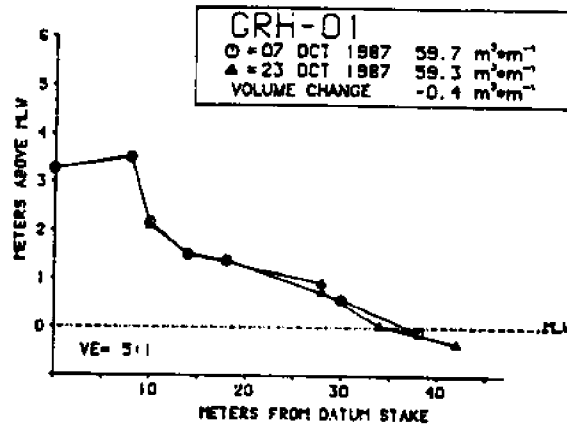


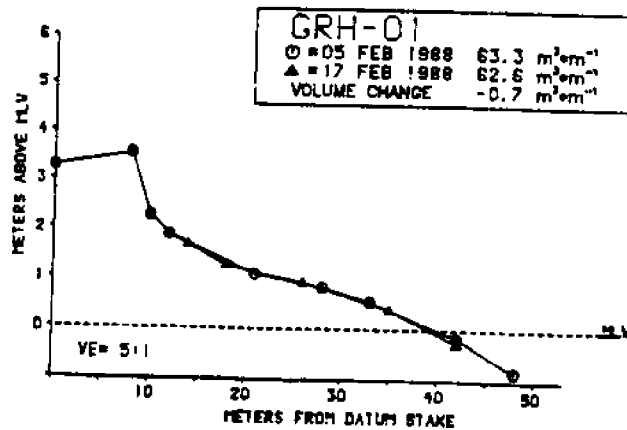
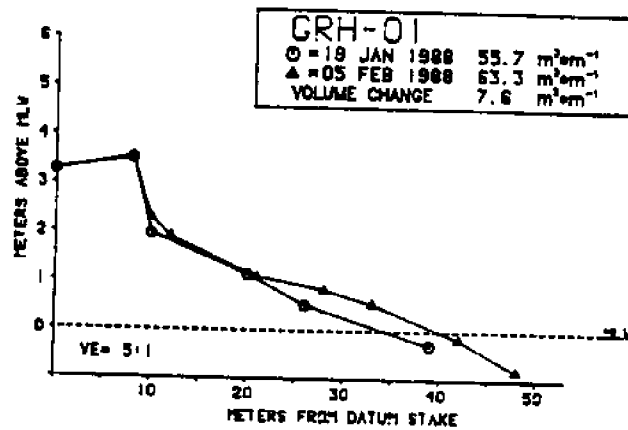
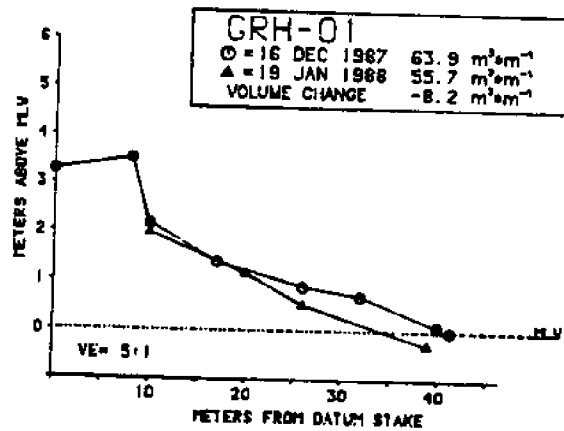
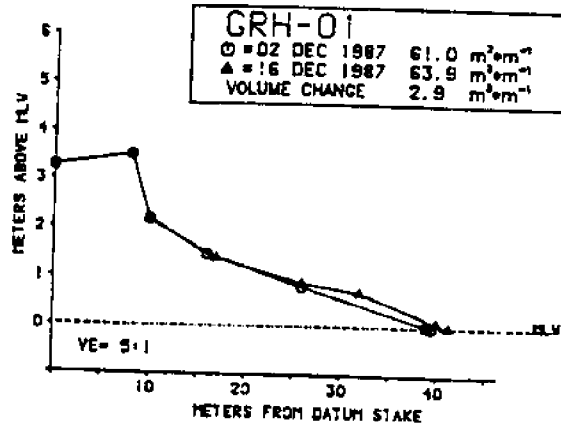




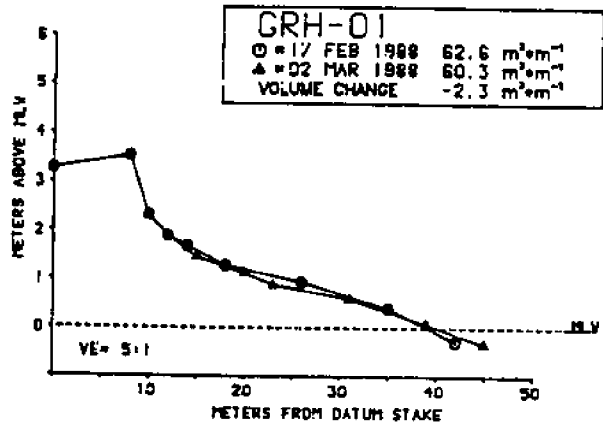




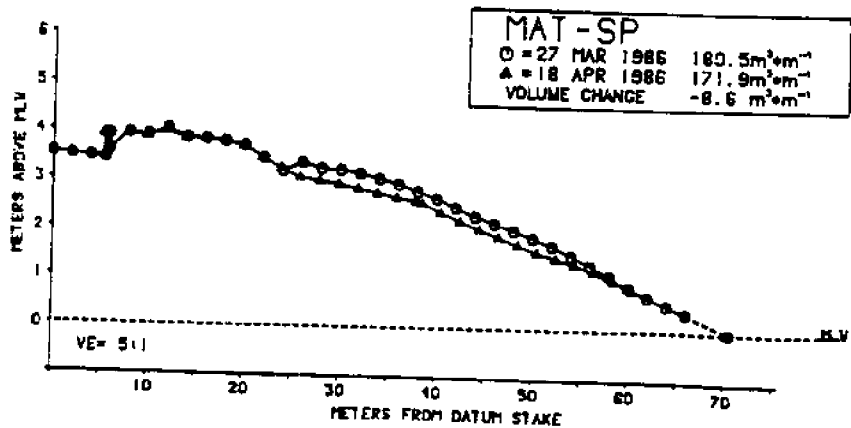
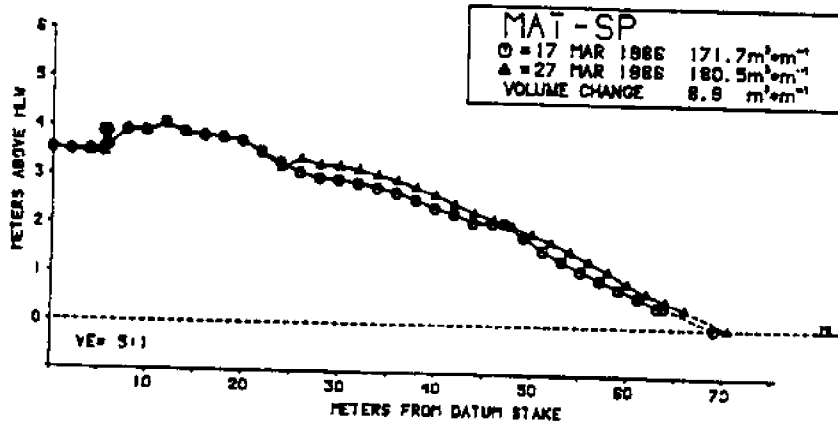
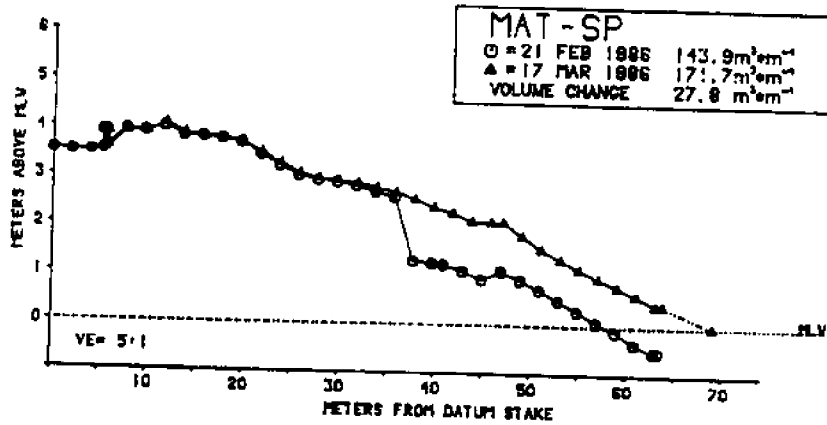
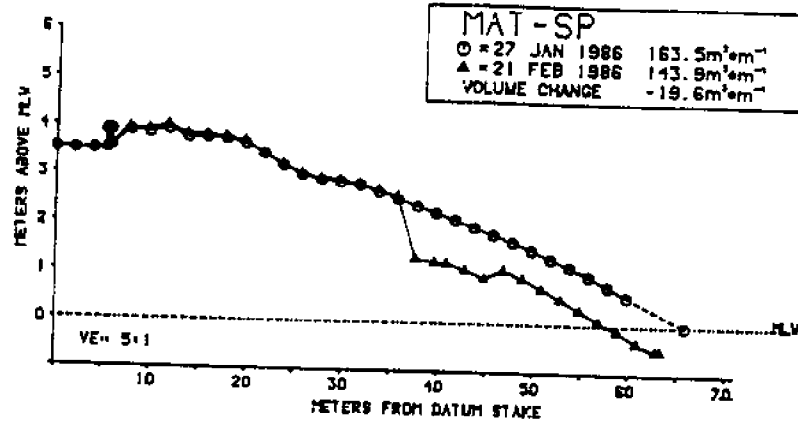


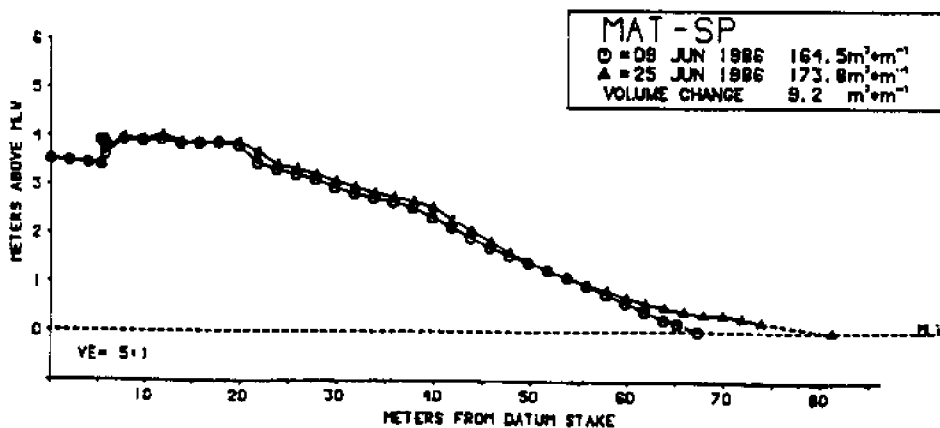
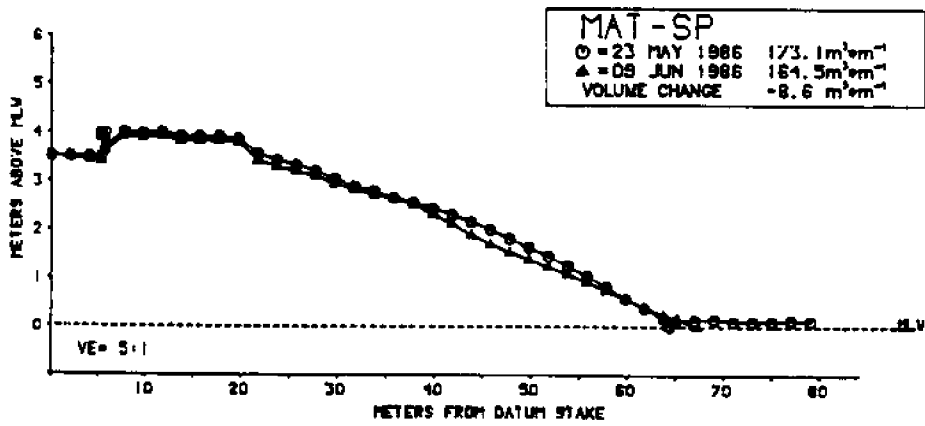
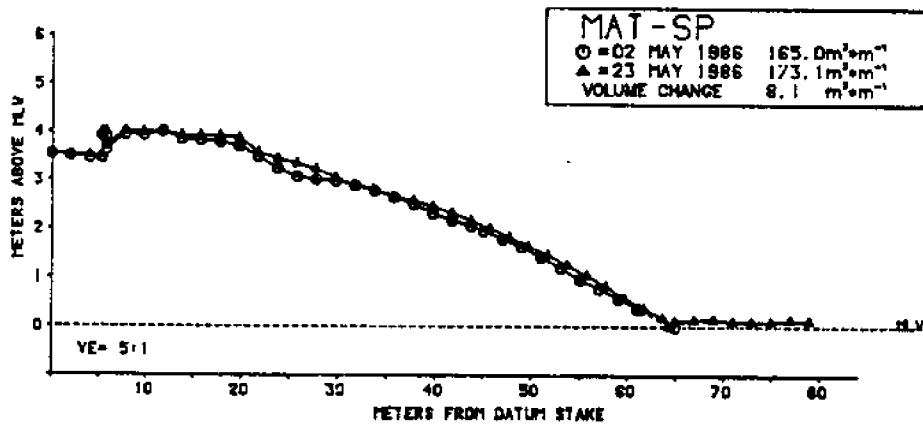
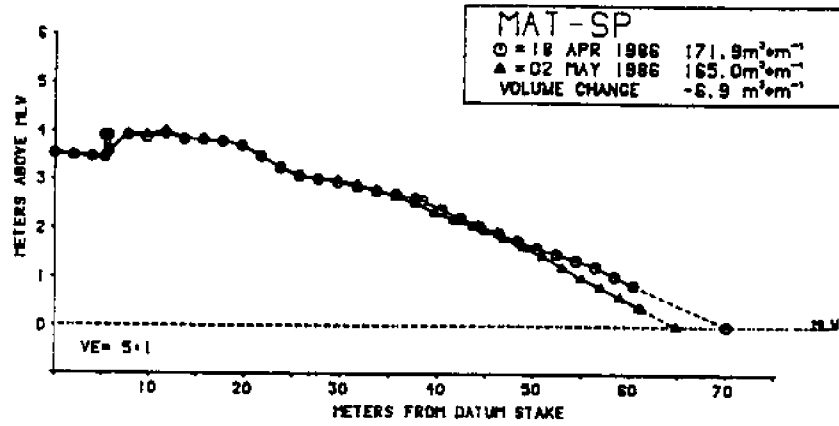


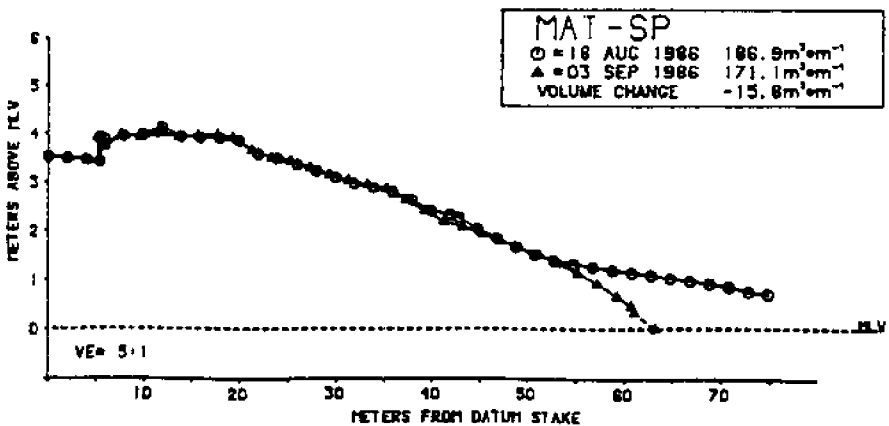
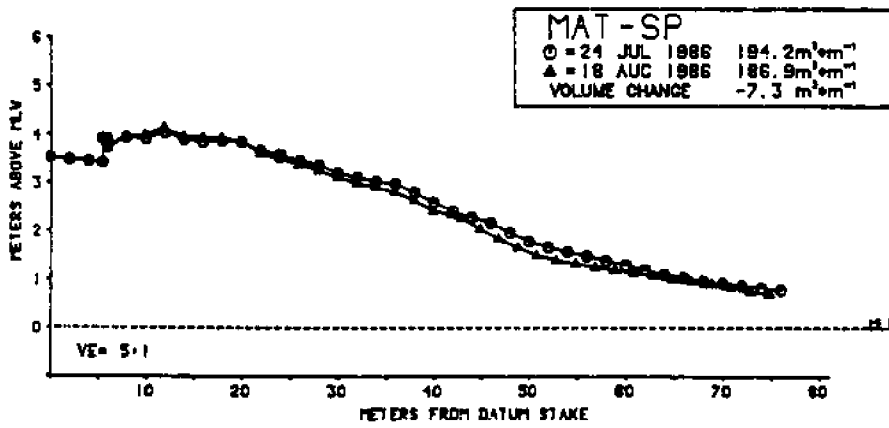
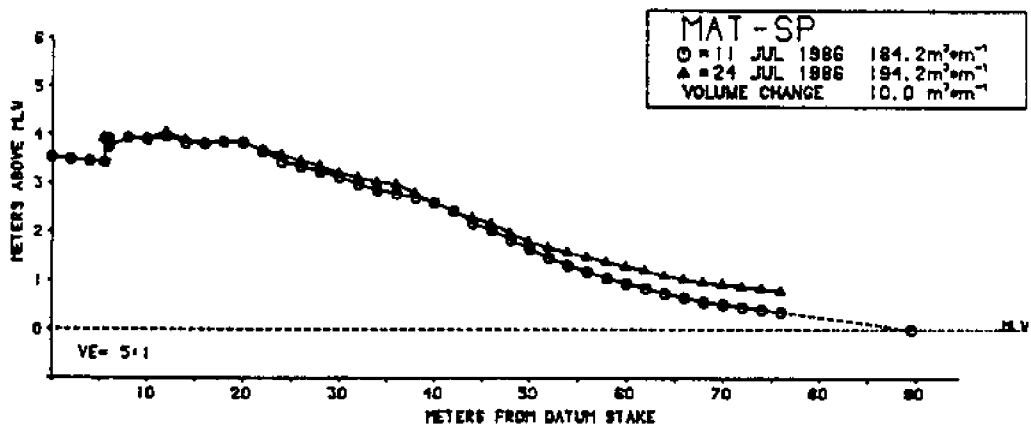
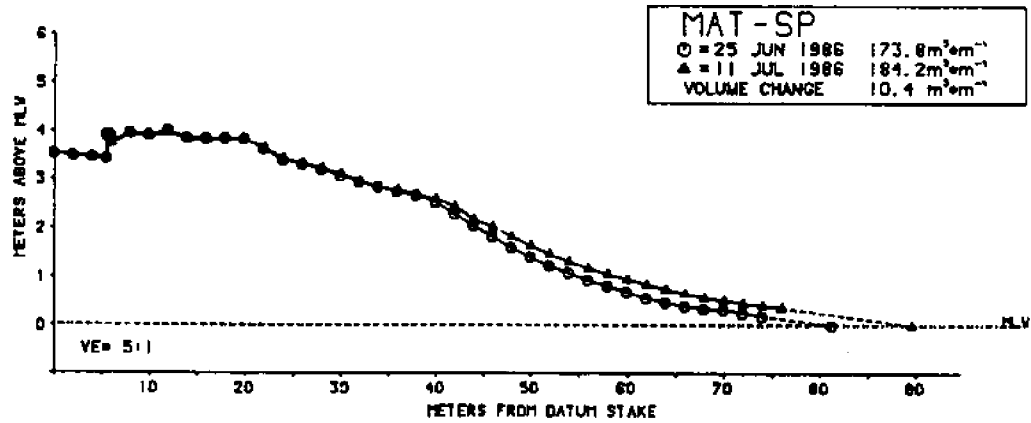


