A SYSTEMATIC SERIES OF EXPERIMENTAL WASH WAVE MEASUREMENTS FOR HIGH SPEED DISPLACEMENT MONOHULL AND CATAMARAN FORMS IN SHALLOW WATER.

A.F. Molland, P.A.Wilson and D.J.Taunton

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CONTENTS

NOMENCLATURE

Fn_L	Froude Number, $\left[U/\sqrt{gL}\right]$
Fn_H	Depth Froude Number $\left[U/\sqrt{gH}\right]$
Rn	Reynolds Number, $\left[UL/\nu\right]$
U	Velocity [m s^{-1}]
W	Tank width [m]
H	Water depth [m]
L	Length on waterline [m]
A	Static wetted surface area [m^2]
B	Demihull maximum beam [m]
T	Demihull draught [m]
S	Separation between catamaran demihull centrelines [m]
∇	Volume of displacement [m^3]
Δ	Mass displacement in freshwater [kg]
C_B	Block coefficient
C_P	Prismatic coefficient
$L/\nabla^{1/3}$	Length : displacement ratio
R_T	Total resistance [N]
C_T	Coefficient of total resistance, $\left[R_T/\tfrac{1}{2}\rho AU^2\right]$
$C_{T\infty}$	Coefficient of total resistance in deep water, $\left[R_T/\tfrac{1}{2}\rho AU^2\right]$
R_W	Wave resistance [N]
C_W	Coefficient of wave resistance, $\left[R_W/\tfrac{1}{2}\rho AU^2\right]$
R_{WP}	Wave pattern resistance [N]
C_{WP}	Coefficient of wave pattern resistance, $\left[R_{WP}/\tfrac{1}{2}\rho AU^2\right]$
C_F	Coefficient of frictional resistance, [ITTC-57 Correlation line]
C_R	Coefficient of residuary resistance
R	Resistance in general [N]
g	Acceleration due to gravity [9.80665 m s^{-1}]
ρ	Density of freshwater [1000 kg m^{-3}]
ν	Kinematic viscosity of freshwater [1.141×10^{-6} m^2 s^{-1} at 15^{o}C]

1 INTRODUCTION

Work on the resistance of high speed displacement catamarans has been ongoing over a number of years at the University of Southampton [1-4] in an effort to improve the understanding of their resistance components, seakeeping performance and to provide design and validation data.

This report describes an extensive series of wash wave measurements for monohull and catamarans models travelling in shallow water. The models were chosen from the series used in [1, 4], for which extensive resistance and wave characteristics in deep water are available.

The tests covered a range of length: displacement ratios [$L/\nabla^{1/3}$] and catamaran separation: length ratios [S/L] at two shallow water depths. The model speeds and water depths tested led to a range of Froude Numbers (based on length) of $Fn_L = 0.25 - 1.2$ and a Froude Number (based on water depth) of $Fn_H = 0.5 - 3.2$. The experiments entailed the measurement of wave profiles at seven transverse positions, model total resistance, sinkage and trim.

The work described forms part of a wider research programme, funded by EPSRC and industry and managed by Marinetech South Ltd over a two year period, which includes the development of theoretical methods for the prediction of the wash and wave resistance of catamarans. The theoretical work is the subject of a separate report [5].

2 DESCRIPTION OF MODELS

Details of the models used in this investigation are given in Table 1.

The models were constructed using an epoxy-foam sandwich skin. Models 4b, 5b and 5s are 1.6m in length. The length of model 6b was increased to 2.1m in order to achieve a satisfactory weight – displacement balance.

It should be noted that Models 4b, 5b and 6b had already been used for resistance tests in deep water and their results published in [6]. Some of the results for these models are used in the present report for comparison and discussion.

The models were of round bilge form with transom sterns, Figure 1, and were derived from the NPL round bilge series [7] and the Series 64 round bilge series [8]. These hulls broadly represent the underwater form of a number of catamarans in service or currently under construction. The models were first tested as monohulls and then in catamaran configurations with Separation: Length ratios (S/L) of 0.2 and 0.4.

The model towing force was in the horizontal direction. The towing point in all cases was situated at the longitudinal centre of gravity and at a height of 1.5 times the draught above the baseline. No compensation was made for the vertical separation of the tow point and the propeller thrust line. The tow fitting allowed free movement in sinkage and trim whilst movements in surge, sway, roll and yaw were restrained. The models were fitted with turbulence stimulation comprising trip studs of 3.2mm diameter and 2.5mm height at a spacing of 25mm. The studs were situated 37.5mm aft of the stem. No underwater appendages were attached to the models. The weight of the towpost was 2.045 Kg.

3 FACILITIES AND TESTS

3.1 General

The model experiments were carried out in the GKN-Westland Aerospace test tank on the Isle of Wight, which has the following principal particulars:

Length	:	200m
Breadth	:	4.6m
Water depth	:	1.7m
Maximum carriage speed	:	14m s^{-1}

In the current tests, water depths of 400mm and 200mm were used.

The tank has a manned carriage which is equipped with a dynamometer for measuring model total resistance together with various computer and instrumentation facilities for automated data acquisition. For these shallow water tests a Wolfson Unit MTIA dynamometer was used which was attached to an aluminium alloy frame situated under the main carriage.

Calm water total resistance, running trim, sinkage and wave pattern measurements were carried out for all the models. All tests were carried out where possible over a speed range of 1m s^{-1} to 4m s^{-1} corresponding to a length Froude Number range of Fn_L 0.25 to 1.0 and a depth Froude Number range Fn_H 0.2 to 2.8. Over the Froude Number range 0.25 to 1.0, the corresponding Reynold's Number range for the models was $1.54*10^6$ to $6.18*10^6$ for the 1.6m models and $2.03*10^6$ to $8.11*10^6$ for the 2.1m model.

3.2 Wave Pattern Measurements

Extensive wave profile measurements were carried out to establish a wide database of wash wave characteristics in shallow water, which would be suitable for design and validation purposes. Such an extensive set of wave data would also facilitate the description of the near field wave pattern in three dimensions from the experimental results and facilitate the interpolation of the experimental data at various transverse positions.

The wave profiles were measured using resistance type wave probes with a length of 300mm coupled to a Churchill wave probe monitor. The data were acquired and stored using a laptop computer situated at the side of the tank adjacent to the wave probes. The signals were acquired at a sampling rate of 100Hz. The acquisition program allowed a run time of up to 40 secs to be used.

During each test run, seven longitudinal wave profiles were measured, with transverse positions (Y) relative to the centreline of the tank as shown in Figures 2a, 2b and 2c. Relative to model length, these positions have values of Y/L =0.43, 0.55, 0.68, 0.80, 0.93, 1.05 and 1.18 for Models 4b, 5b and 5s and Y/L=0.33, 0.42, 0.52, 0.61, 0.71, 0.80 and 0.90 for Model 6b. The longitudinal position of the wave probes in the tank are shown in Figure 2c. This position allowed adequate time for the wave system to settle before measurements commenced.

3.3 Trim and Sinkage Measurements

Trim and sinkage were monitored for all of the tests. Trim (positive bow up) was measured by means of a potentiometer mounted on the tow fitting; accuracy of the measurement was within $\pm 0.05^{o}$. Sinkage (positve downwards) was measured by means of a potentiometer and a track on the towpost; accuracy of the measurement was within ±0.1mm.

3.4 Trim changes

A limited series of tests were carried out with model 5b and 5s at 200mm water depth for the cases of significant bow and stern trim. These would provide information on the influence of trim changes on the model resistance and the measured wash waves.

4 DATA REDUCTION AND CORRECTIONS

4.1 Coefficients

All resistance data were reduced to coefficient form using fresh water density (ρ=1000 kg m^{-3}), static wetted surface area (A) and model speed (U):

$$\text{Resistance Coefficient} = \frac{\text{Resistance}}{\frac{1}{2}\rho A U^2} \quad (1)$$

Noting A is the wetted area of both demihulls in the case of the catamaran.

Corrections were applied as necessary to the measured data and these are described in the following sections:

4.2 Temperature Correction

During the tests the water temperature varied from 18^{o}C to 20^{o}C. The total resistance measurements were corrected to the standard temperature of 15^{o}C by modifying the frictional resistance component. The correction which has been applied is as follows:

$$C_{T_{15}} = C_{T_{test}} - C_{F_{test}} + C_{F_{15}} \quad (2)$$

The correction should be slightly larger due to the form factor being greater than unity. However, the correction is in any case small and the above equation is considered to be sufficiently accurate.

4.3 Resistance due to Turbulence Studs

Turbulence studs were attached to all the models as described in Section 2. A detailed investigation of their influence on model drag was carried out, and is described in [6]. It was found that, whilst there was additional drag on the studs, this is to a certain extent negated by the laminar region upstream and the boundary layer momentum thickness increase down stream due to the studs.

4.4 Wetted Surface Area

Static wetted surface area was used to non-dimensionalise the resistance measurements. A detailed investigation into the use of running wetted surface area is described in [6]. The conclusions in [6] indicate that whilst the use of running wetted surface might provide a better understanding of the physical components of resistance, the use of static wetted area does not have a significant effect on model to ship extrapolation providing both model and full scale coefficients are based on static wetted surface area. Running wetted surface area is difficult to measure experimentally in a routine manner, and will not be available for a new design. From a practical viewpoint it is necessary to use the static wetted surface area, and it has therefore been applied in the current work.

5 PRESENTATION OF DATA

The basic presentation of the experimental resistance data is as follows:

$$C_T = C_F + C_R \tag{2}$$

The wave profiles are presented in terms of wave height (mm) to a base of distance (m).

The measured experimental wave cuts are presented in Figures 3 to 174. Figures 3 to 72 present the experimental data for a water depth of 400mm and Figures 73 to 153 present the experimental data for a water depth of 200mm. Figures 154 to 174 present the experimental wave cuts for Models 5s and 5b trimmed by the bow and stern. For all 1.6m models, wave cuts were measured at the following Y/L positions of 0.426, 0.551, 0.676, 0.801, 0.926, 1.051 and 1.176 from the centreline of the tank. The 2.1m Model 6b used Y/L=0.33, 0.42, 0.52, 0.61, 0.71, 0.80 and 0.90.

The measured experimental resistance and sinkage/ trim data are presented in Figures 175 to 236. Figures 175 to 182 give the total resistance for the demihulls (or monohulls) in isolation at the two water depths whilst Figures 183 to 198 give the data for the catamaran configurations. The running trim and sinkage have been plotted against length Froude number Fn_L, Figures 199 to 206 and 207 to 222. Dynamic sinkage has been presented as a percentage of the draught of the vessel. Figures 223 to 230 present the resistance, dynamic sinkage and trim for Models 5s and 5b catamarans at a separation to length ratio (S/L) of 0.2 with static trim applied. The models were run with a nominal static trim of 2^o bow down and 2^o bow up.

The residuary resistance coefficients C_R derived from the experimental data are plotted in Figures 231 to 236.

Figures 237 and 238 show typical wave patterns for monohull forms travelling at sub-critical and super-critical speeds.

6 DISCUSSION OF RESULTS

6.1 Wave profiles

The longitudinal wave profiles are shown in Figures 3 to 174 for different models, a range of speeds and two depths of water at seven transverse positions from the centreline of the track of the model.

These profiles provide a wide range of data for input to wave propagation models, for assessing the effects of changing the hull parameters and for the validation of theoretical methods.

In Figures 239 and 240, the seven 2-D longitudinal wave profiles have been used to create 3-D representations of the wave patterns. Figure 239 shows a sub-critical case and Figure 240 a super-critical case. This type of presentation is useful in the validation of theoretical methods.

It should be noted that at or close to critical speed [Fn_H=1.0], solitary waves (solitons) were generated which moved on ahead of the model, Figure 241. As it is likely that this phenomenon was amplified due to operation in a relatively narrow tank, discussion of the origins and behaviour of the solitary waves is not taken further in this report.

6.2 Total Resistance

The total resistance C_T, has been plotted against length Froude number Fn_L. The non-dimensional total resistance C_T has been compared with the total resistance $C_{T\infty}$ in deep water. The deep water results are plotted as a dotted line on the graphs in Figures 175 to 198 and 223 to 226. These deep water $C_{T\infty}$ values were obtained from earlier tests as reported in [6] and [4]. From these results it is seen that near the critical speed there is a significant increase in shallow water resistance over the deep water result. At higher Froude numbers the C_T in shallow water generally approaches the deep water $C_{T\infty}$ value. With forced static trim changes, Figures 223 to 226, bow up trim led to significant increase in resistance whilst bow down trim led to relatively small changes. Similarly, increases in the wave height occur for the bow up conditions compared with the level trim case, Figures 244 and 245.

6.3 Running sinkage and trim

Like the resistance results, the trim and sinkage values, Figures 184 to 207, show significant changes around the critical speed, although they tend to settle at about the deep water values at higher speeds.

6.4 Residuary Resistance: Effect of Hull Parameters

The coefficient of residuary resistance C_R (derived as $C_R=C_T-C_F$) has been plotted in Figures 216 to 221. Like the total resistance curves, the residuary resistance curves again illustrate the significant amplification of the resistance around the critical speed, $Fn_H=1.0$. These figures show that the coefficient of residuary resistance increases with reducing $L/\nabla^{1/3}$. It is however seen that changes in hull shape for the same length: displacement ratio, Models 5s and 5b, have relatively little influence on the coefficient of residuary resistance.

7 CONCLUSIONS

7.1 A large database of experimental wash wave measurements for ship models travelling in shallow water has been established. The experiments covered a range of displacement monohull and catamaran forms over a wide range of speeds

7.2 The data should prove useful for assessing the effects of changing principal hull parameters, for the validation of theoretical wash prediction methods and for input into wave propagation models.

7.3 Significant changes in model behaviour occurred at or near critical speed, $Fn_H=1.0$. There were large increases in resistance and wave height and significant changes in sinkage and trim.

7.4 In the main, at higher speeds well beyond critical, the shallow water results for resistance, sinkage and trim tend to settle at about the deep water values.

ACKNOWLEDGEMENTS

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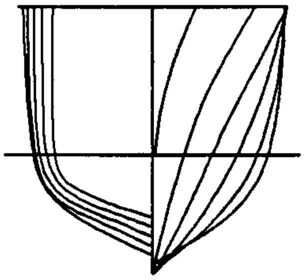
TABLES

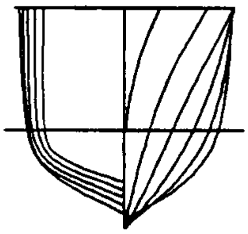
Model	4b	5b	6b	5s
L [m]	1.6	1.6	2.1	1.6
B [m]	0.178	0.146	0.160	0.125
T[m]	0.089	0.073	0.080	0.063
∇ [m^3]	0.0101	0.00667	0.0108	0.00667
Δ [Kg]	10.10	6.67	10.75	6.67
$L/\nabla^{1/3}$	7.4	8.5	9.5	8.5
L/B	9.0	11.0	13.1	12.8
B/T	2.0	2.0	2.0	2.0
C_B	0.397	0.397	0.397	0.537
C_P	0.693	0.693	0.693	0.633
C_M	0.565	0.565	0.565	0.848
A [m^2]	0.338	0.276	0.401	0.261
LCB [%]	-6.4	-6.4	-6.4	-6.4

Table 1 Principal particulars of Models (demihulls)

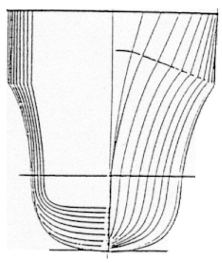
FIGURES



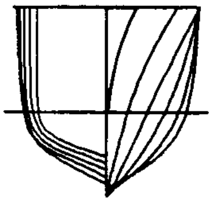
Model: 4b



Model: 5b



Model: 5s



Model: 6b

Figure 1: Model Bodyplans and Notation

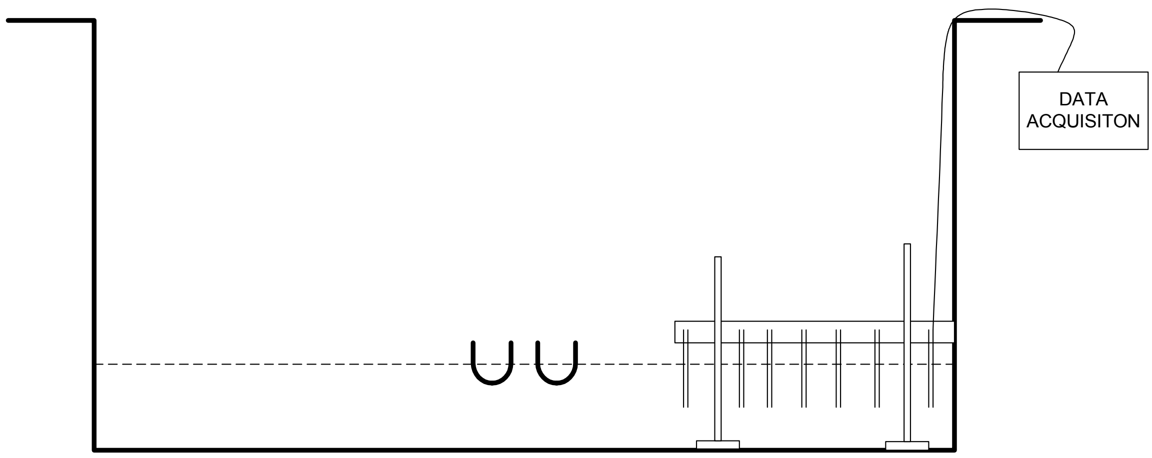


Figure 2a: Schematic of GKN-Westland tank (cross Section)

Figure 2b: View of model passing probe array from beach.

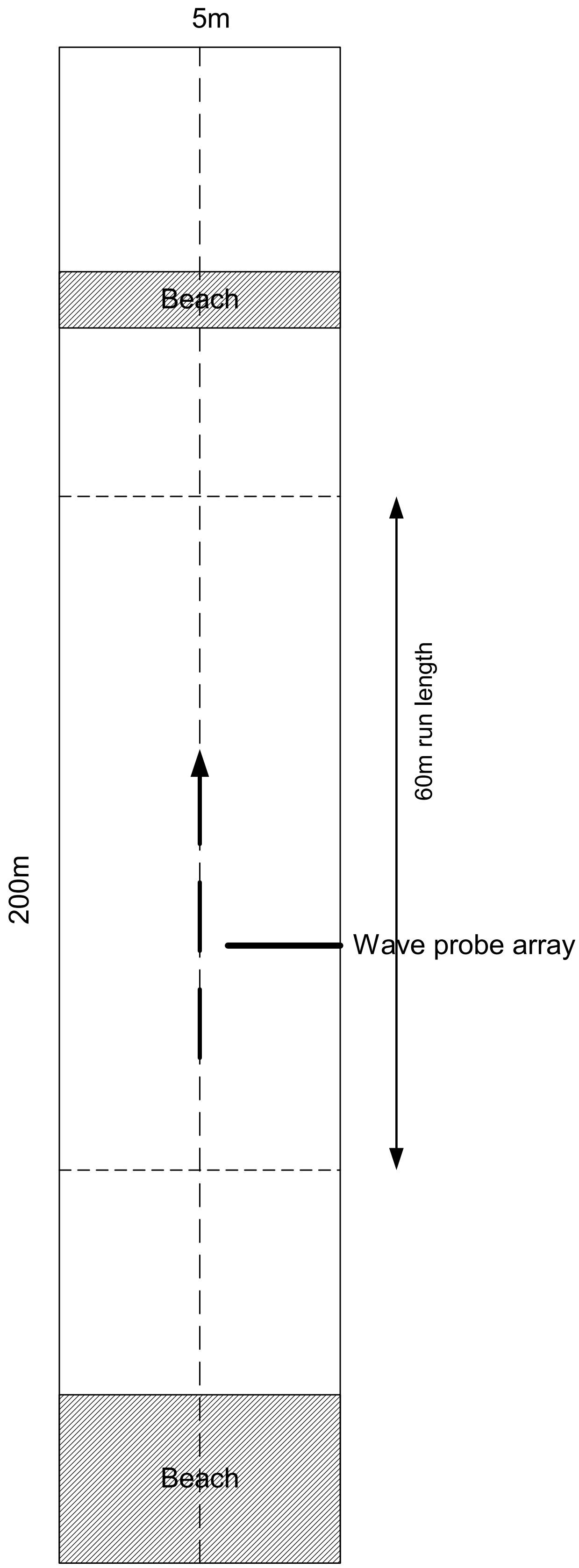
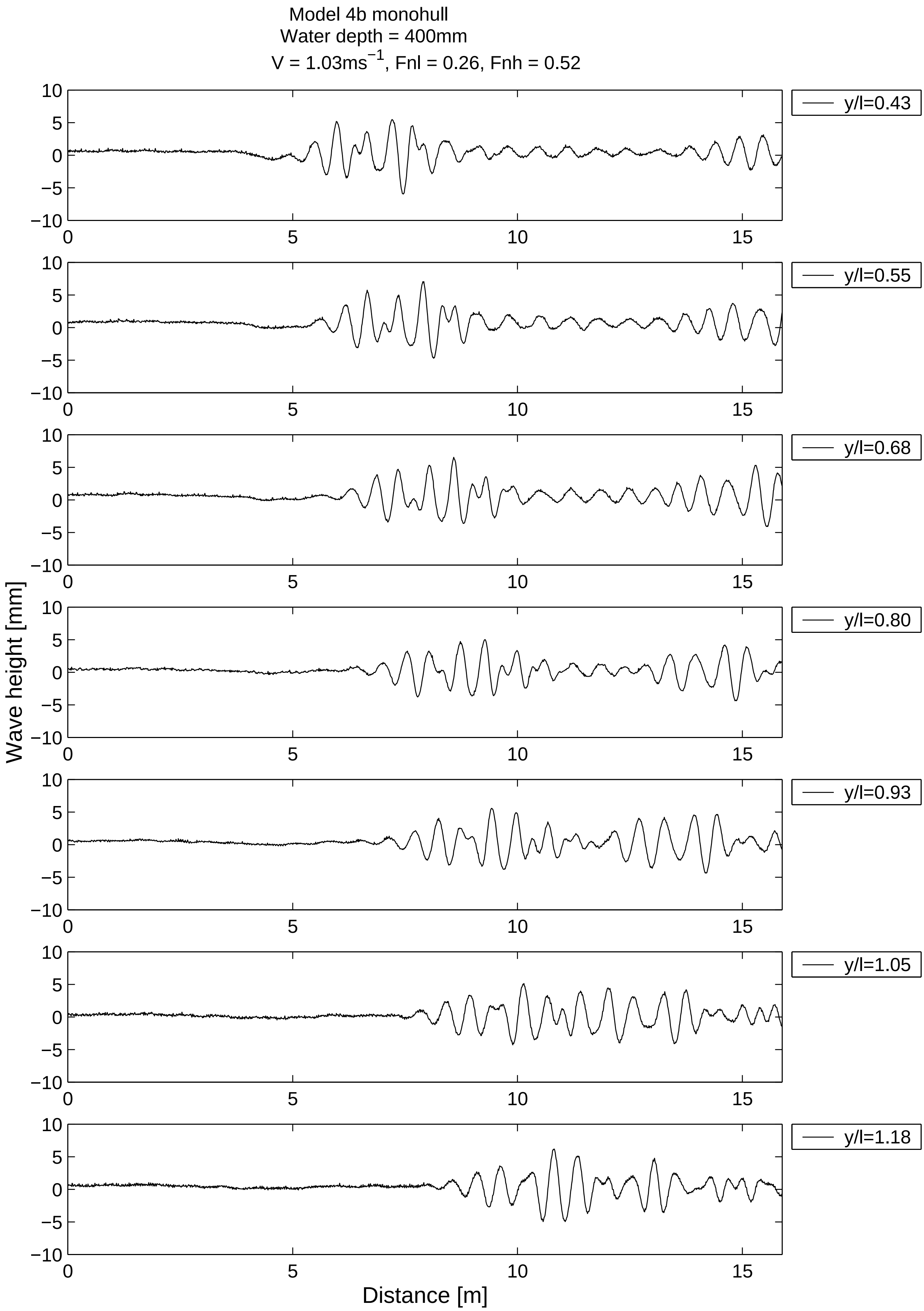


Figure 2c: Schematic of GKN test tank



Model 4b monohull
Water depth = 400mm
V = 1.03ms−1, Fnl = 0.26, Fnh = 0.52
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 3

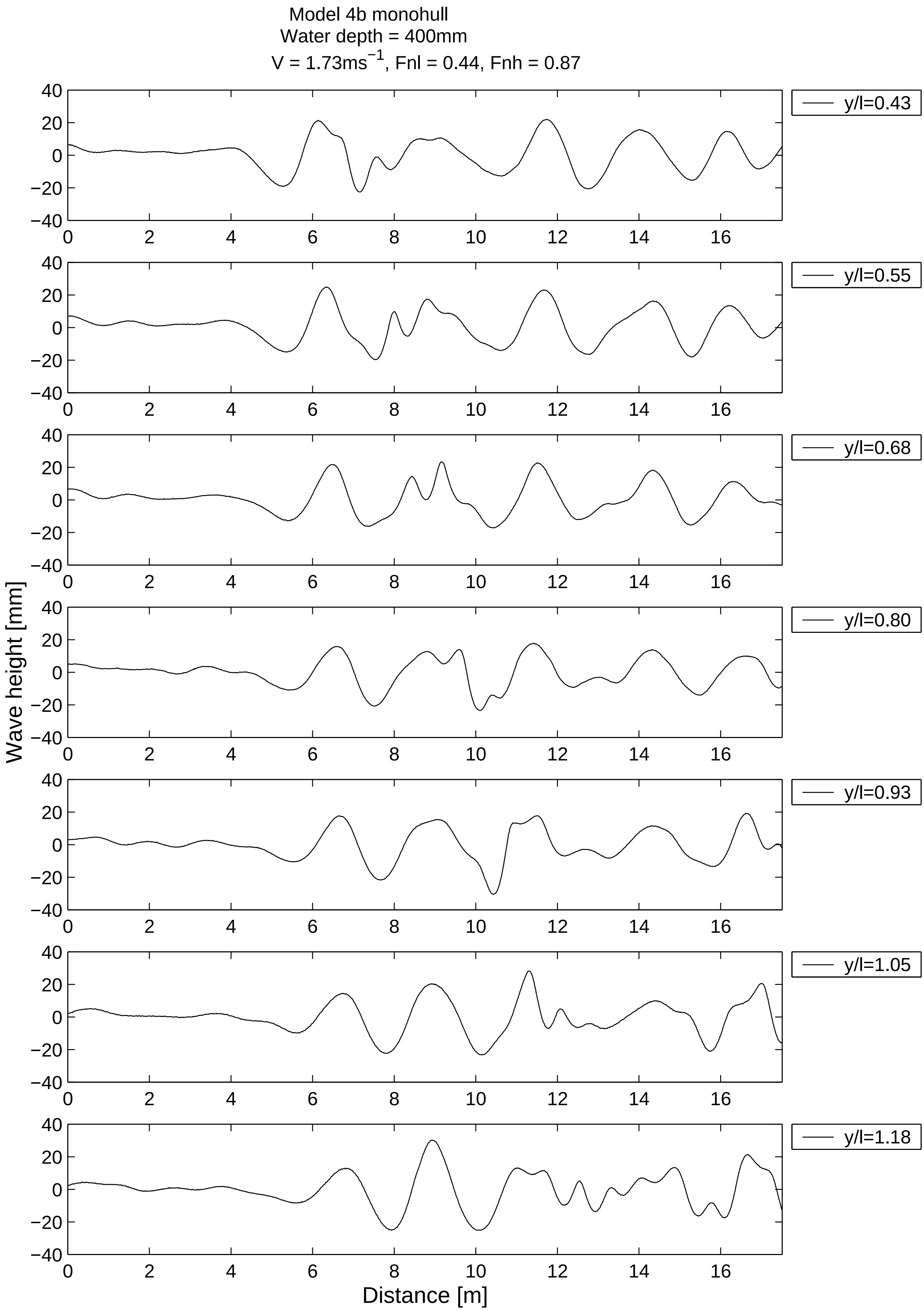

Model 4b monohull
Water depth = 400mm
V = 1.73ms⁻¹, Fnl = 0.44, Fnh = 0.87
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 4

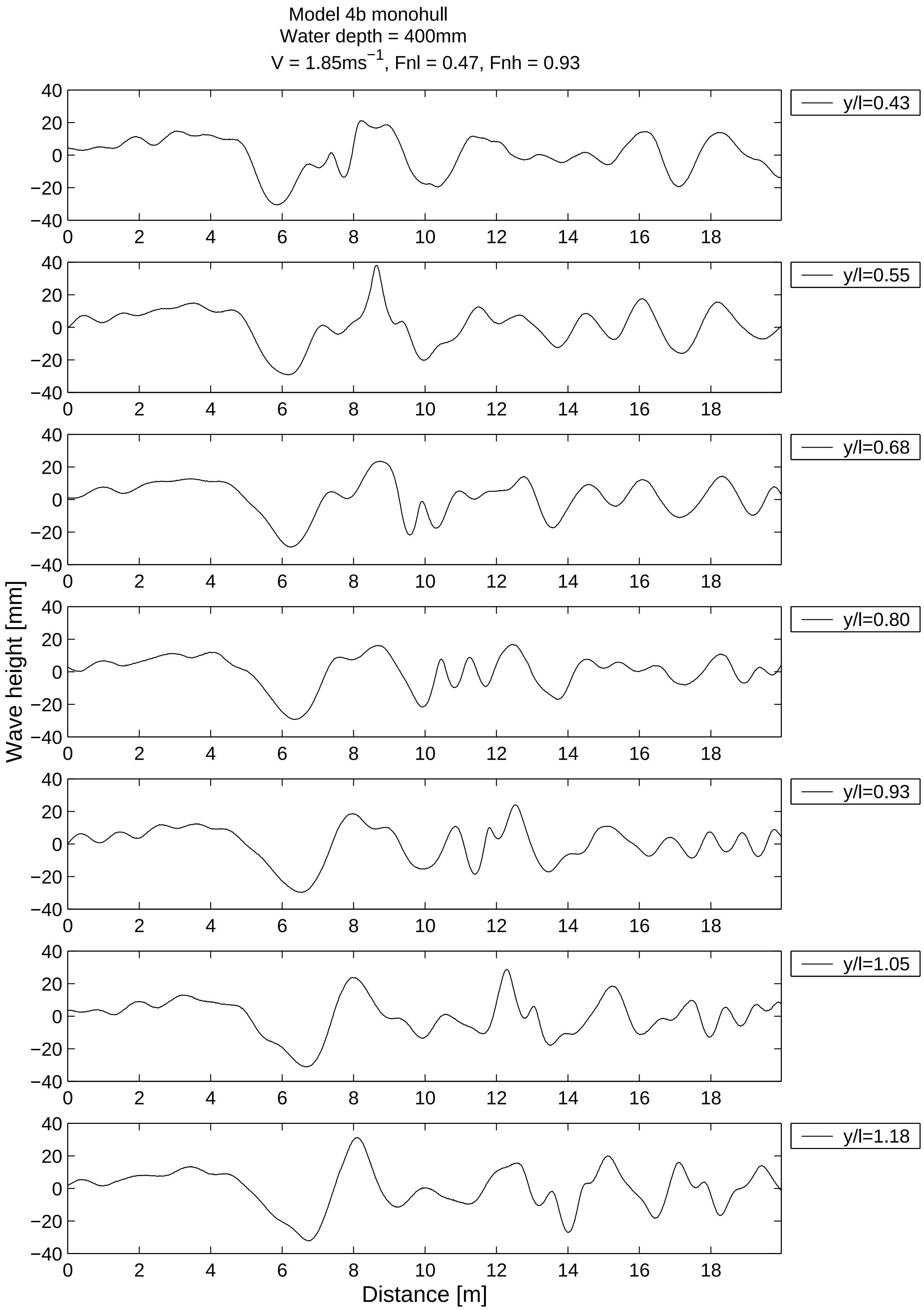
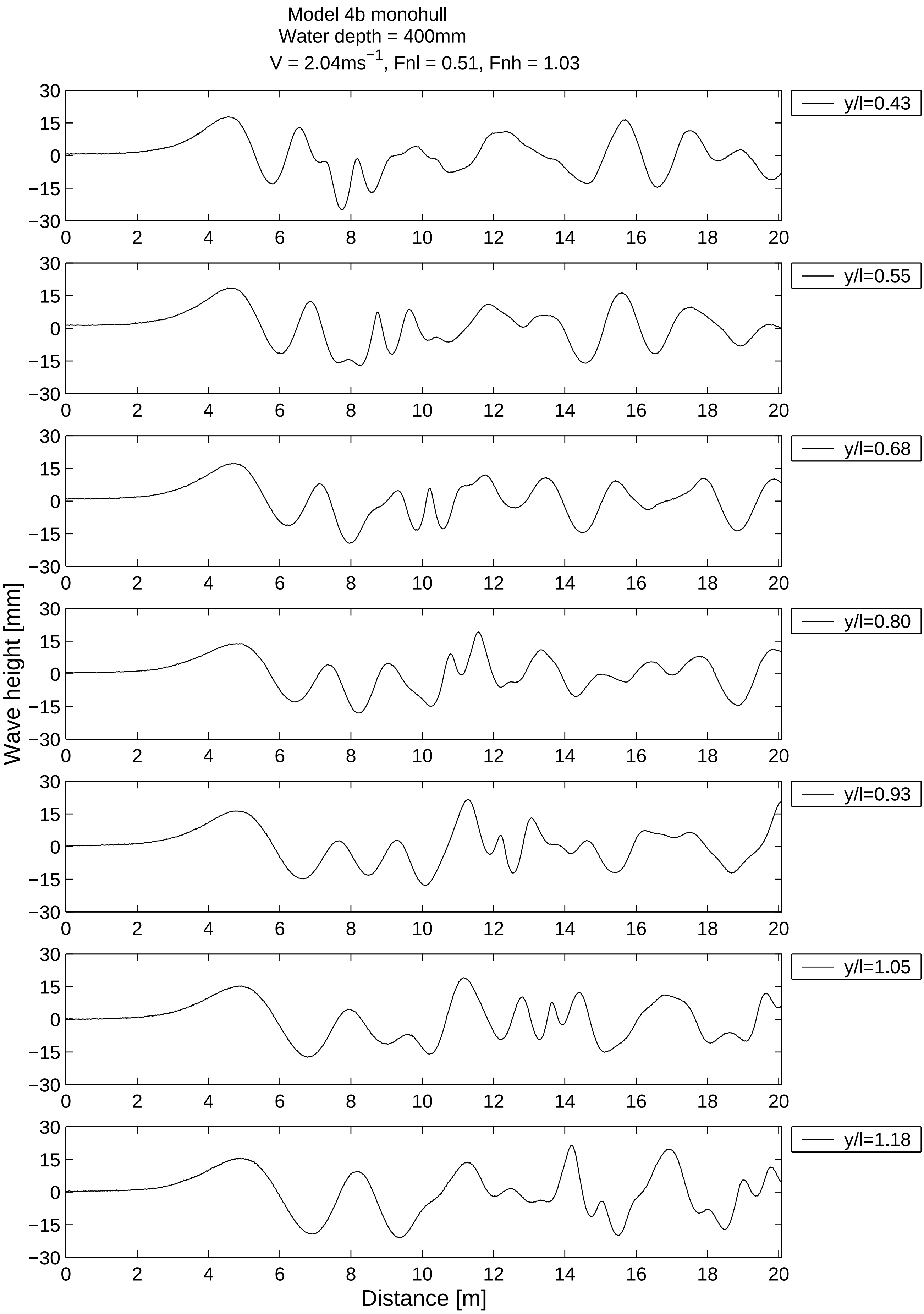

Model 4b monohull
Water depth = 400mm
V = 1.85ms^{-1}, Fnl = 0.47, Fnh = 0.93
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 5



Model 4b monohull
Water depth = 400mm
V = 2.04ms^{-1}, Fnl = 0.51, Fnh = 1.03
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
2
4
6
8
10
12
14
16
18
20

Figure 6

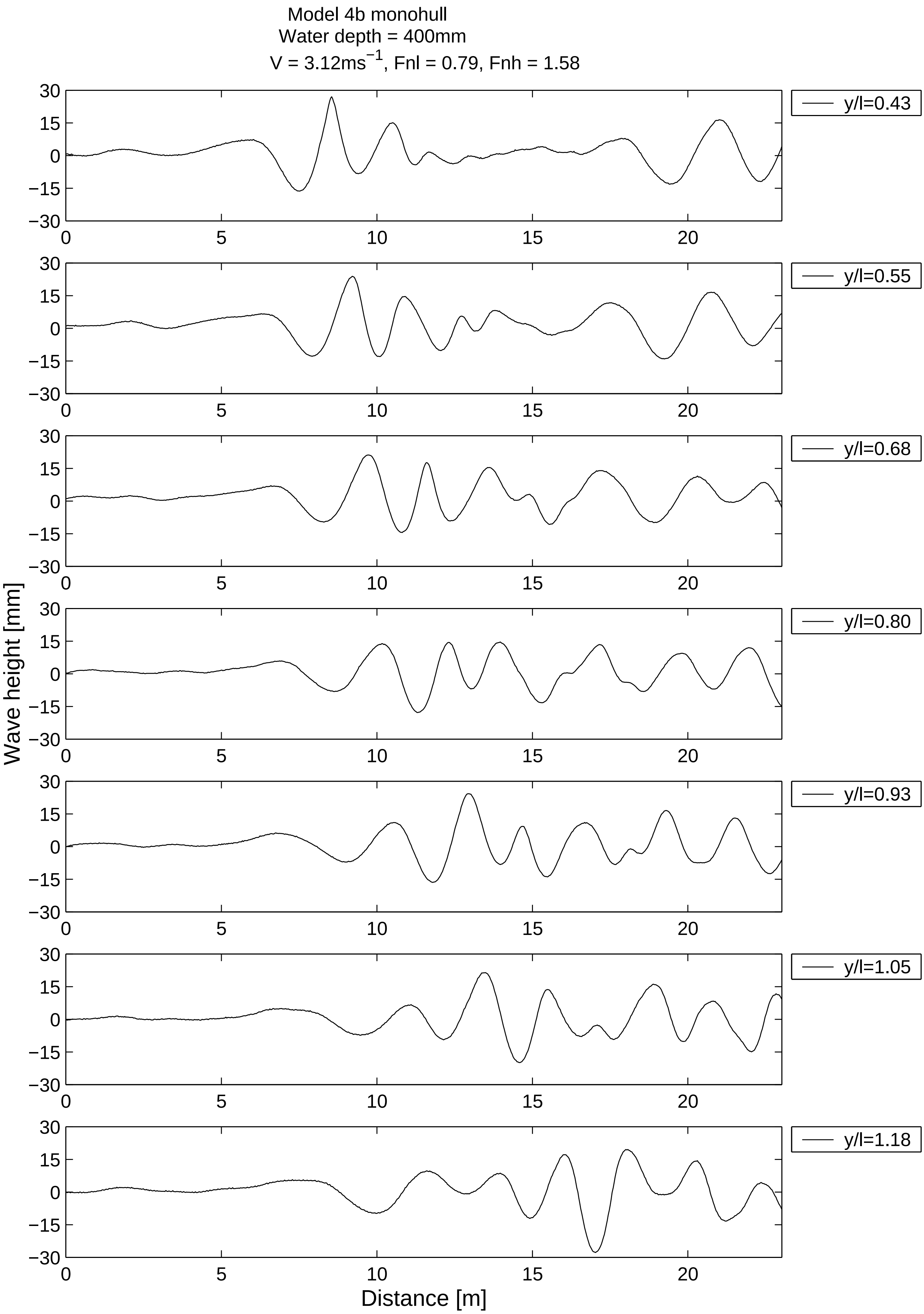
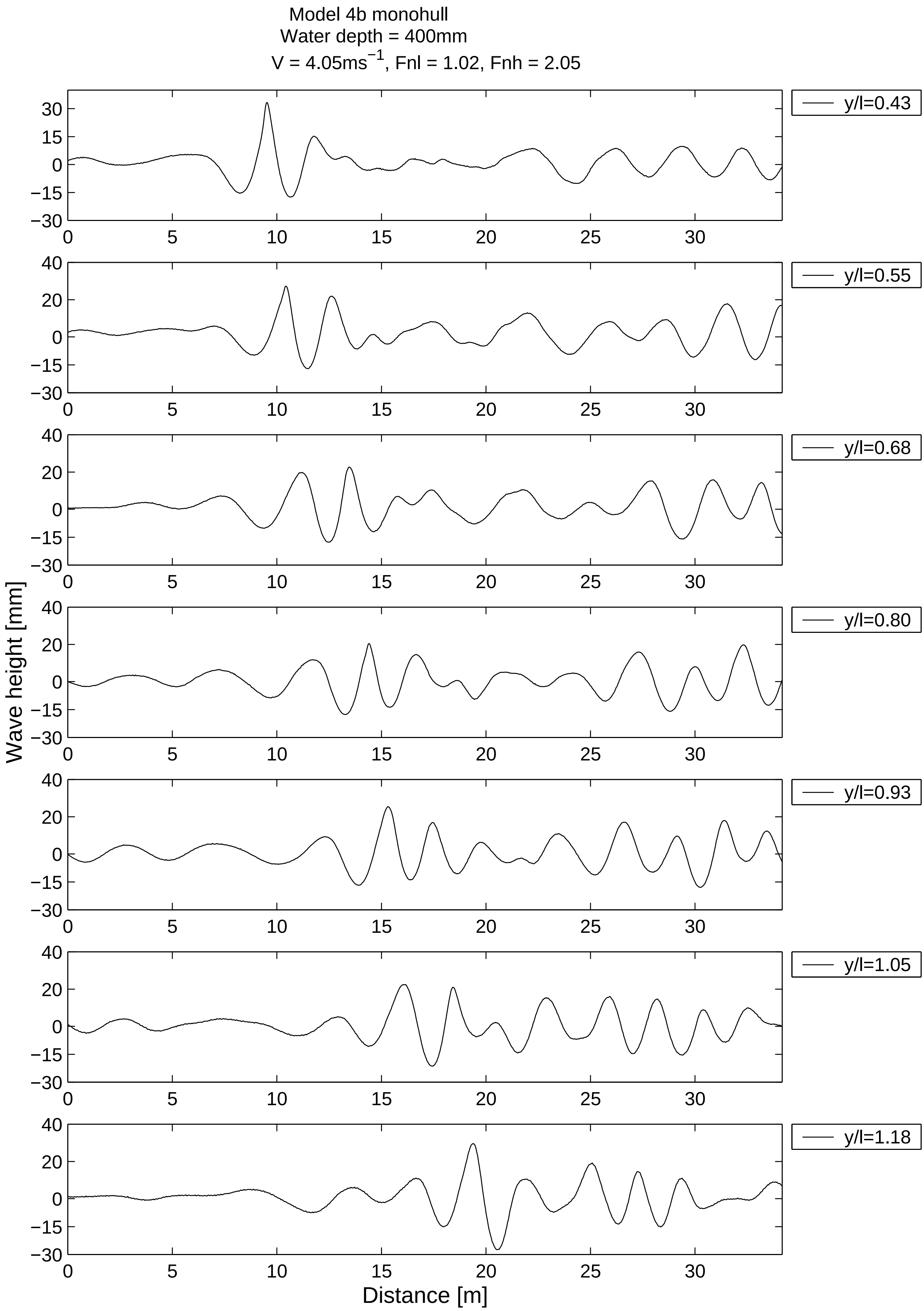

Model 4b monohull
Water depth = 400mm
V = 3.12ms−1, Fnl = 0.79, Fnh = 1.58
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 7



Model 4b monohull
Water depth = 400mm
V = 4.05ms^{-1}, Fnl = 1.02, Fnh = 2.05
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 8

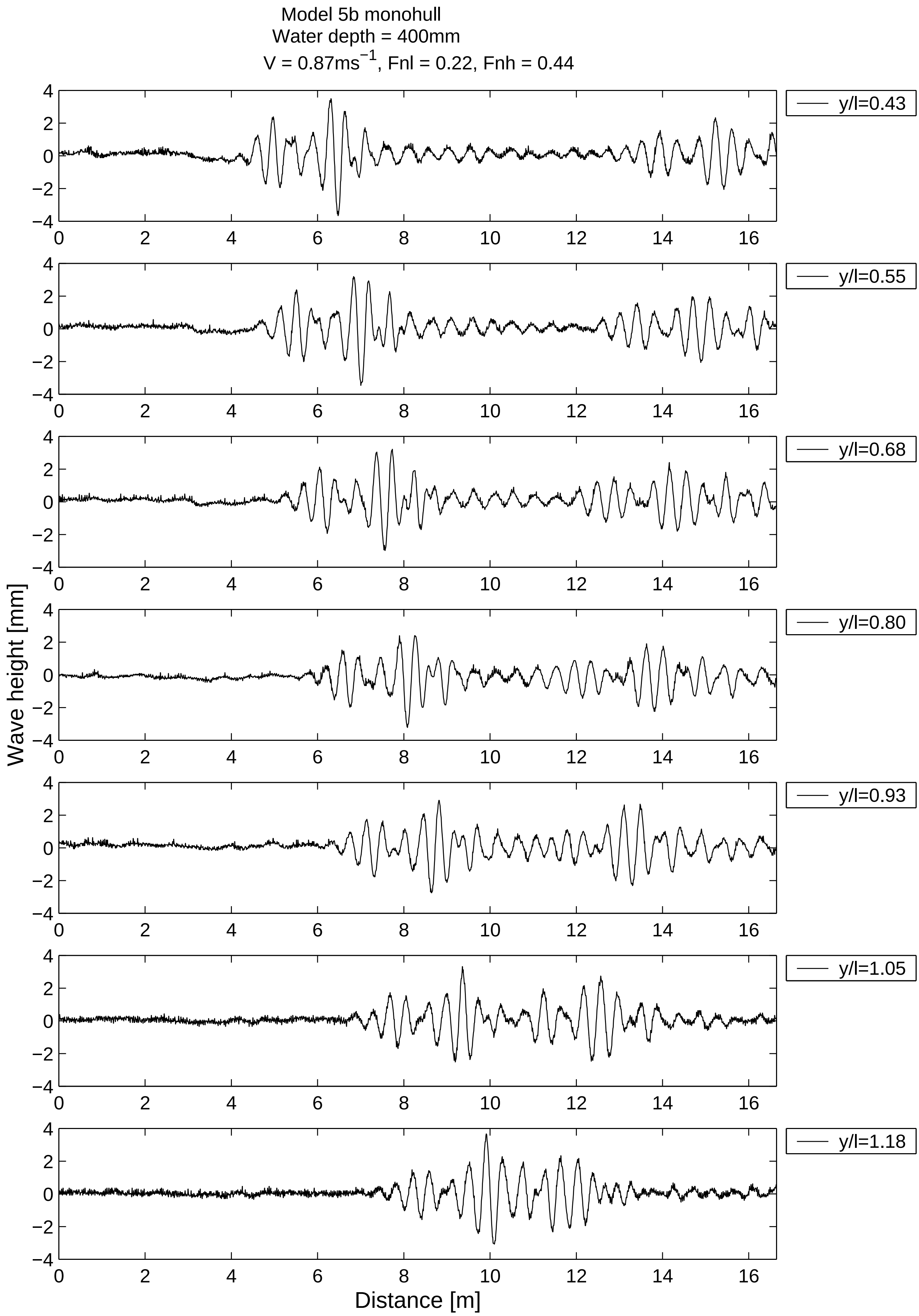
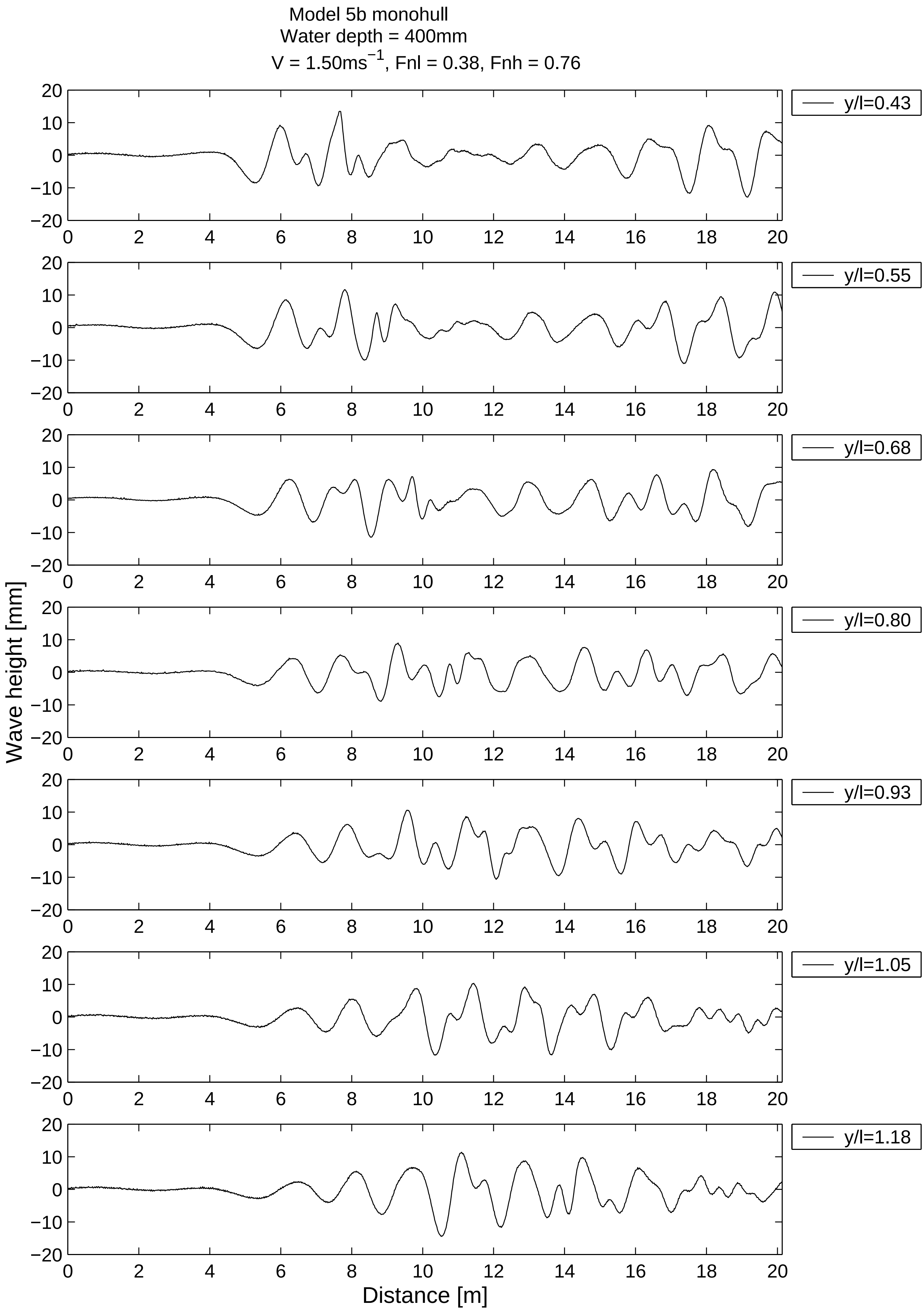
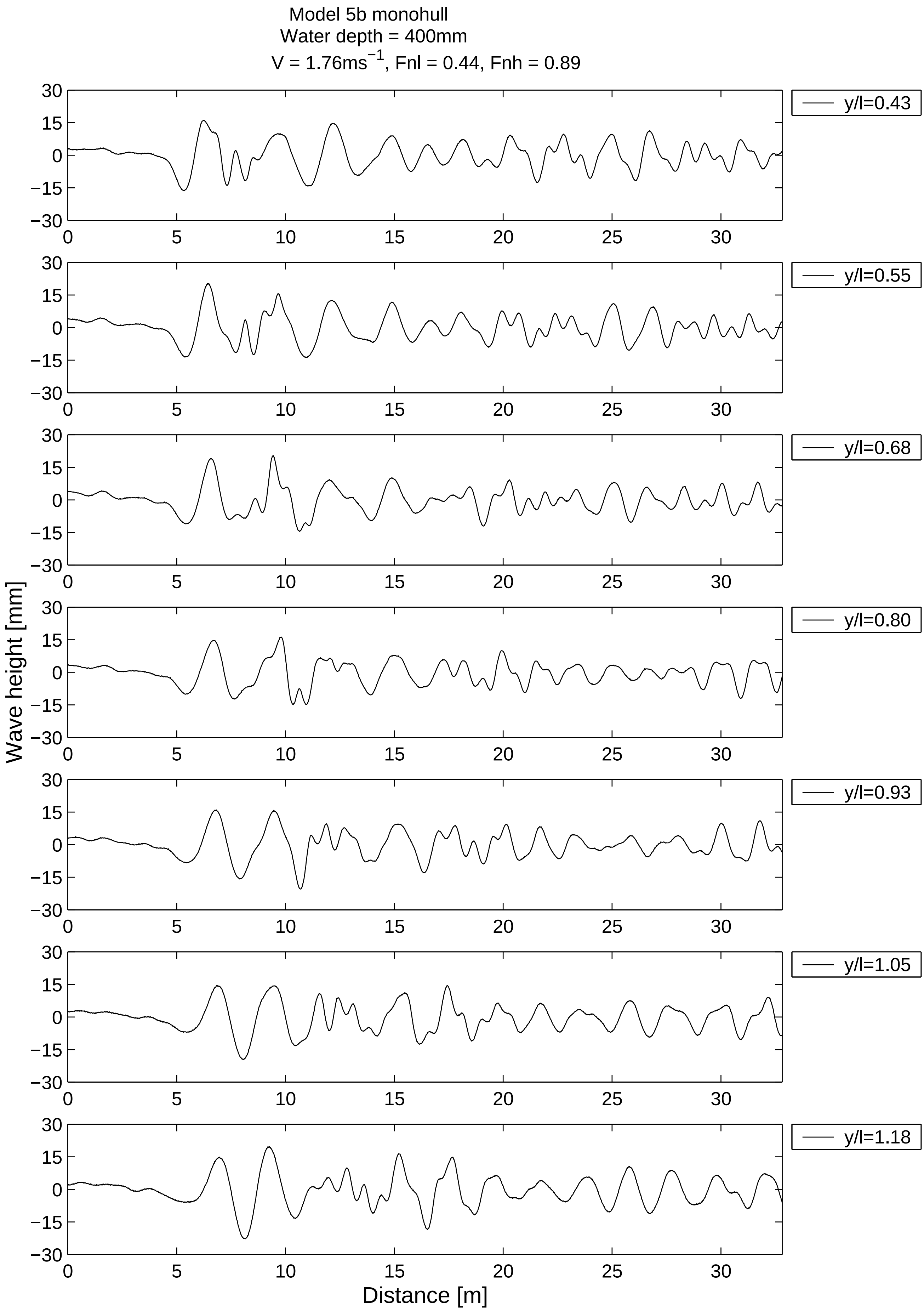

Model 5b monohull
Water depth = 400mm
V = 0.87ms^{-1}, Fnl = 0.22, Fnh = 0.44
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 9



Model 5b monohull
Water depth = 400mm
V = 1.50ms−1, Fnl = 0.38, Fnh = 0.76
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 10



Model 5b monohull
Water depth = 400mm
V = 1.76ms−1, Fnl = 0.44, Fnh = 0.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 11

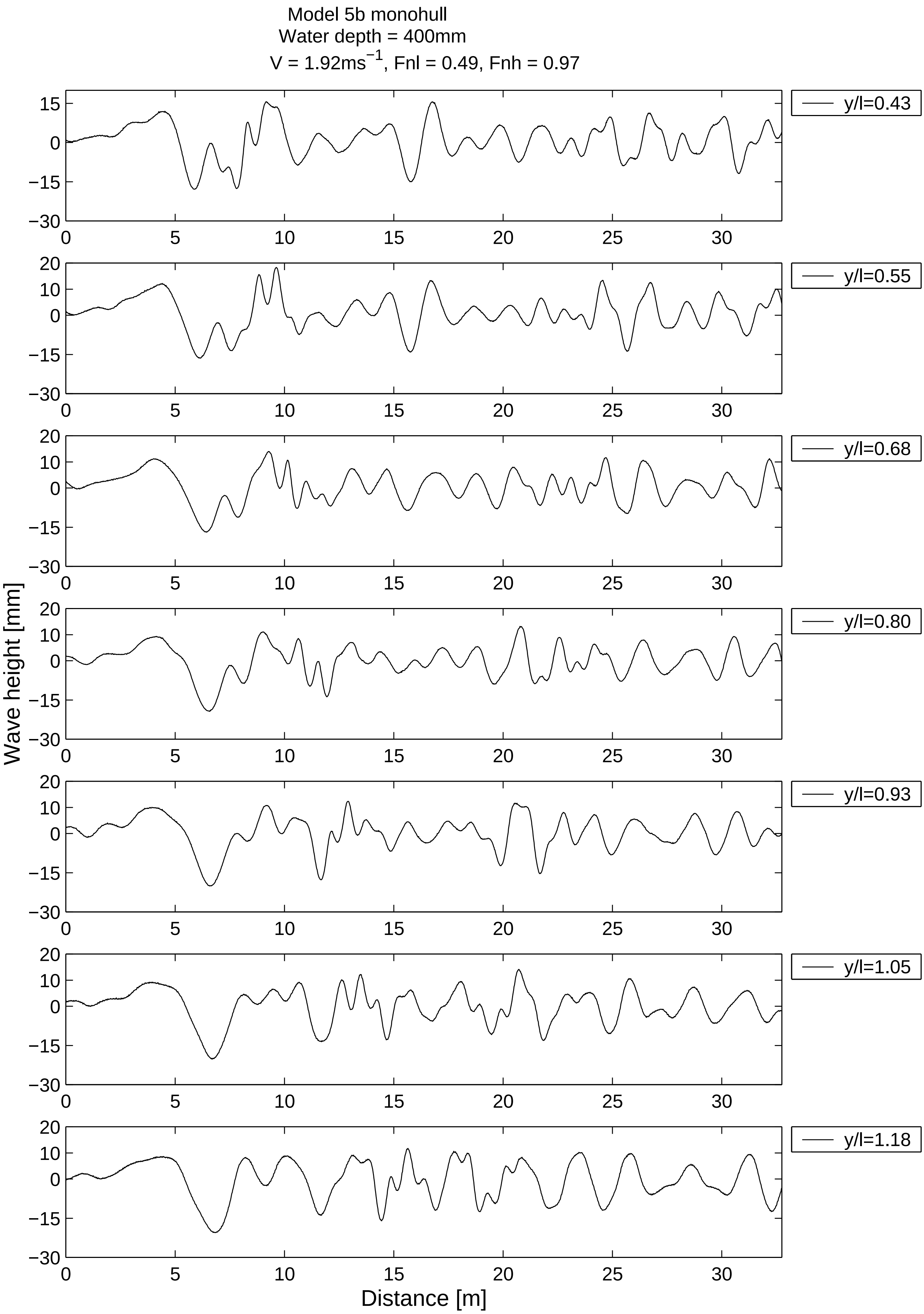
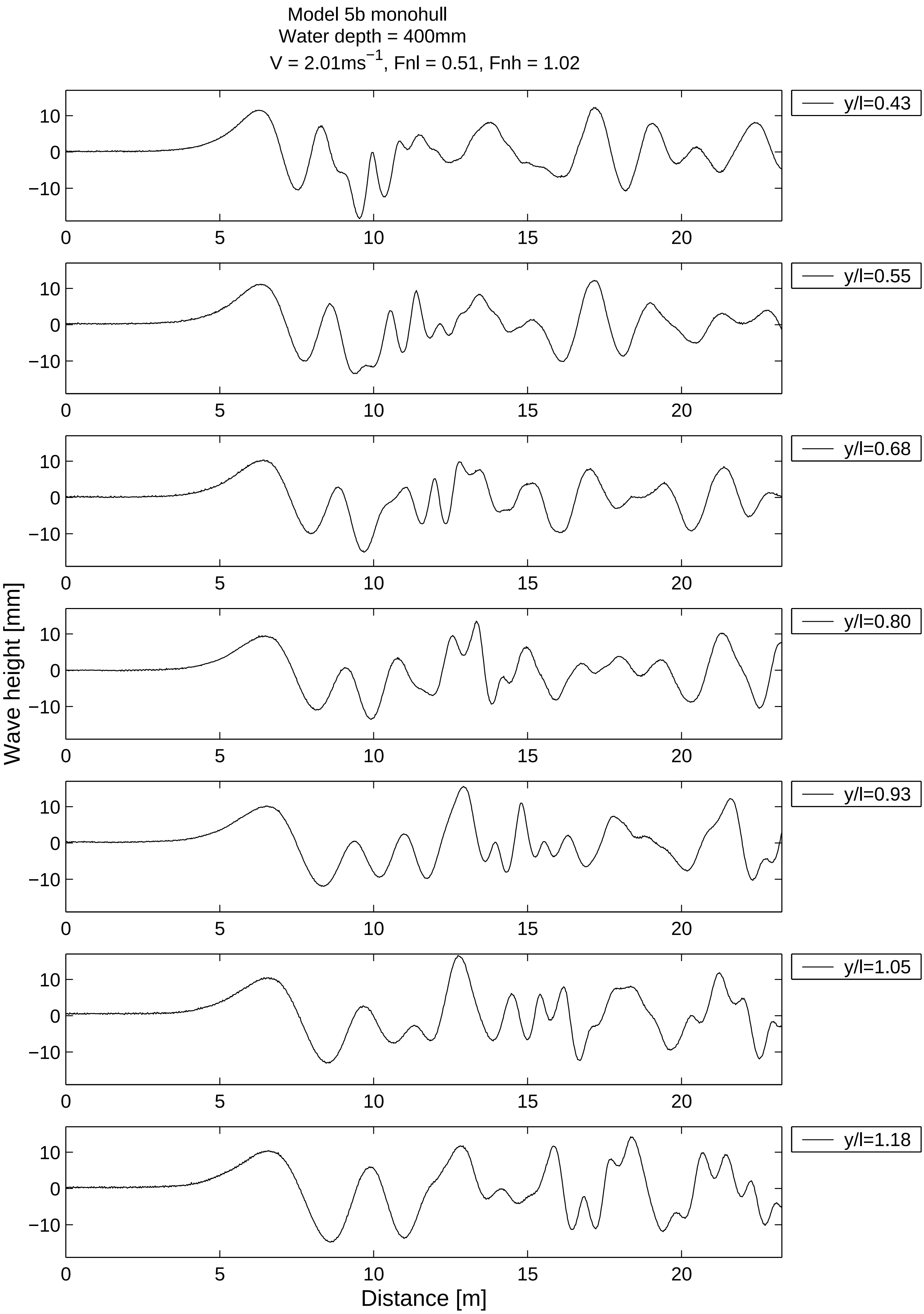

Model 5b monohull
Water depth = 400mm
V = 1.92ms−1, Fnl = 0.49, Fnh = 0.97
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 12



Model 5b monohull
Water depth = 400mm
V = 2.01ms−1, Fnl = 0.51, Fnh = 1.02
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 13

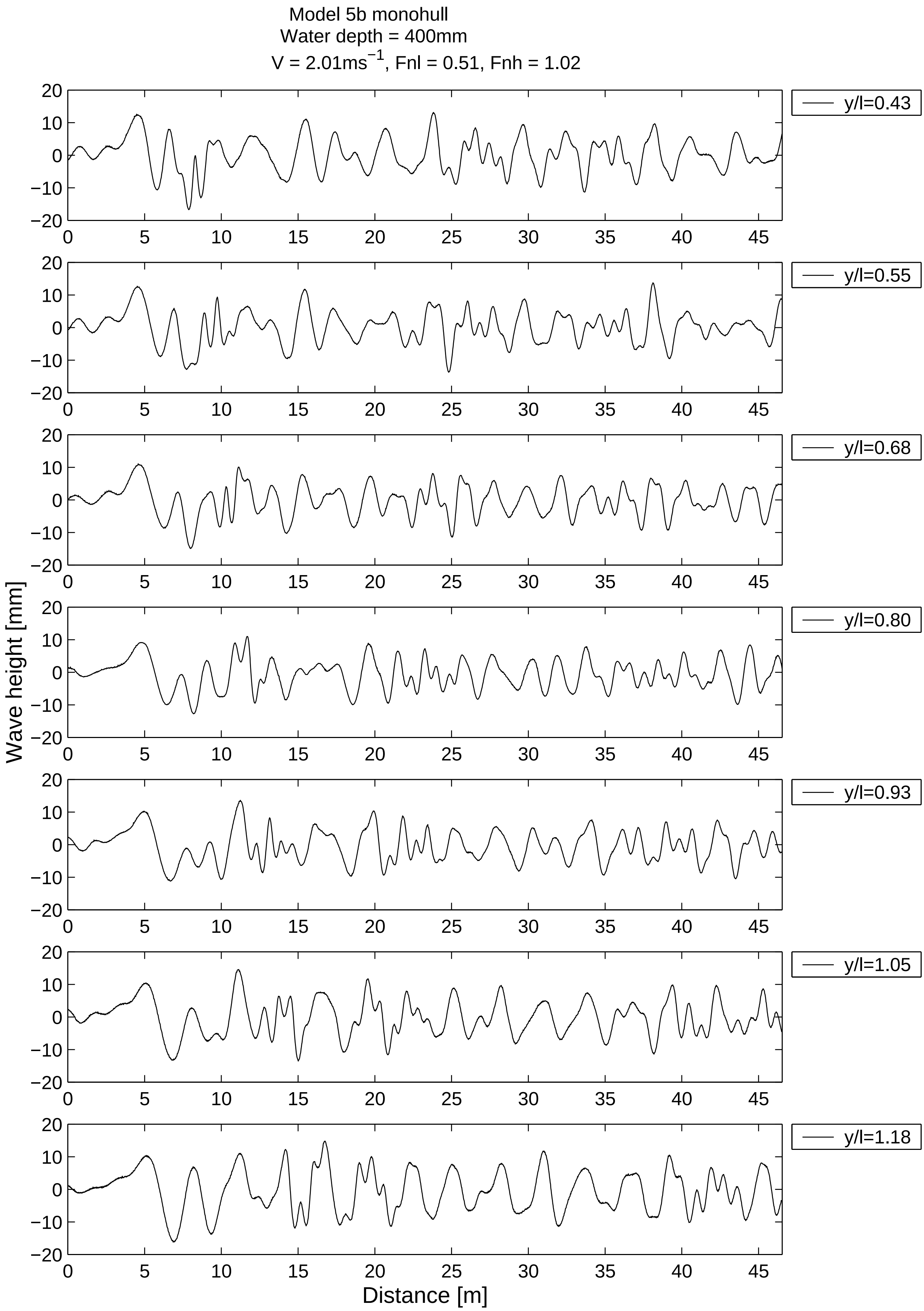

Model 5b monohull
Water depth = 400mm
V = 2.01ms^{-1}, Fnl = 0.51, Fnh = 1.02
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 14

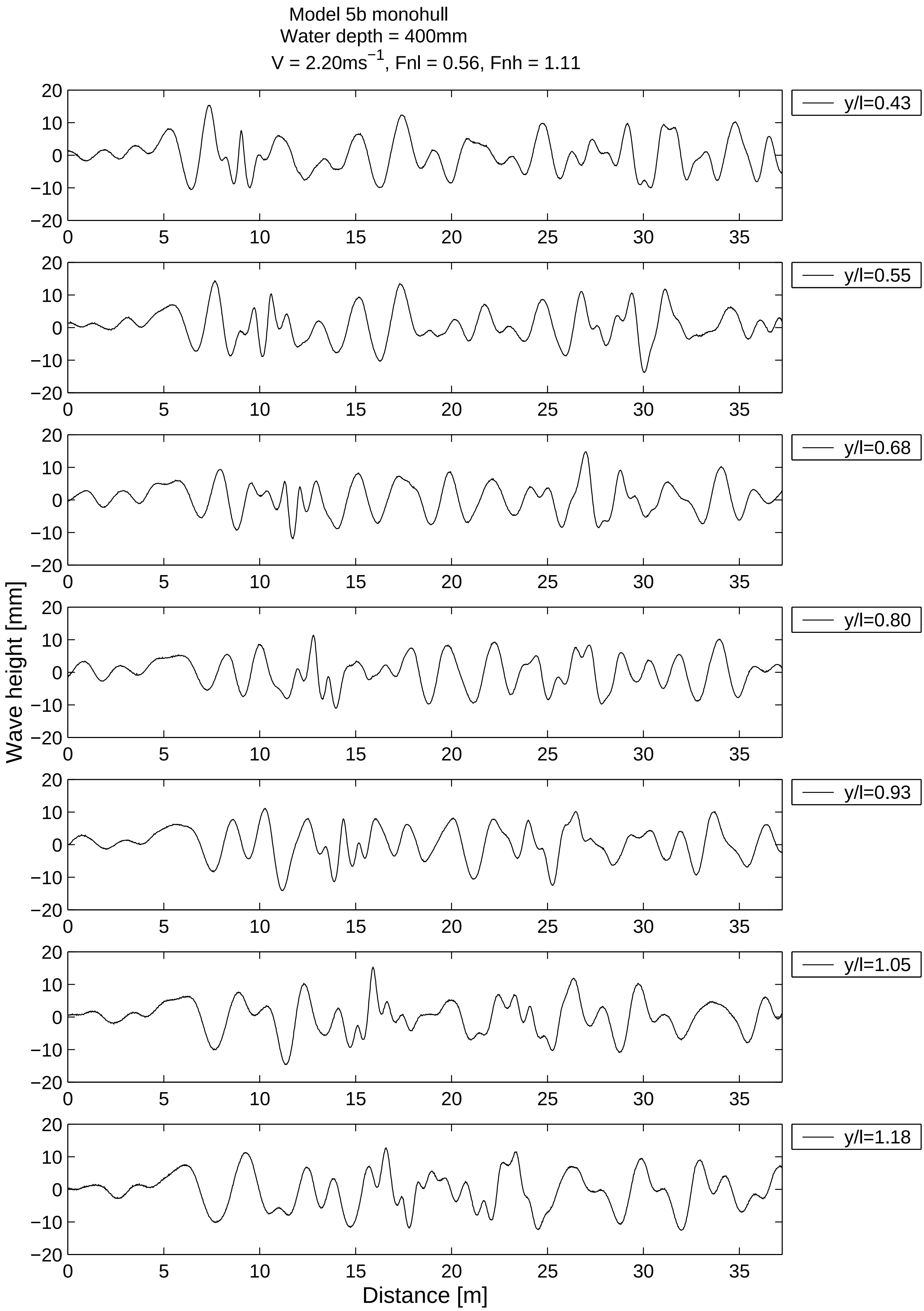

Model 5b monohull
Water depth = 400mm
V = 2.20ms−1, Fnl = 0.56, Fnh = 1.11
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 15

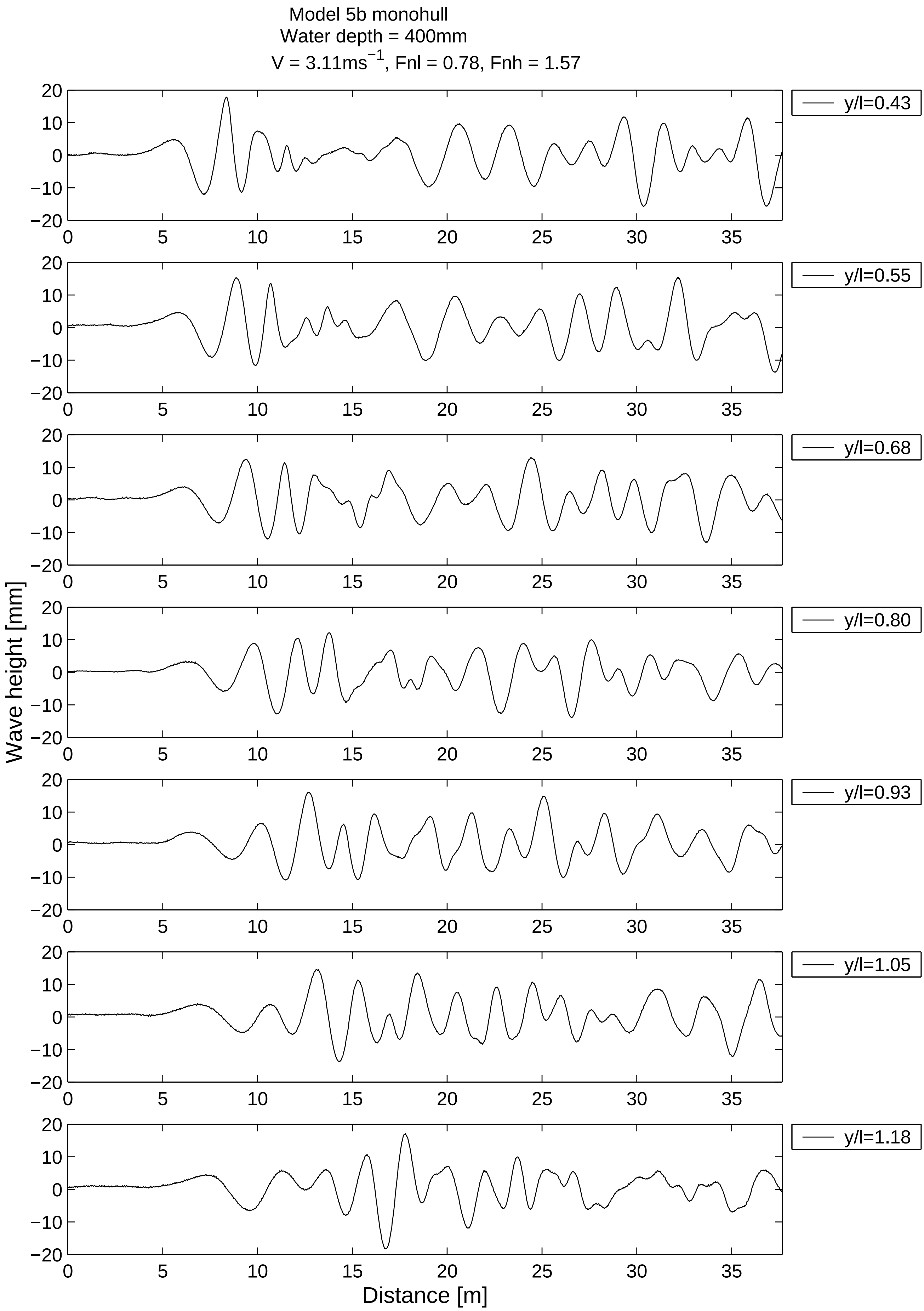

Model 5b monohull
Water depth = 400mm
V = 3.11ms^{-1}, Fnl = 0.78, Fnh = 1.57
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 16

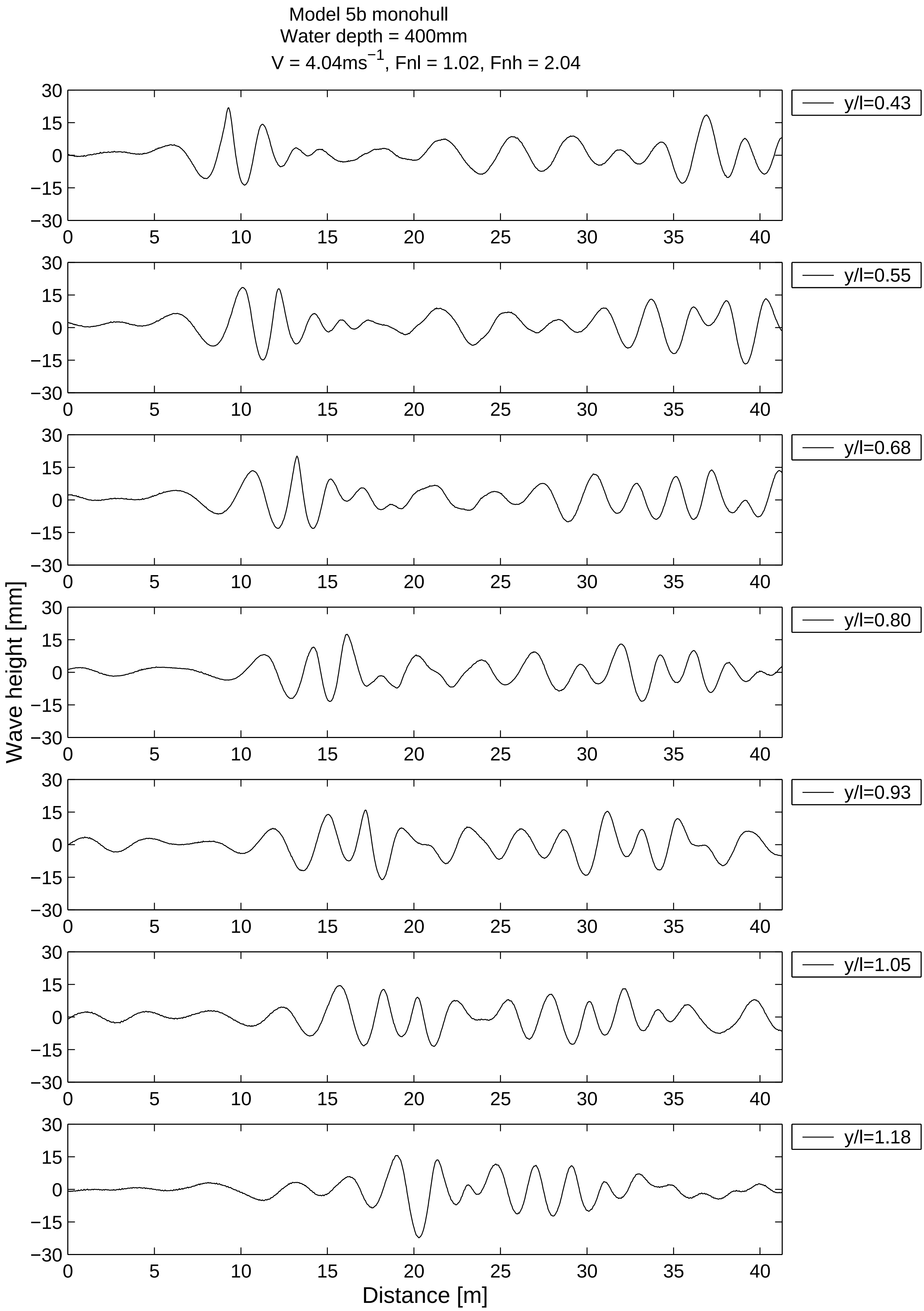
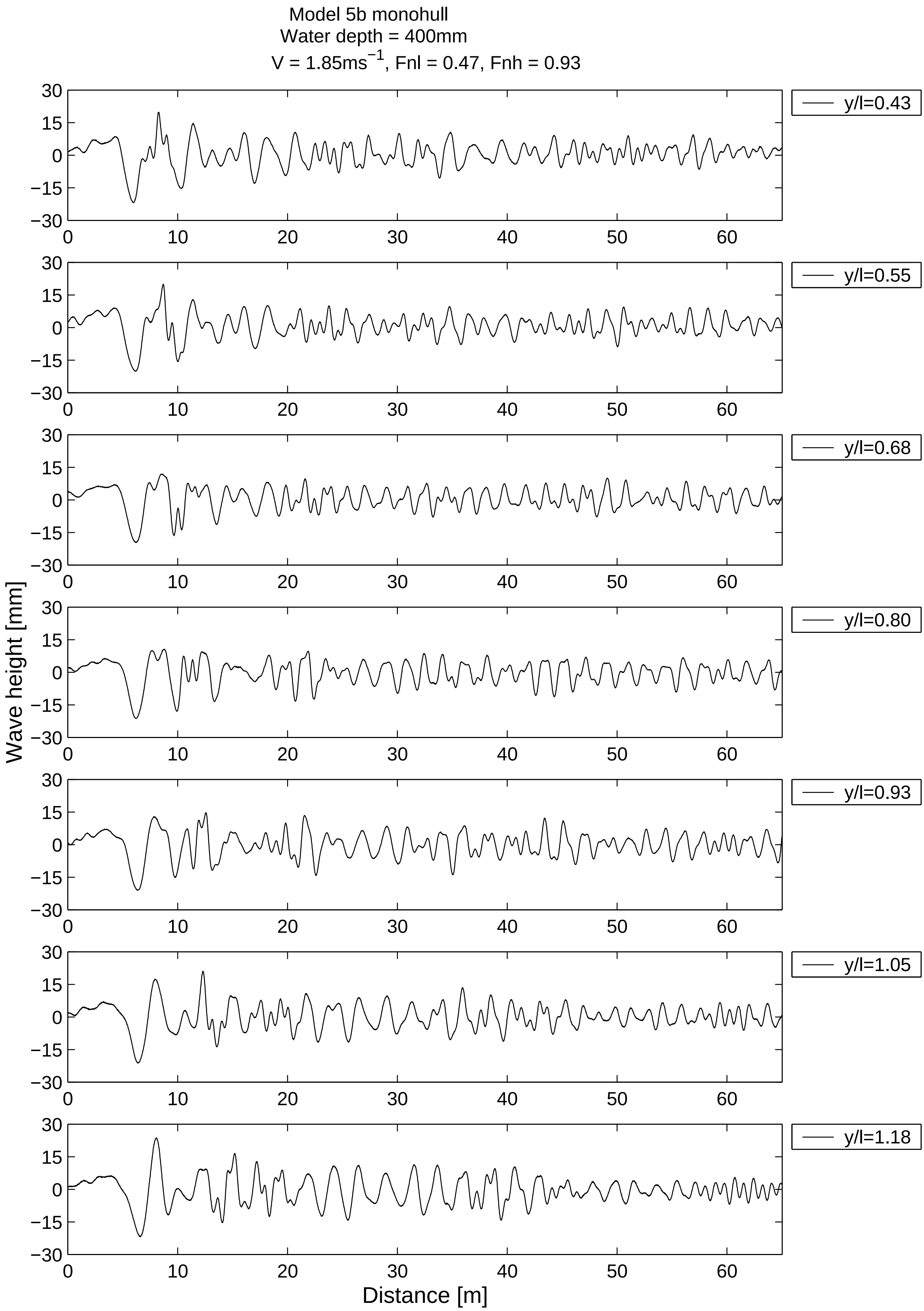

Model 5b monohull
Water depth = 400mm
V = 4.04ms^{-1}, Fnl = 1.02, Fnh = 2.04
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20
25
30
35
40

Figure 17



Model 5b monohull
Water depth = 400mm
V = 1.85ms^{-1}, Fnl = 0.47, Fnh = 0.93
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 18

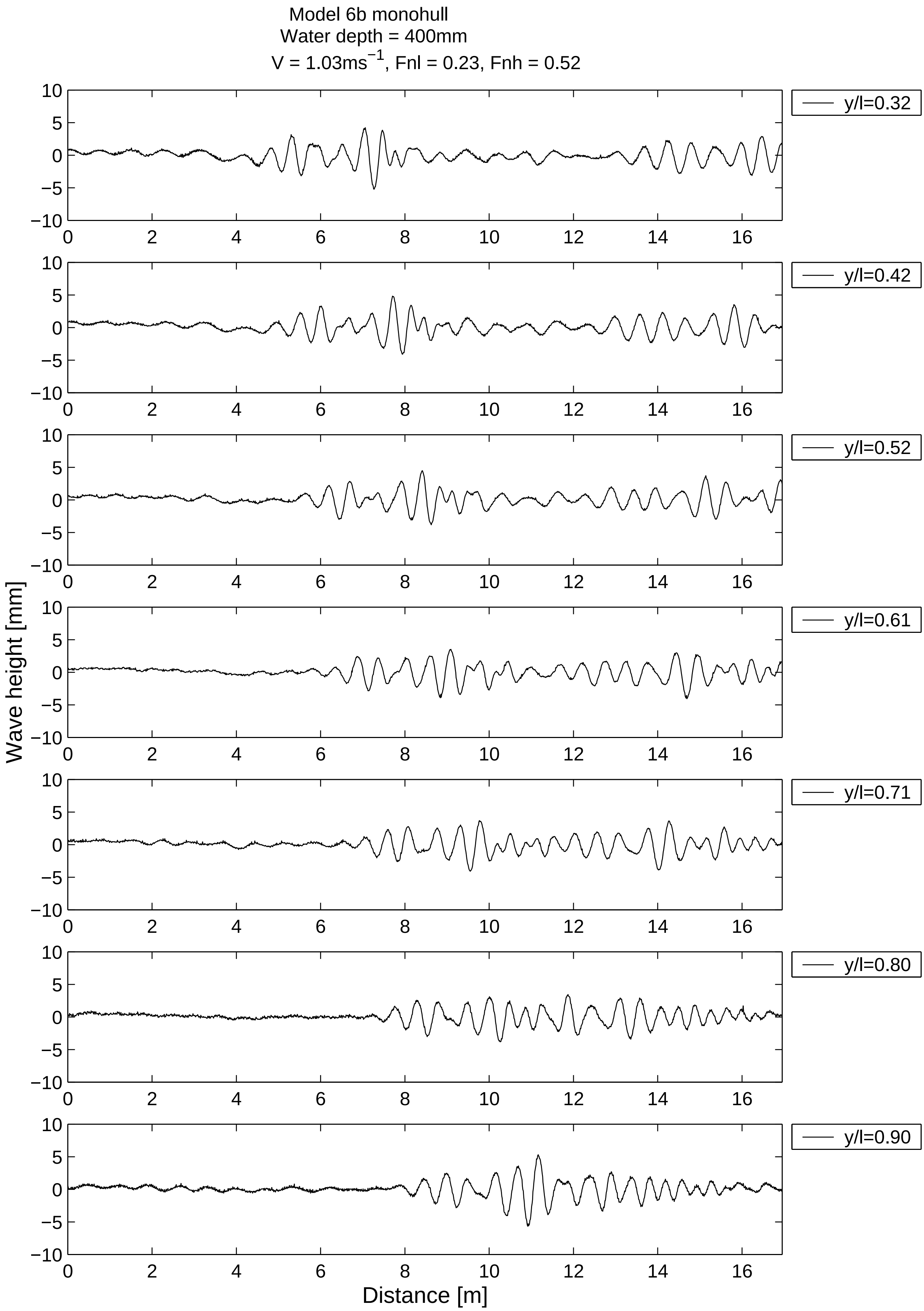

Model 6b monohull
Water depth = 400mm
V = 1.03ms^{-1}, Fnl = 0.23, Fnh = 0.52
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 19

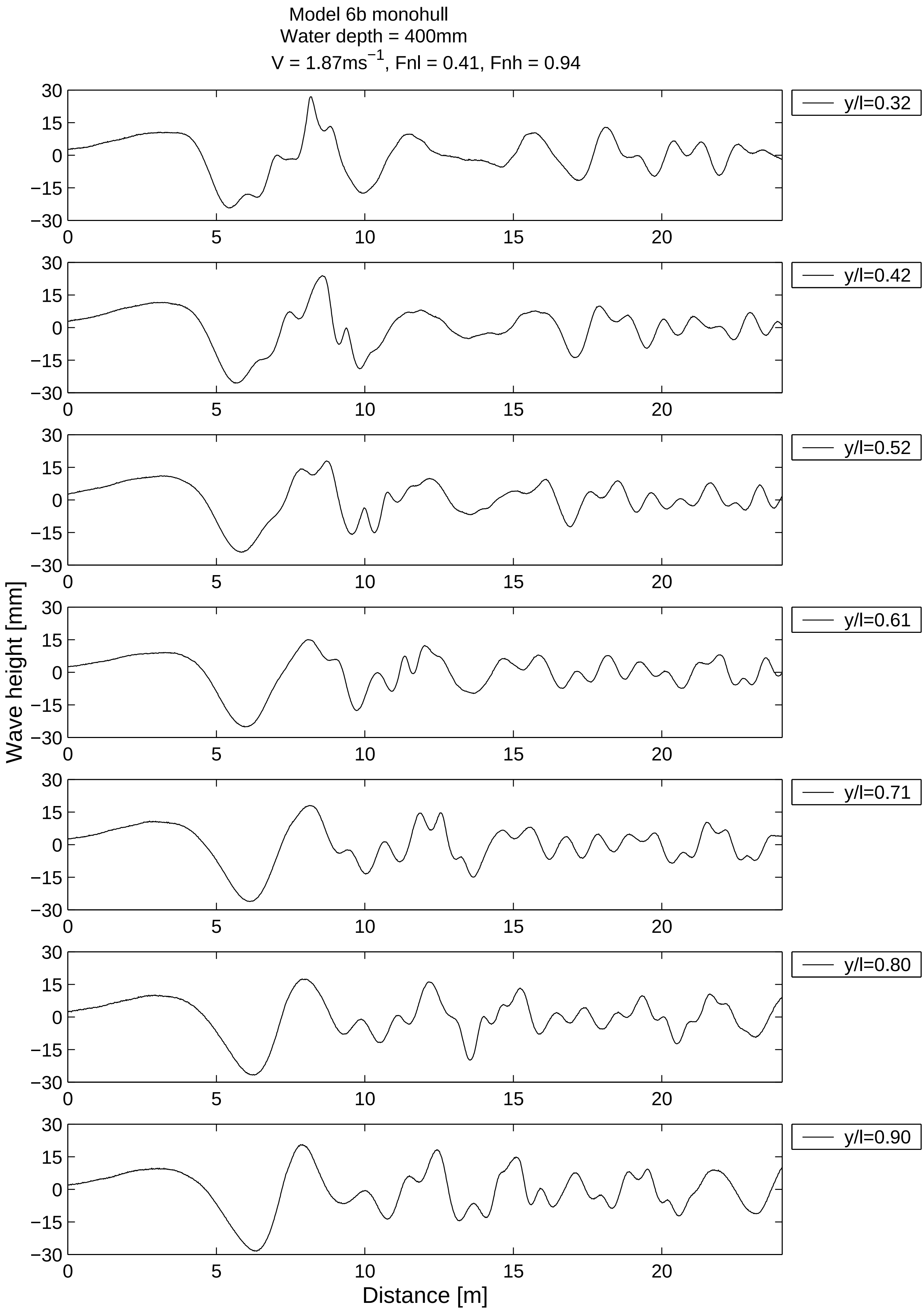
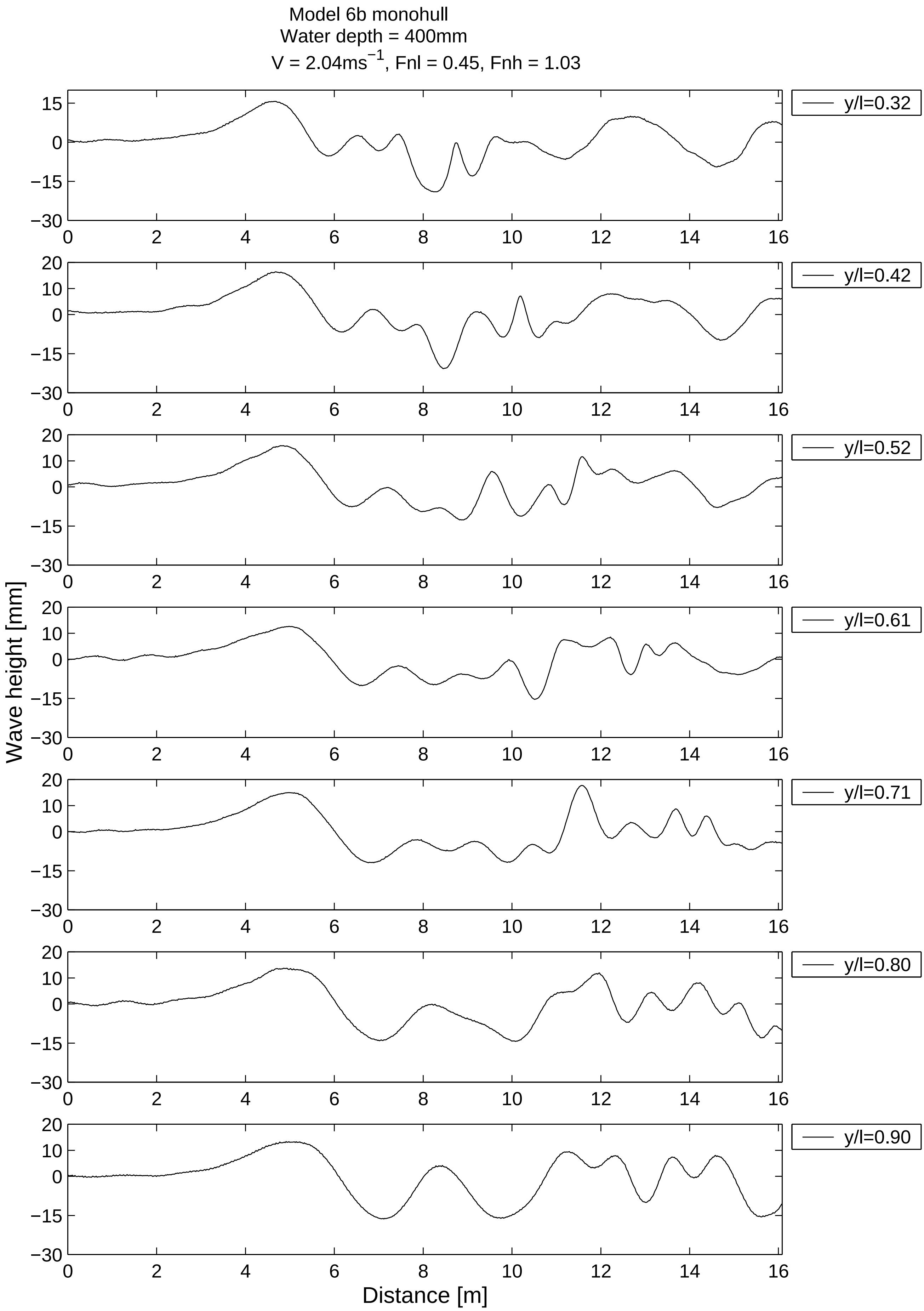
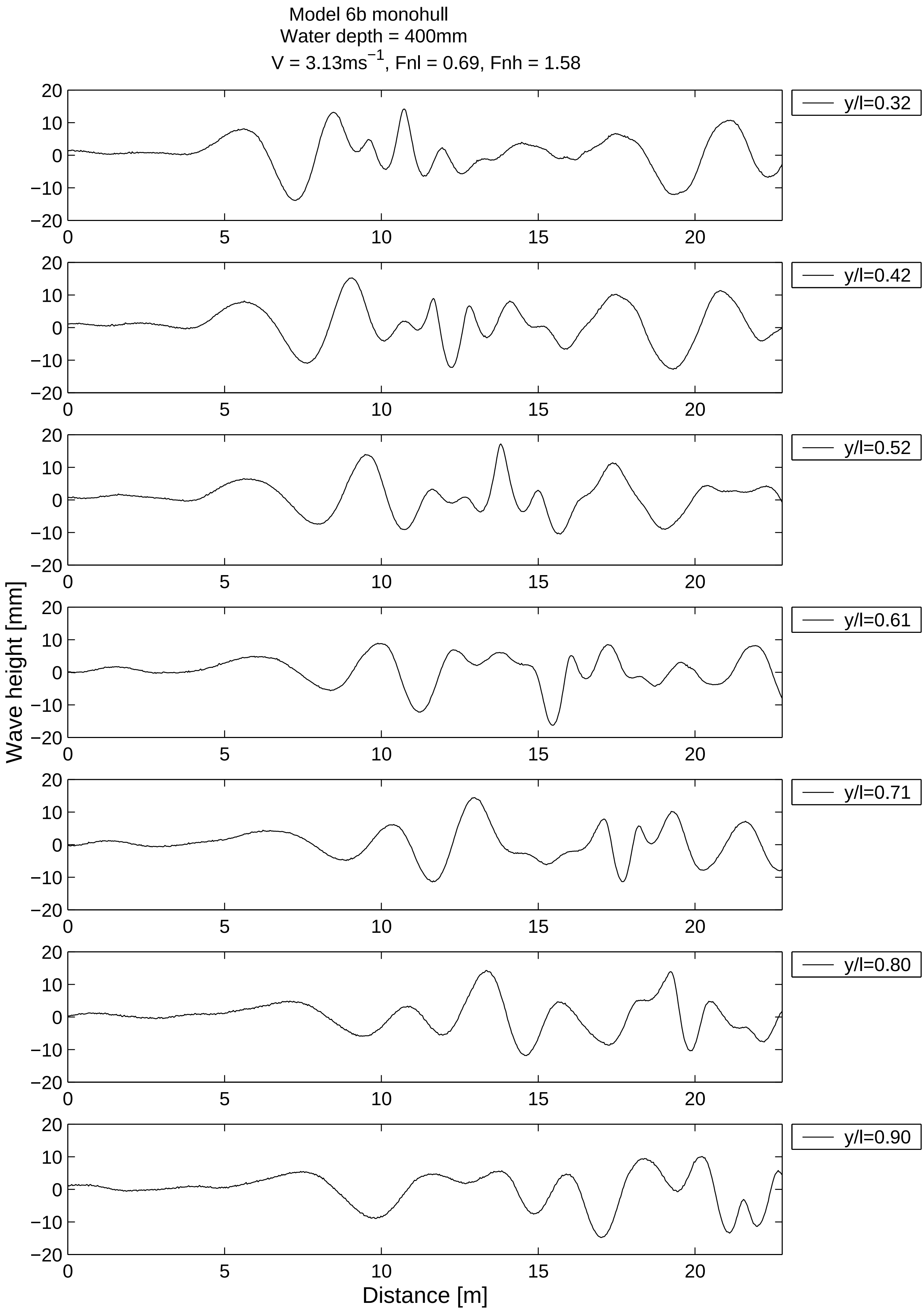