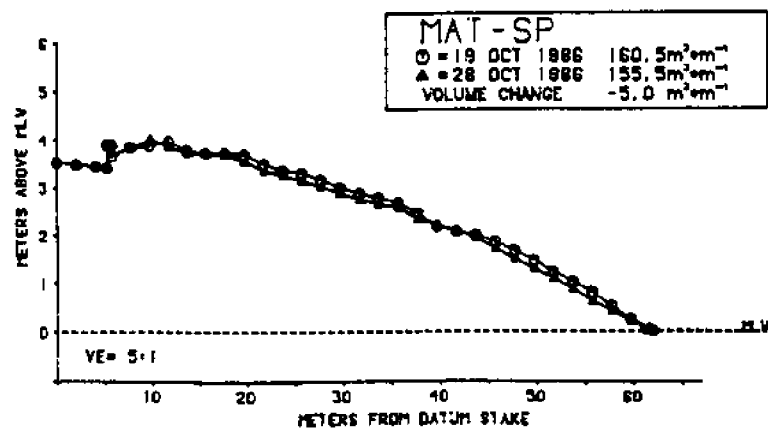
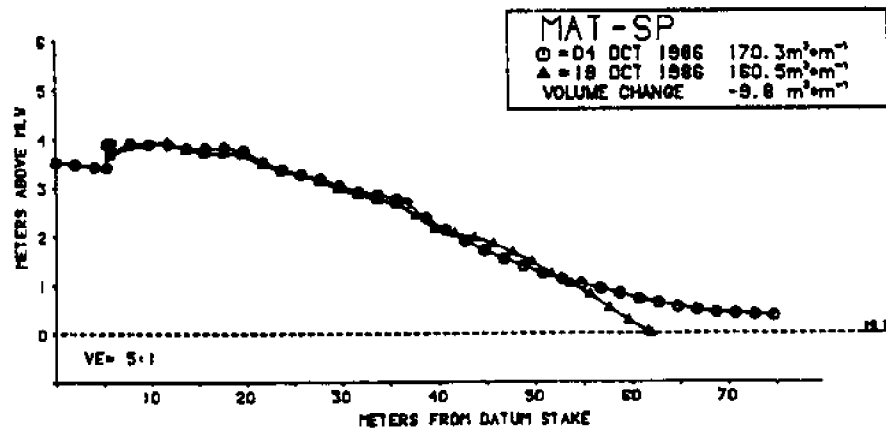
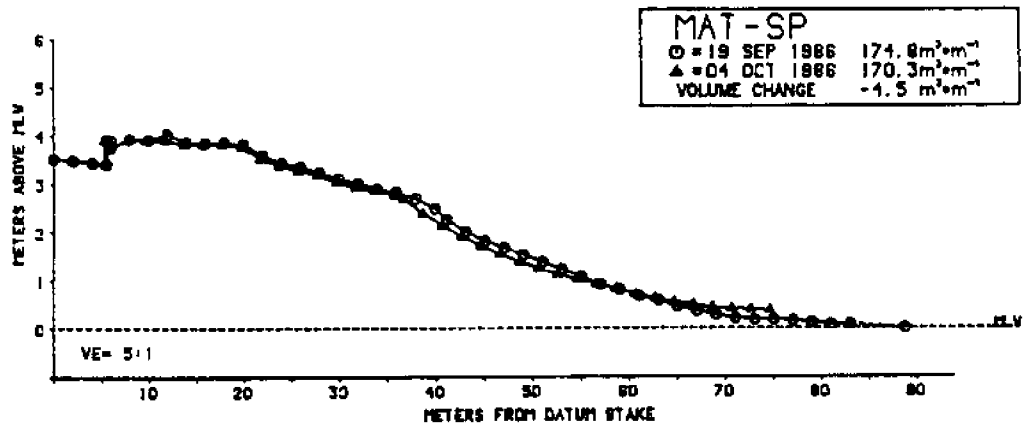
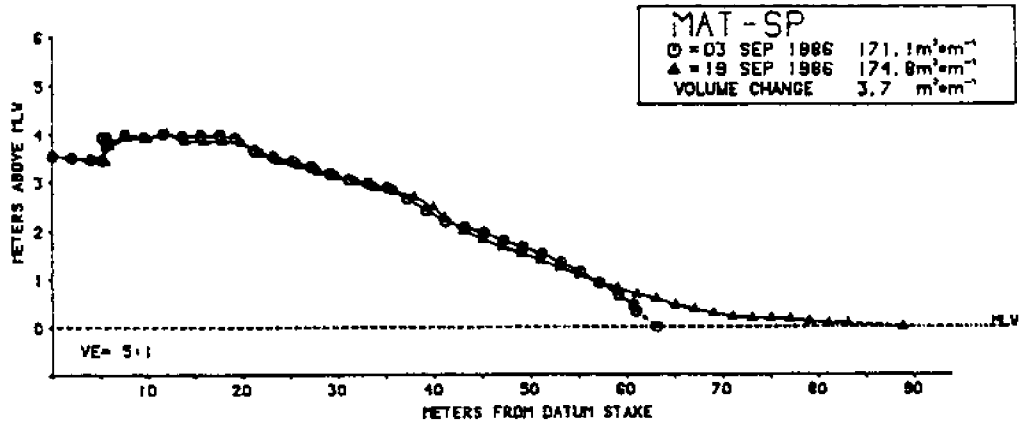


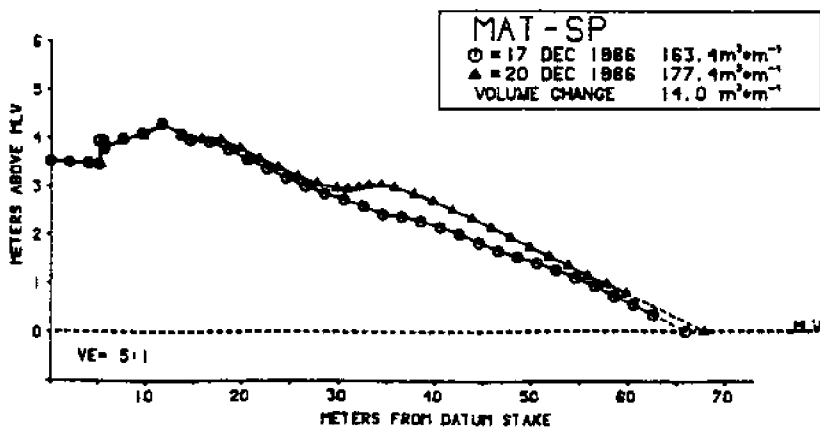
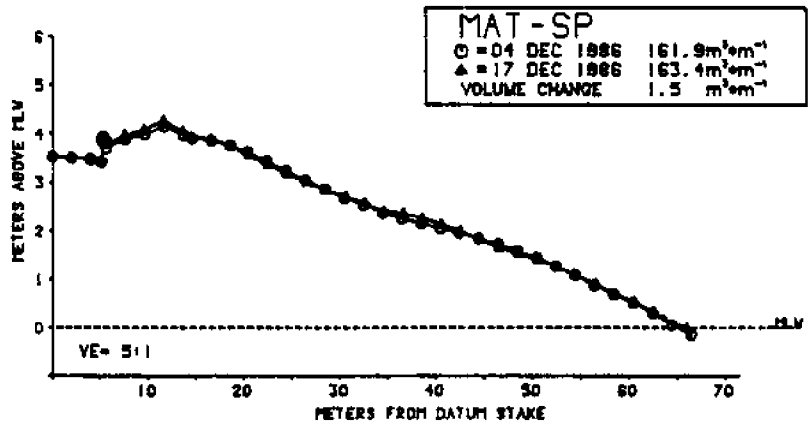
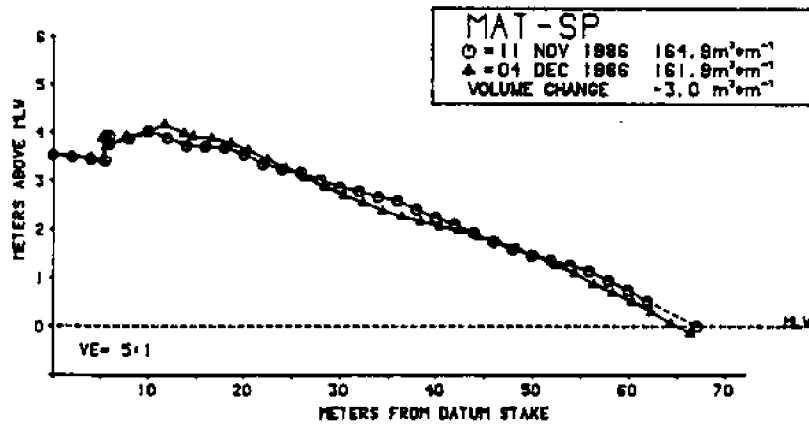
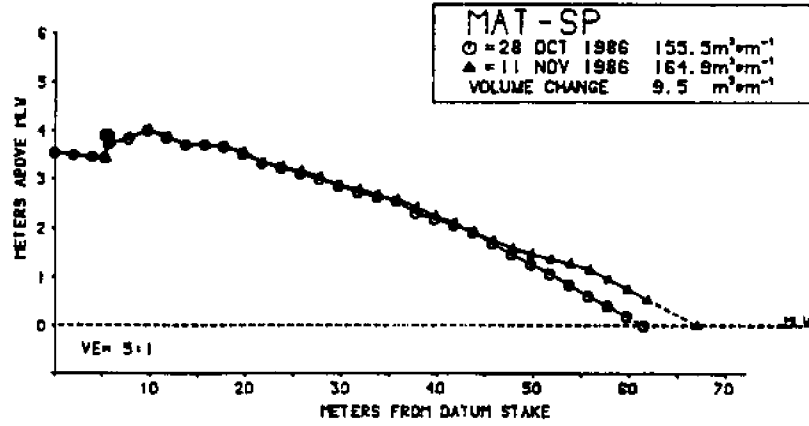
**APPENDIX 1G**  
**MAT-SP Profile Plots**

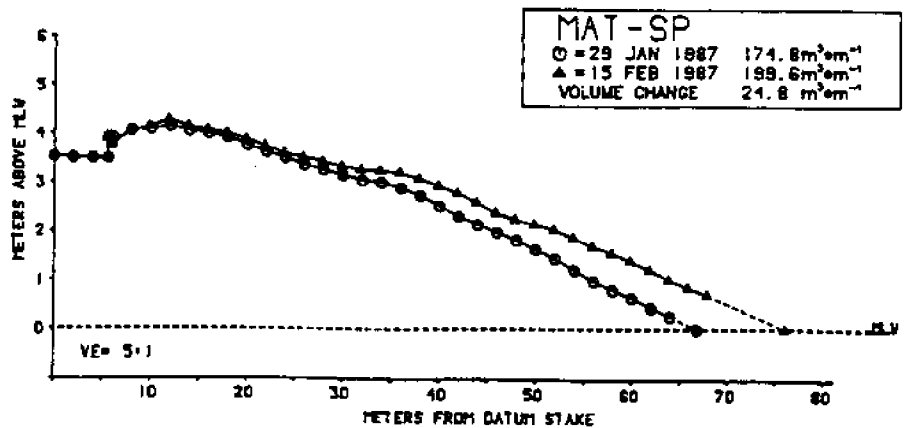
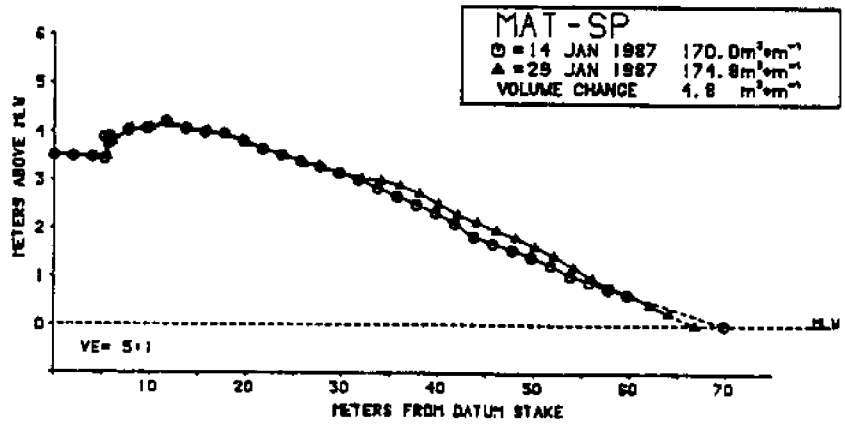
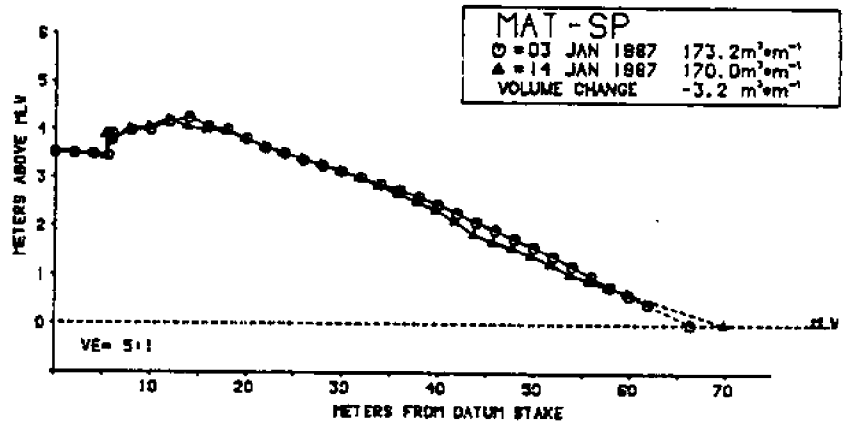
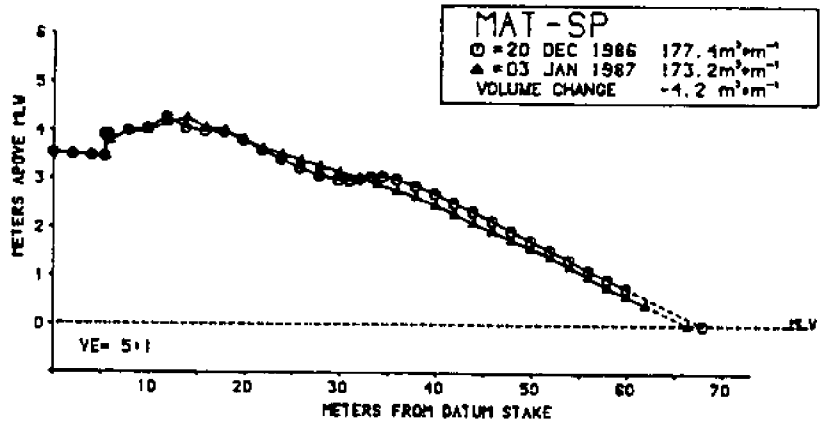




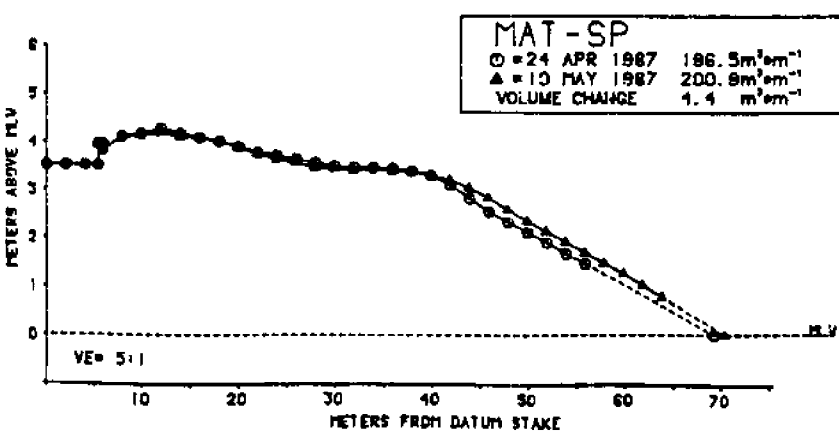
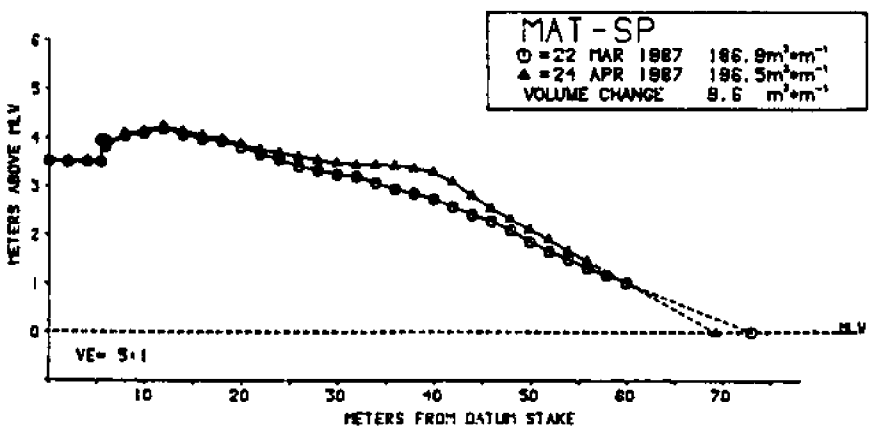
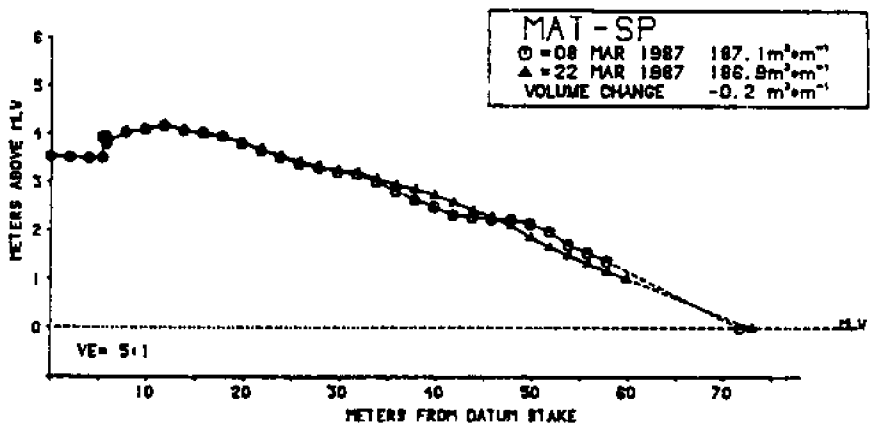
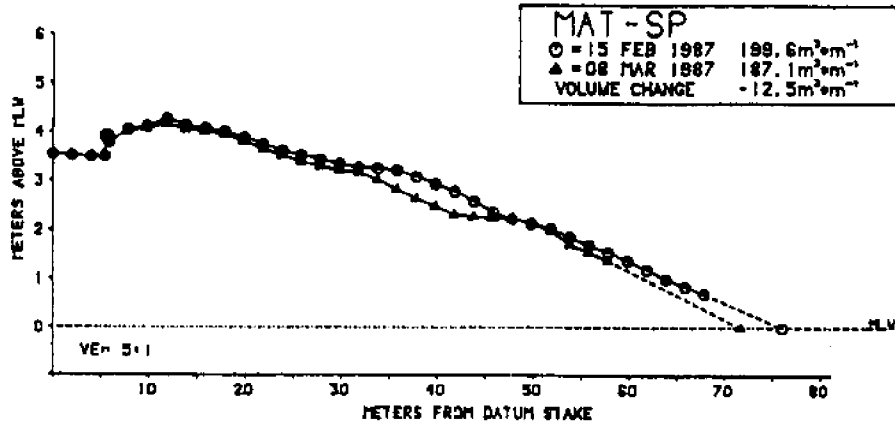


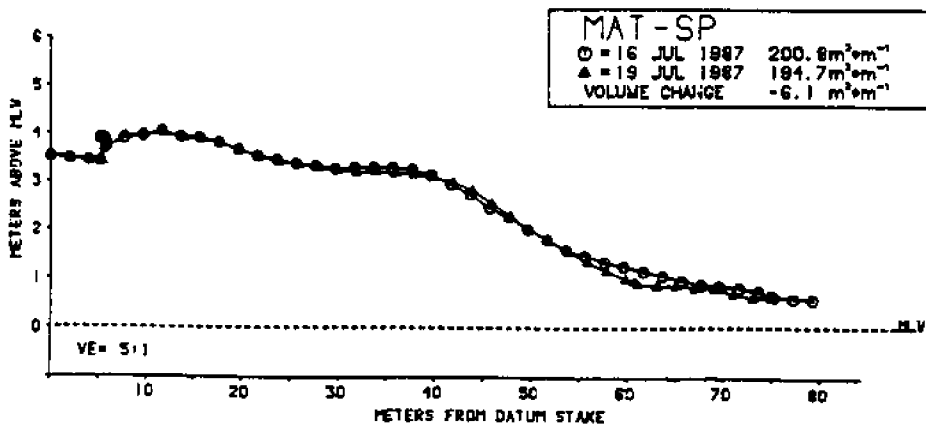
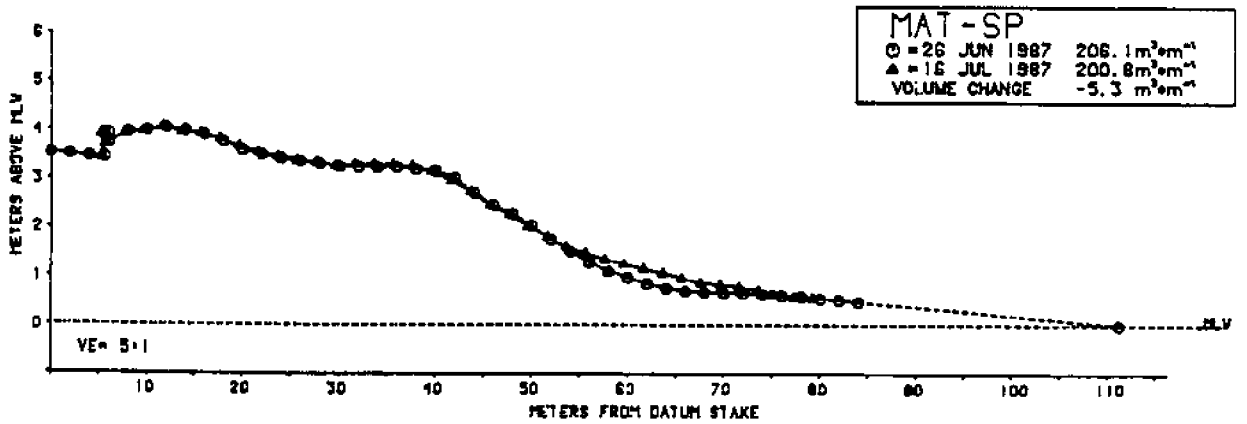
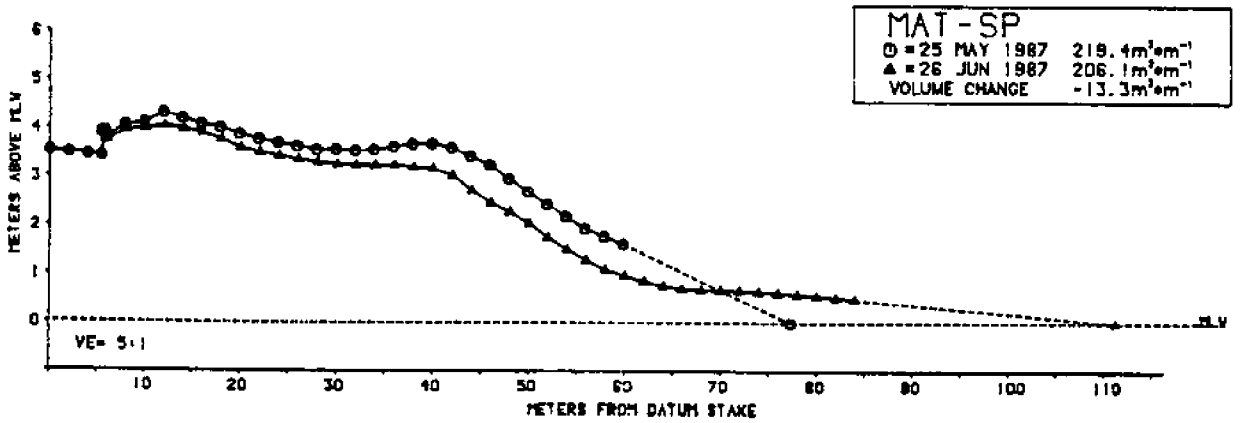
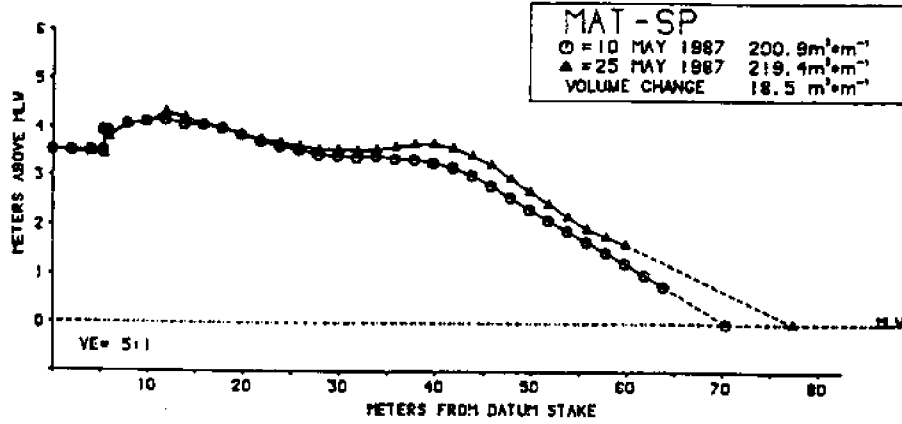


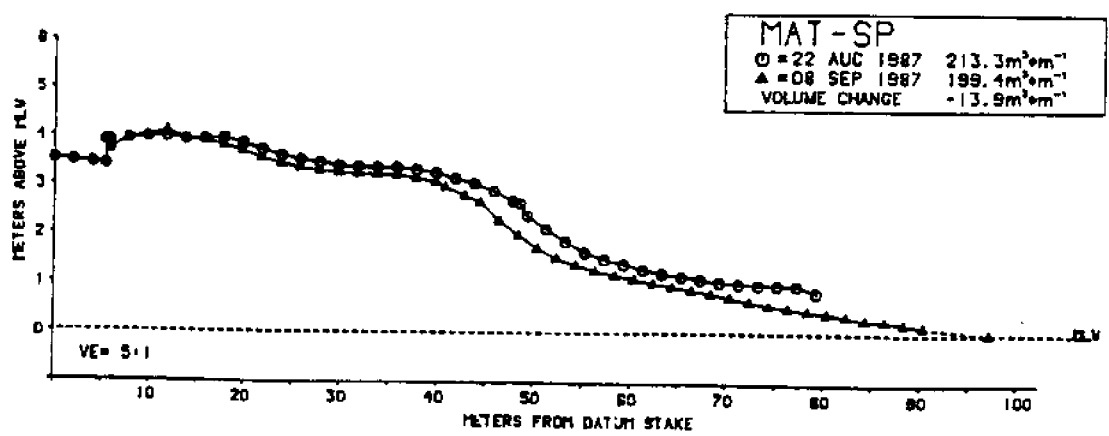
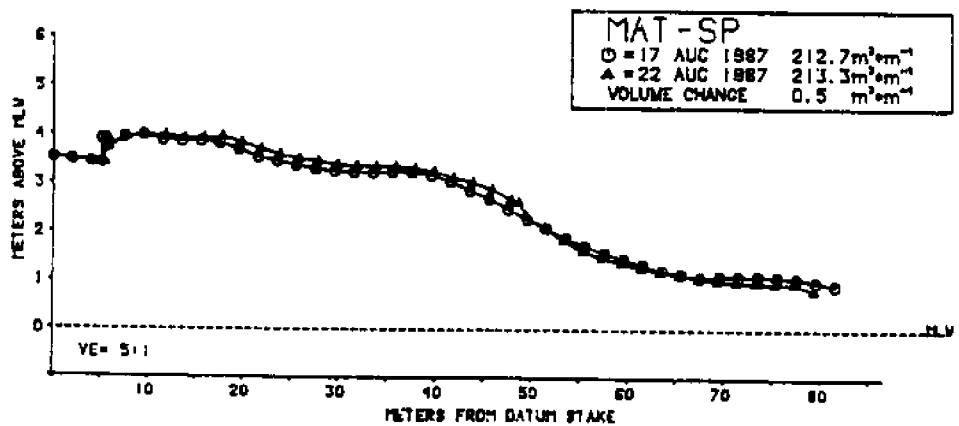
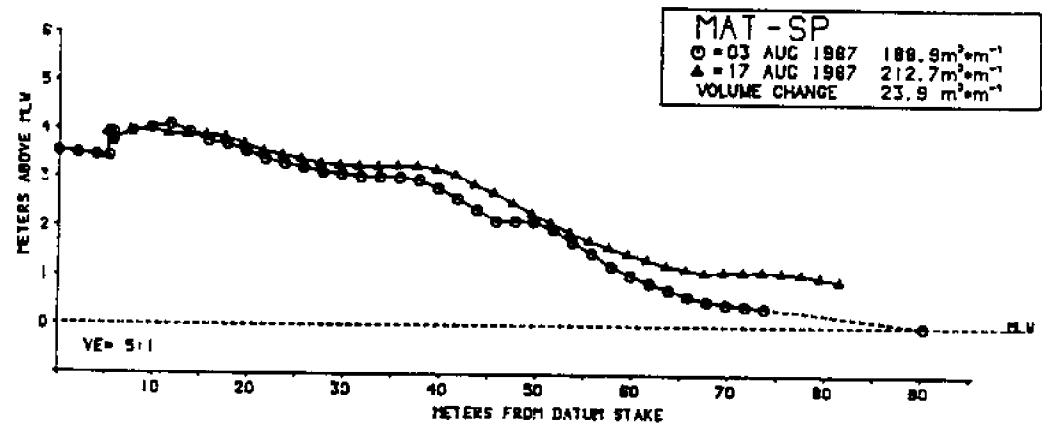
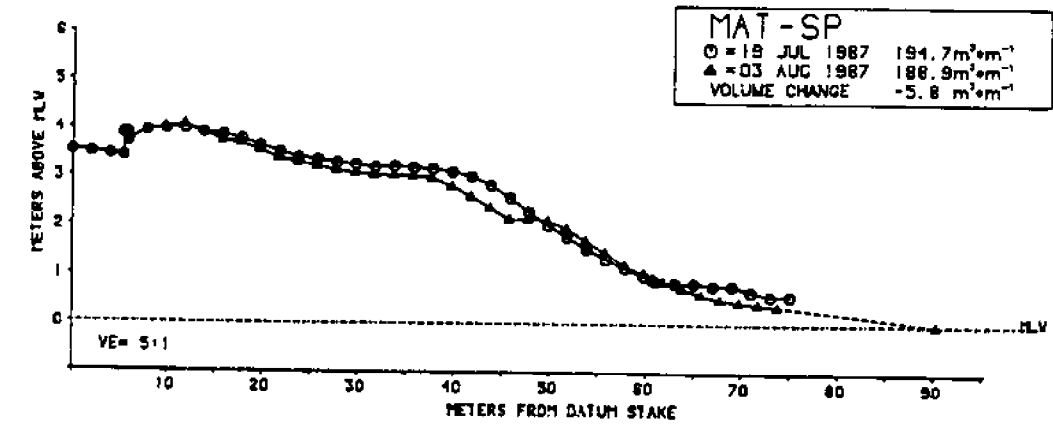


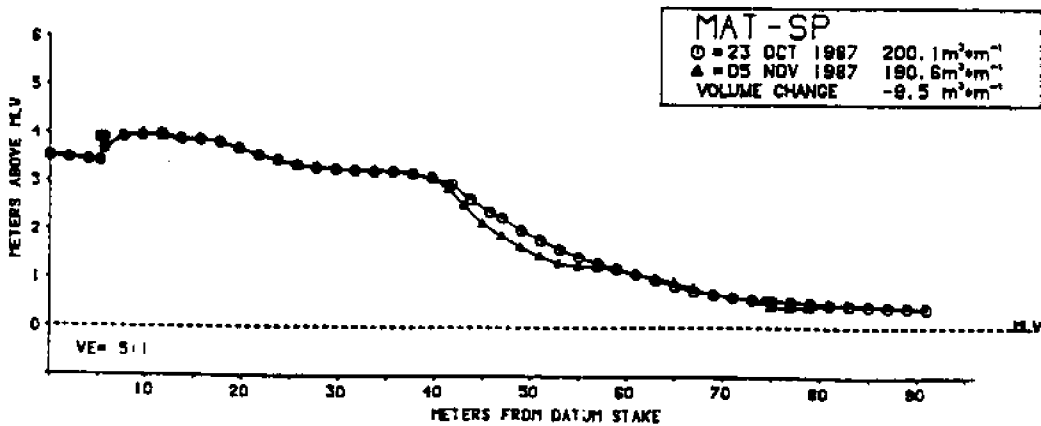
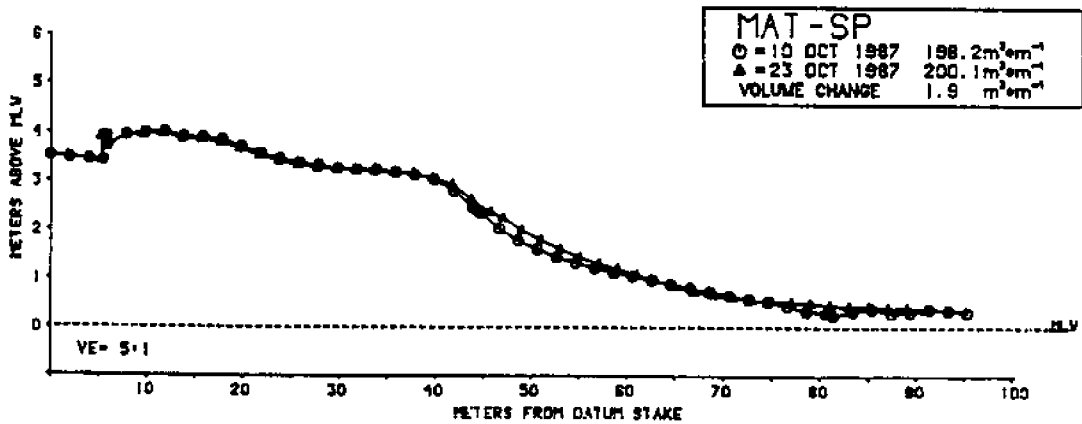
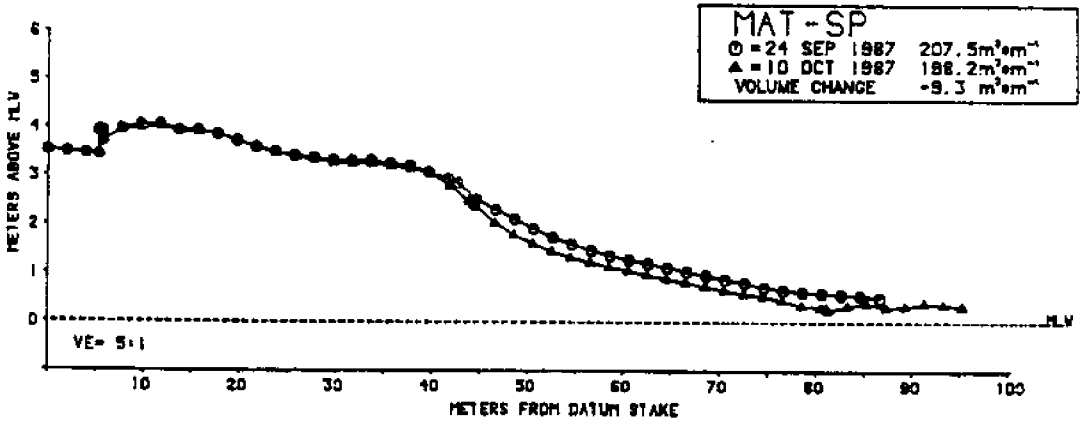
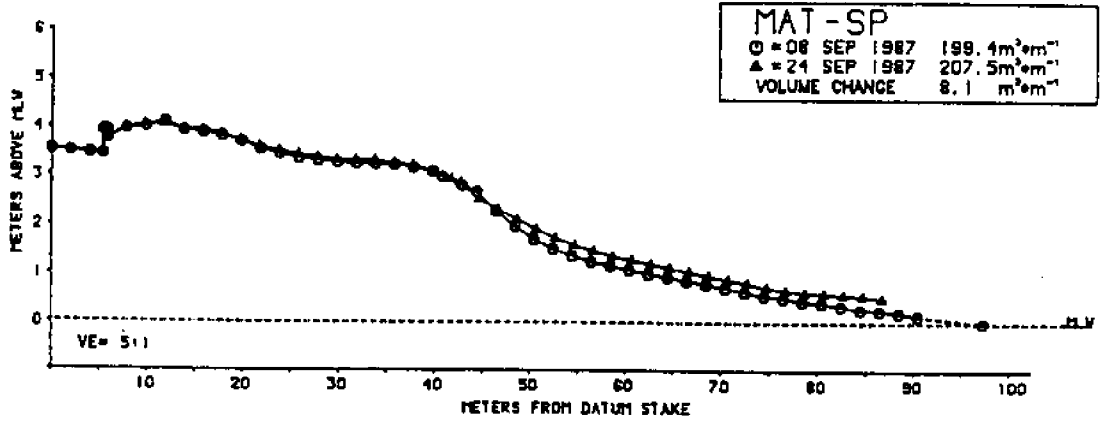