Model 6b monohull
Water depth = 400mm
V = 1.87ms−1, Fnl = 0.41, Fnh = 0.94
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 20



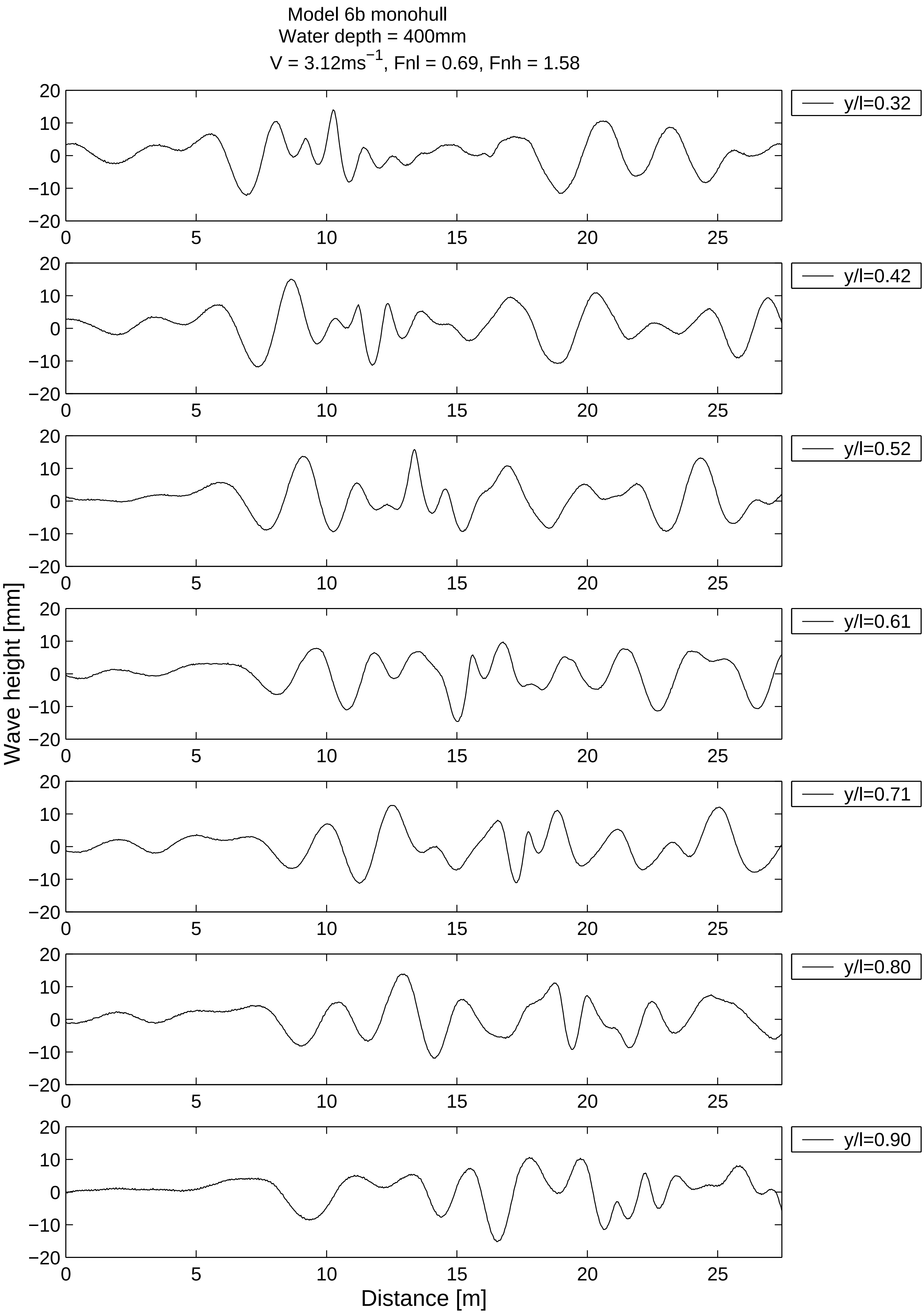
Model 6b monohull
Water depth = 400mm
V = 2.04ms−1, Fnl = 0.45, Fnh = 1.03
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 21



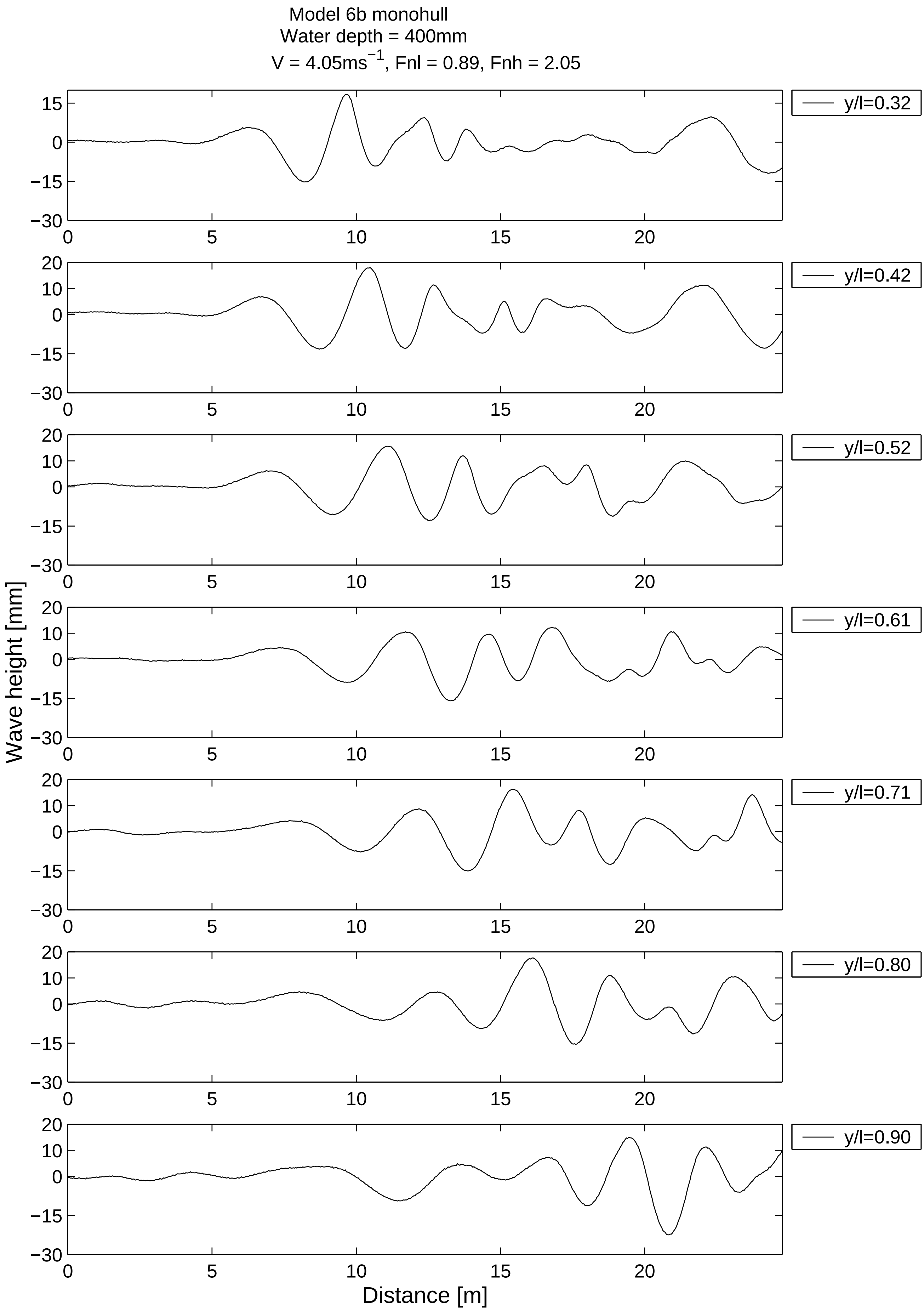
Model 6b monohull
Water depth = 400mm
V = 3.13ms−1, Fnl = 0.69, Fnh = 1.58
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 22



Model 6b monohull
Water depth = 400mm
V = 3.12ms−1, Fnl = 0.69, Fnh = 1.58
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 23



Model 6b monohull
Water depth = 400mm
V = 4.05ms−1, Fnl = 0.89, Fnh = 2.05
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 24

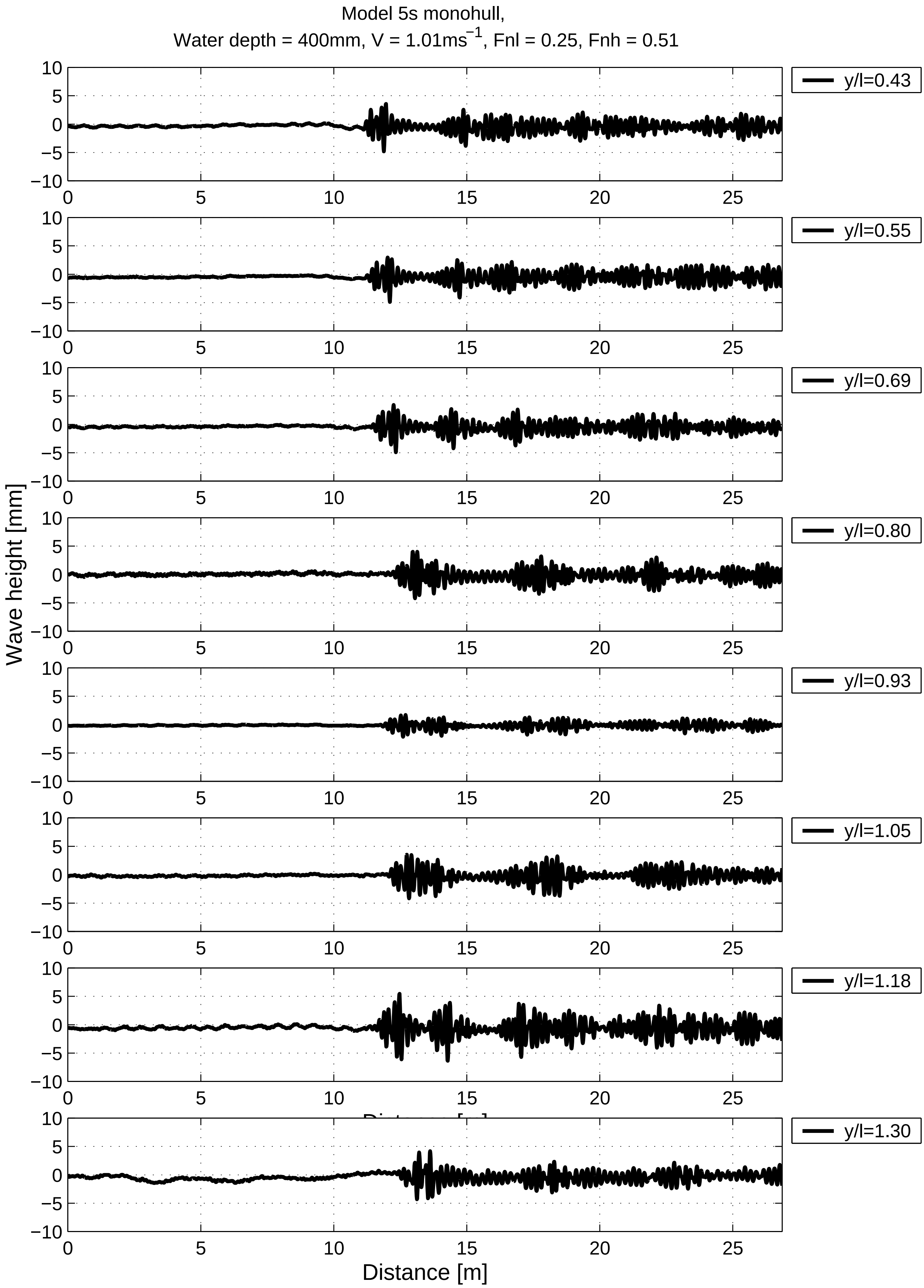
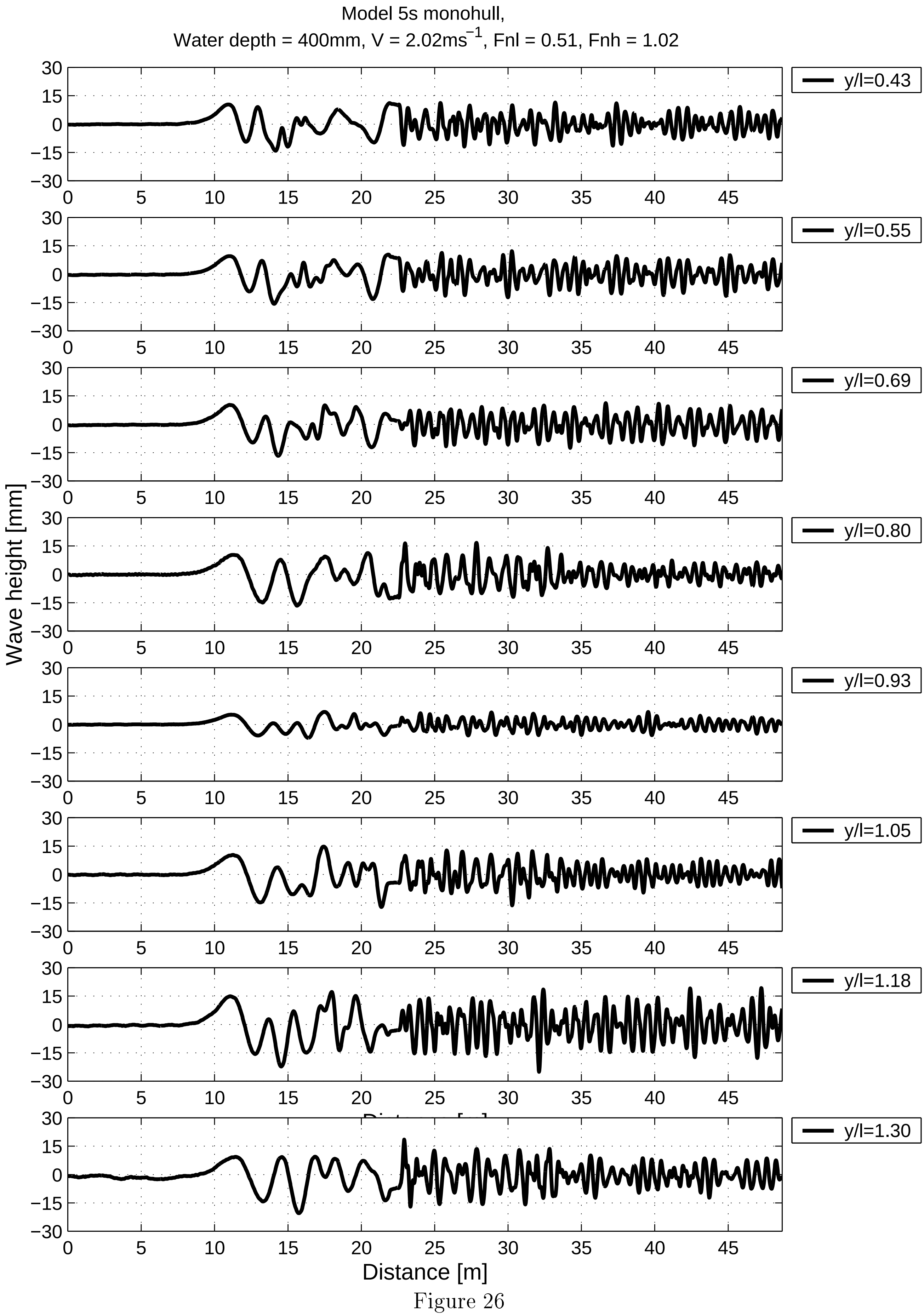

Model 5s monohull,
Water depth = 400mm, V = 1.01ms^{-1}, Fnl = 0.25, Fnh = 0.51
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 25



Model 5s monohull,
Water depth = 400mm, V = 2.02ms^{-1}, Fnl = 0.51, Fnh = 1.02
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 26

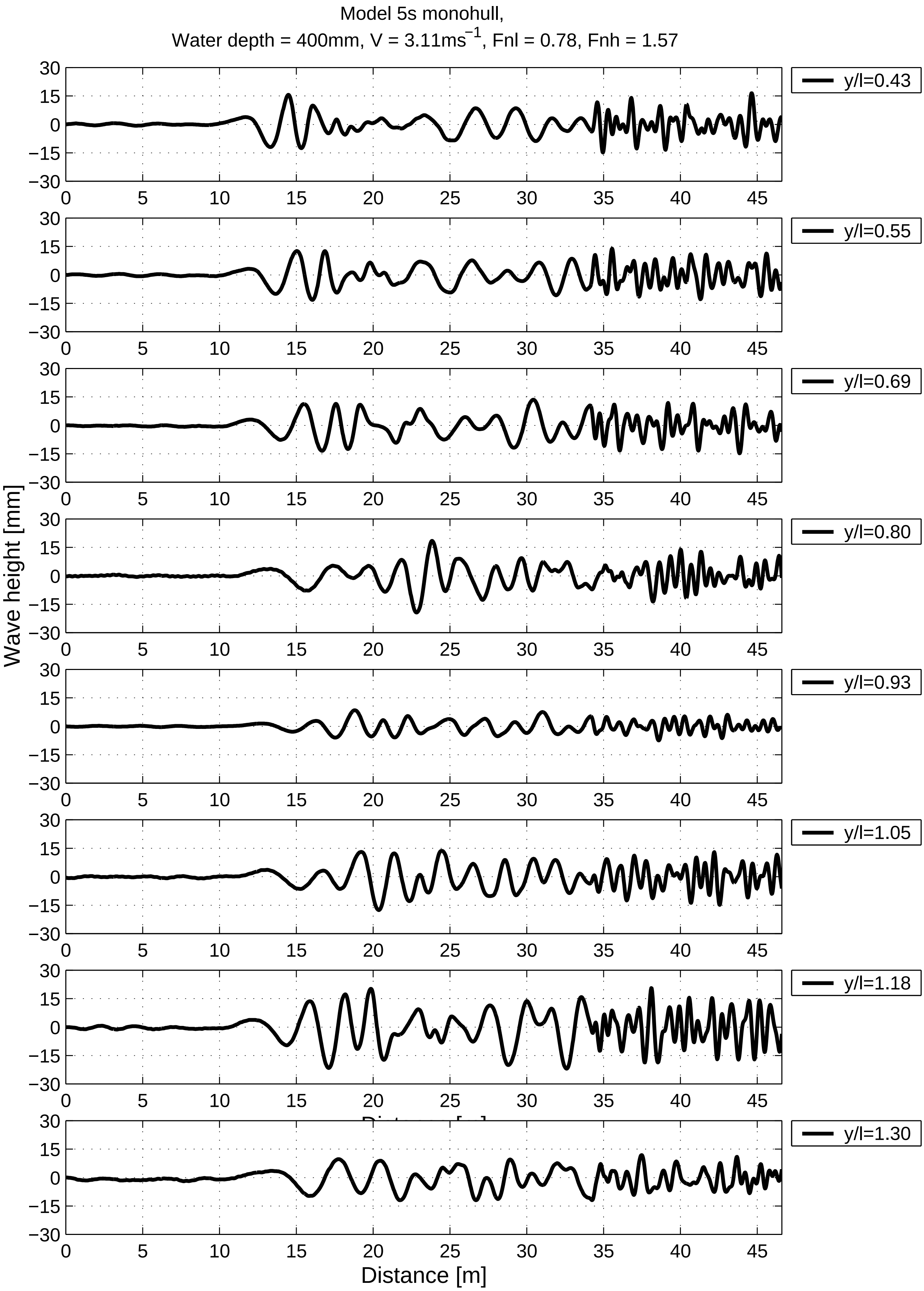
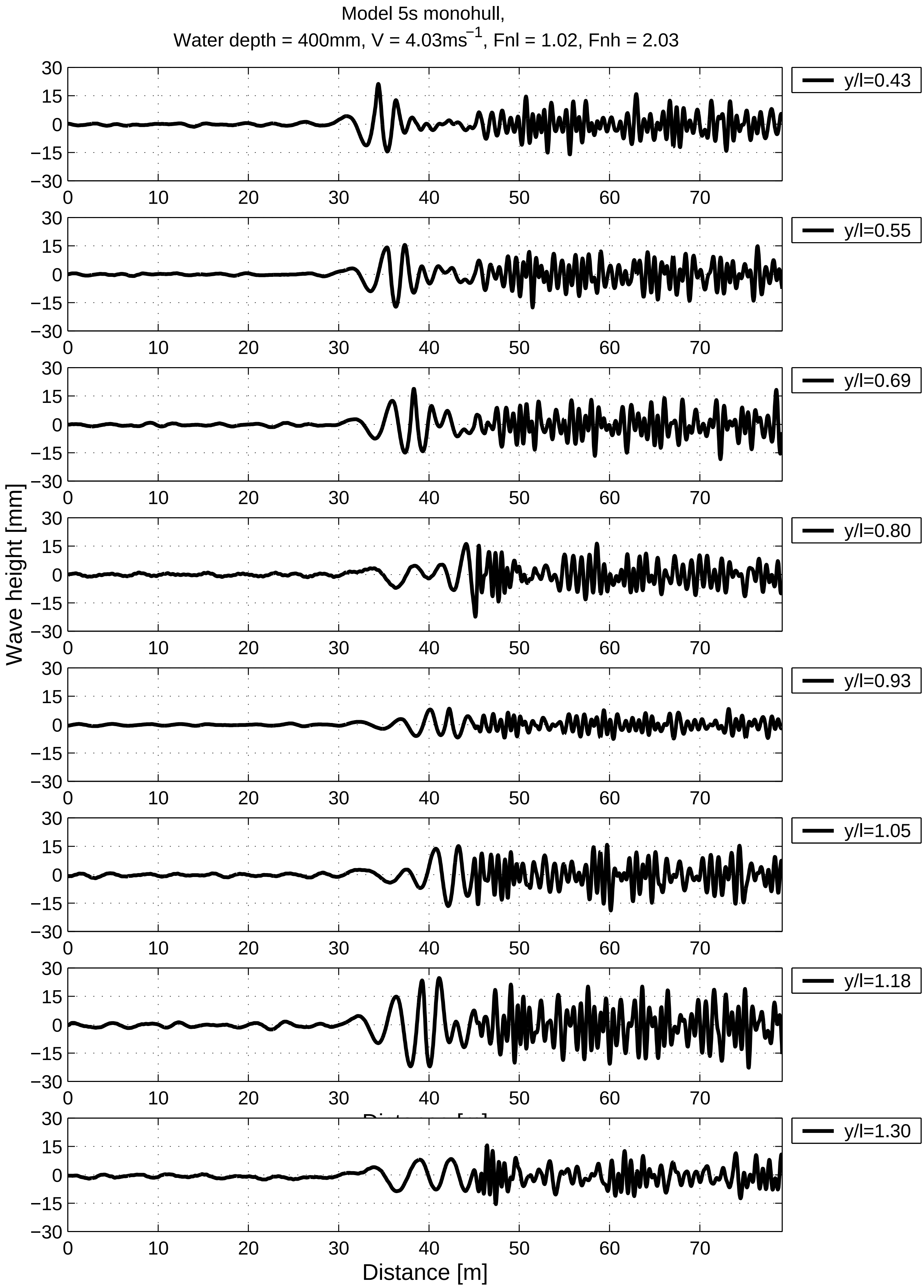
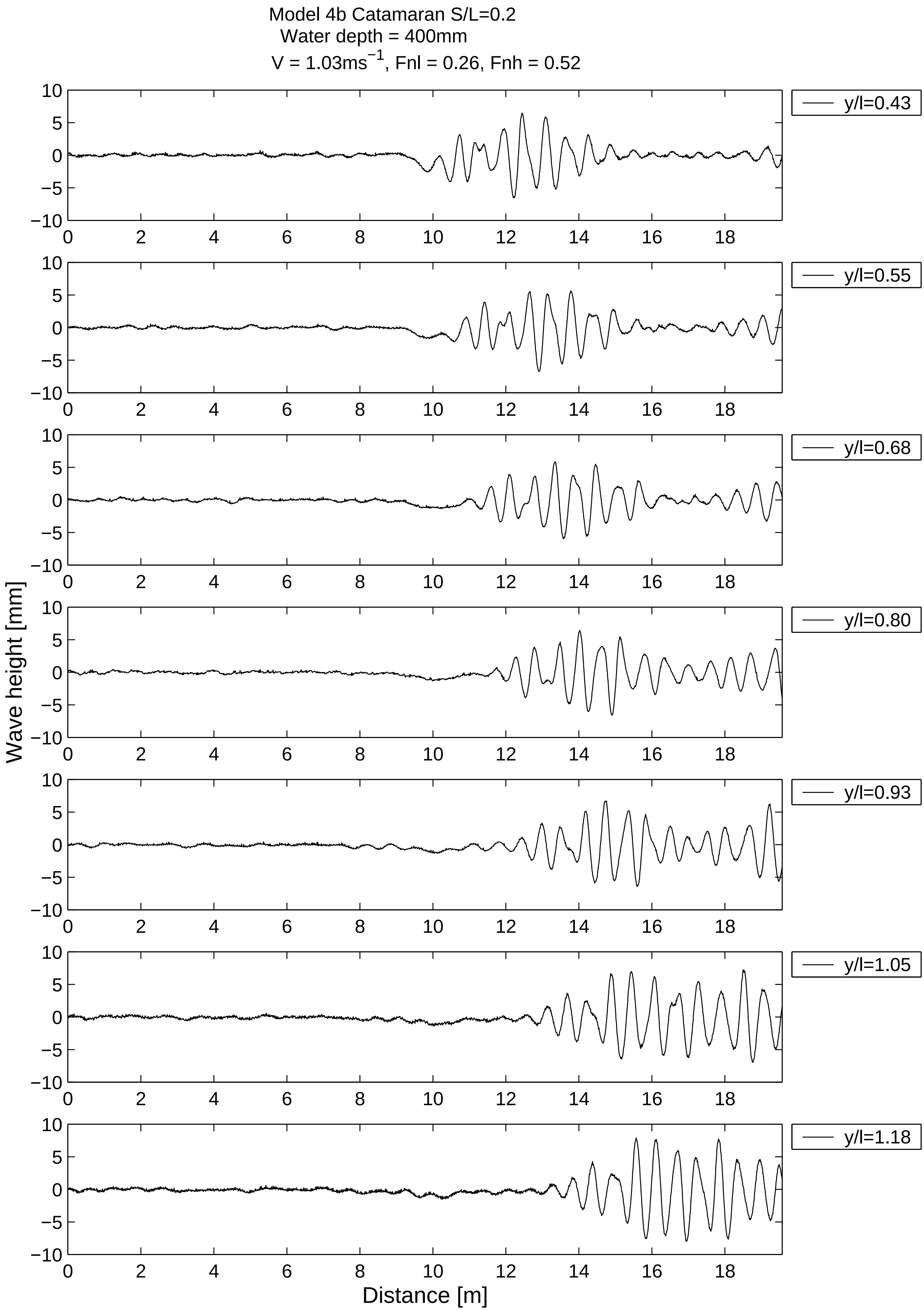

Model 5s monohull,
Water depth = 400mm, V = 3.11ms^{-1}, Fnl = 0.78, Fnh = 1.57
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30
30
15
0
−15
−30
0
5
10
15
20
25
30
35
40
45

Figure 27



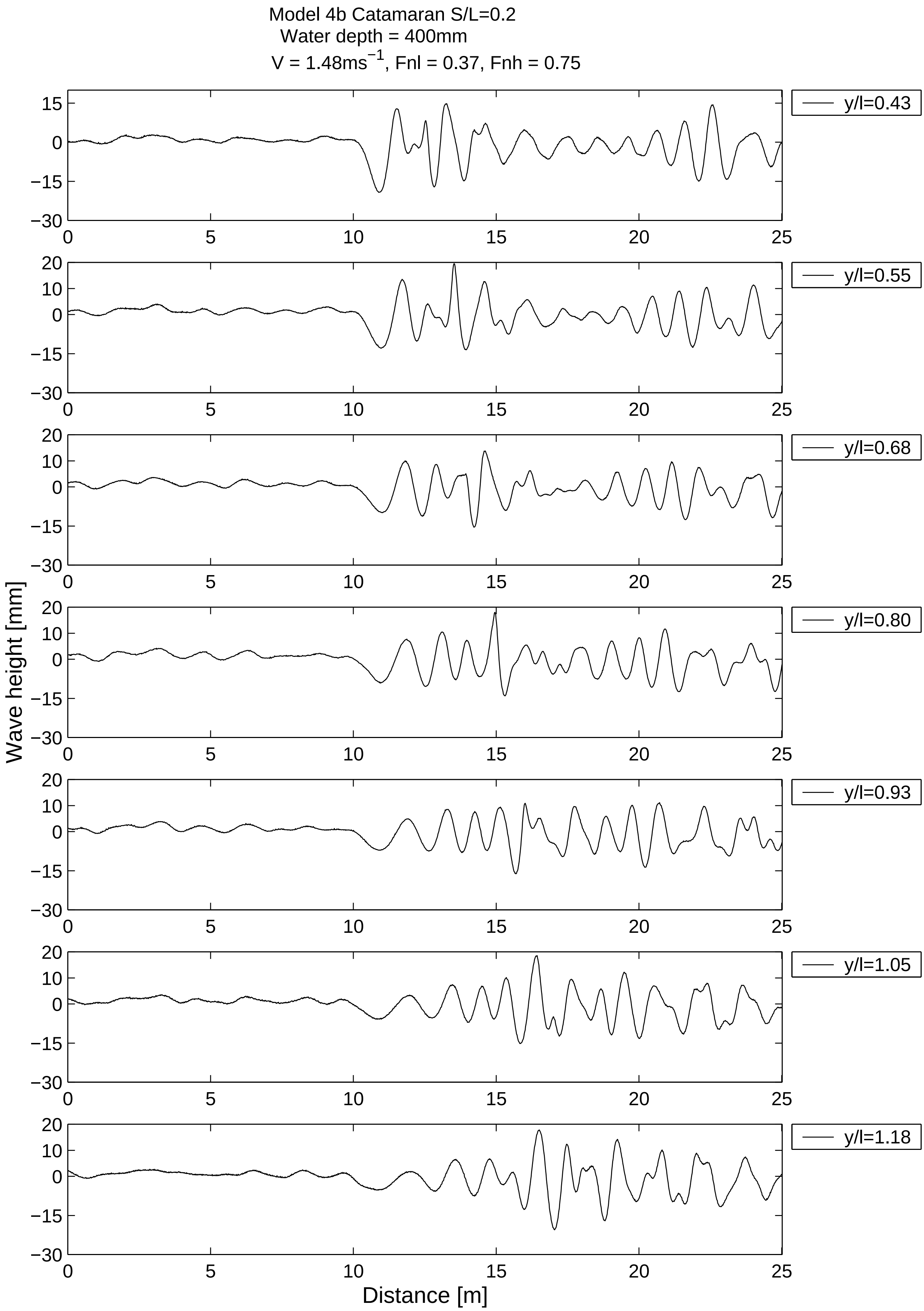
Model 5s monohull,
Water depth = 400mm, V = 4.03ms^{-1}, Fnl = 1.02, Fnh = 2.03
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 28



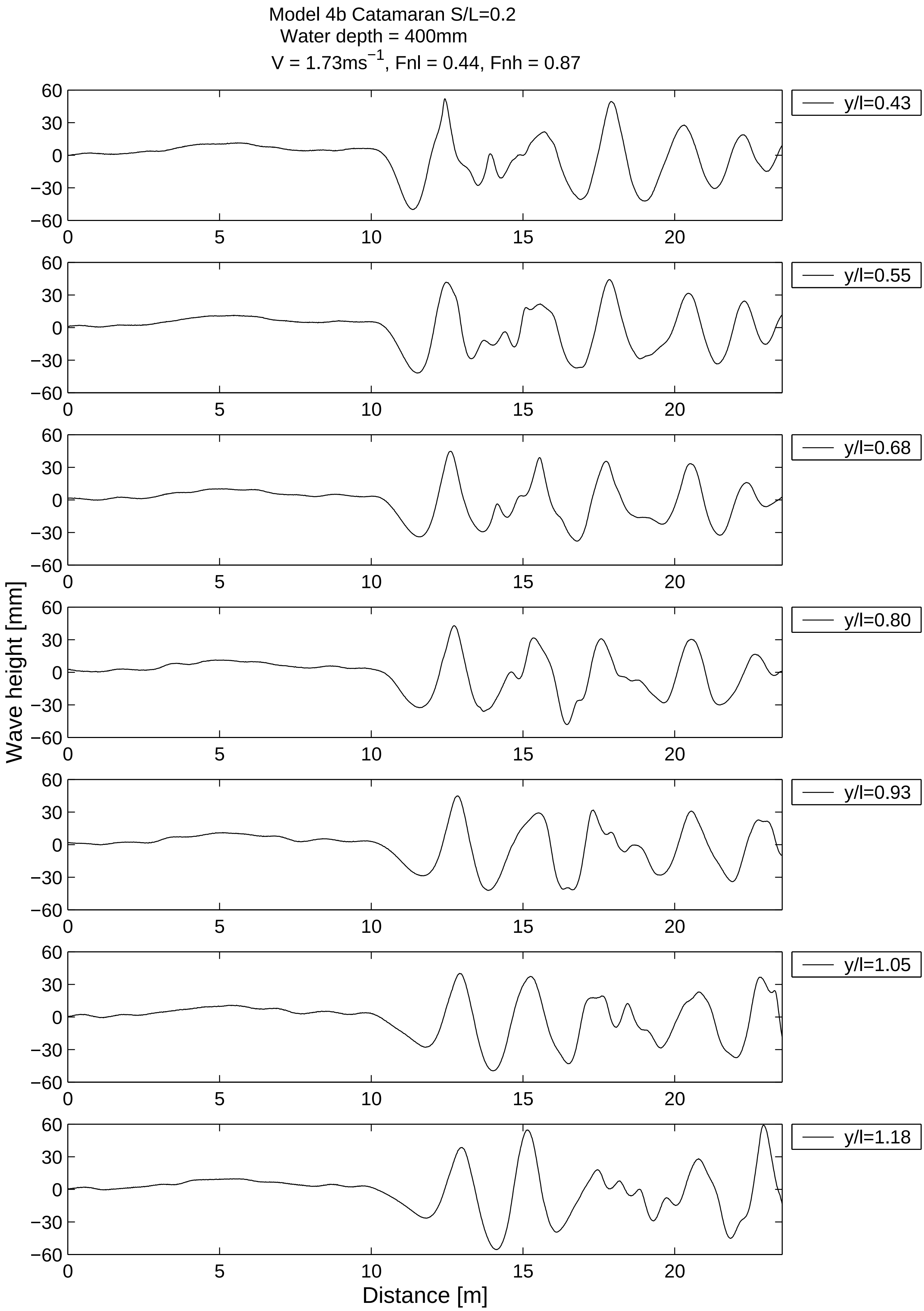
Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 1.03ms−1, Fnl = 0.26, Fnh = 0.52
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 29



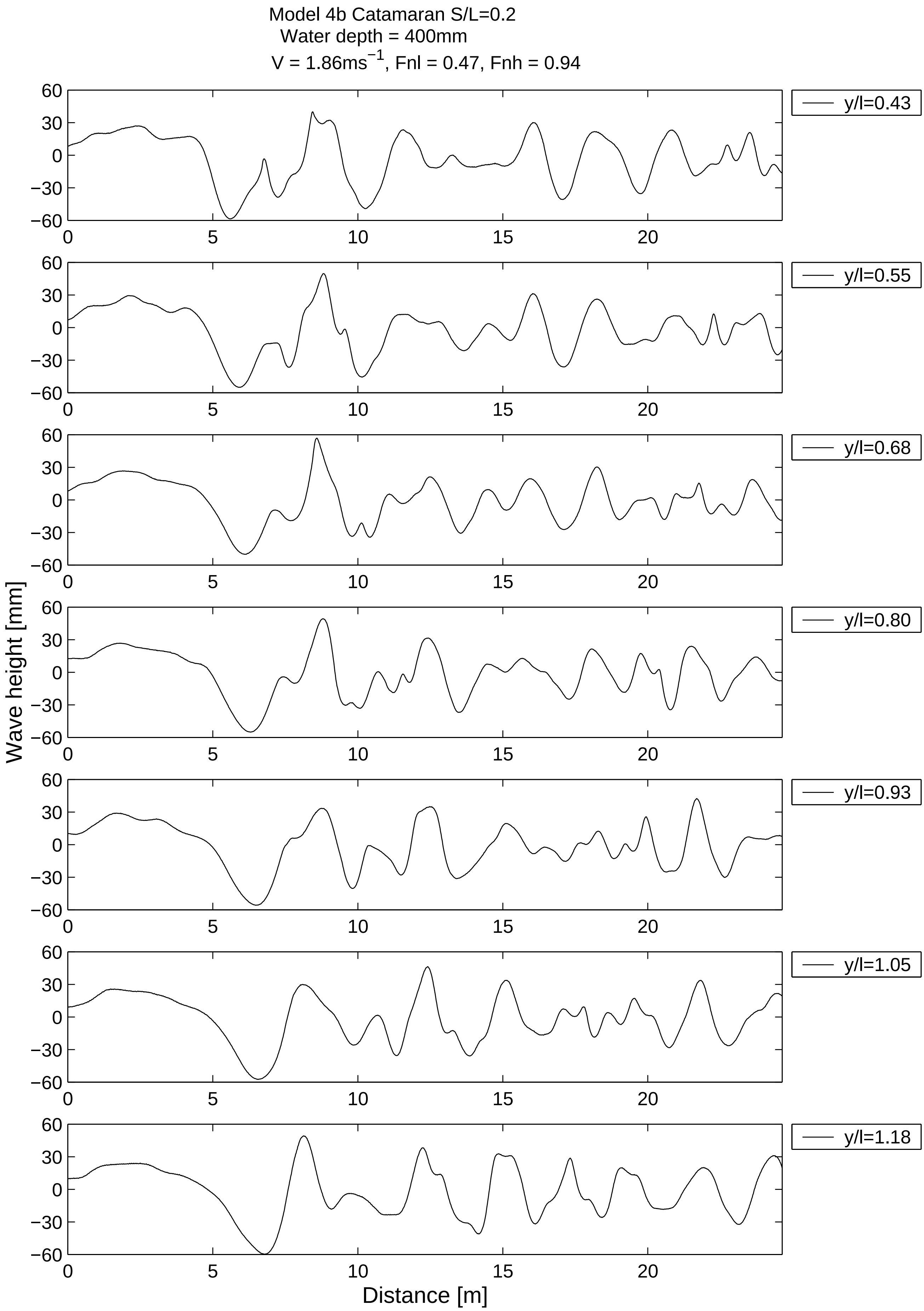
Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 1.48ms⁻¹, Fnl = 0.37, Fnh = 0.75
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 30



Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 1.73ms−1, Fnl = 0.44, Fnh = 0.87
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
60
30
0
−30
−60
0
5
10
15
20

Figure 31


Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 1.86ms−1, Fnl = 0.47, Fnh = 0.94
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
Figure 32

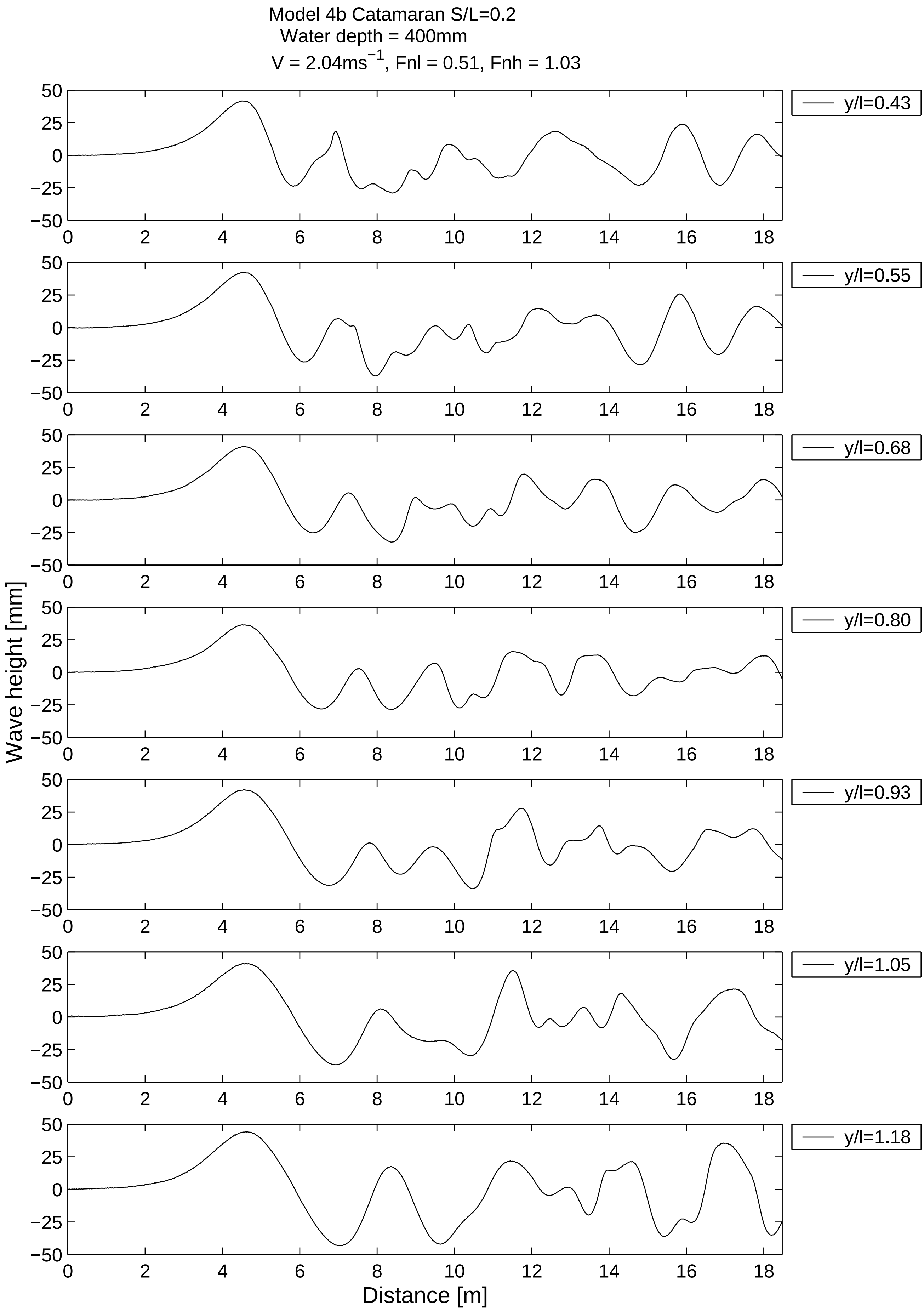
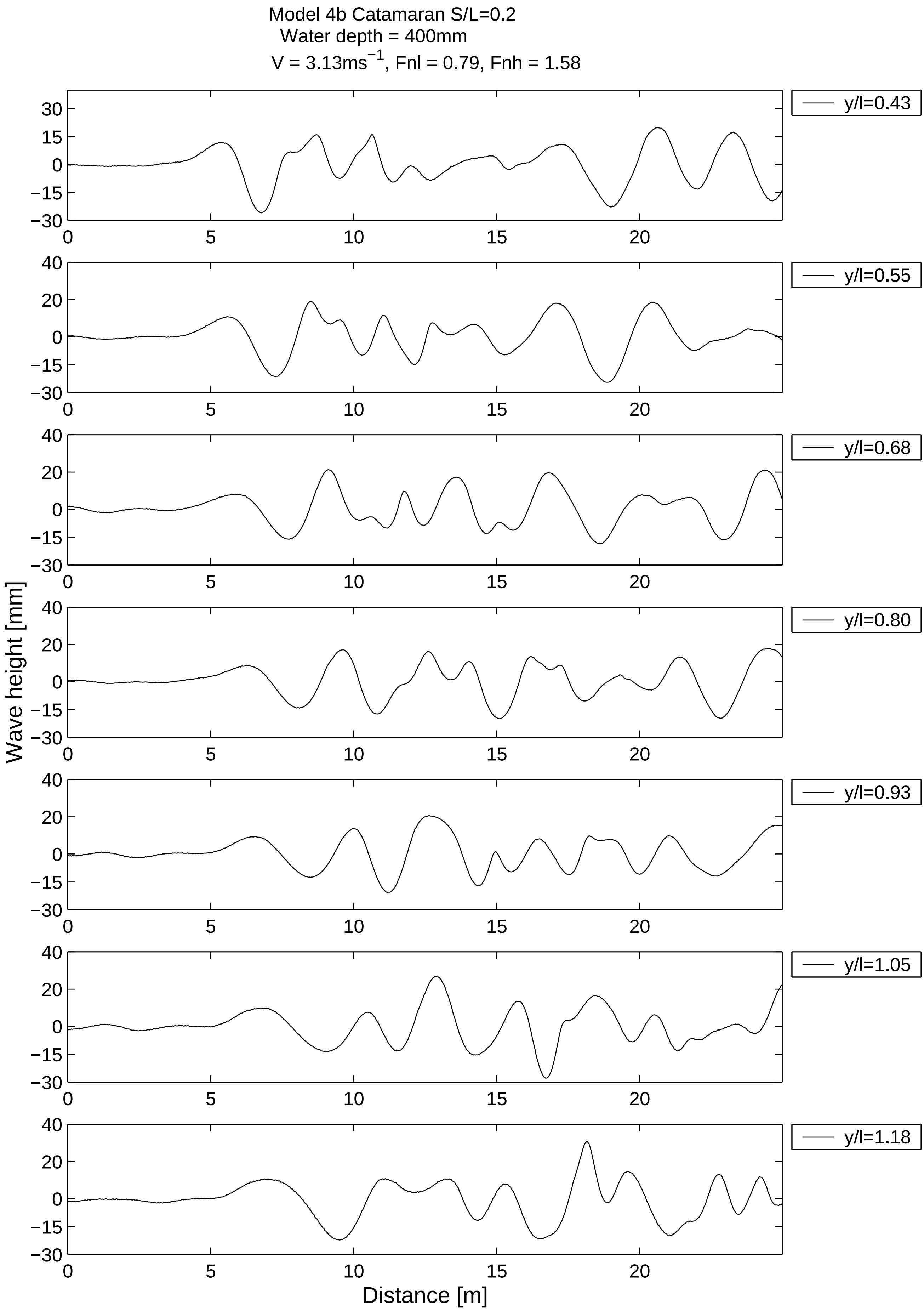

Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 2.04ms−1, Fnl = 0.51, Fnh = 1.03
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 33



Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 1.58
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 34

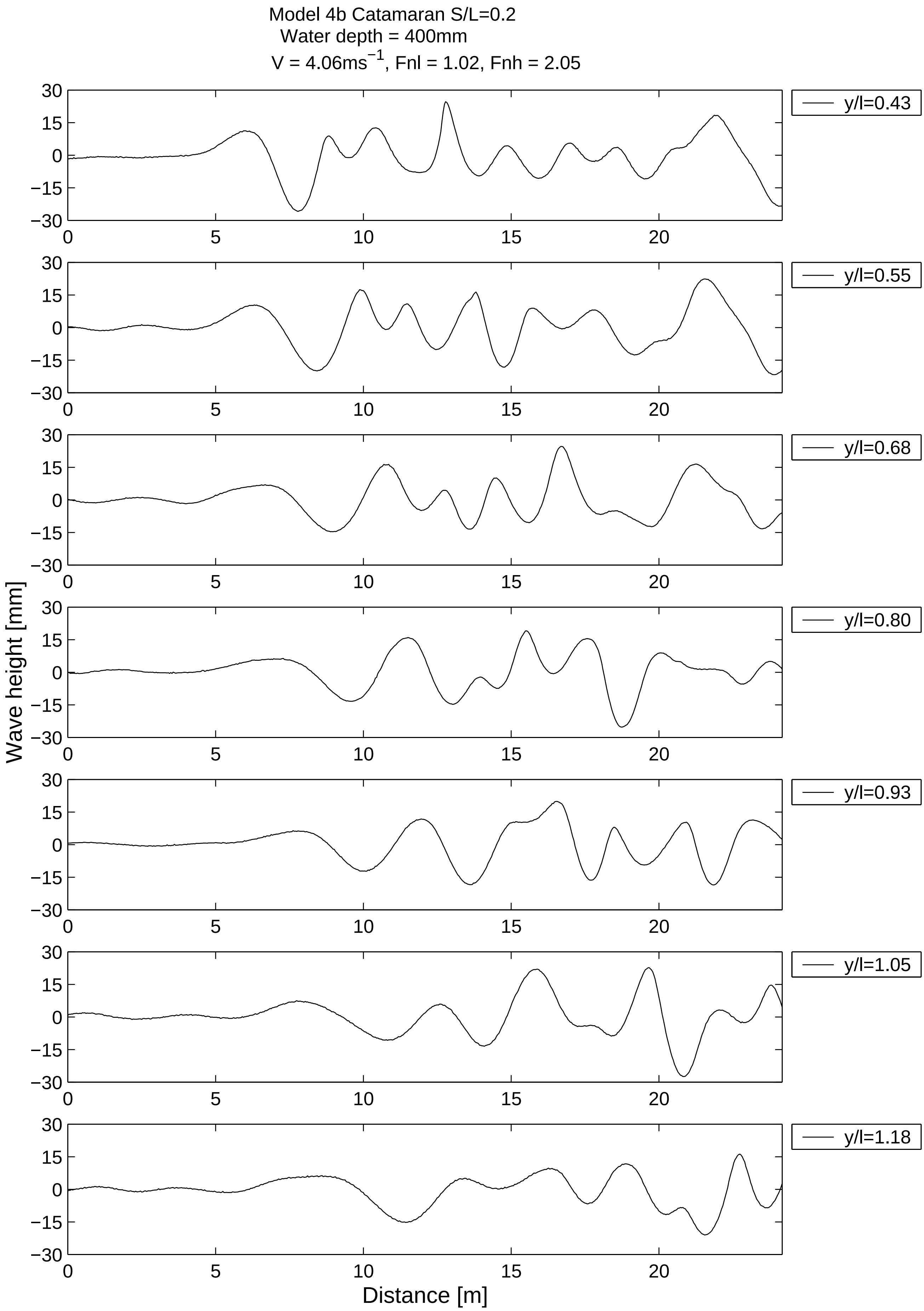
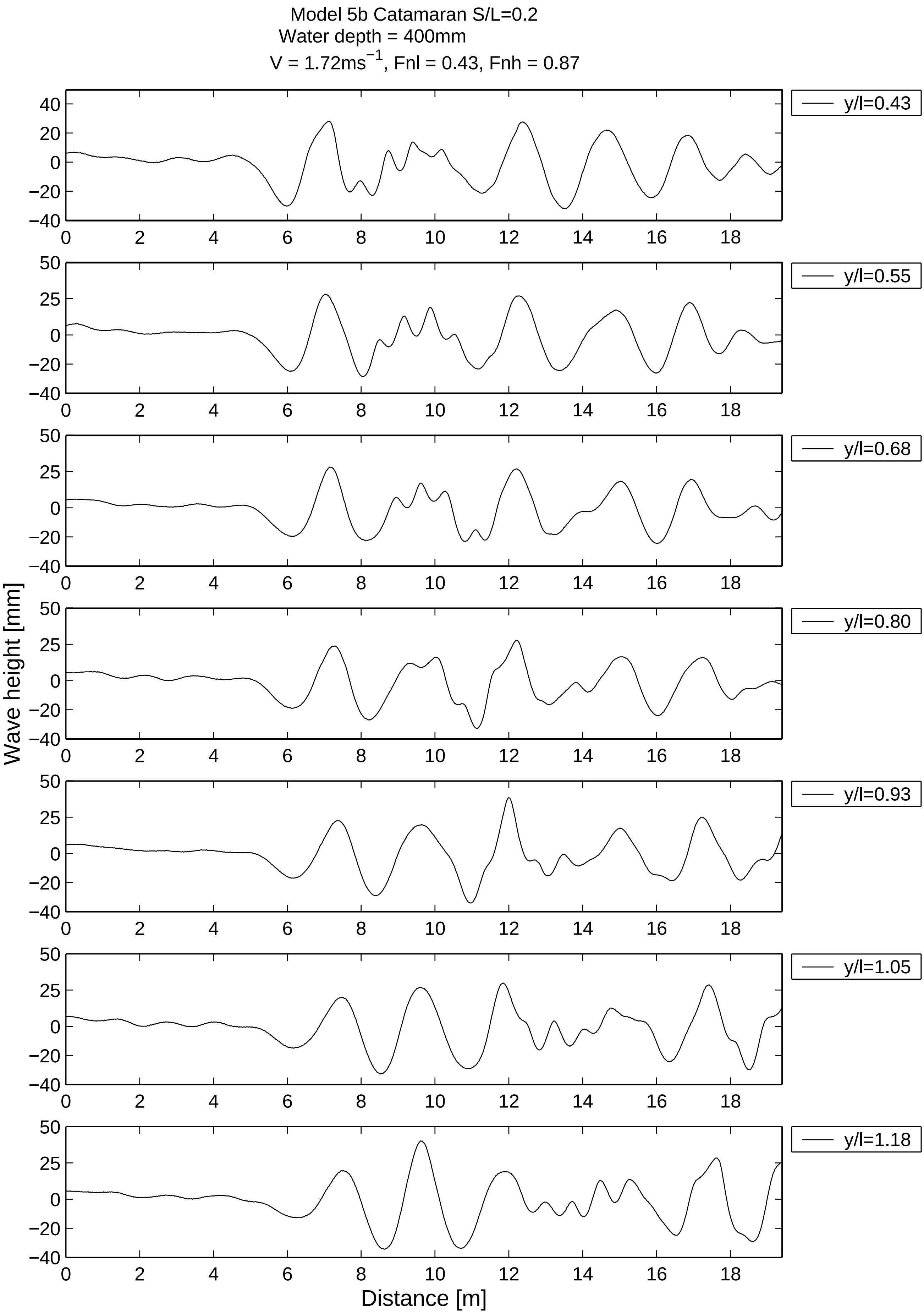

Model 4b Catamaran S/L=0.2
Water depth = 400mm
V = 4.06ms−1, Fnl = 1.02, Fnh = 2.05
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 35


Model 5b Catamaran S/L=0.2
Water depth = 400mm
V = 1.72ms−1, Fnl = 0.43, Fnh = 0.87
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
Figure 36

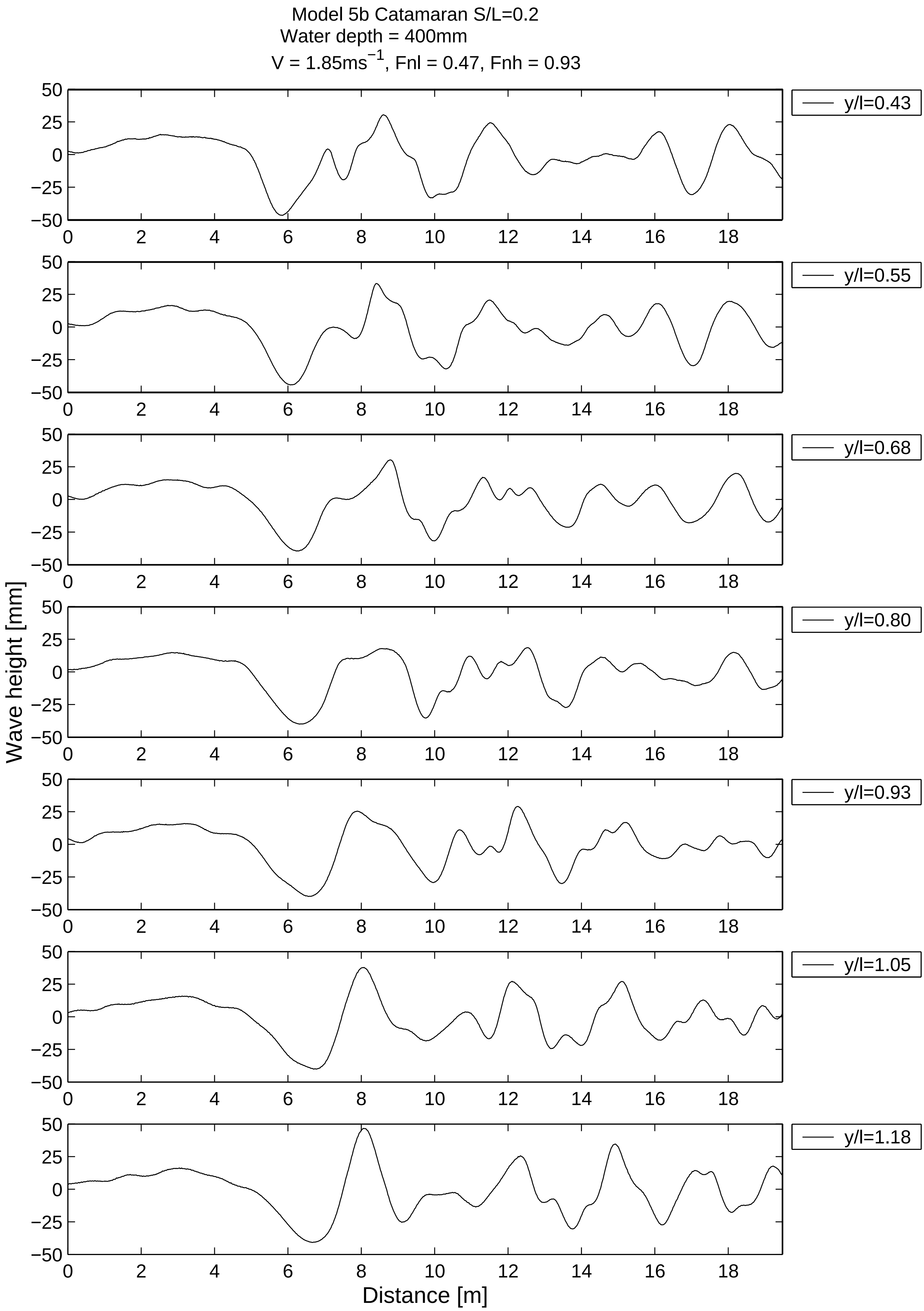

Model 5b Catamaran S/L=0.2
Water depth = 400mm
V = 1.85ms−1, Fnl = 0.47, Fnh = 0.93
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 37

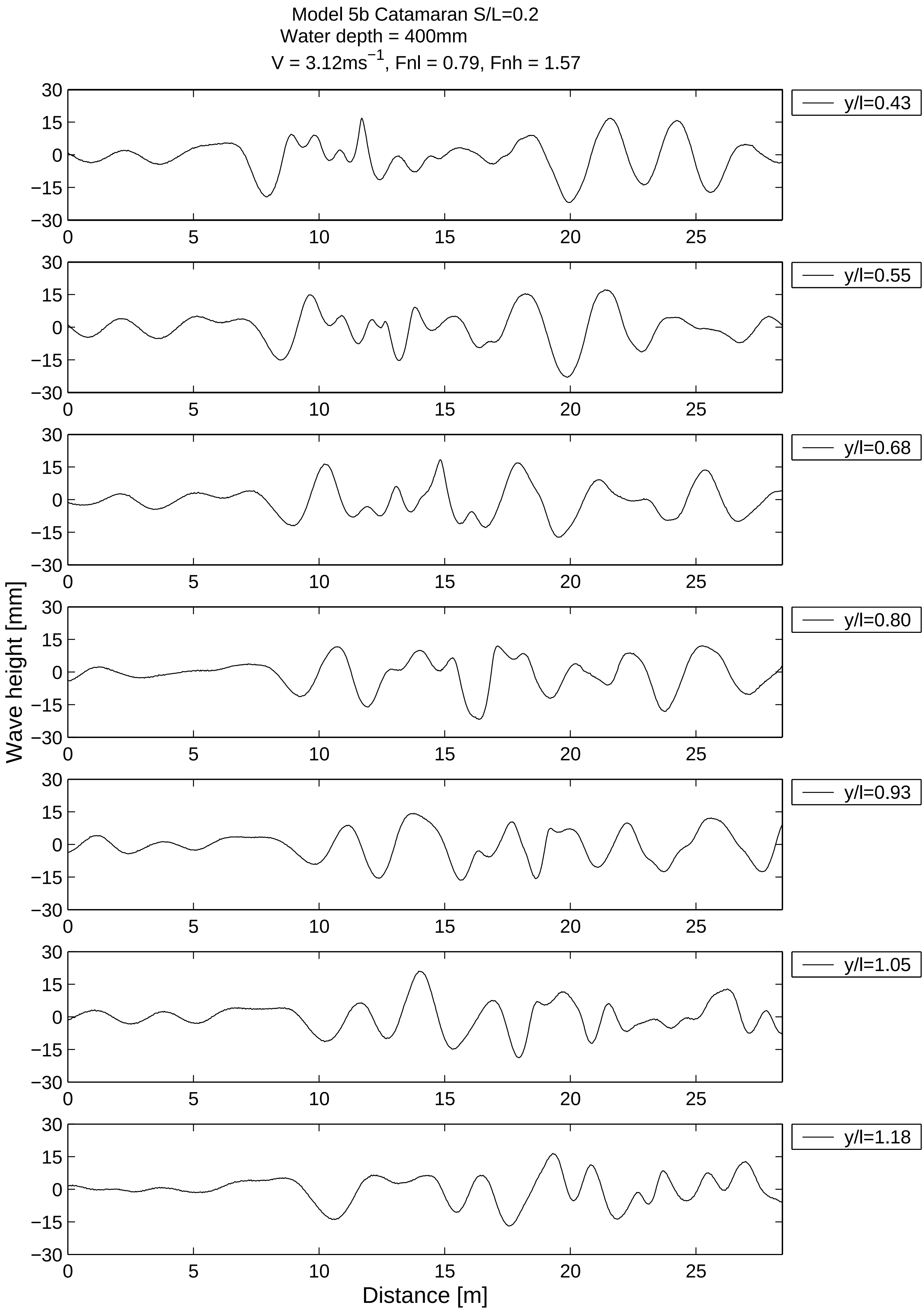
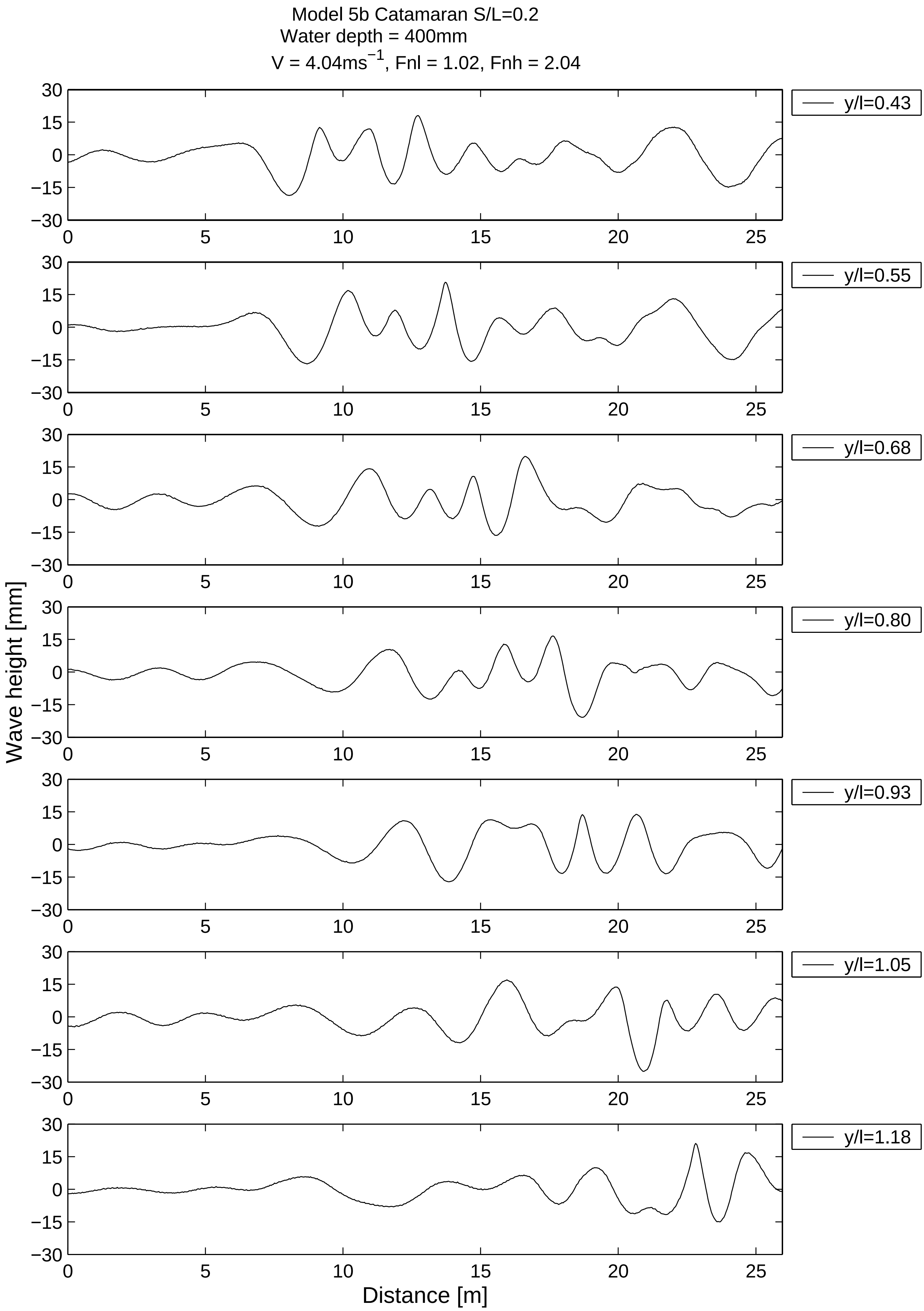

Model 5b Catamaran S/L=0.2
Water depth = 400mm
V = 3.12ms−1, Fnl = 0.79, Fnh = 1.57
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20
25

Figure 38



Model 5b Catamaran S/L=0.2
Water depth = 400mm
V = 4.04ms−1, Fnl = 1.02, Fnh = 2.04
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 39

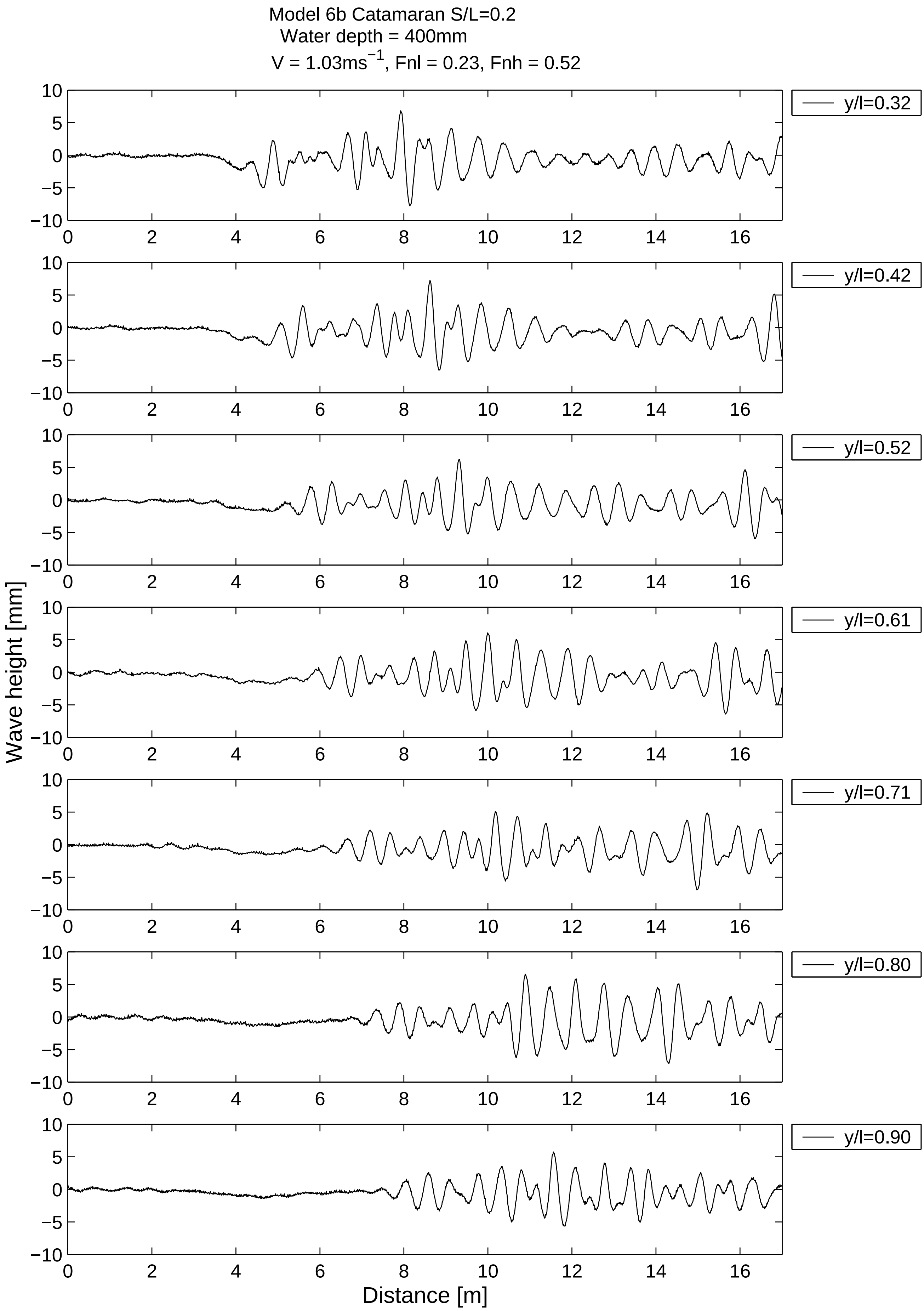

Model 6b Catamaran S/L=0.2
Water depth = 400mm
V = 1.03ms−1, Fnl = 0.23, Fnh = 0.52
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 40

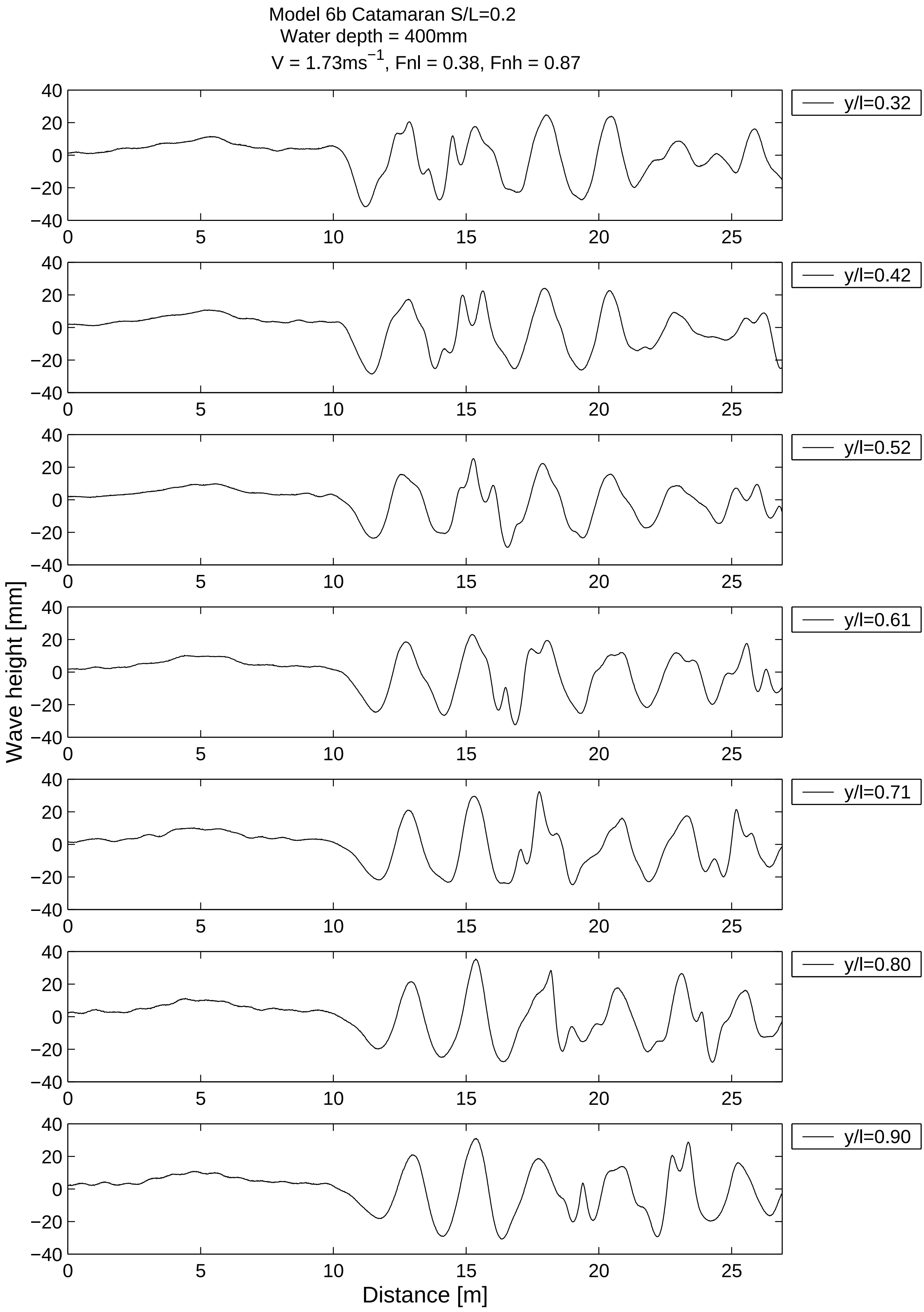
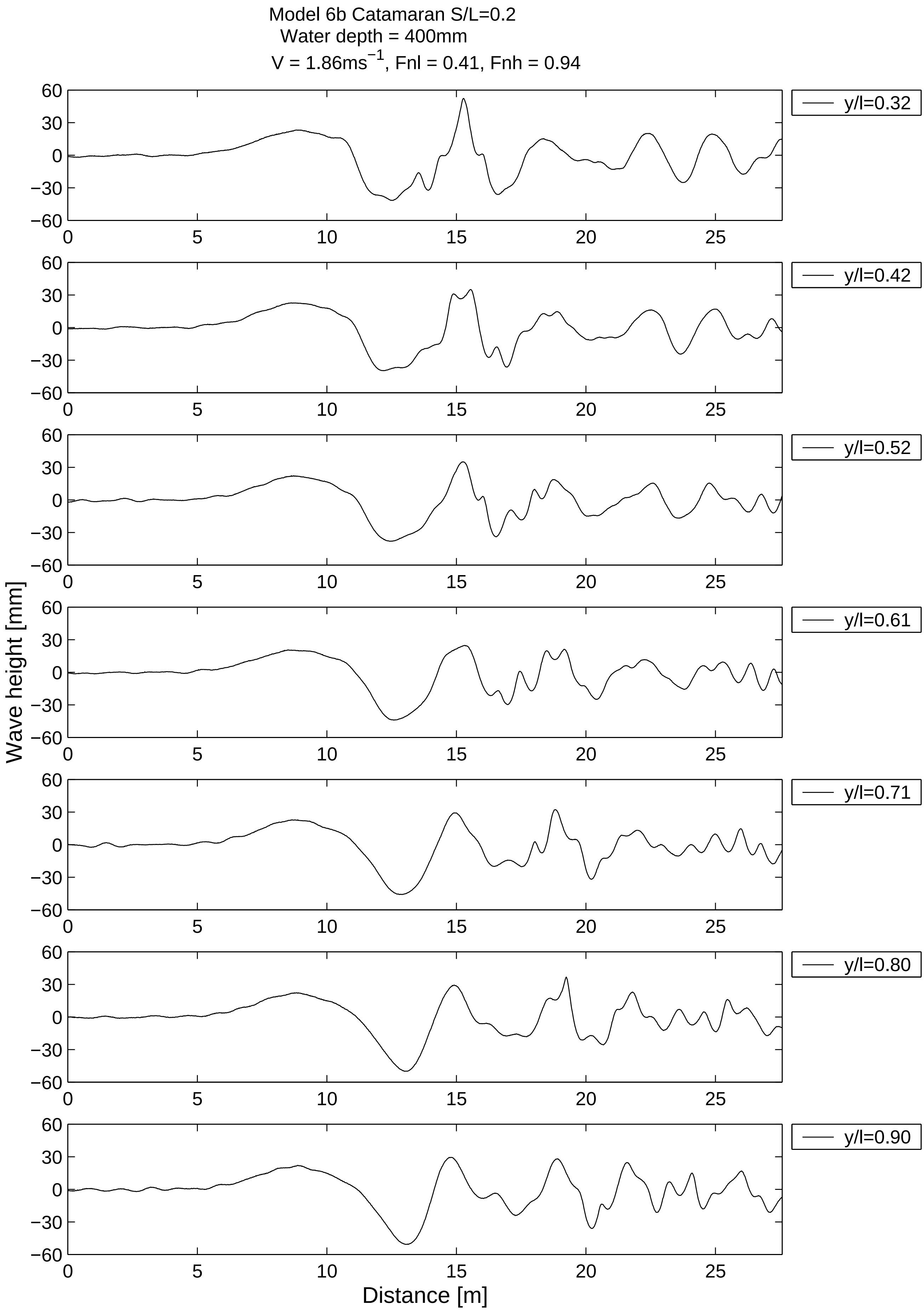
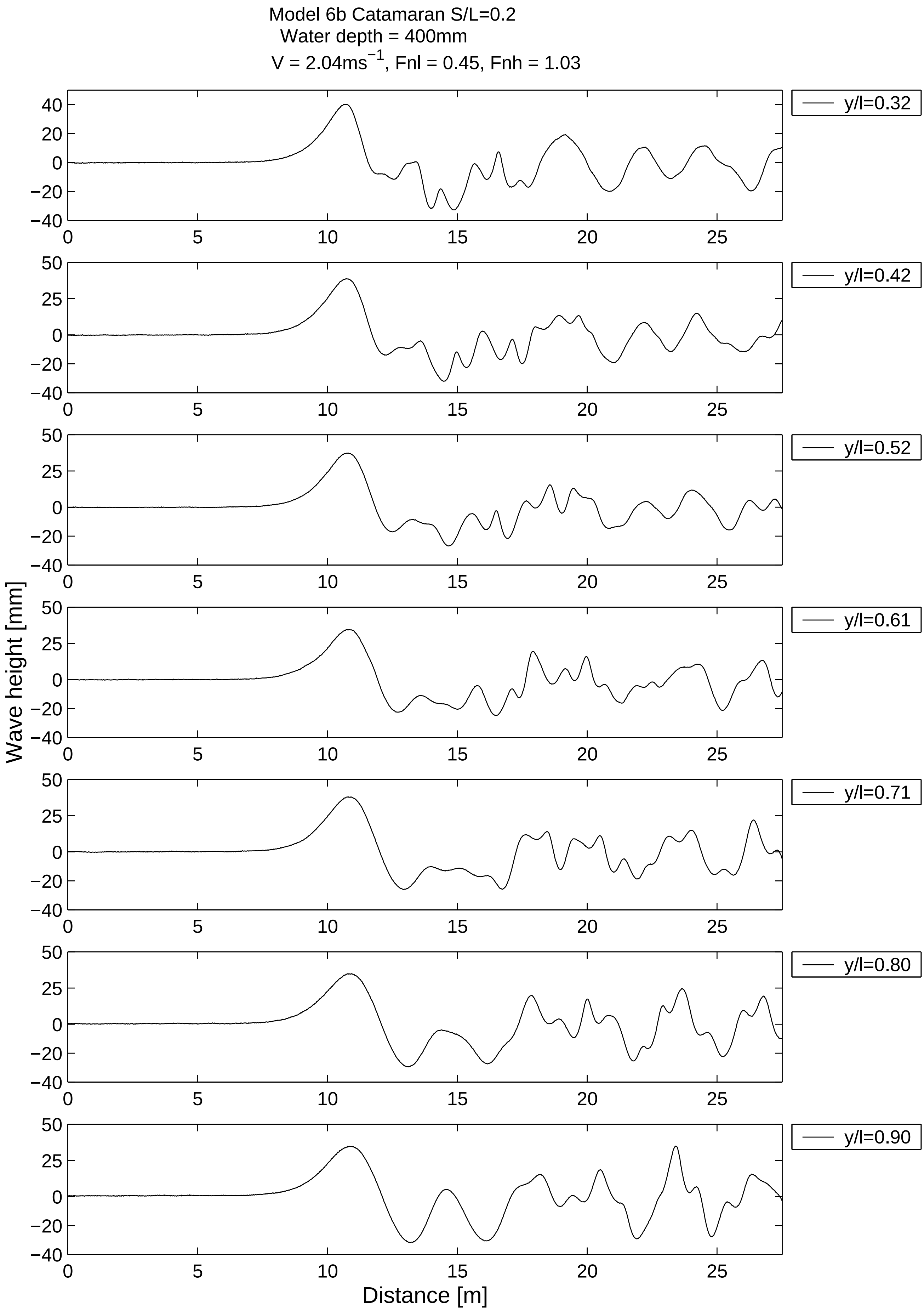

Model 6b Catamaran S/L=0.2
Water depth = 400mm
V = 1.73ms^{-1}, Fnl = 0.38, Fnh = 0.87
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

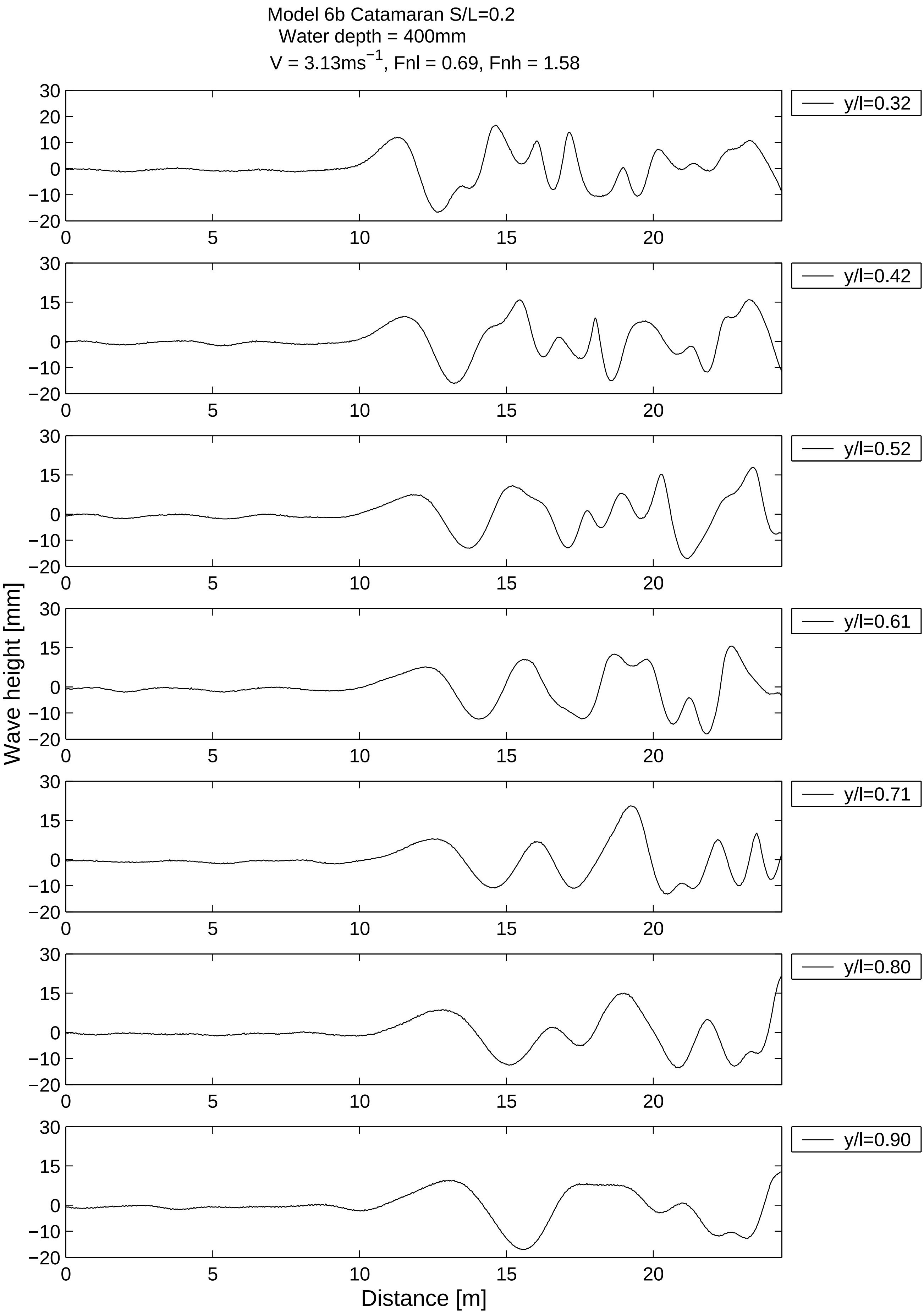
Figure 41


Model 6b Catamaran S/L=0.2
Water depth = 400mm
V = 1.86ms−1, Fnl = 0.41, Fnh = 0.94
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]
Figure 42



Model 6b Catamaran S/L=0.2
Water depth = 400mm
V = 2.04ms−1, Fnl = 0.45, Fnh = 1.03
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 43



Model 6b Catamaran S/L=0.2
Water depth = 400mm
V = 3.13ms^{-1}, Fnl = 0.69, Fnh = 1.58
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 44

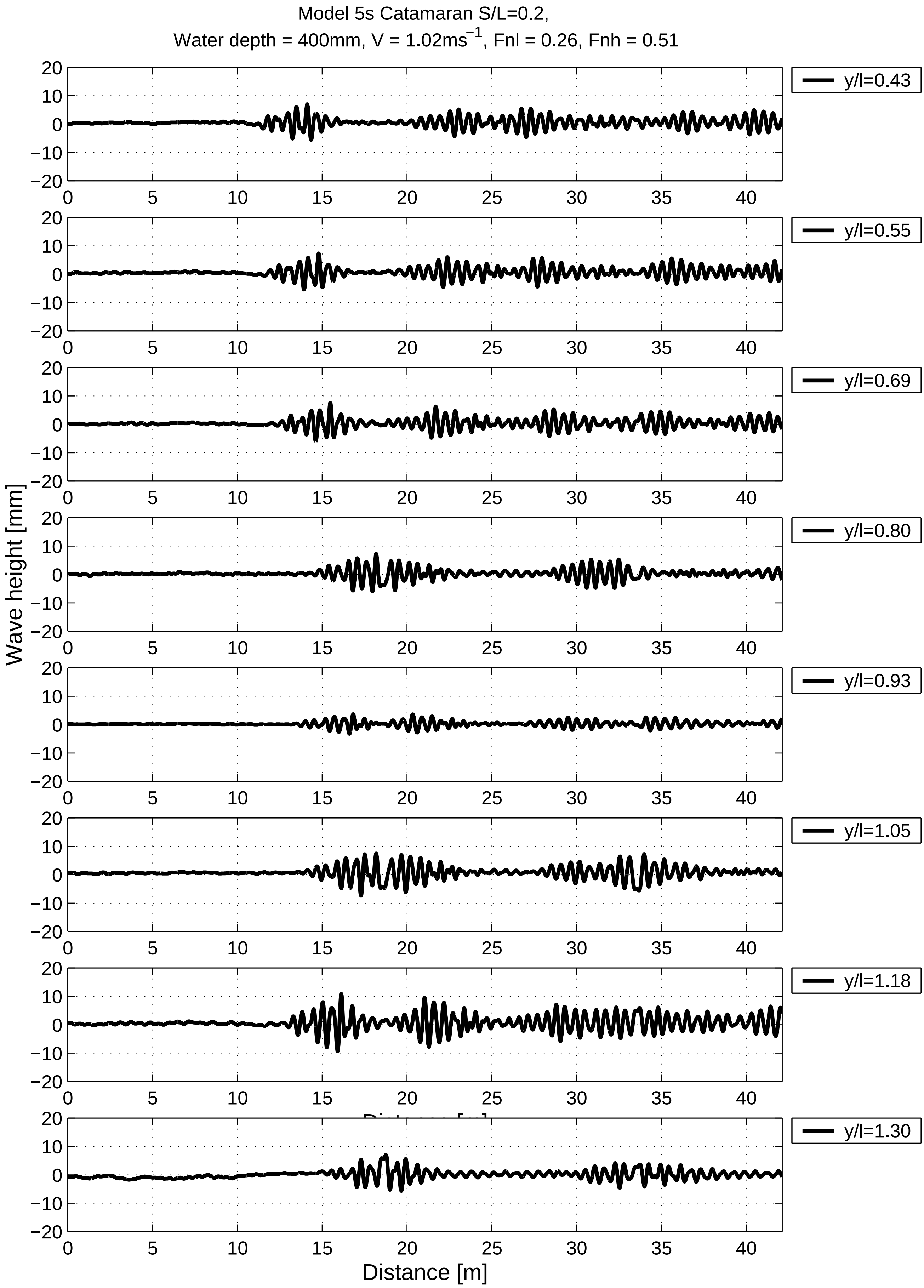

Model 5s Catamaran S/L=0.2,
Water depth = 400mm, V = 1.02ms−1, Fnl = 0.26, Fnh = 0.51
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 45

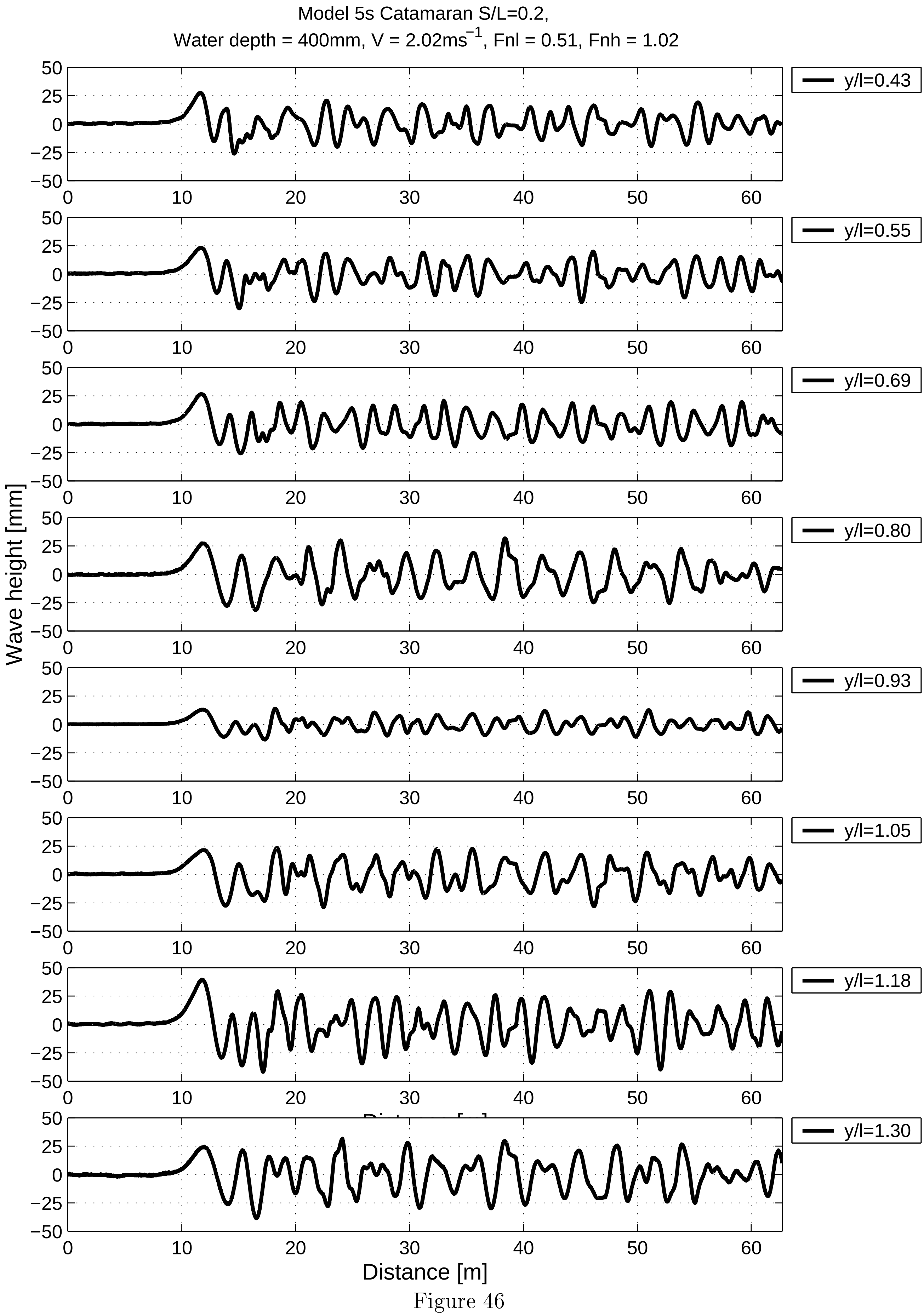
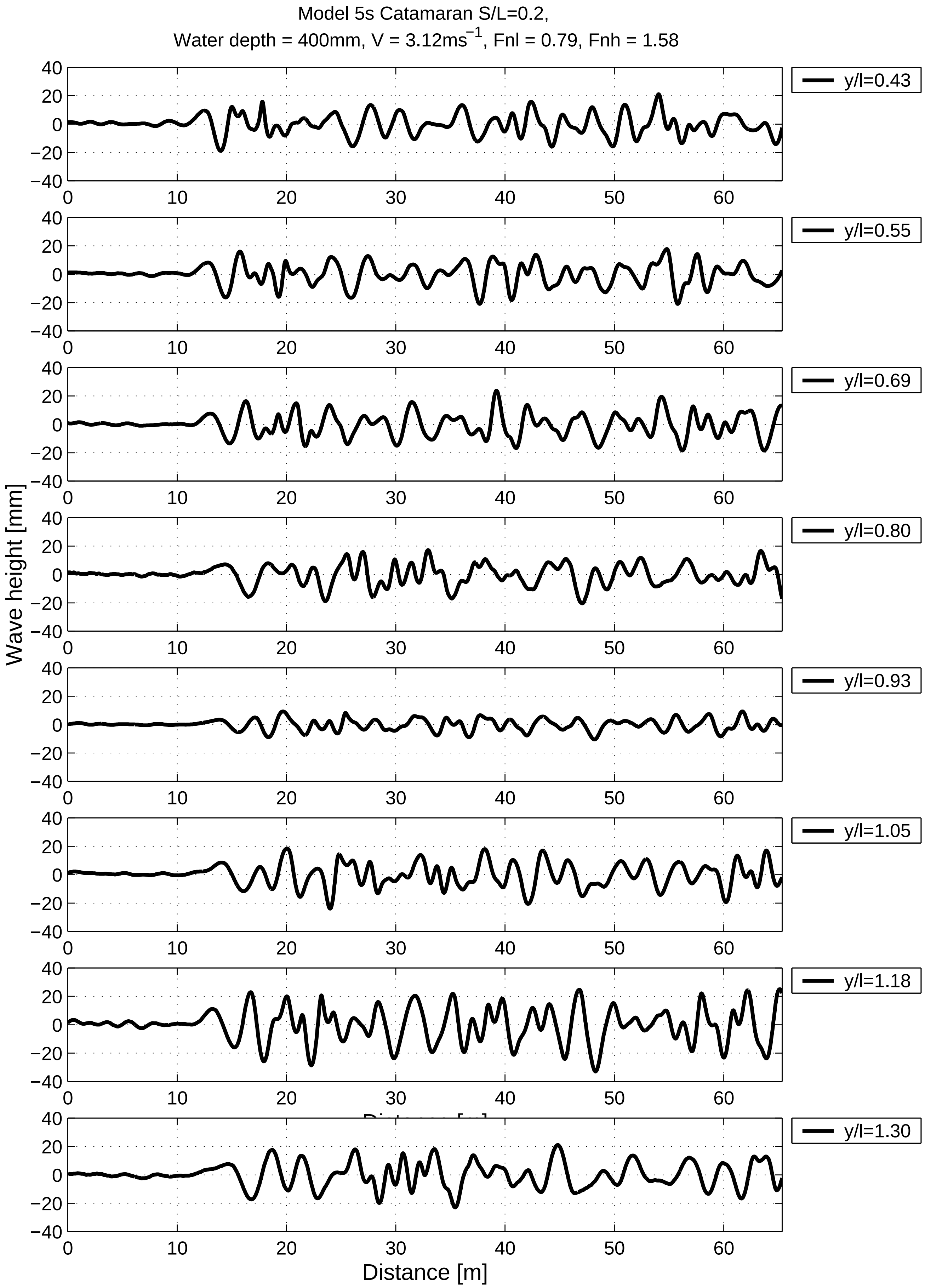
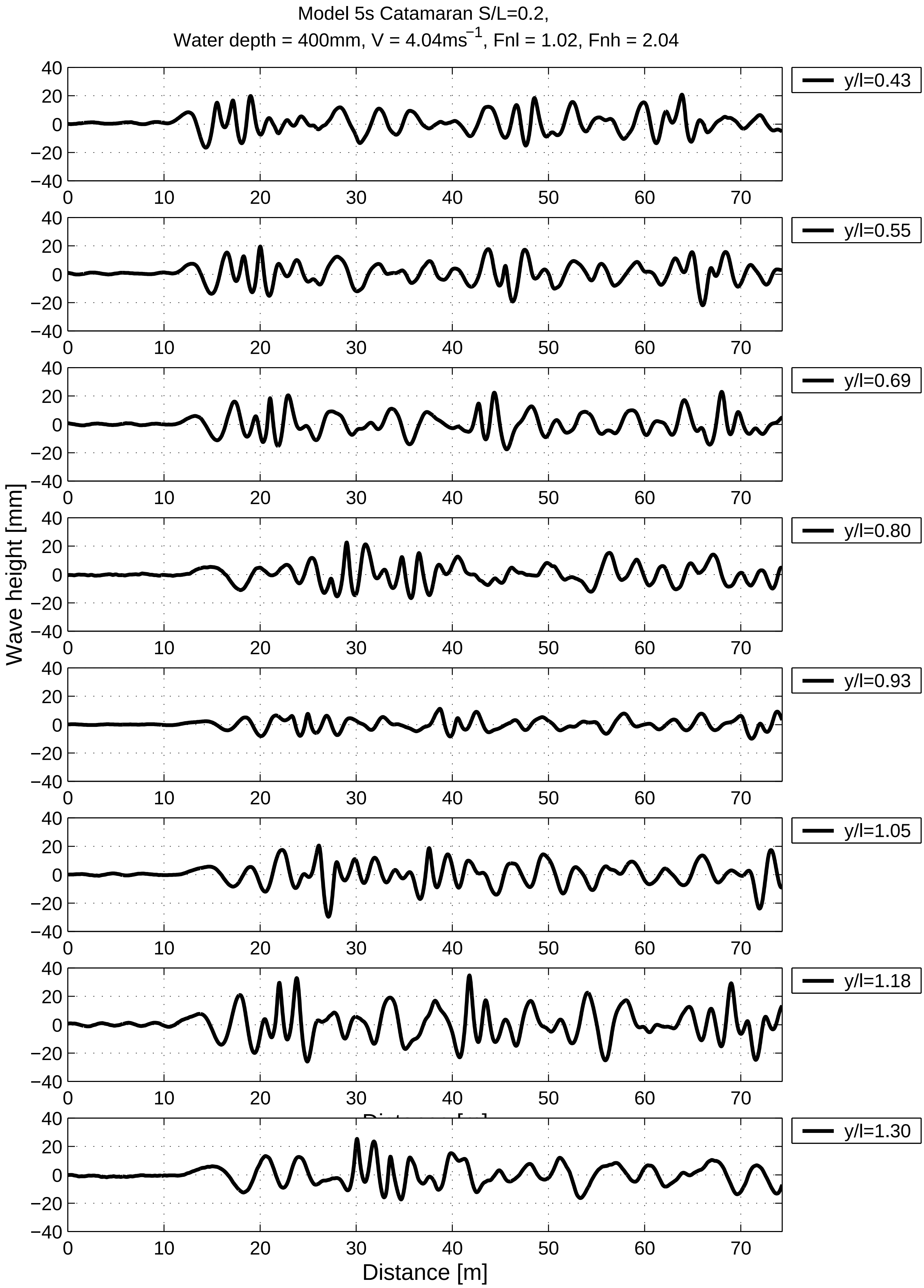

Model 5s Catamaran S/L=0.2,
Water depth = 400mm, V = 2.02ms^{-1}, Fnl = 0.51, Fnh = 1.02
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30
Wave height [mm]
Distance [m]

Figure 46



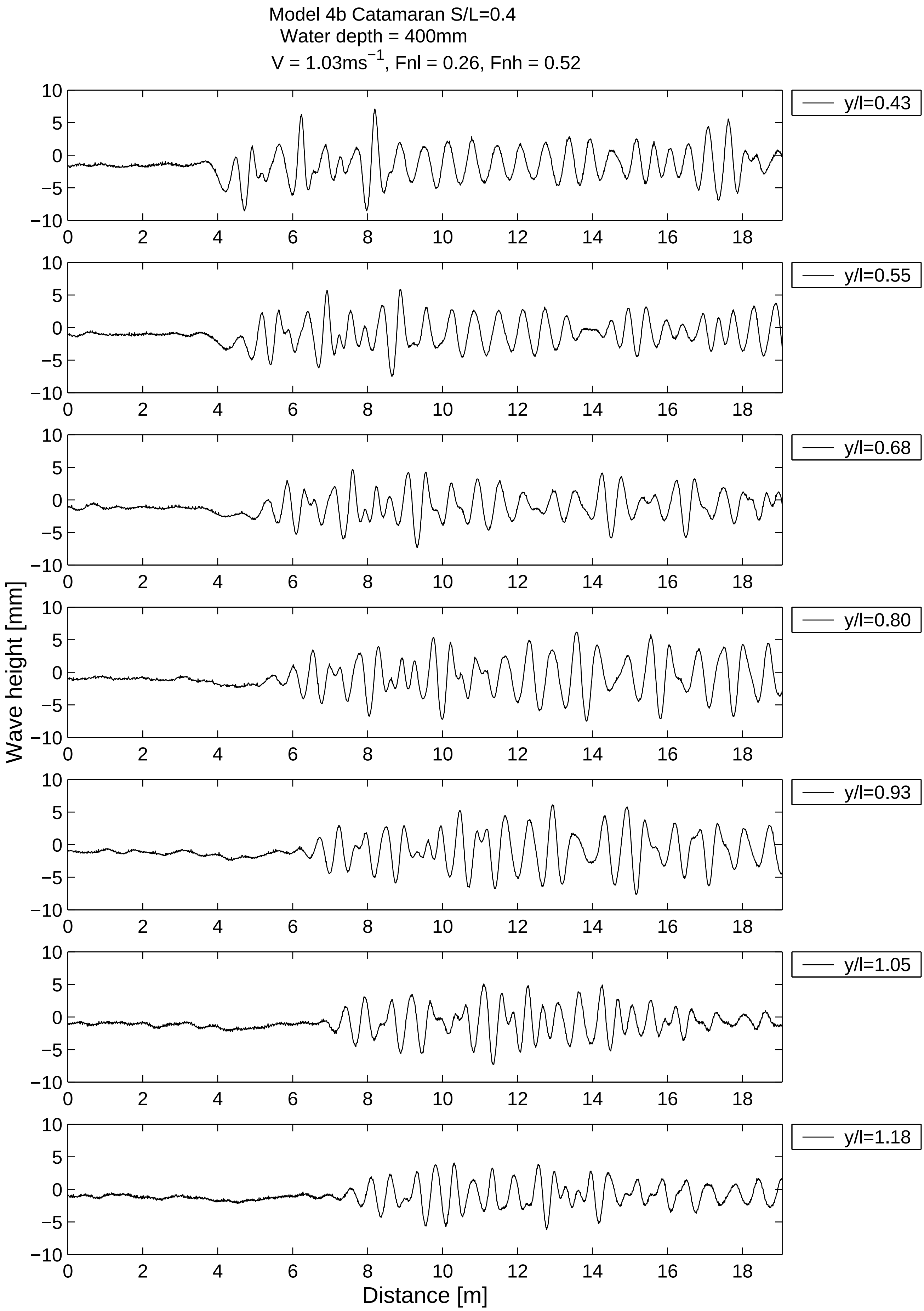
Model 5s Catamaran S/L=0.2,
Water depth = 400mm, V = 3.12ms^{-1}, Fnl = 0.79, Fnh = 1.58
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 47



Model 5s Catamaran S/L=0.2,
Water depth = 400mm, V = 4.04ms^{-1}, Fnl = 1.02, Fnh = 2.04
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30
Wave height [mm]
Distance [m]

Figure 48



Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 1.03ms^{-1}, Fnl = 0.26, Fnh = 0.52
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 49

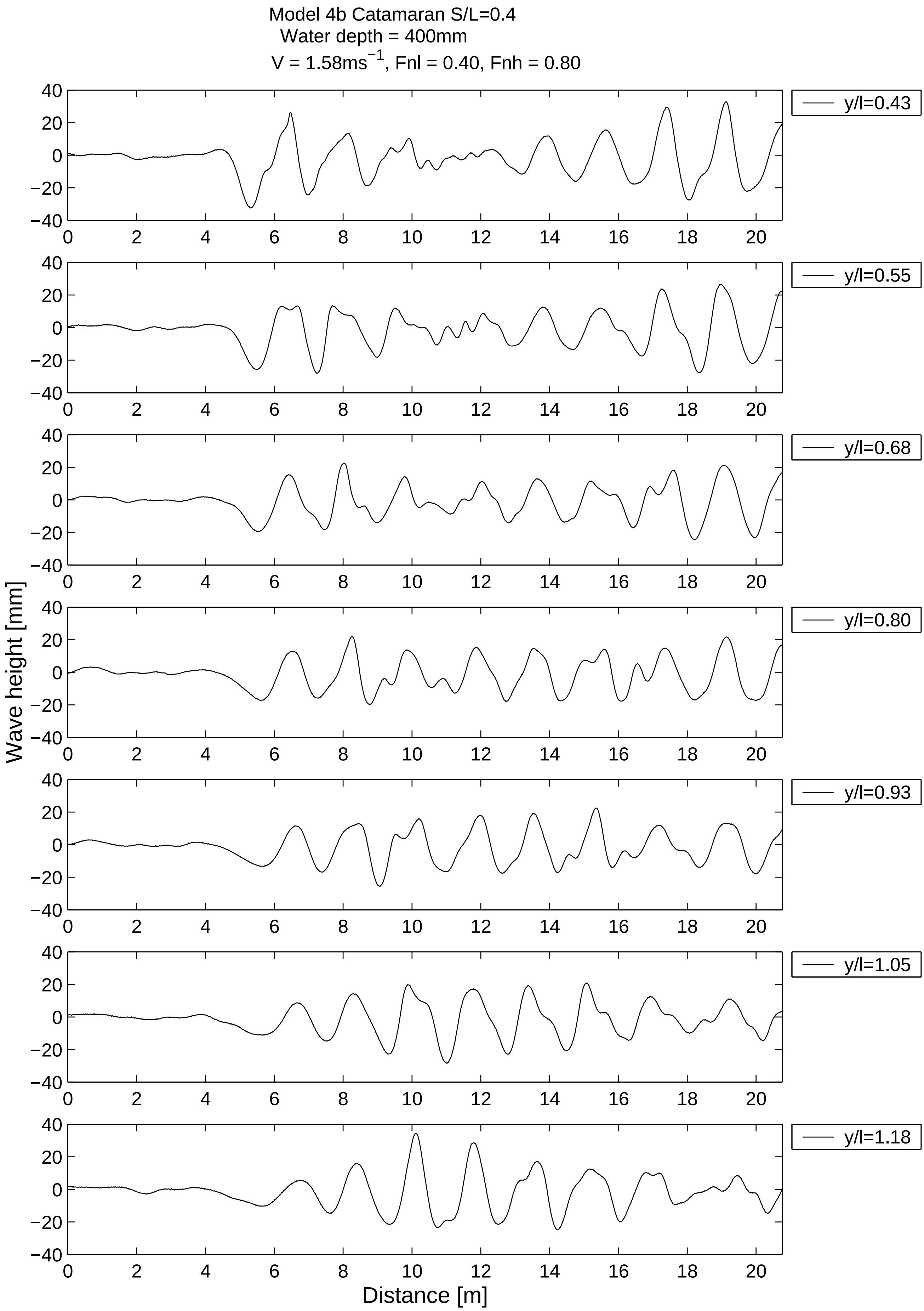
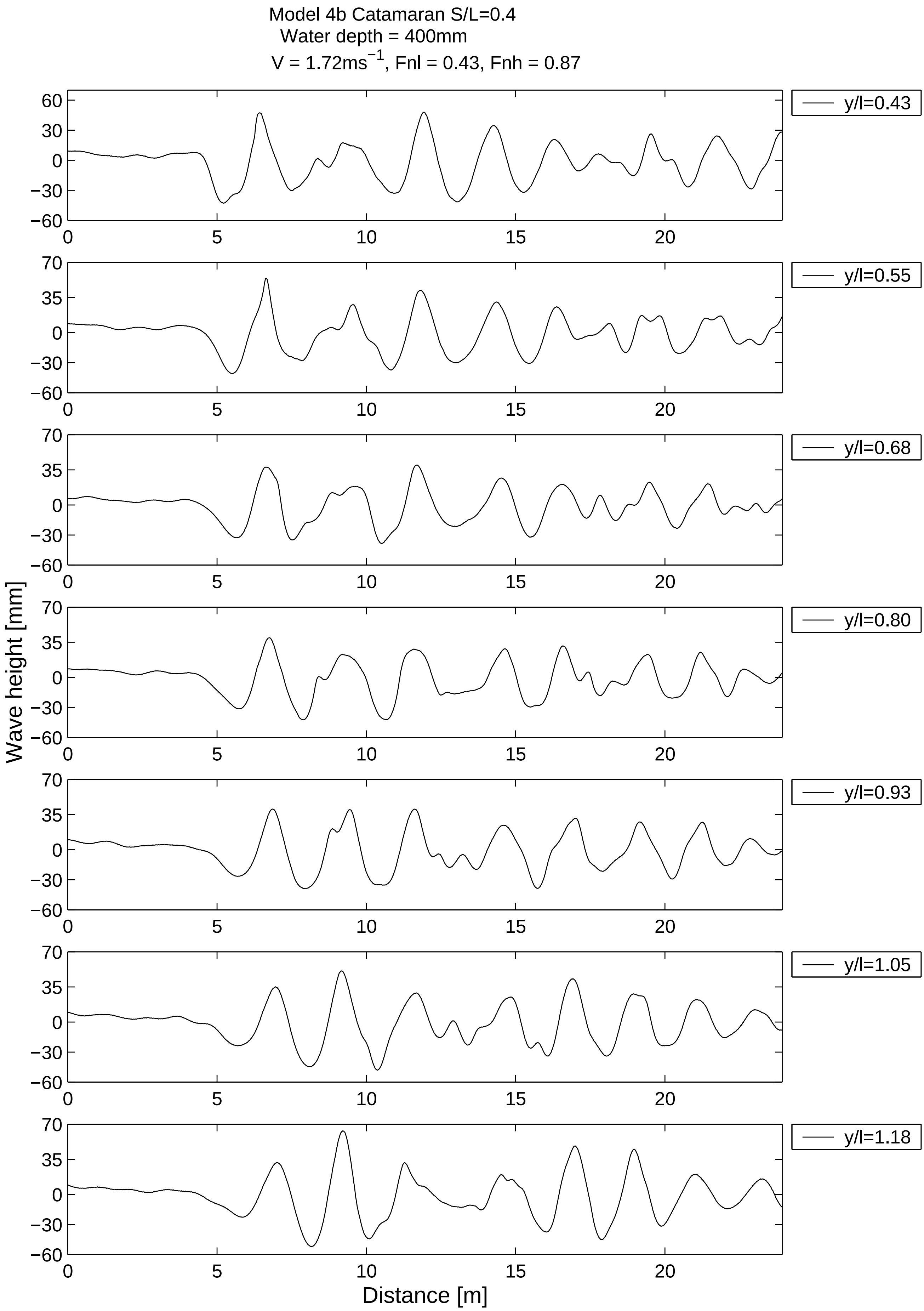
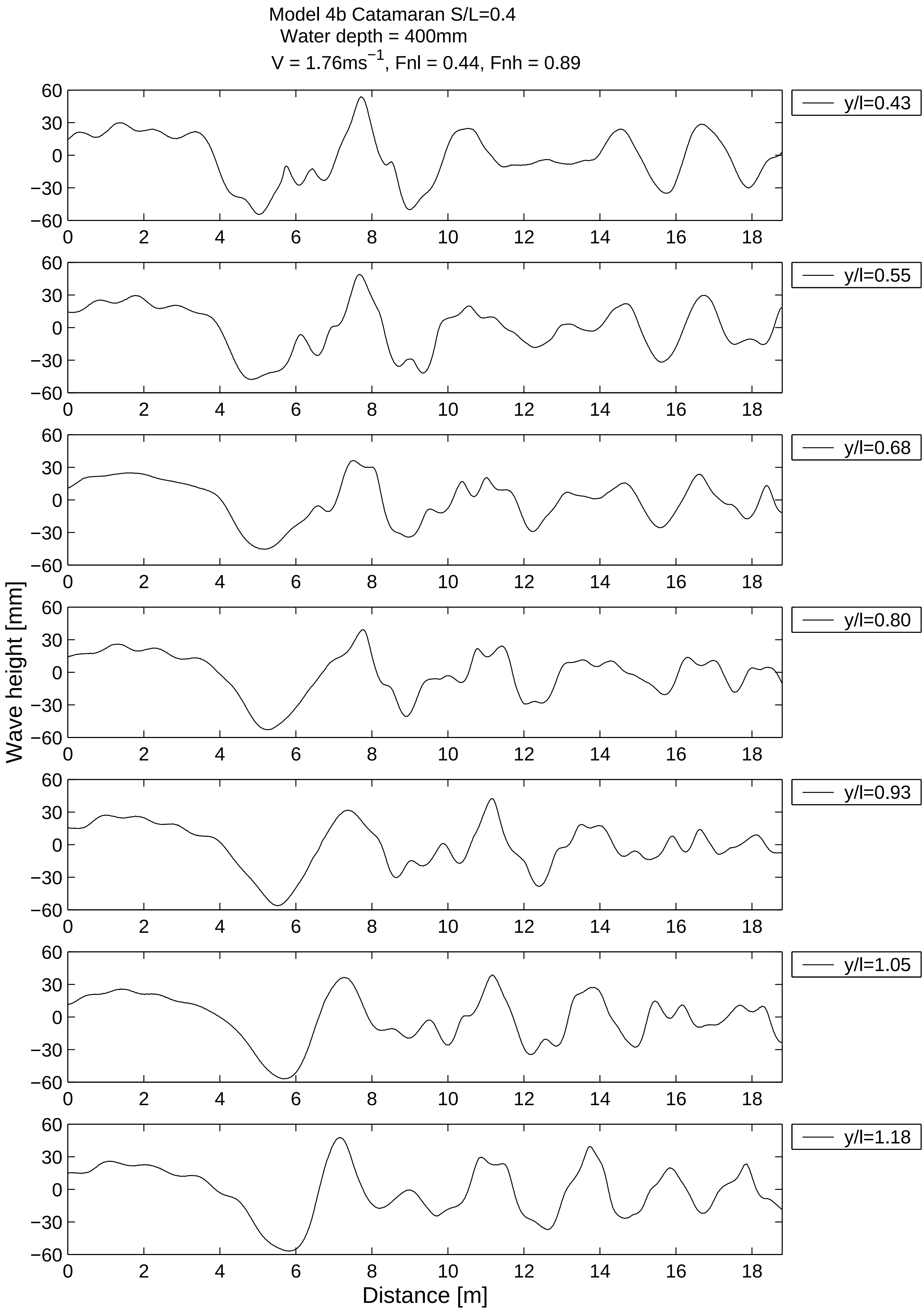

Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 1.58ms−1, Fnl = 0.40, Fnh = 0.80
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 50



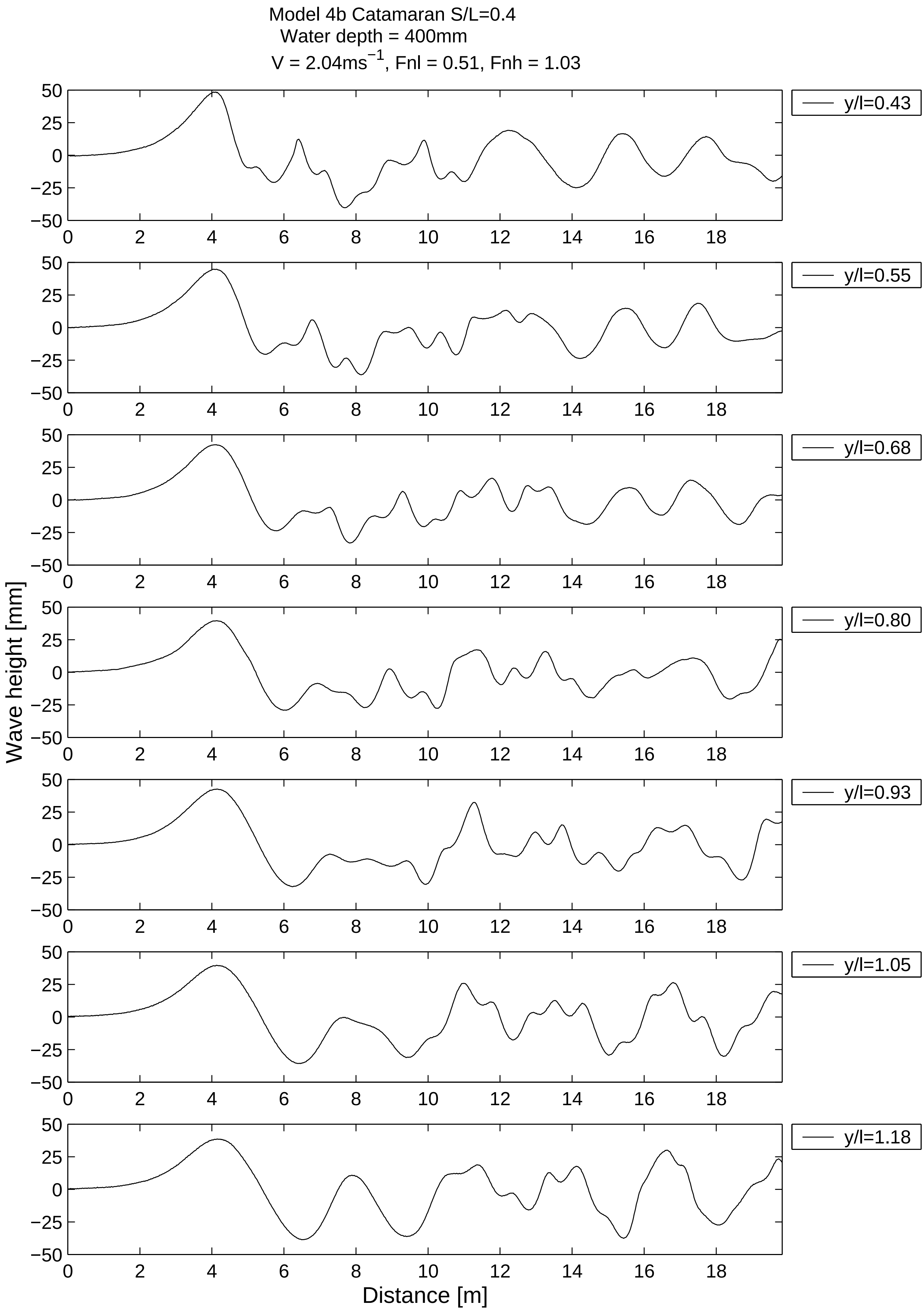
Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 1.72ms⁻¹, Fnl = 0.43, Fnh = 0.87
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 51



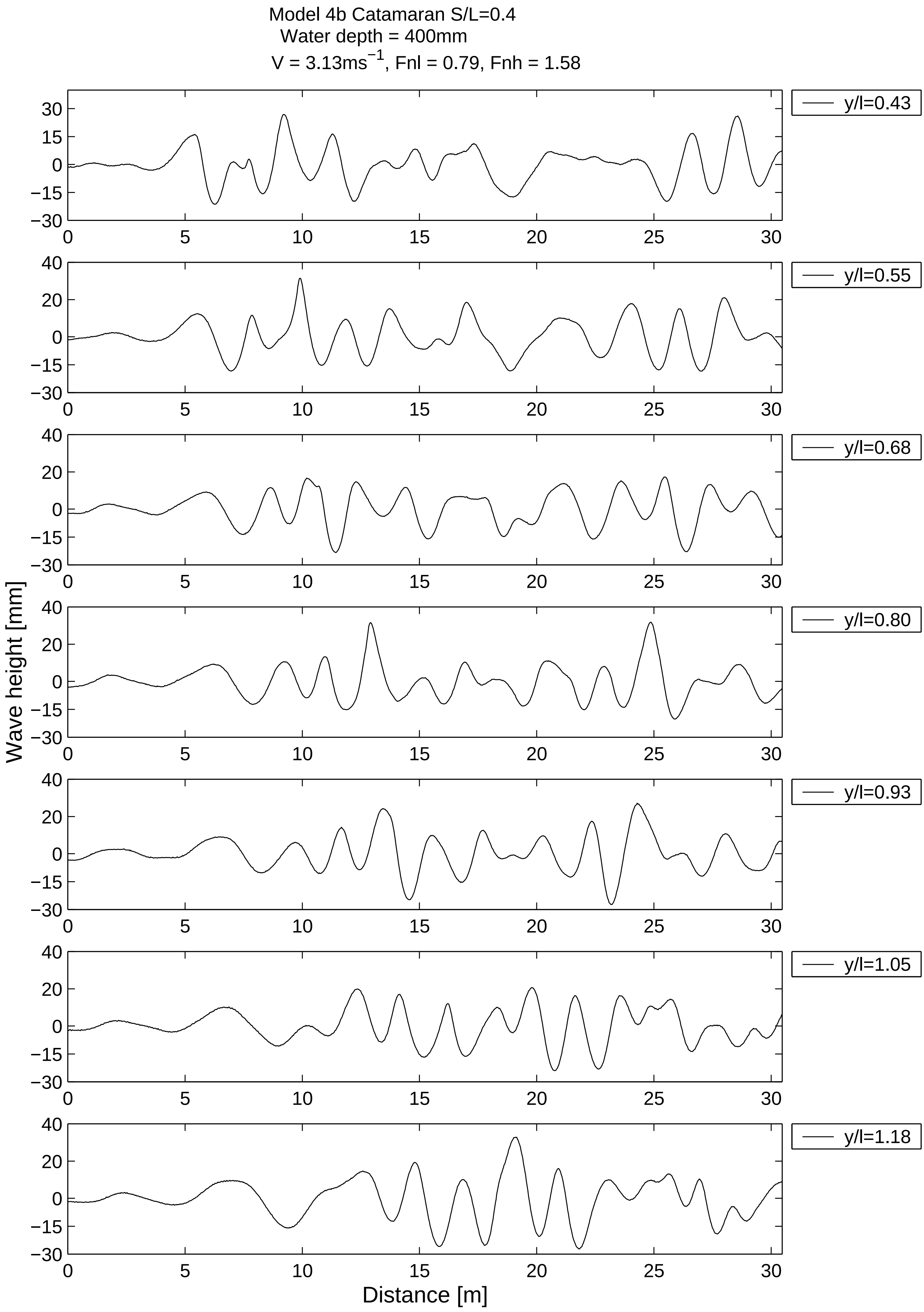
Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 1.76ms^{-1}, Fnl = 0.44, Fnh = 0.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 52



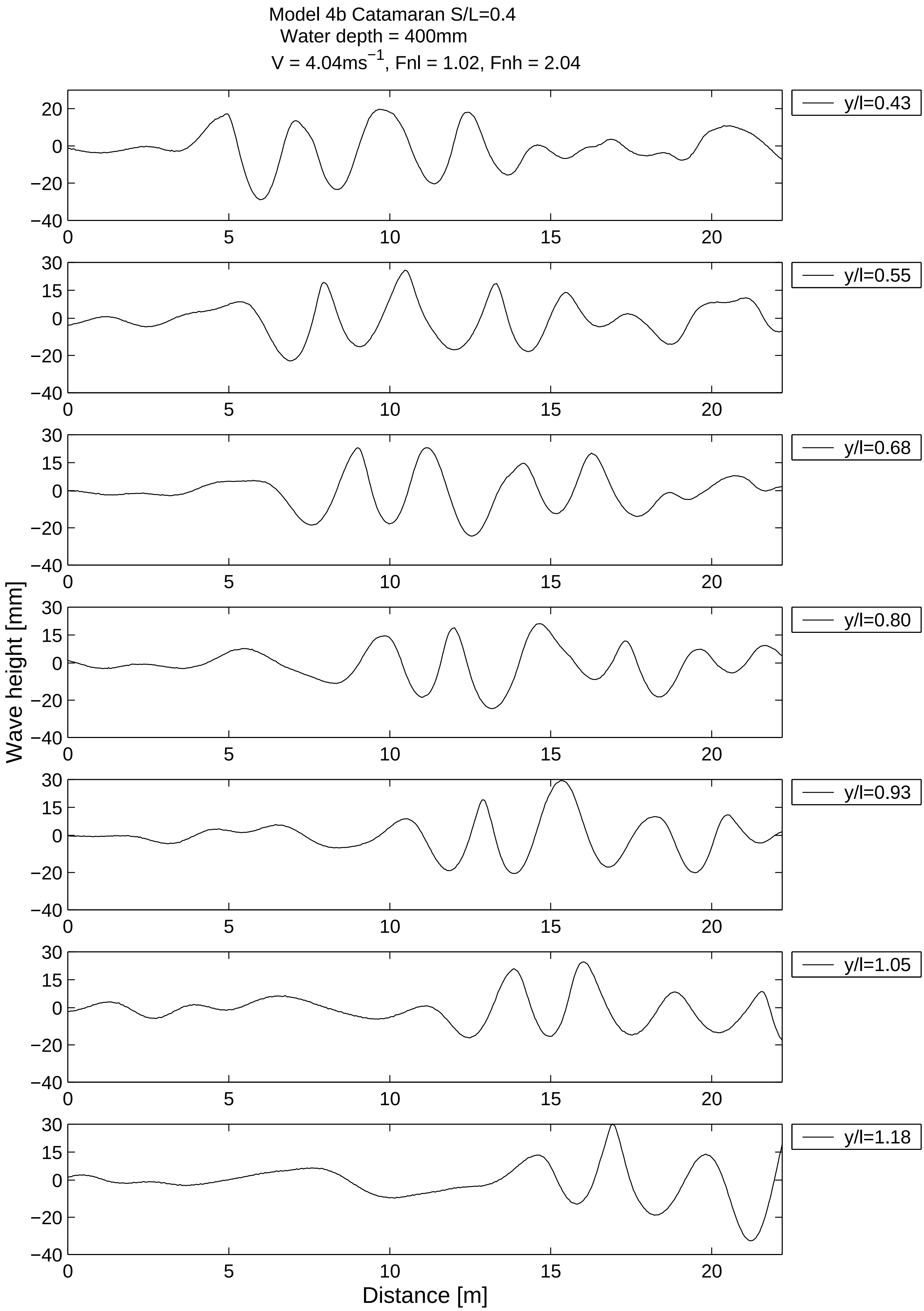
Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 2.04ms^{-1}, Fnl = 0.51, Fnh = 1.03
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

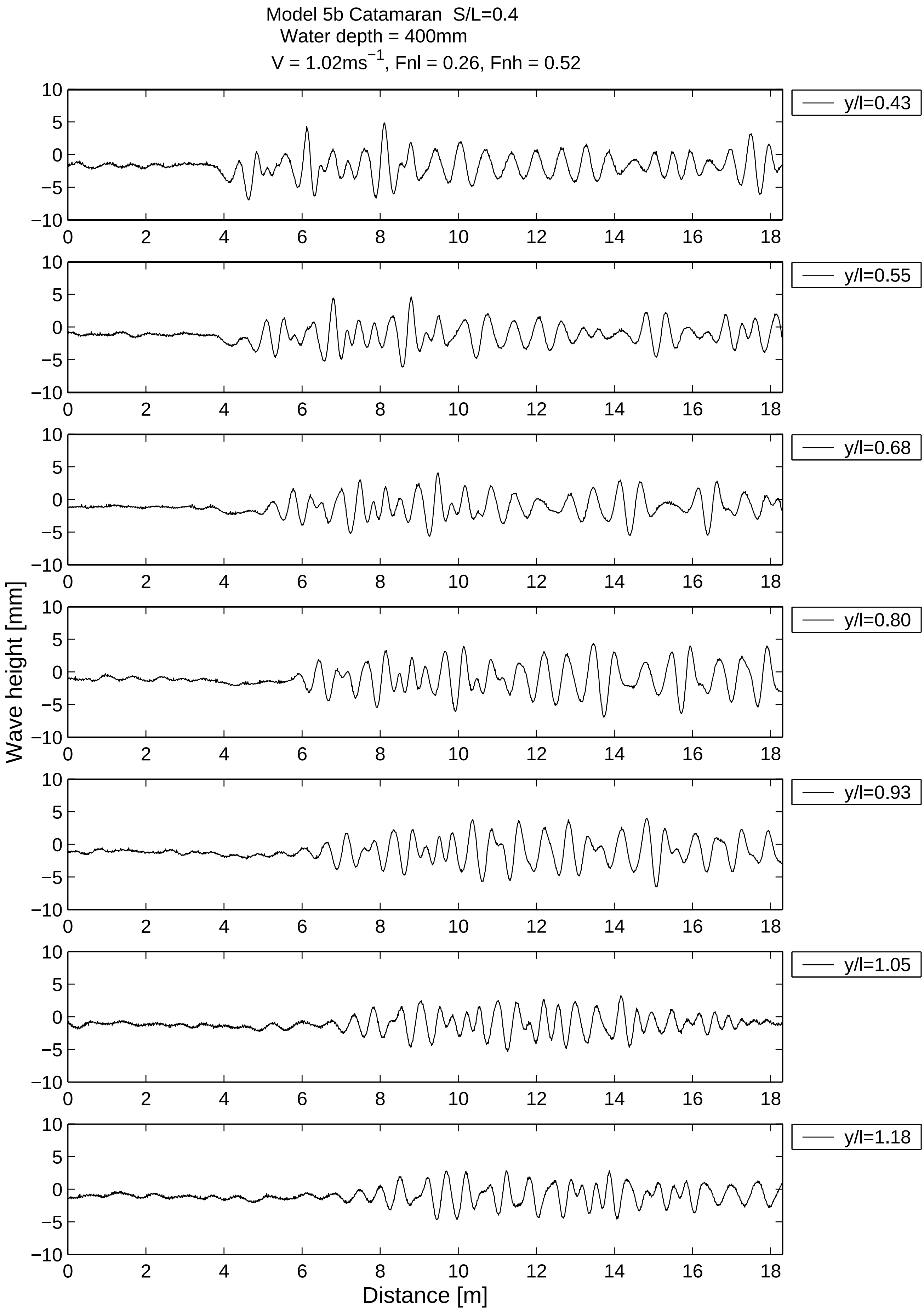
Figure 53



Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 1.58
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

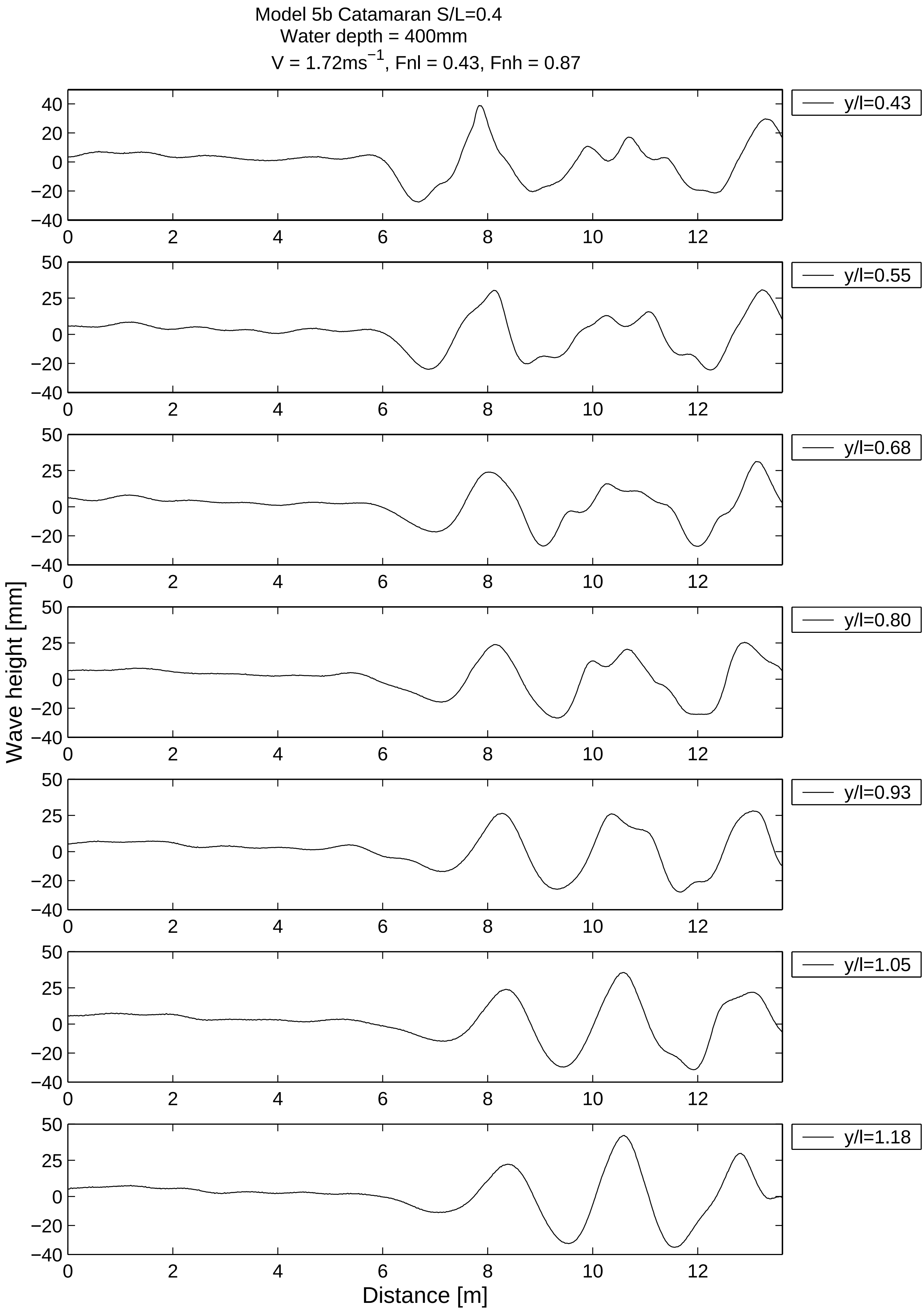
Figure 54


Model 4b Catamaran S/L=0.4
Water depth = 400mm
V = 4.04ms^{-1}, Fnl = 1.02, Fnh = 2.04
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
Figure 55



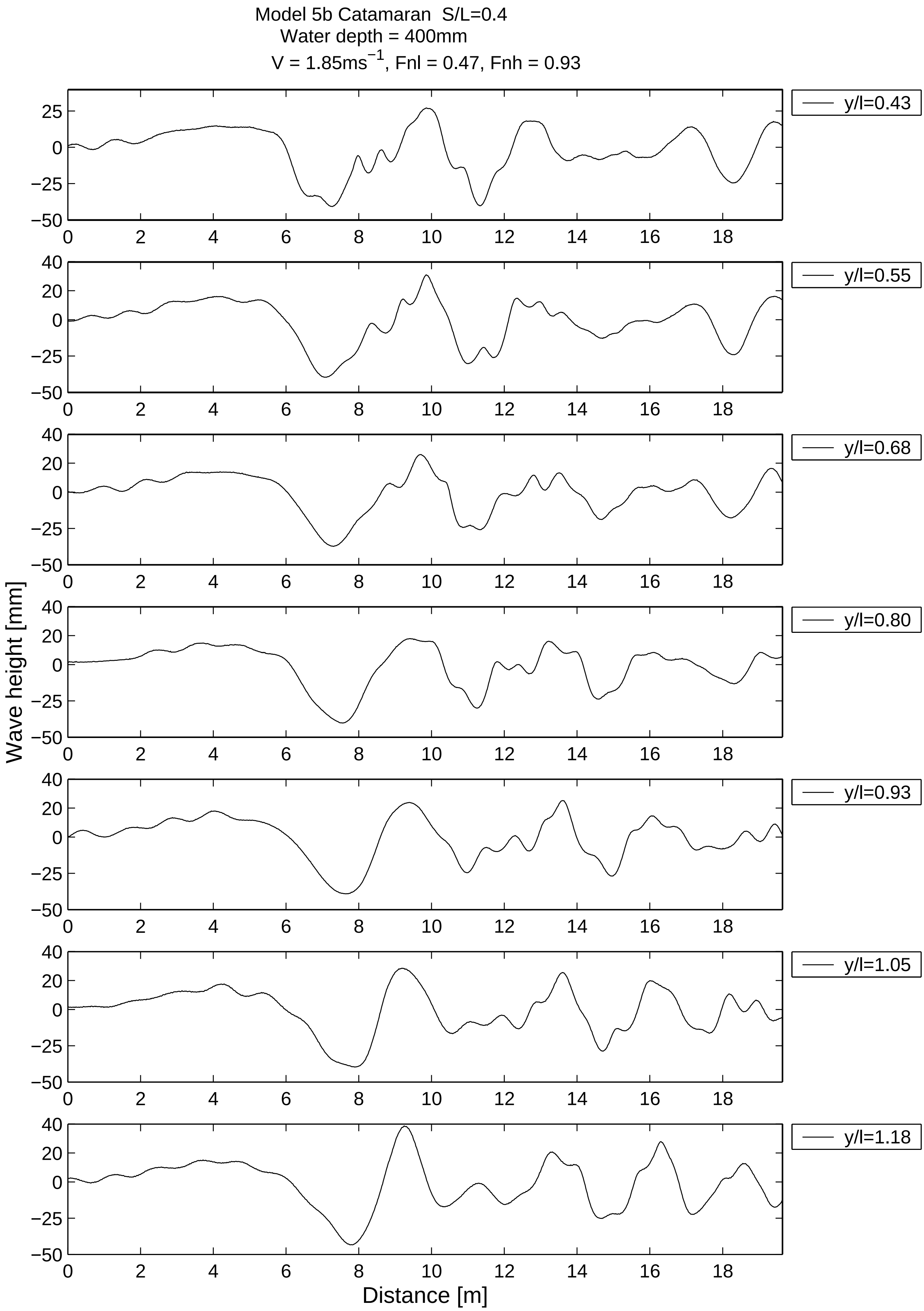
Model 5b Catamaran S/L=0.4
Water depth = 400mm
V = 1.02ms−1, Fnl = 0.26, Fnh = 0.52
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 56



Model 5b Catamaran S/L=0.4
Water depth = 400mm
V = 1.72ms−1, Fnl = 0.43, Fnh = 0.87
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 57



Model 5b Catamaran S/L=0.4
Water depth = 400mm
V = 1.85ms−1, Fnl = 0.47, Fnh = 0.93
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 58

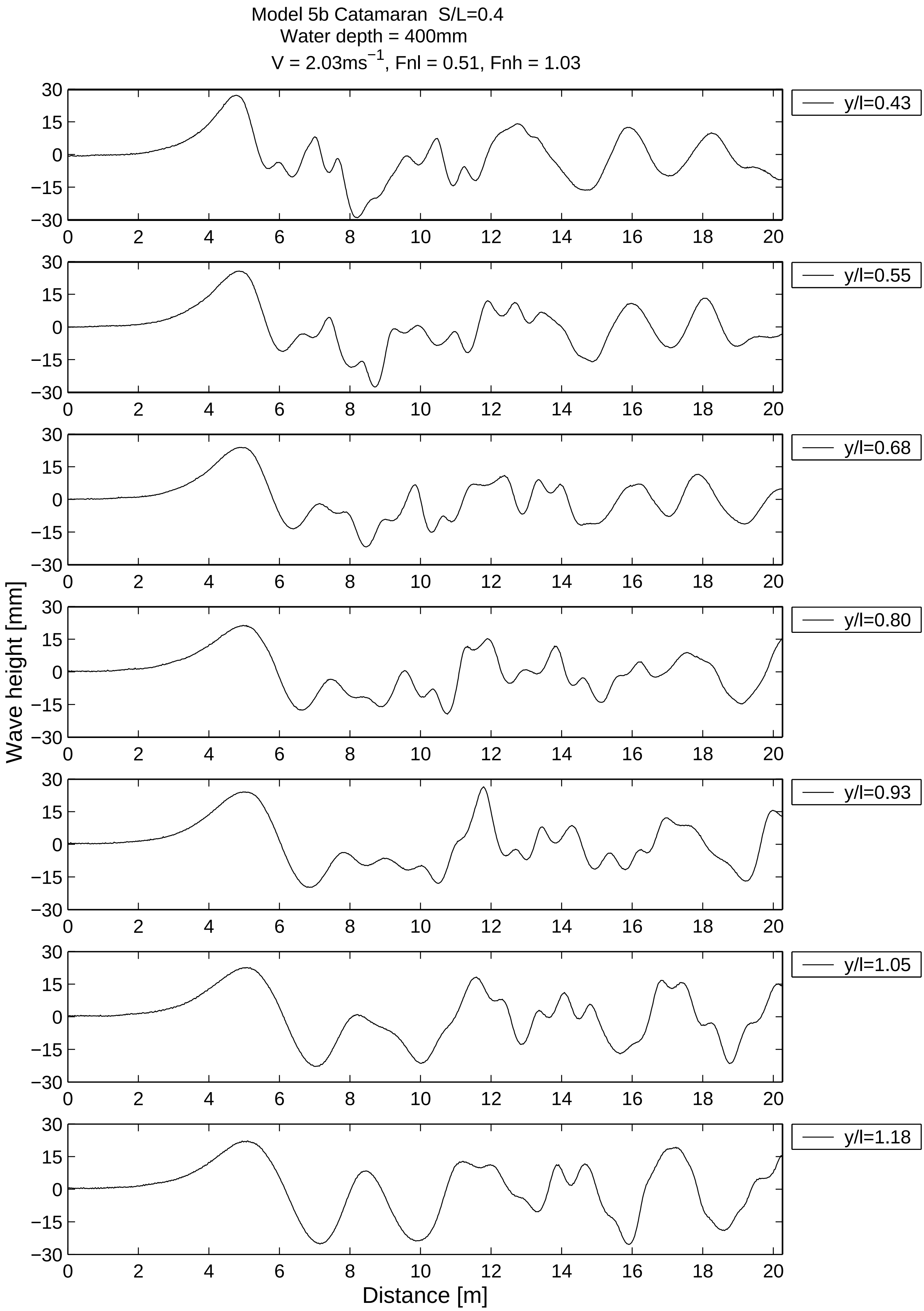
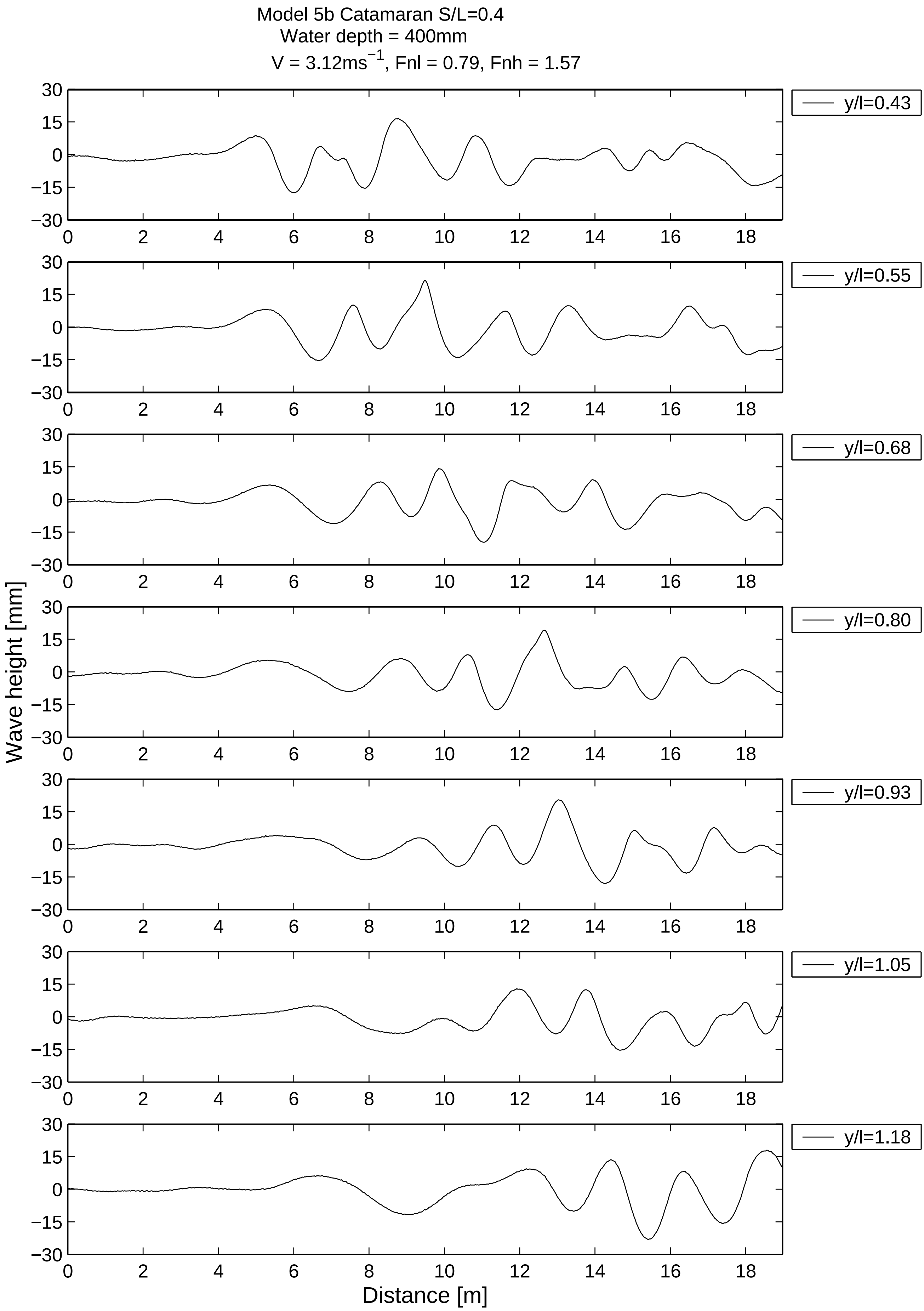

Model 5b Catamaran S/L=0.4
Water depth = 400mm
V = 2.03ms−1, Fnl = 0.51, Fnh = 1.03
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 59



Model 5b Catamaran S/L=0.4
Water depth = 400mm
V = 3.12ms^{-1}, Fnl = 0.79, Fnh = 1.57
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
2
4
6
8
10
12
14
16
18

Figure 60

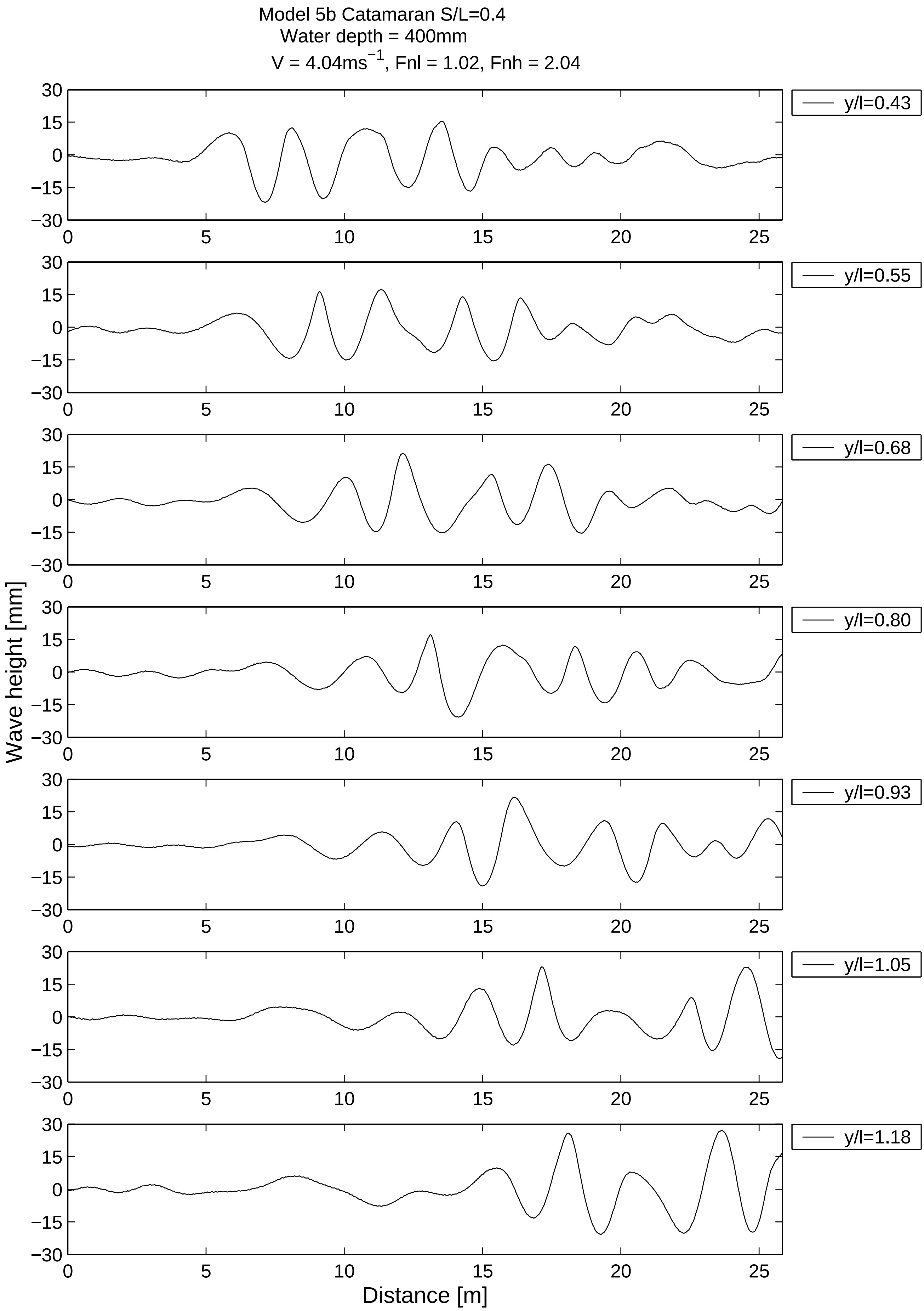
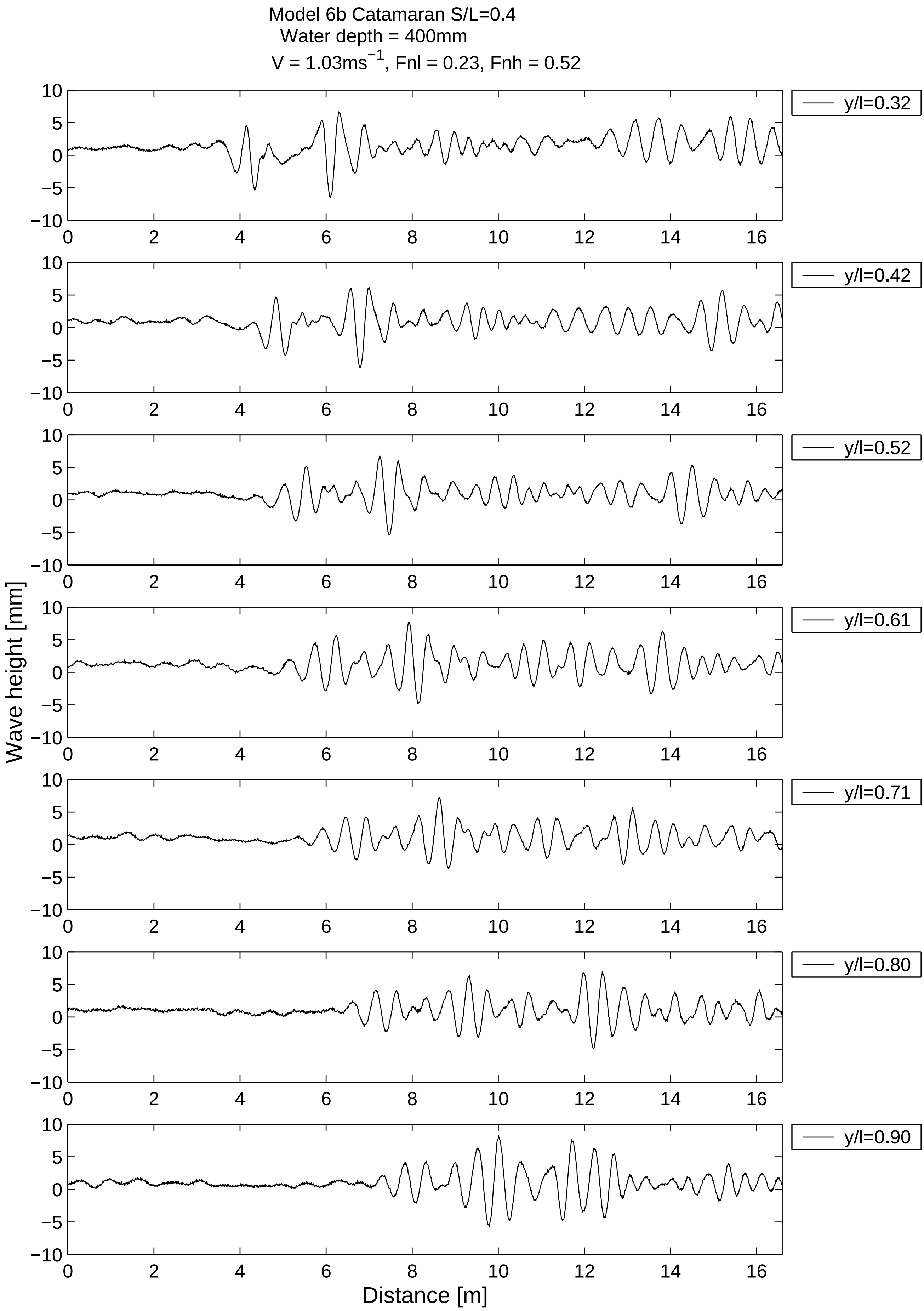
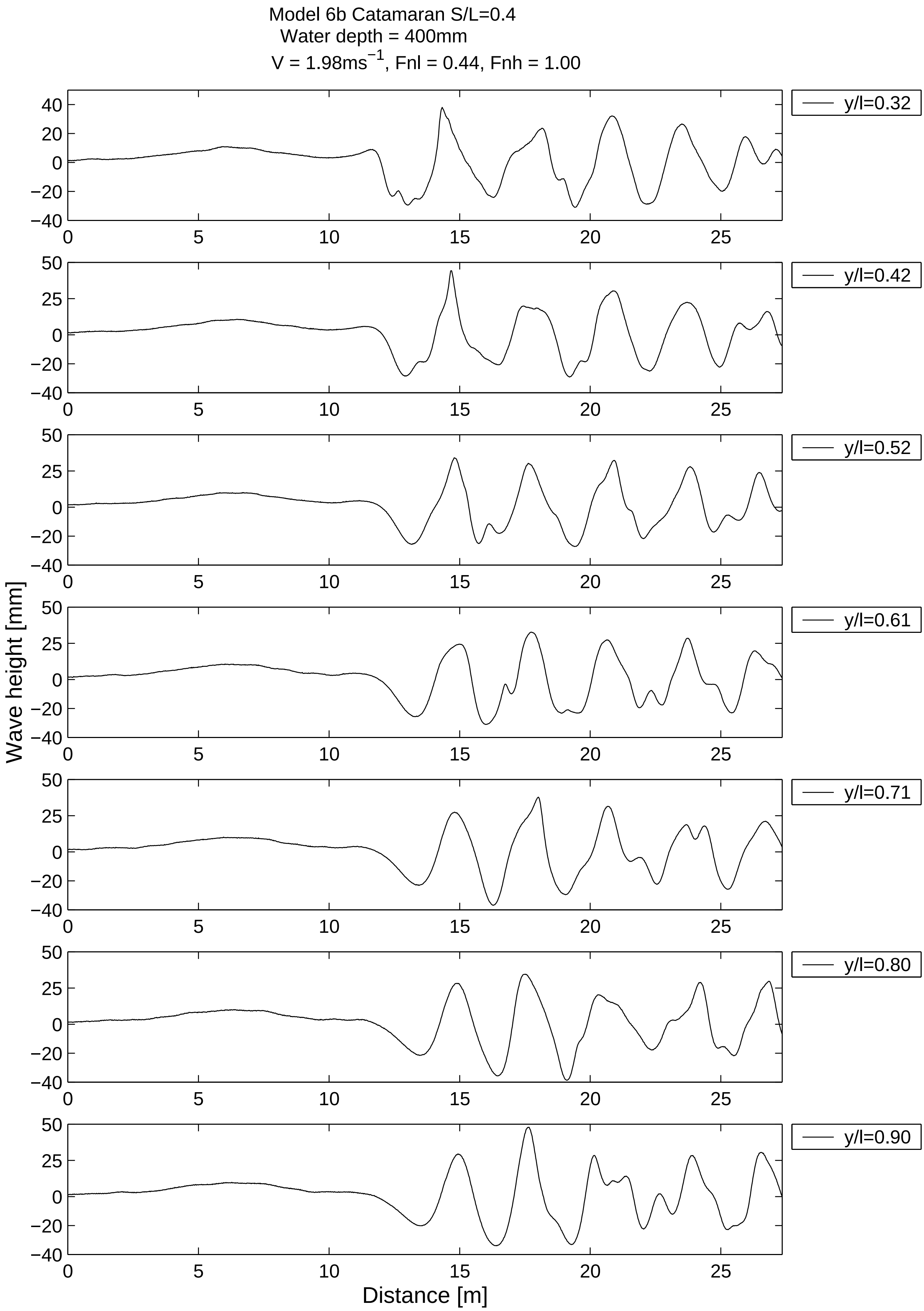

Model 5b Catamaran S/L=0.4
Water depth = 400mm
V = 4.04ms−1, Fnl = 1.02, Fnh = 2.04
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

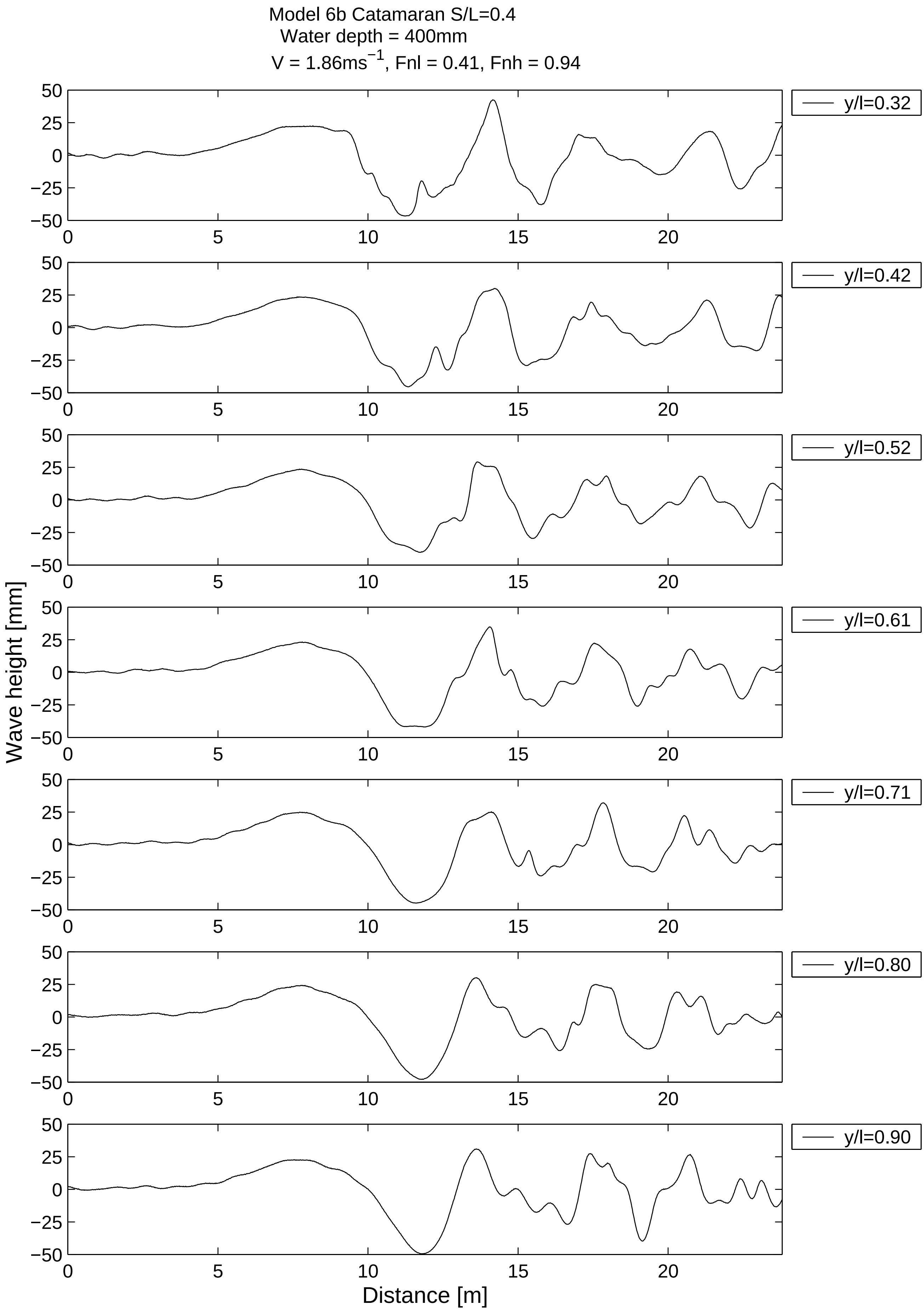
Figure 61



Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 1.03ms−1, Fnl = 0.23, Fnh = 0.52
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

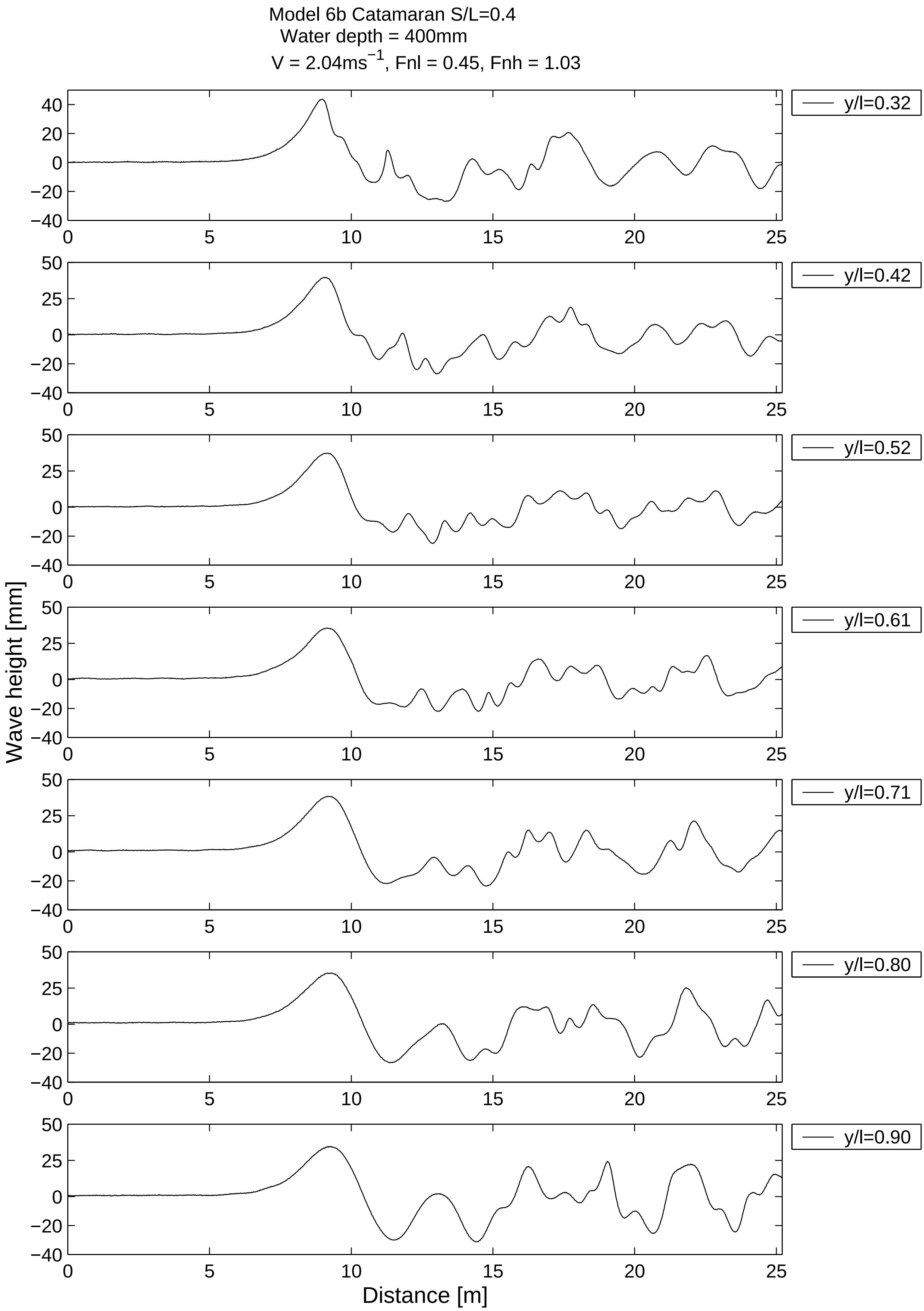
Figure 62

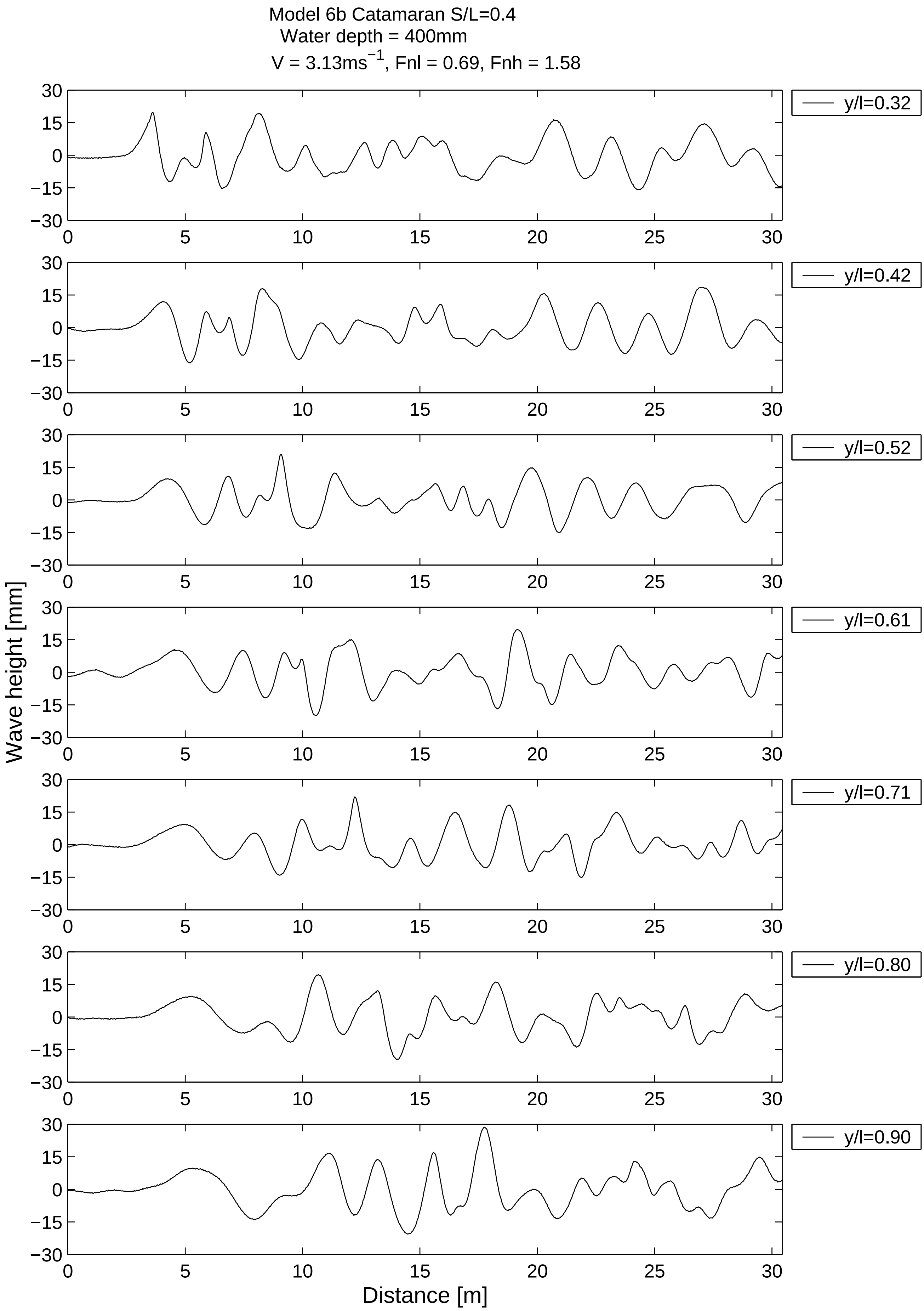

Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 1.98ms−1, Fnl = 0.44, Fnh = 1.00
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]
Figure 63



Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 1.86ms−1, Fnl = 0.41, Fnh = 0.94
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

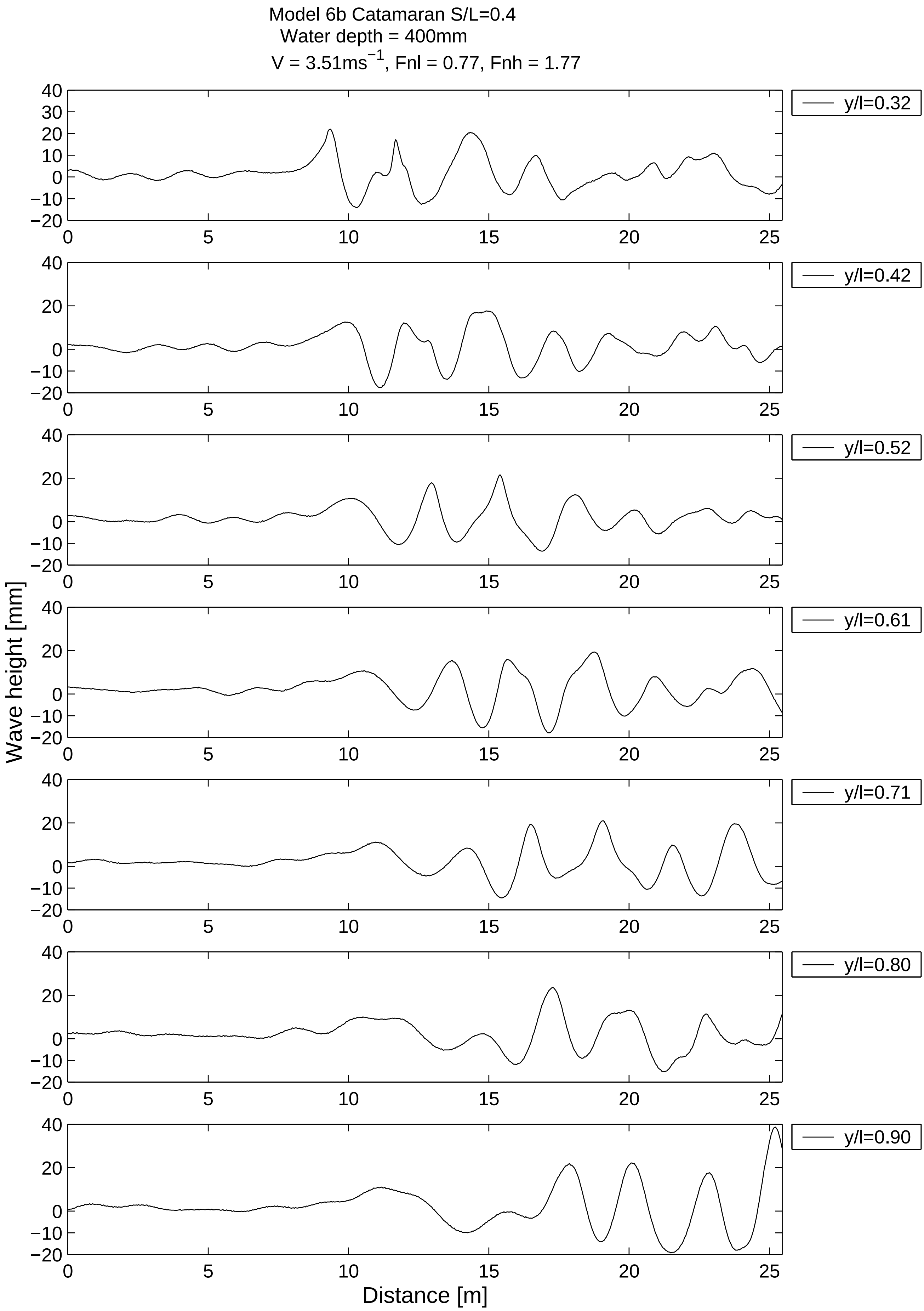
Figure 64


Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 2.04ms−1, Fnl = 0.45, Fnh = 1.03
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]
Figure 65



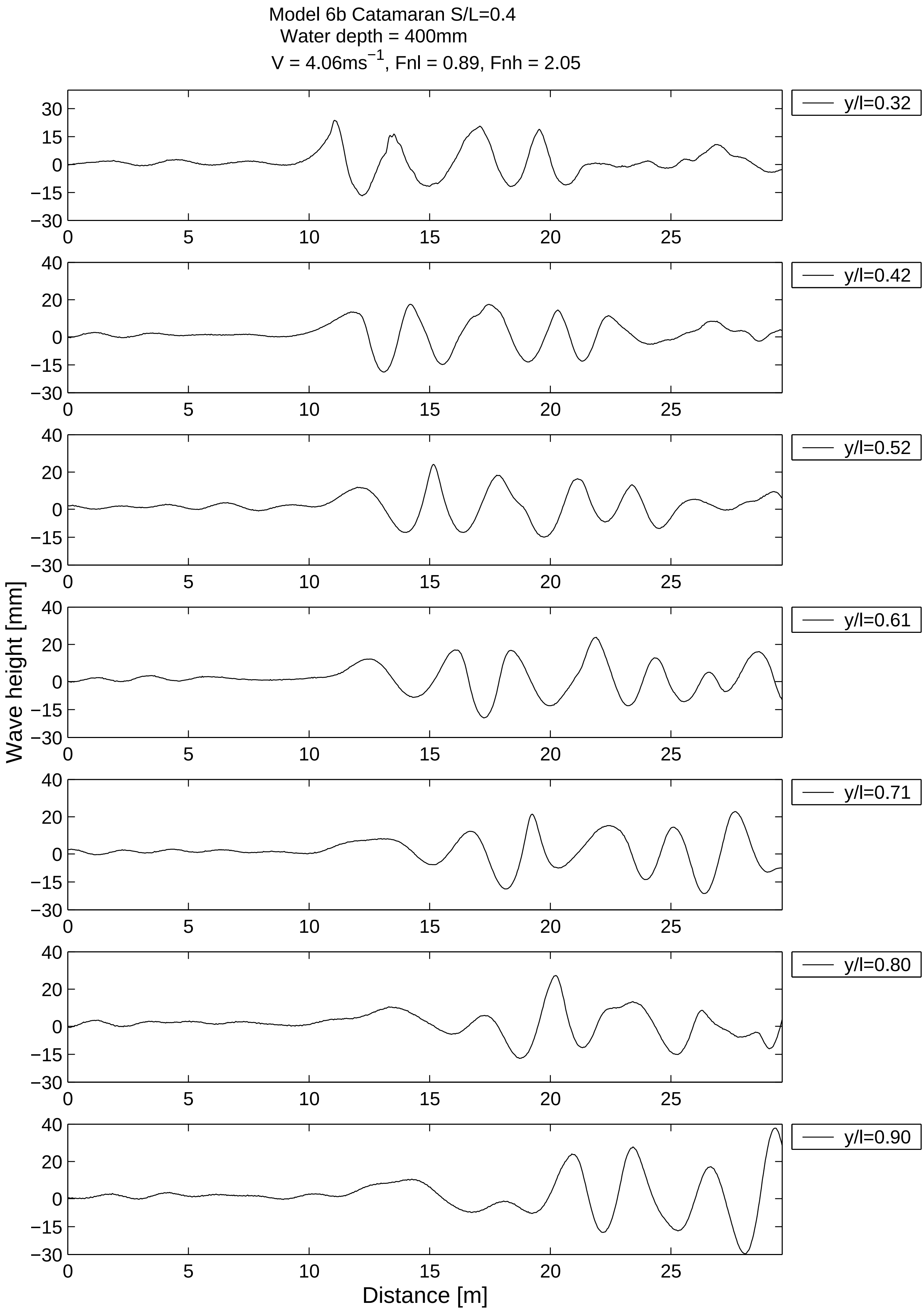
Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 3.13ms⁻¹, Fnl = 0.69, Fnh = 1.58
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 66