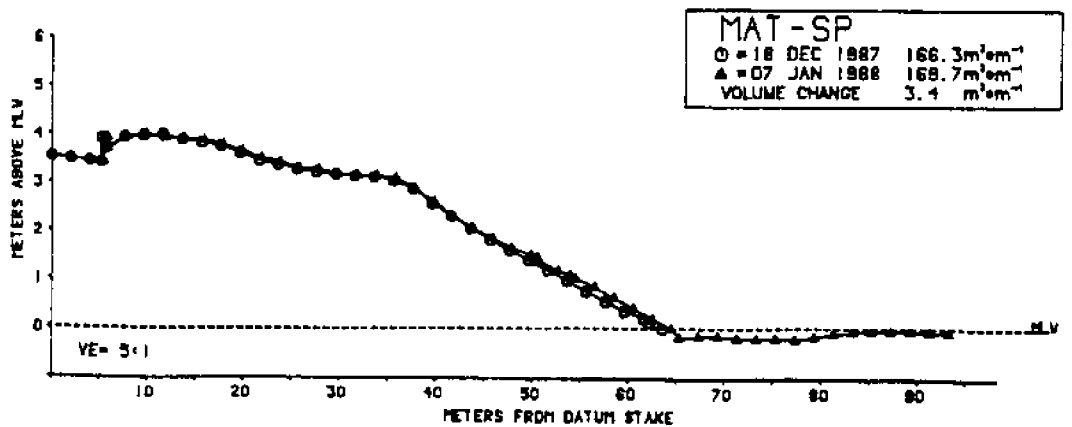
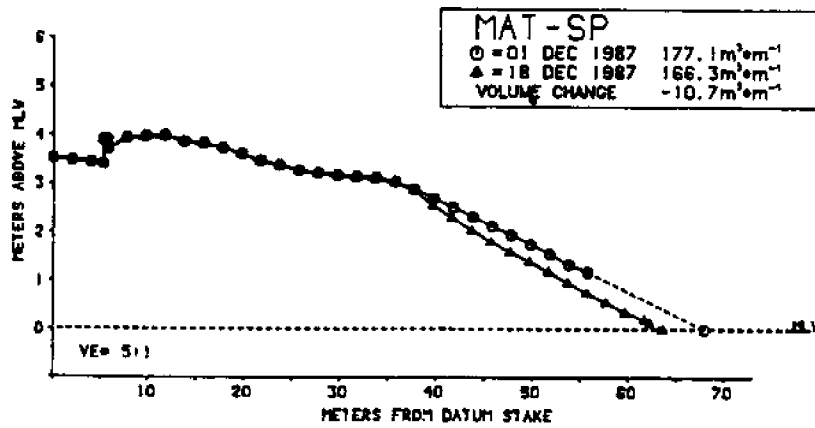
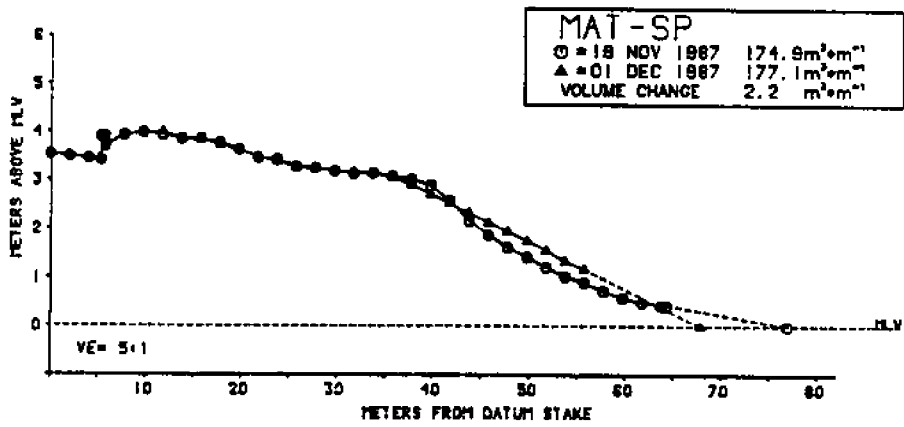
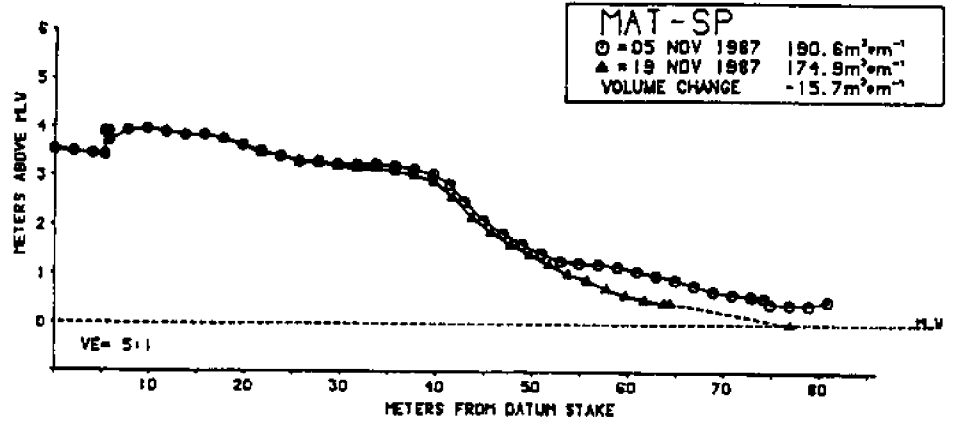


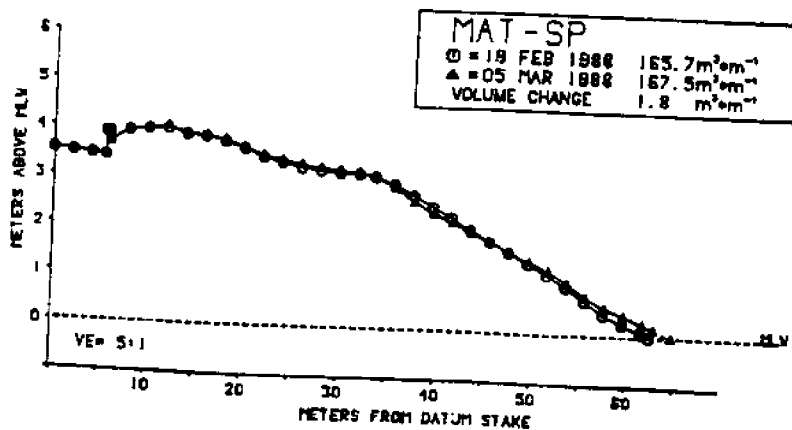
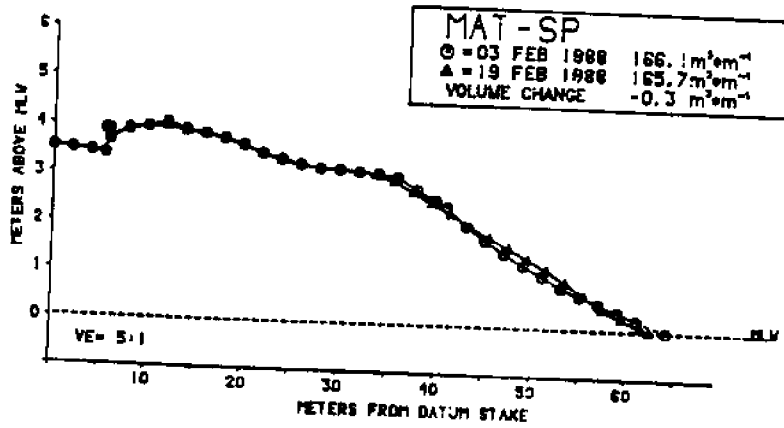
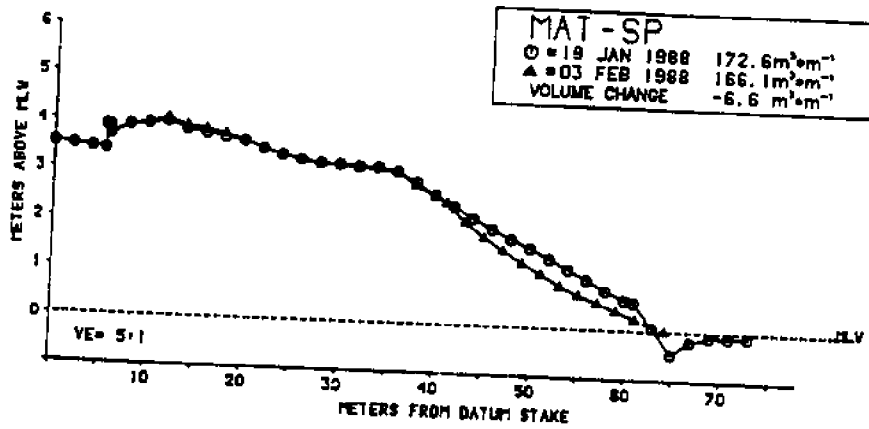
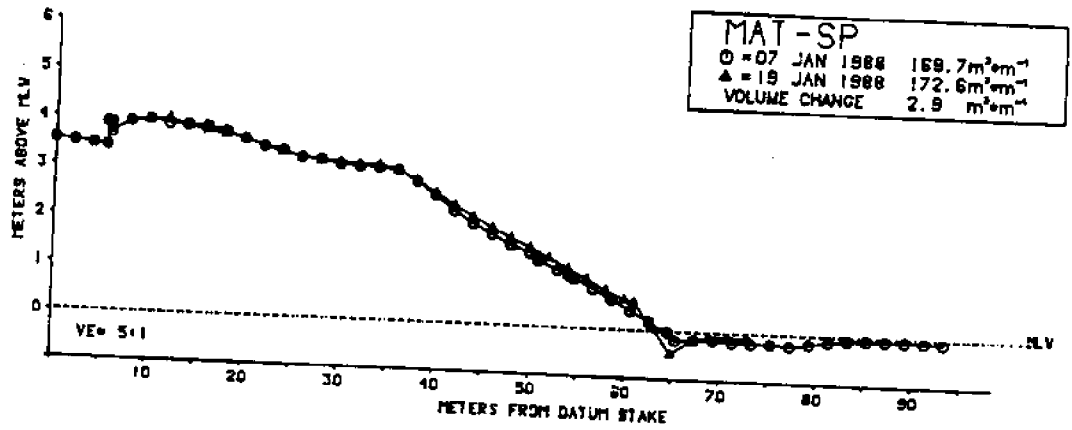


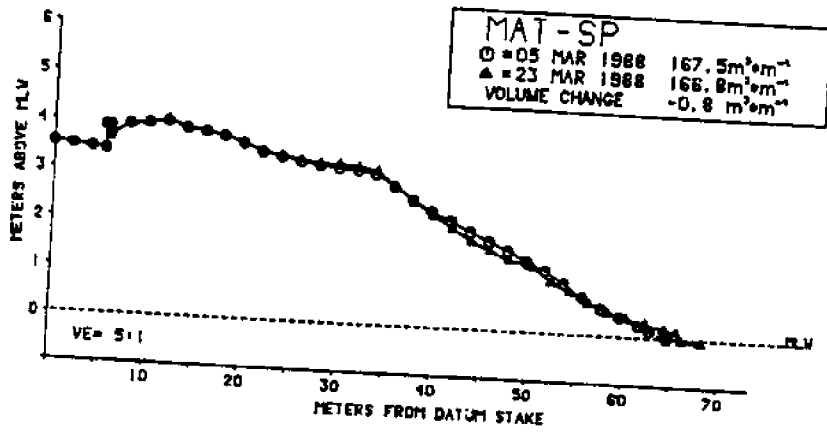








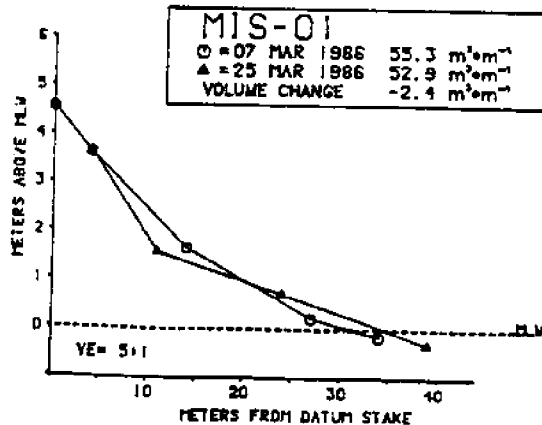
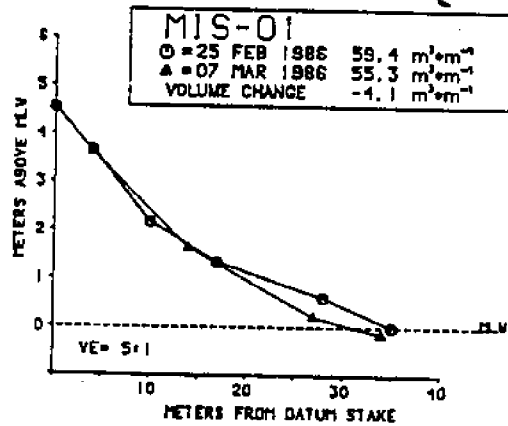
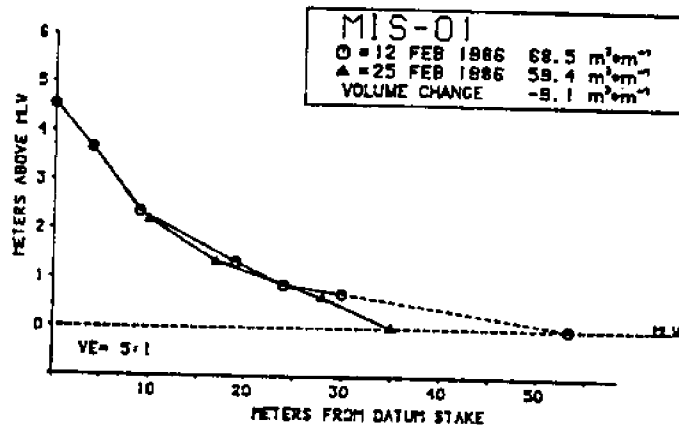
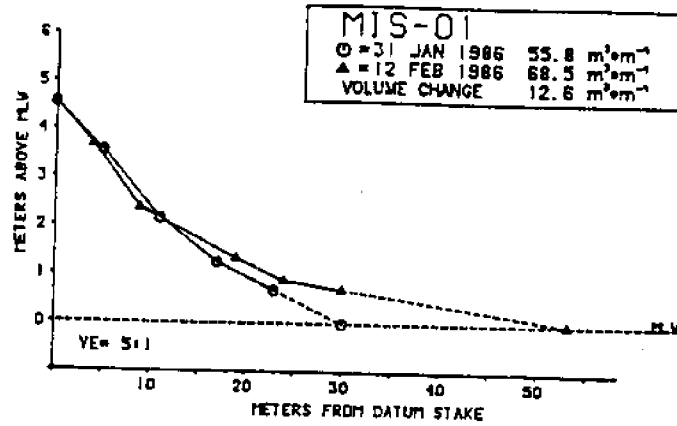


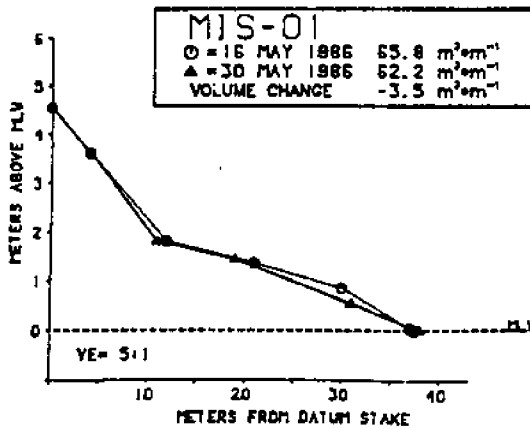
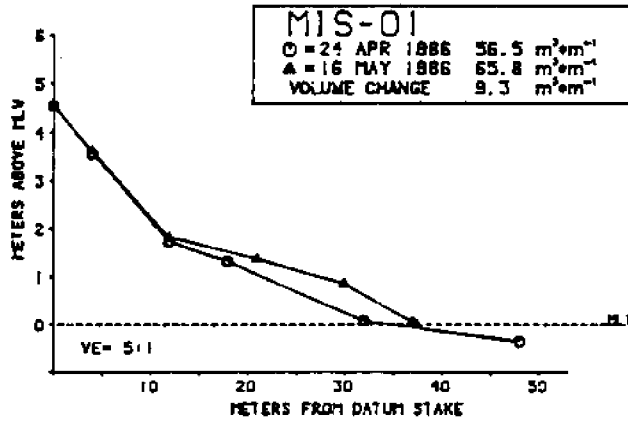
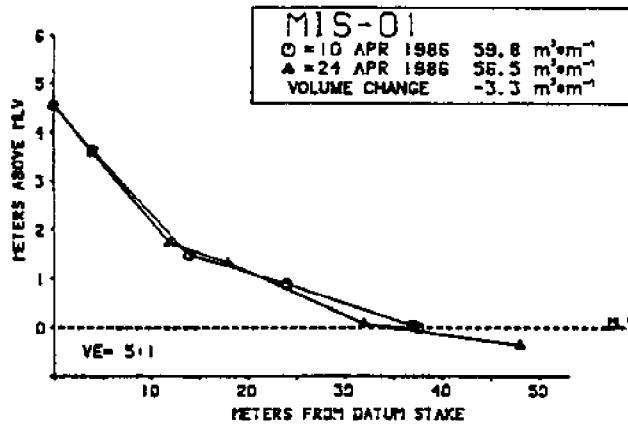
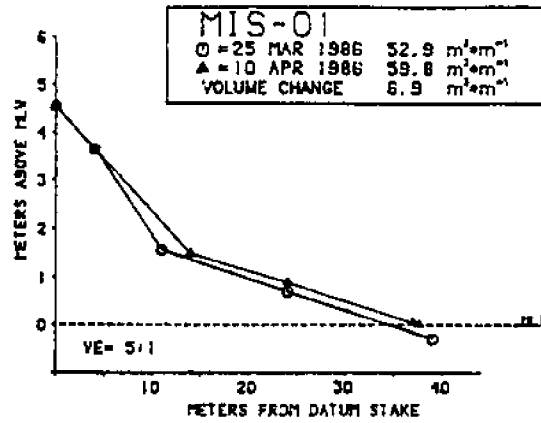