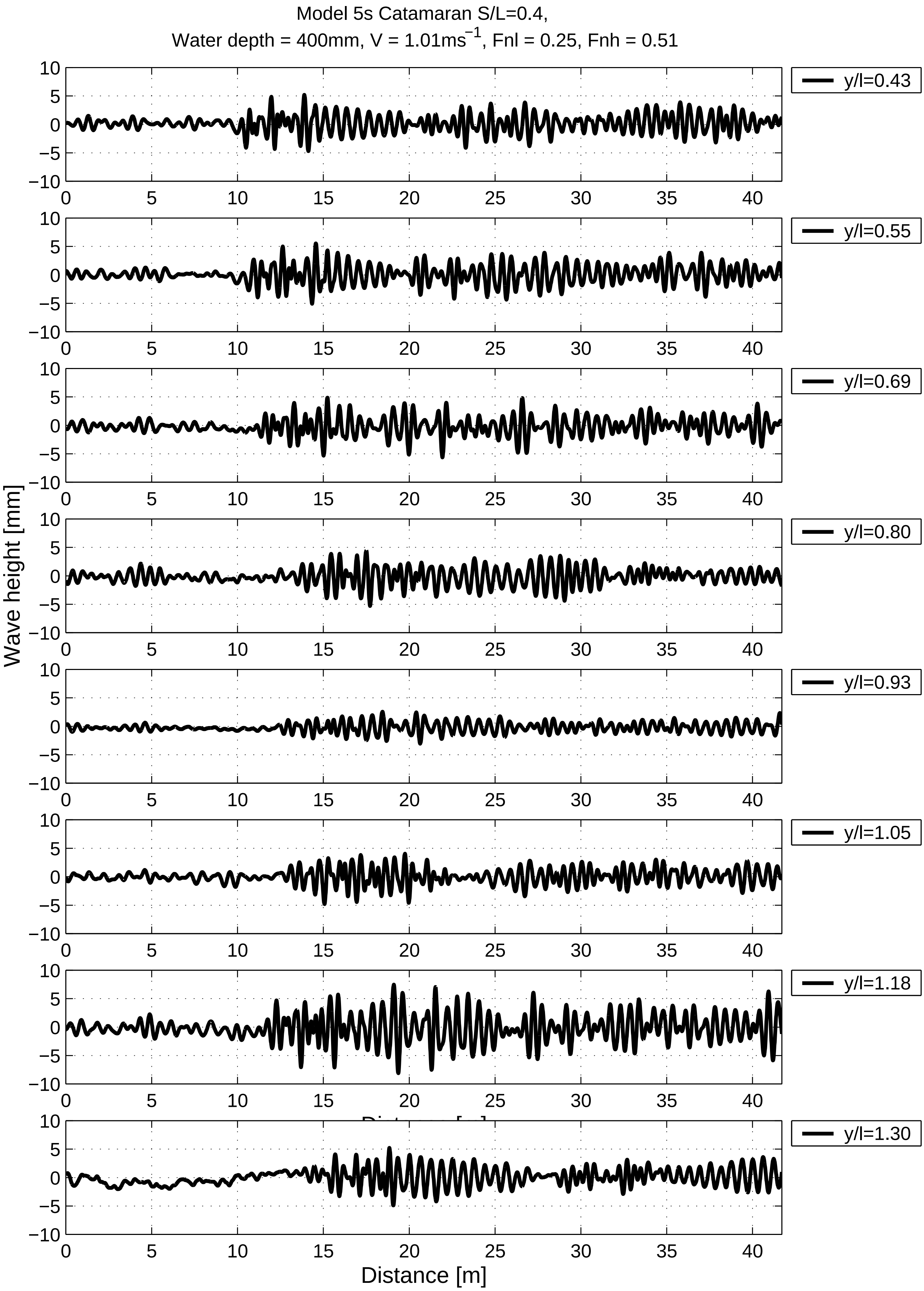
Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 3.51ms−1, Fnl = 0.77, Fnh = 1.77
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 67



Model 6b Catamaran S/L=0.4
Water depth = 400mm
V = 4.06ms−1, Fnl = 0.89, Fnh = 2.05
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 68



Model 5s Catamaran S/L=0.4,
Water depth = 400mm, V = 1.01ms^{-1}, Fnl = 0.25, Fnh = 0.51
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30
Wave height [mm]
Distance [m]

Figure 69

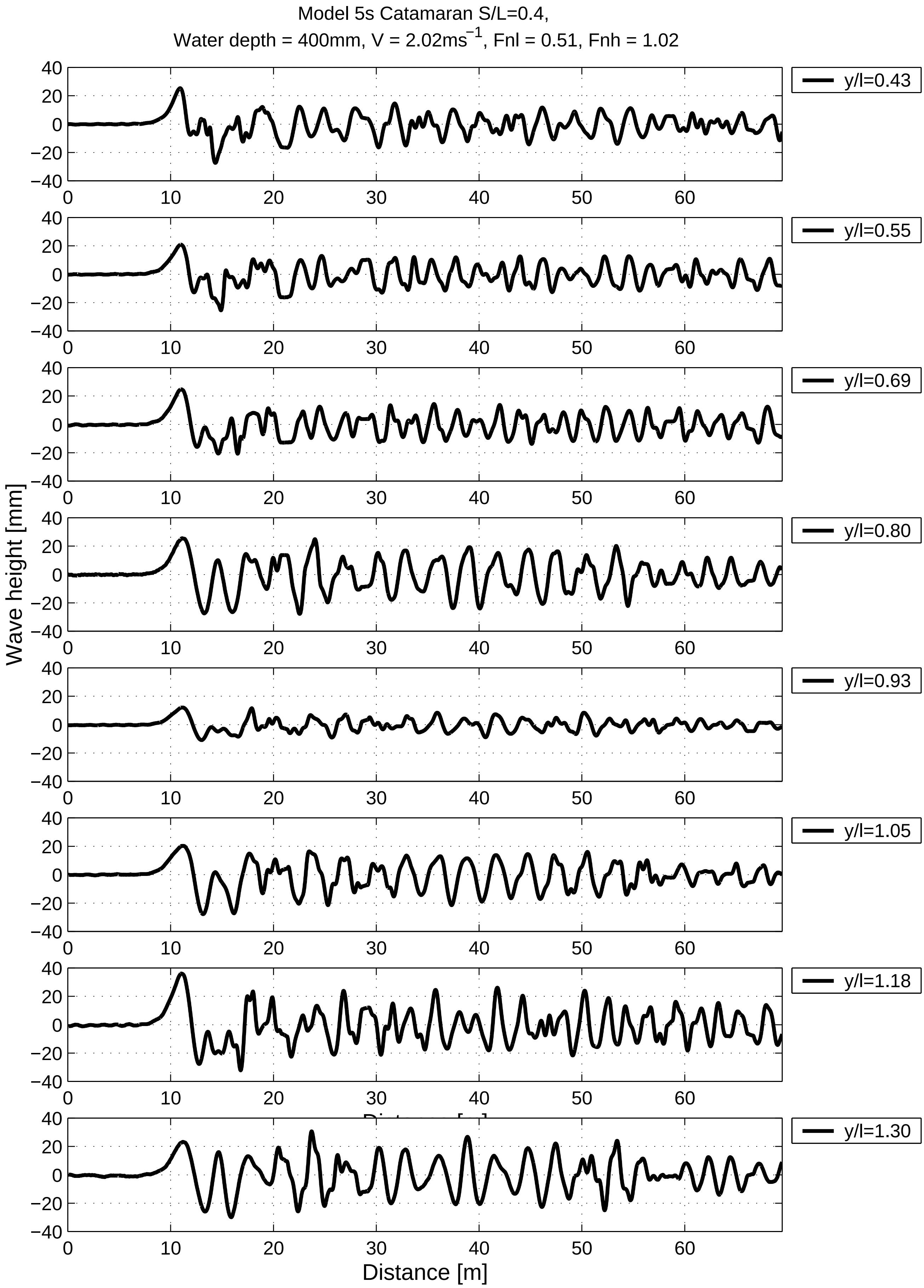

Model 5s Catamaran S/L=0.4,
Water depth = 400mm, V = 2.02ms^{-1}, Fnl = 0.51, Fnh = 1.02
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30
40
20
0
−20
−40
0
10
20
30
40
50
60

Figure 70

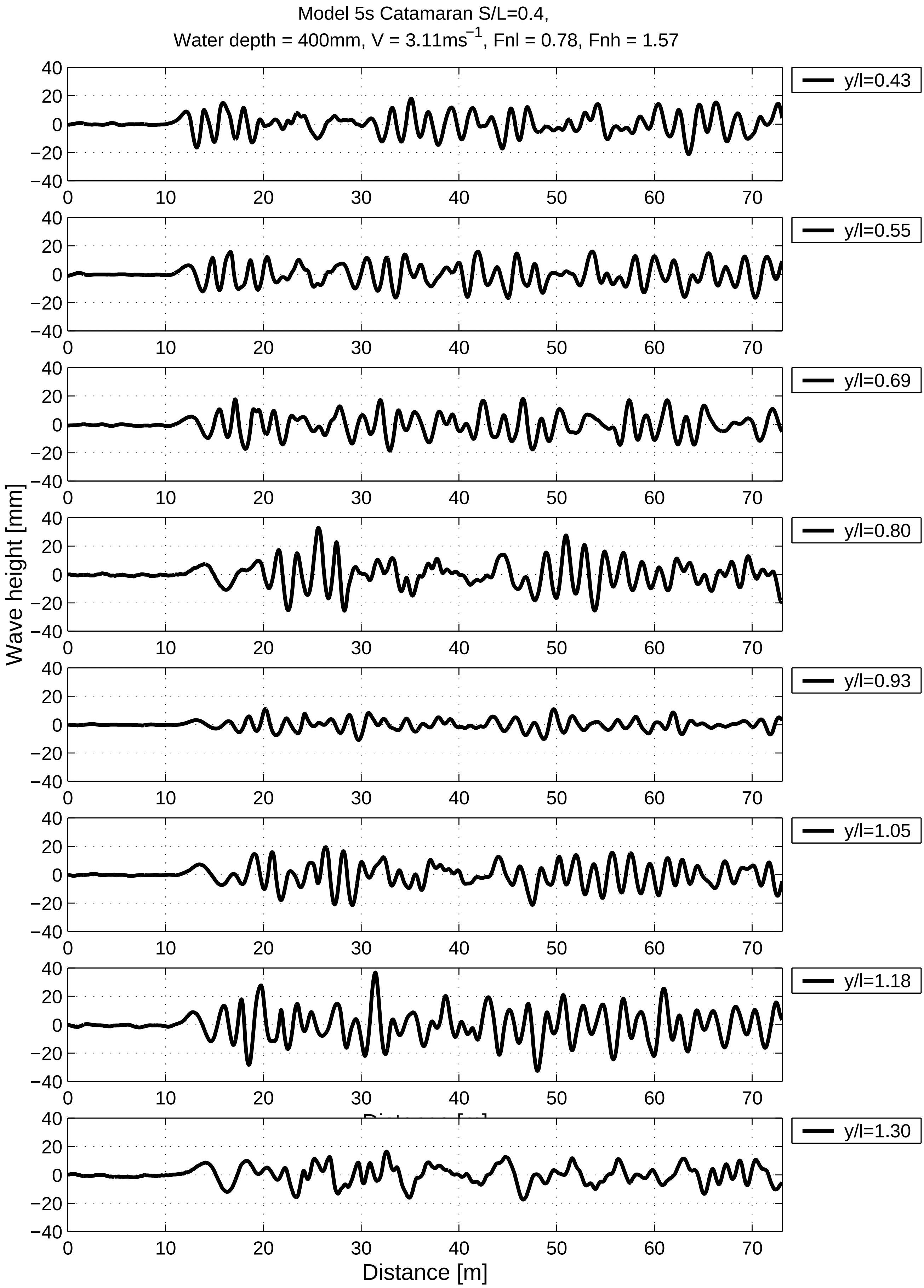
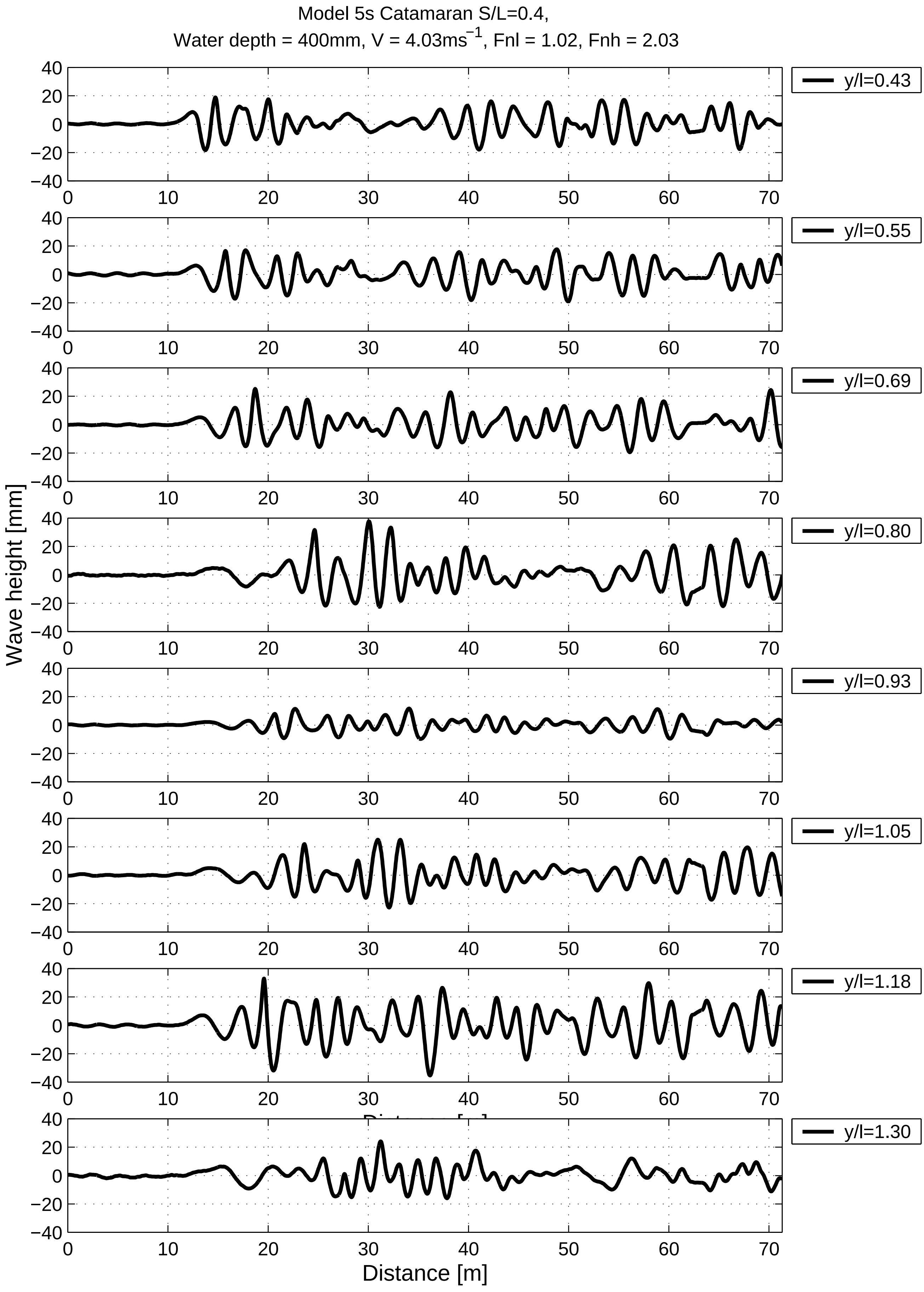

Model 5s Catamaran S/L=0.4,
Water depth = 400mm, V = 3.11ms^{-1}, Fnl = 0.78, Fnh = 1.57
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 71



Model 5s Catamaran S/L=0.4,
Water depth = 400mm, V = 4.03ms^{-1}, Fnl = 1.02, Fnh = 2.03
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.69
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
y/l=1.30

Figure 72

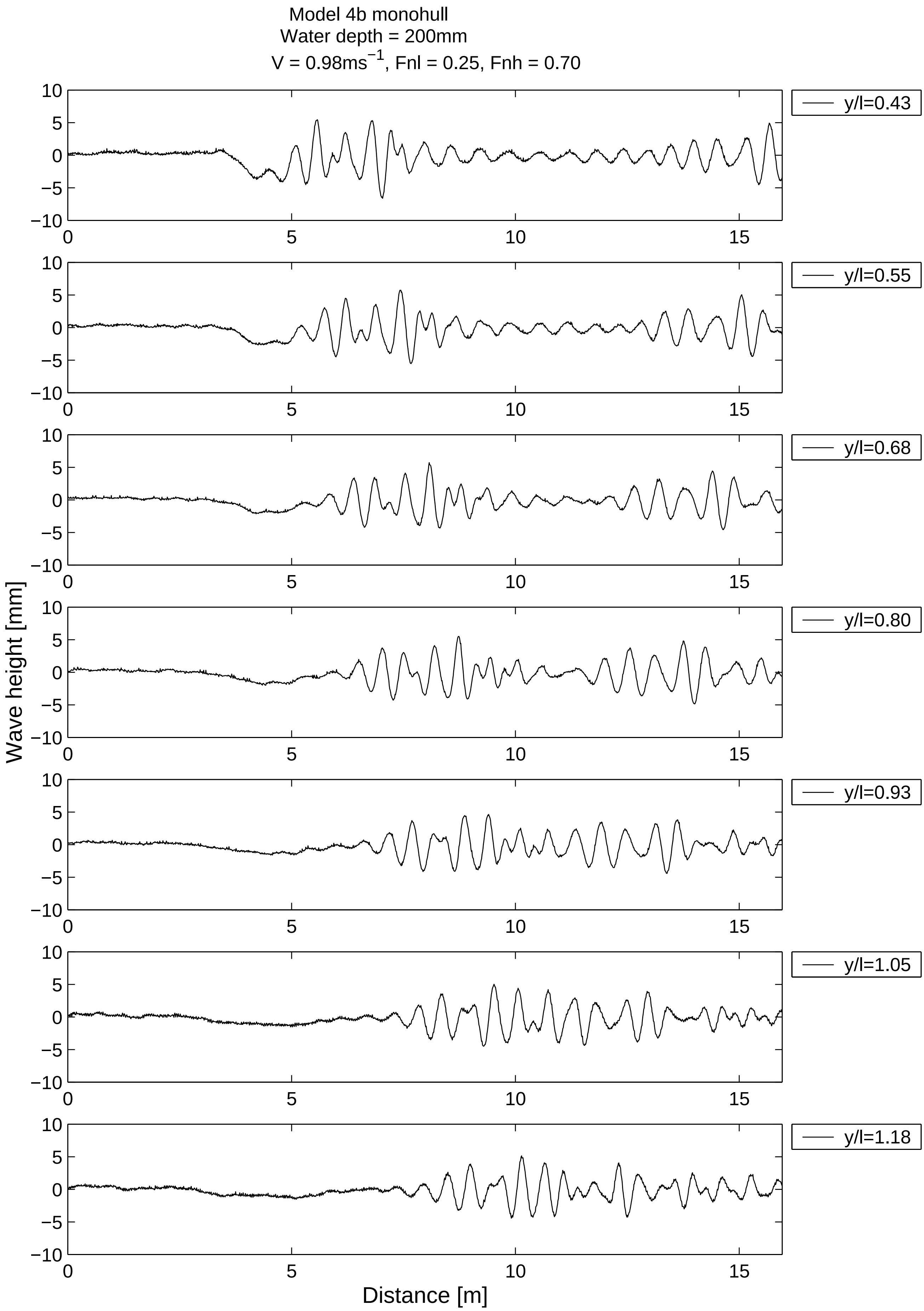
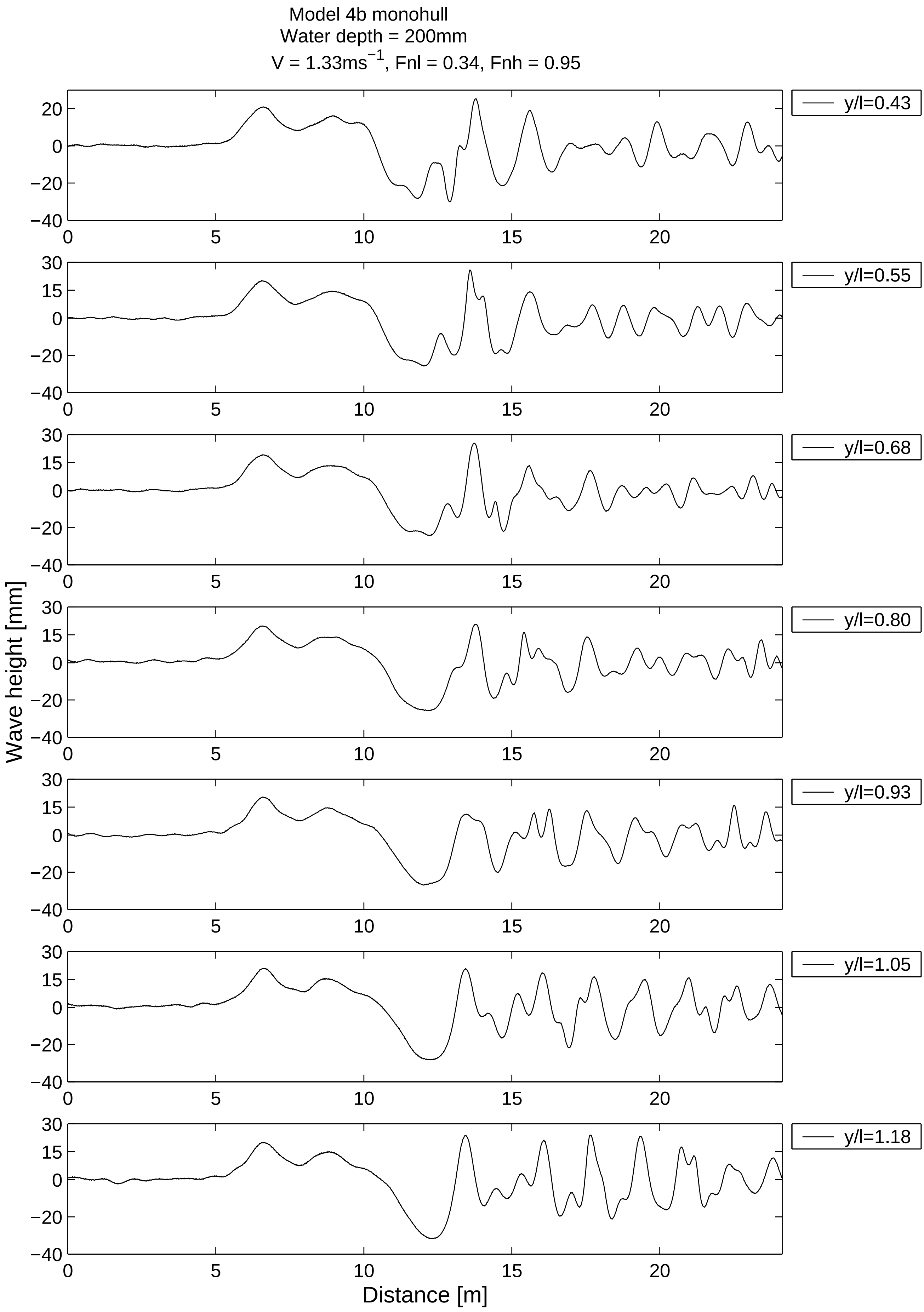

Model 4b monohull
Water depth = 200mm
V = 0.98ms−1, Fnl = 0.25, Fnh = 0.70
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 73



Model 4b monohull
Water depth = 200mm
V = 1.33ms^−1, Fnl = 0.34, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 74

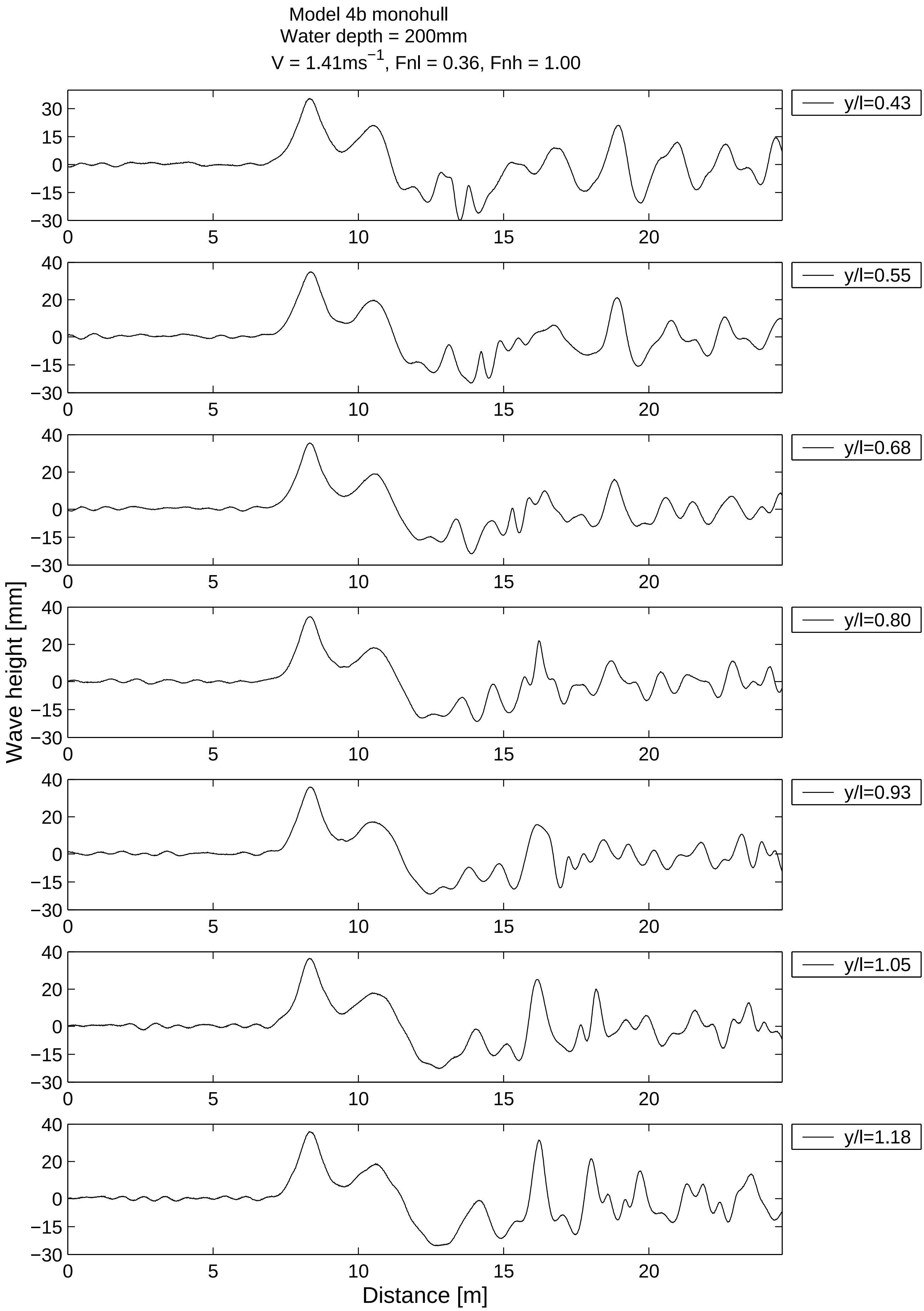
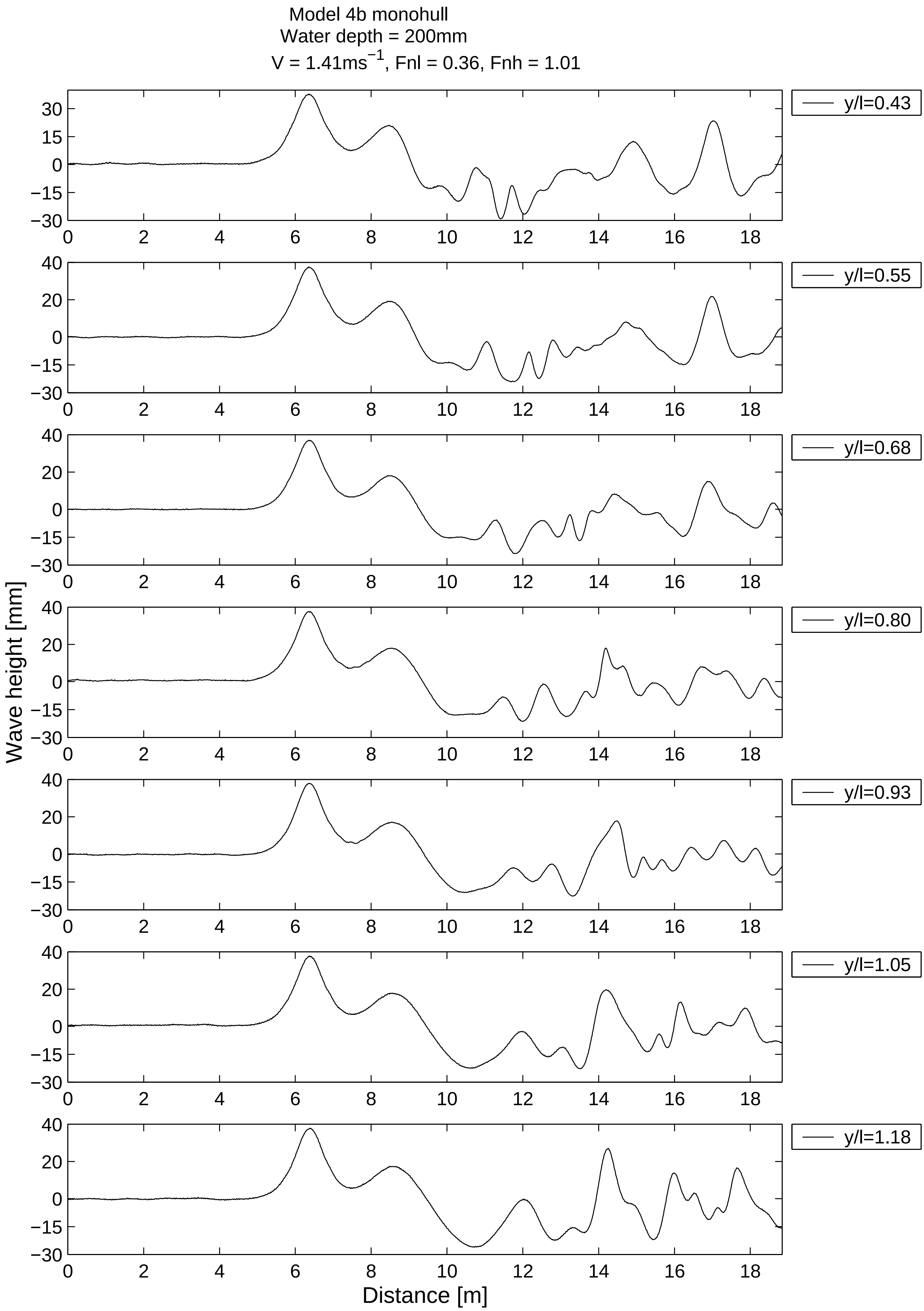
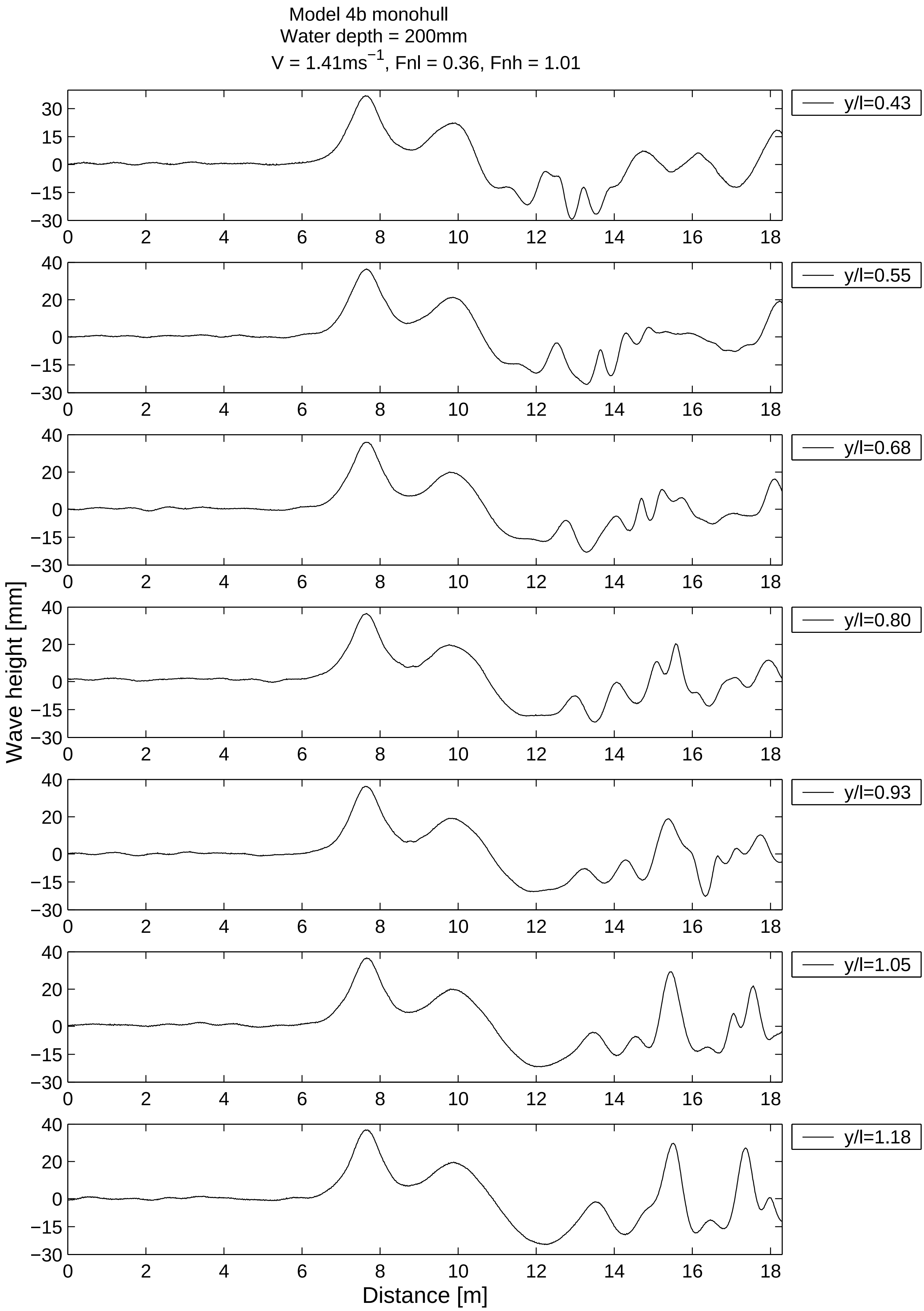

Model 4b monohull
Water depth = 200mm
V = 1.41ms^{-1}, Fnl = 0.36, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

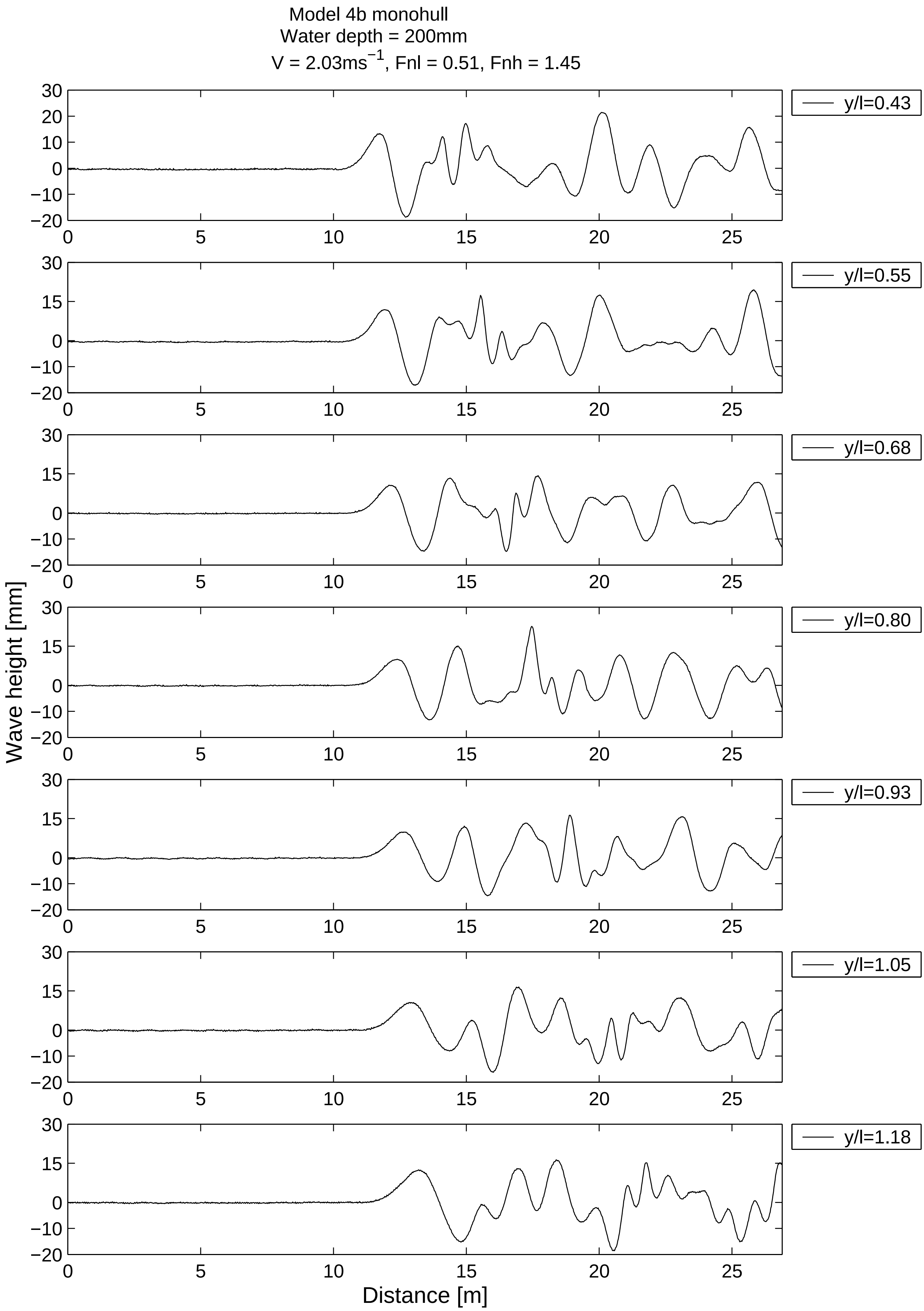
Figure 75


Model 4b monohull
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.36, Fnh = 1.01
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
Figure 76



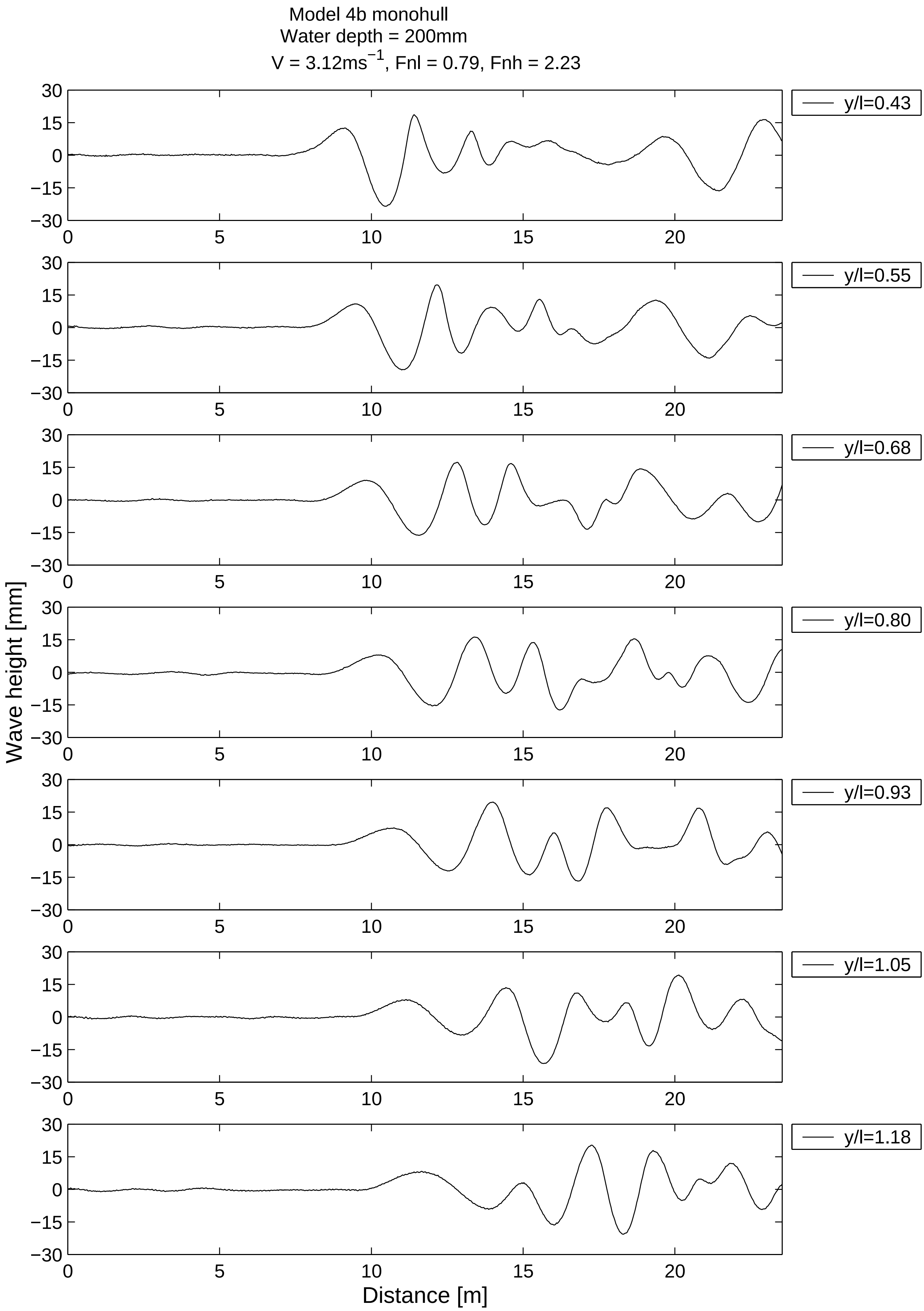
Model 4b monohull
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.36, Fnh = 1.01
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 77



Model 4b monohull
Water depth = 200mm
V = 2.03ms−1, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 78



Model 4b monohull
Water depth = 200mm
V = 3.12ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 79

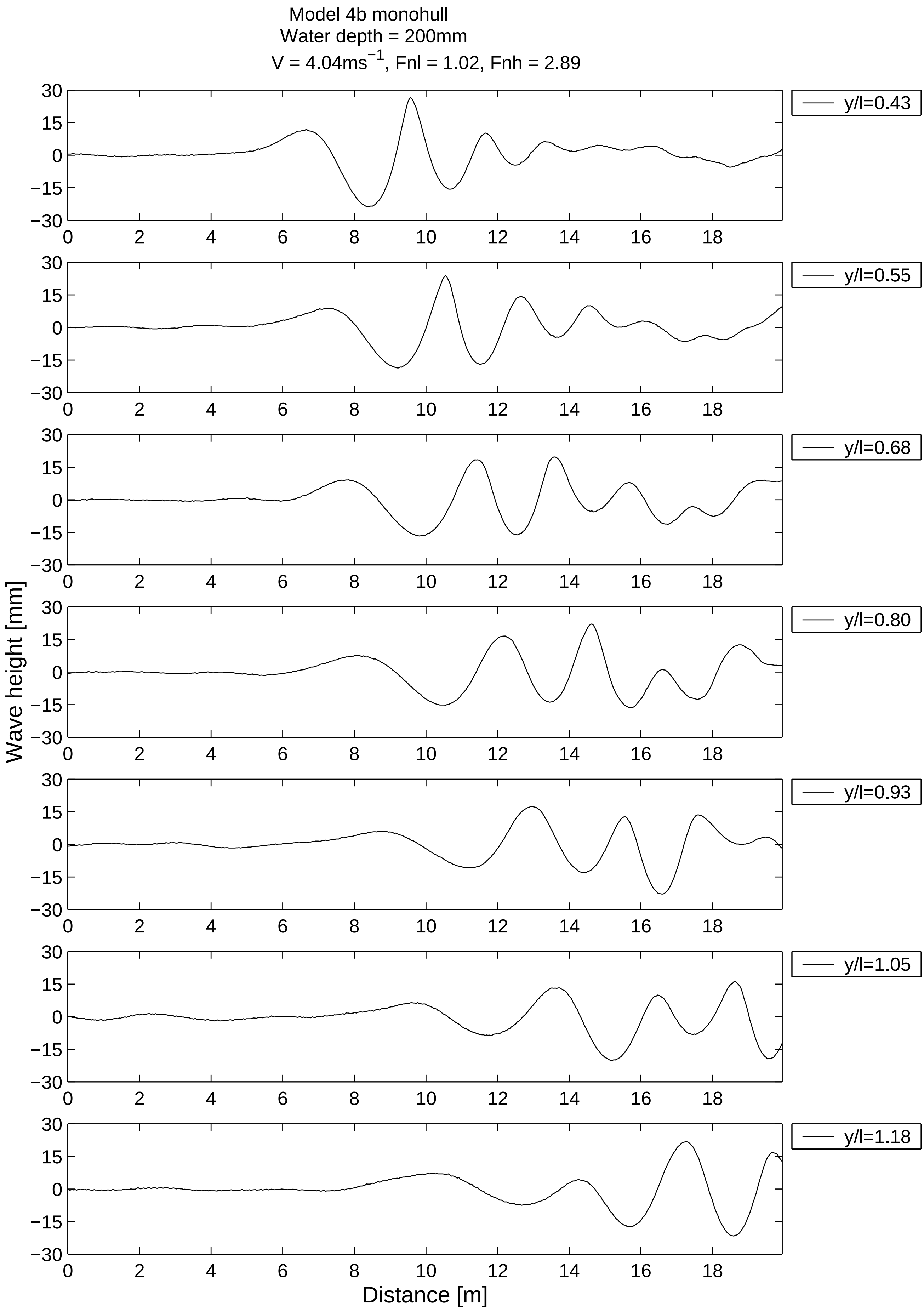
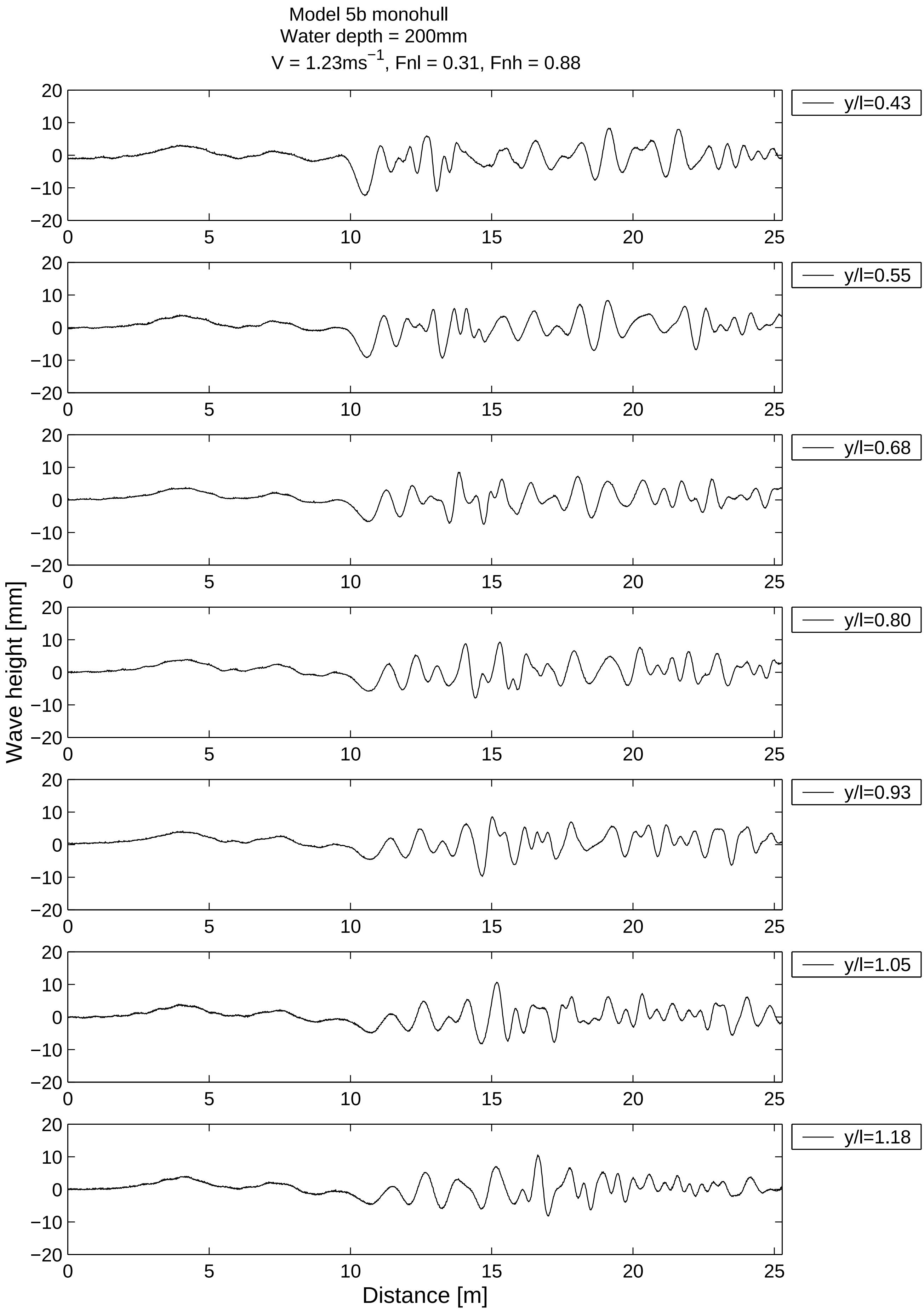
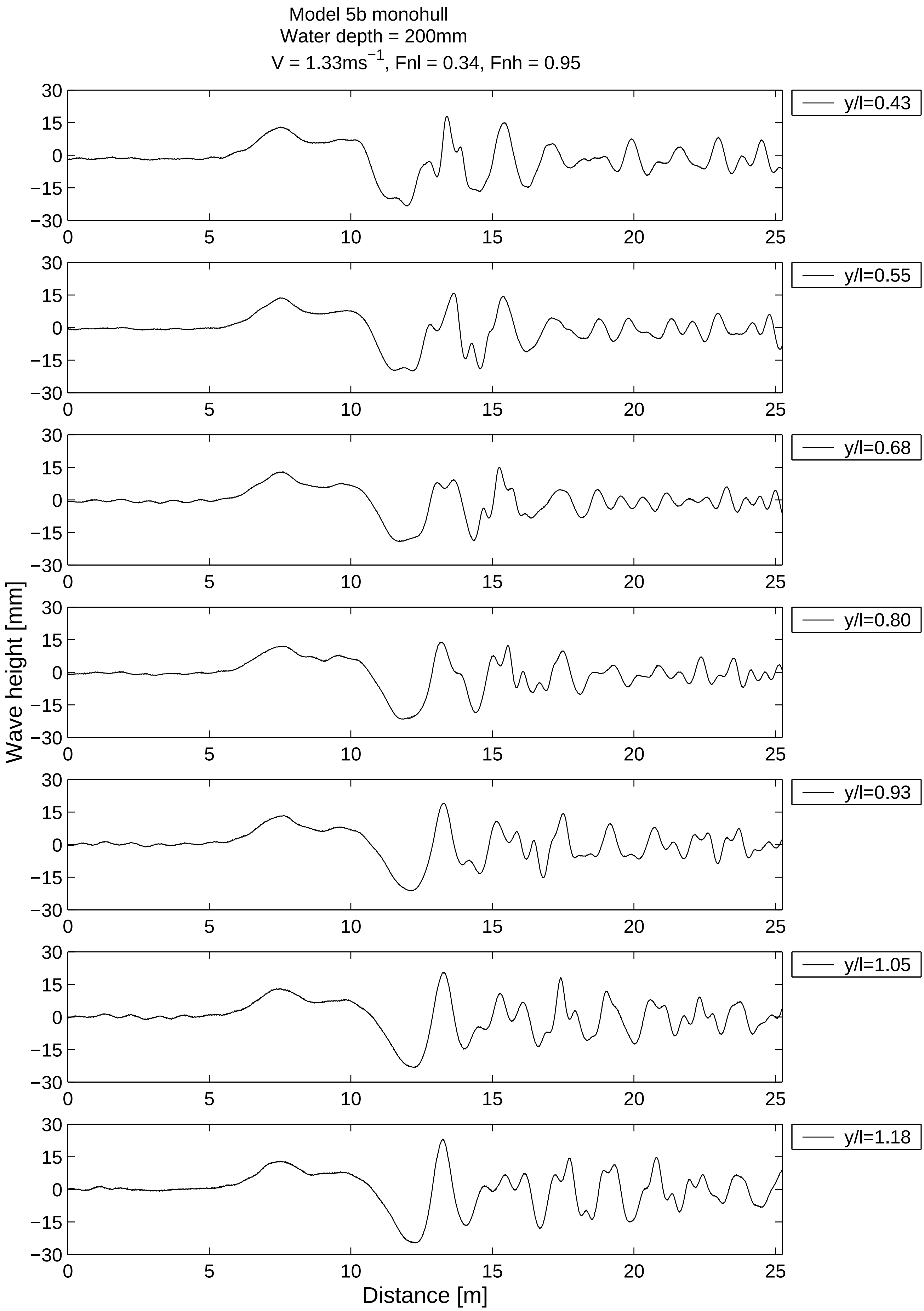

Model 4b monohull
Water depth = 200mm
V = 4.04ms^{-1}, Fnl = 1.02, Fnh = 2.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
2
4
6
8
10
12
14
16
18

Figure 80



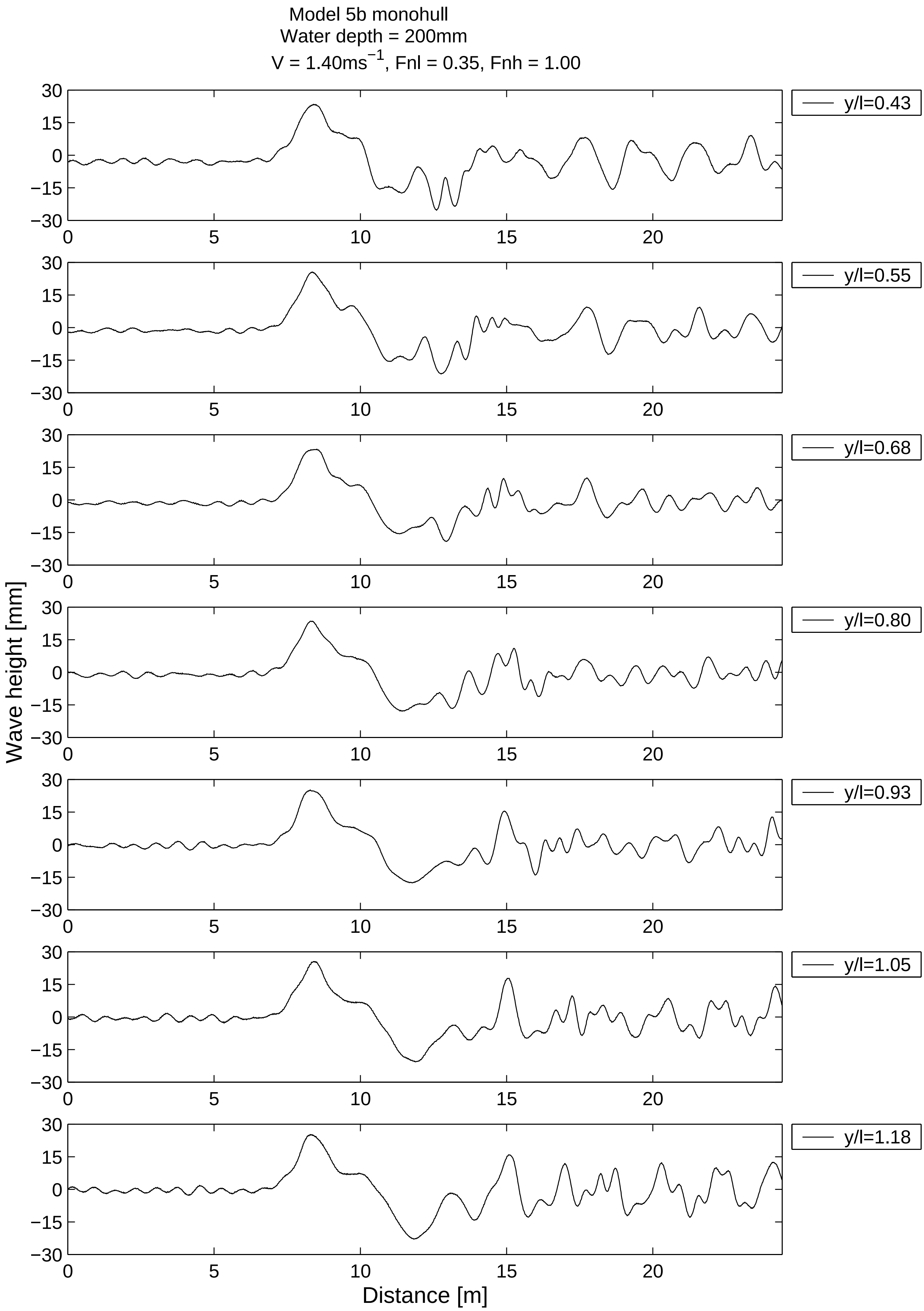
Model 5b monohull
Water depth = 200mm
V = 1.23ms−1, Fnl = 0.31, Fnh = 0.88
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 81



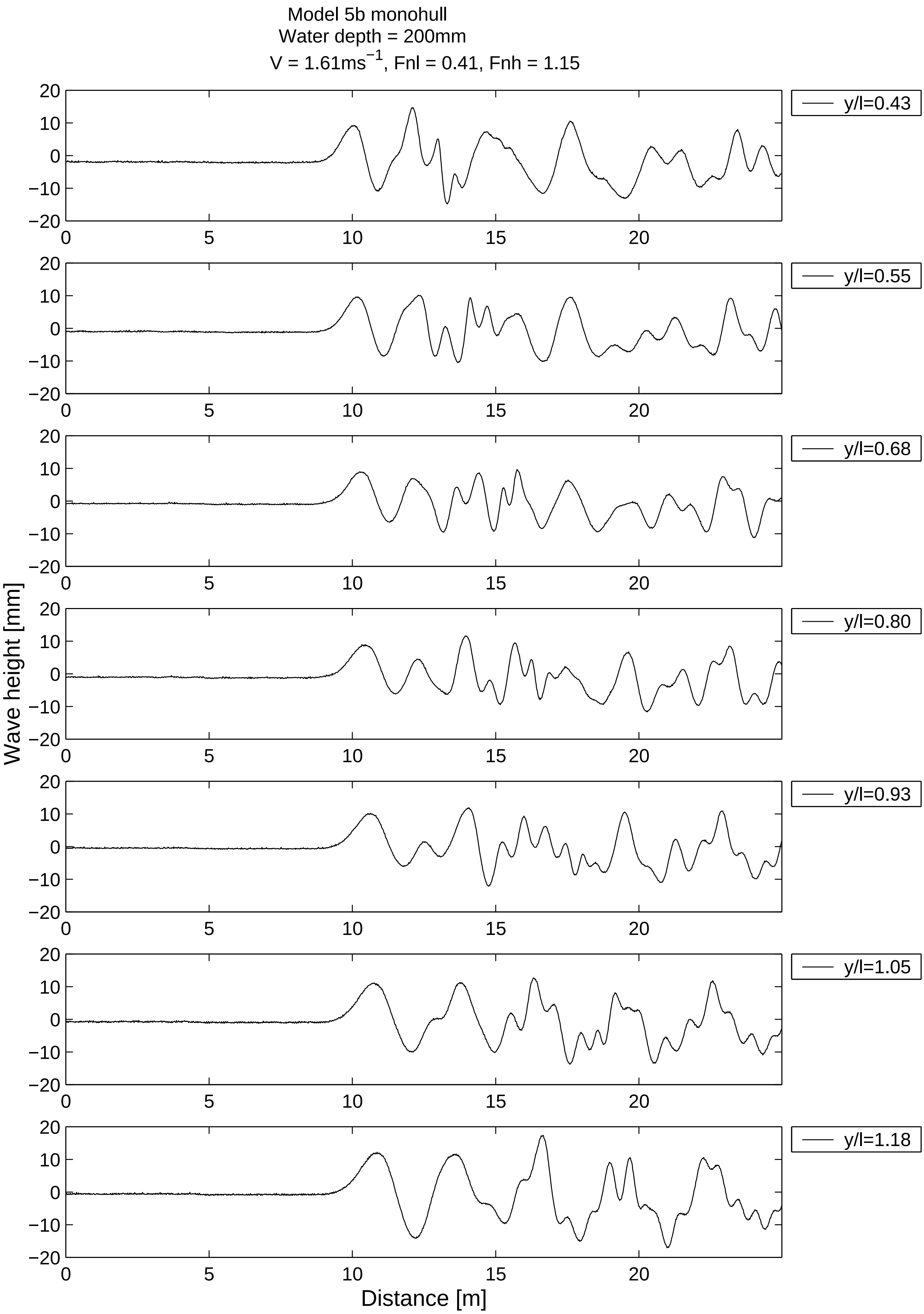
Model 5b monohull
Water depth = 200mm
V = 1.33ms^−1, Fnl = 0.34, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 82



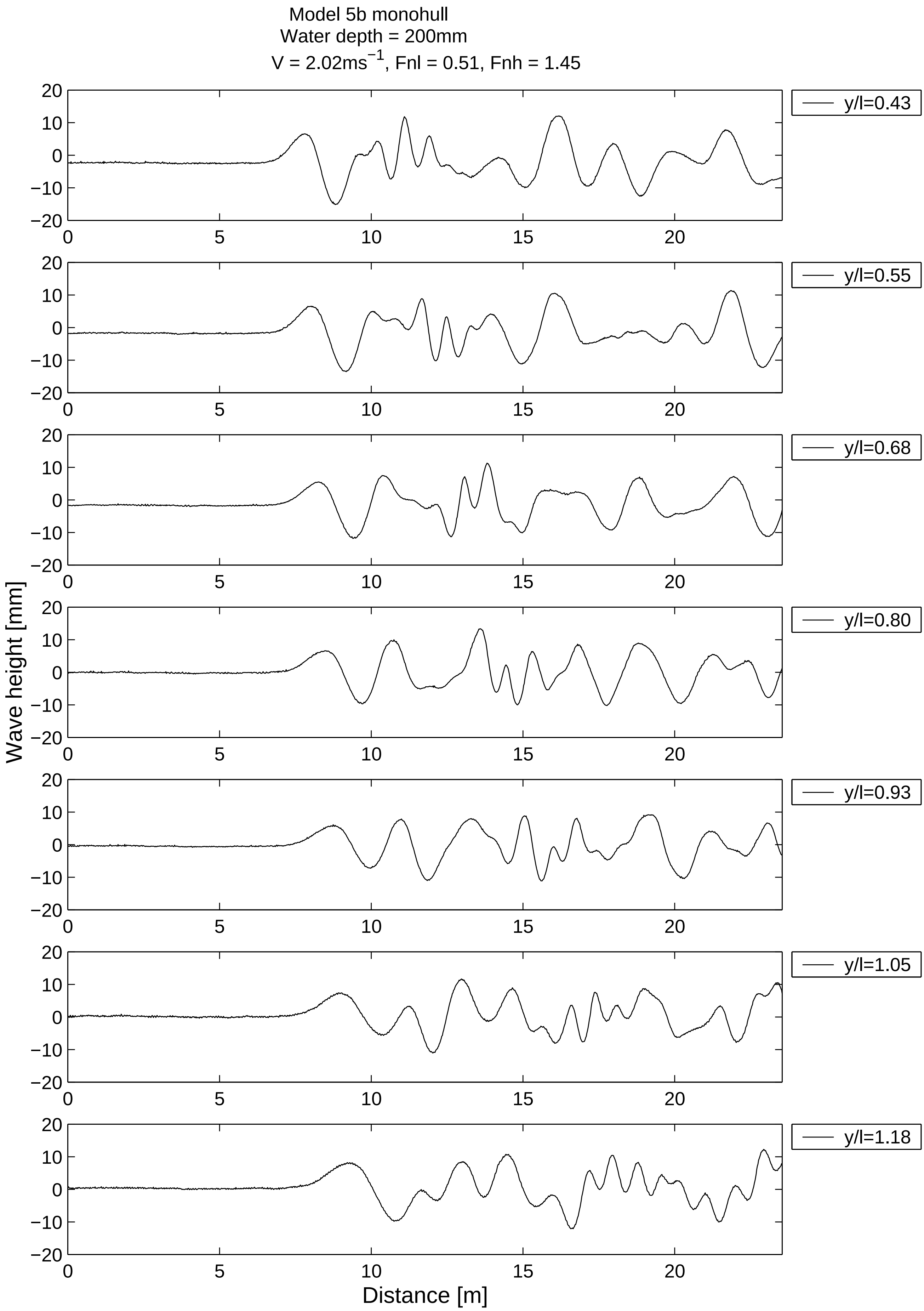
Model 5b monohull
Water depth = 200mm
V = 1.40ms−1, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20

Figure 83



Model 5b monohull
Water depth = 200mm
V = 1.61ms−1, Fnl = 0.41, Fnh = 1.15
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
20
10
0
−10
−20
0
5
10
15
20

Figure 84



Model 5b monohull
Water depth = 200mm
V = 2.02ms−1, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 85

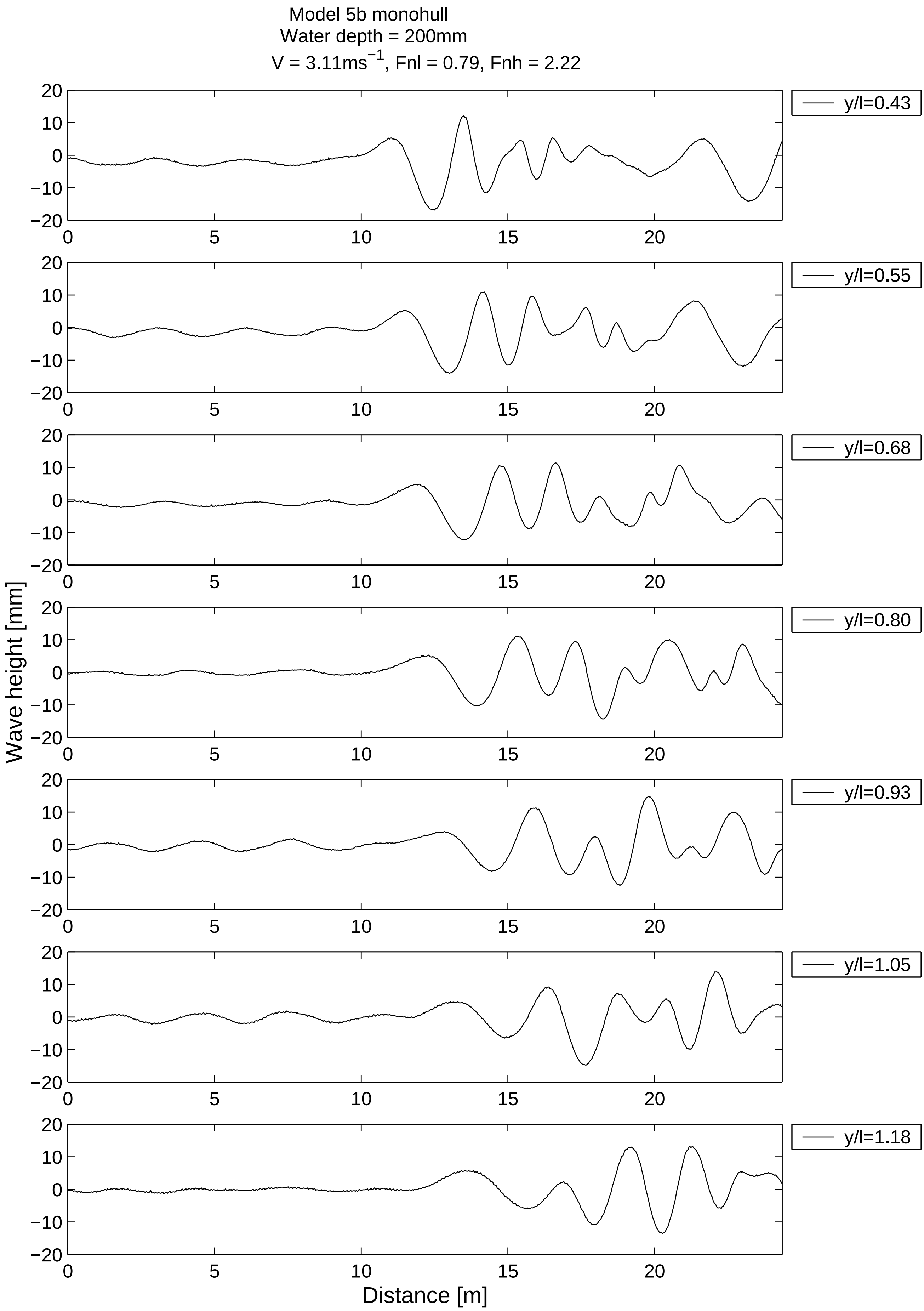

Model 5b monohull
Water depth = 200mm
V = 3.11ms−1, Fnl = 0.79, Fnh = 2.22
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 86

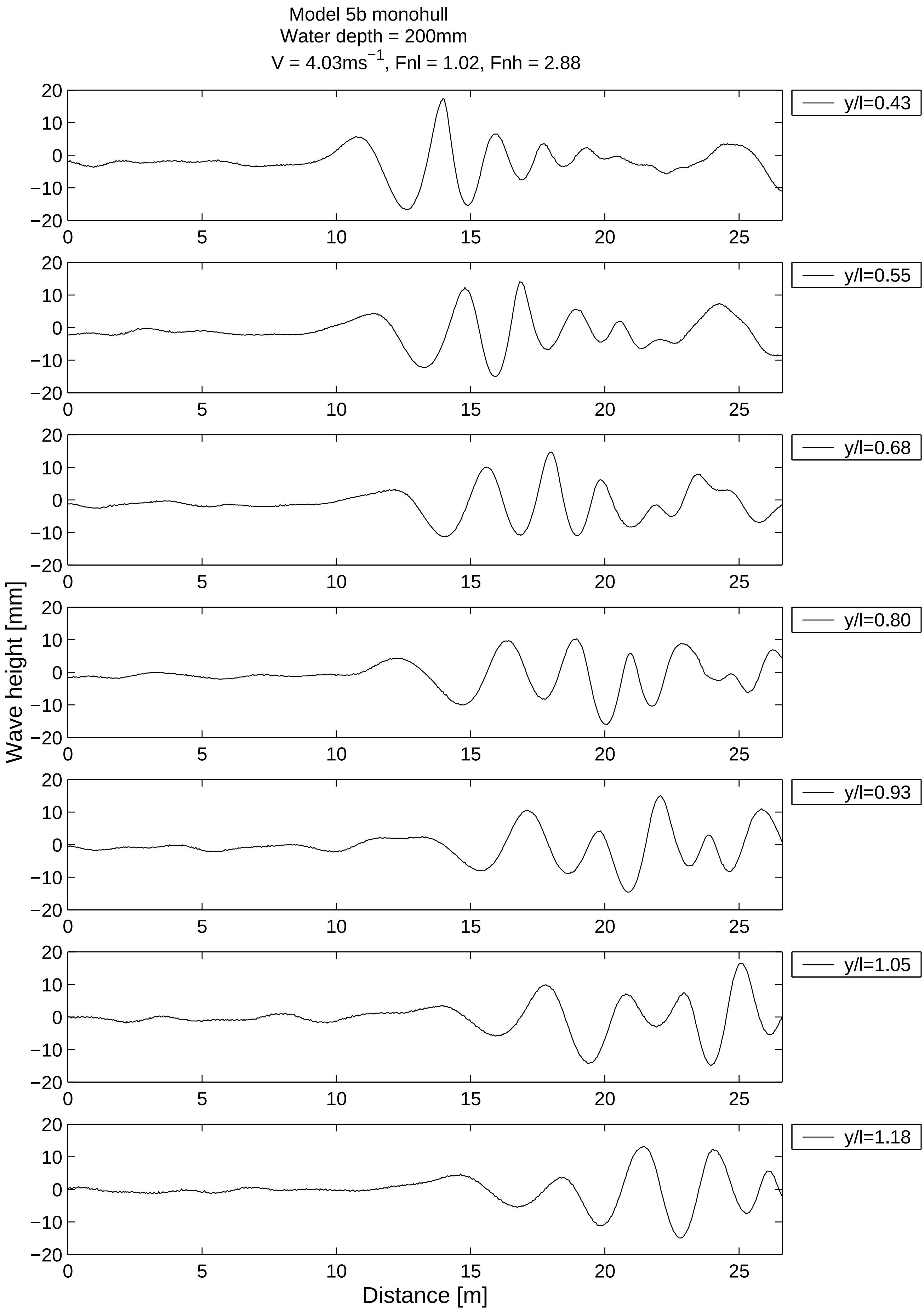
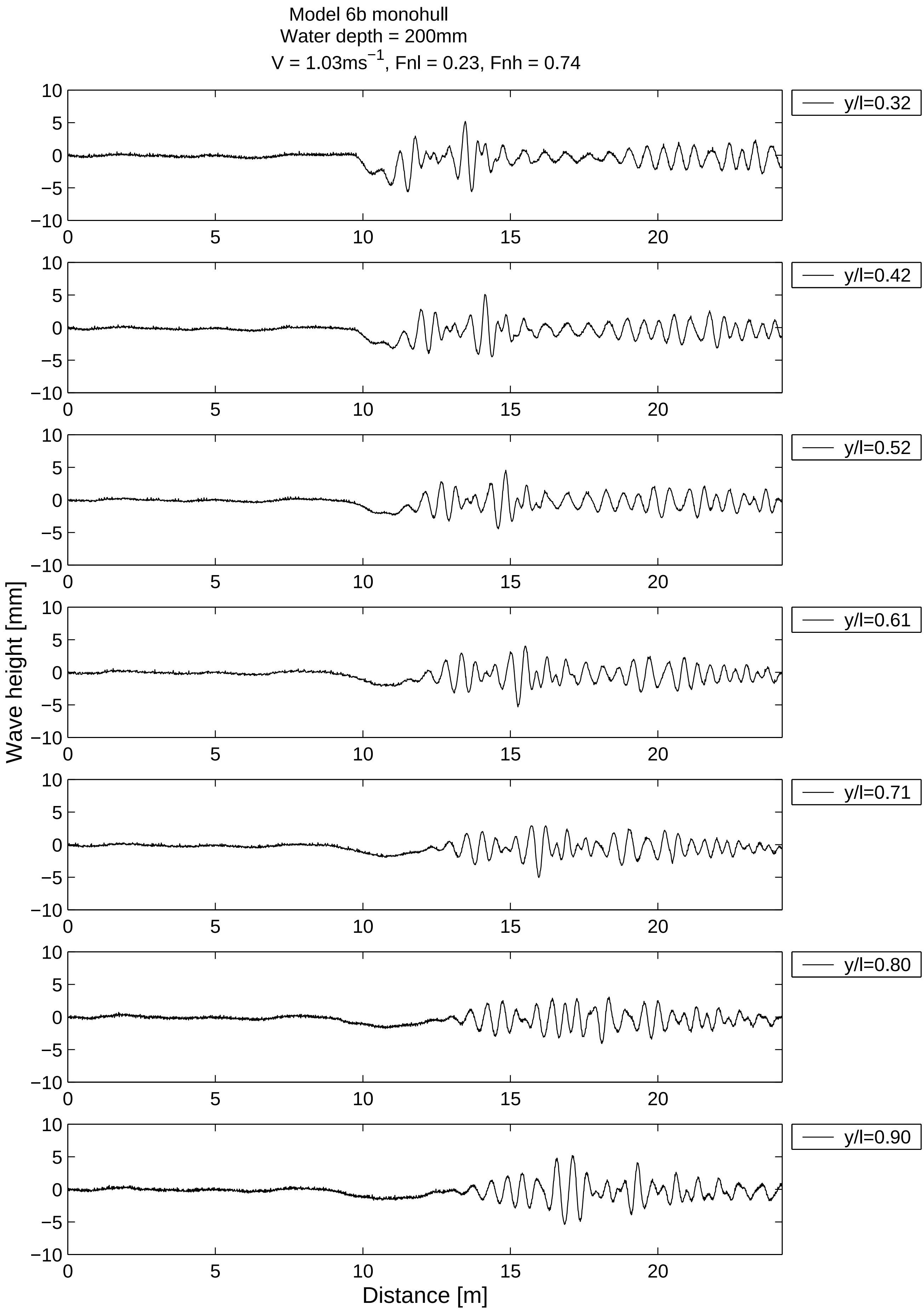
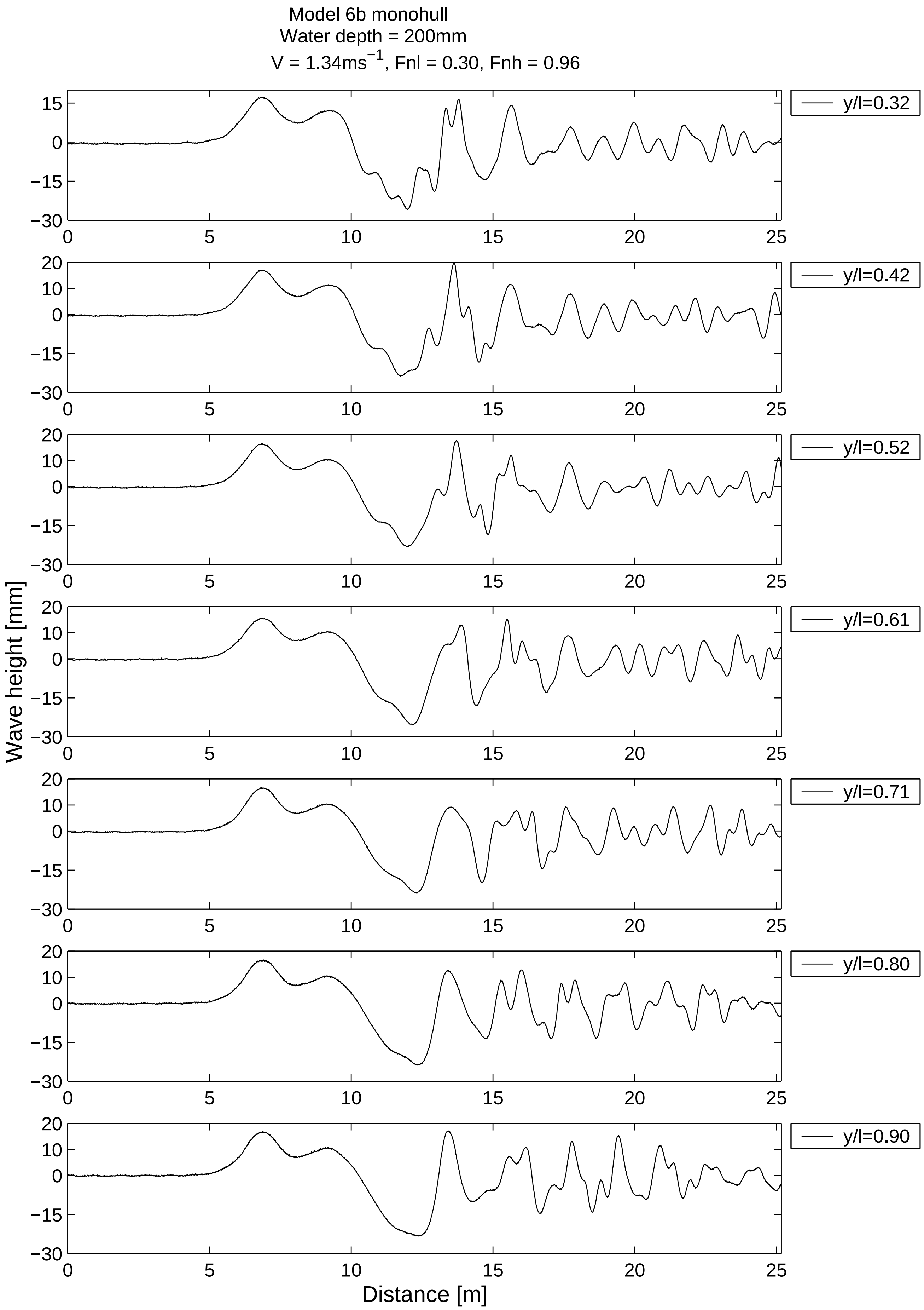

Model 5b monohull
Water depth = 200mm
V = 4.03ms−1, Fnl = 1.02, Fnh = 2.88
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 87



Model 6b monohull
Water depth = 200mm
V = 1.03ms−1, Fnl = 0.23, Fnh = 0.74
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]
10
5
0
−5
−10
0
5
10
15
20

Figure 88



Model 6b monohull
Water depth = 200mm
V = 1.34ms−1, Fnl = 0.30, Fnh = 0.96
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 89

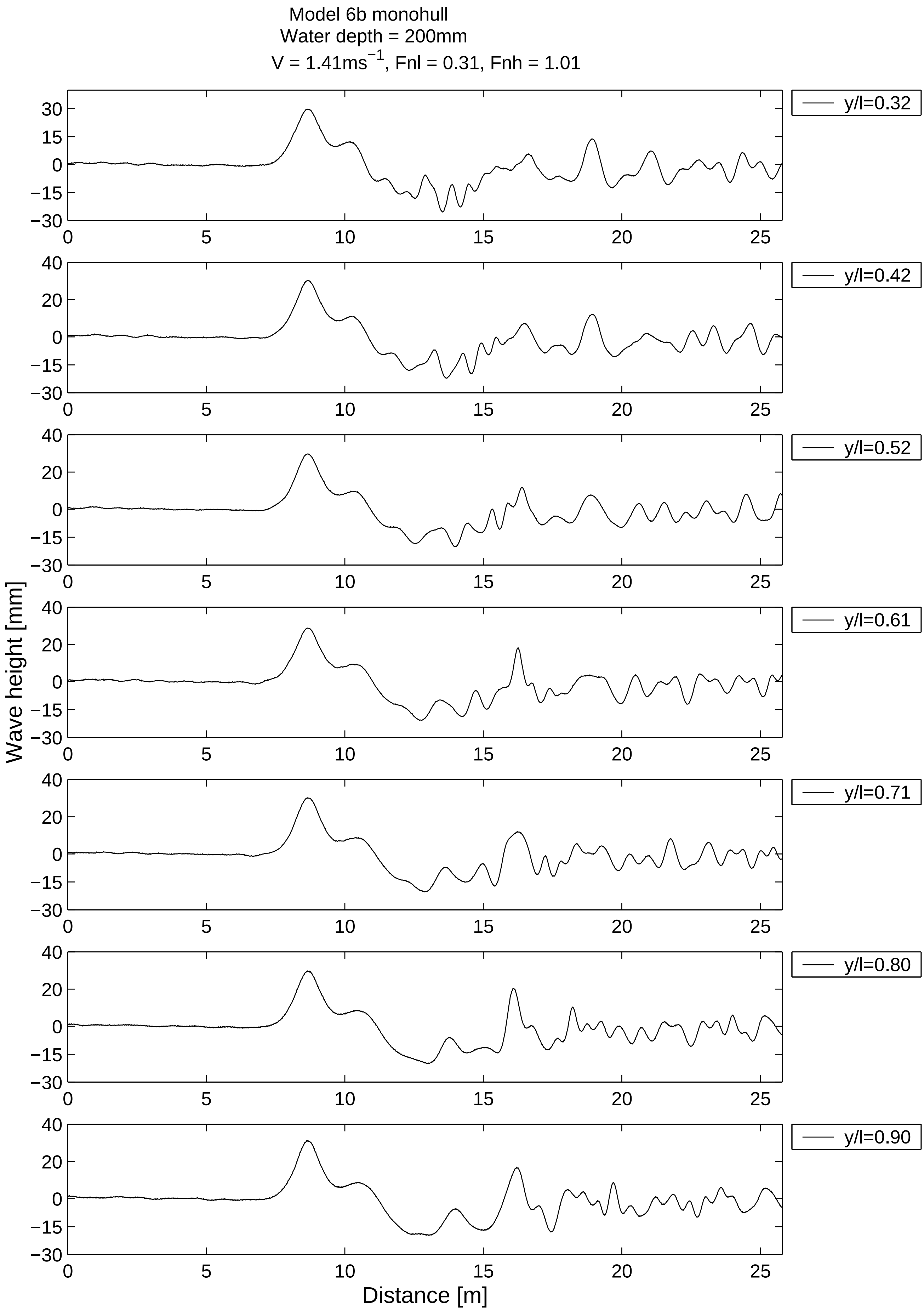
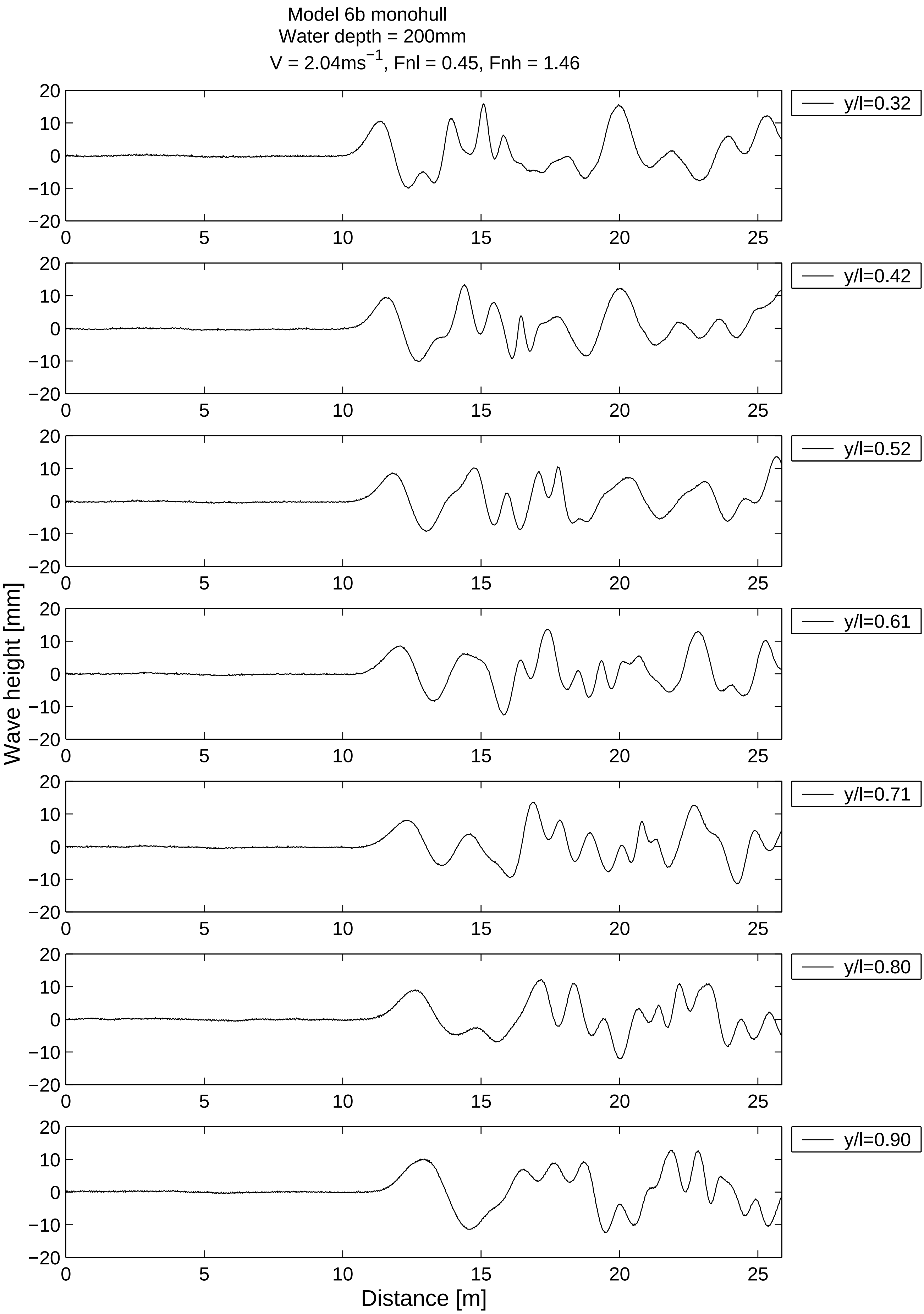
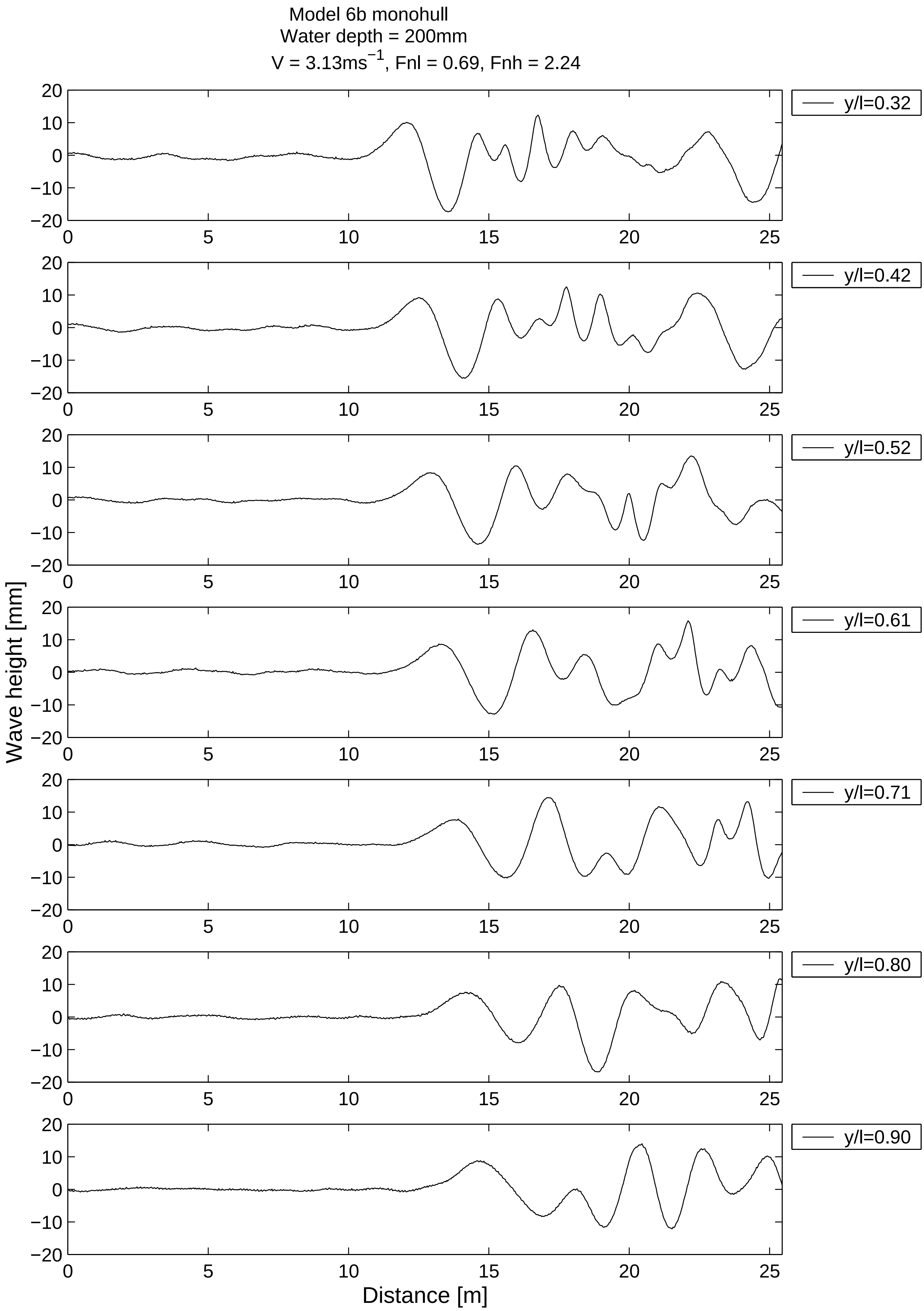

Model 6b monohull
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.31, Fnh = 1.01
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 90



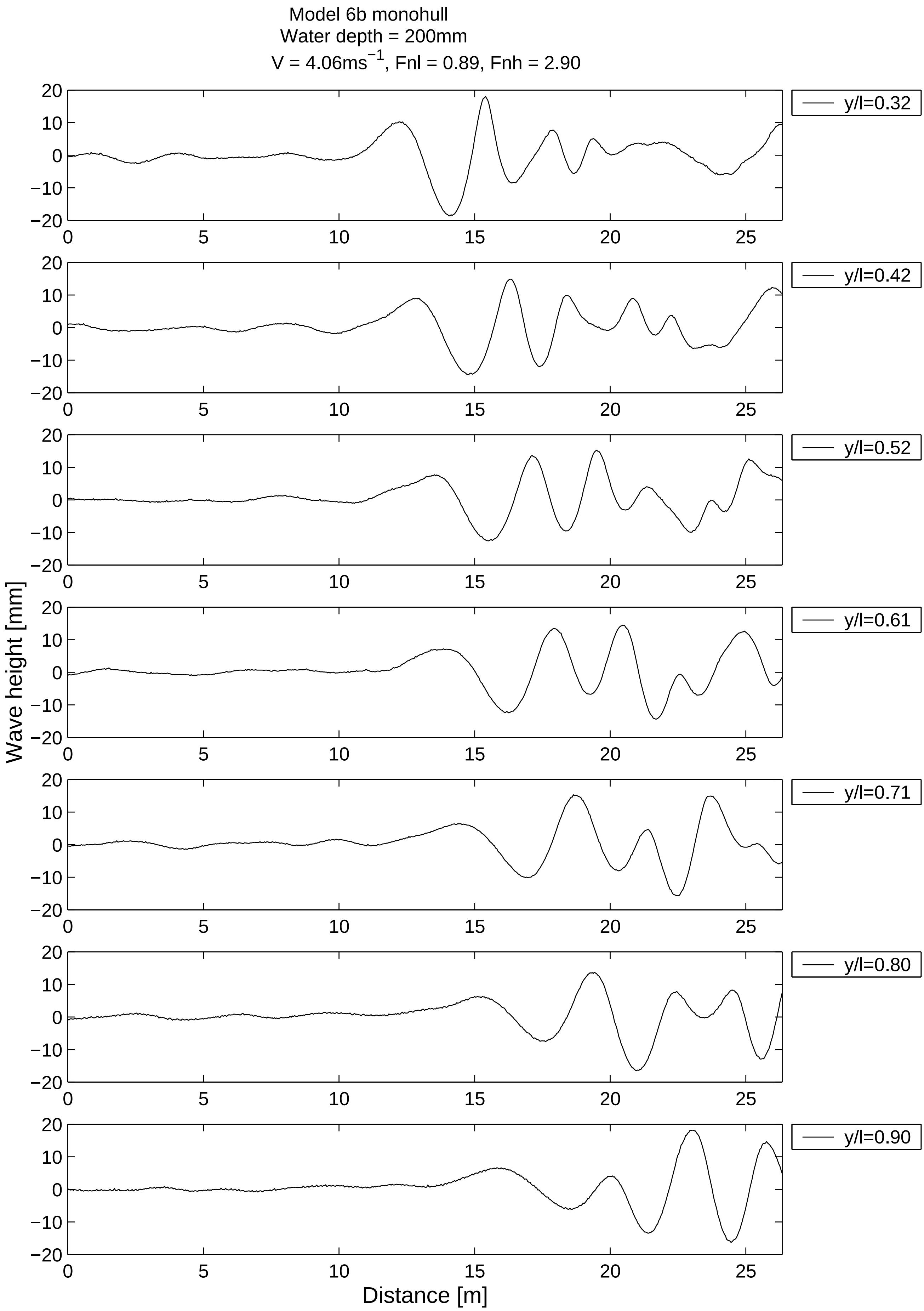
Model 6b monohull
Water depth = 200mm
V = 2.04ms−1, Fnl = 0.45, Fnh = 1.46
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 91



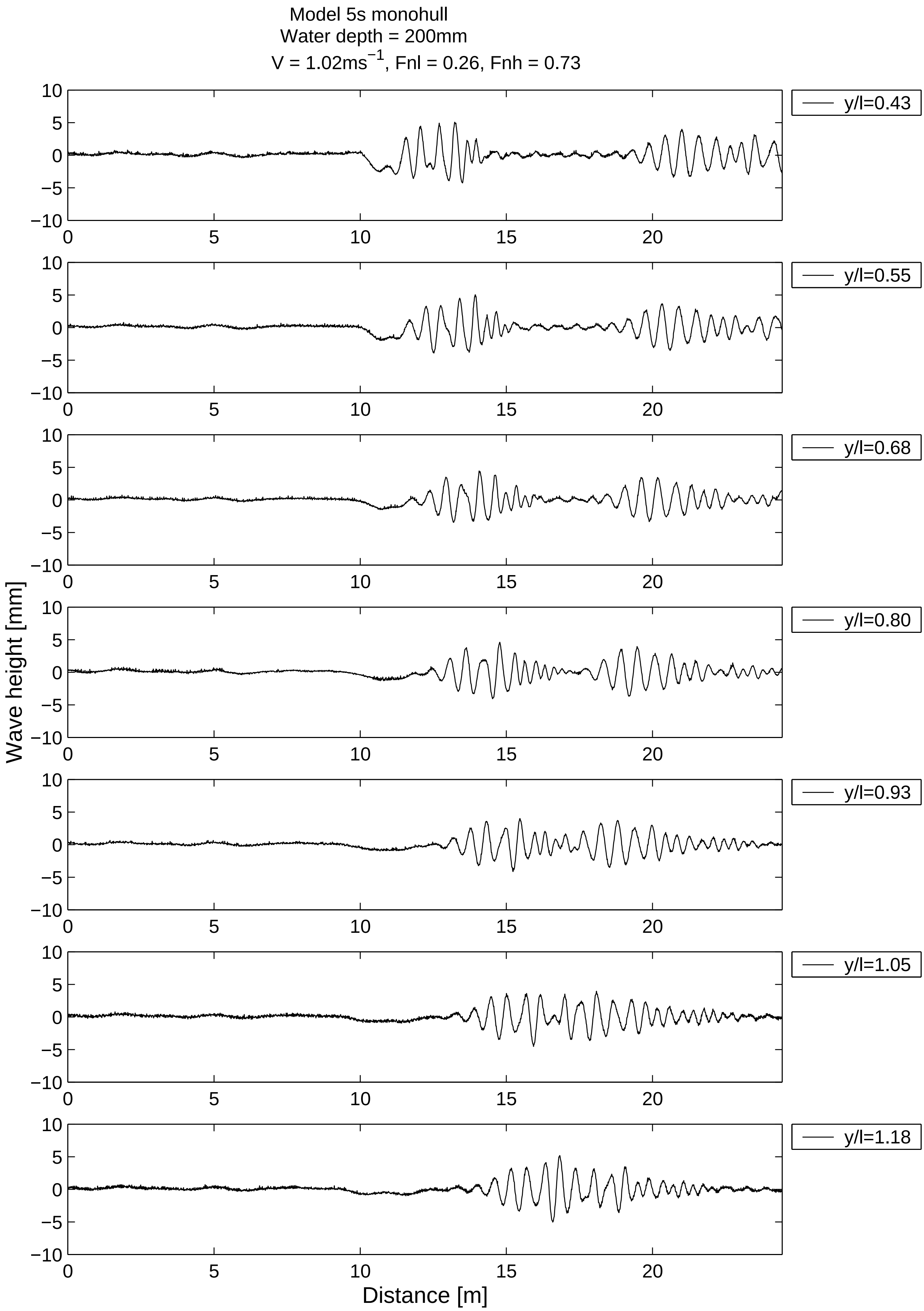
Model 6b monohull
Water depth = 200mm
V = 3.13ms−1, Fnl = 0.69, Fnh = 2.24
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 92



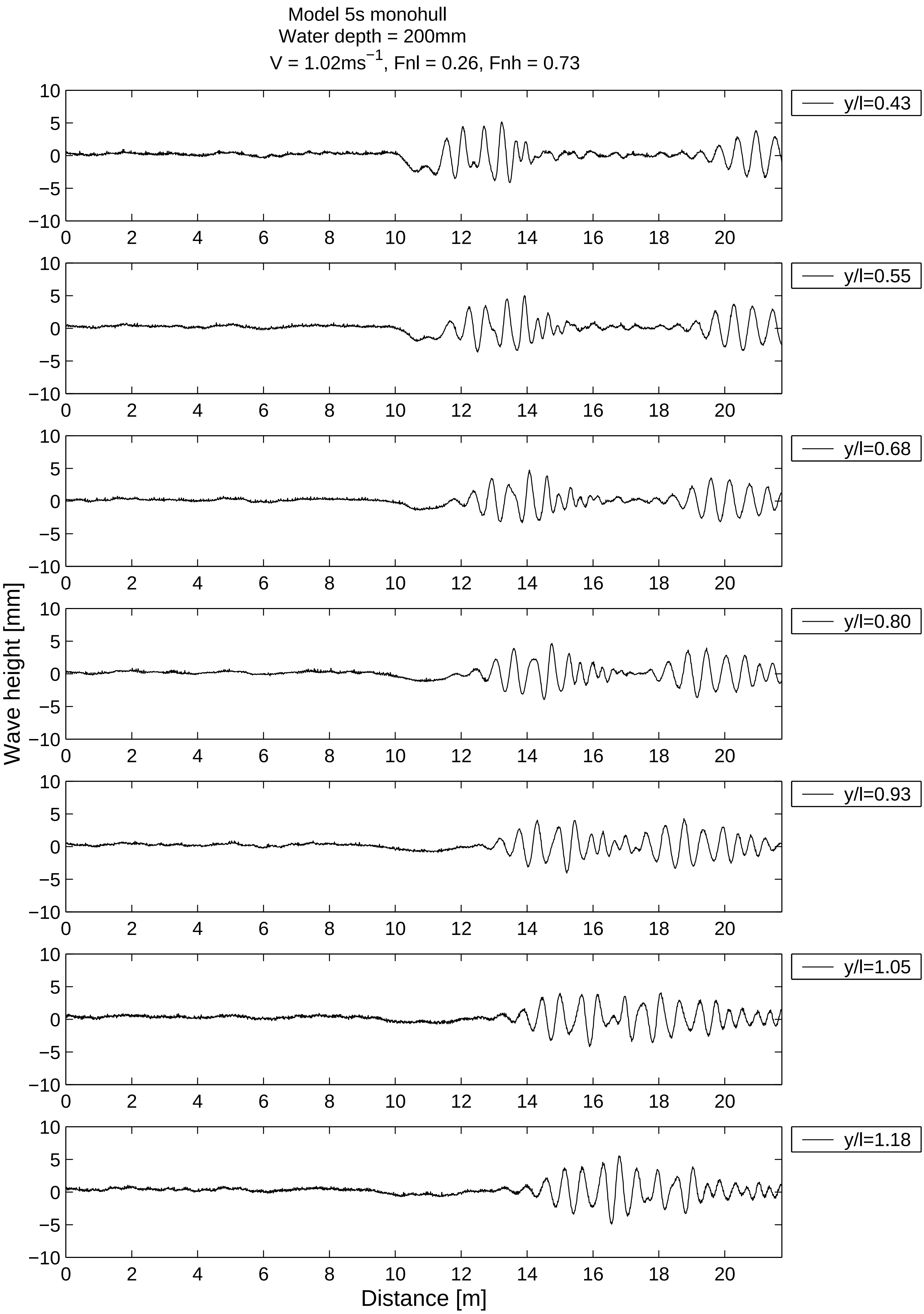
Model 6b monohull
Water depth = 200mm
V = 4.06ms−1, Fnl = 0.89, Fnh = 2.90
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

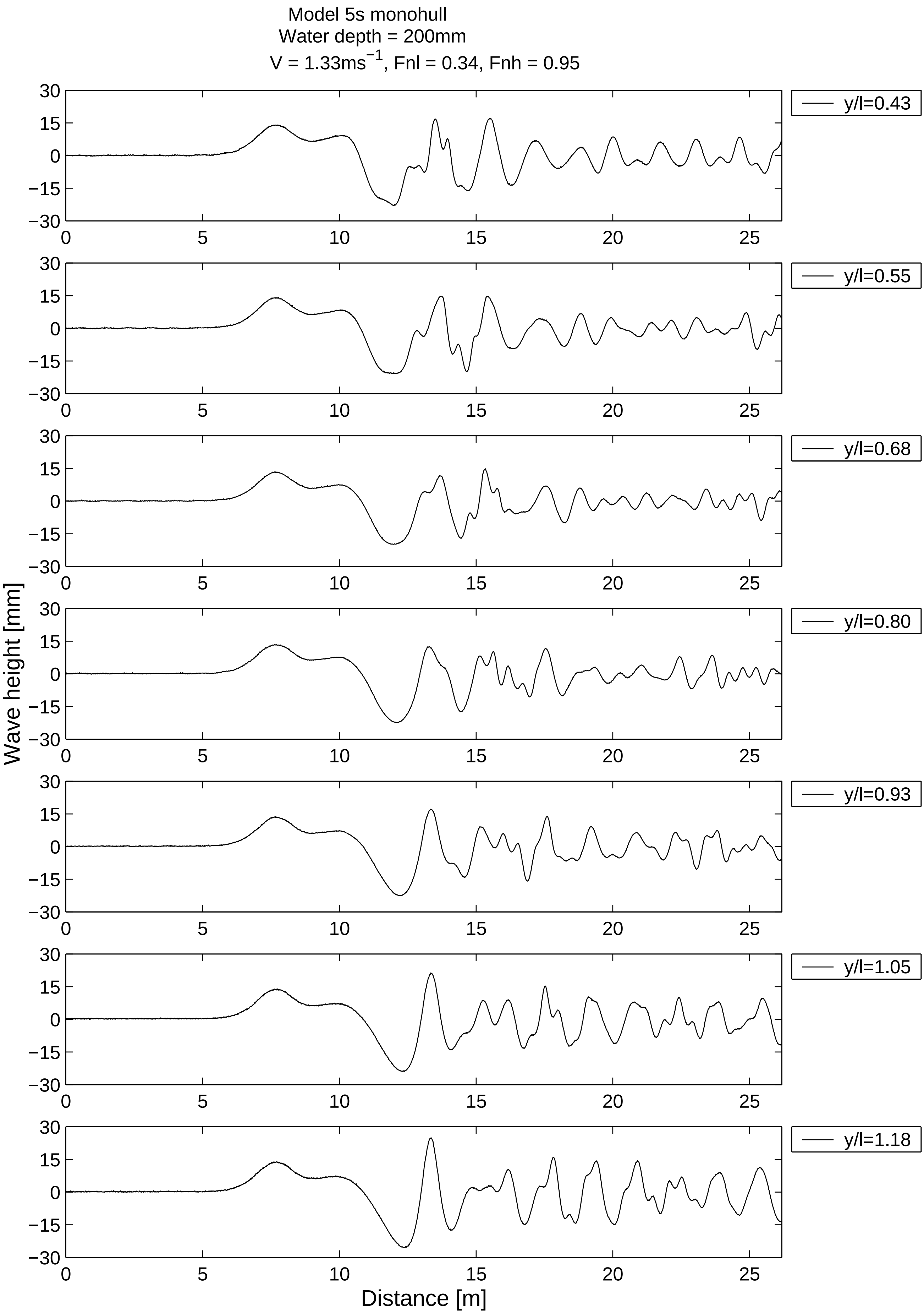
Figure 93



Model 5s monohull
Water depth = 200mm
V = 1.02ms−1, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
10
5
0
−5
−10
0
5
10
15
20

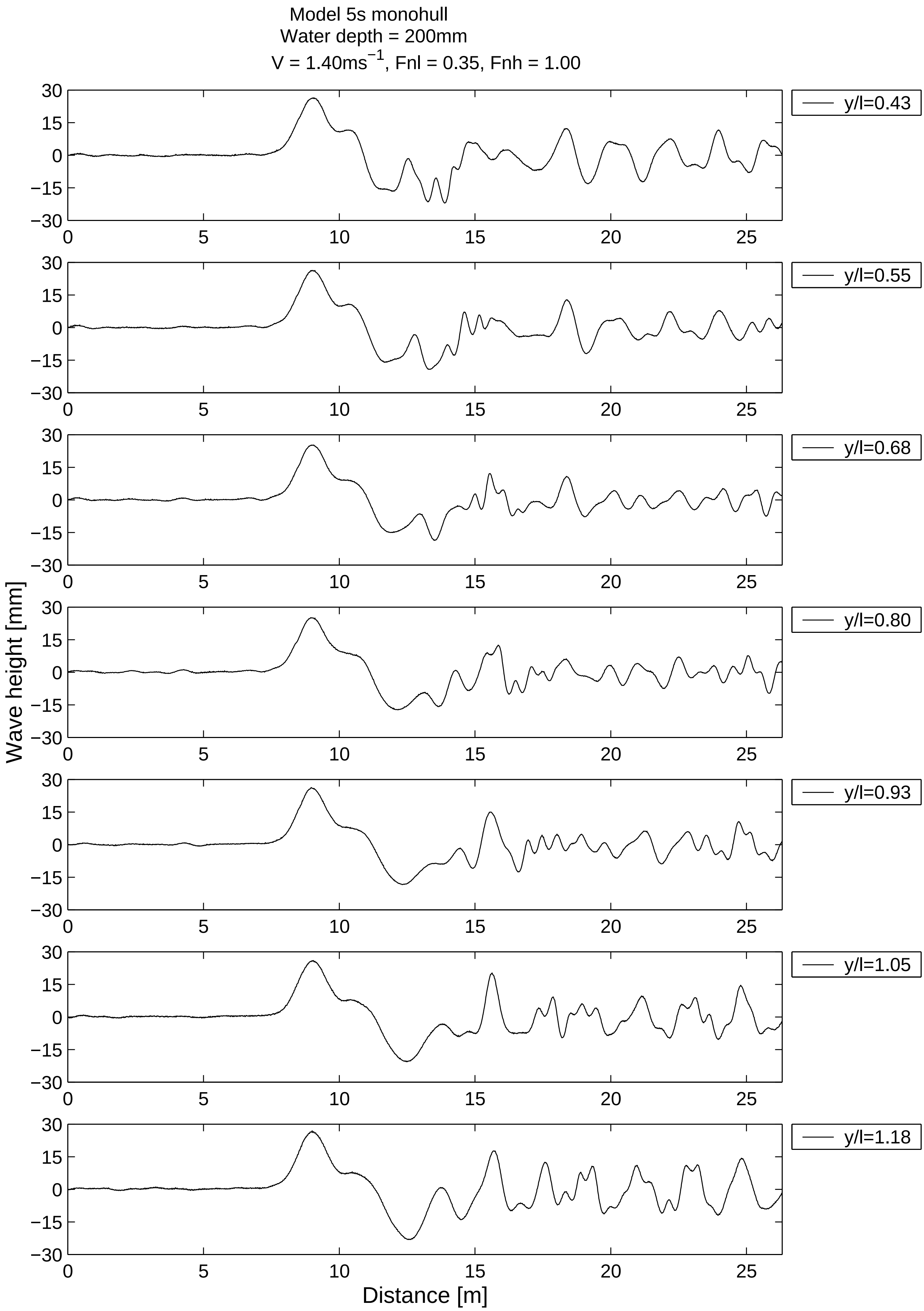
Figure 94


Model 5s monohull
Water depth = 200mm
V = 1.02ms⁻¹, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
Figure 95



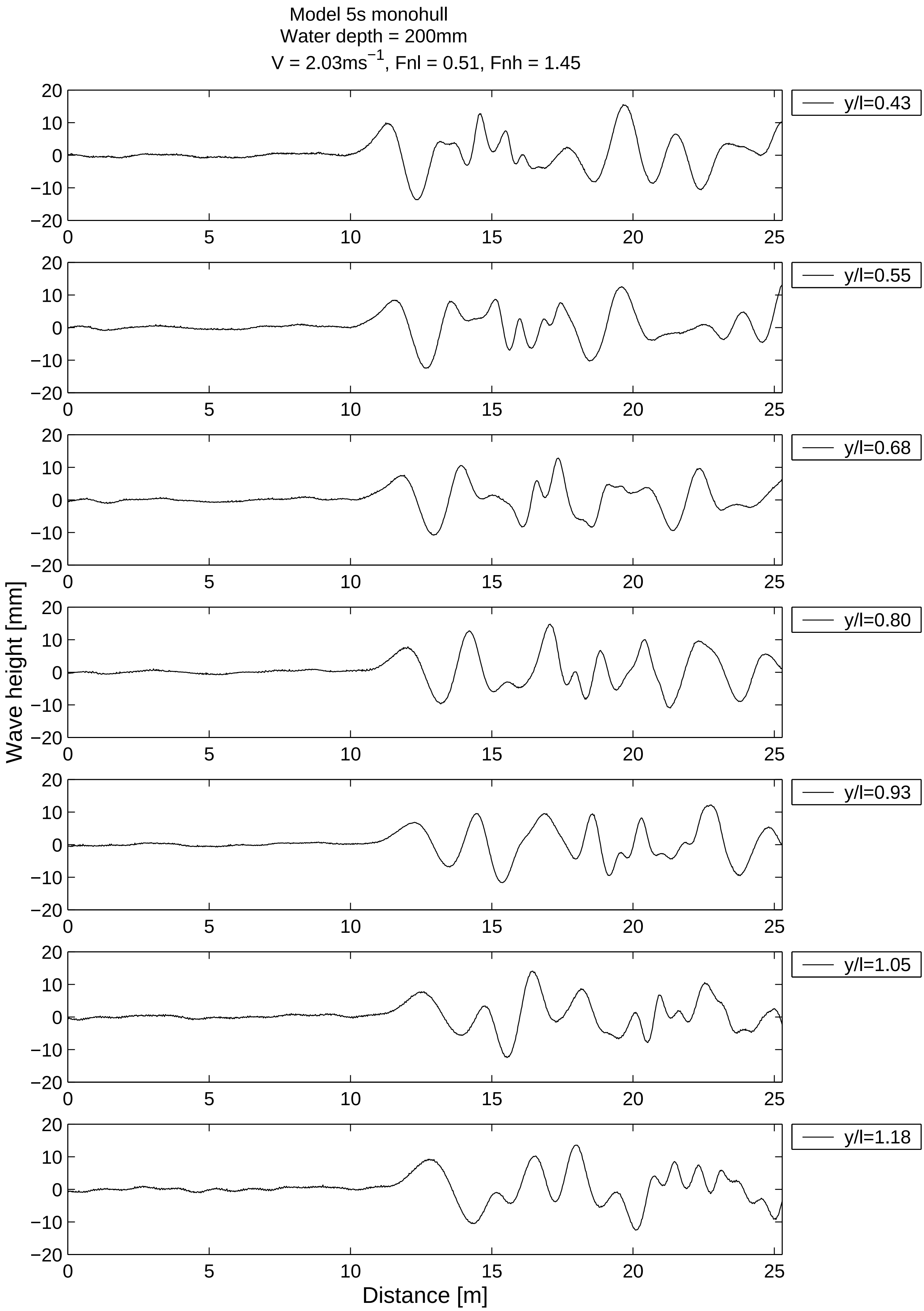
Model 5s monohull
Water depth = 200mm
V = 1.33ms−1, Fnl = 0.34, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20
25

Figure 96



Model 5s monohull
Water depth = 200mm
V = 1.40ms⁻¹, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 97



Model 5s monohull
Water depth = 200mm
V = 2.03ms−1, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 98

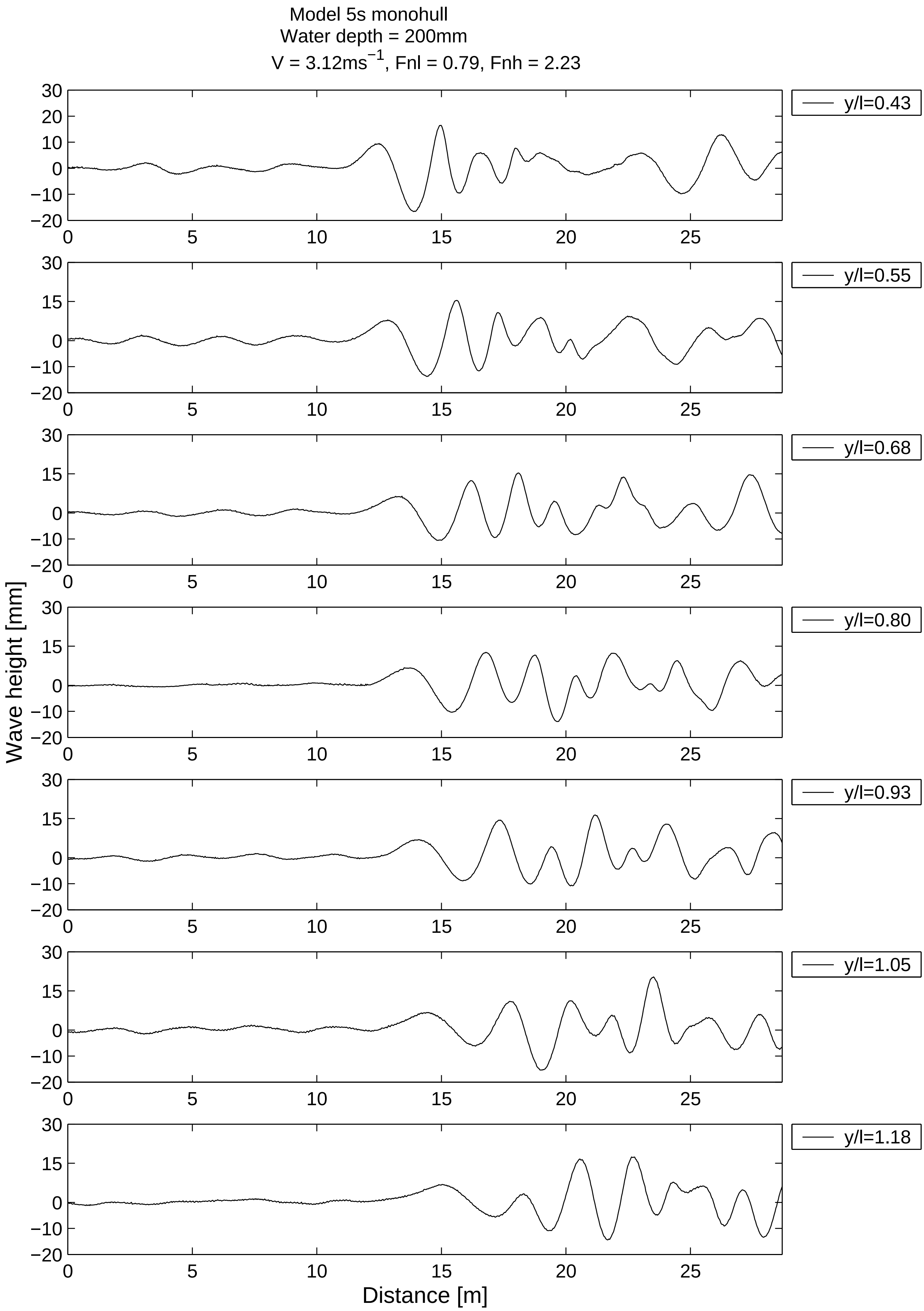
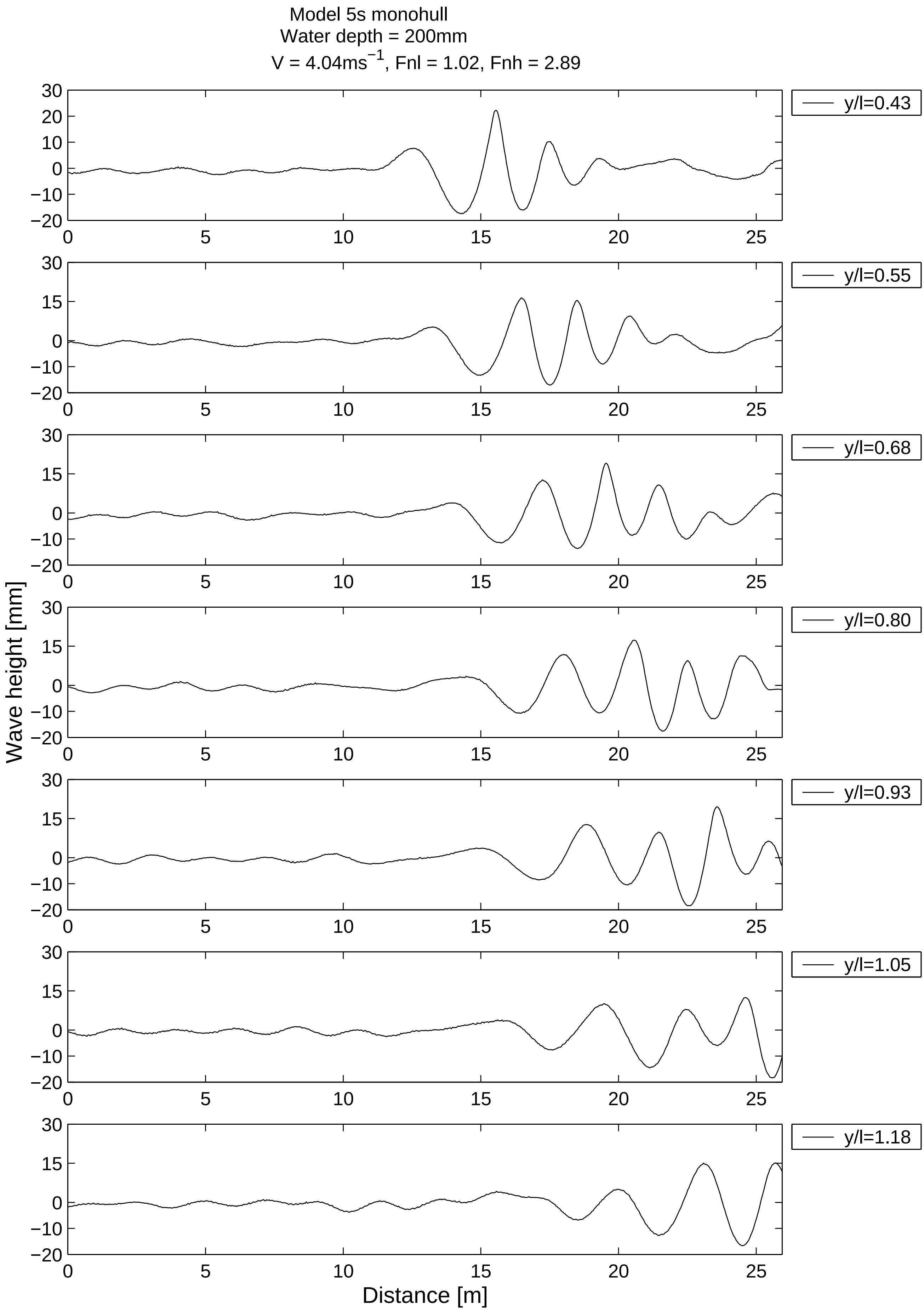

Model 5s monohull
Water depth = 200mm
V = 3.12ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 99



Model 5s monohull
Water depth = 200mm
V = 4.04ms−1, Fnl = 1.02, Fnh = 2.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 100

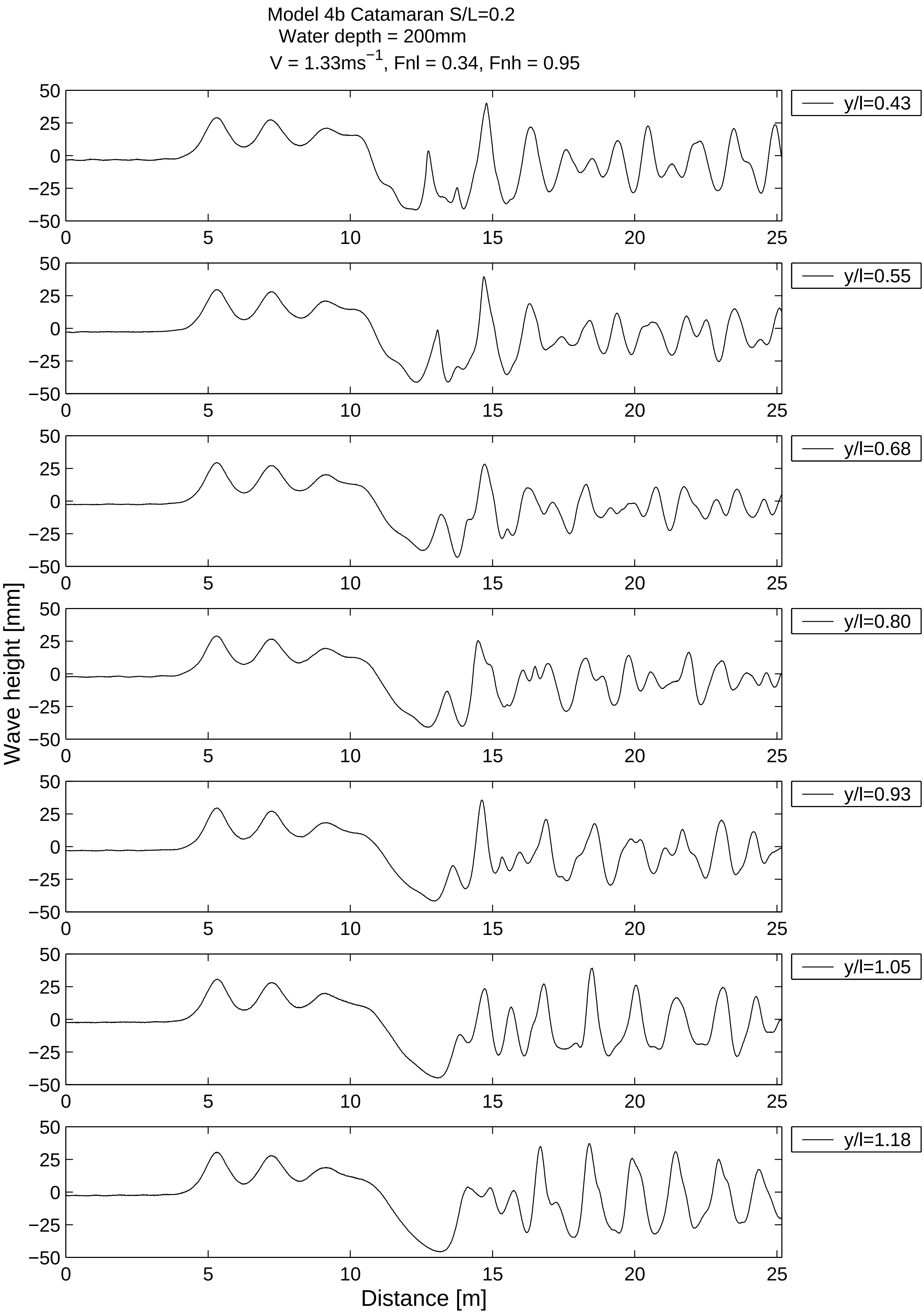
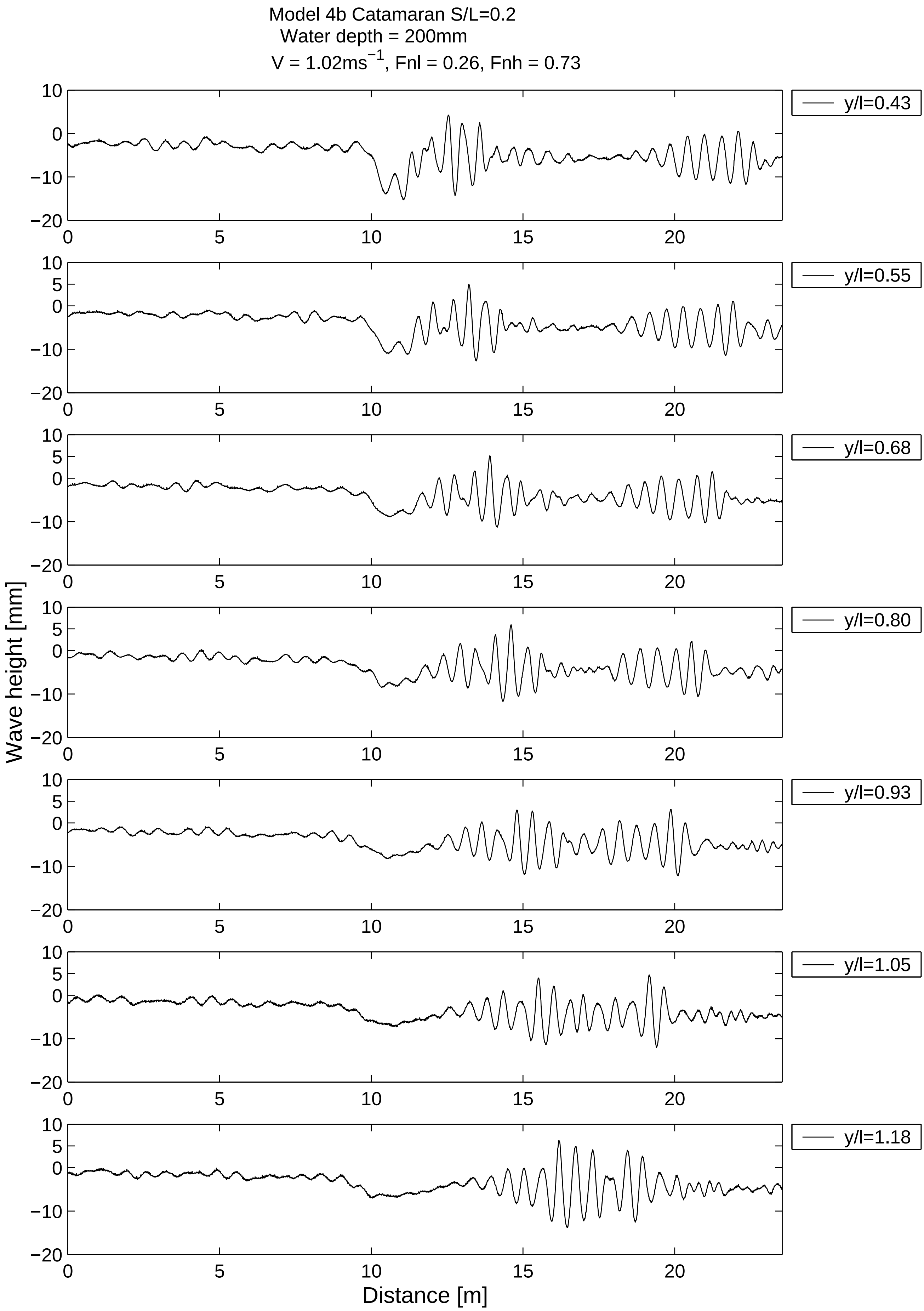

Model 4b Catamaran S/L=0.2
Water depth = 200mm
V = 1.33ms−1, Fnl = 0.34, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 101



Model 4b Catamaran S/L=0.2
Water depth = 200mm
V = 1.02ms−1, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 102

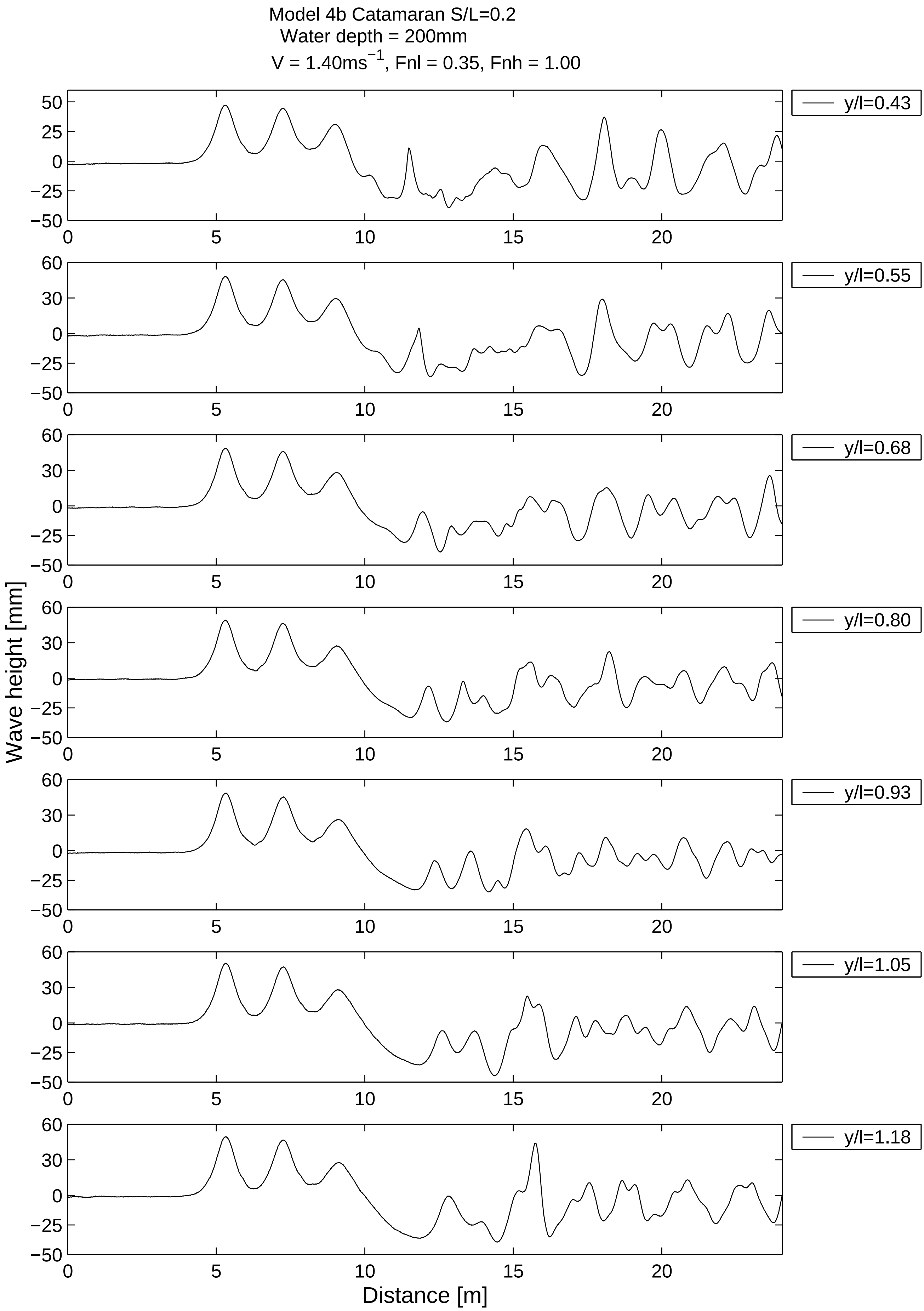
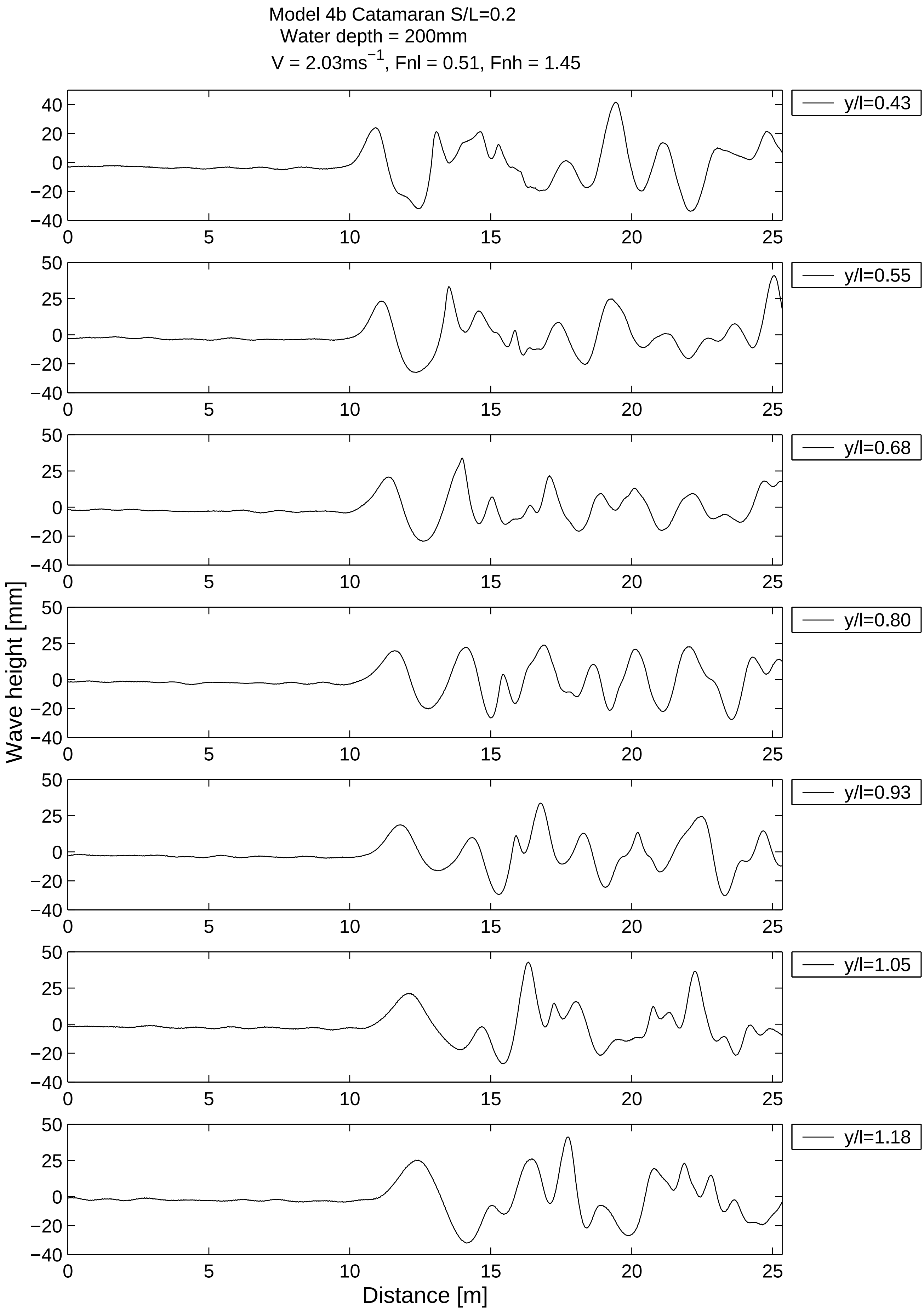
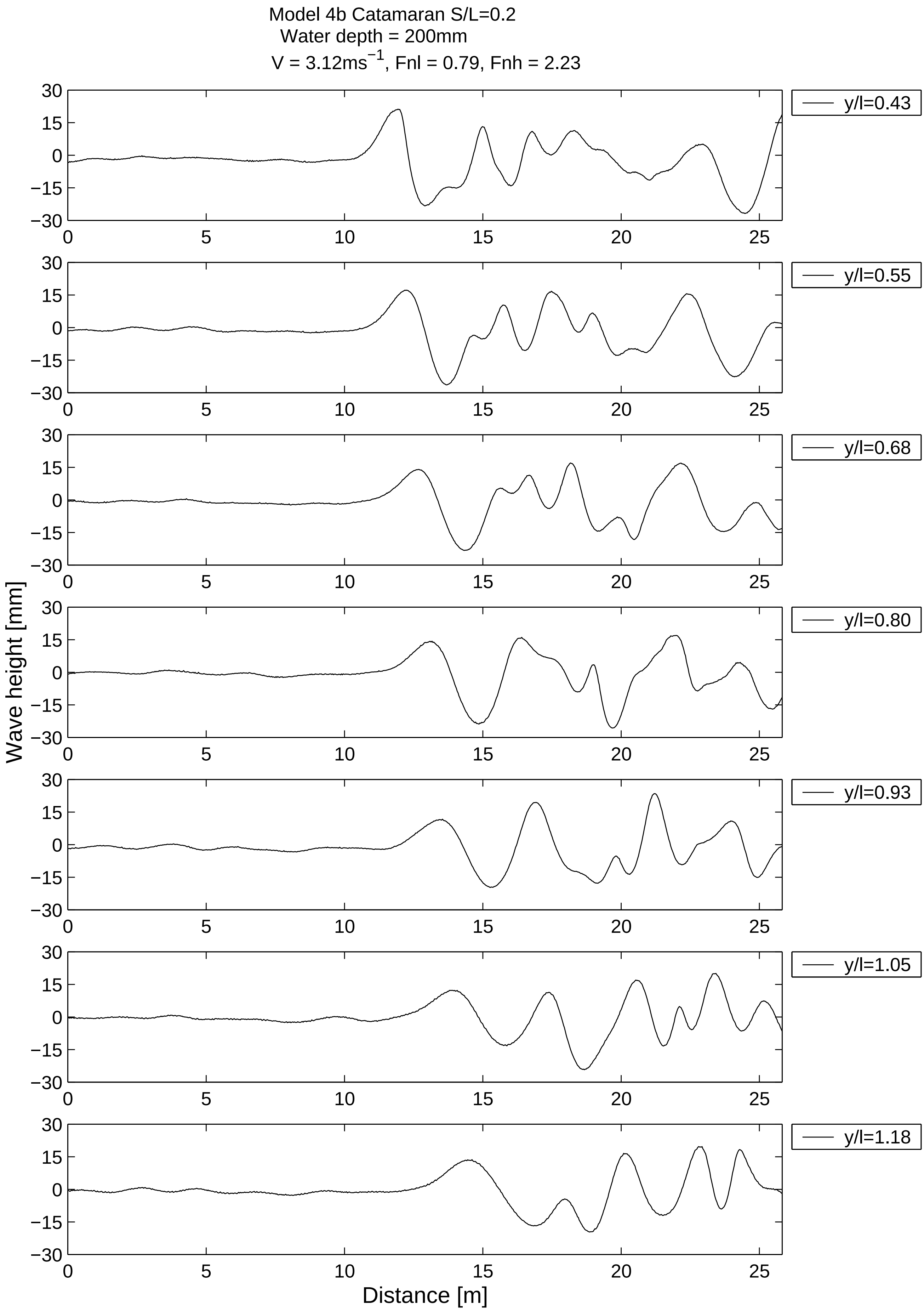

Model 4b Catamaran S/L=0.2
Water depth = 200mm
V = 1.40ms−1, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 103



Model 4b Catamaran S/L=0.2
Water depth = 200mm
V = 2.03ms−1, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 104



Model 4b Catamaran S/L=0.2
Water depth = 200mm
V = 3.12ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 105

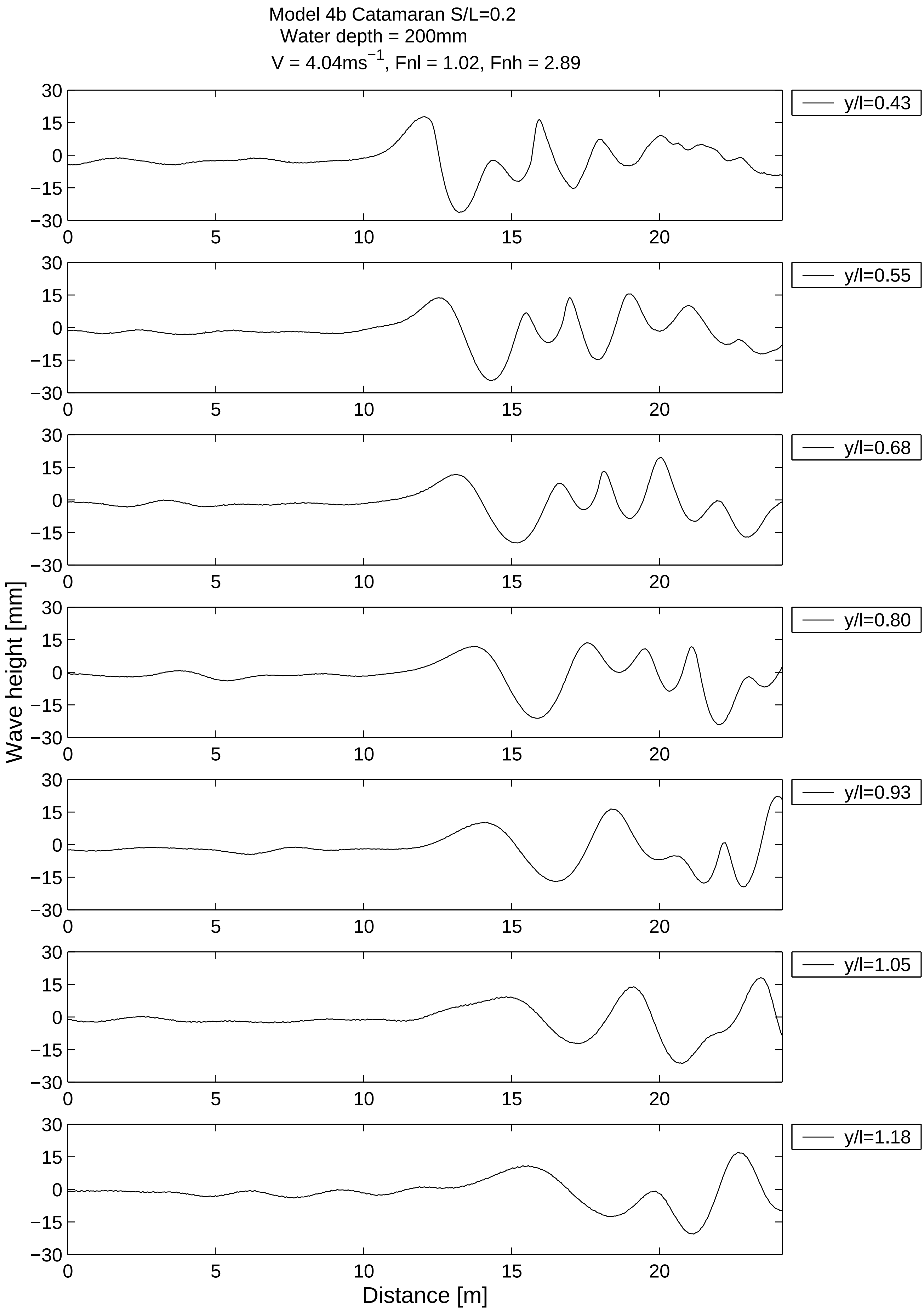
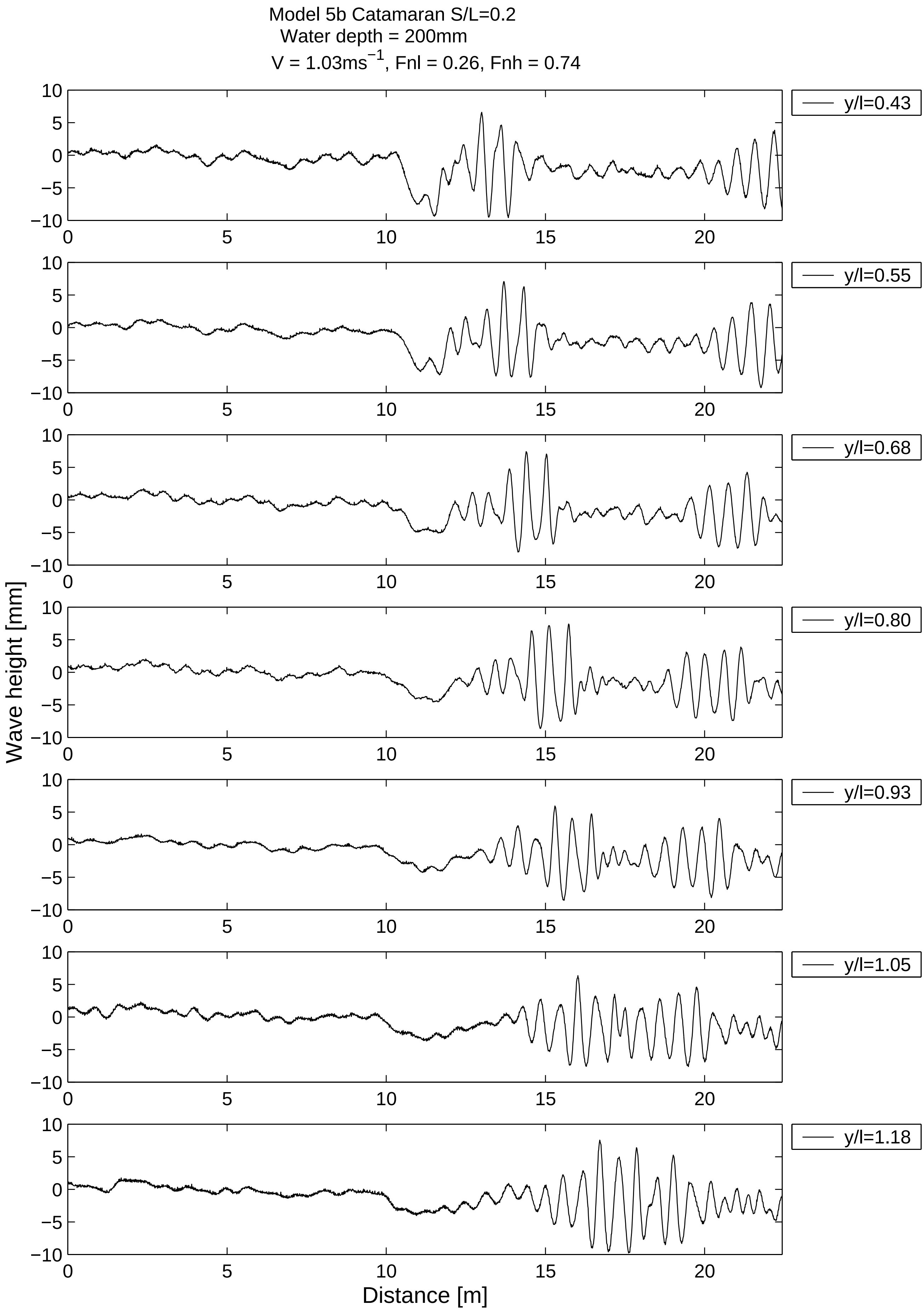

Model 4b Catamaran S/L=0.2
Water depth = 200mm
V = 4.04ms−1, Fnl = 1.02, Fnh = 2.89
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18

Figure 106



Model 5b Catamaran S/L=0.2
Water depth = 200mm
V = 1.03ms^{-1}, Fnl = 0.26, Fnh = 0.74
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 107

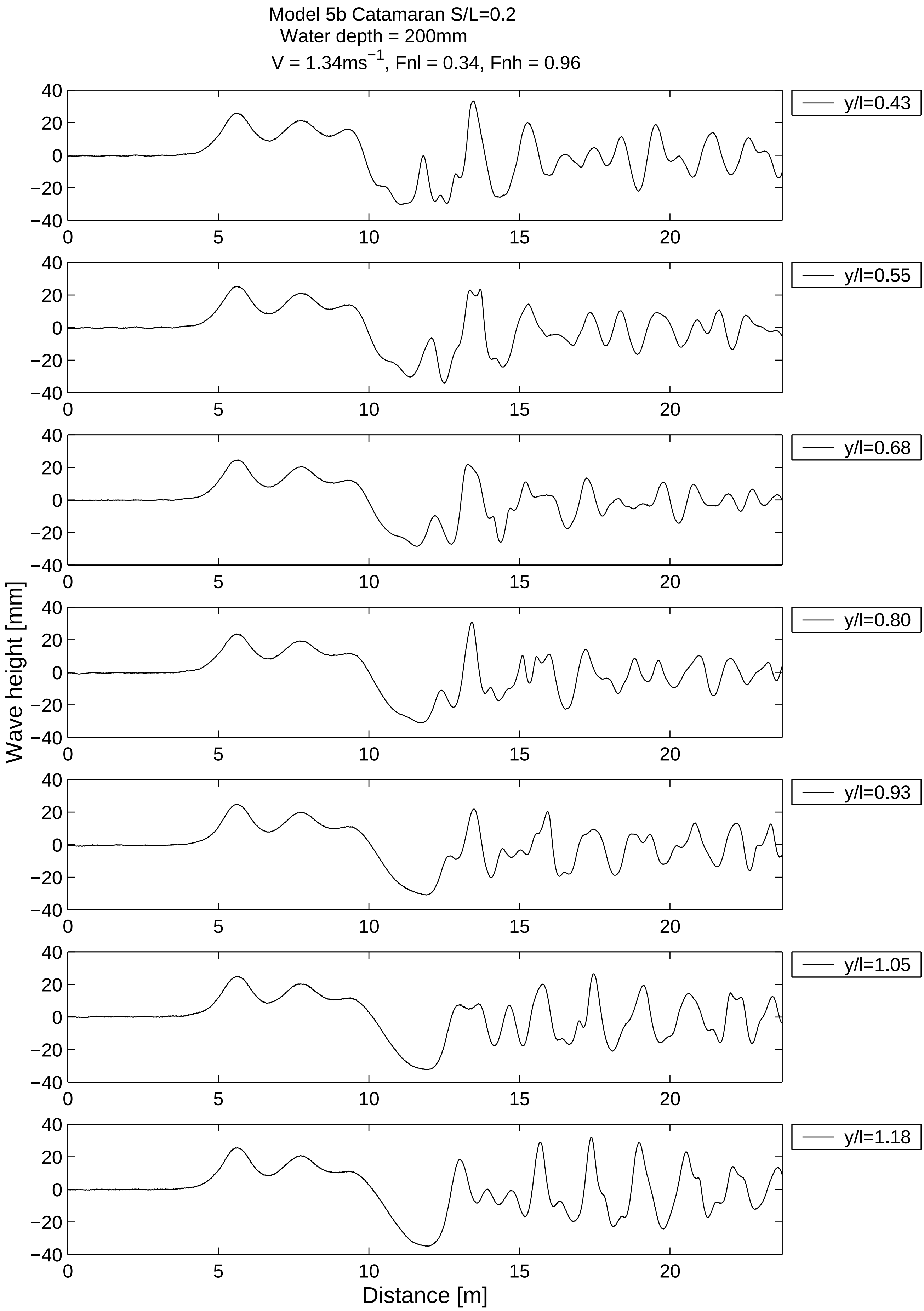
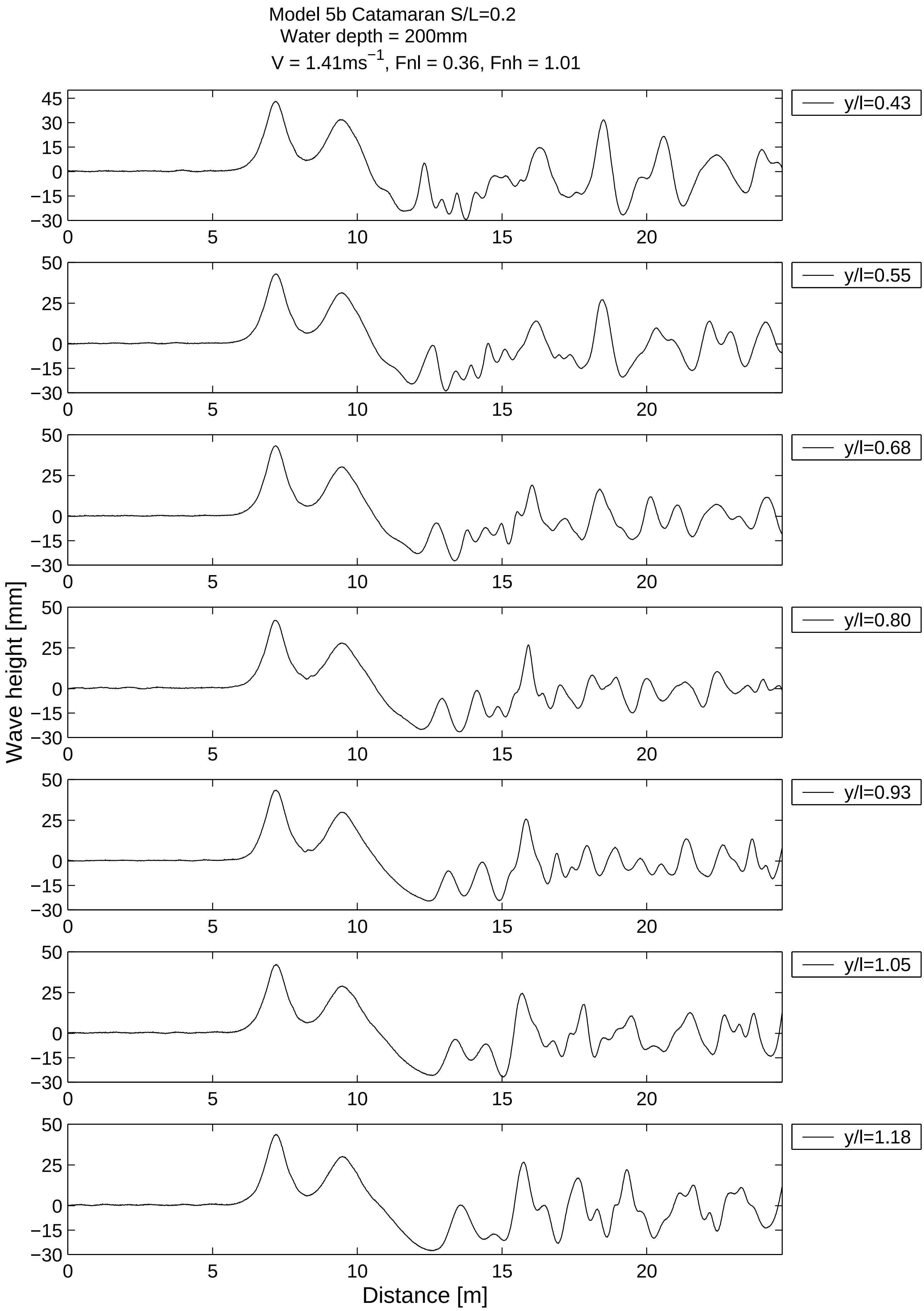

Model 5b Catamaran S/L=0.2
Water depth = 200mm
V = 1.34ms−1, Fnl = 0.34, Fnh = 0.96
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 108


Model 5b Catamaran S/L=0.2
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.36, Fnh = 1.01
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
Figure 109

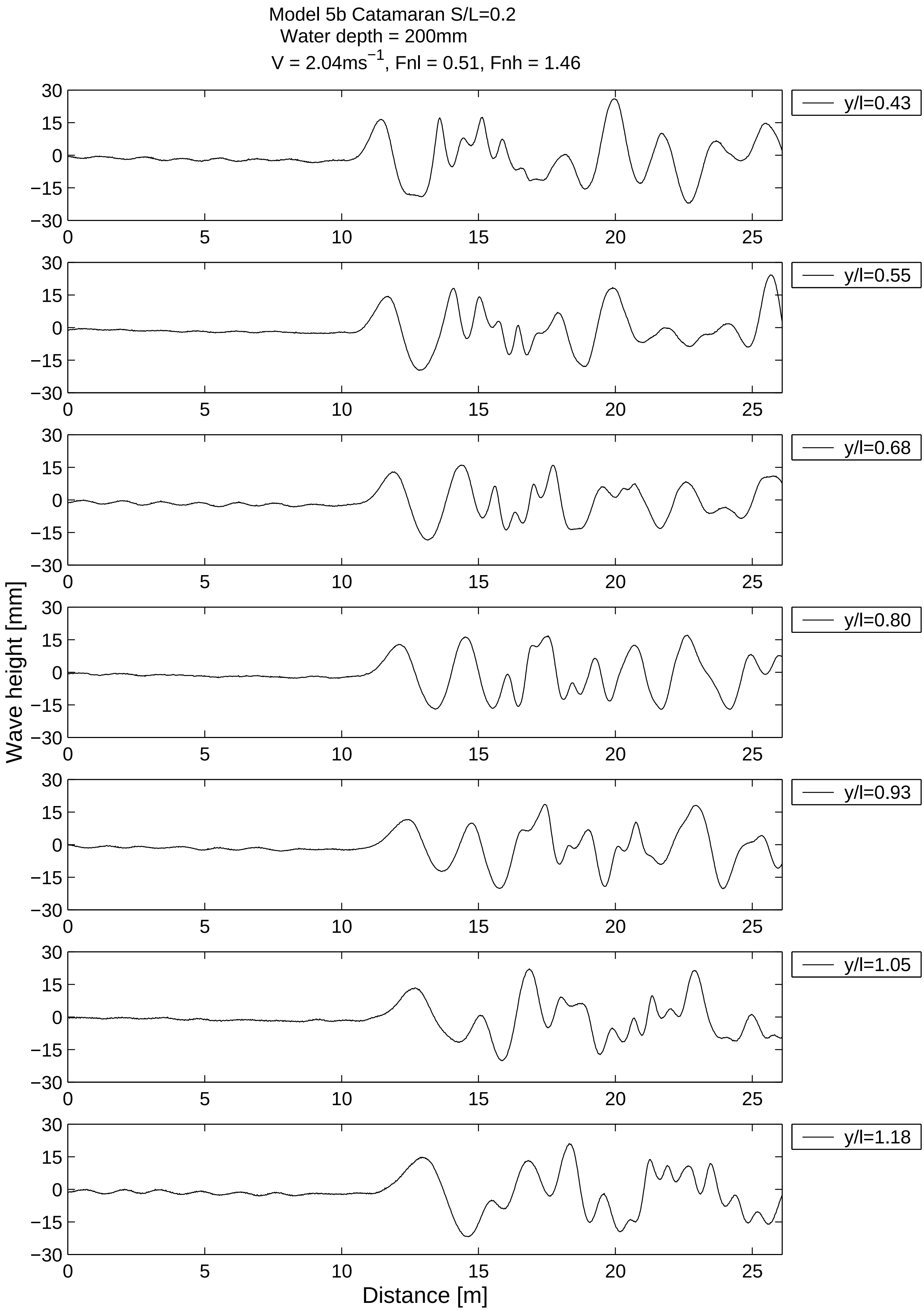

Model 5b Catamaran S/L=0.2
Water depth = 200mm
V = 2.04ms−1, Fnl = 0.51, Fnh = 1.46
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20
25

Figure 110

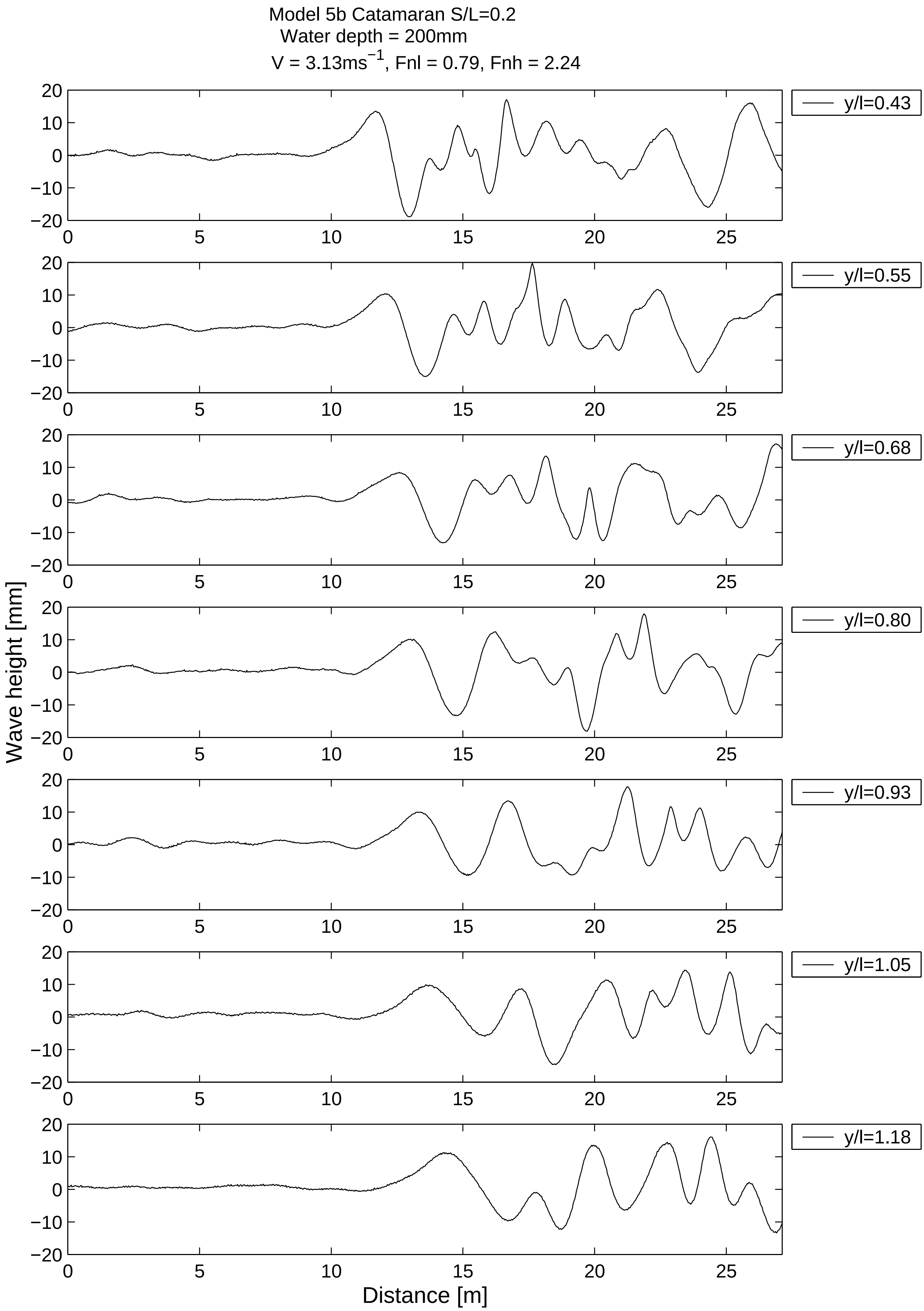
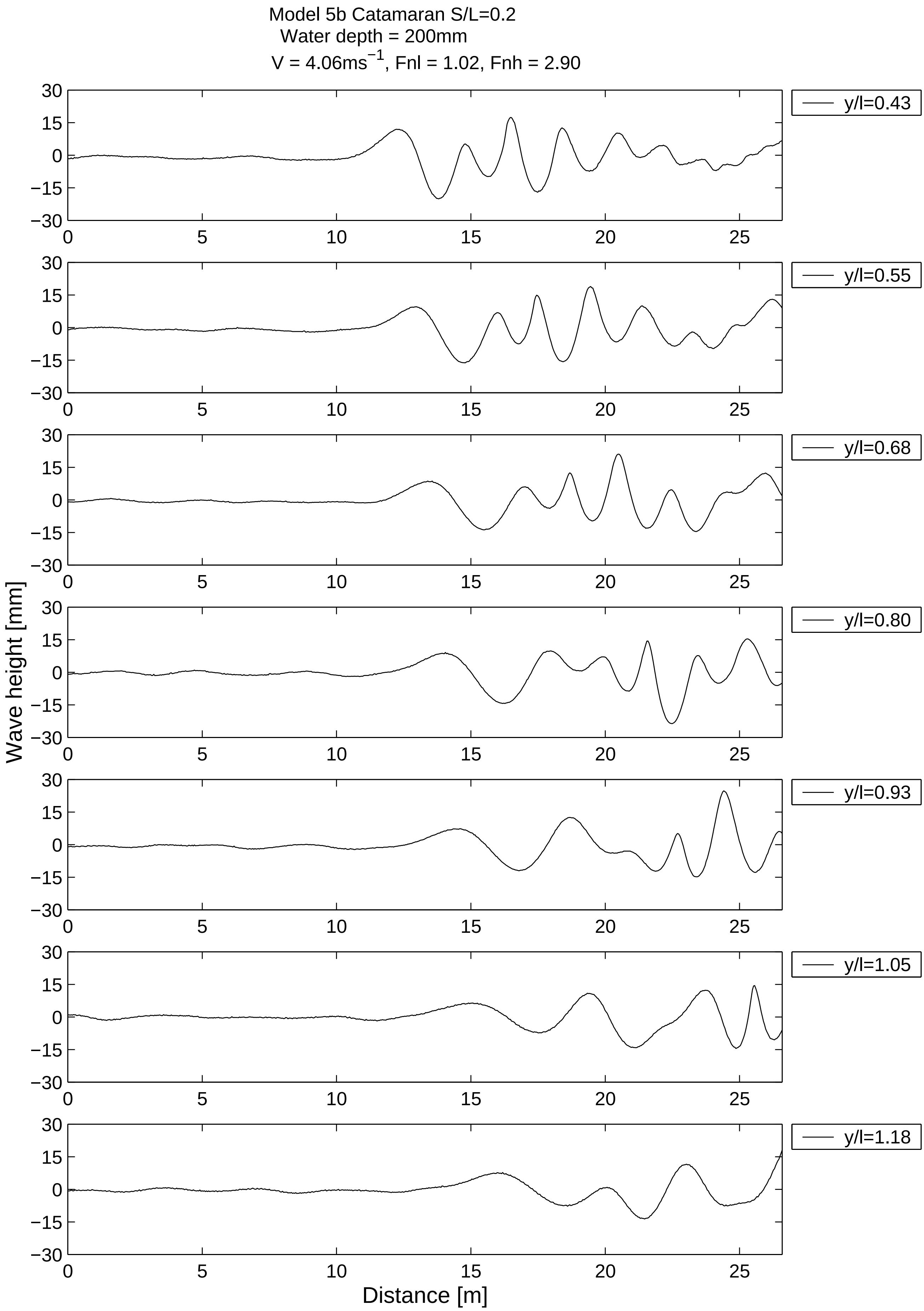
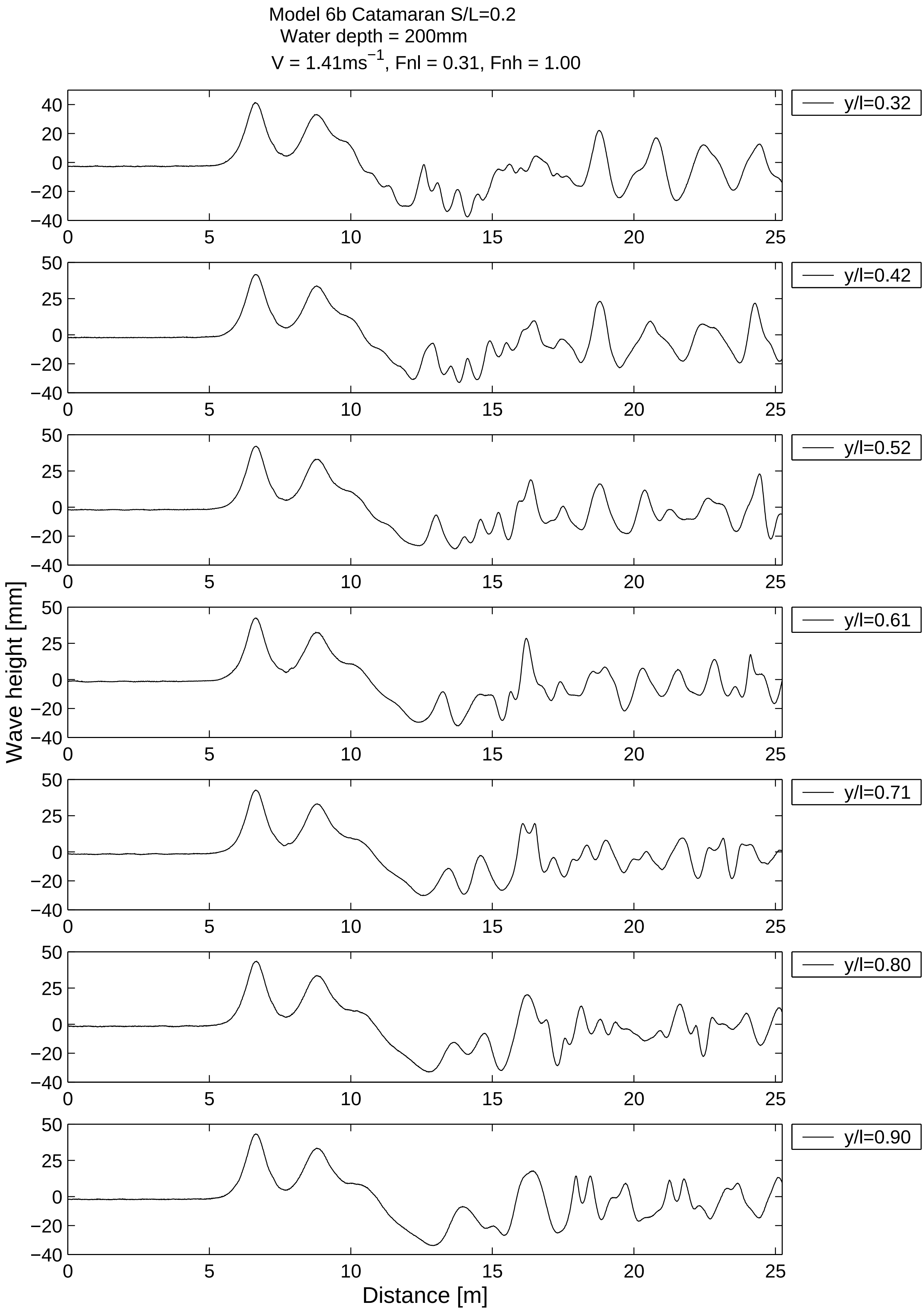

Model 5b Catamaran S/L=0.2
Water depth = 200mm
V = 3.13ms^{-1}, Fnl = 0.79, Fnh = 2.24
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

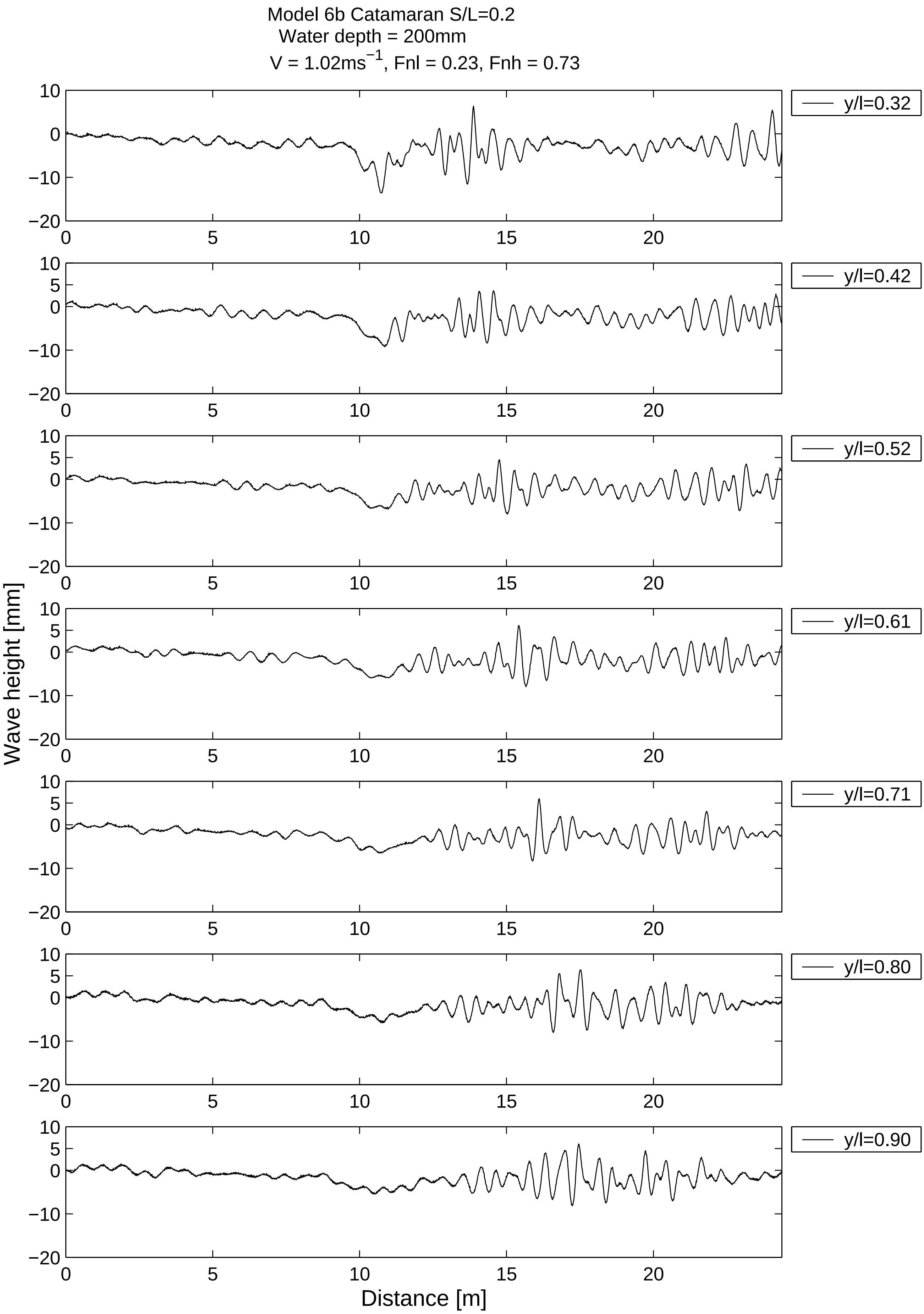
Figure 111


Model 5b Catamaran S/L=0.2
Water depth = 200mm
V = 4.06ms−1, Fnl = 1.02, Fnh = 2.90
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20
25
Figure 112



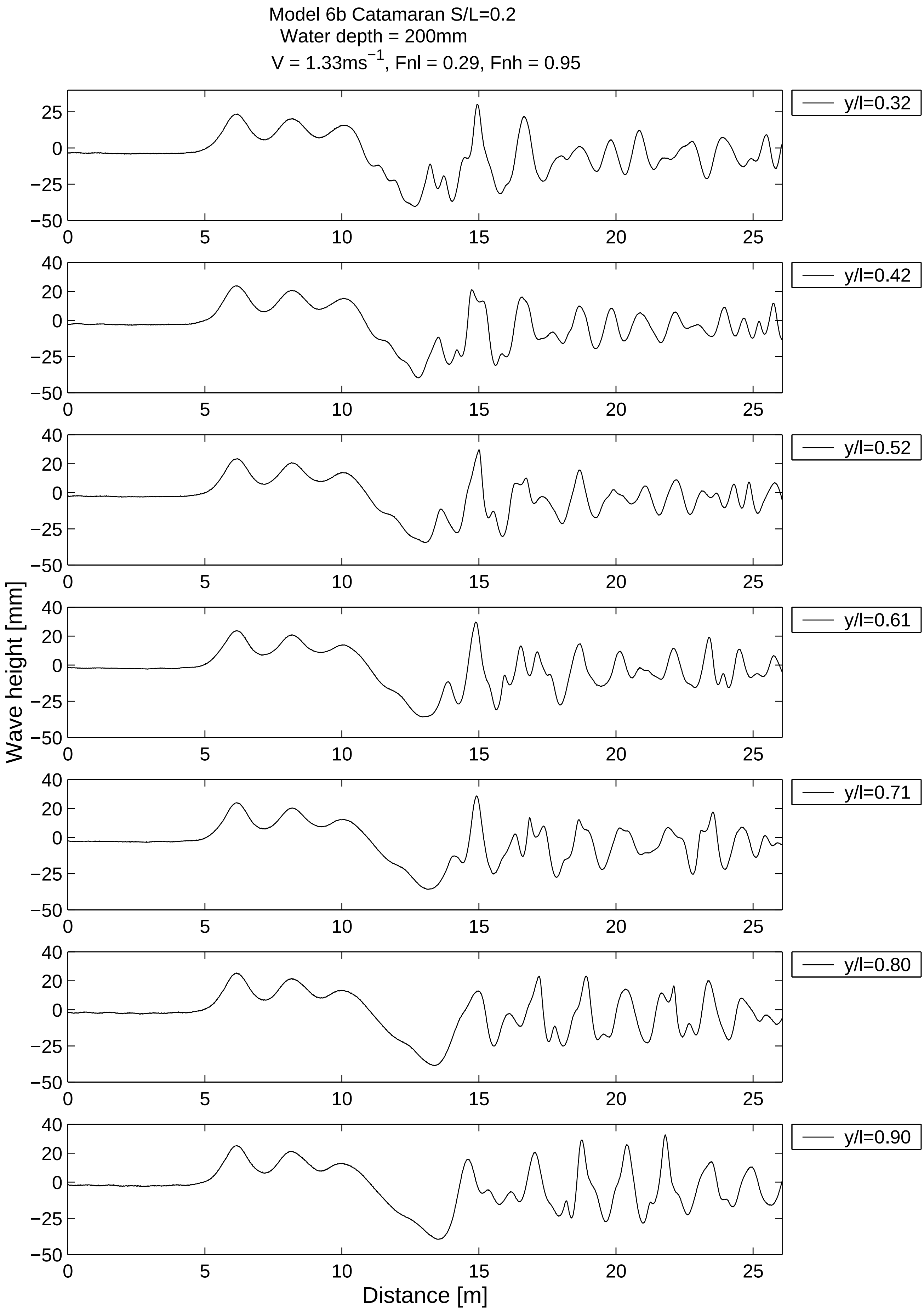
Model 6b Catamaran S/L=0.2
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.31, Fnh = 1.00
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 113



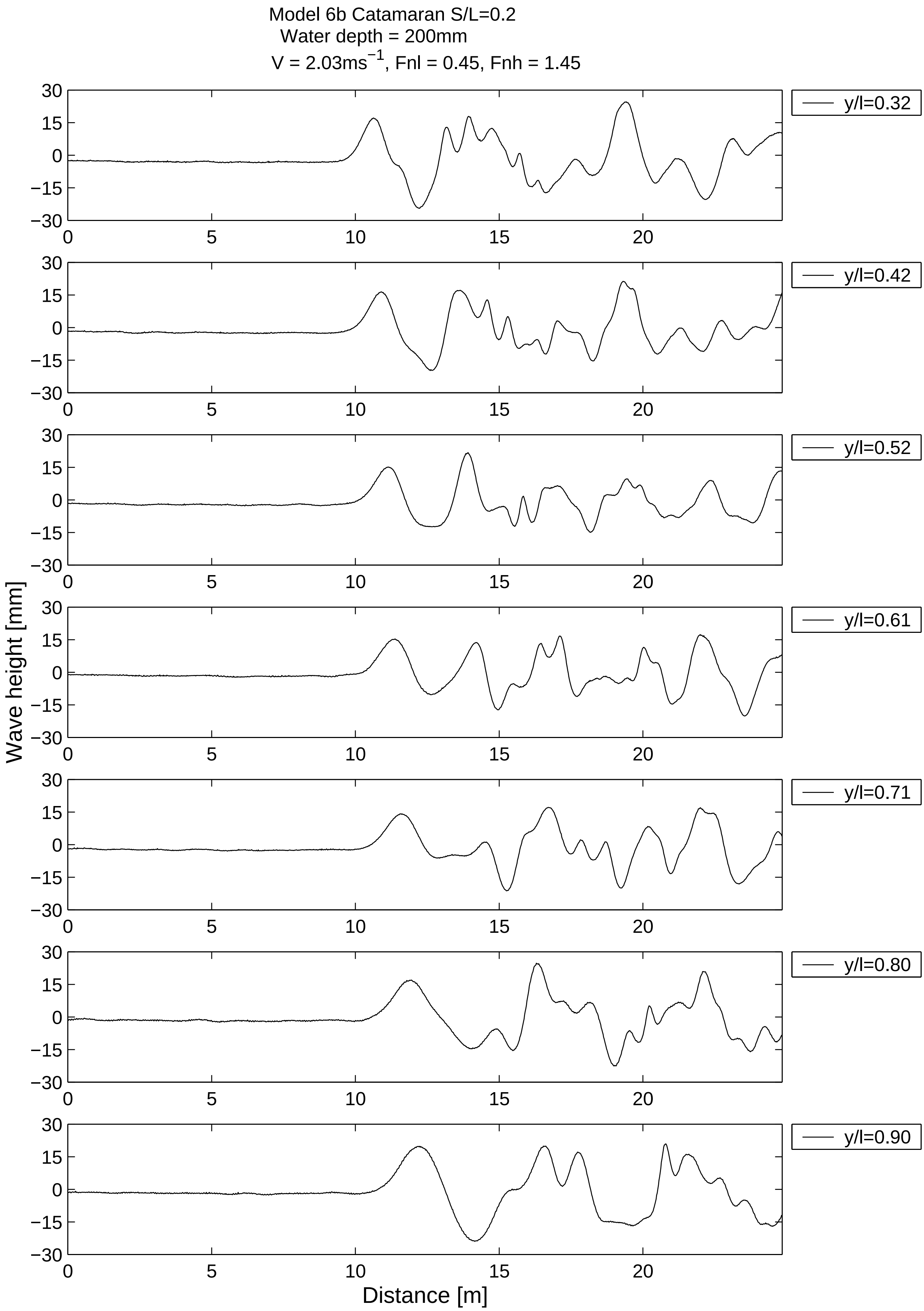
Model 6b Catamaran S/L=0.2
Water depth = 200mm
V = 1.02ms^{-1}, Fnl = 0.23, Fnh = 0.73
Wave height [mm]
Distance [m]
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90