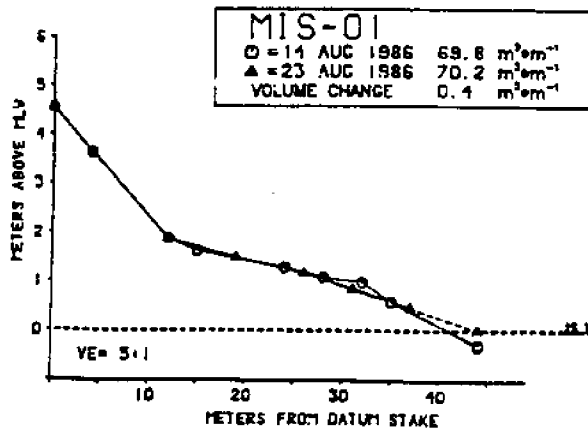
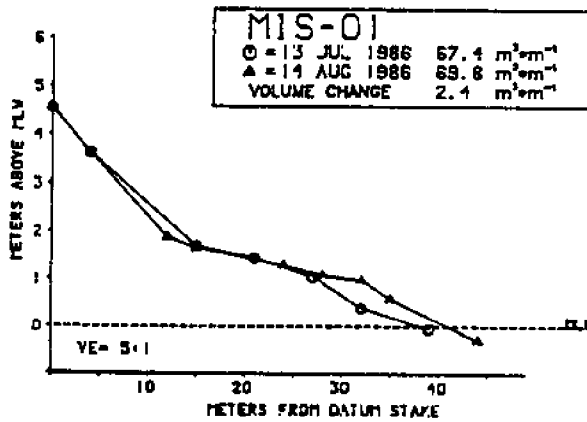
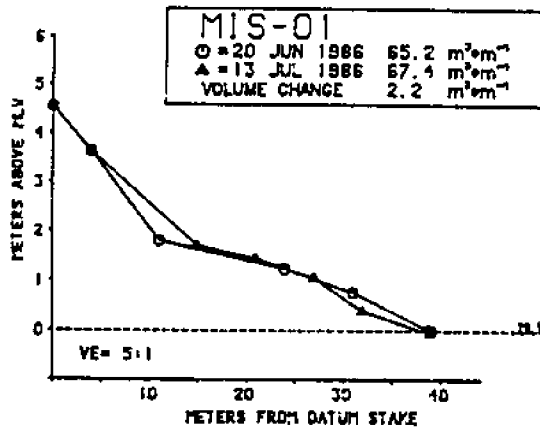
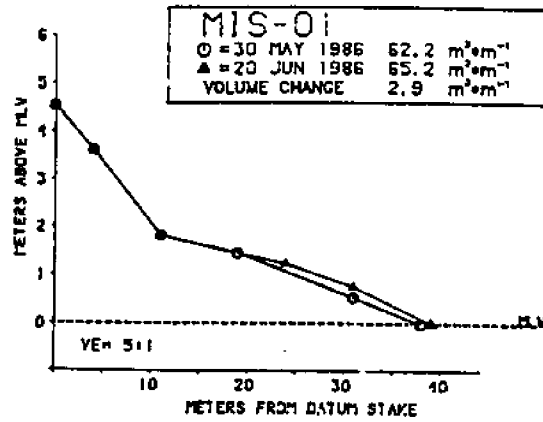
## **APPENDIX 1H**

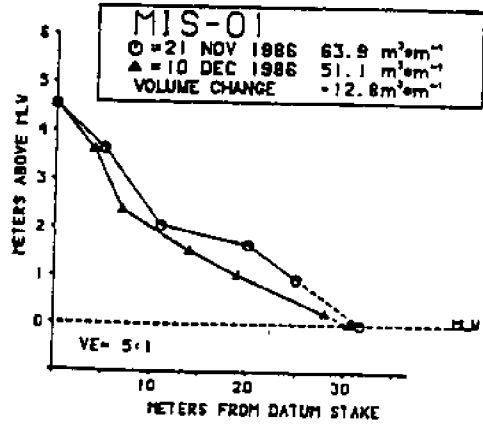
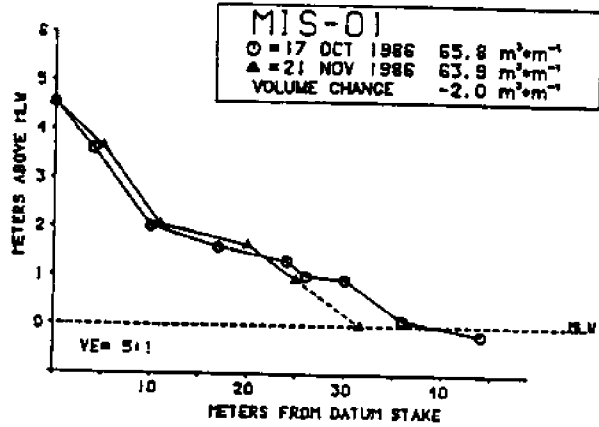
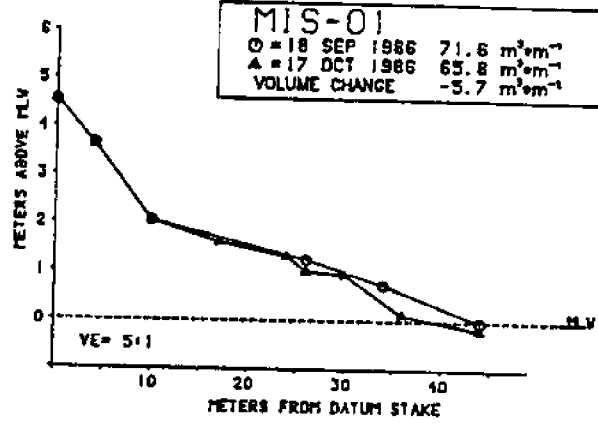
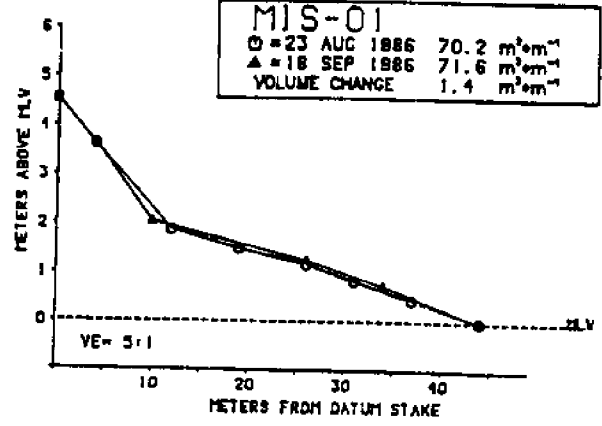
### **MIS-01 Profile Plots**

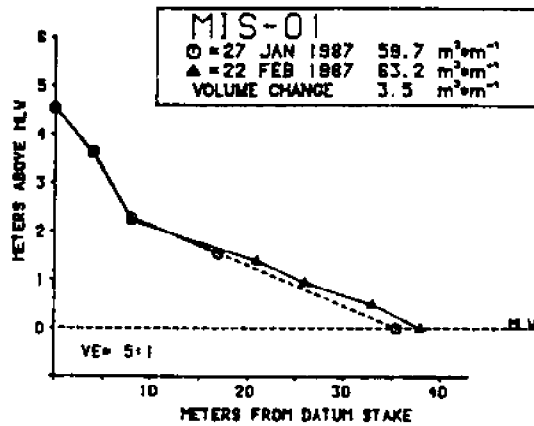
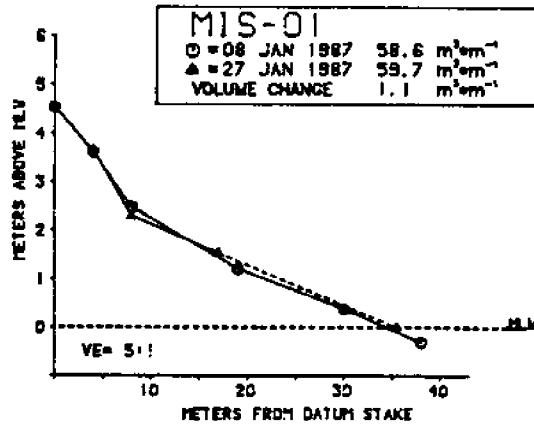
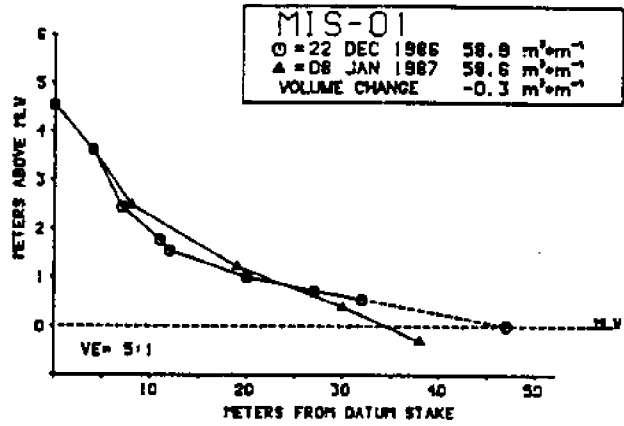
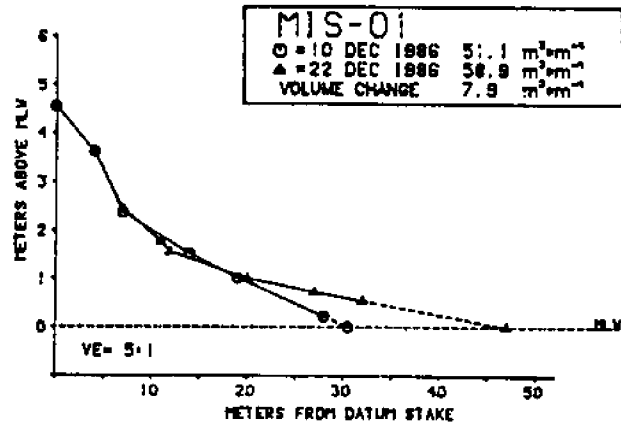


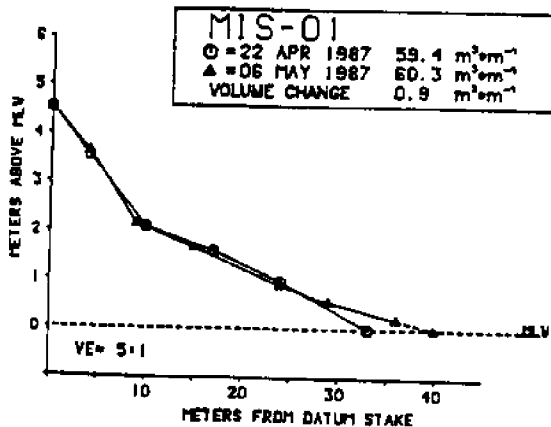
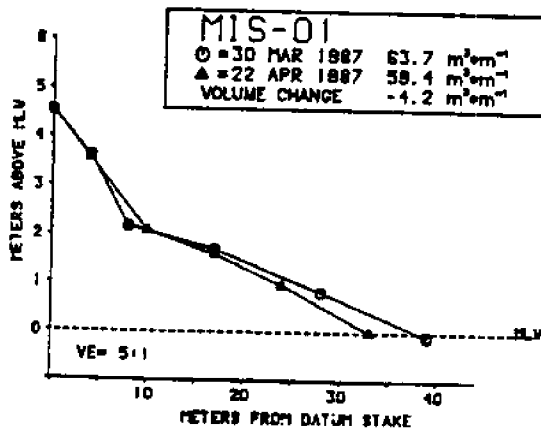
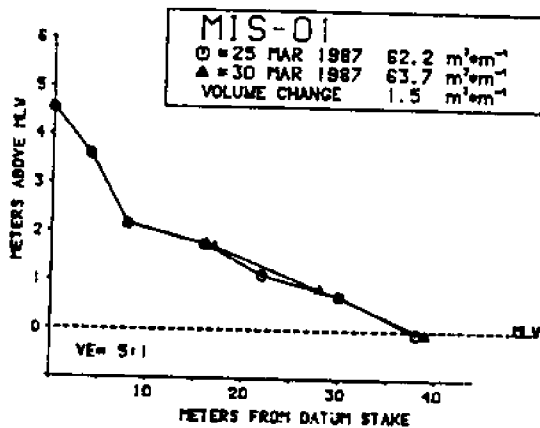
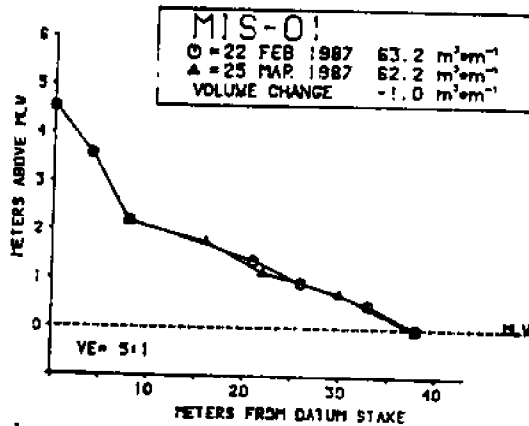


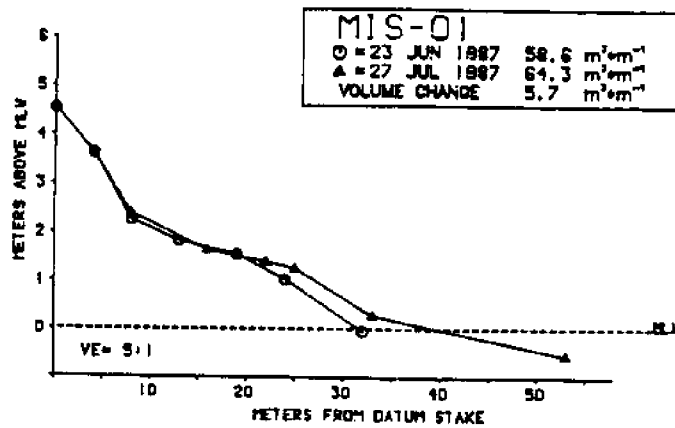
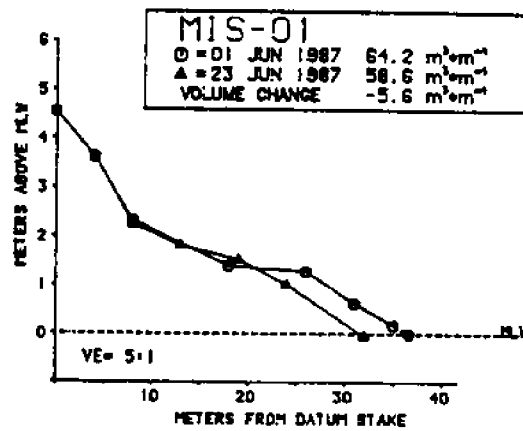
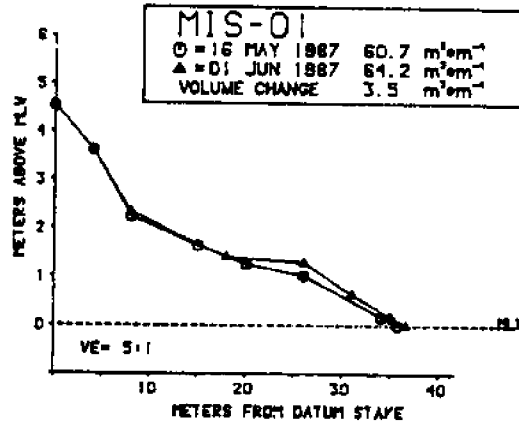
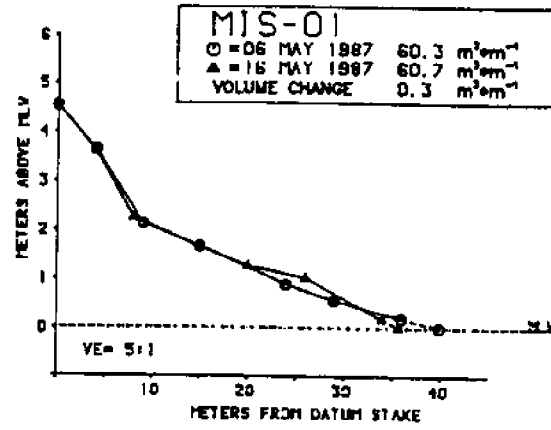


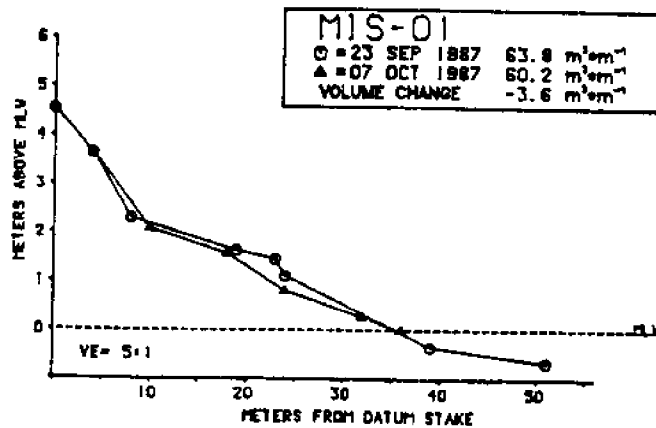
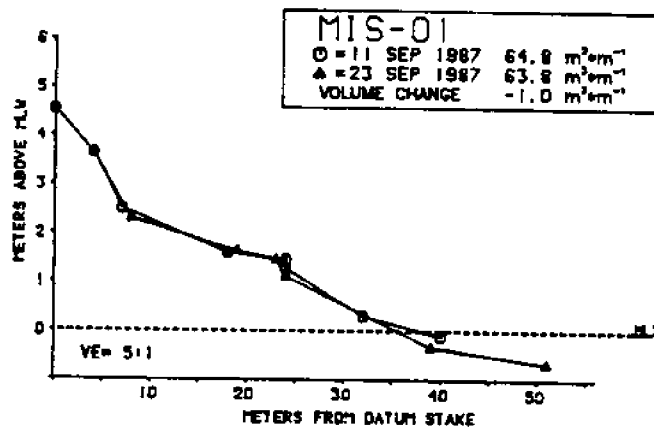
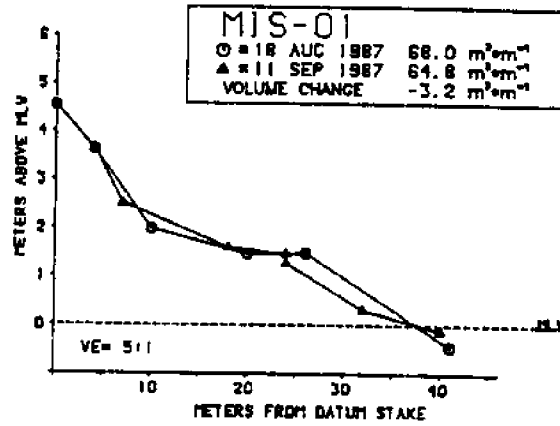
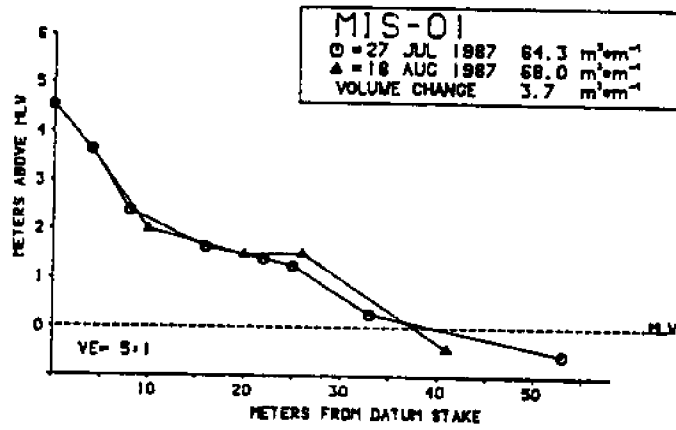