Figure 114



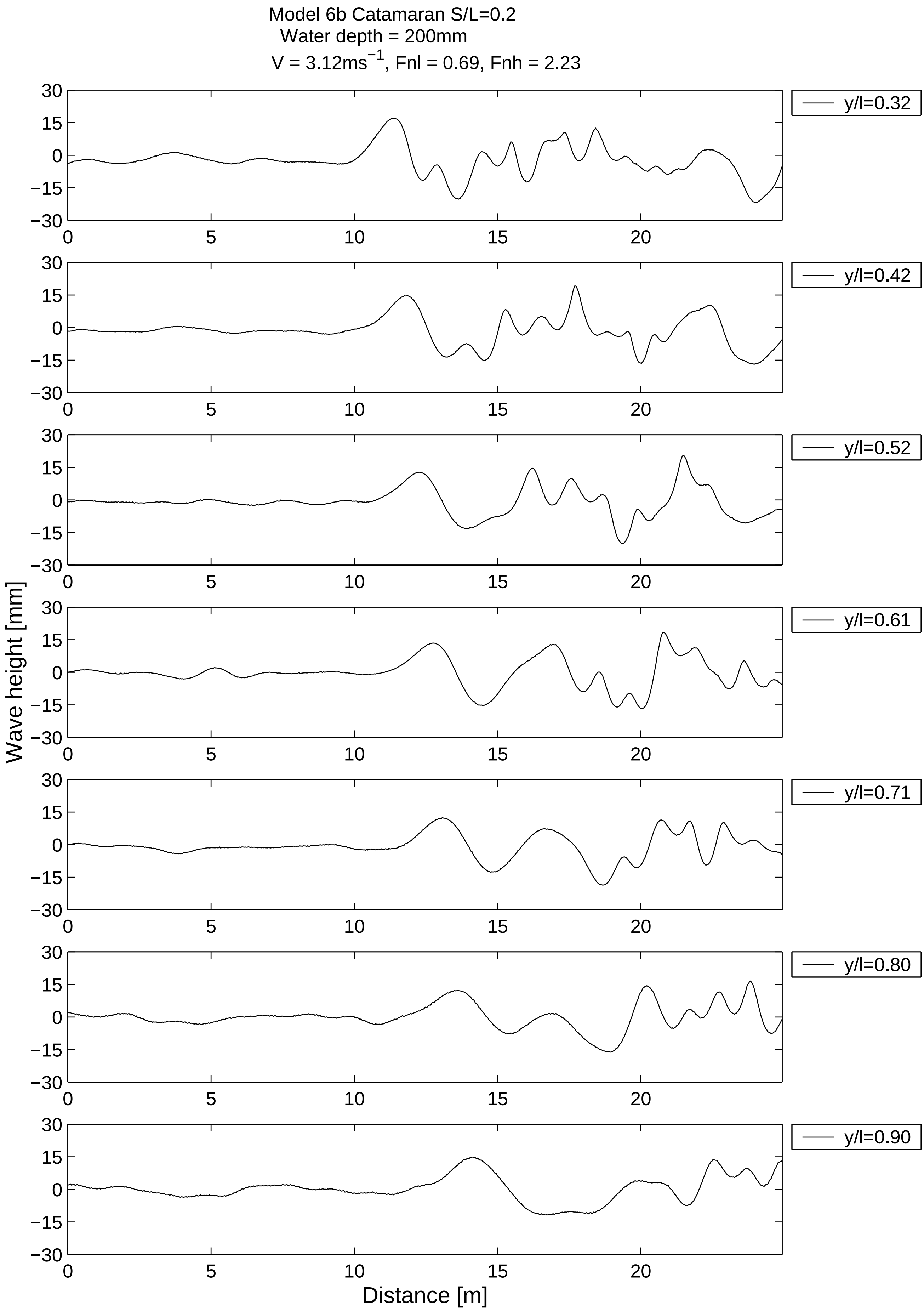
Model 6b Catamaran S/L=0.2
Water depth = 200mm
V = 1.33ms^{-1}, Fnl = 0.29, Fnh = 0.95
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 115



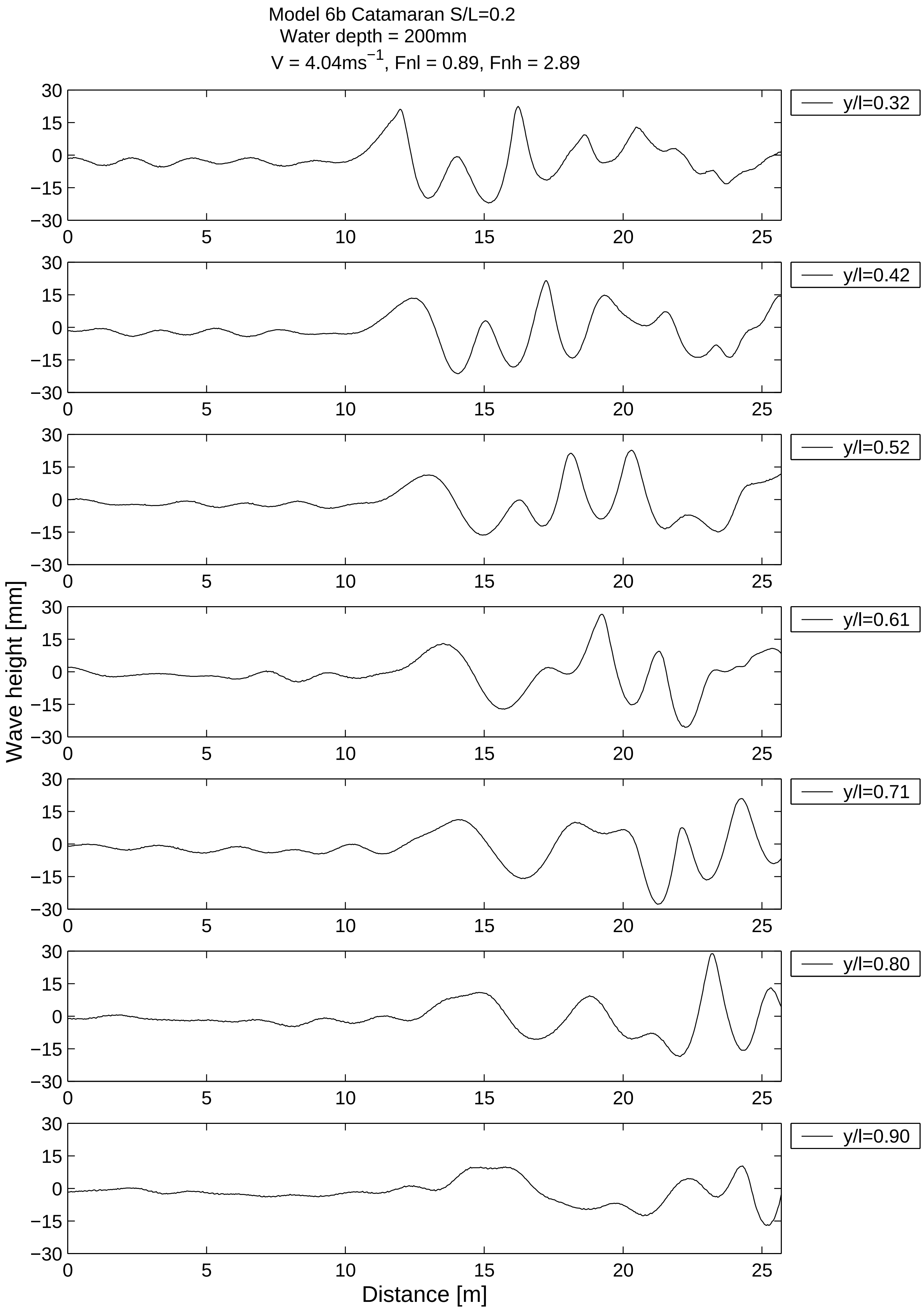
Model 6b Catamaran S/L=0.2
Water depth = 200mm
V = 2.03ms−1, Fnl = 0.45, Fnh = 1.45
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 116



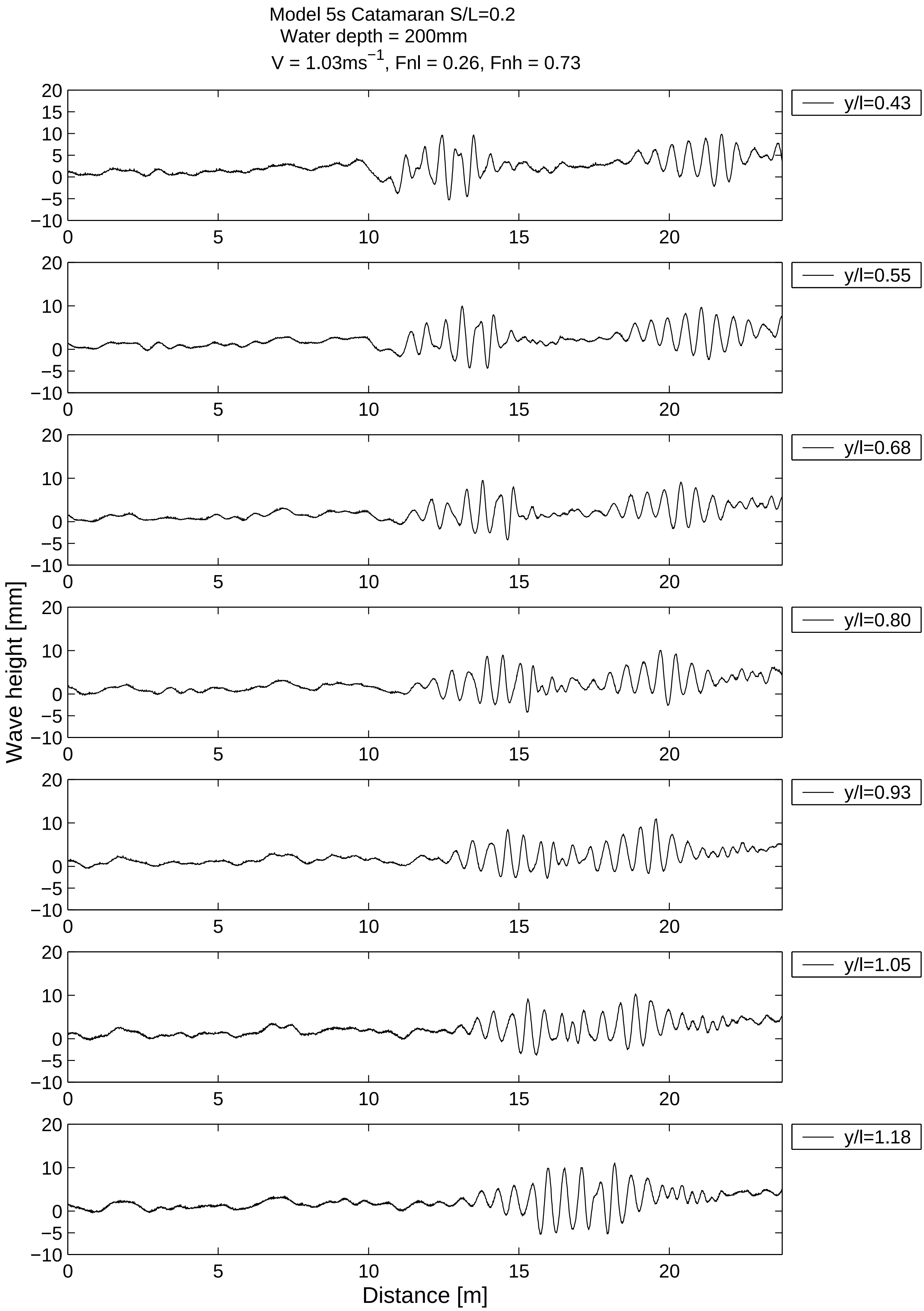
Model 6b Catamaran S/L=0.2
Water depth = 200mm
V = 3.12ms−1, Fnl = 0.69, Fnh = 2.23
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 117



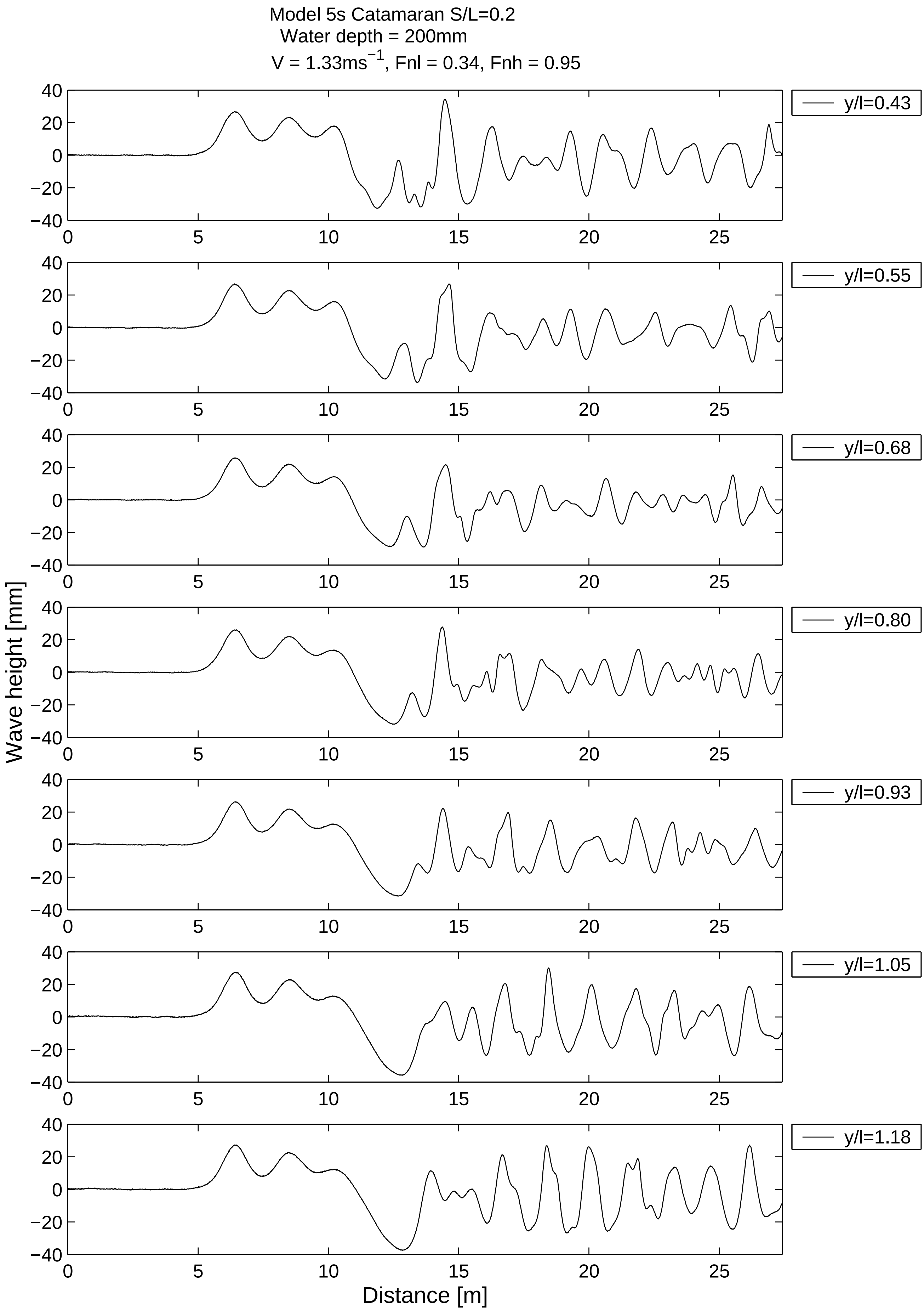
Model 6b Catamaran S/L=0.2
Water depth = 200mm
V = 4.04ms−1, Fnl = 0.89, Fnh = 2.89
y/l=0.32
y/l=0.42
y/l=0.52
y/l=0.61
y/l=0.71
y/l=0.80
y/l=0.90
Wave height [mm]
Distance [m]

Figure 118



Model 5s Catamaran S/L=0.2
Water depth = 200mm
V = 1.03ms−1, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 119



Model 5s Catamaran S/L=0.2
Water depth = 200mm
V = 1.33ms^{-1}, Fnl = 0.34, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 120

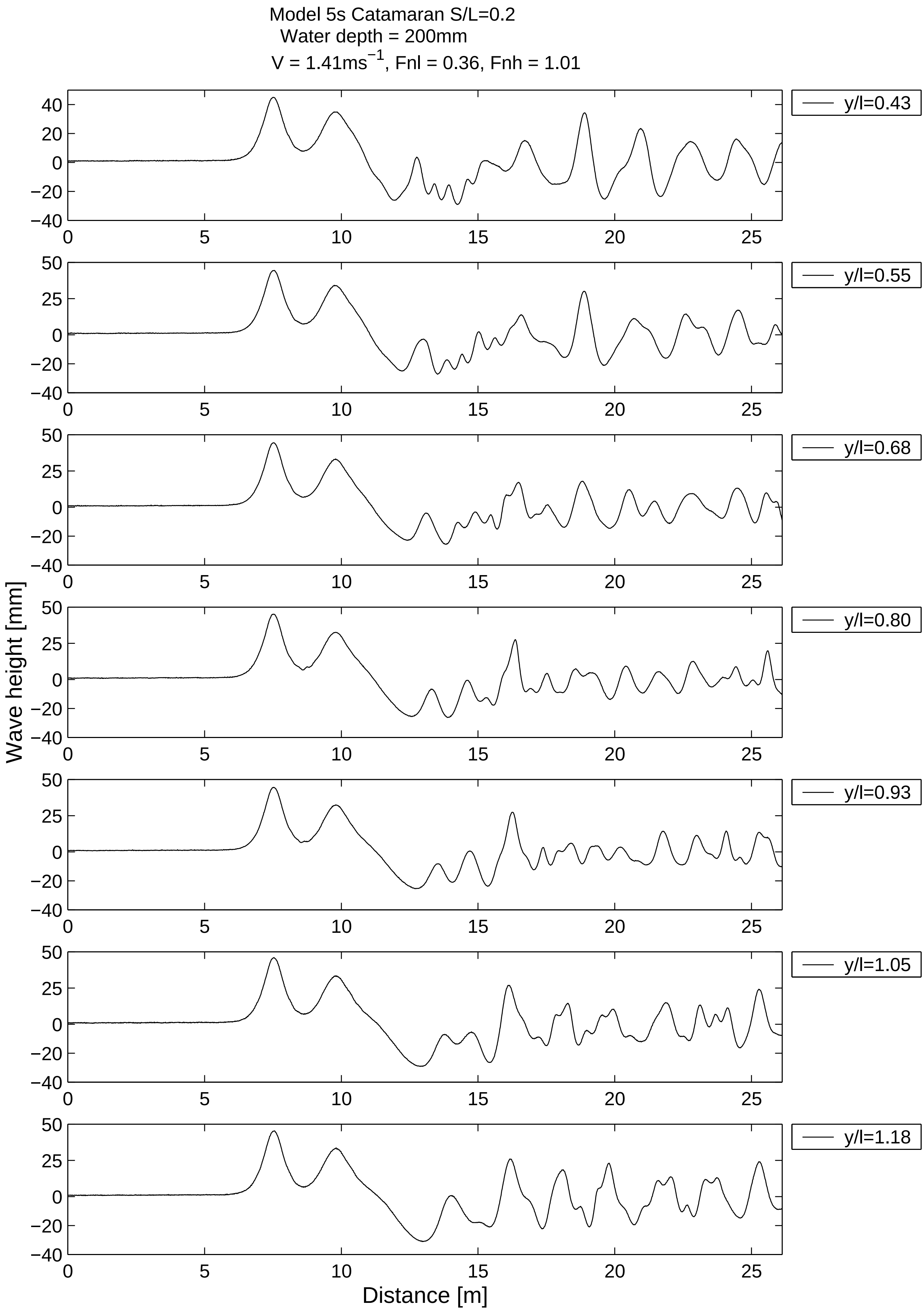
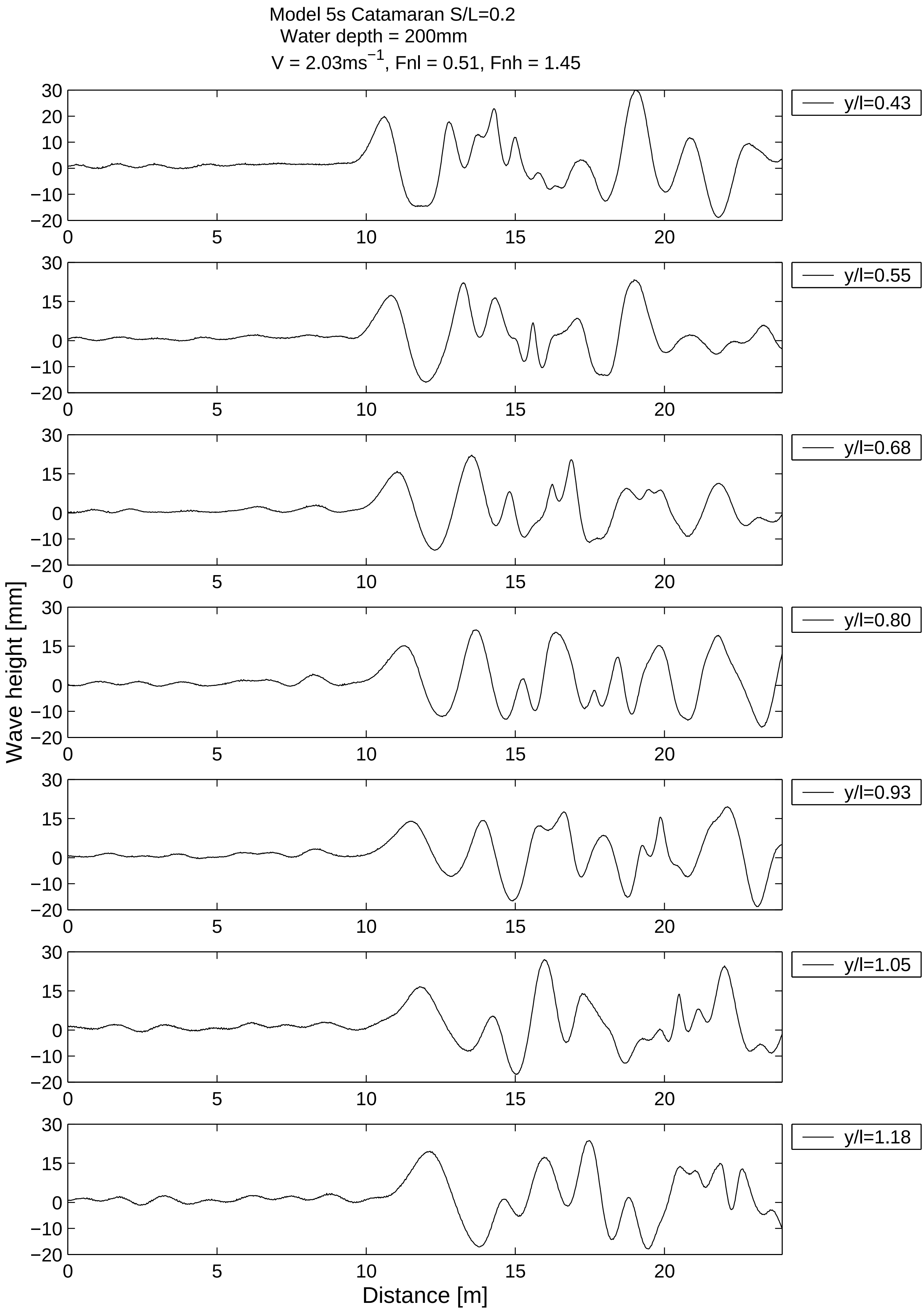
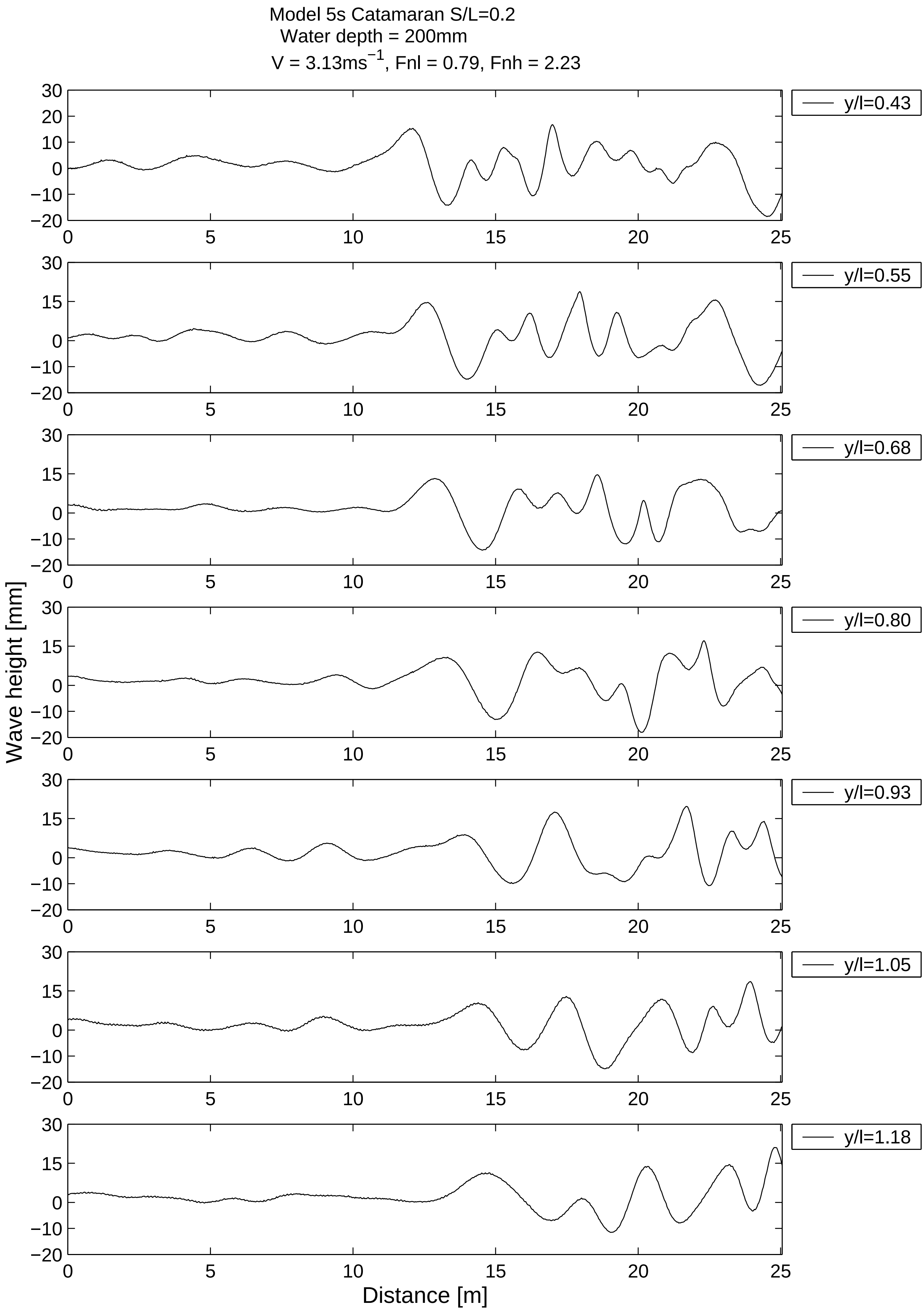

Model 5s Catamaran S/L=0.2
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.36, Fnh = 1.01
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 121



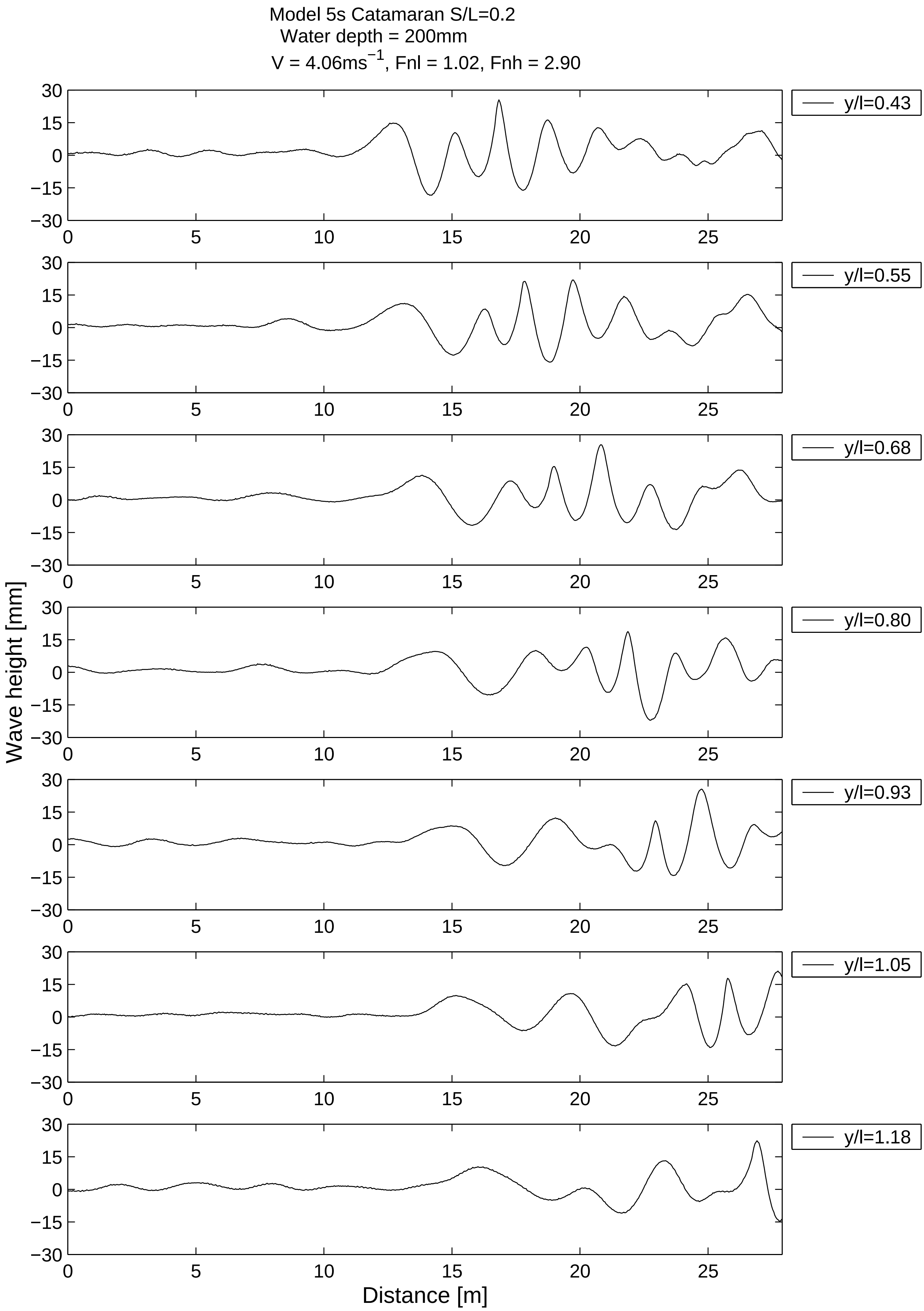
Model 5s Catamaran S/L=0.2
Water depth = 200mm
V = 2.03ms−1, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 122



Model 5s Catamaran S/L=0.2
Water depth = 200mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 123



Model 5s Catamaran S/L=0.2
Water depth = 200mm
V = 4.06ms−1, Fnl = 1.02, Fnh = 2.90
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 124

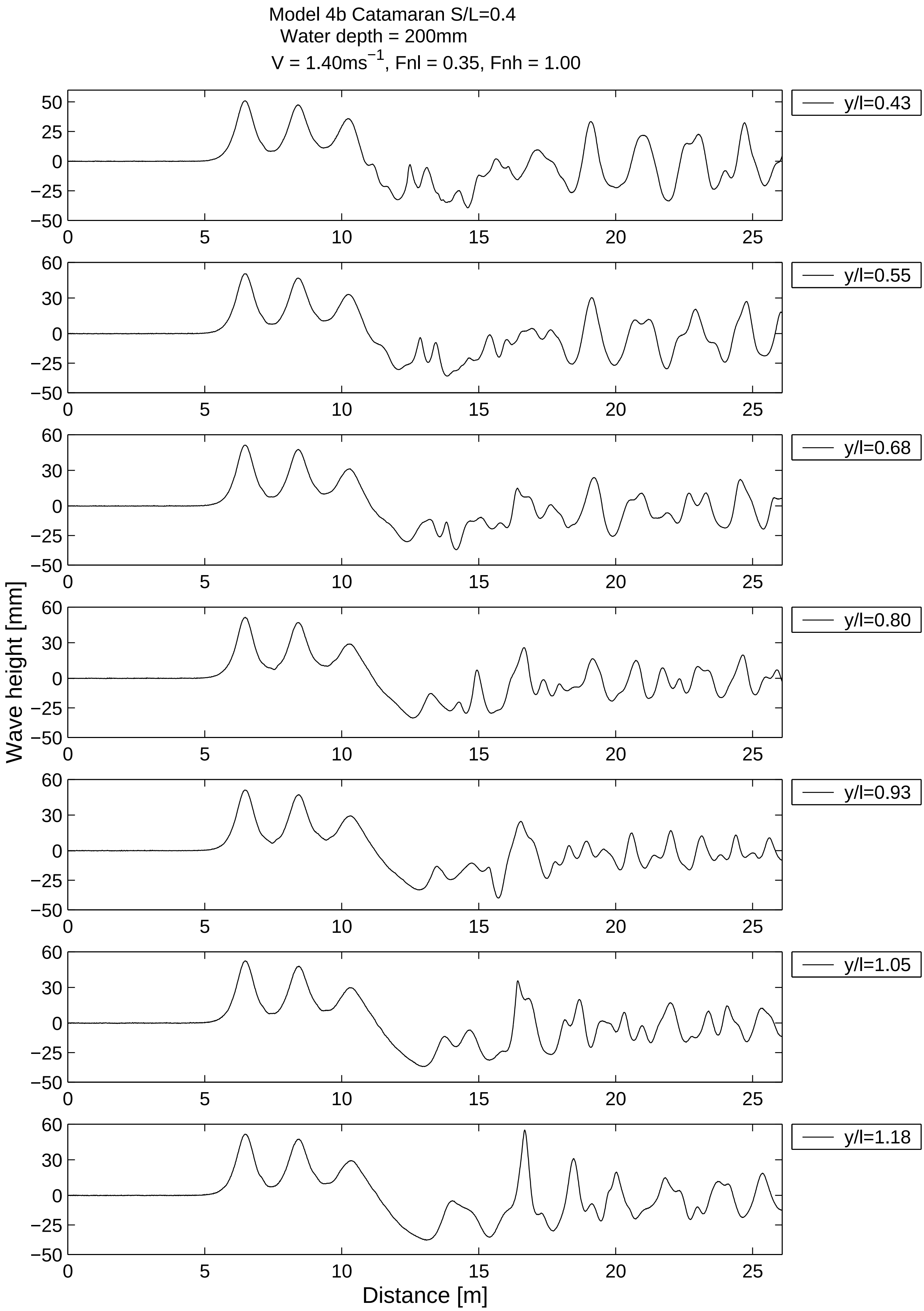
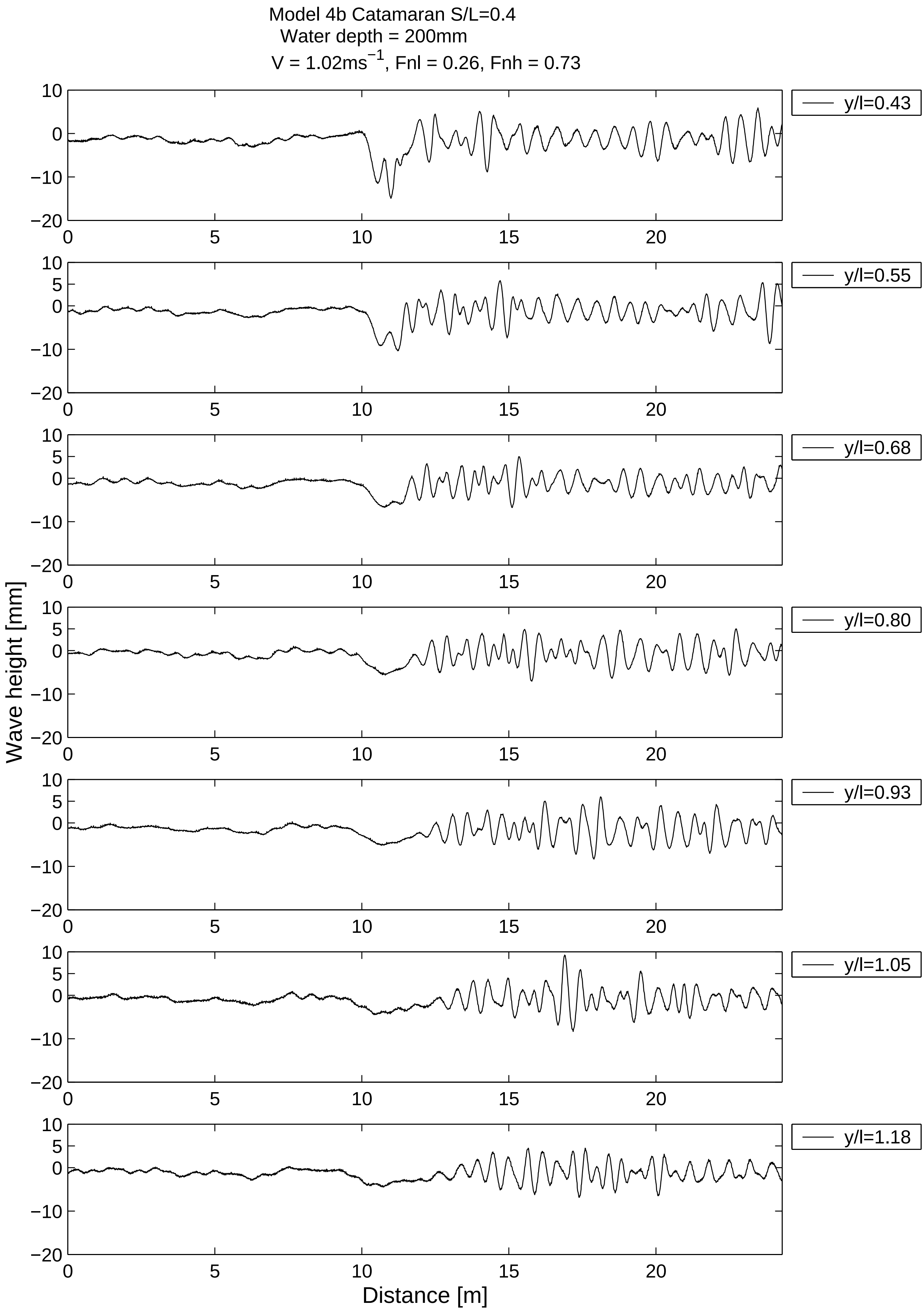

Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 1.40ms−1, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 125



Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 1.02ms⁻¹, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 126

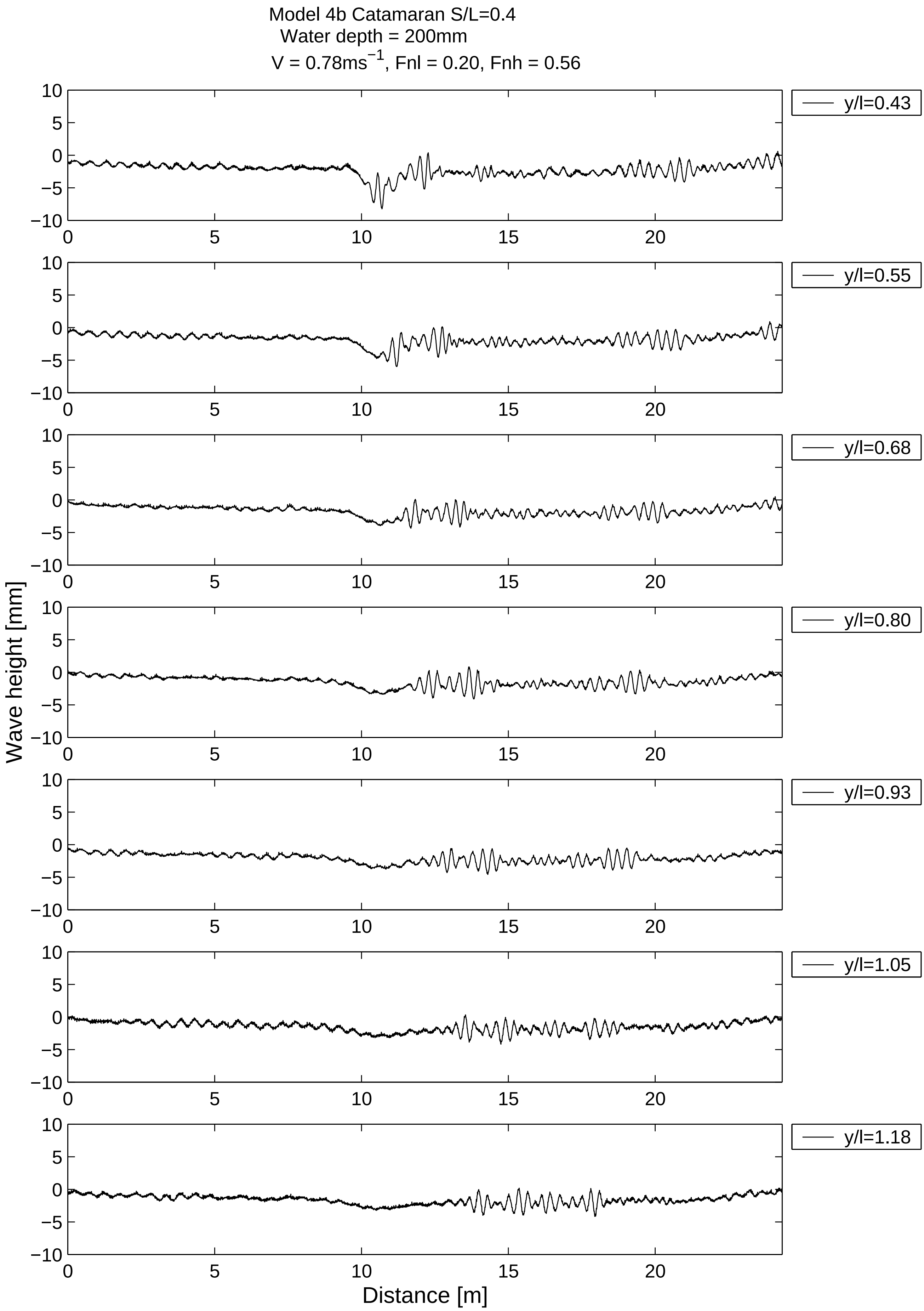

Model 4b Catamaran S/L=0.4
Water depth = 200mm
$V = 0.78ms^{-1}$, Fnl = 0.20, Fnh = 0.56
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
10
5
0
−5
−10
0
5
10
15
20

Figure 127

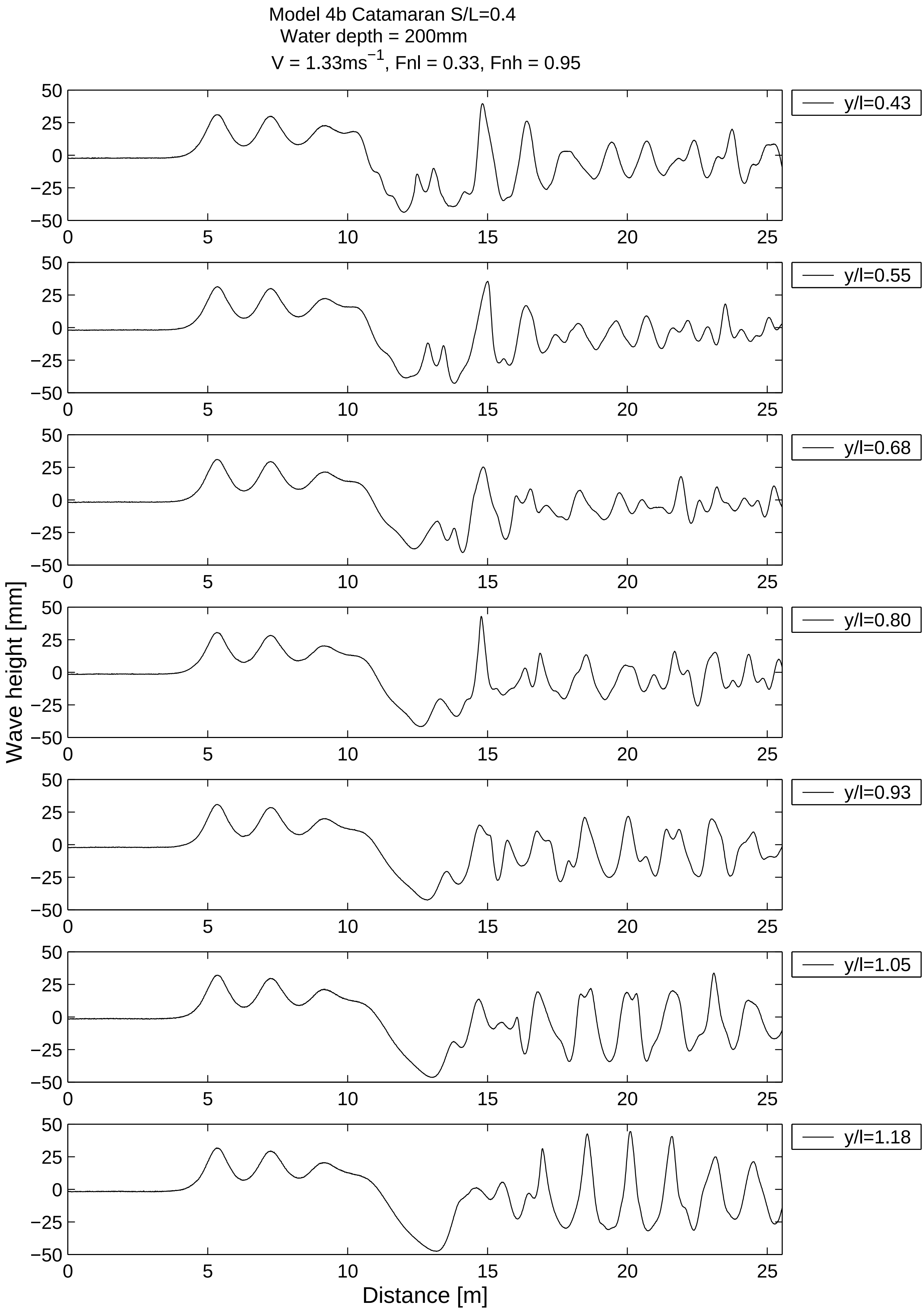
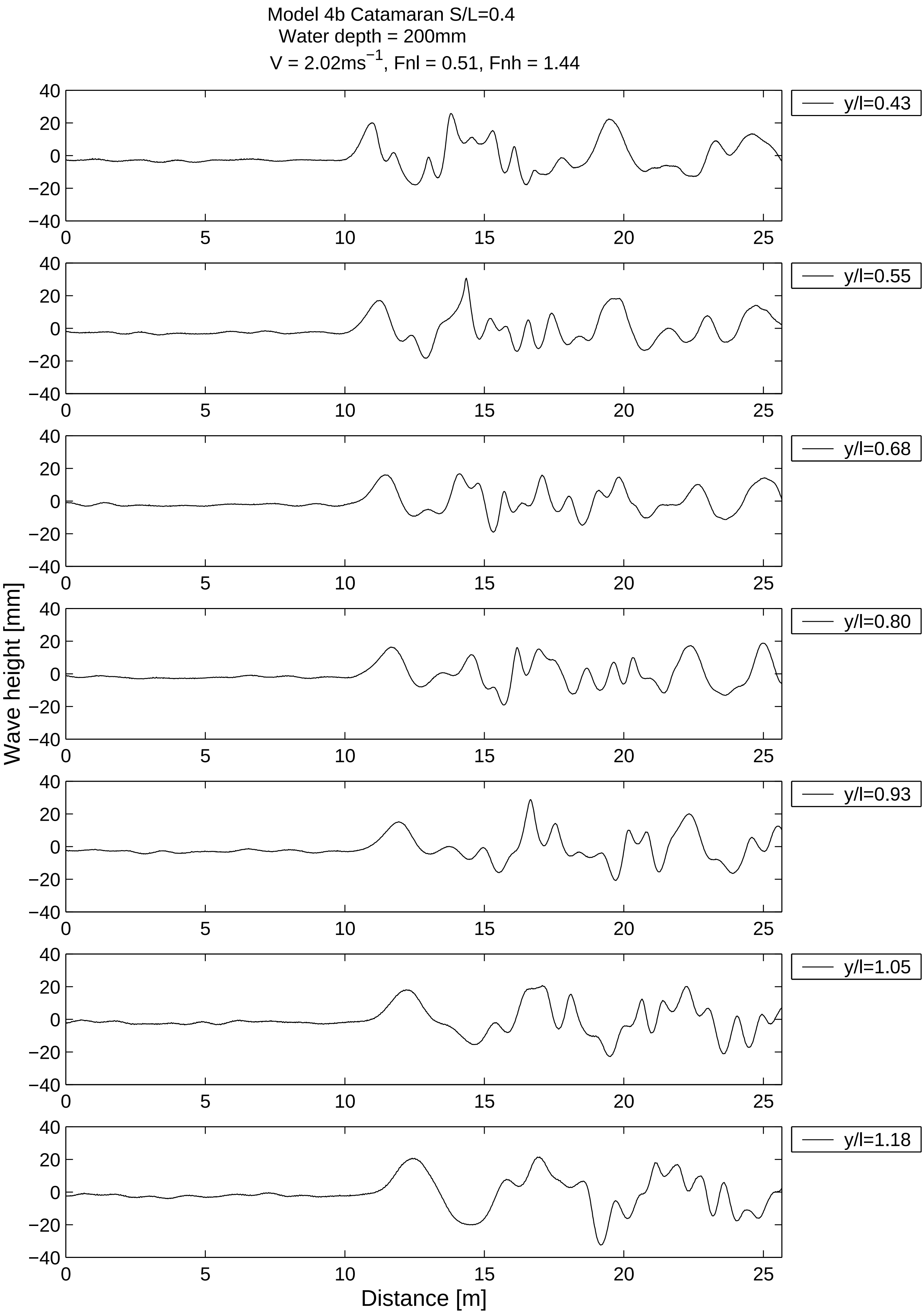
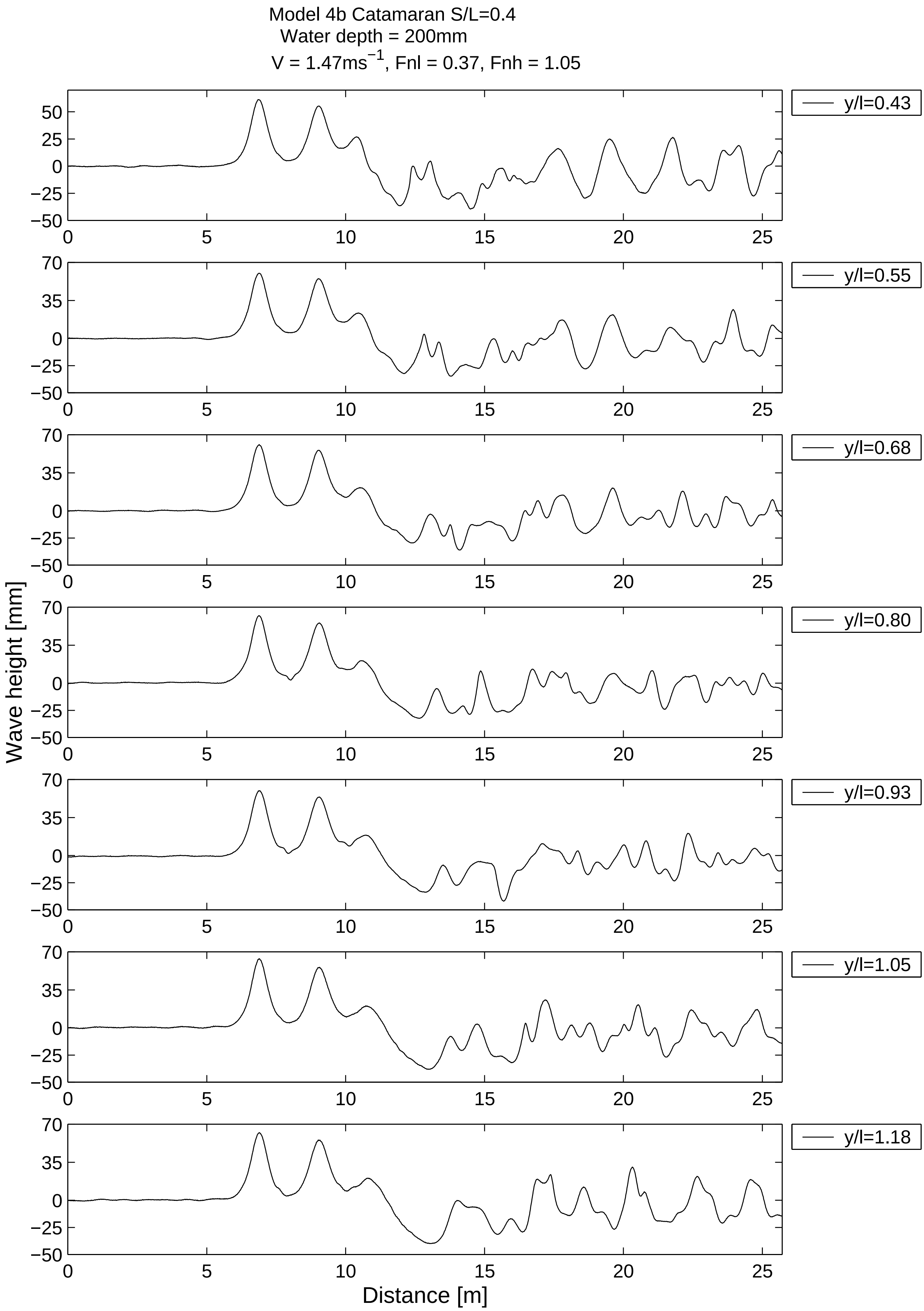

Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 1.33ms^{-1}, Fnl = 0.33, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 128



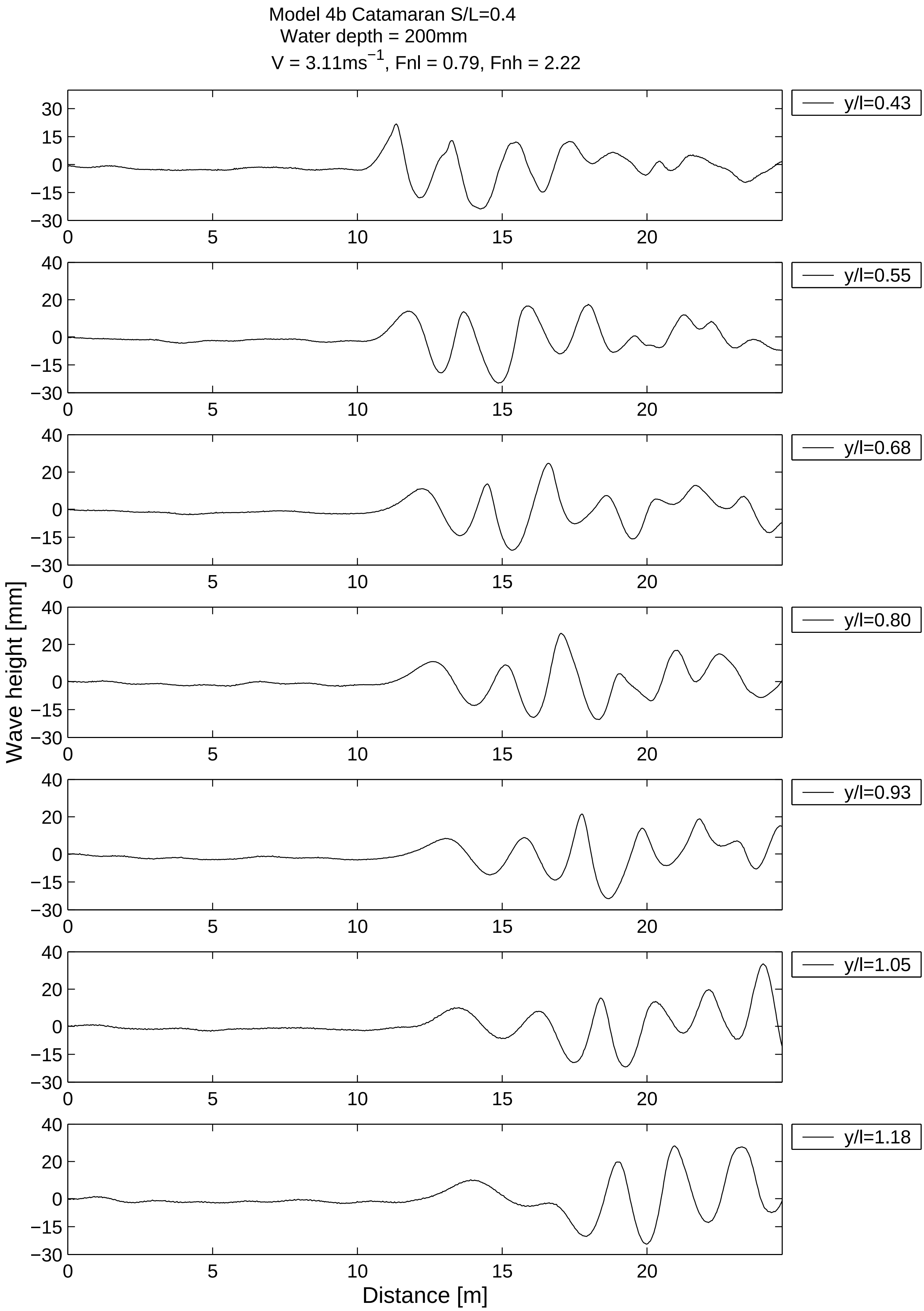
Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 2.02ms^{-1}, Fnl = 0.51, Fnh = 1.44
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 129



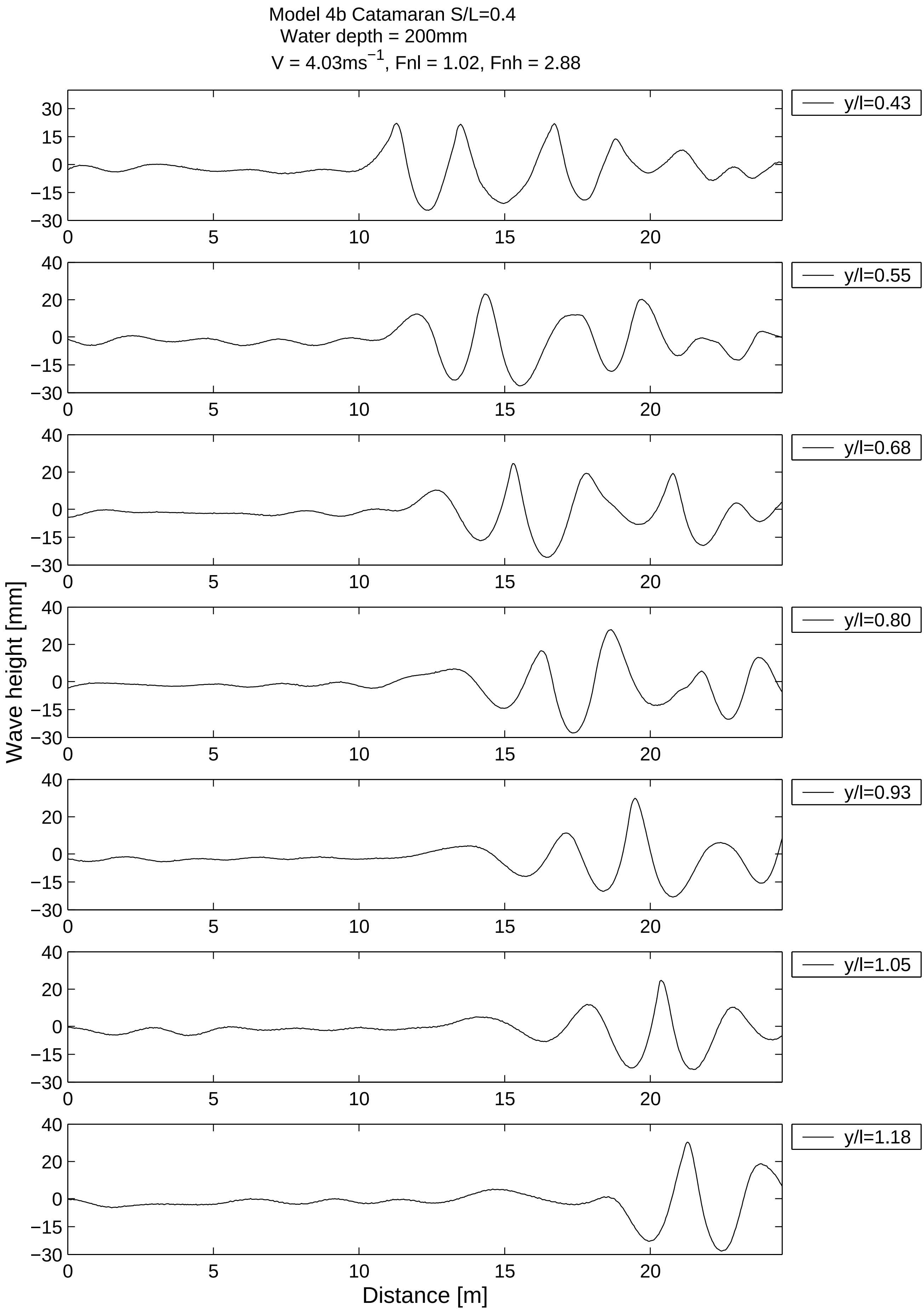
Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 1.47ms^{-1}, Fnl = 0.37, Fnh = 1.05
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 130



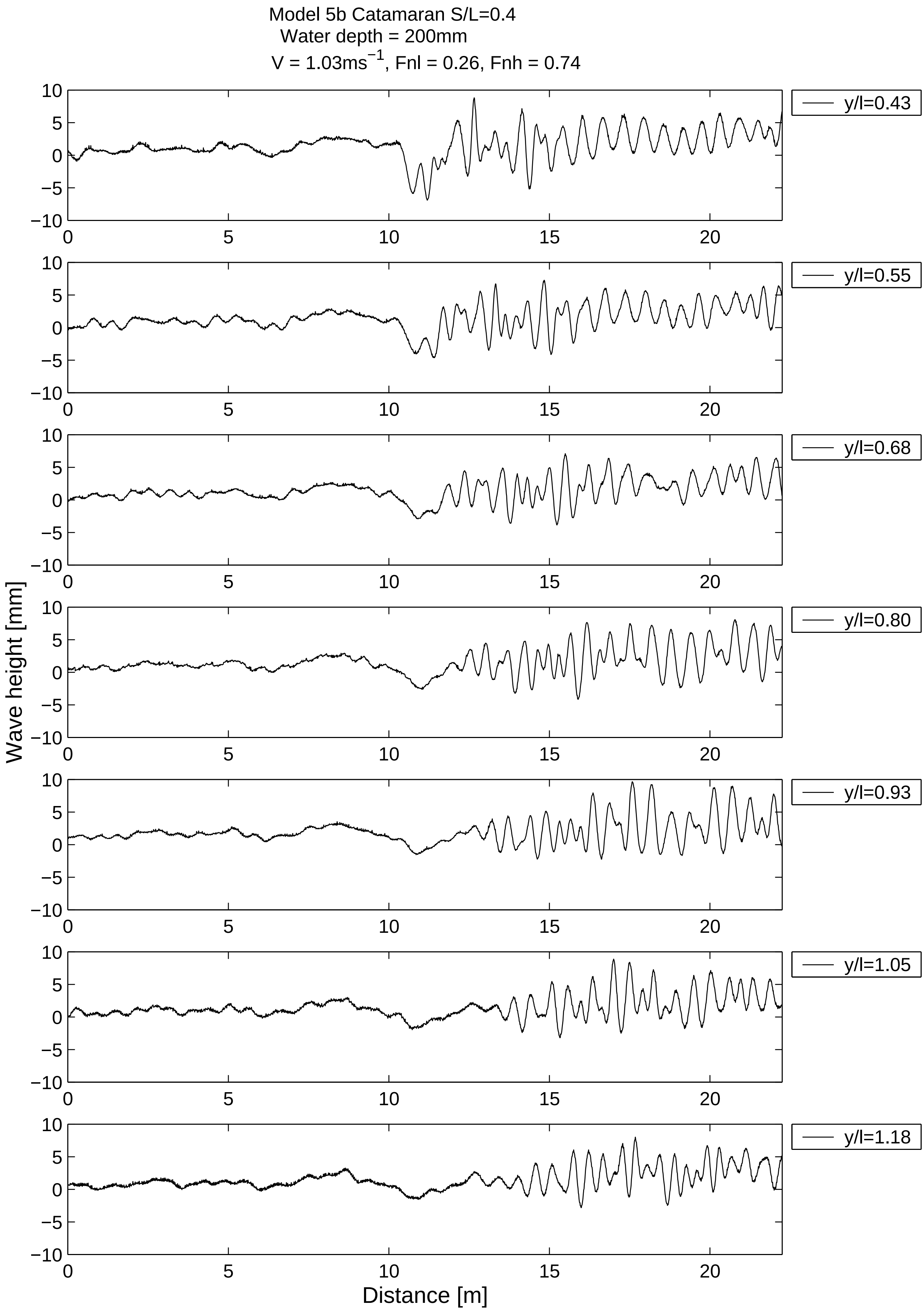
Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 3.11ms−1, Fnl = 0.79, Fnh = 2.22
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 131



Model 4b Catamaran S/L=0.4
Water depth = 200mm
V = 4.03ms−1, Fnl = 1.02, Fnh = 2.88
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 132



Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.03ms−1, Fnl = 0.26, Fnh = 0.74
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 133

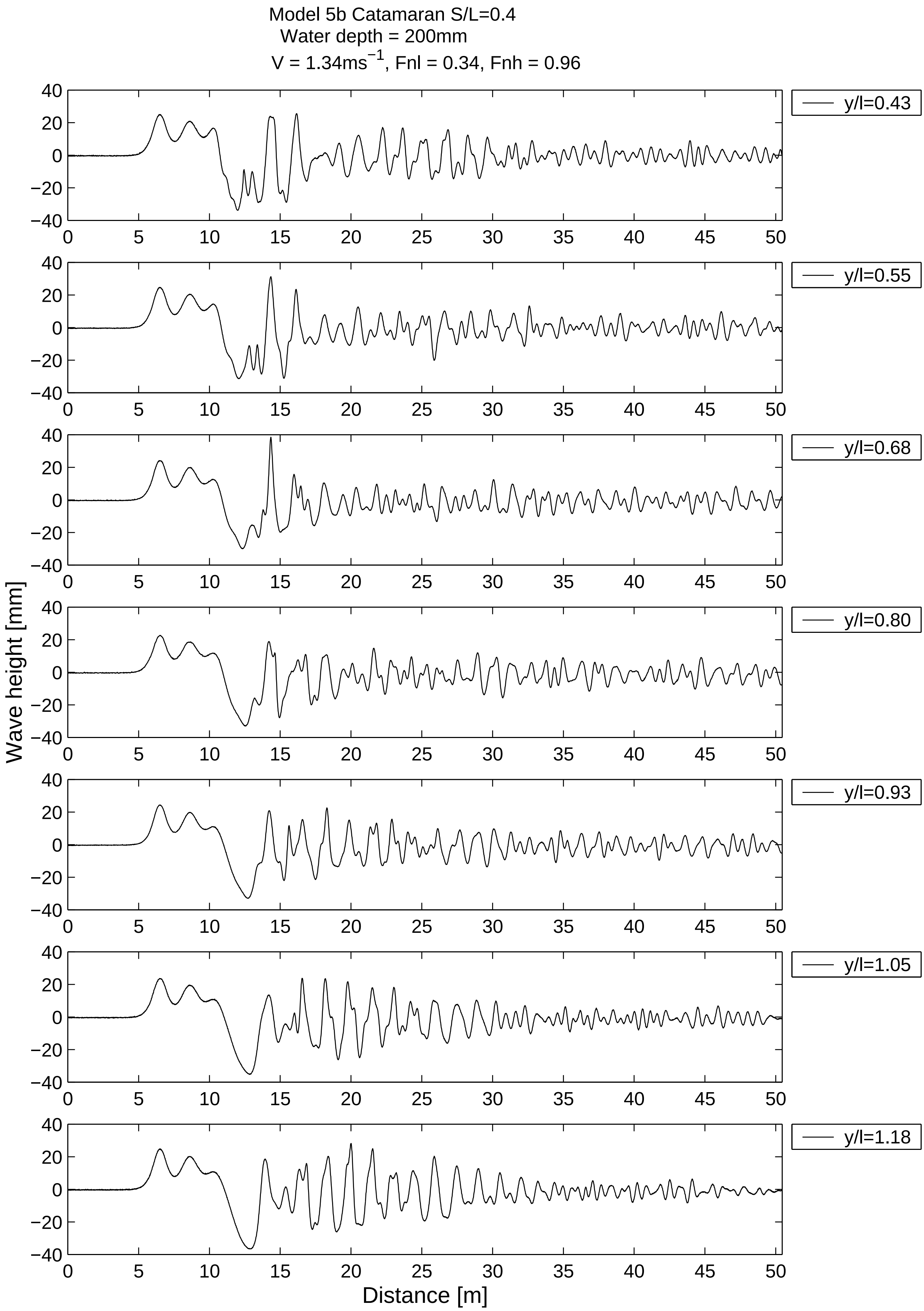

Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.34ms^{-1}, Fnl = 0.34, Fnh = 0.96
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 134

Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.42ms^{-1}, Fnl = 0.36, Fnh = 1.01

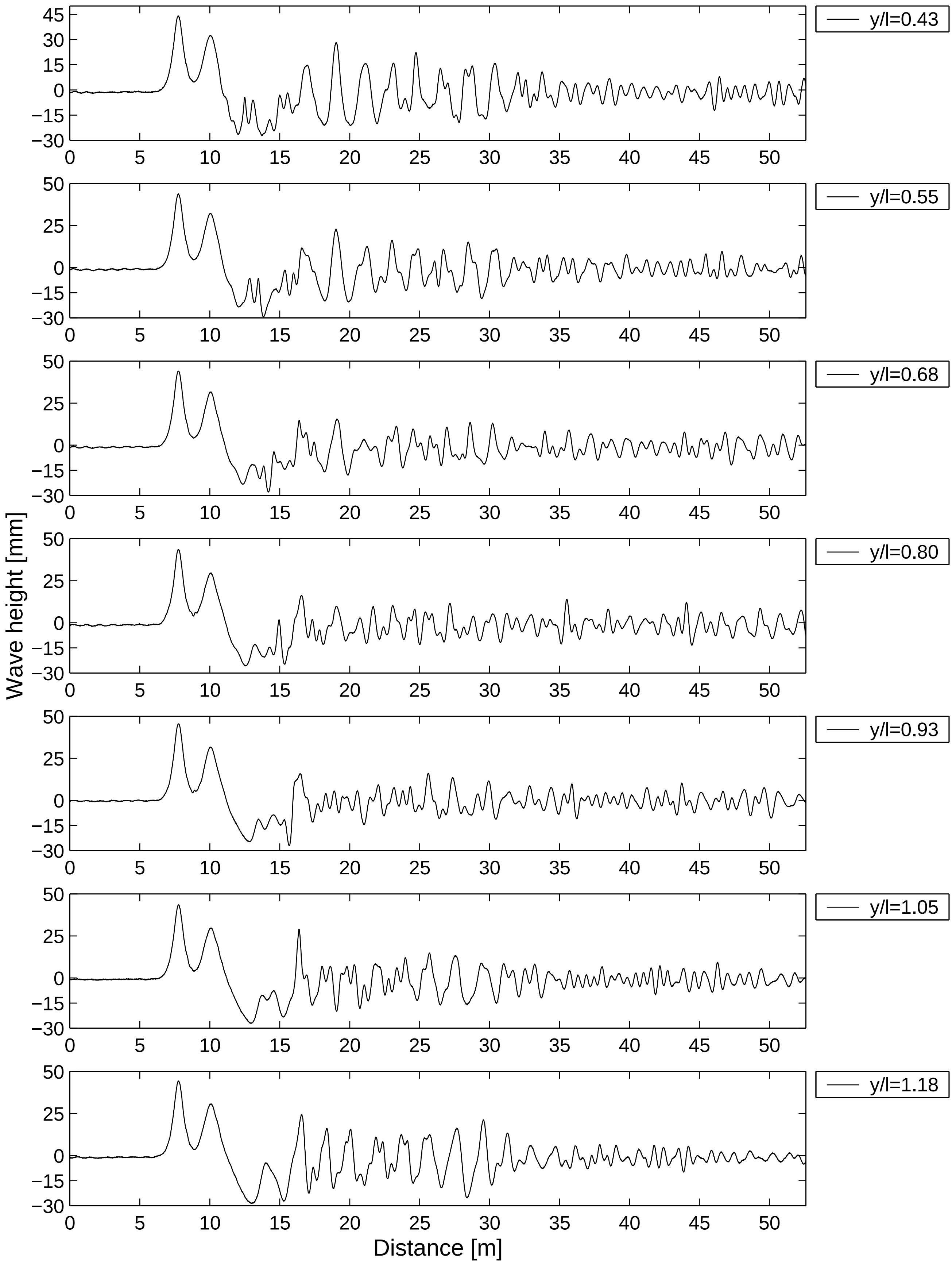
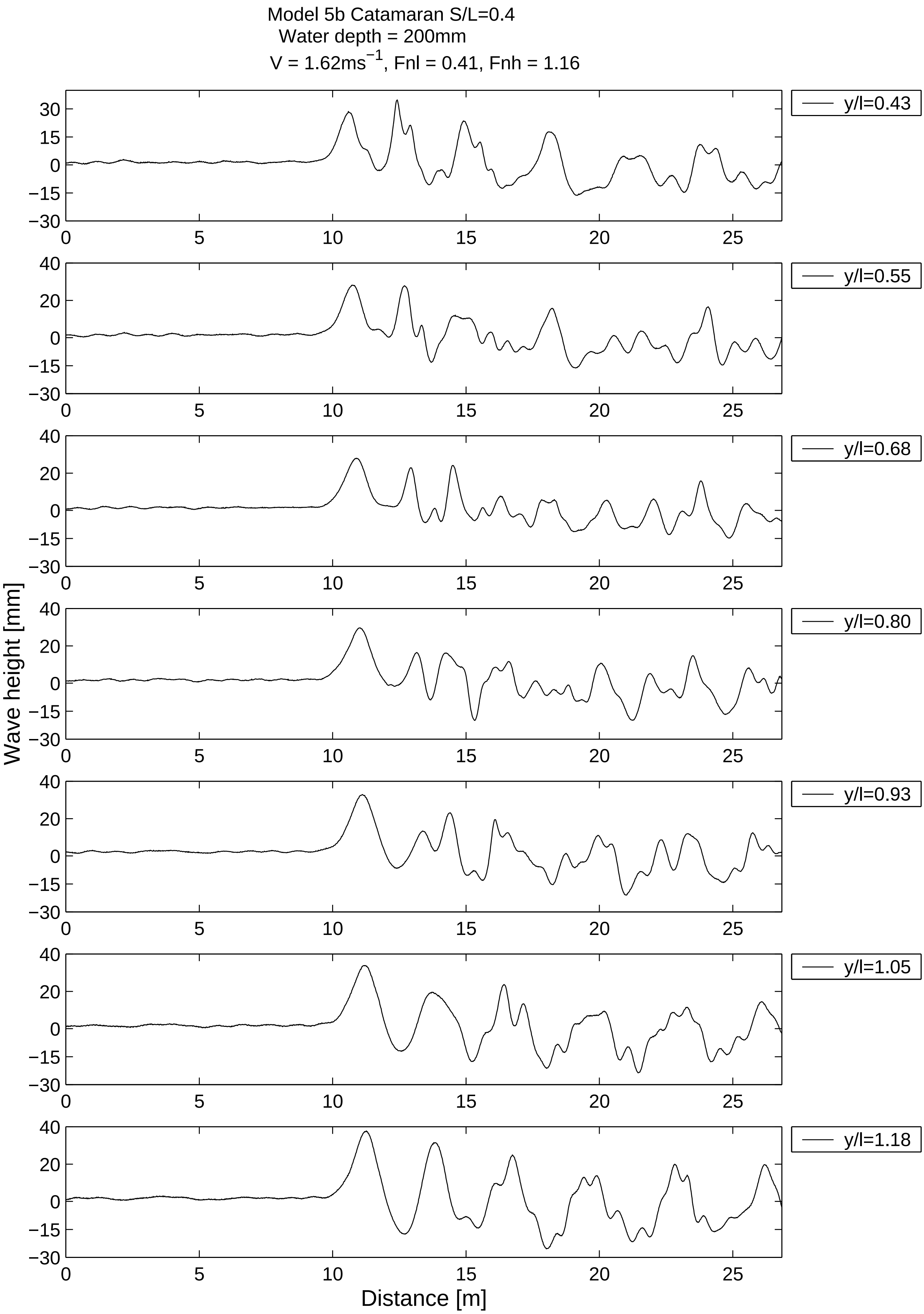
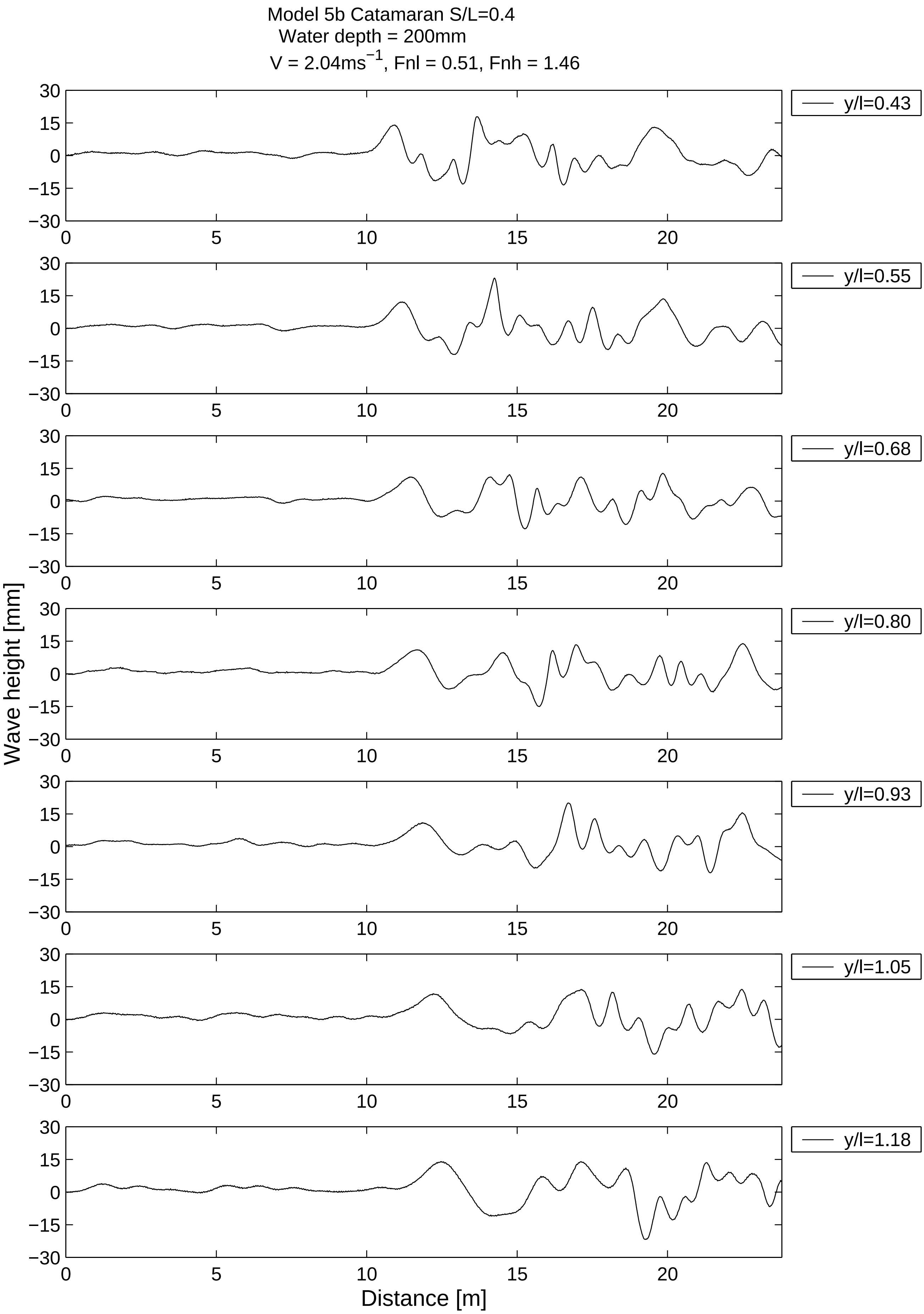


Figure 135



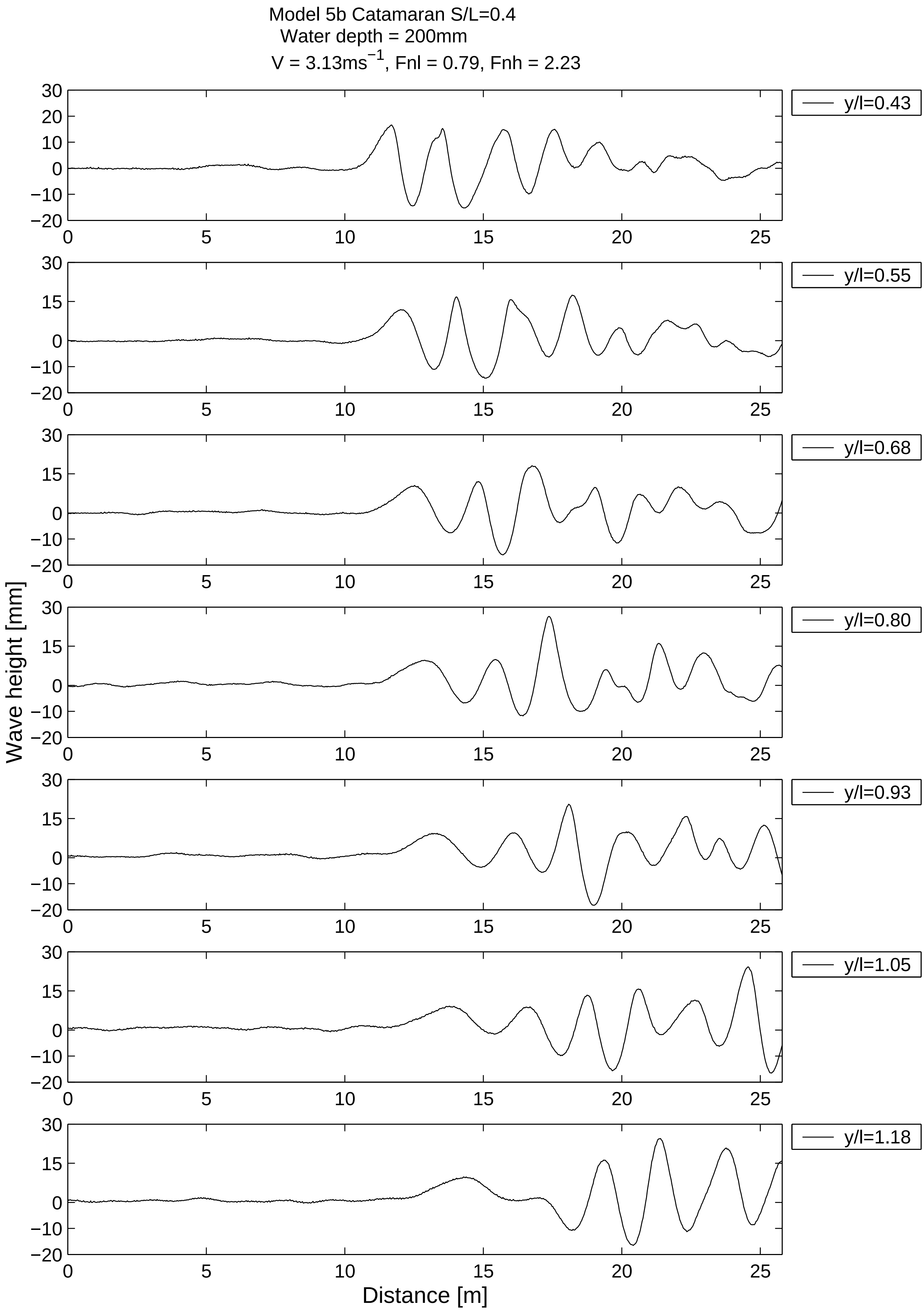
Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.62ms−1, Fnl = 0.41, Fnh = 1.16
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 136



Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 2.04ms^{-1}, Fnl = 0.51, Fnh = 1.46
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20

Figure 137



Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 138

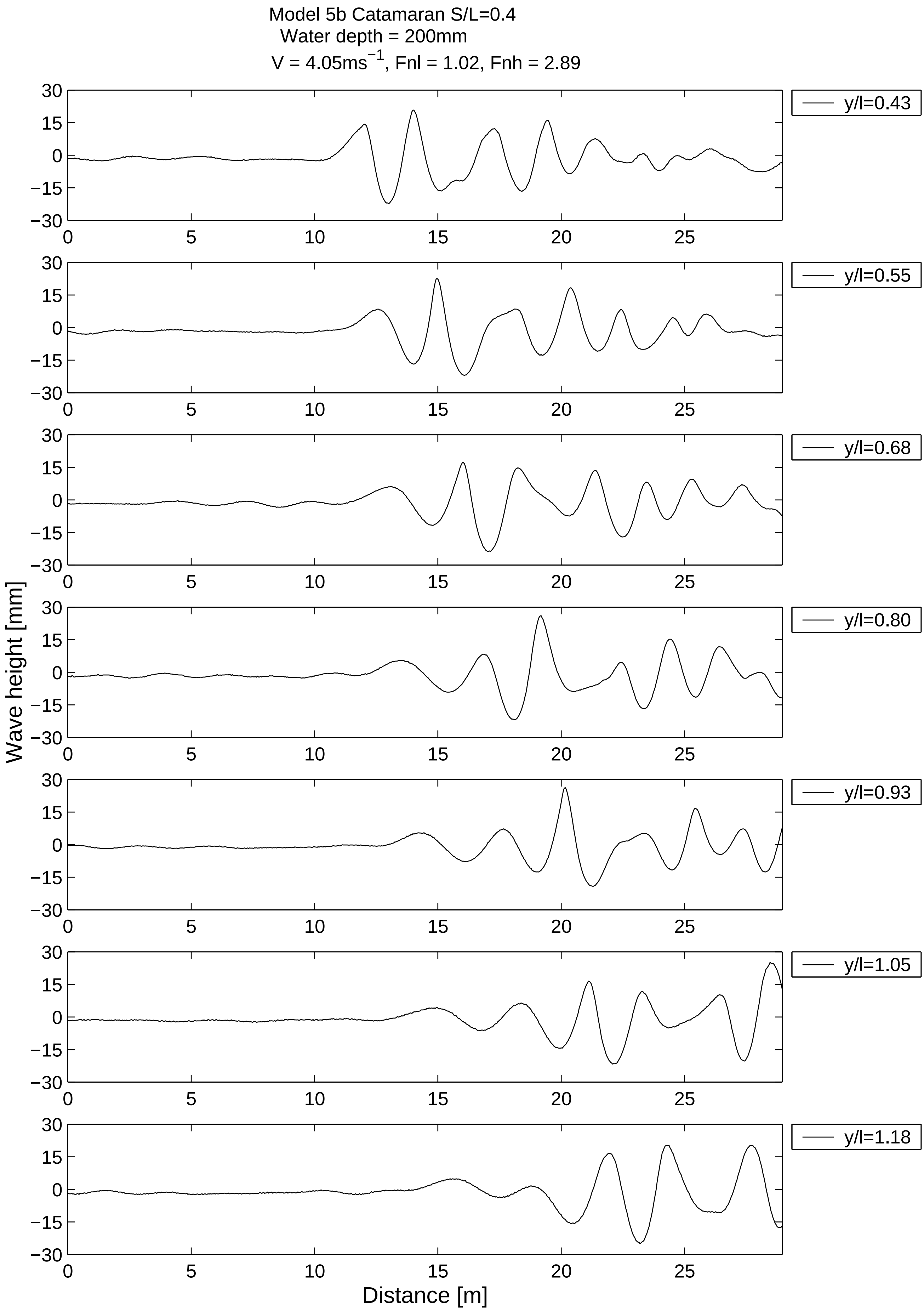

Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 4.05ms^{-1}, Fnl = 1.02, Fnh = 2.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 139

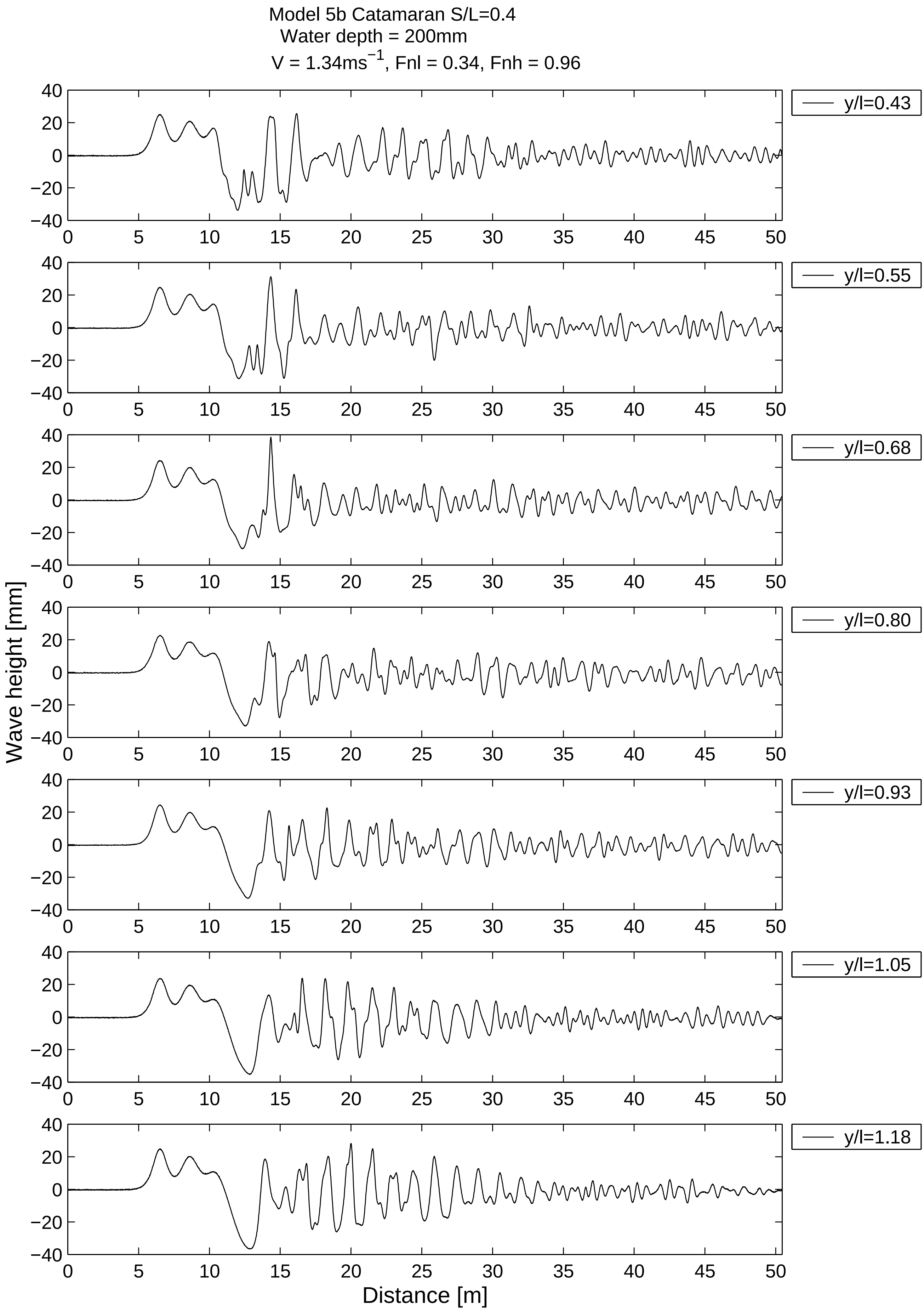

Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.34ms−1, Fnl = 0.34, Fnh = 0.96
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 140

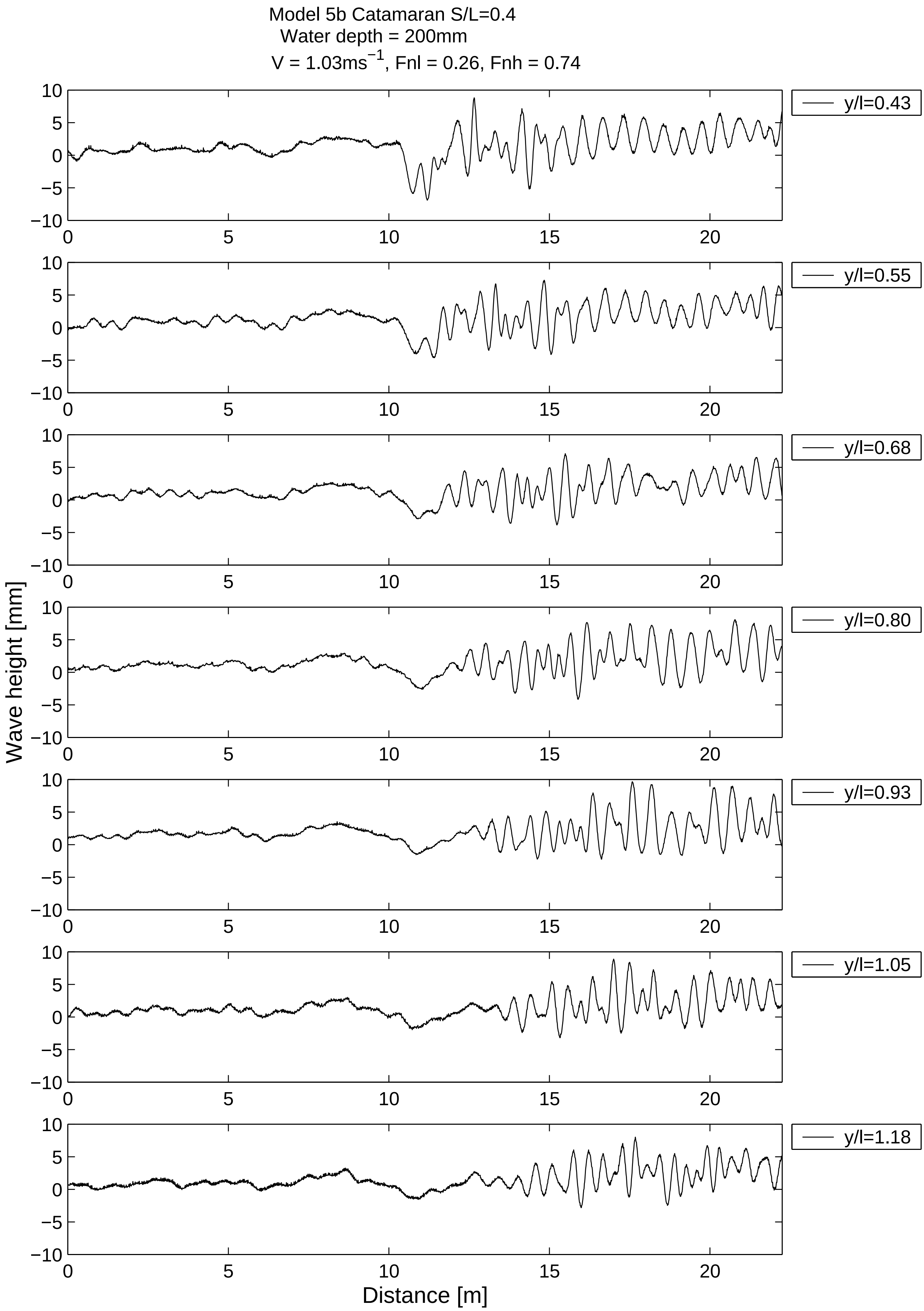
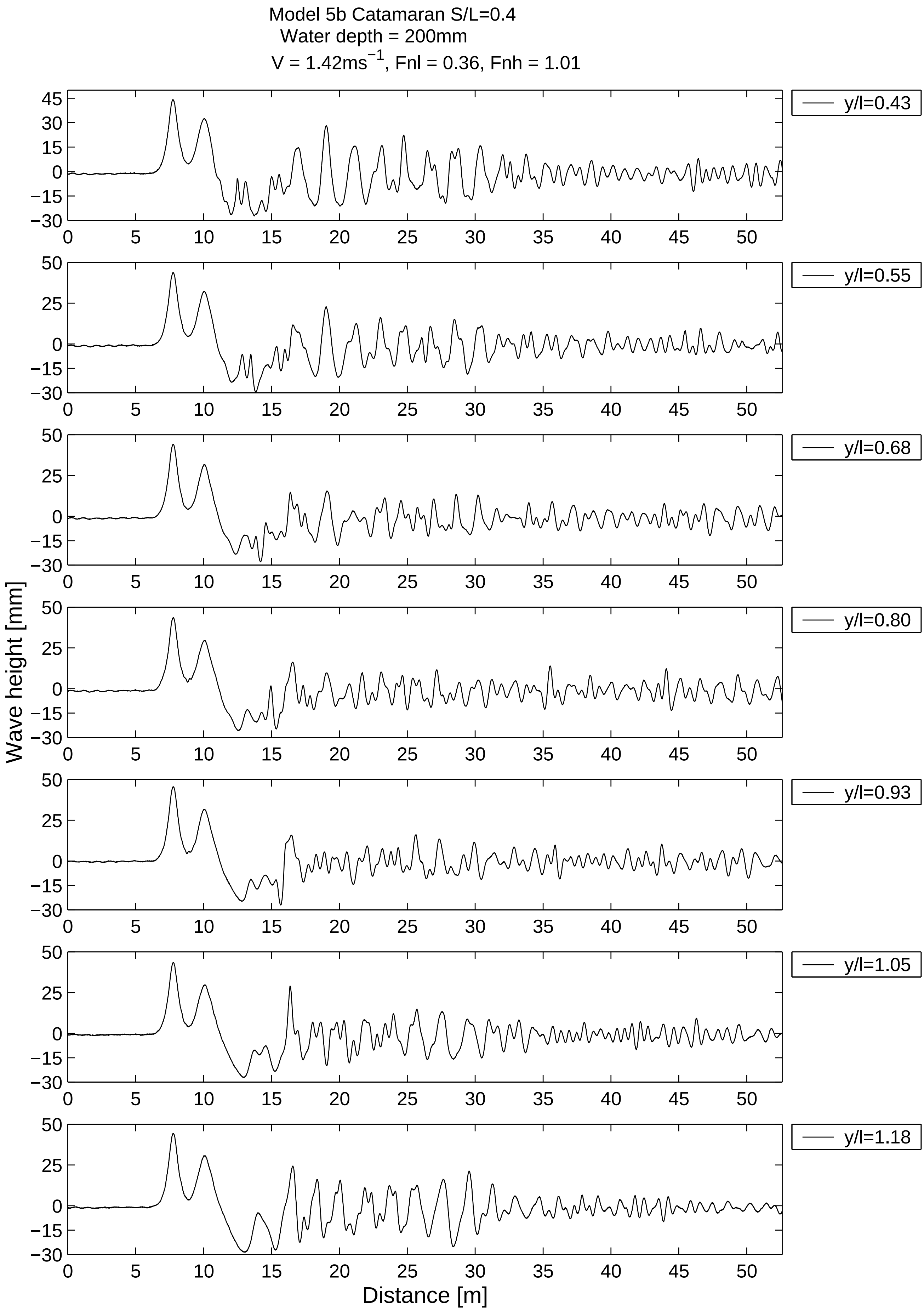
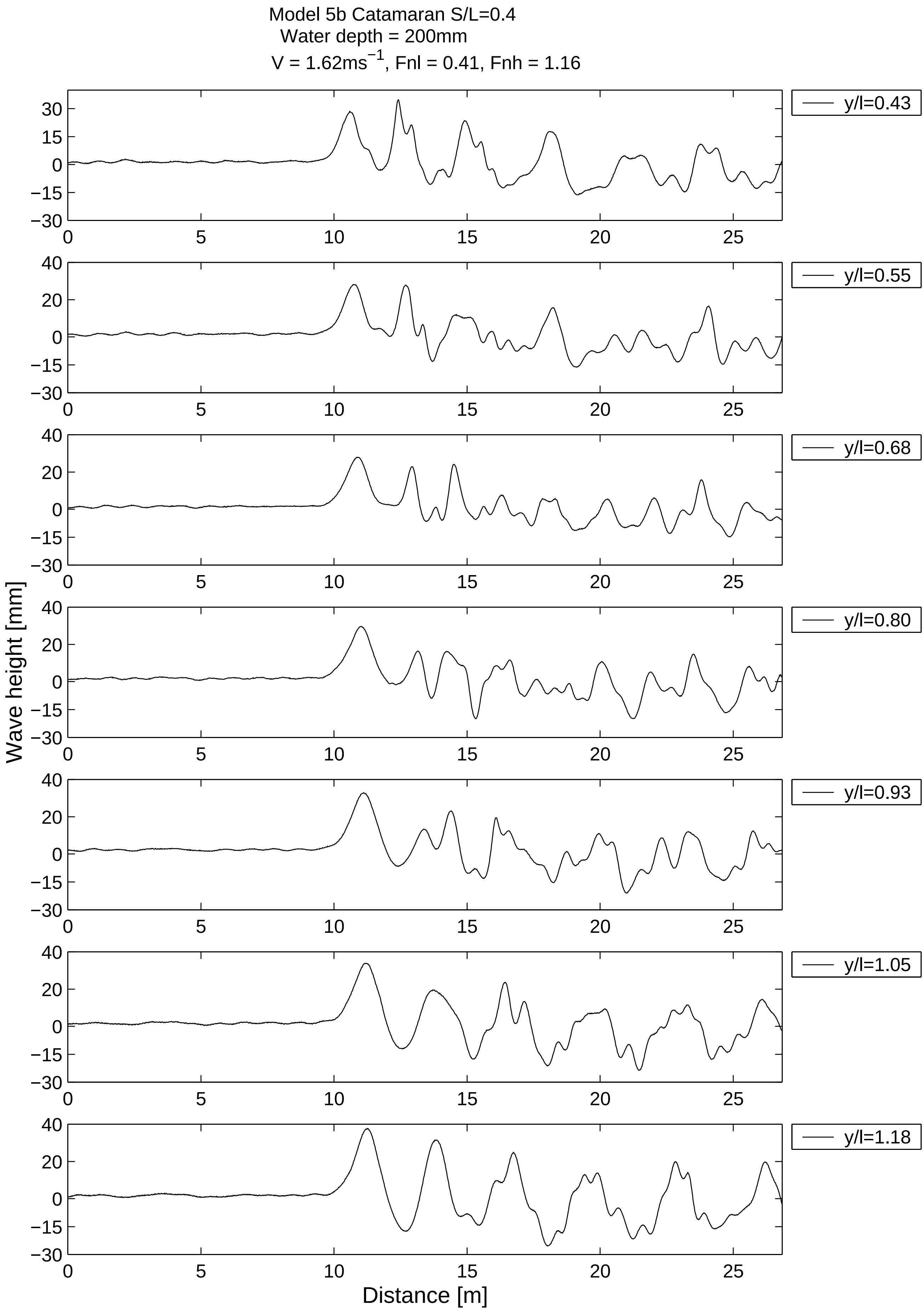

Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.03ms^{-1}, Fnl = 0.26, Fnh = 0.74
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 141



Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.42ms−1, Fnl = 0.36, Fnh = 1.01
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 142



Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 1.62ms^{-1}, Fnl = 0.41, Fnh = 1.16
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 143

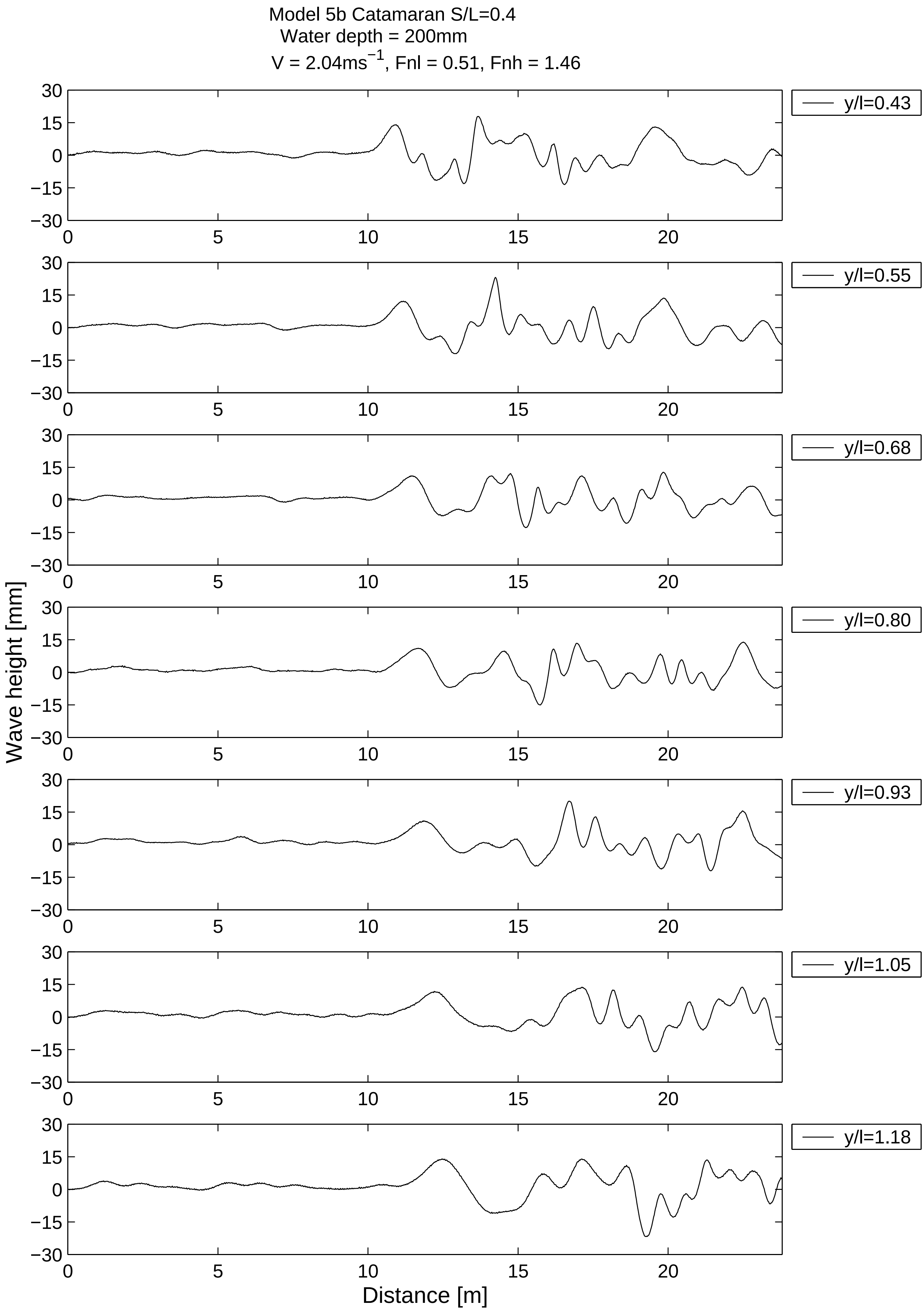
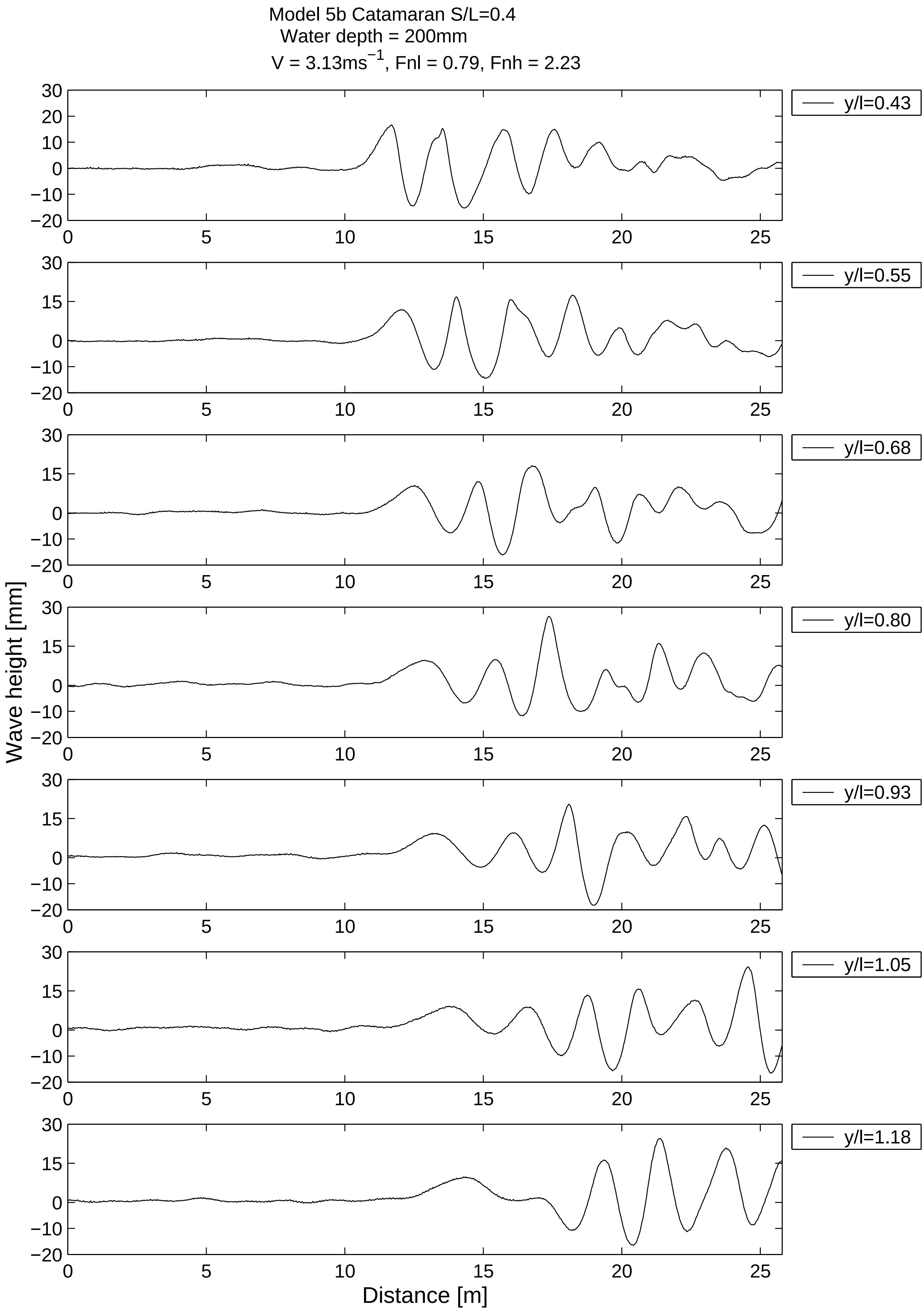
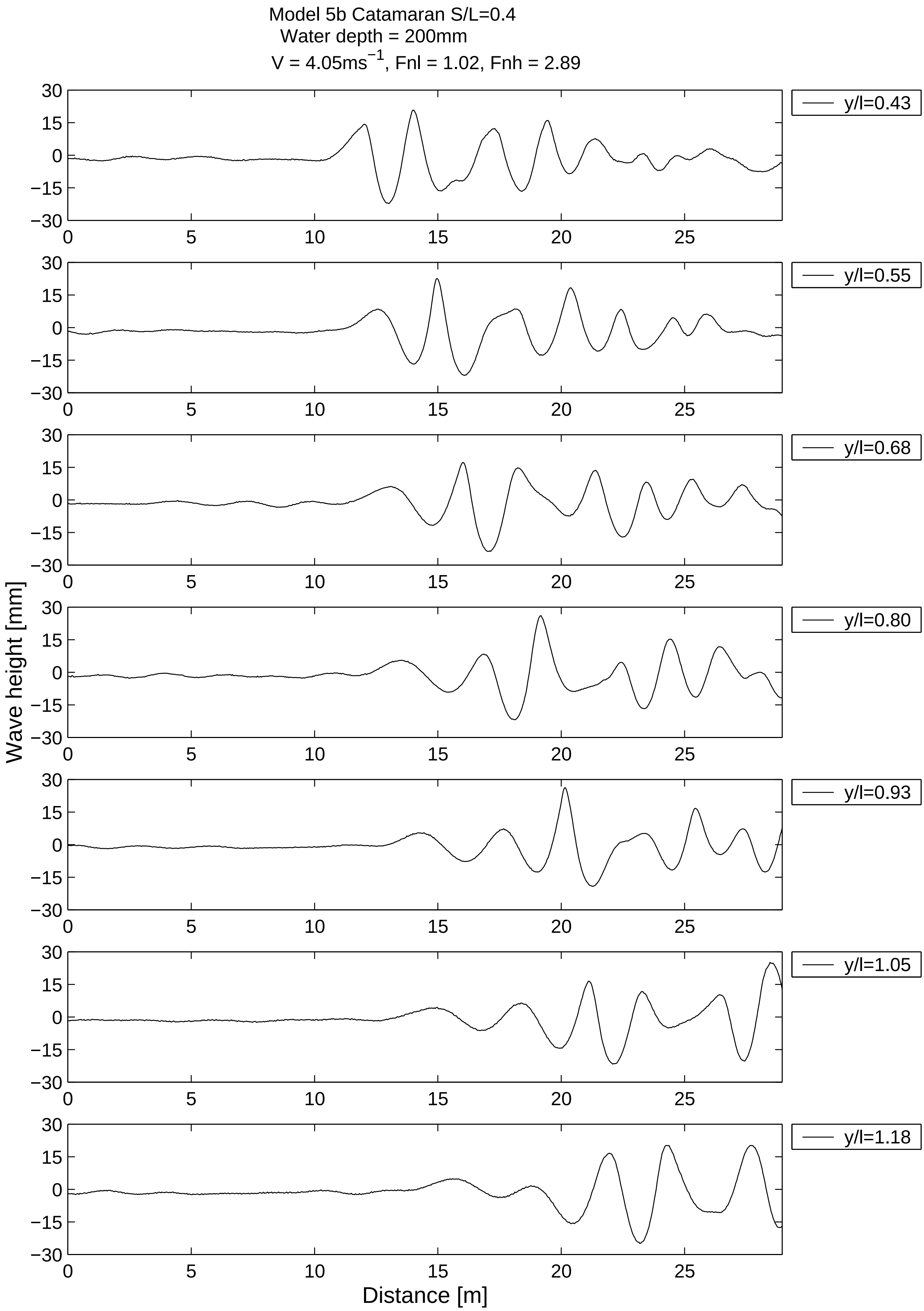

Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 2.04ms−1, Fnl = 0.51, Fnh = 1.46
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 144



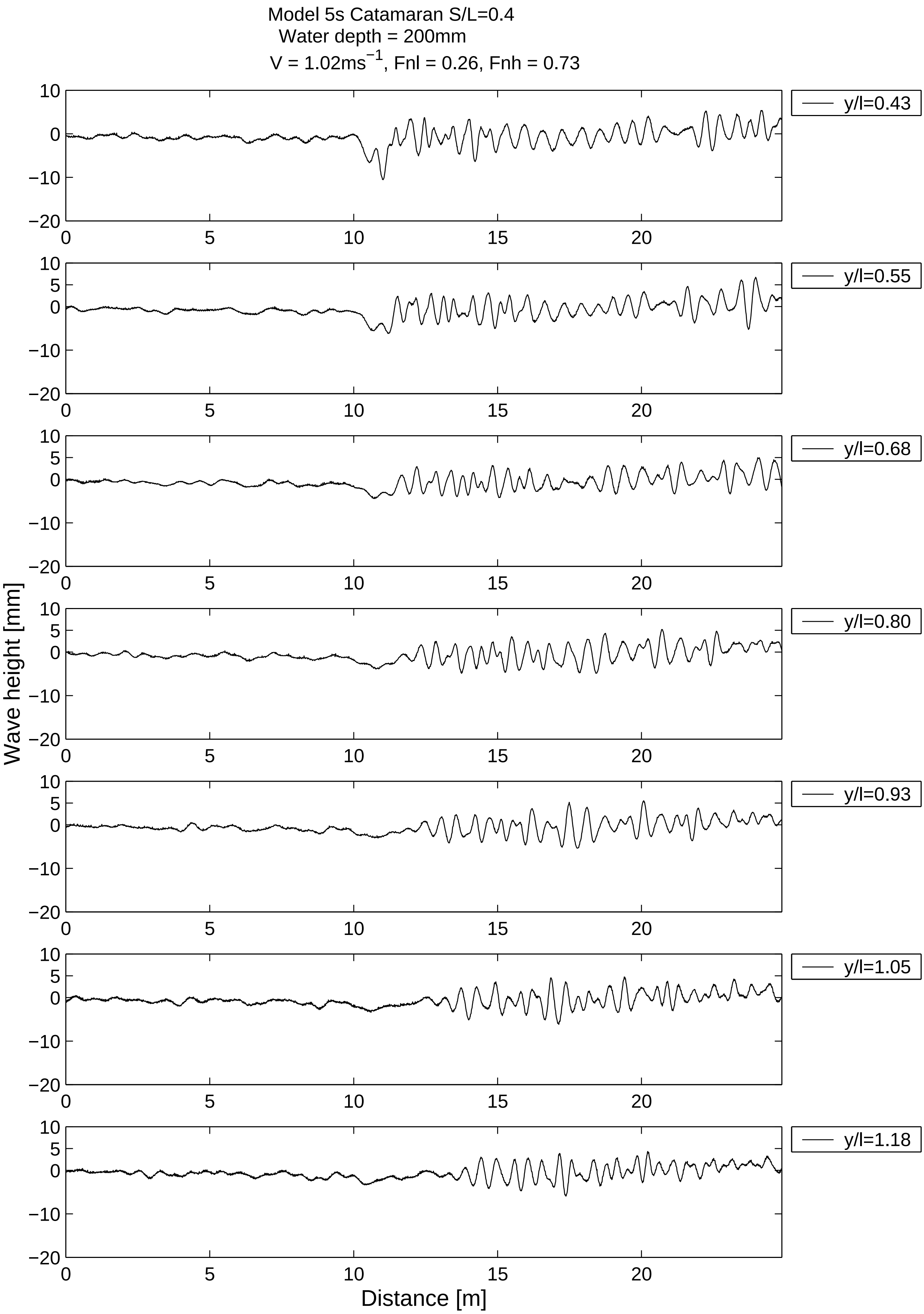
Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 145



Model 5b Catamaran S/L=0.4
Water depth = 200mm
V = 4.05ms−1, Fnl = 1.02, Fnh = 2.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 146



Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 1.02ms−1, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 147

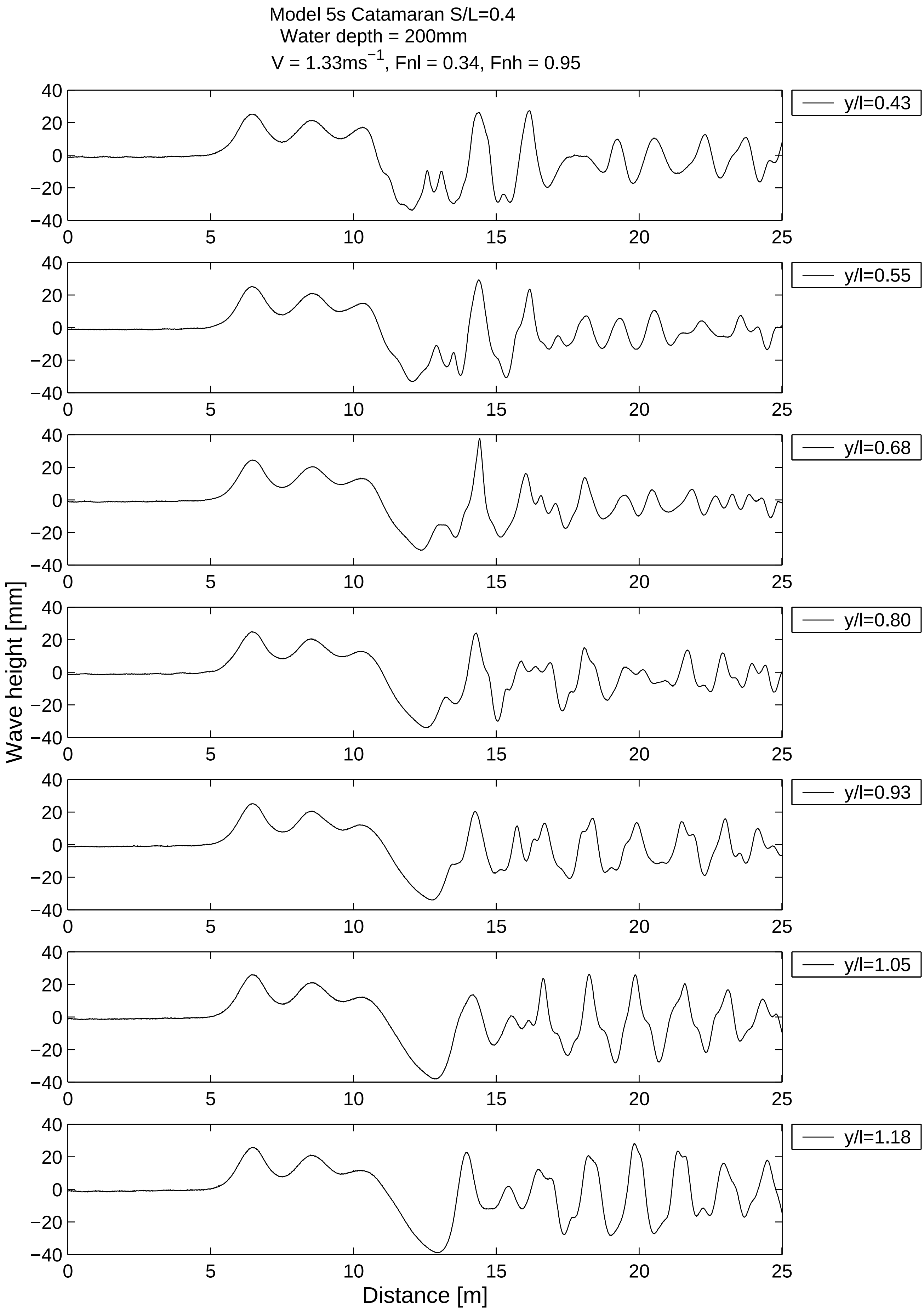

Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 1.33ms−1, Fnl = 0.34, Fnh = 0.95
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 148

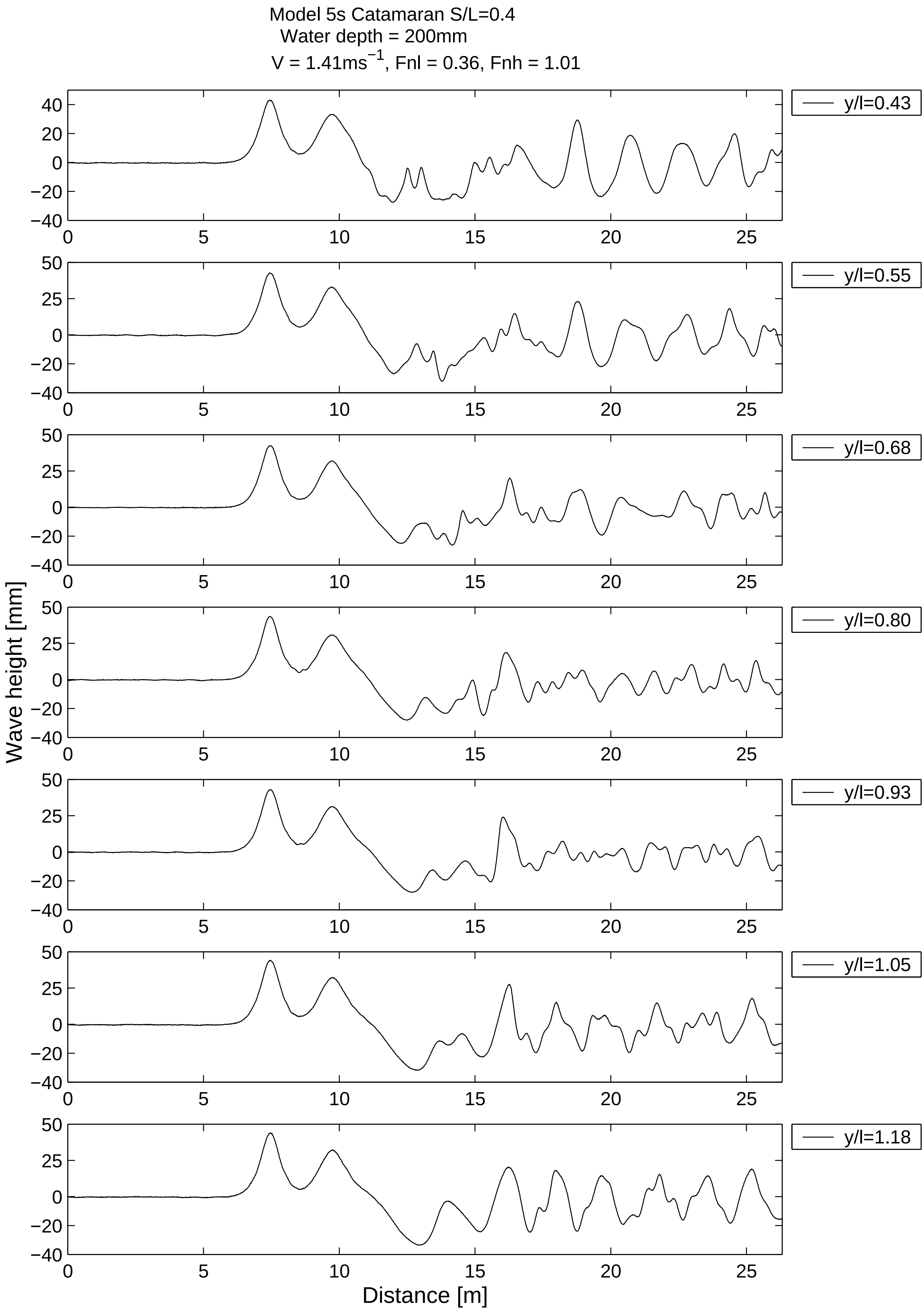
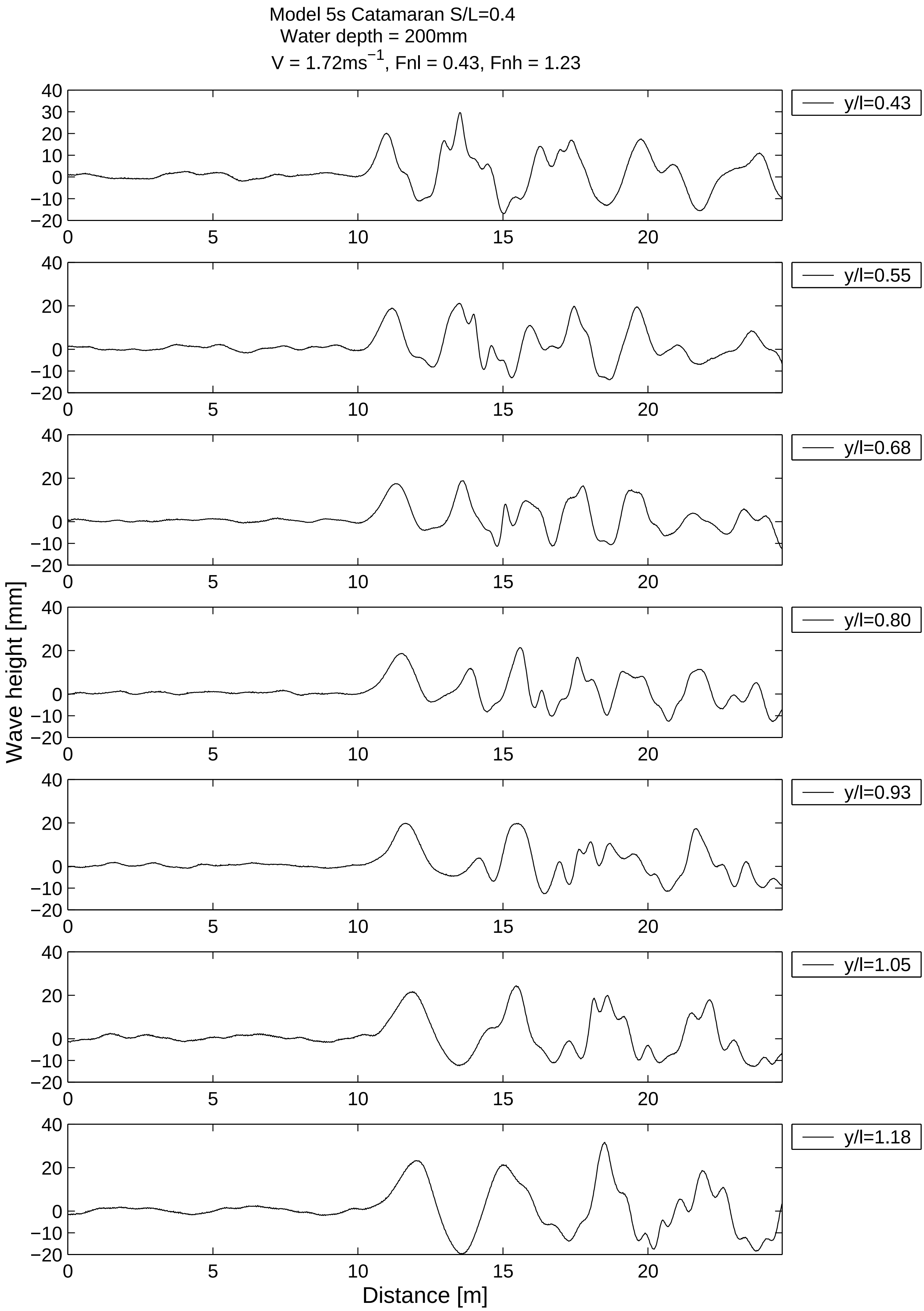
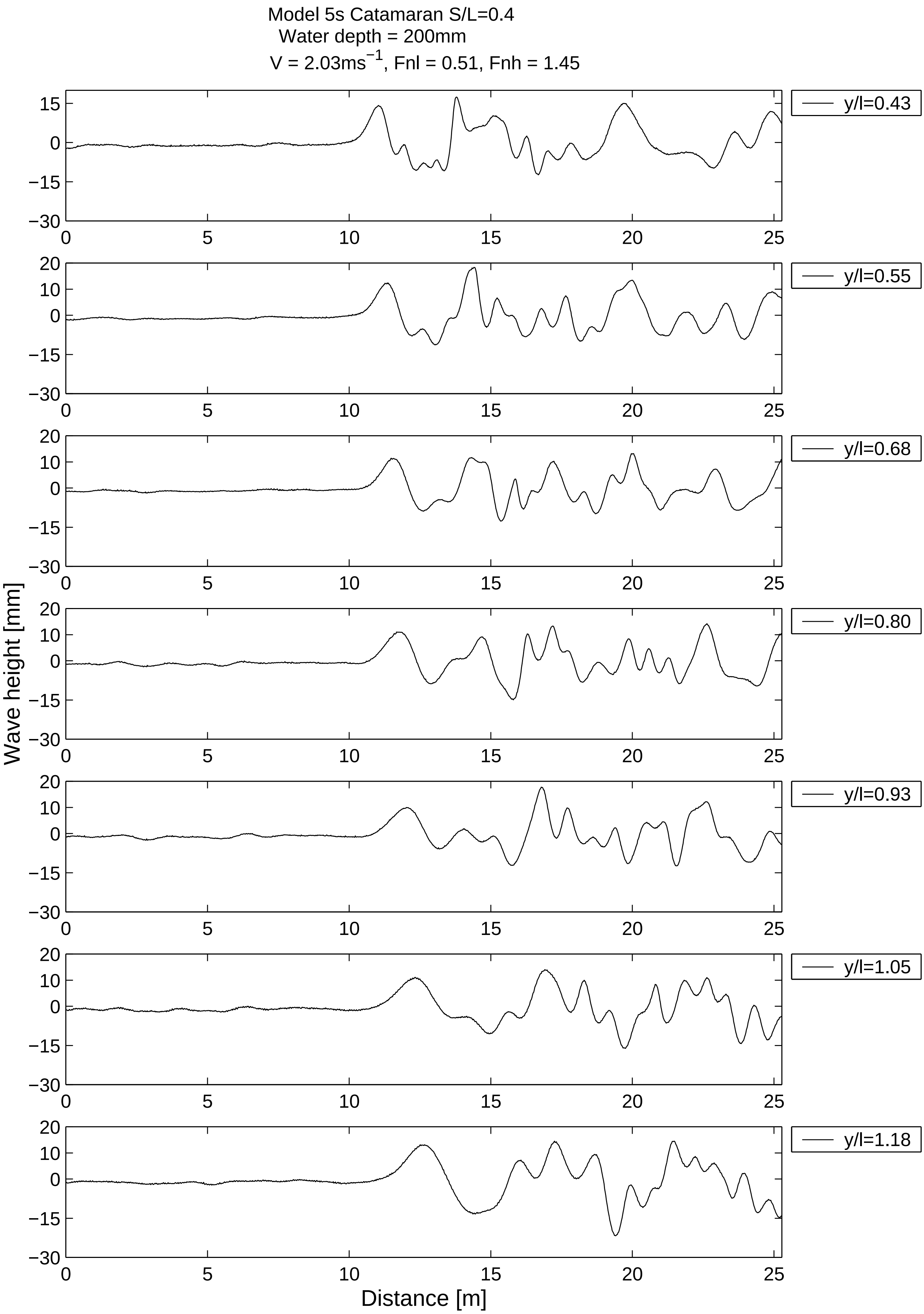

Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 1.41ms−1, Fnl = 0.36, Fnh = 1.01
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 149



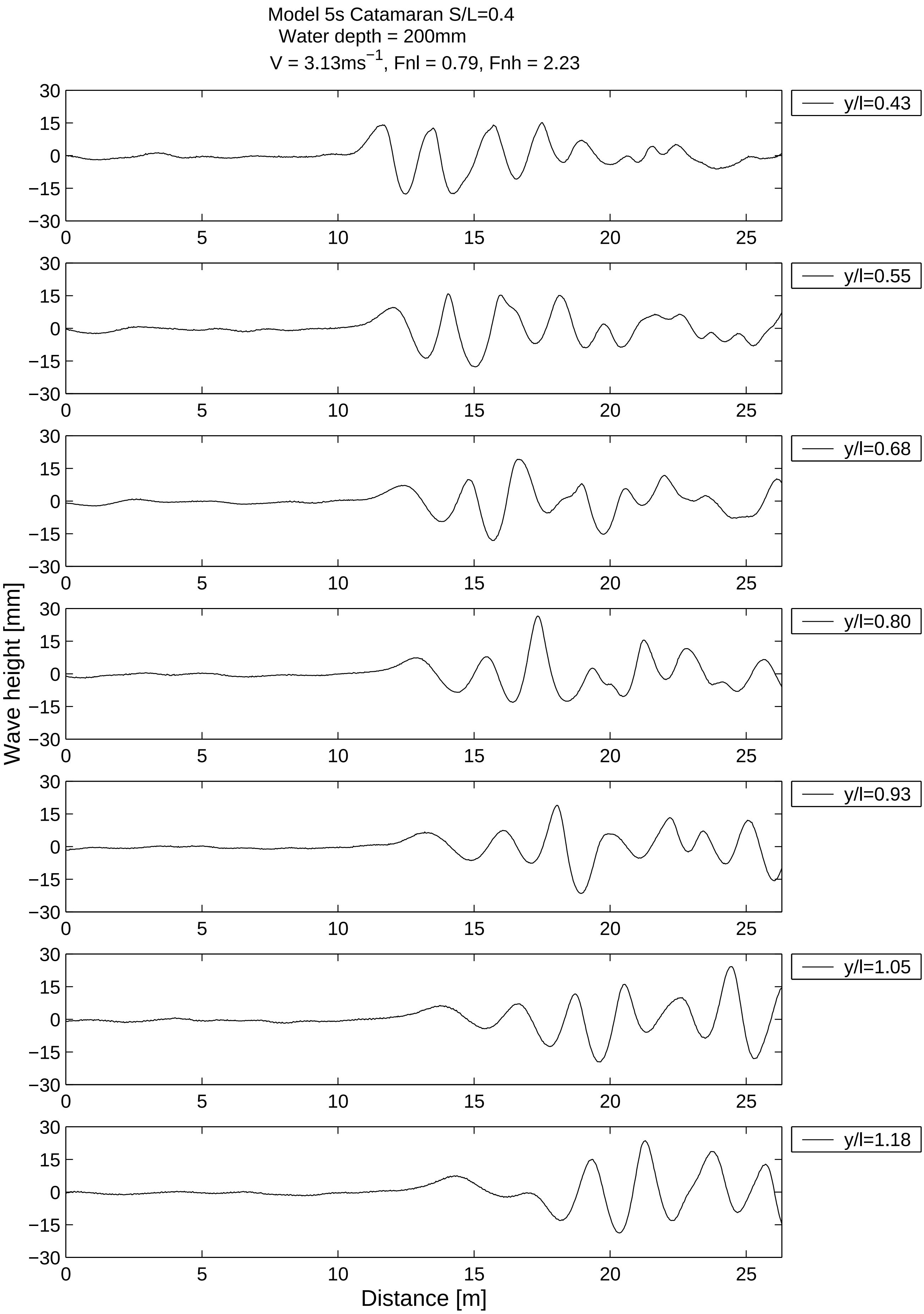
Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 1.72ms^{-1}, Fnl = 0.43, Fnh = 1.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 150



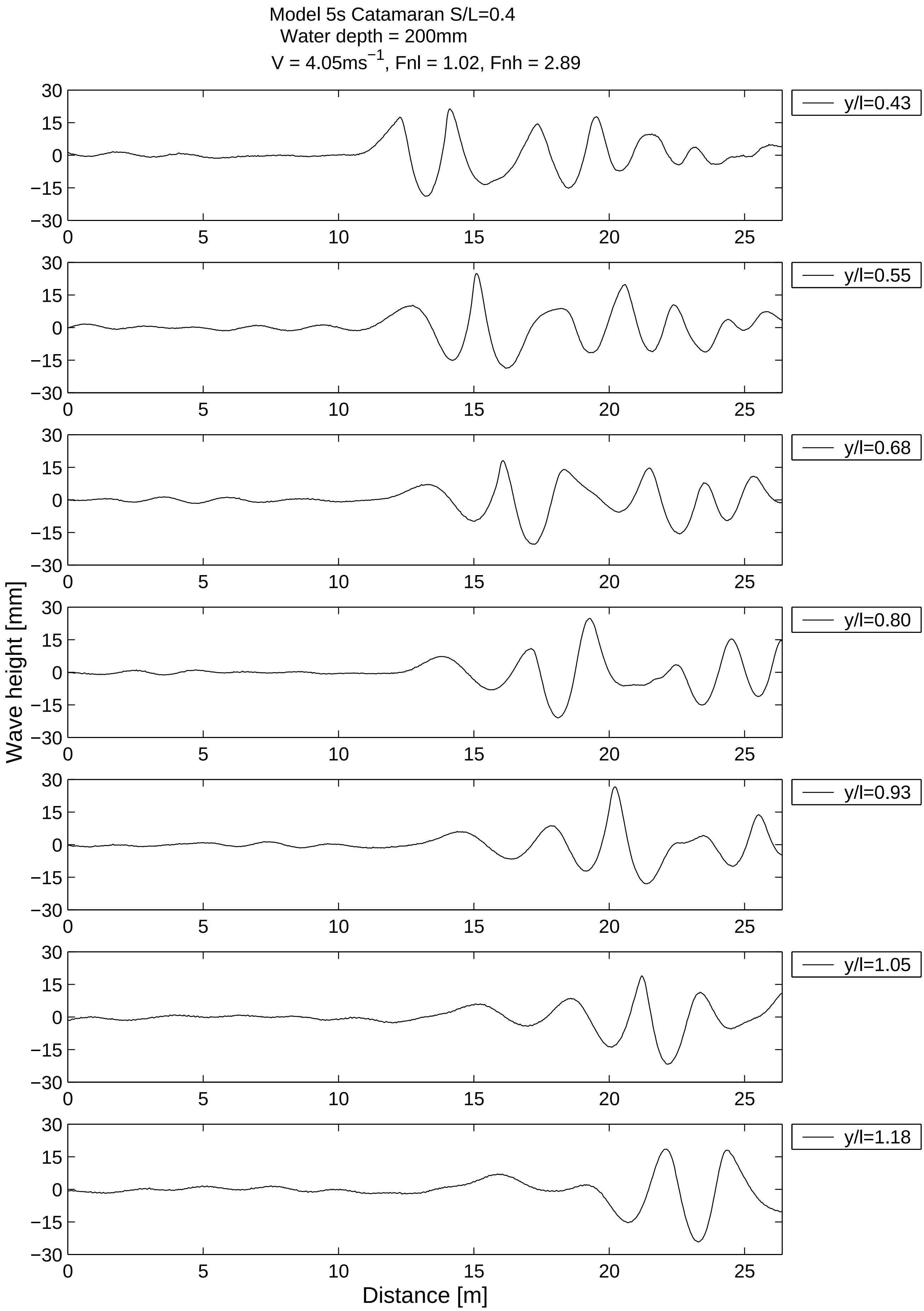
Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 2.03ms−1, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 151



Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 152



Model 5s Catamaran S/L=0.4
Water depth = 200mm
V = 4.05ms−1, Fnl = 1.02, Fnh = 2.89
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 153

Model 5b Catamaran S/L=0.2 trimmed bow up 2^o
Water depth = 200mm
V = 1.02ms^{-1}, Fnl = 0.26, Fnh = 0.73

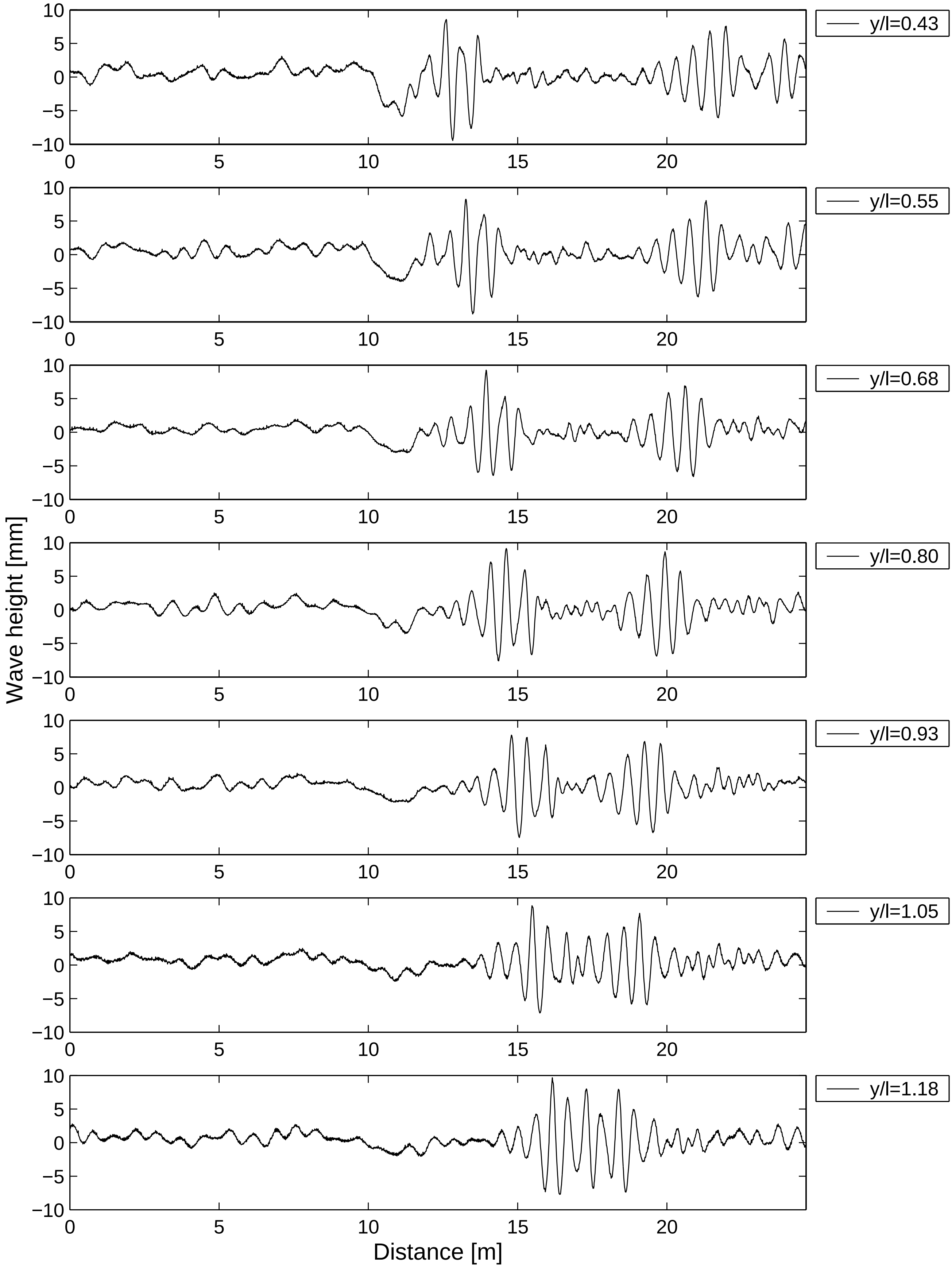
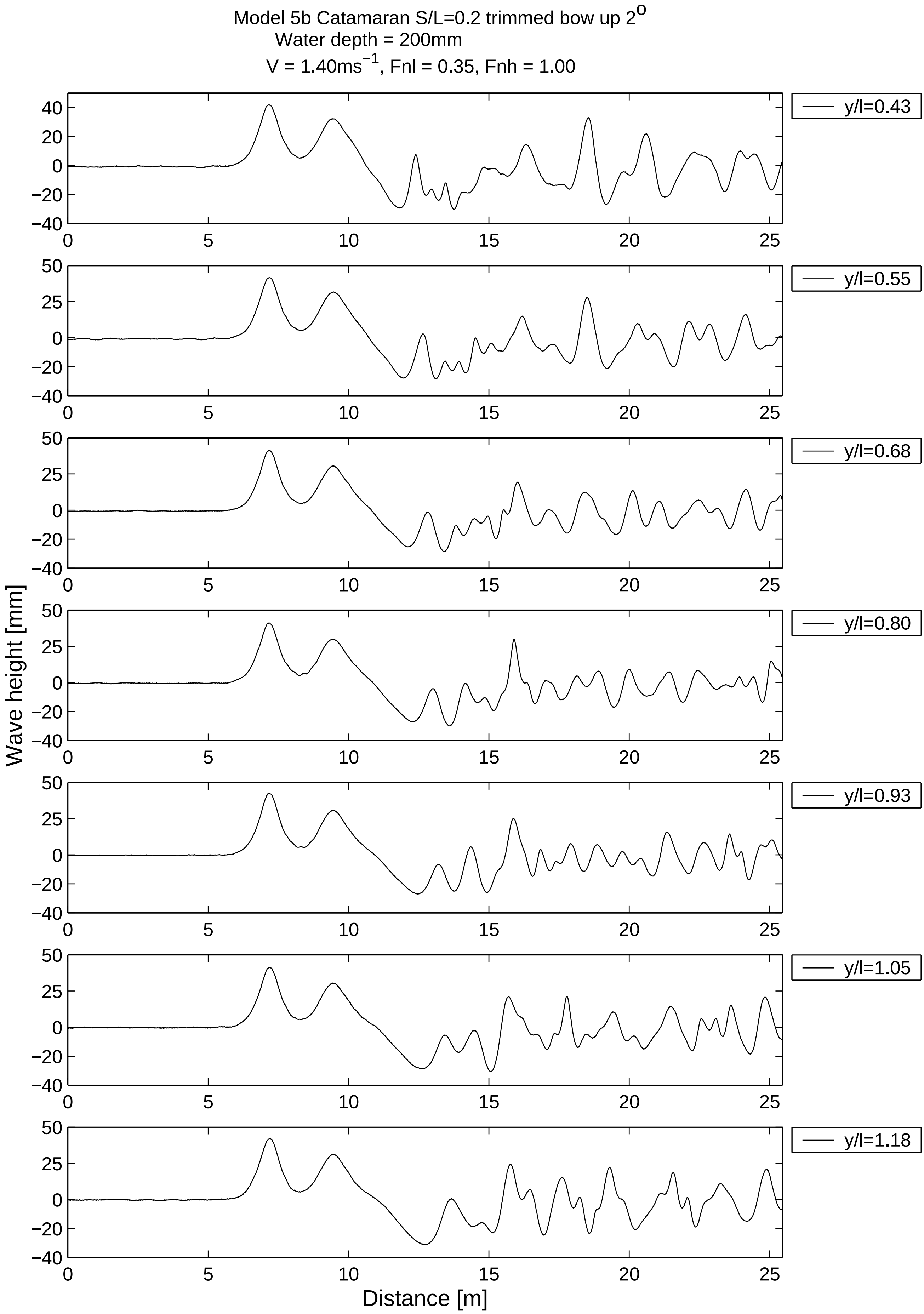
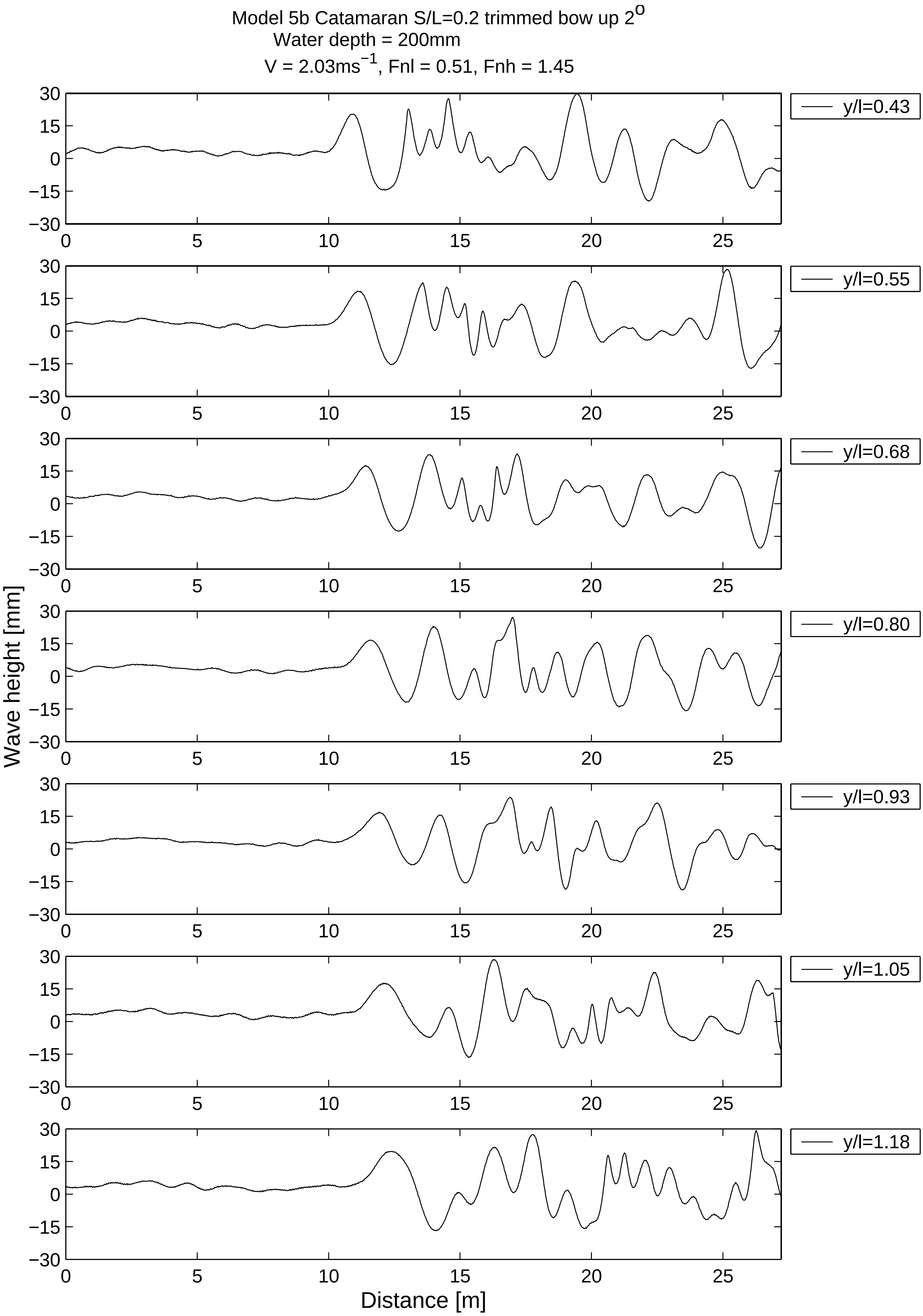


Figure 154



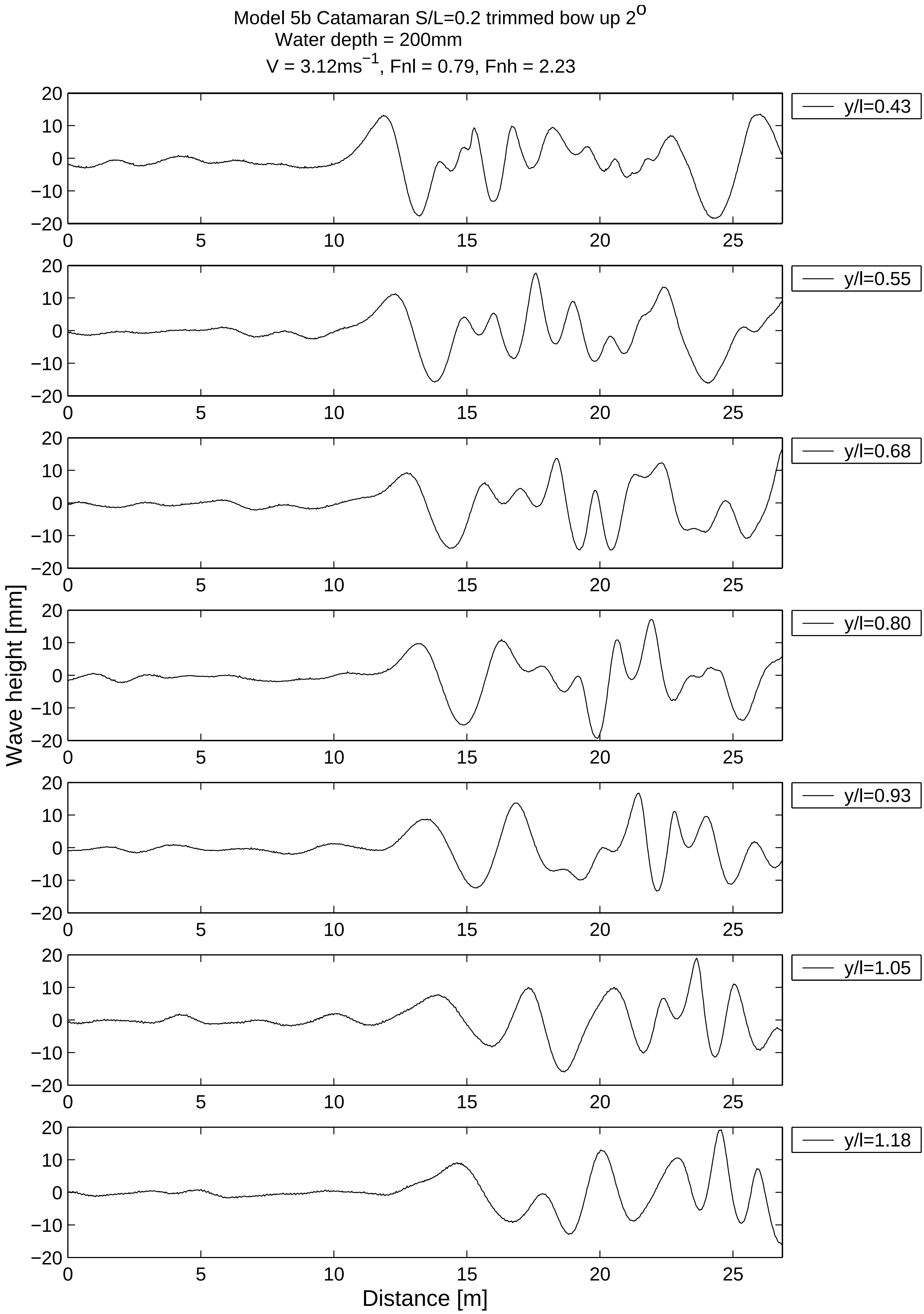
Model 5b Catamaran S/L=0.2 trimmed bow up 2°
Water depth = 200mm
V = 1.40ms−1, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 155



Model 5b Catamaran S/L=0.2 trimmed bow up 2°
Water depth = 200mm
V = 2.03ms⁻¹, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 156



Model 5b Catamaran S/L=0.2 trimmed bow up 2°
Water depth = 200mm
V = 3.12ms⁻¹, Fnl = 0.79, Fnh = 2.23
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 157

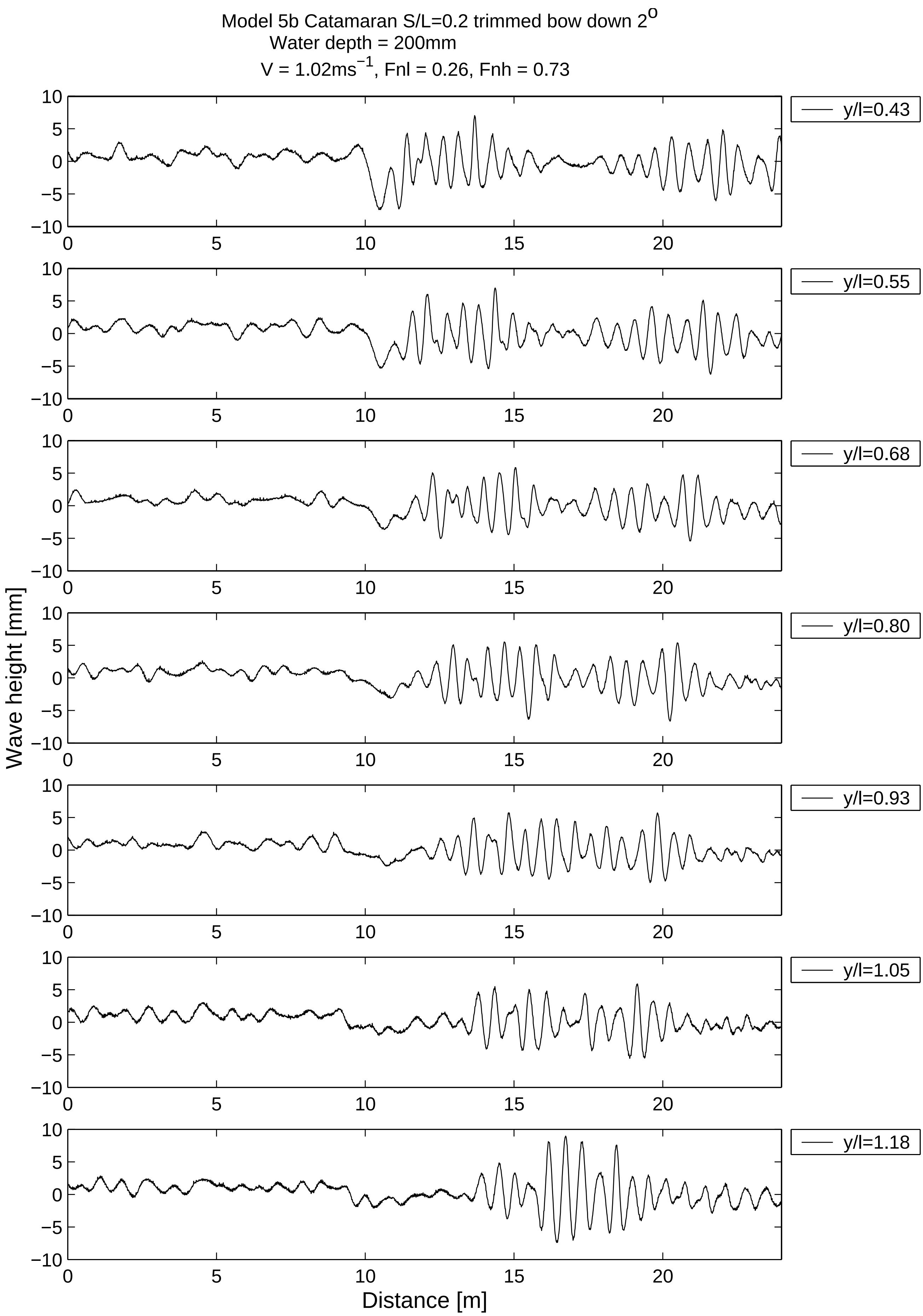
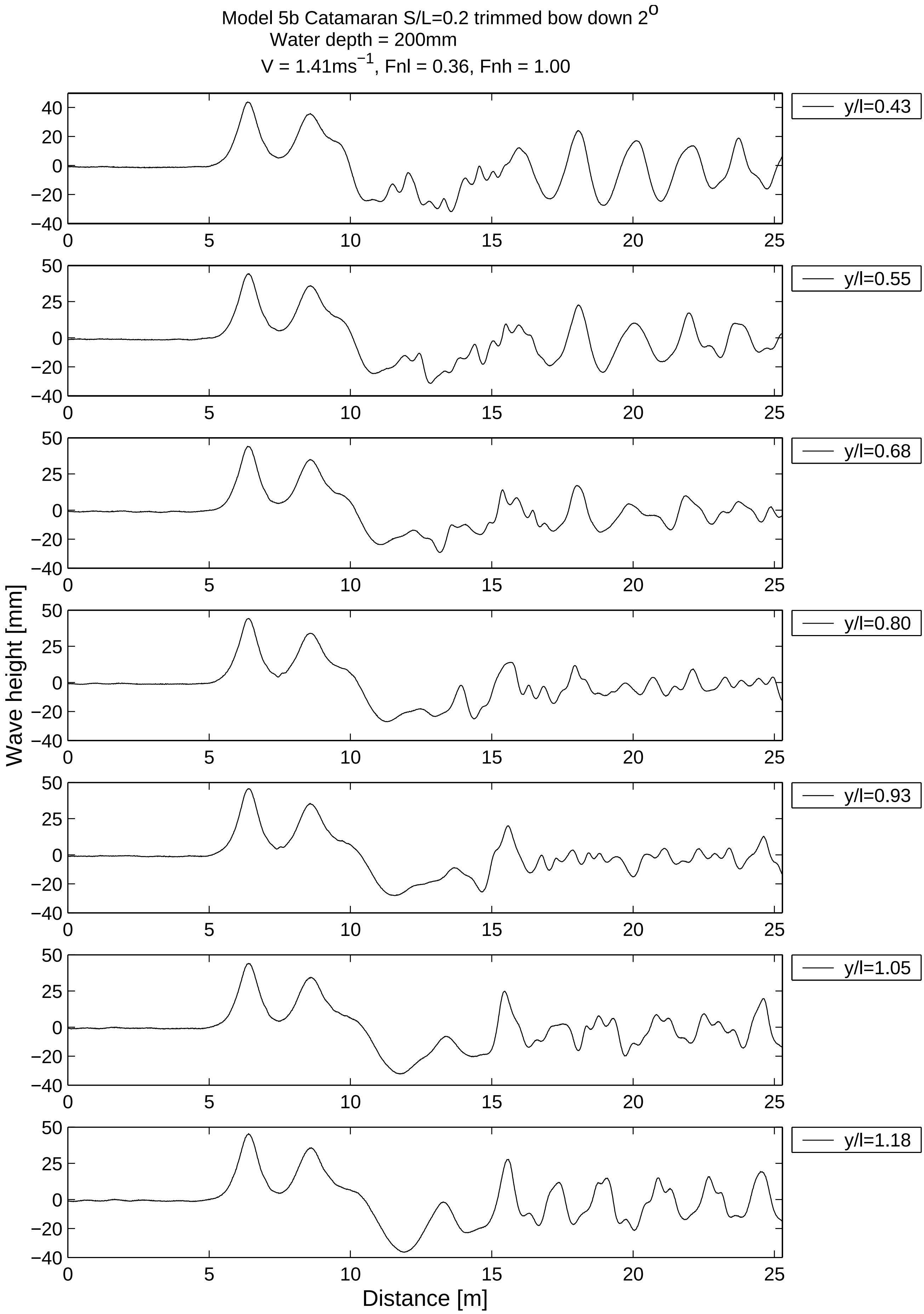
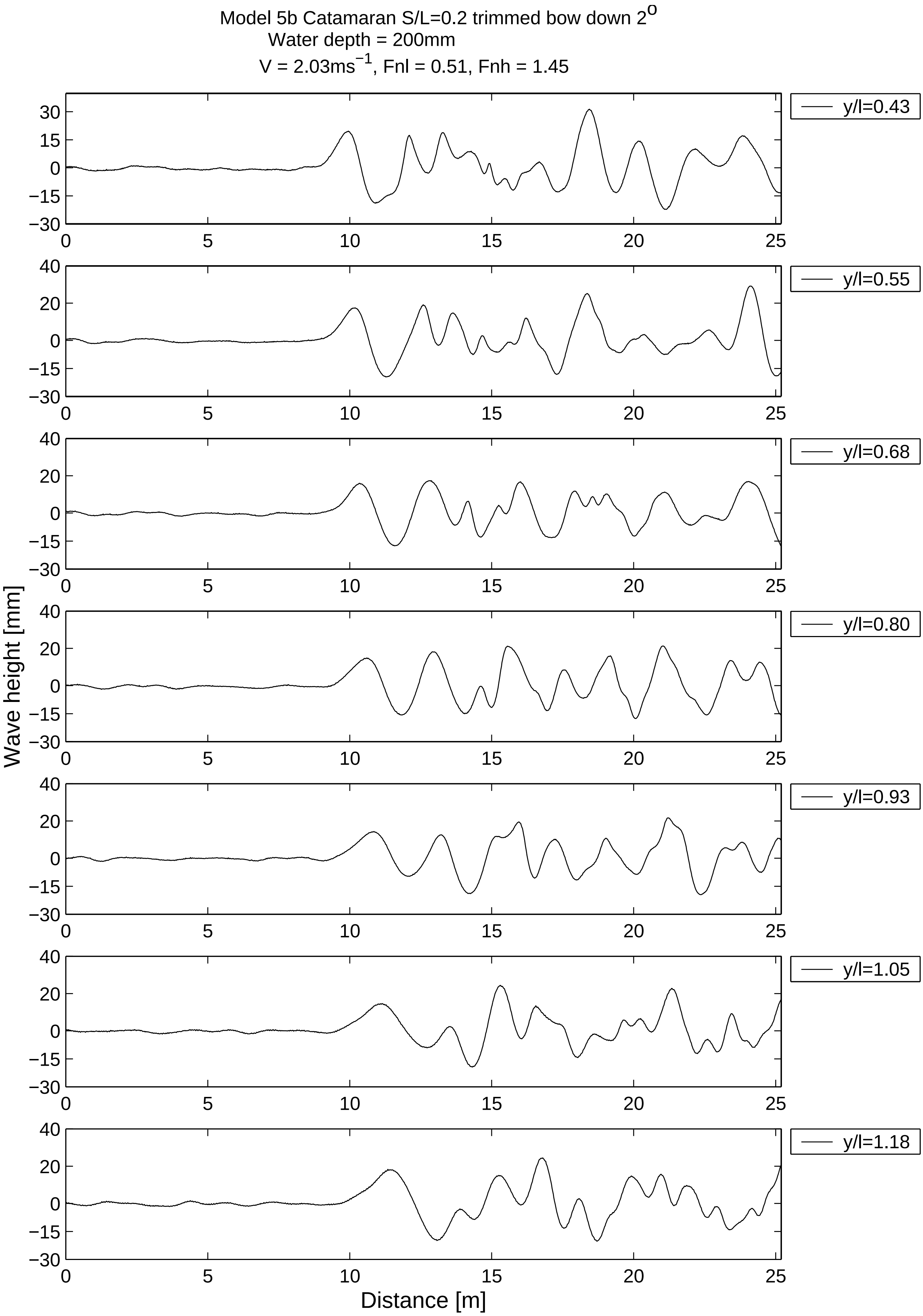

Model 5b Catamaran S/L=0.2 trimmed bow down 2°
Water depth = 200mm
V = 1.02ms−1, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 158



Model 5b Catamaran S/L=0.2 trimmed bow down 2°
Water depth = 200mm
V = 1.41ms⁻¹, Fnl = 0.36, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 159



Model 5b Catamaran S/L=0.2 trimmed bow down 2°
Water depth = 200mm
V = 2.03ms⁻¹, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 160

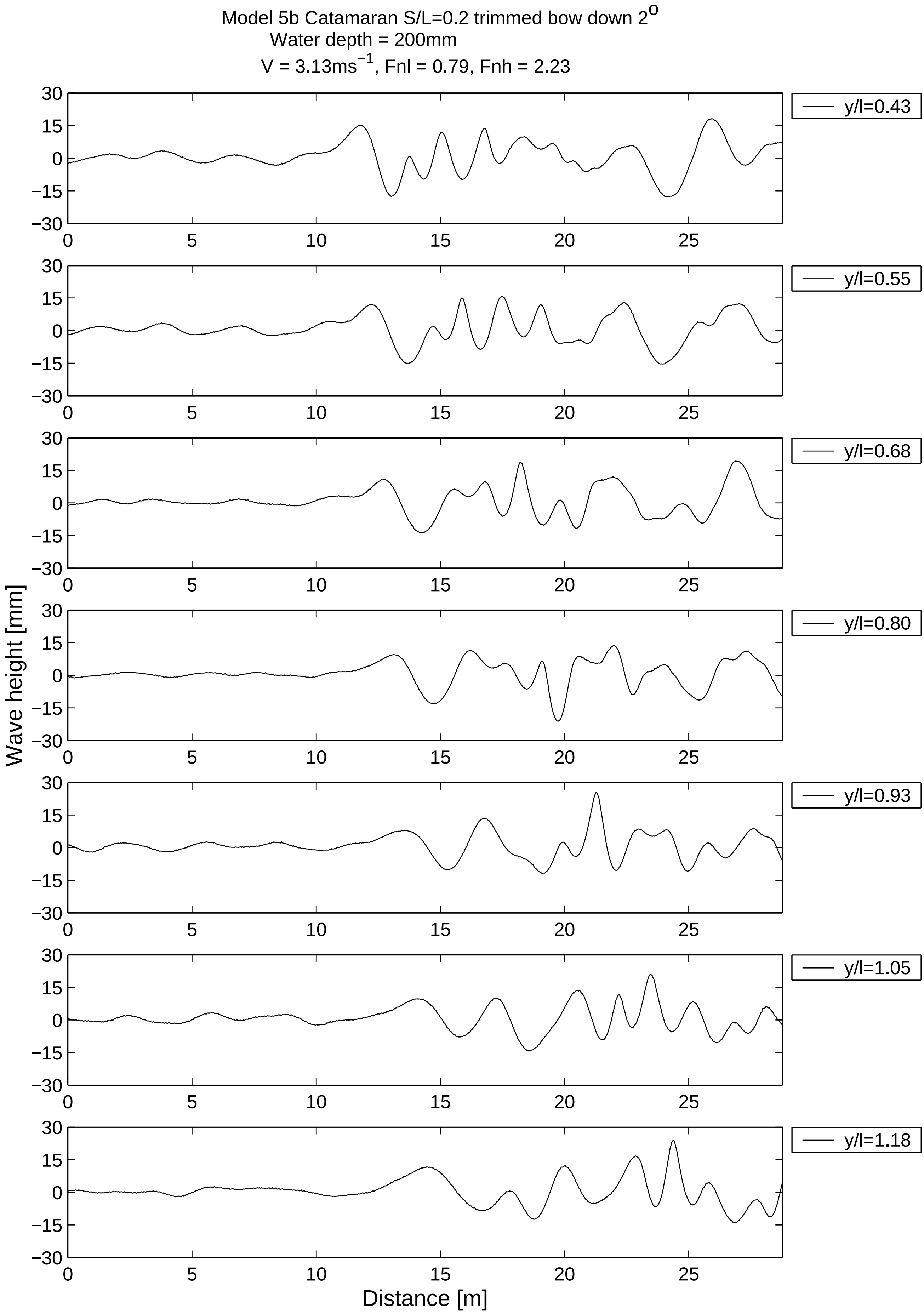
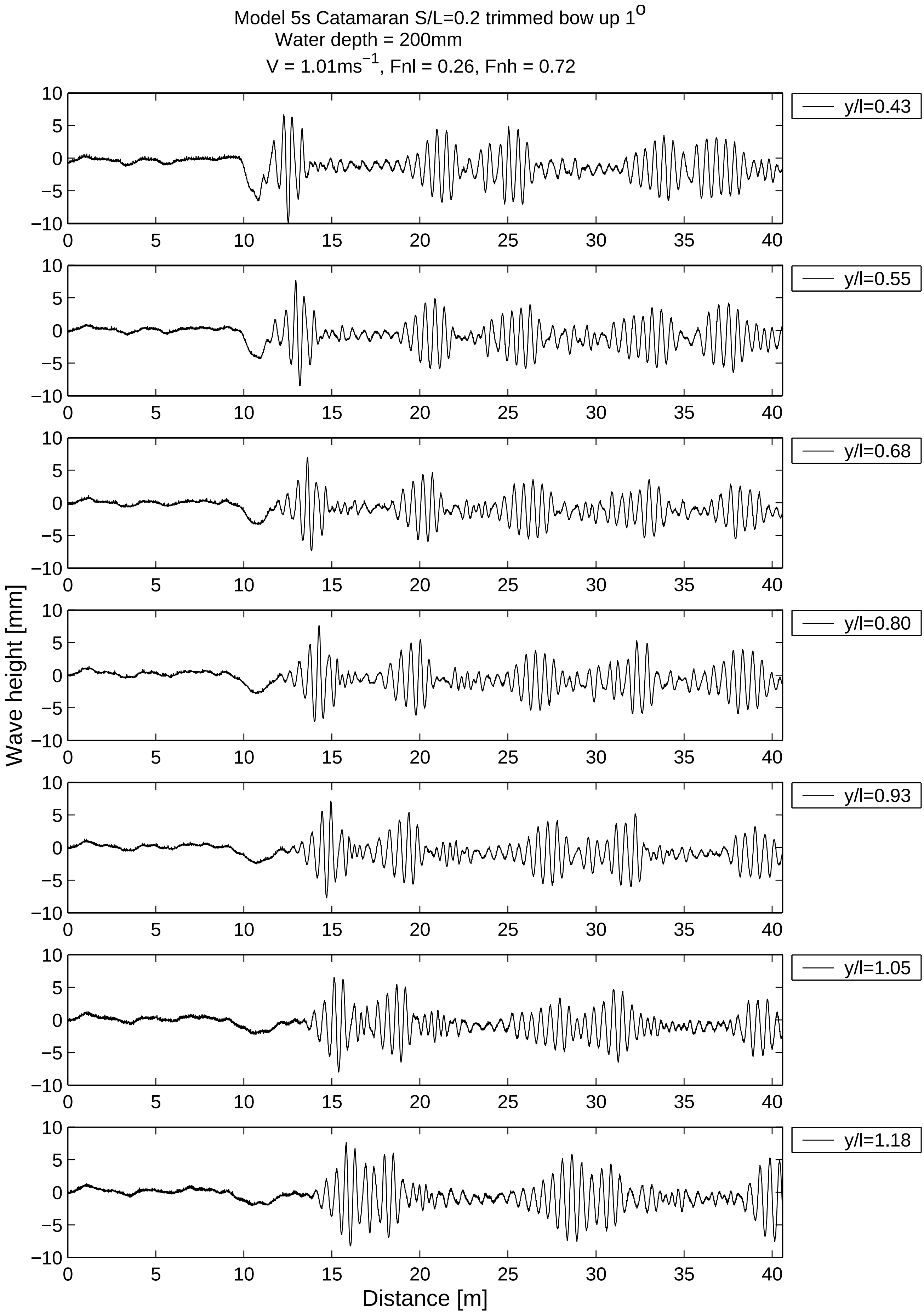

Model 5b Catamaran S/L=0.2 trimmed bow down 2°
Water depth = 200mm
V = 3.13ms−1, Fnl = 0.79, Fnh = 2.23
Wave height [mm]
Distance [m]
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18

Figure 161



Model 5s Catamaran S/L=0.2 trimmed bow up 1°
Water depth = 200mm
V = 1.01ms⁻¹, Fnl = 0.26, Fnh = 0.72
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 162

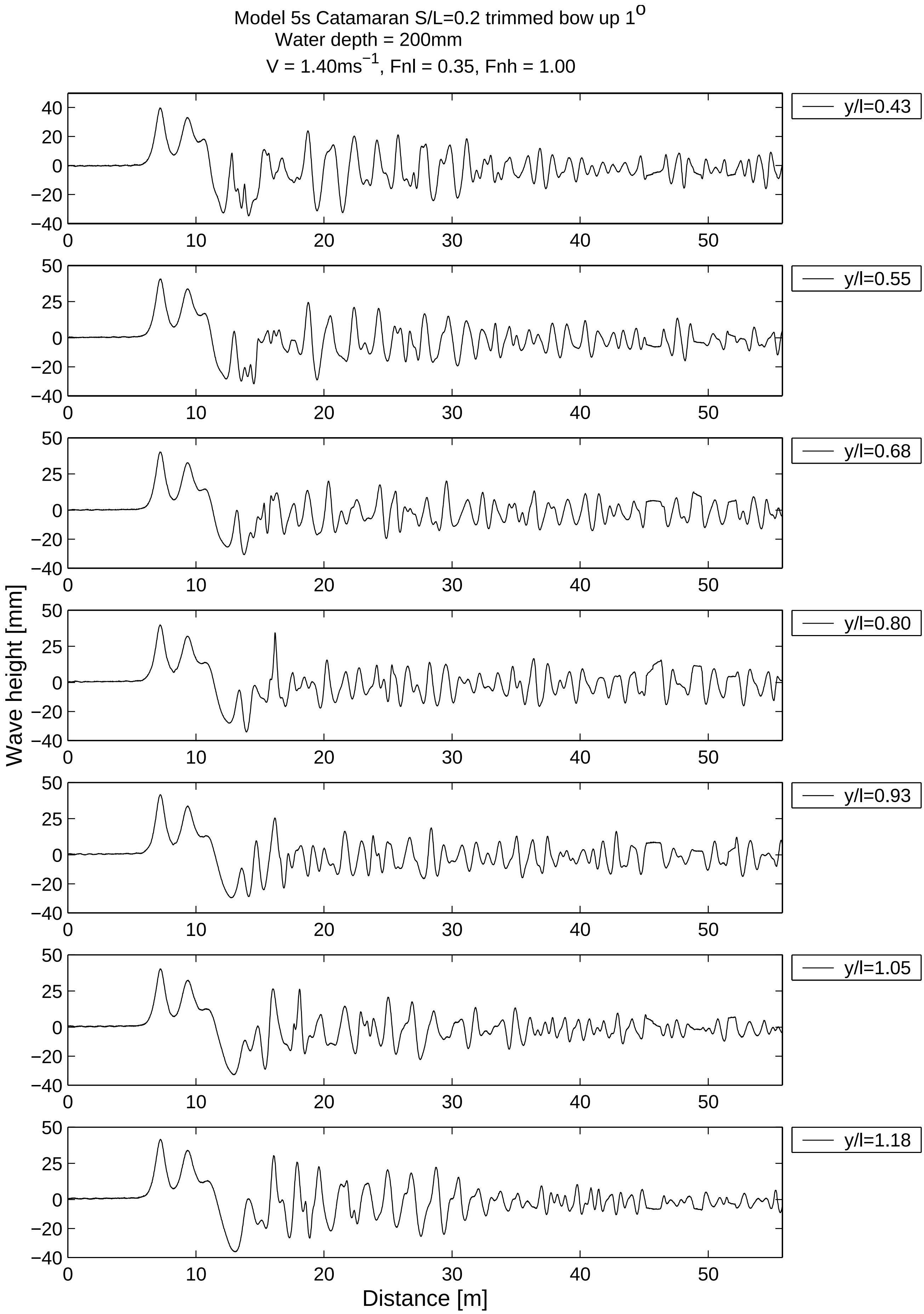
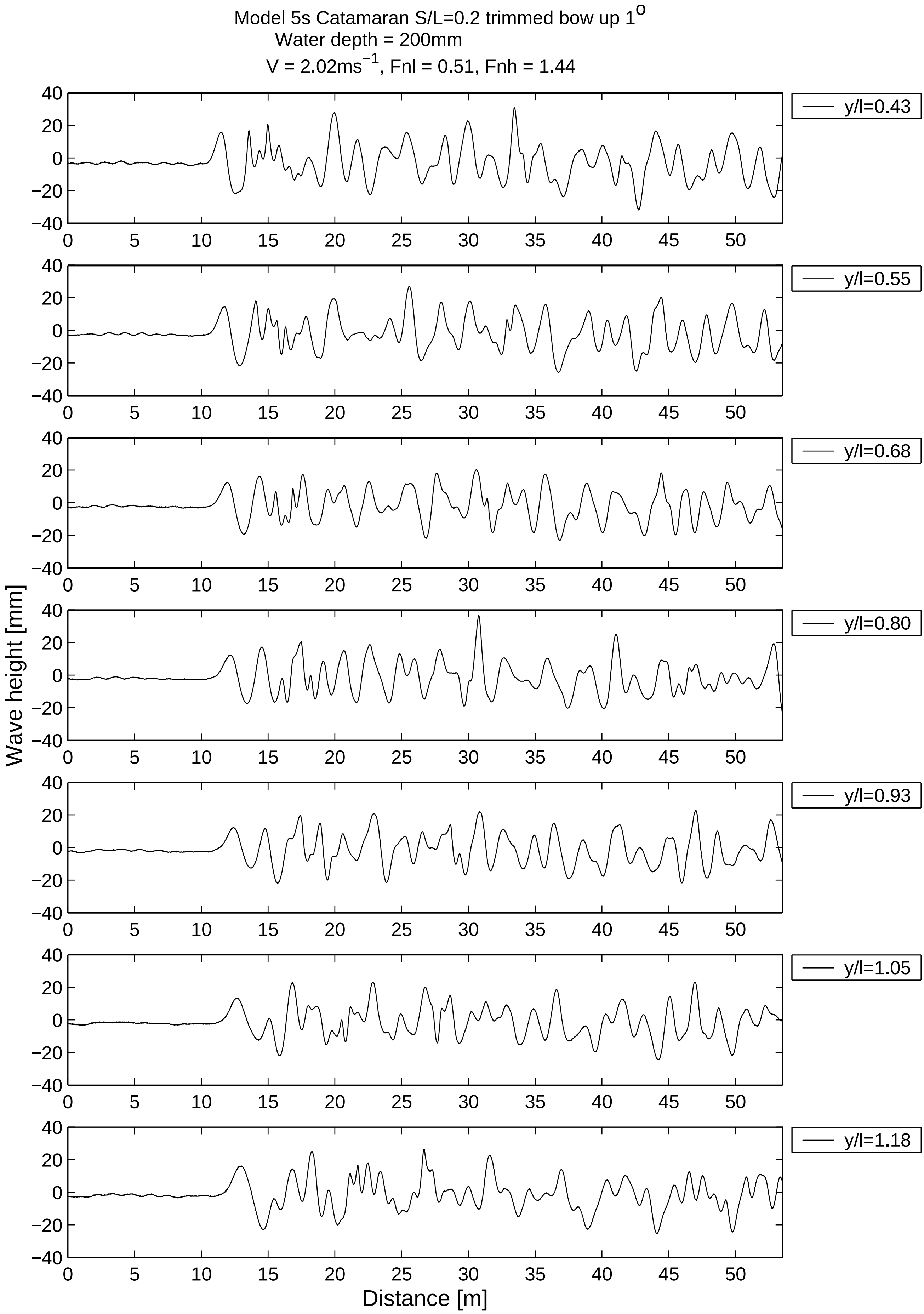