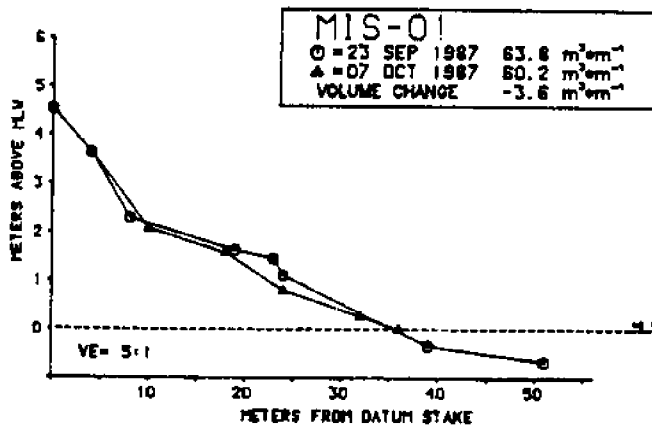
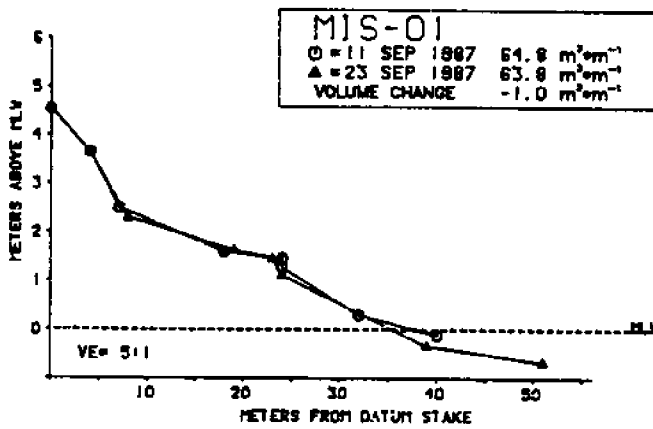
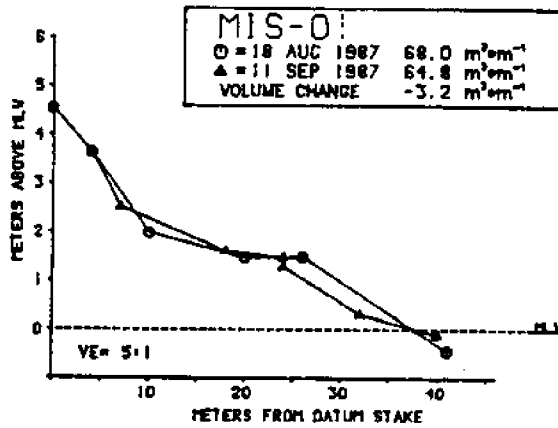
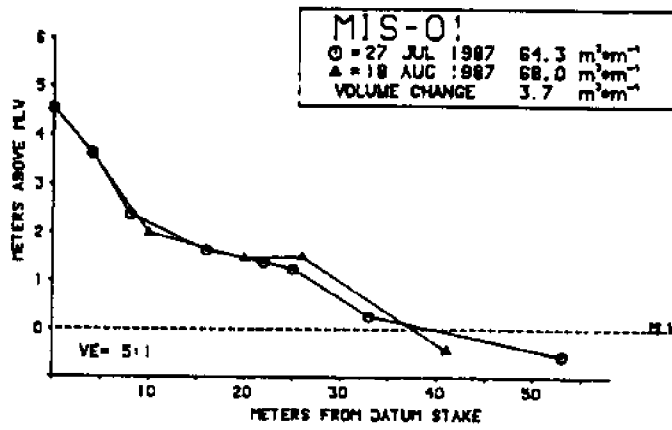


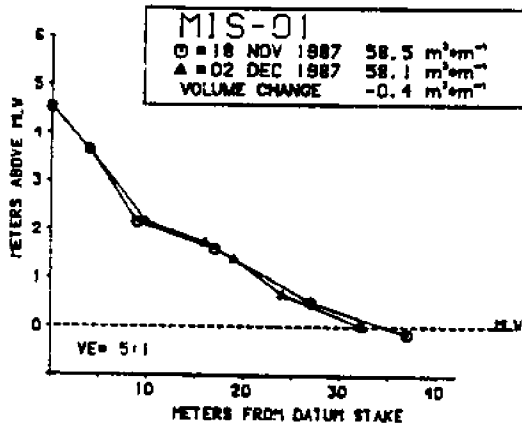
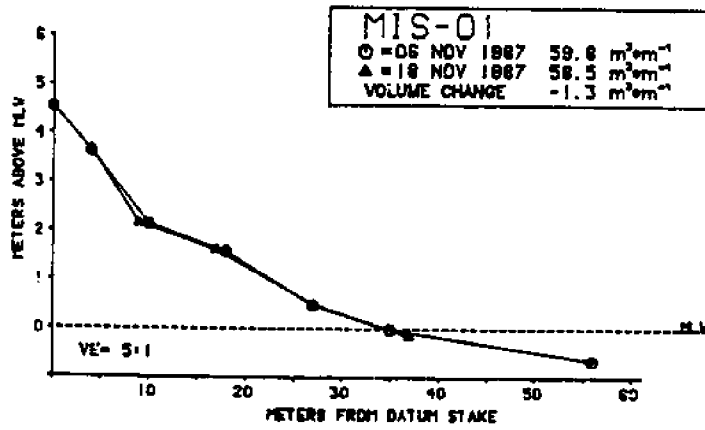
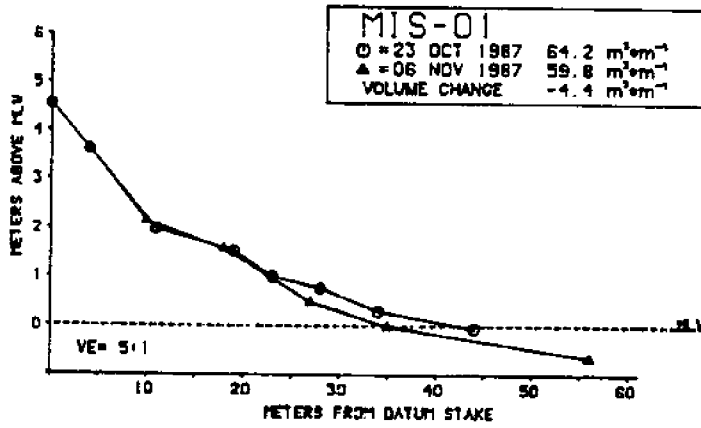
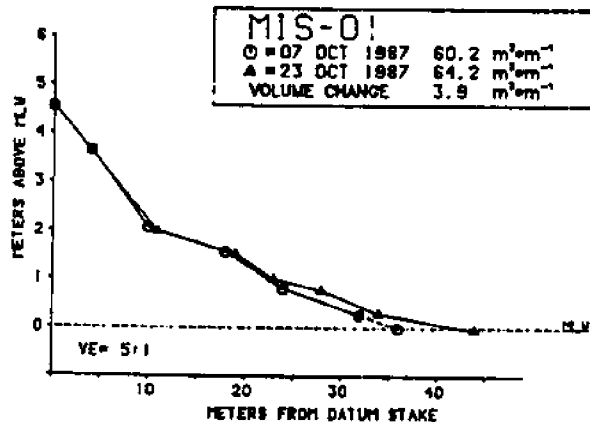


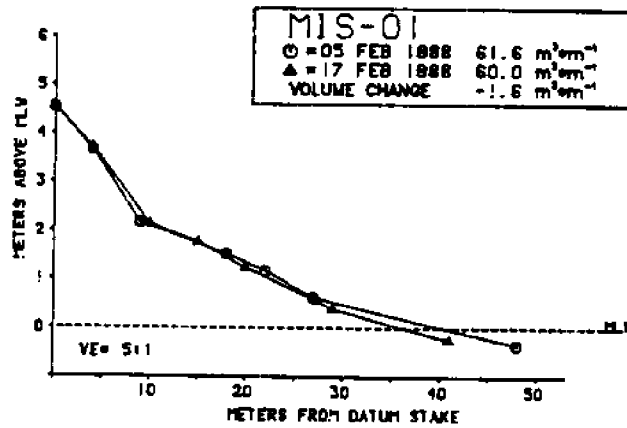
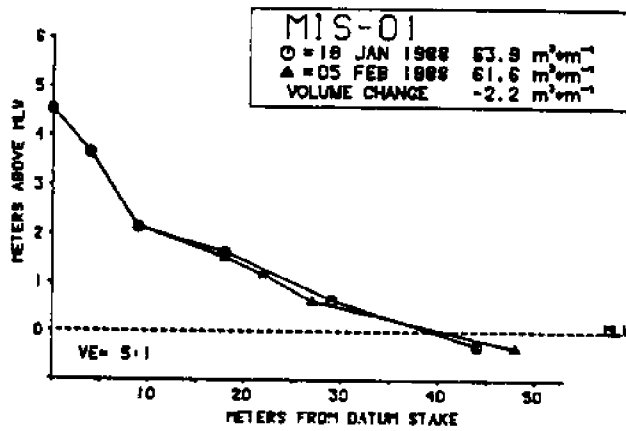
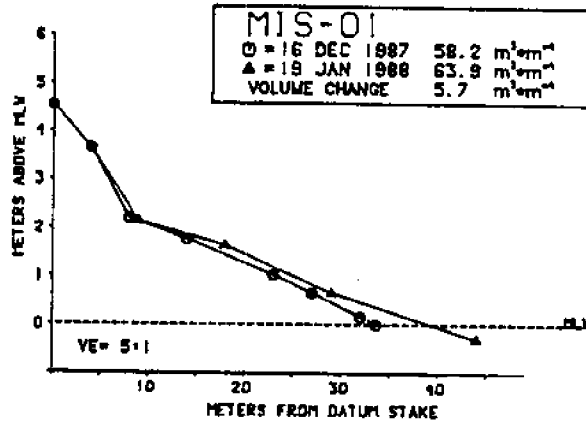
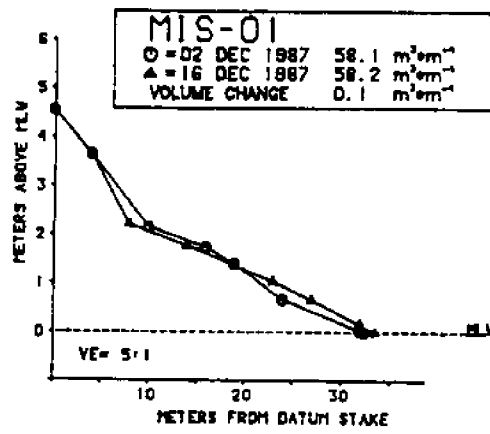


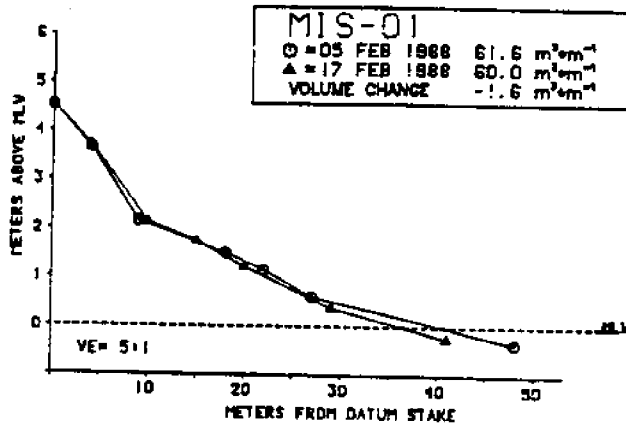
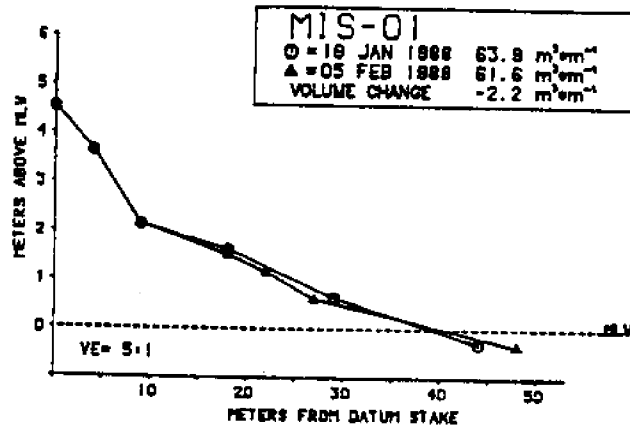
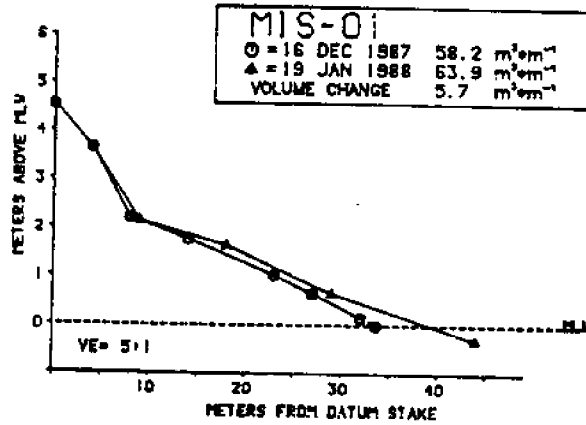
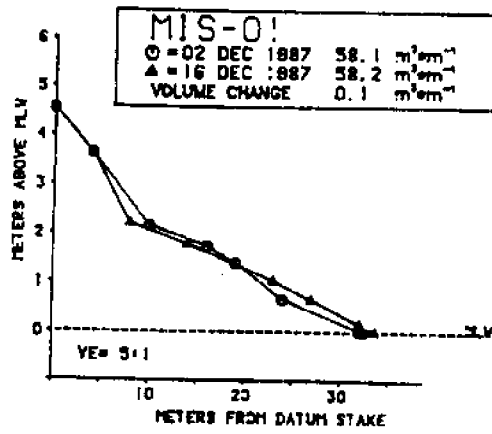


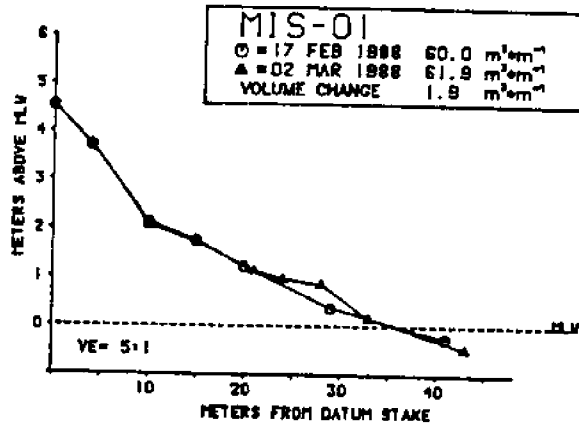






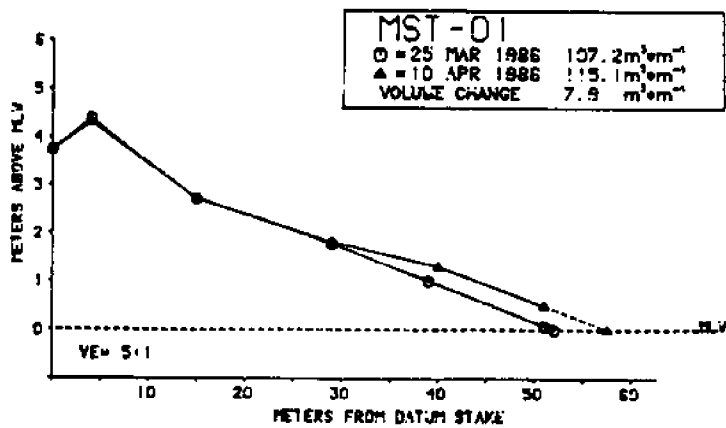
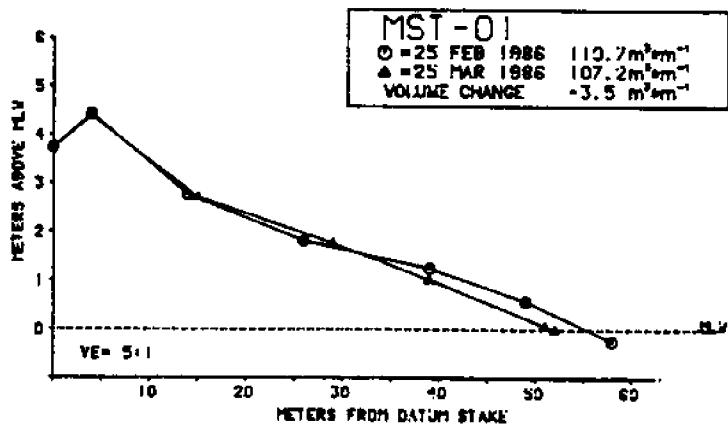
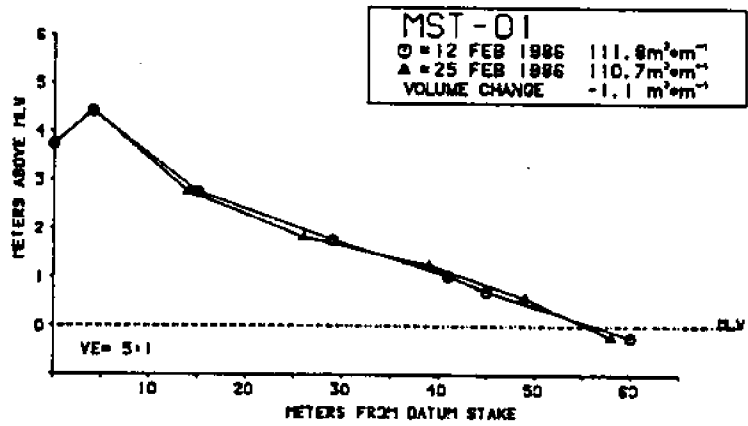
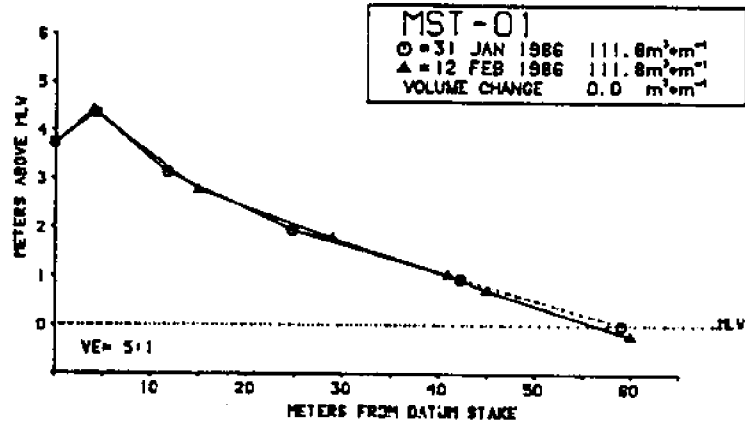


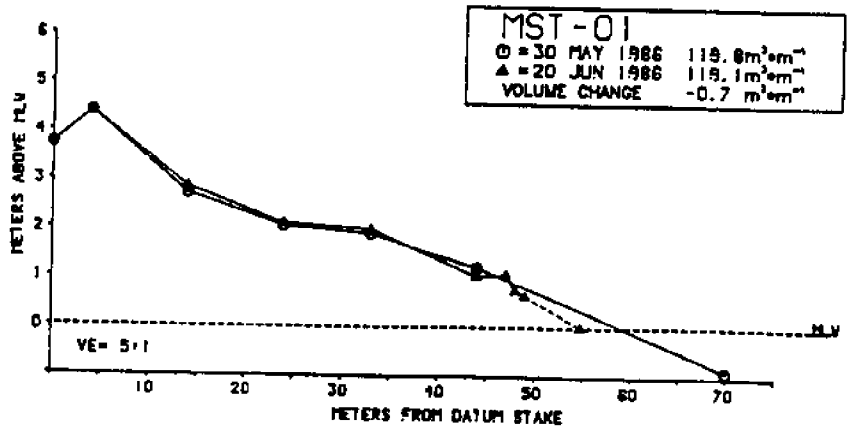
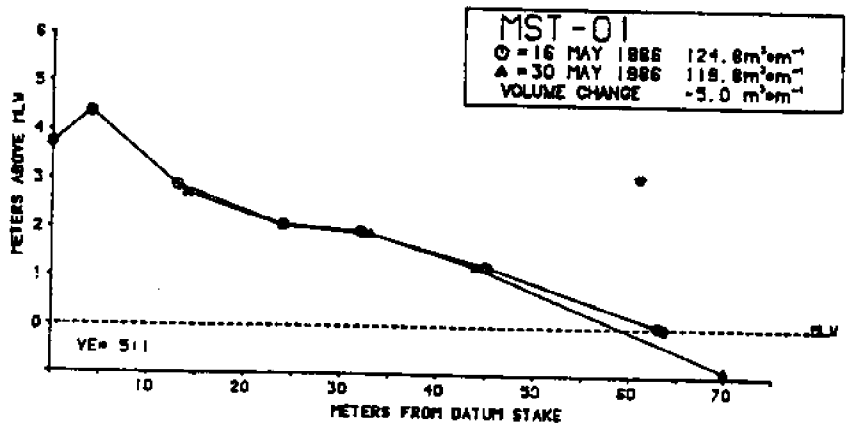
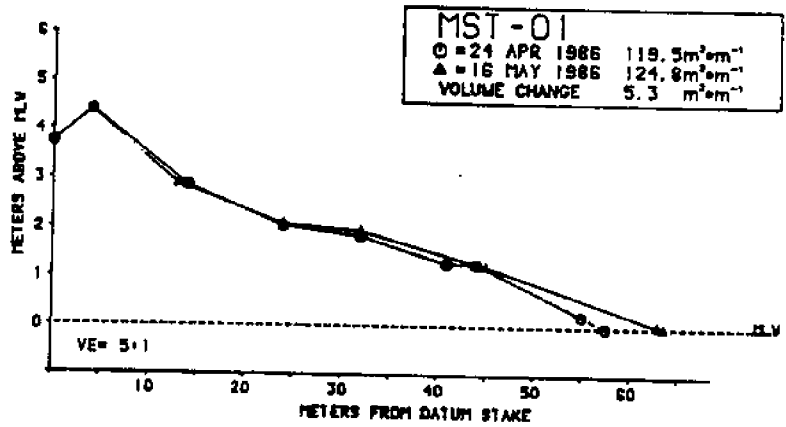
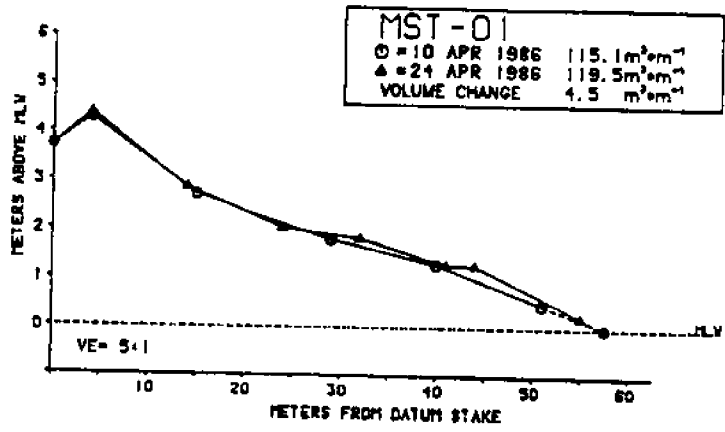




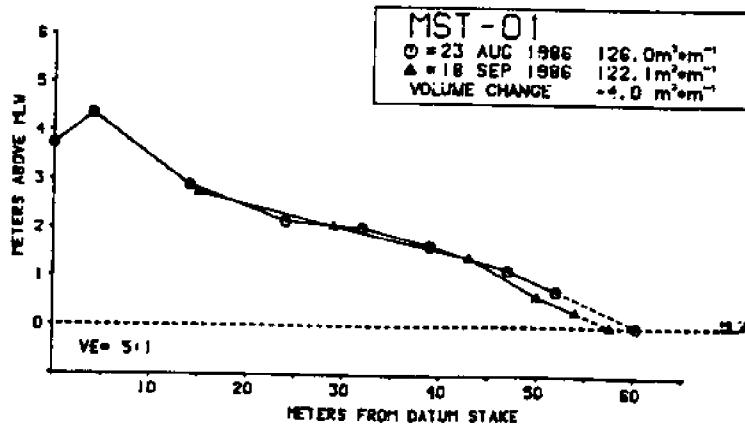
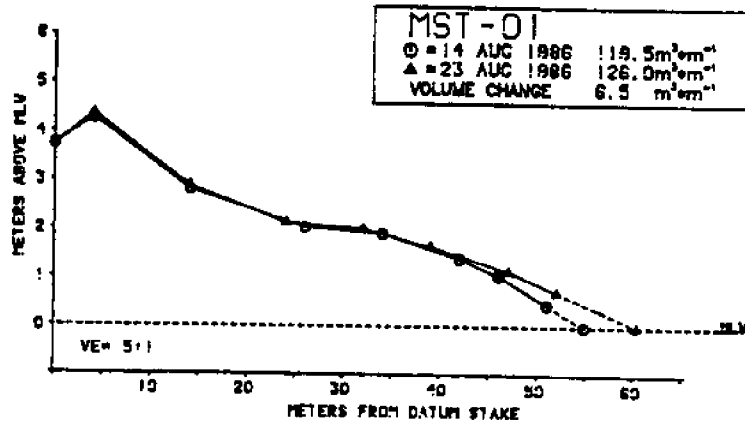
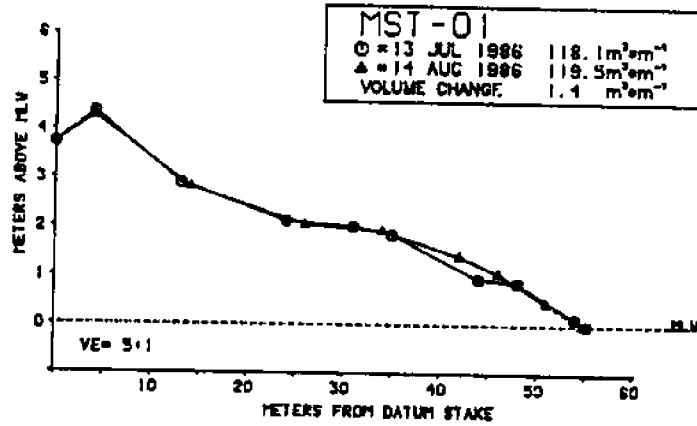
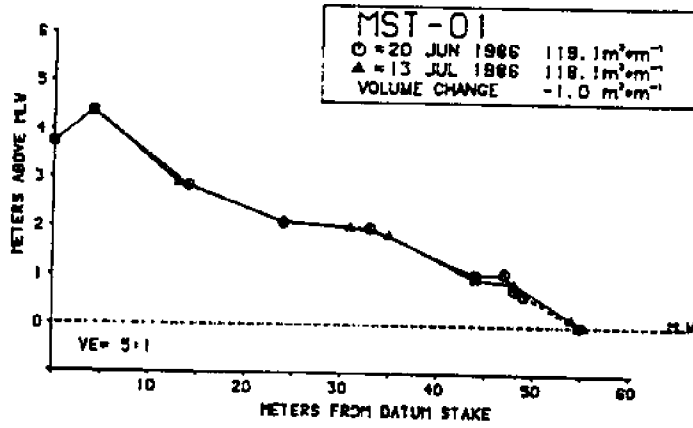
**APPENDIX 1I**

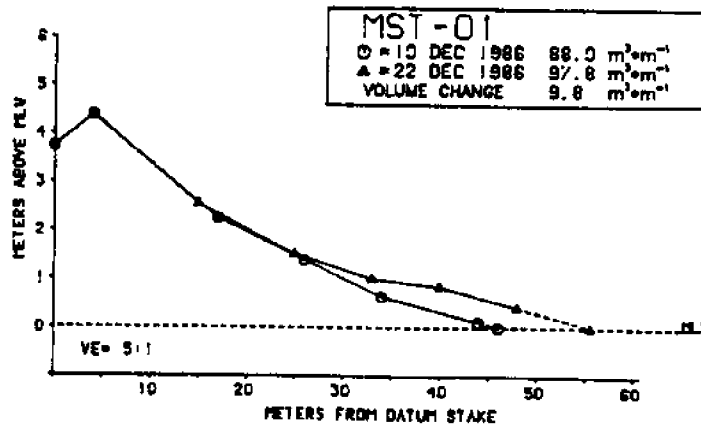
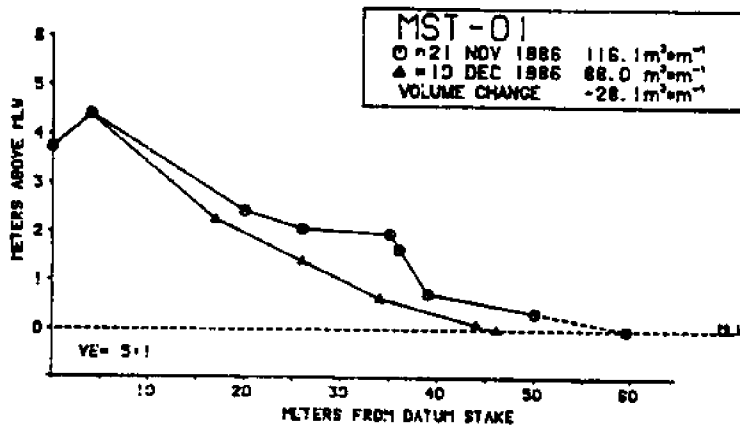
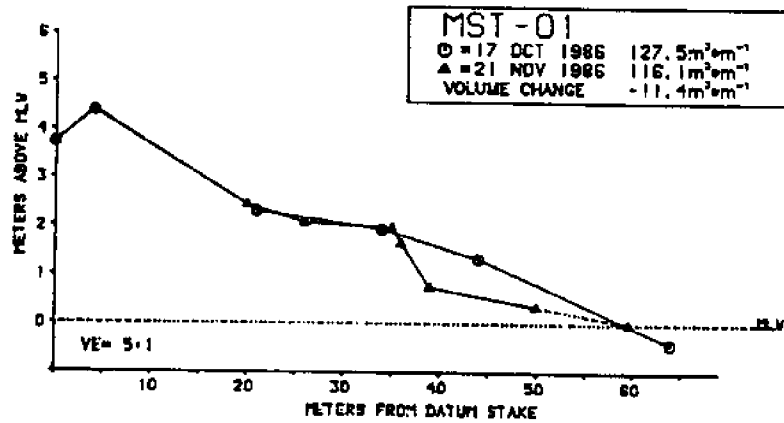
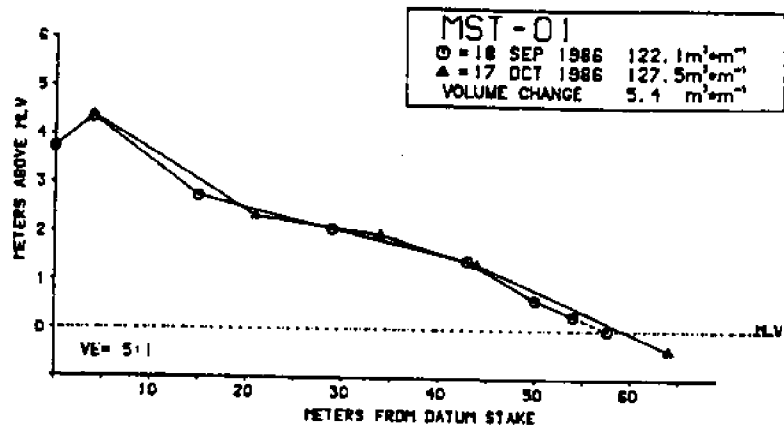
**MST-01 Profile Plots**

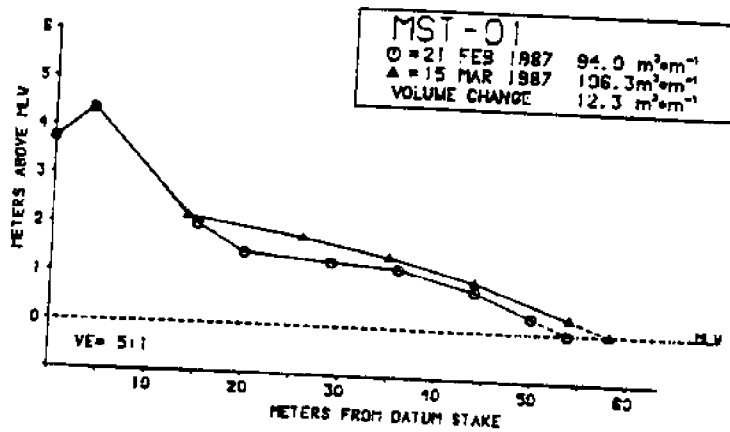
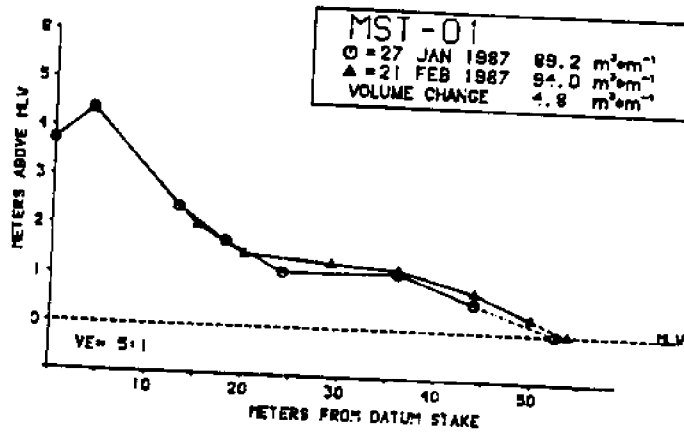
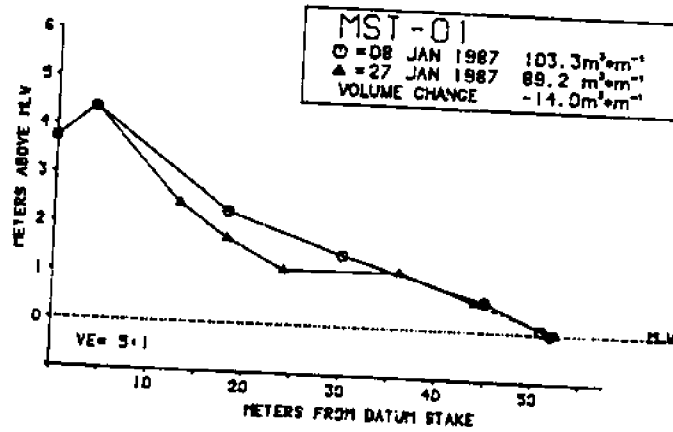
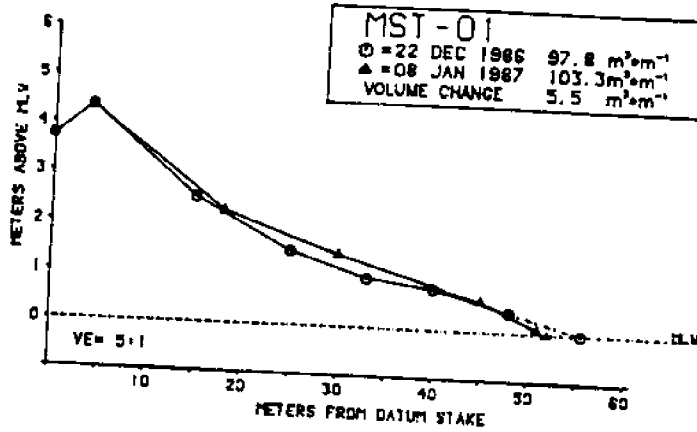


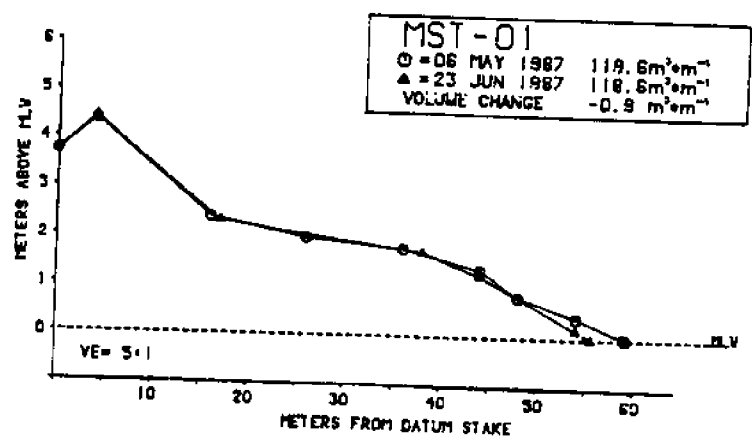
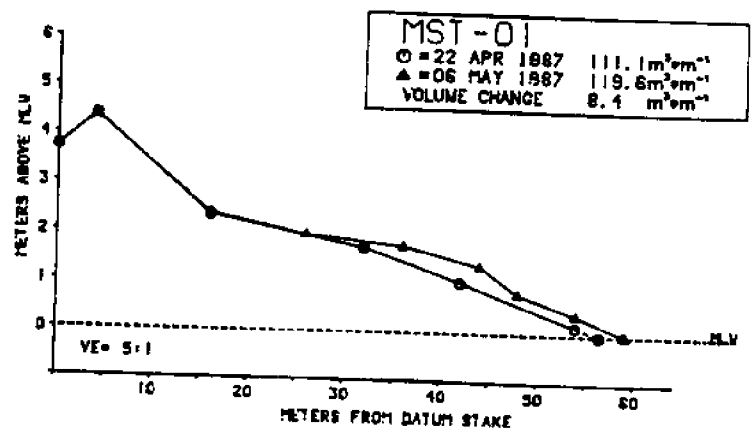
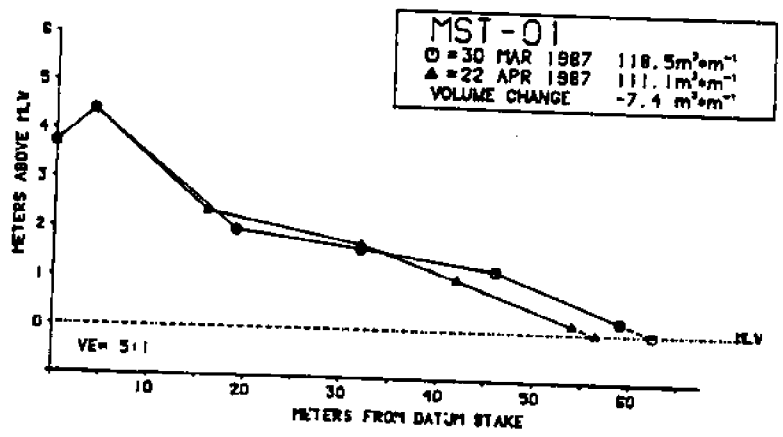
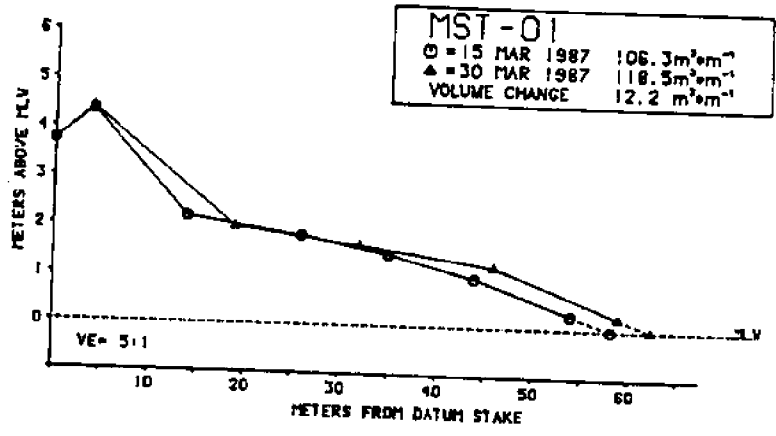


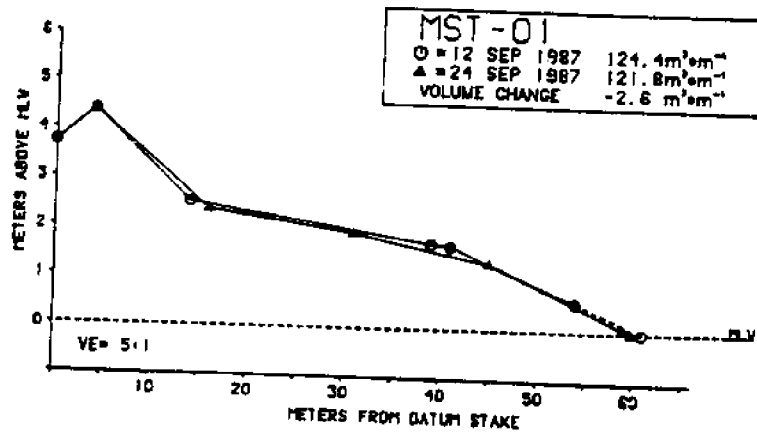
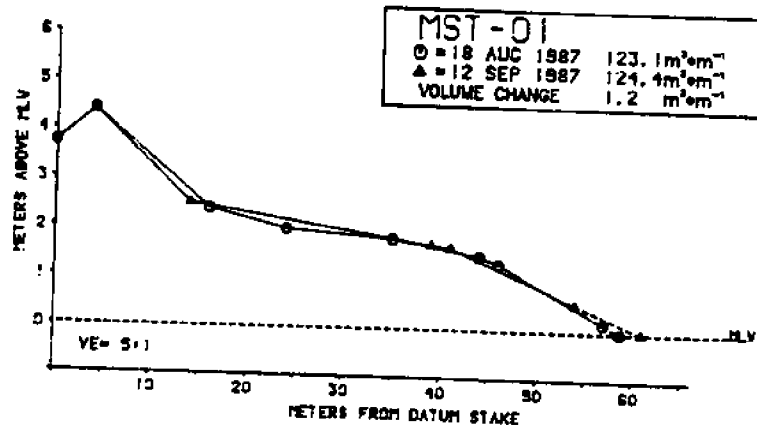
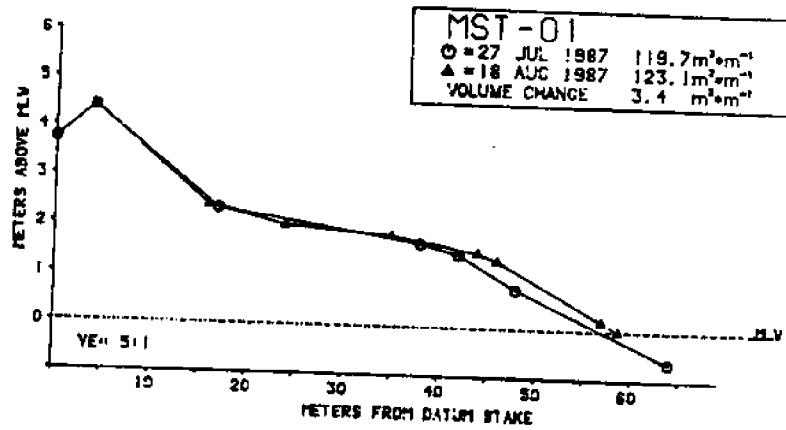
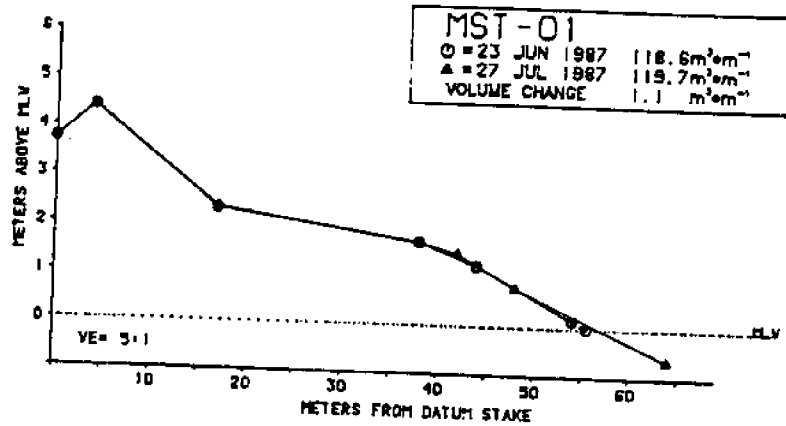


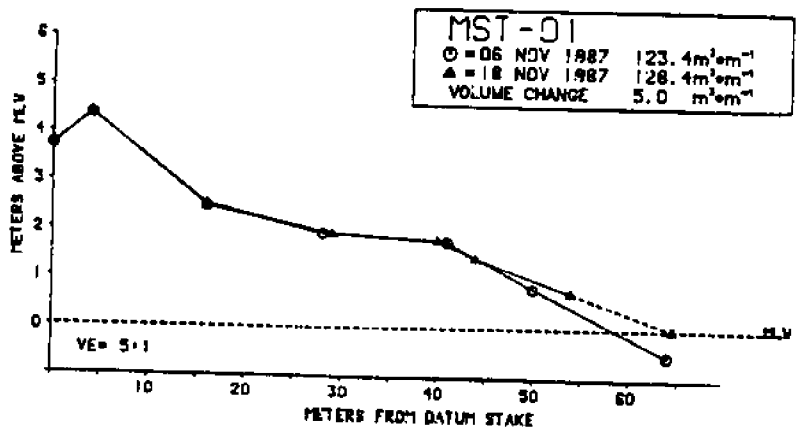
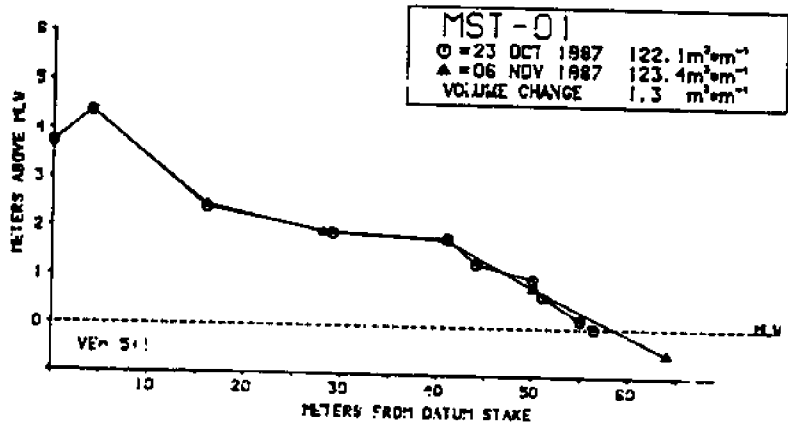
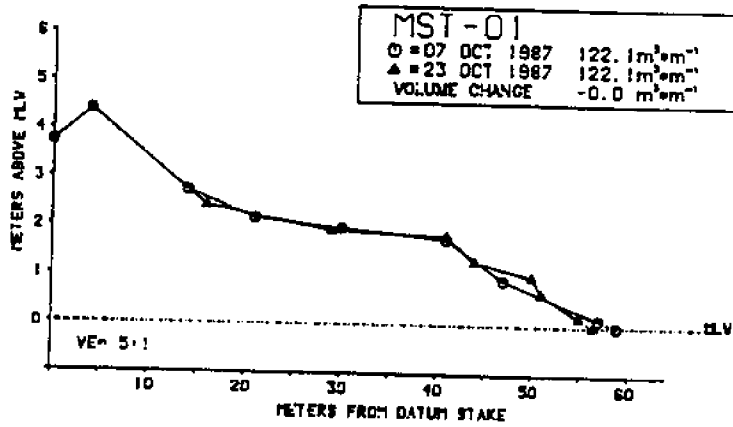
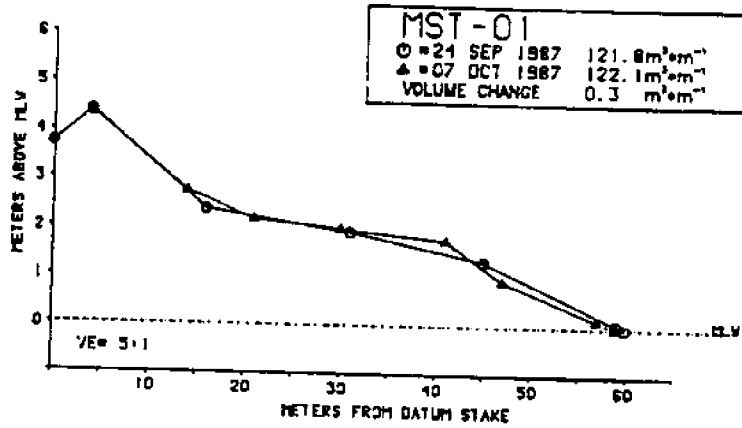


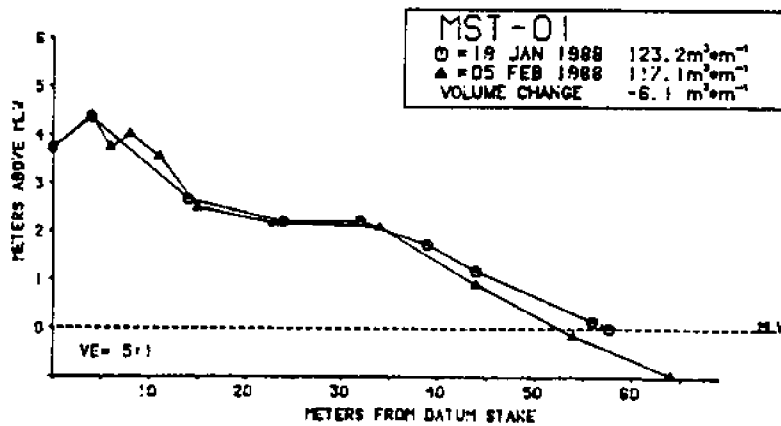
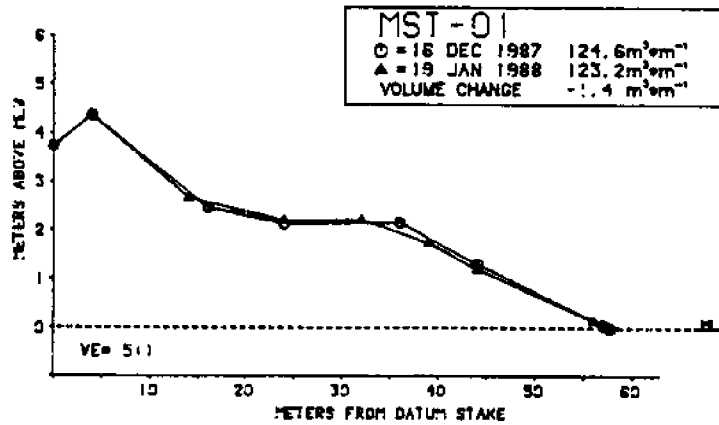
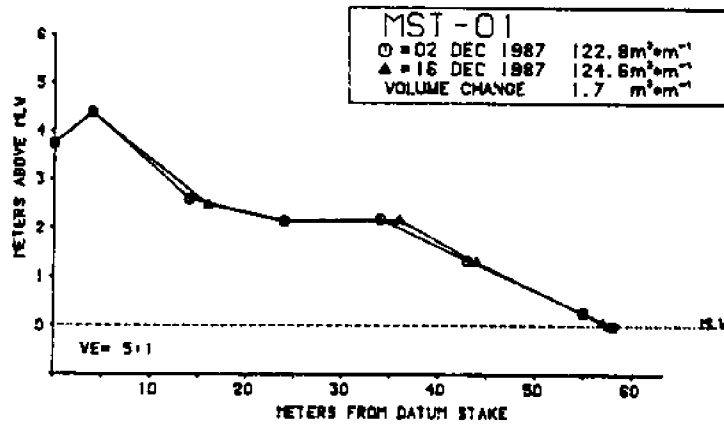
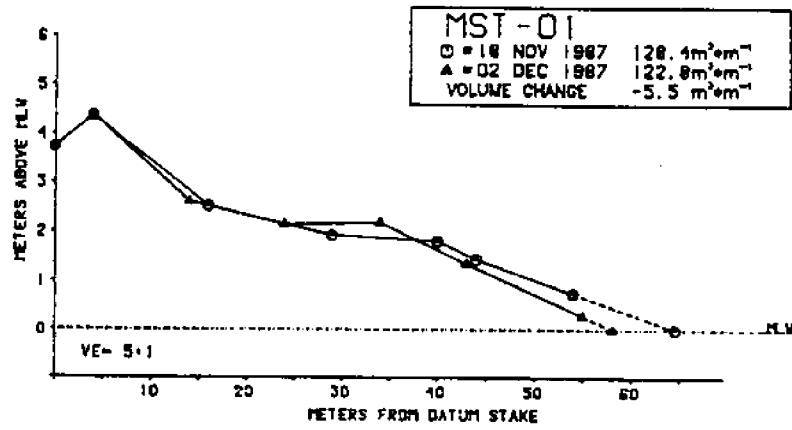


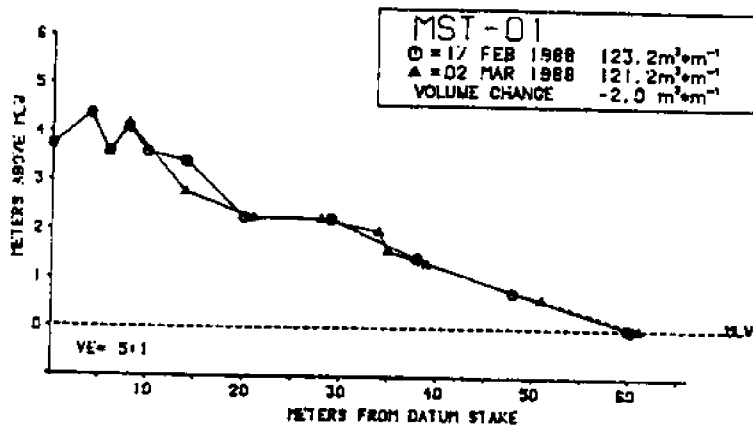
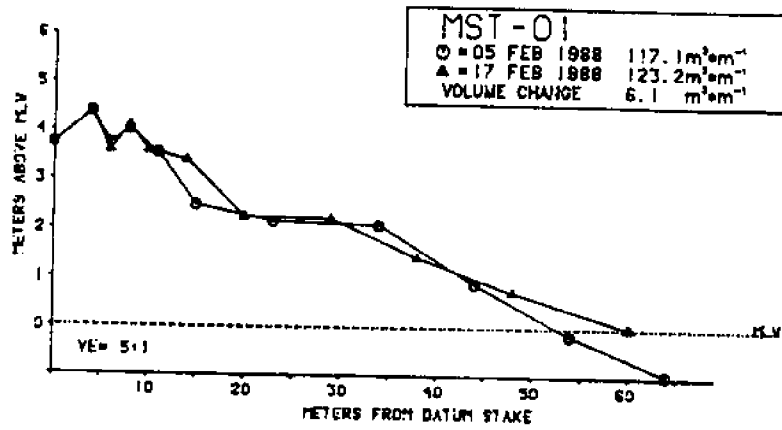














**APPENDIX 1J**

**WKG-01 Profile Plots**