Model 5s Catamaran S/L=0.2 trimmed bow up 1°
Water depth = 200mm
V = 1.40ms⁻¹, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 163



Model 5s Catamaran S/L=0.2 trimmed bow up 1°
Water depth = 200mm
V = 2.02ms⁻¹, Fnl = 0.51, Fnh = 1.44
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 164

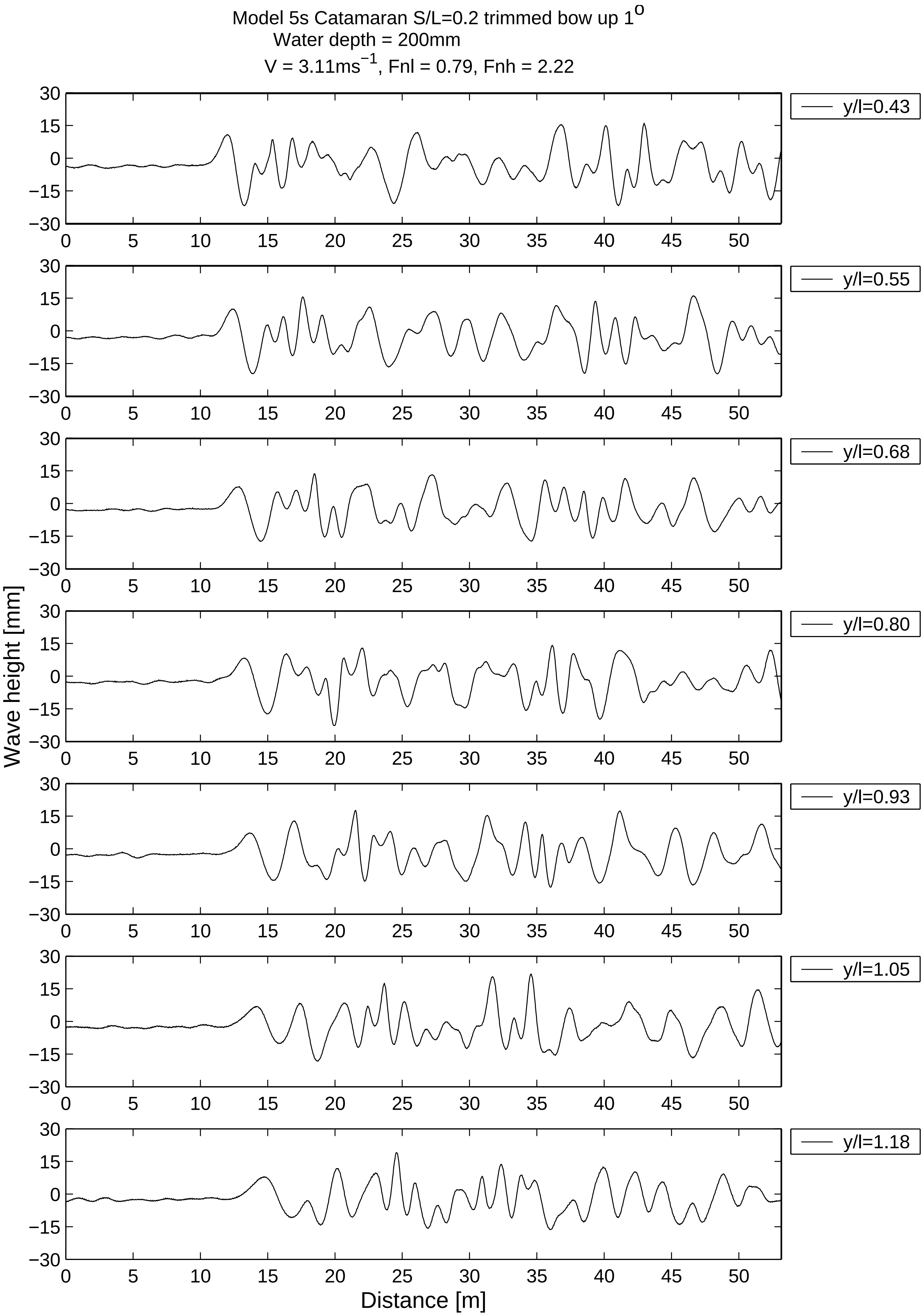
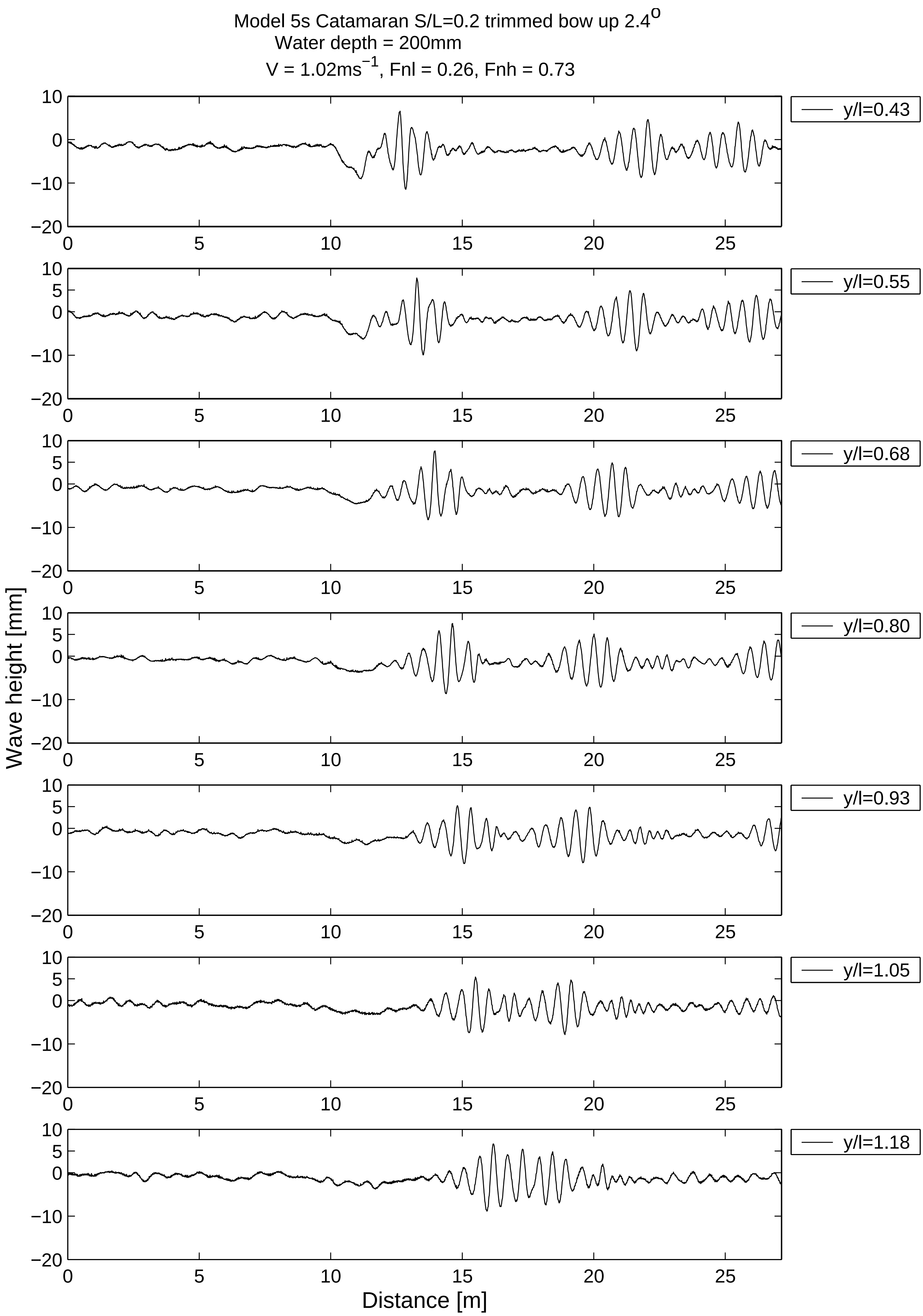
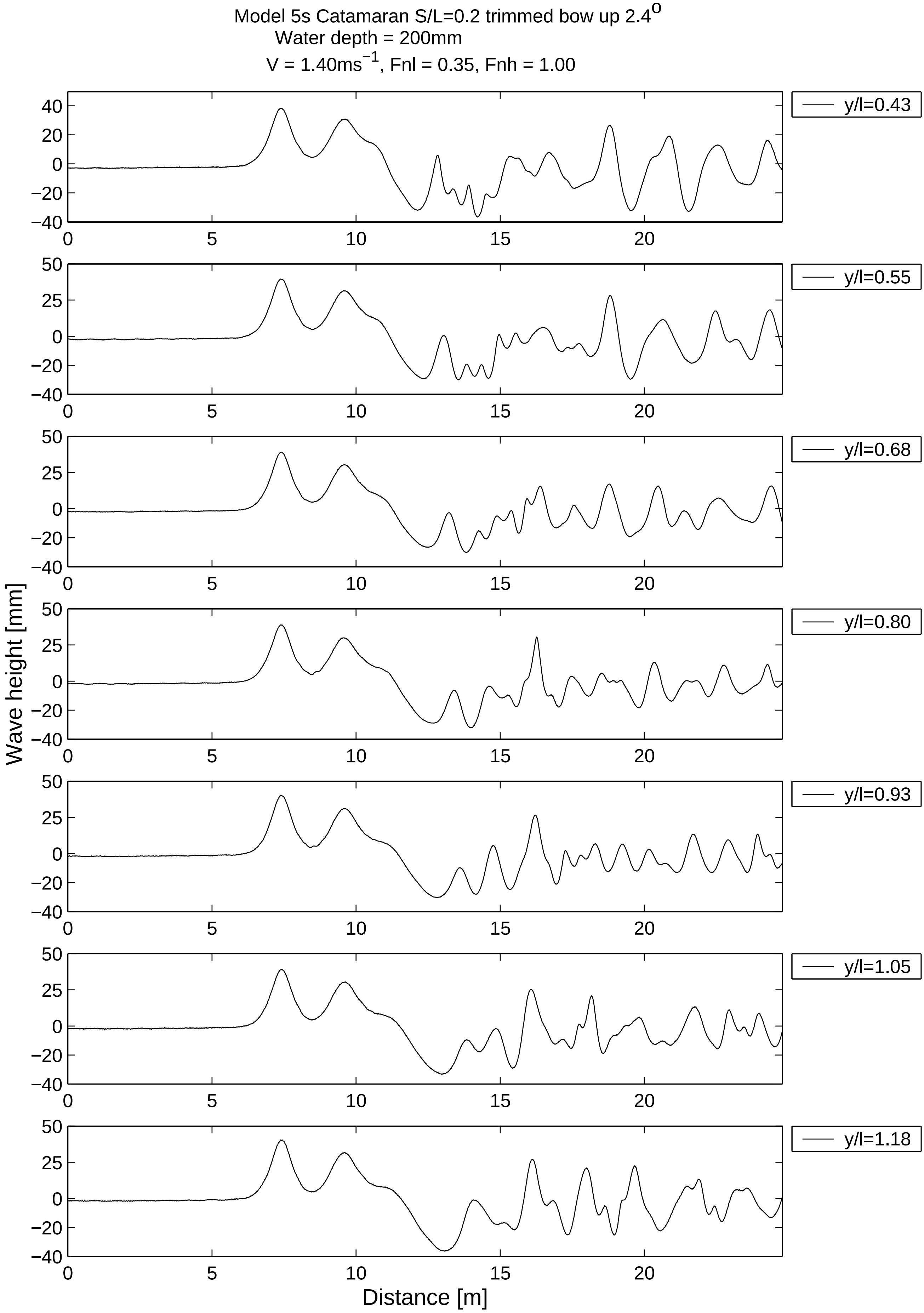

Model 5s Catamaran S/L=0.2 trimmed bow up 1°
Water depth = 200mm
V = 3.11ms−1, Fnl = 0.79, Fnh = 2.22
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]
30
15
0
−15
−30
0
5
10
15
20
25
30
35
40
45
50

Figure 165



Model 5s Catamaran S/L=0.2 trimmed bow up 2.4°
Water depth = 200mm
V = 1.02ms−1, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 166



Model 5s Catamaran S/L=0.2 trimmed bow up 2.4°
Water depth = 200mm
V = 1.40ms⁻¹, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 167

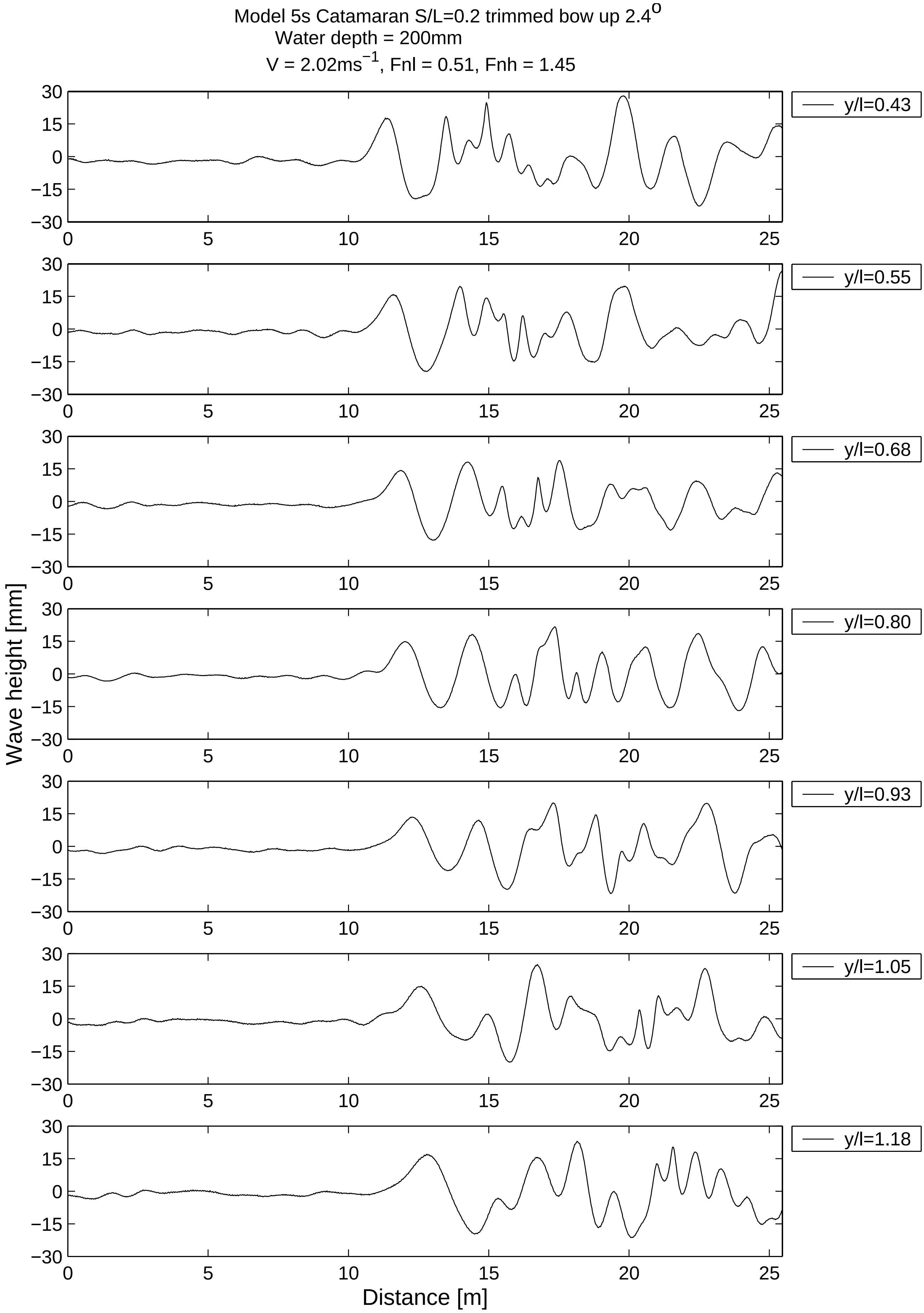
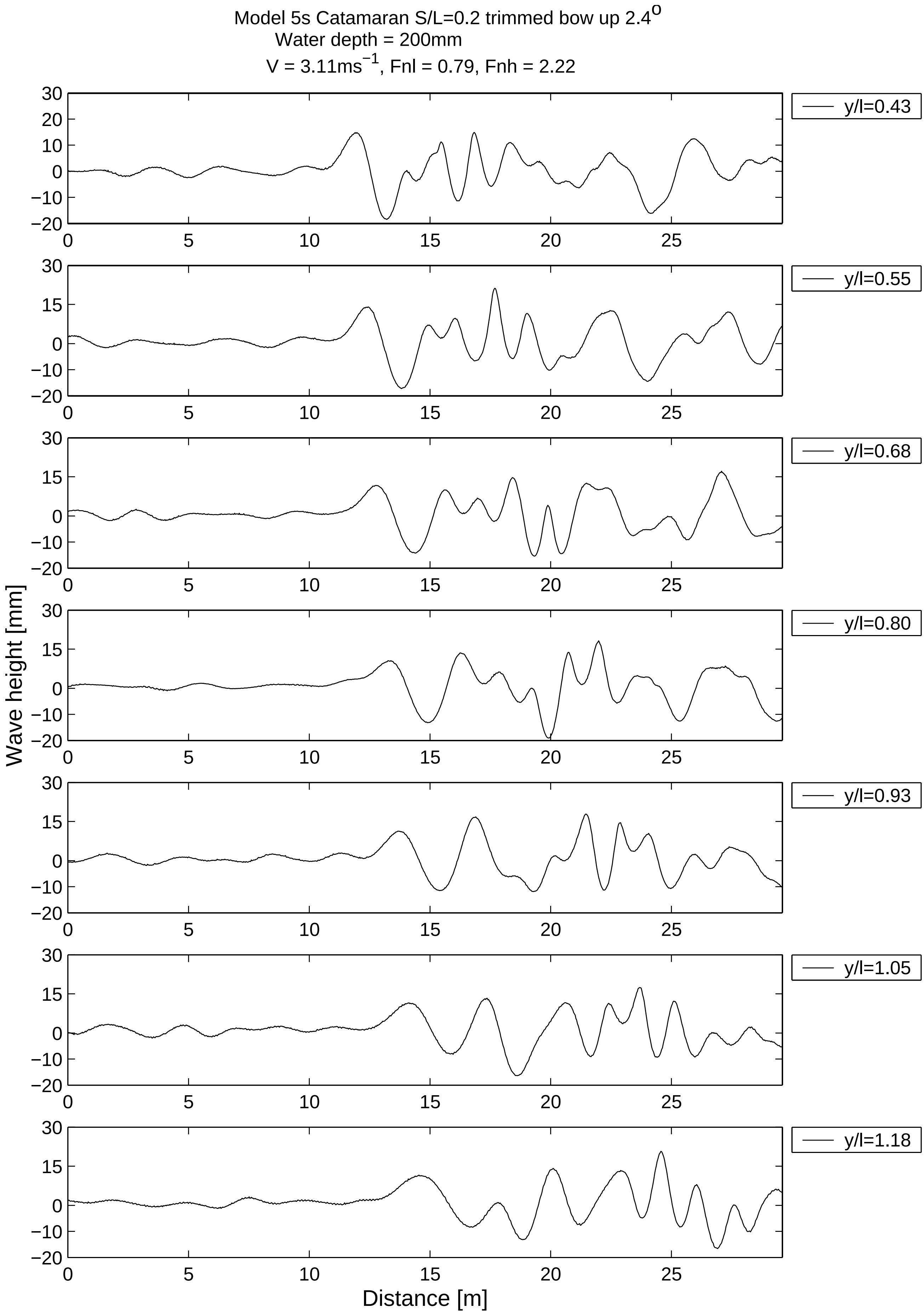

Model 5s Catamaran S/L=0.2 trimmed bow up 2.4°
Water depth = 200mm
V = 2.02ms⁻¹, Fnl = 0.51, Fnh = 1.45
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 168



Model 5s Catamaran S/L=0.2 trimmed bow up 2.4°
Water depth = 200mm
V = 3.11ms⁻¹, Fnl = 0.79, Fnh = 2.22
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 169

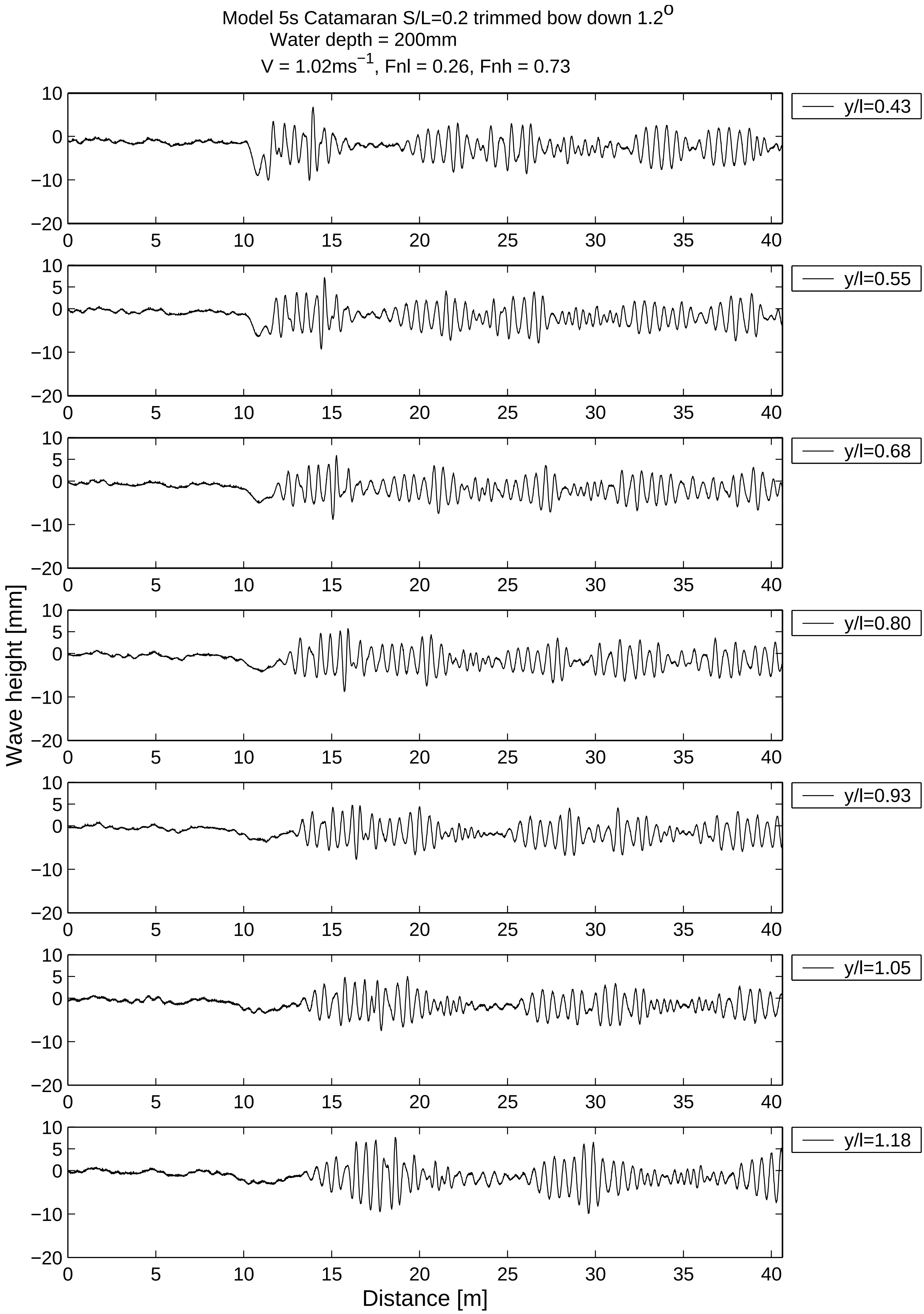
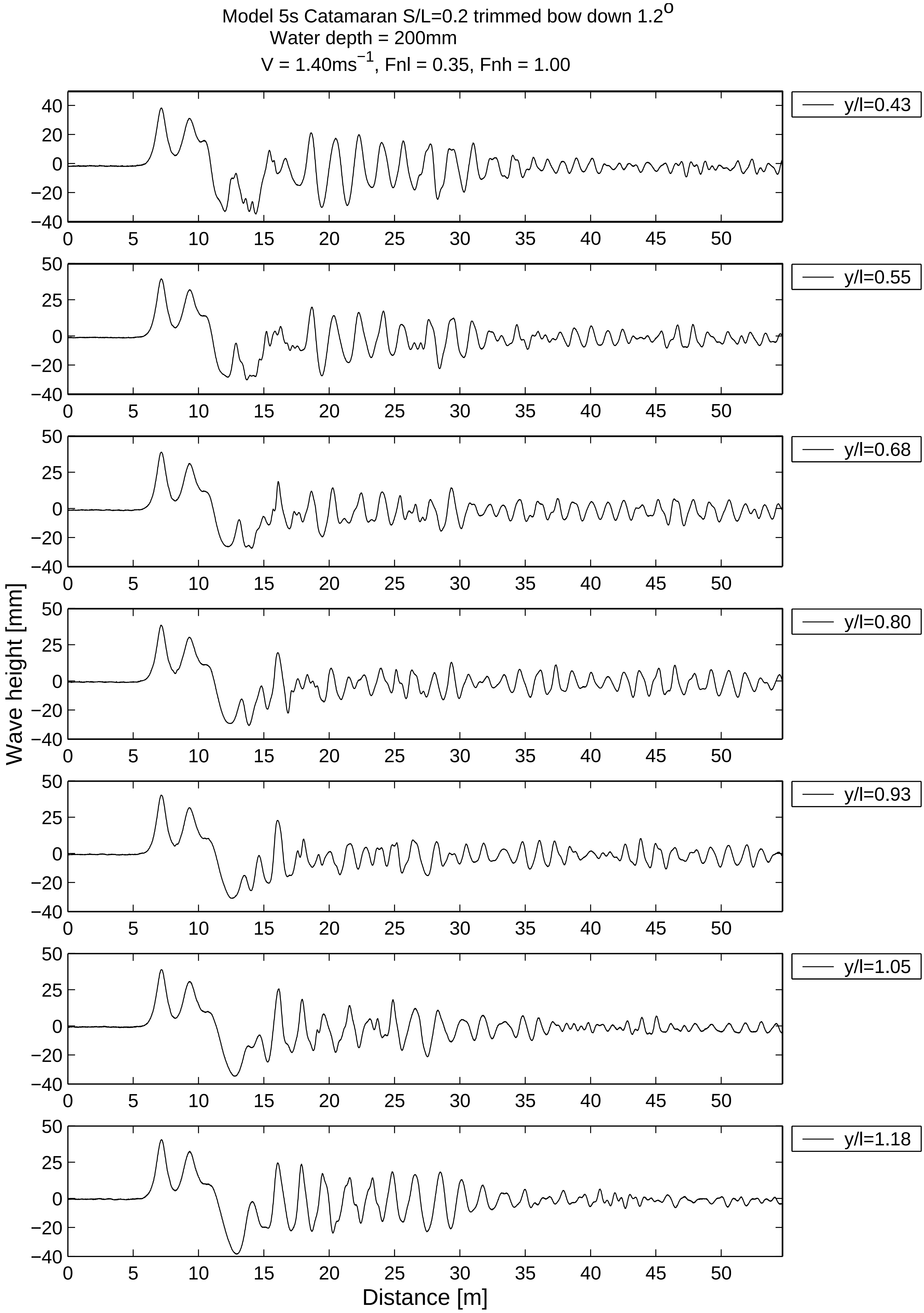

Model 5s Catamaran S/L=0.2 trimmed bow down 1.2°
Water depth = 200mm
V = 1.02ms⁻¹, Fnl = 0.26, Fnh = 0.73
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 170



Model 5s Catamaran S/L=0.2 trimmed bow down 1.2°
Water depth = 200mm
V = 1.40ms⁻¹, Fnl = 0.35, Fnh = 1.00
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 171

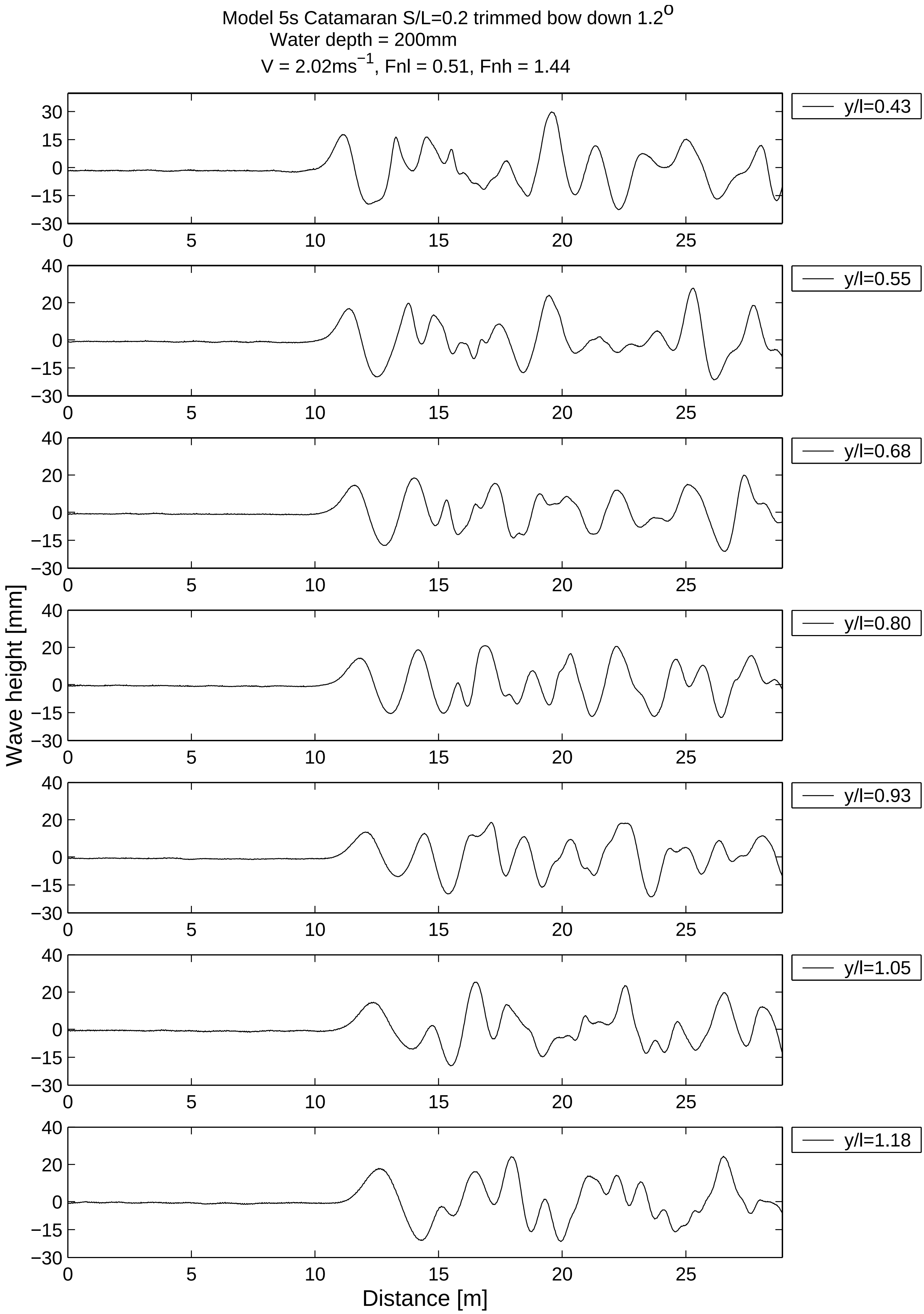
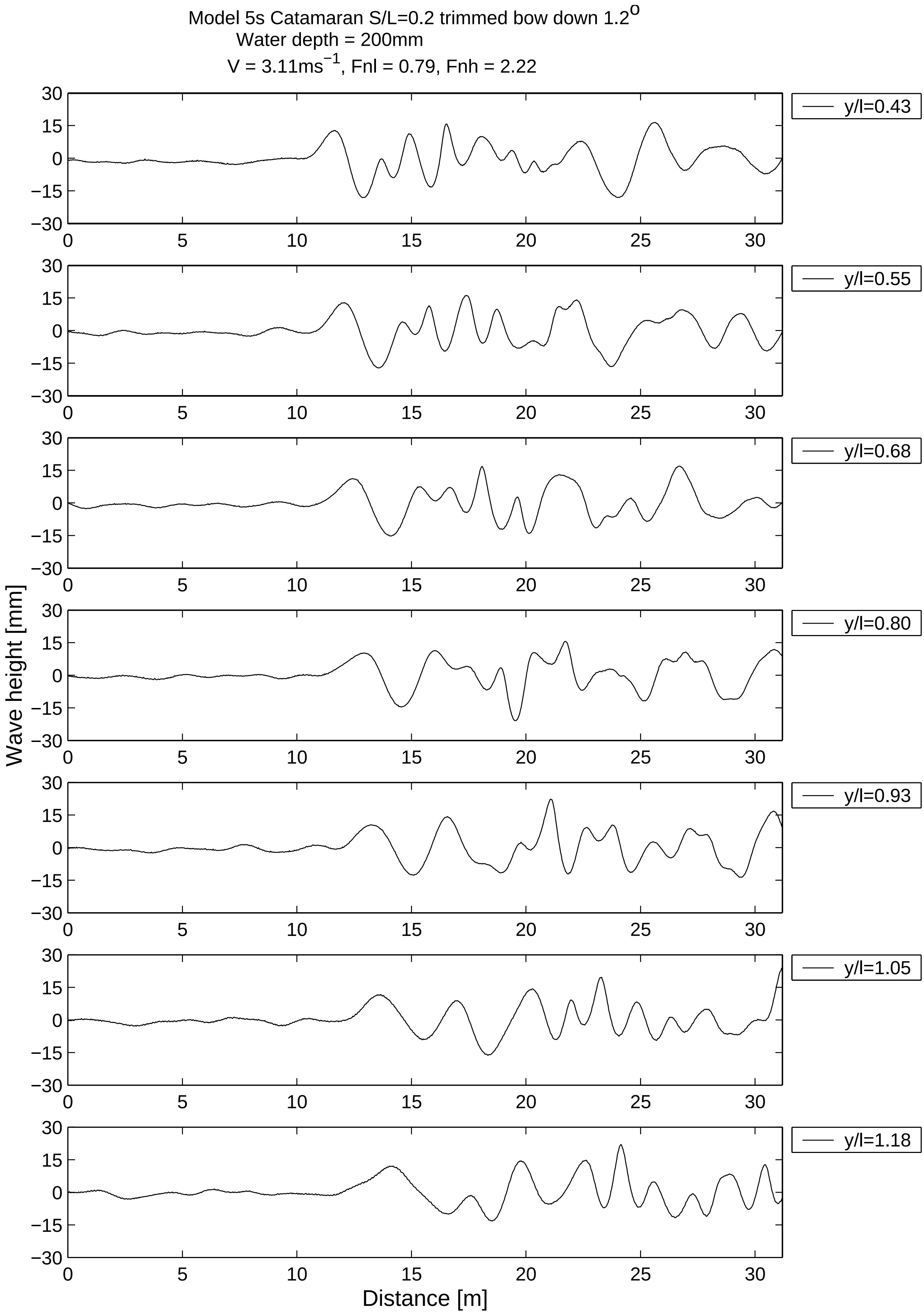
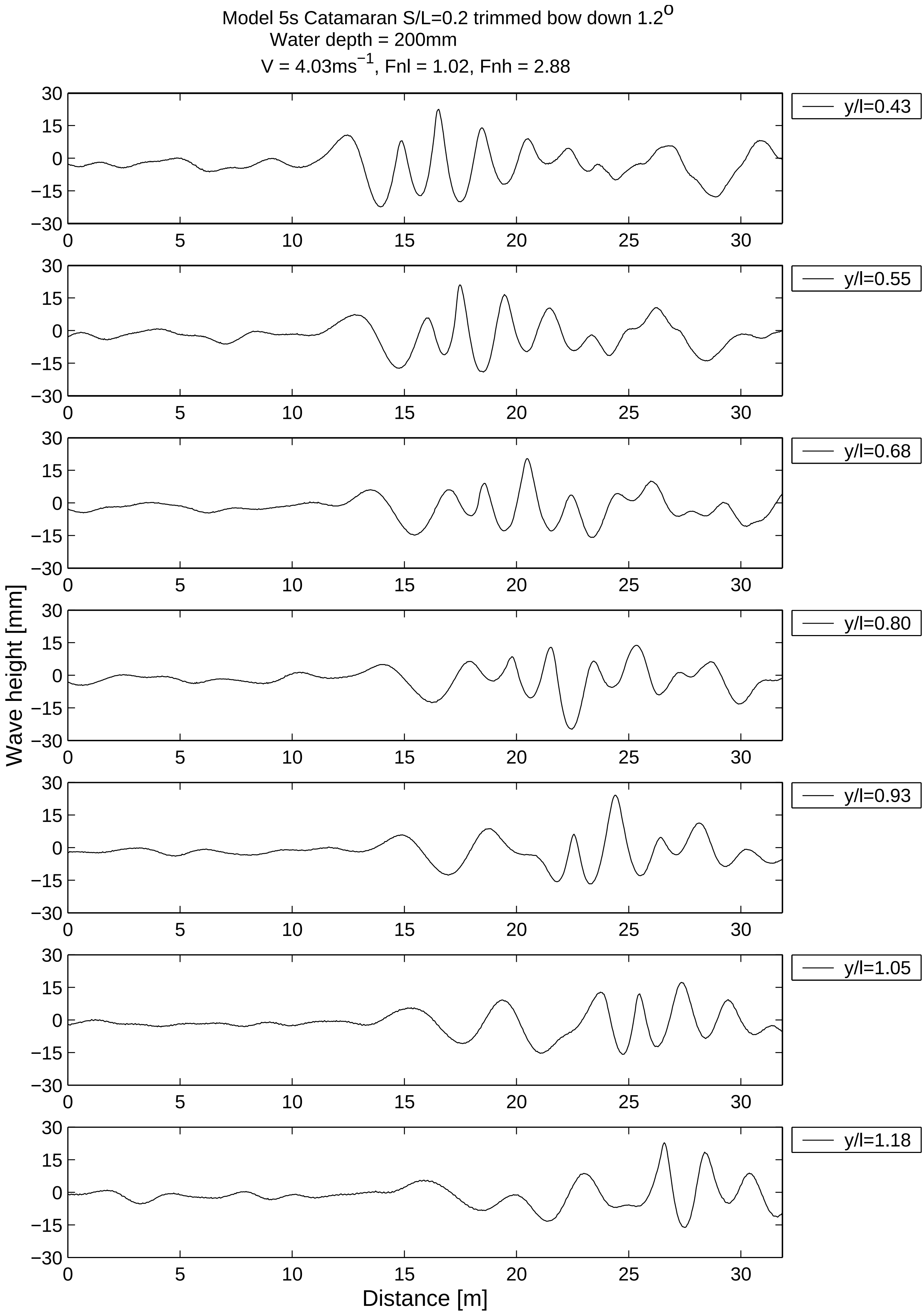

Model 5s Catamaran S/L=0.2 trimmed bow down 1.2°
Water depth = 200mm
V = 2.02ms⁻¹, Fnl = 0.51, Fnh = 1.44
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 172



Model 5s Catamaran S/L=0.2 trimmed bow down 1.2°
Water depth = 200mm
V = 3.11ms⁻¹, Fnl = 0.79, Fnh = 2.22
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 173



Model 5s Catamaran S/L=0.2 trimmed bow down 1.2°
Water depth = 200mm
V = 4.03ms−1, Fnl = 1.02, Fnh = 2.88
y/l=0.43
y/l=0.55
y/l=0.68
y/l=0.80
y/l=0.93
y/l=1.05
y/l=1.18
Wave height [mm]
Distance [m]

Figure 174

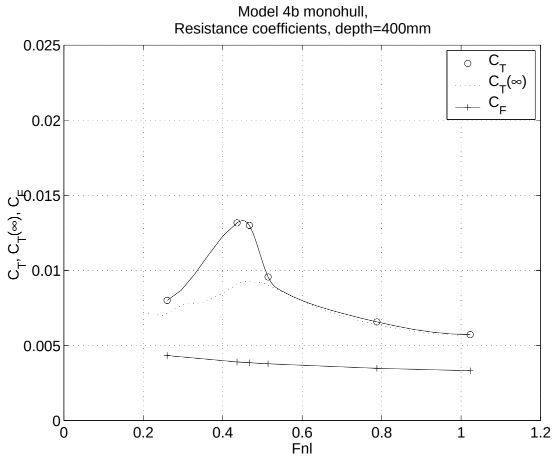


Figure 175

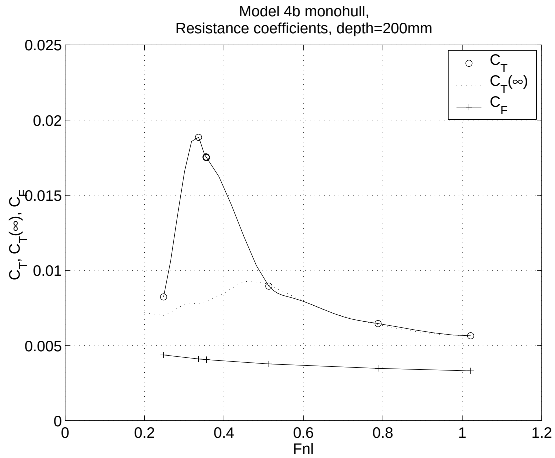


Figure 176

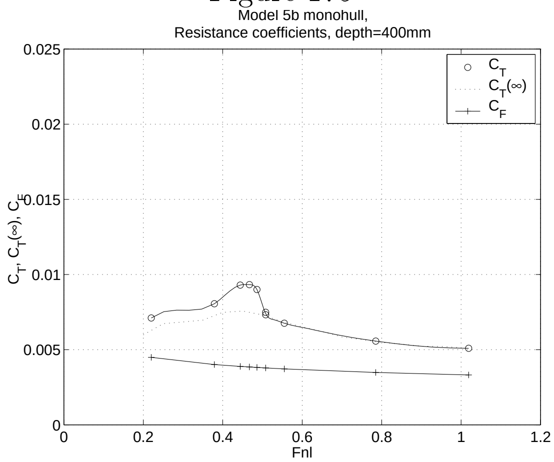


Figure 177

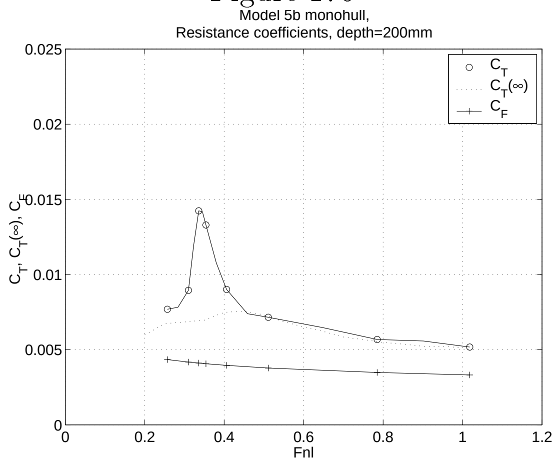


Figure 178

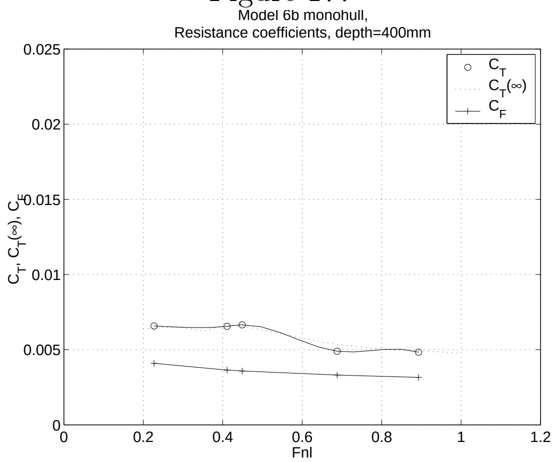


Figure 179

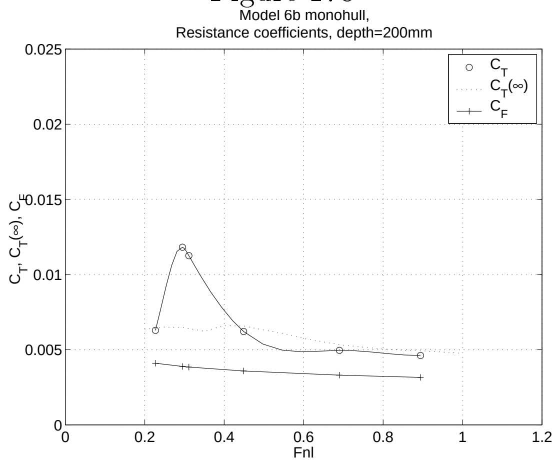


Figure 180

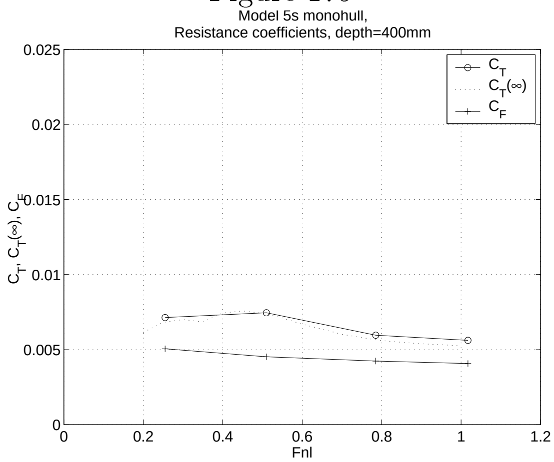


Figure 181

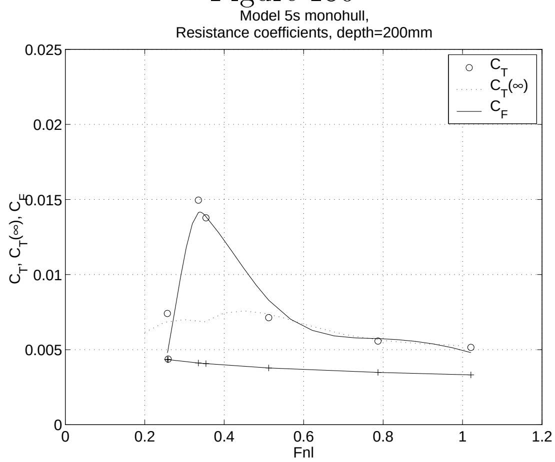


Figure 182

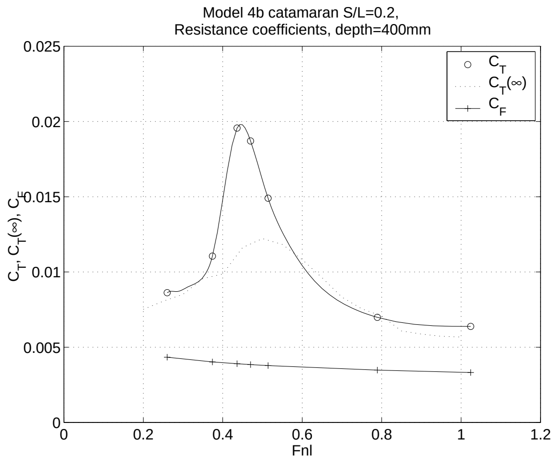


Figure 183

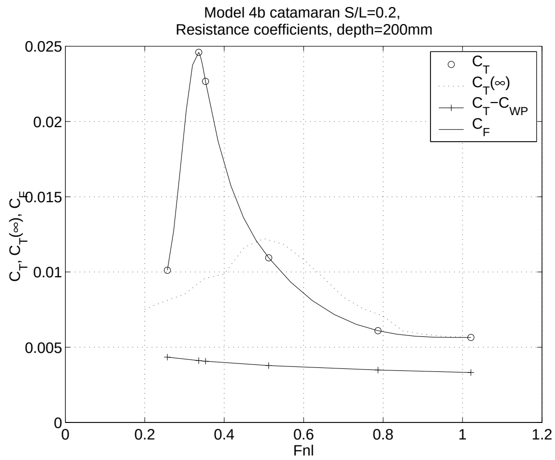


Figure 184

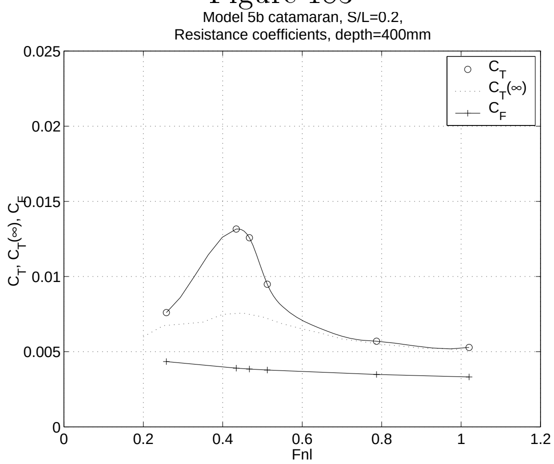


Figure 185

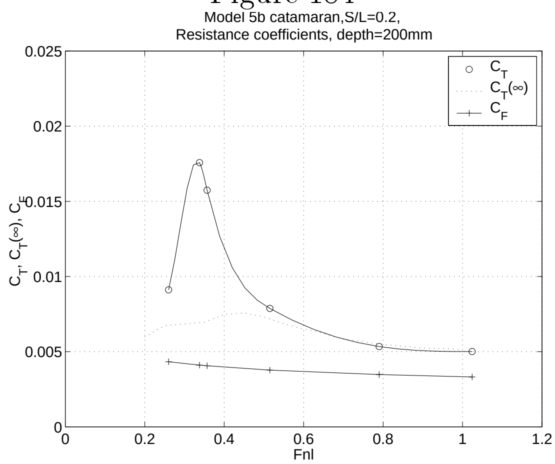


Figure 186

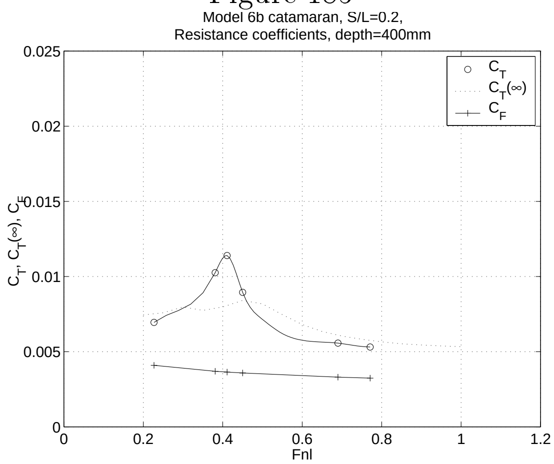


Figure 187

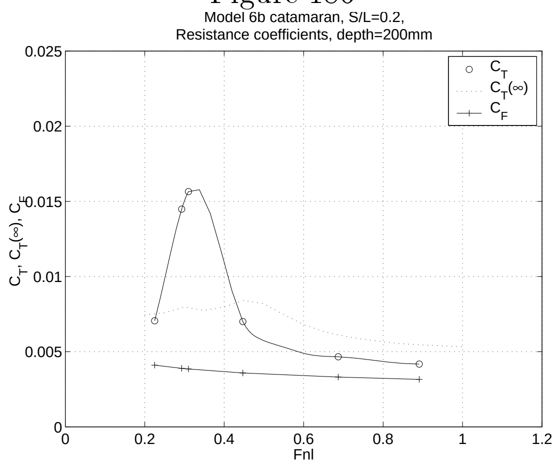


Figure 188

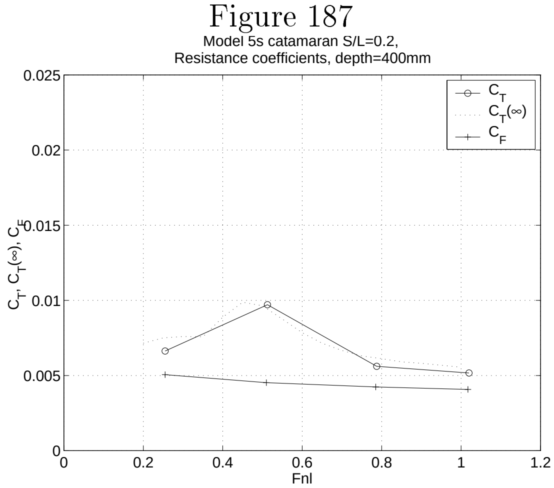


Figure 189

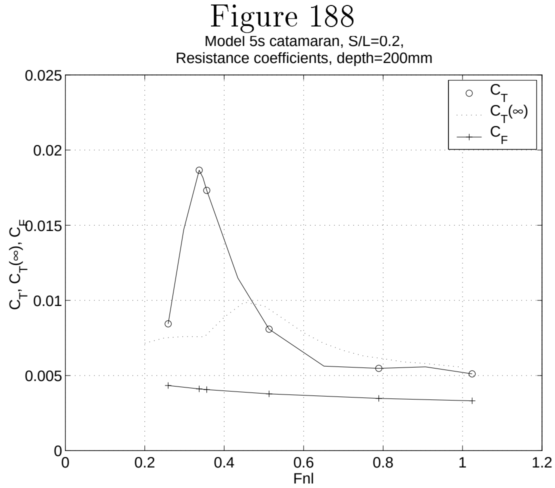


Figure 190

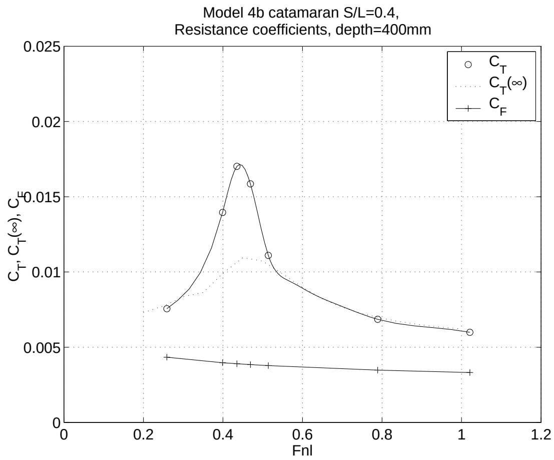


Figure 191

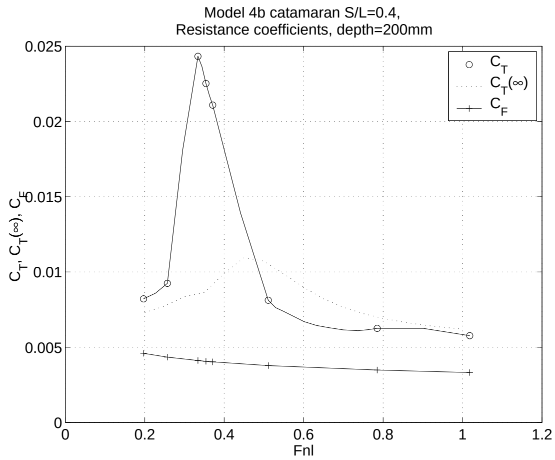


Figure 192

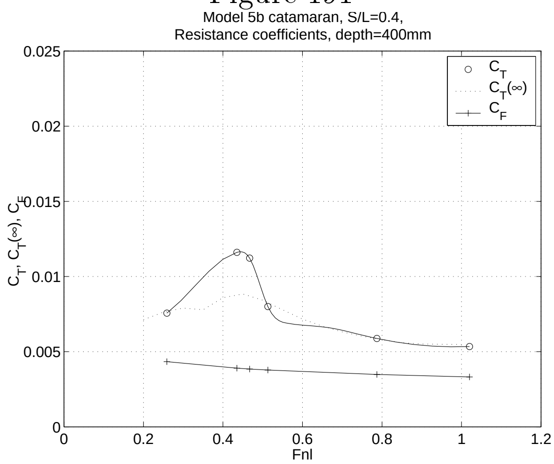


Figure 193

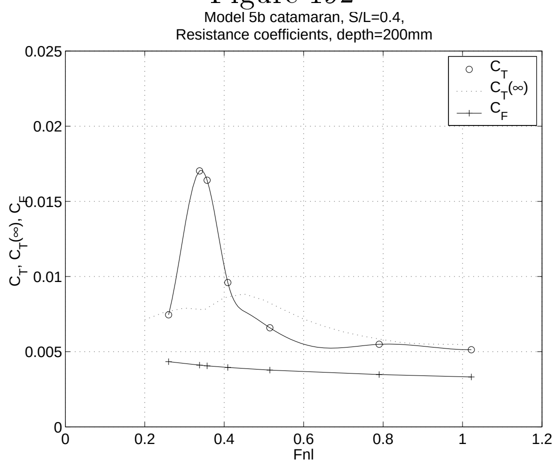


Figure 194

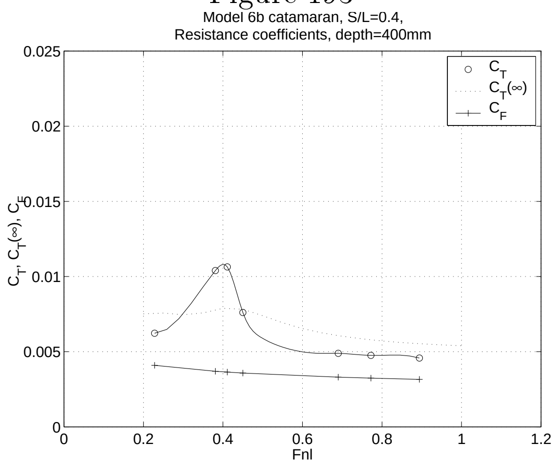


Figure 195

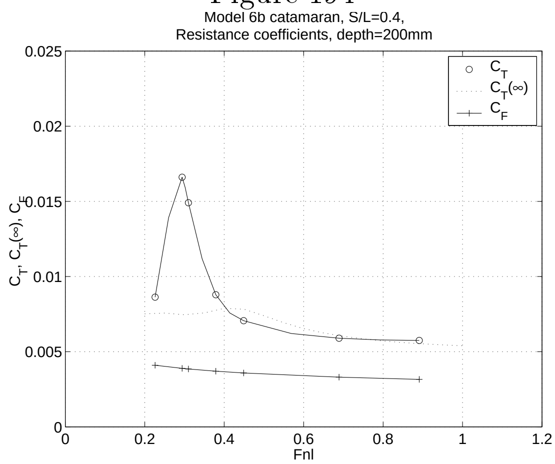


Figure 196

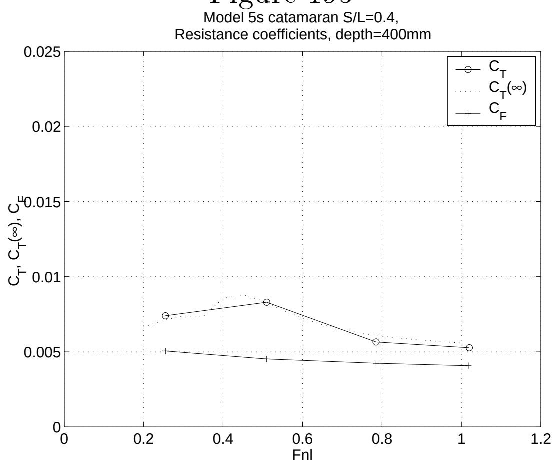


Figure 197

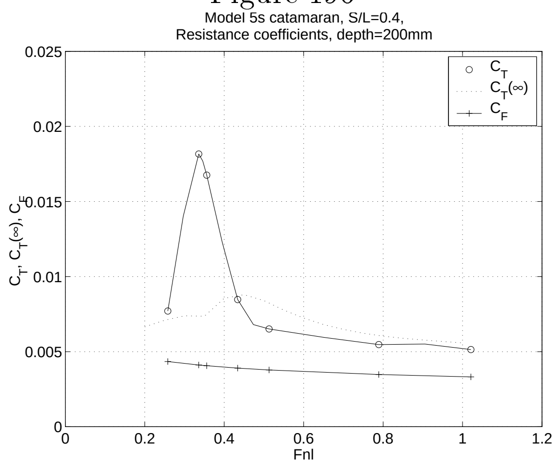


Figure 198

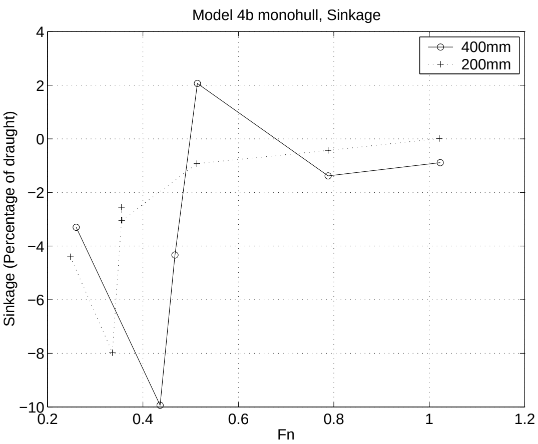


Figure 199

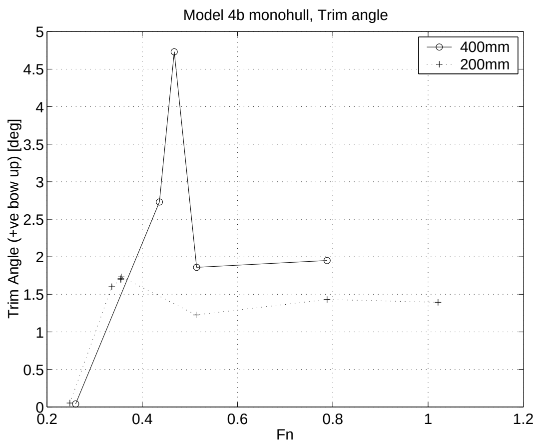


Figure 200

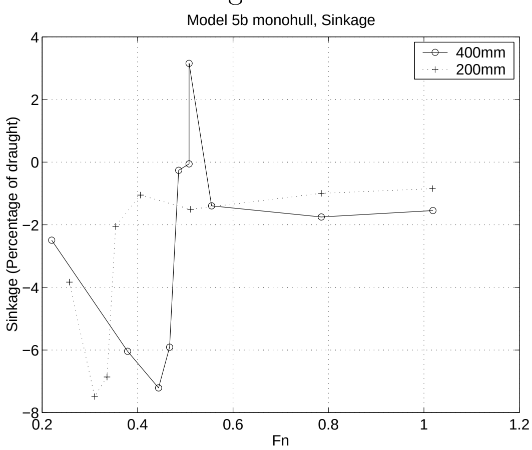


Figure 201

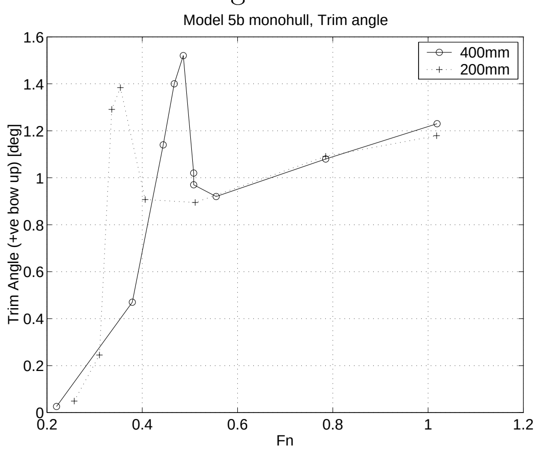


Figure 202

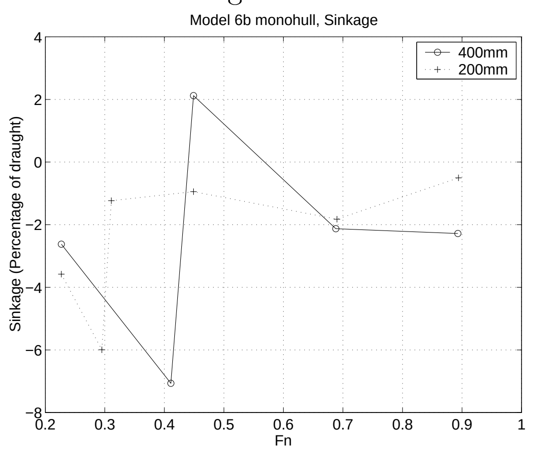


Figure 203

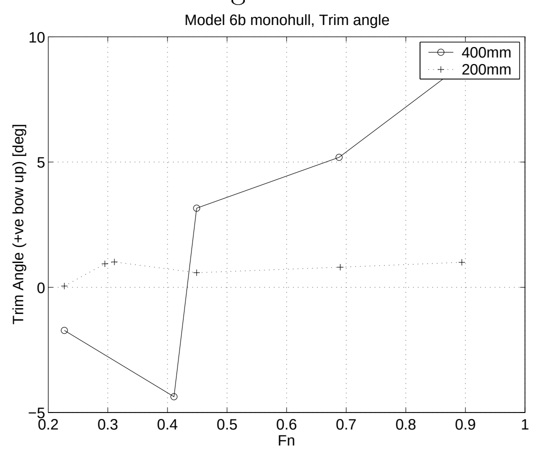


Figure 204

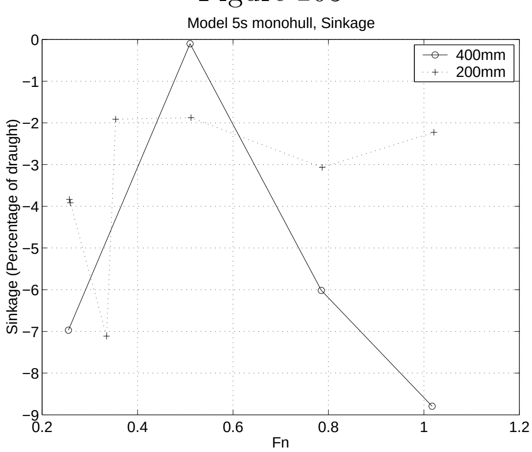


Figure 205

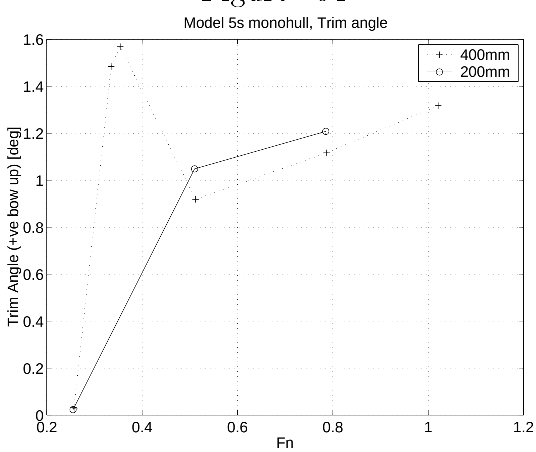


Figure 206

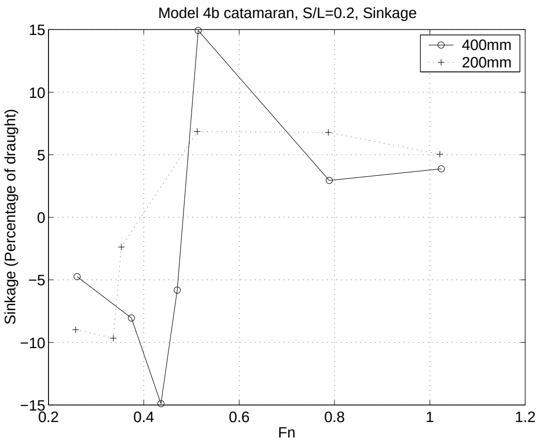
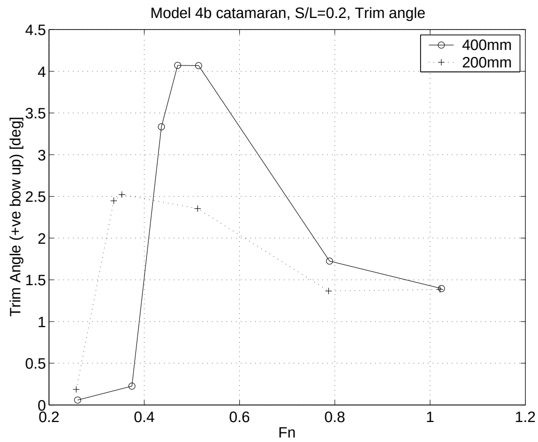


Figure 207



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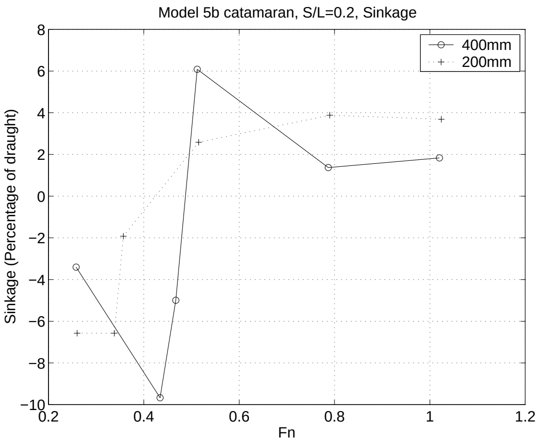

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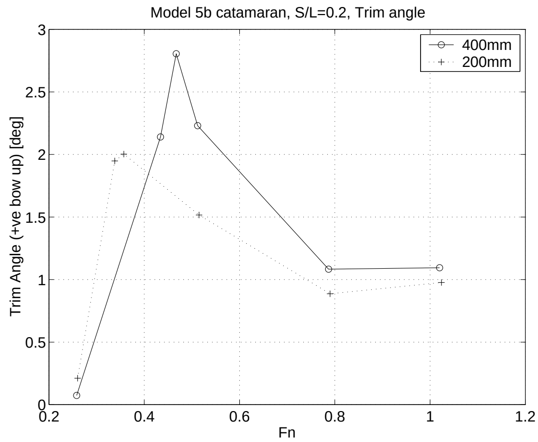

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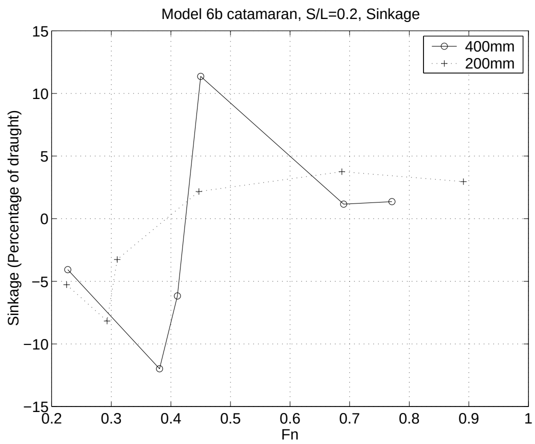

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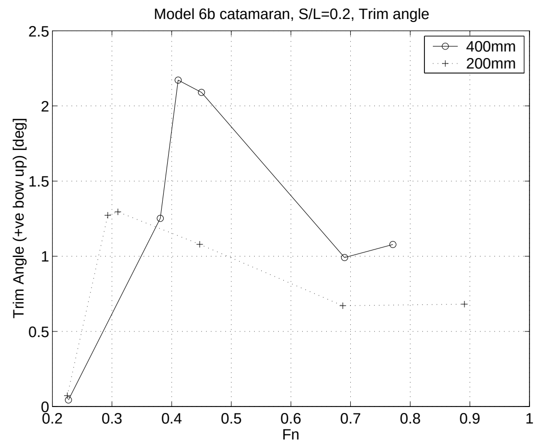

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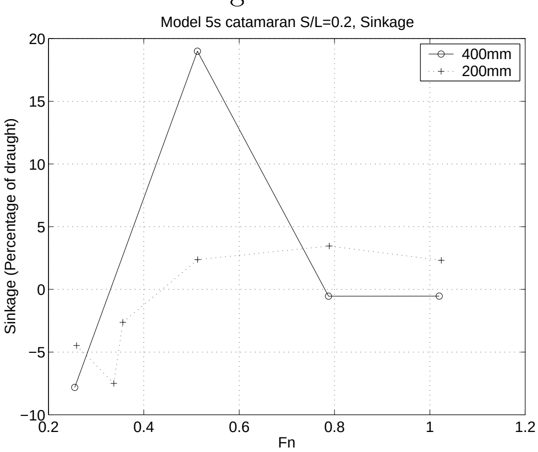

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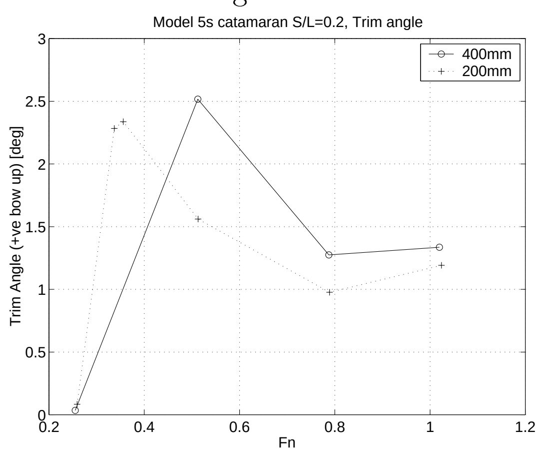

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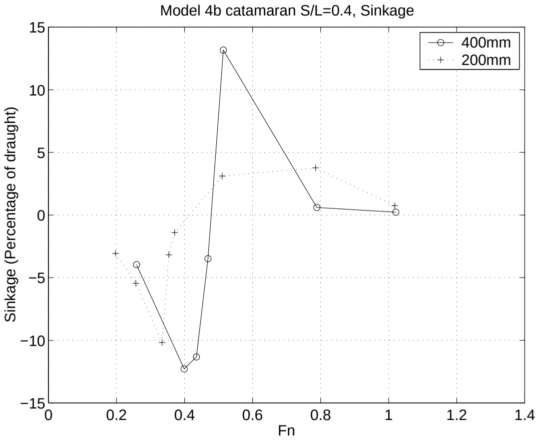

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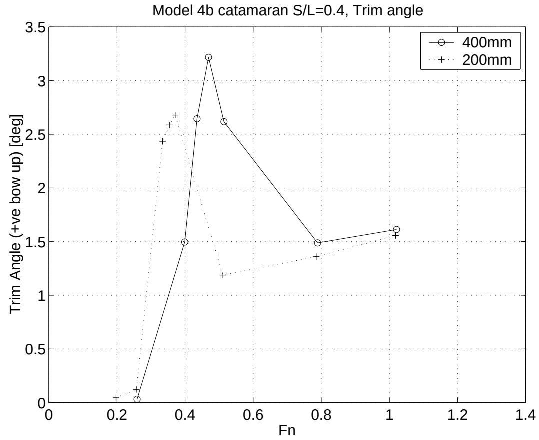

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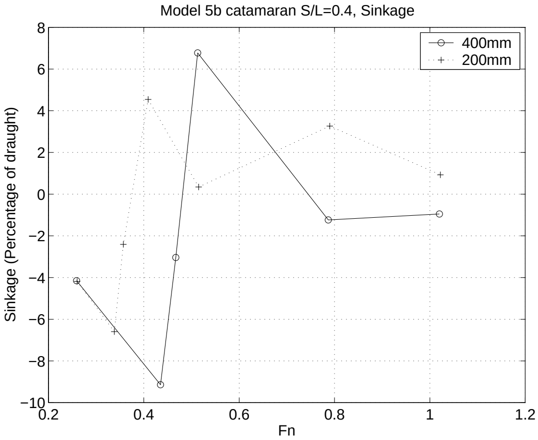

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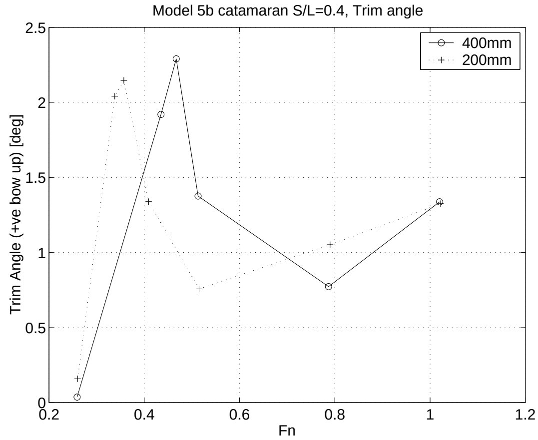

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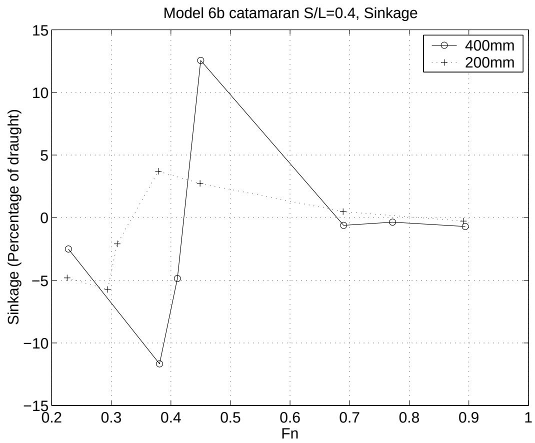

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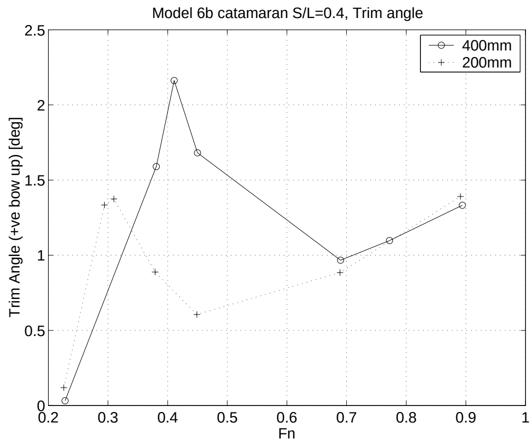

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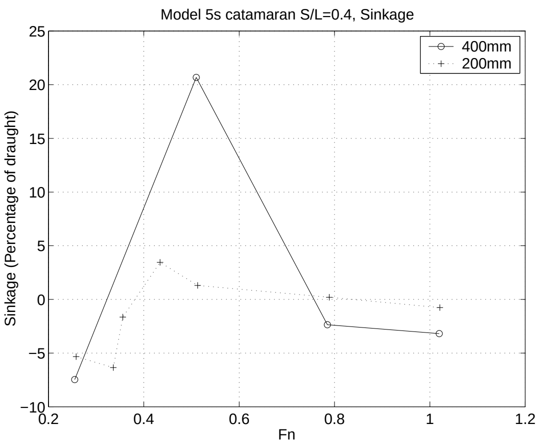

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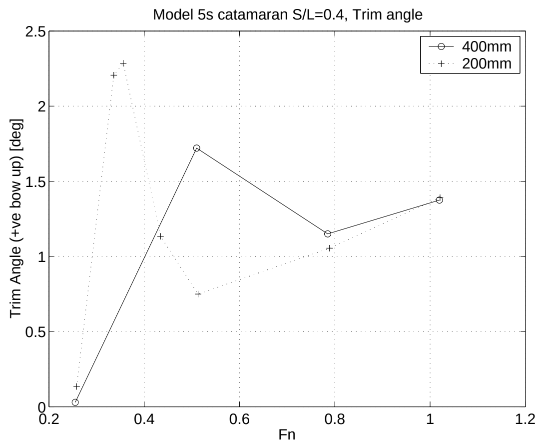

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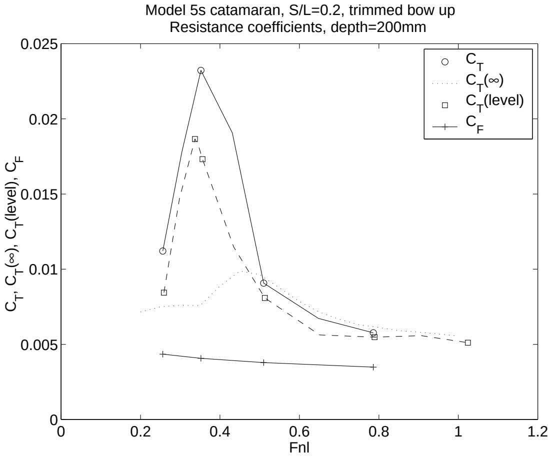

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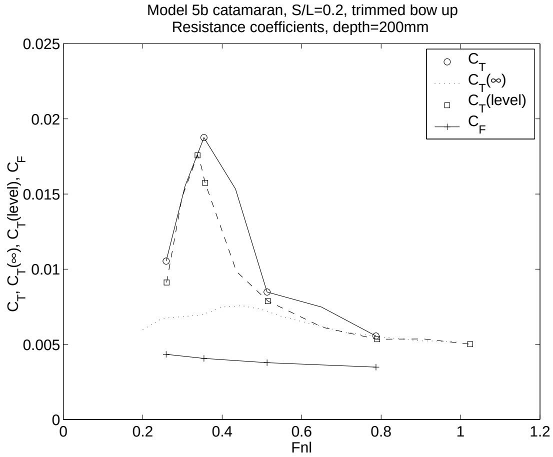

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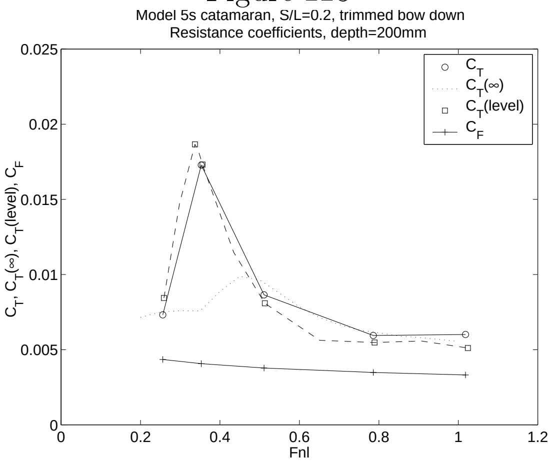

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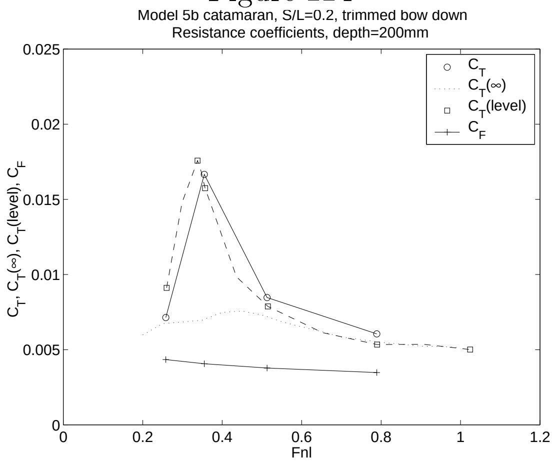

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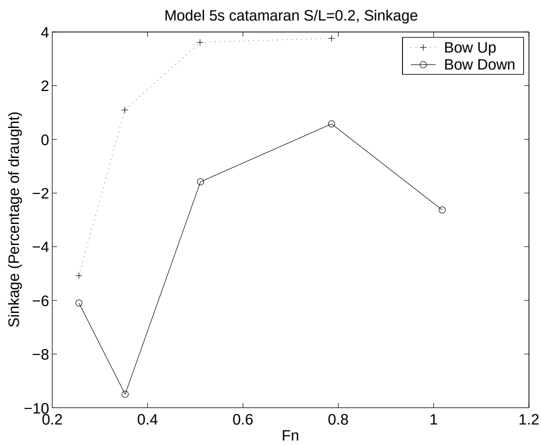

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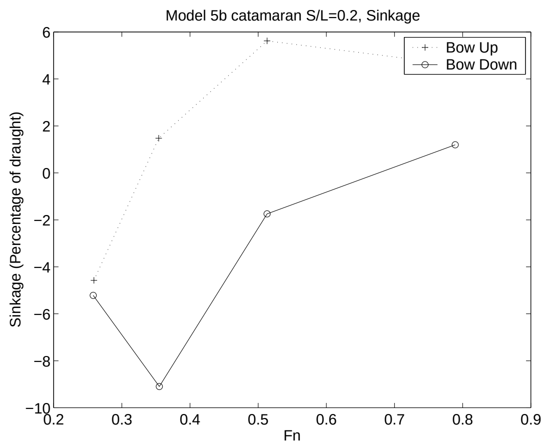

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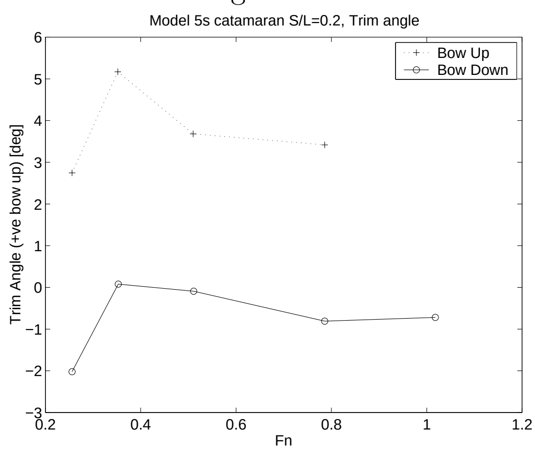

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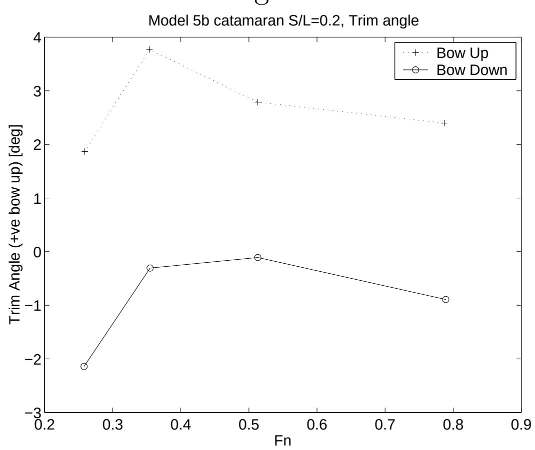

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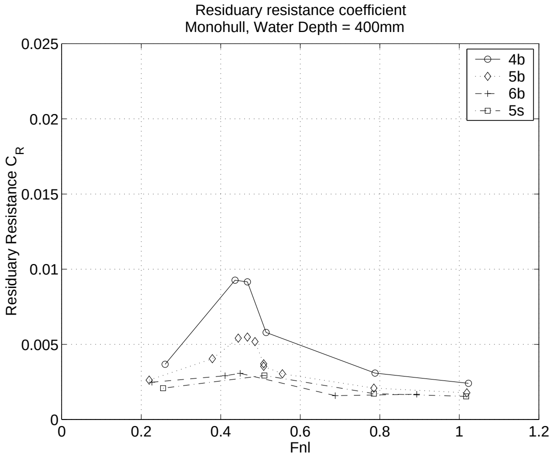

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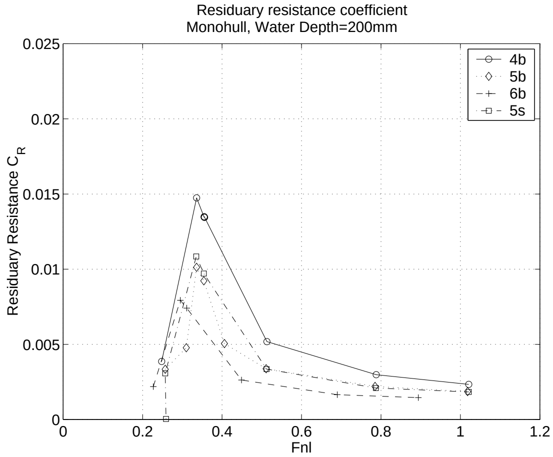

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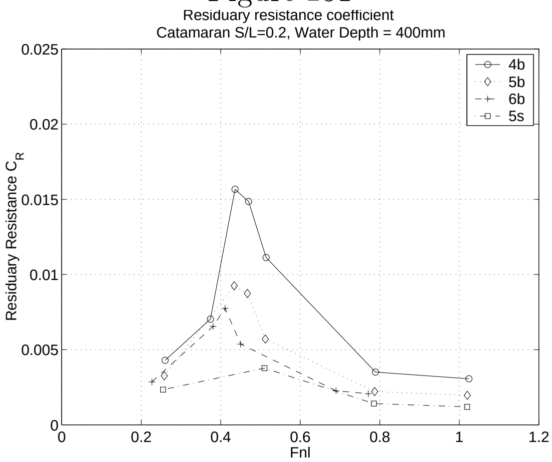

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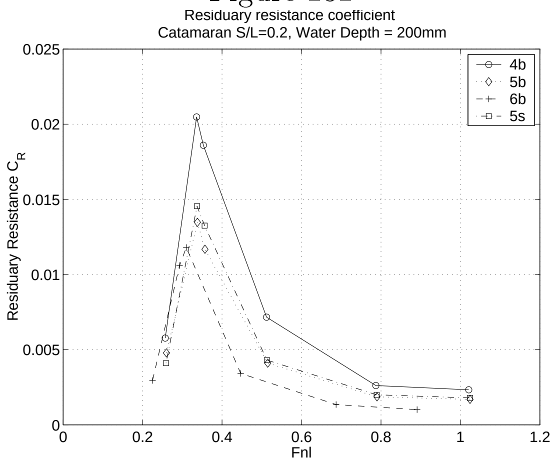

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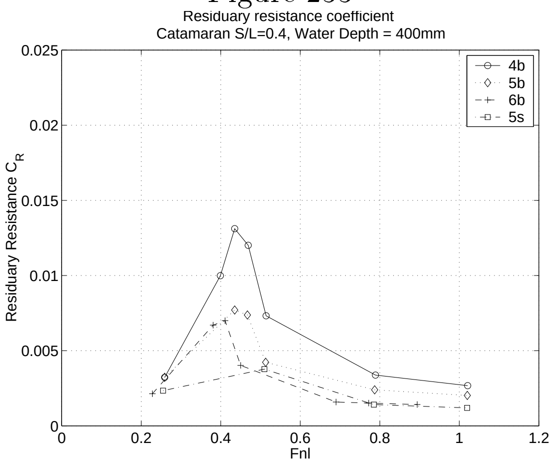

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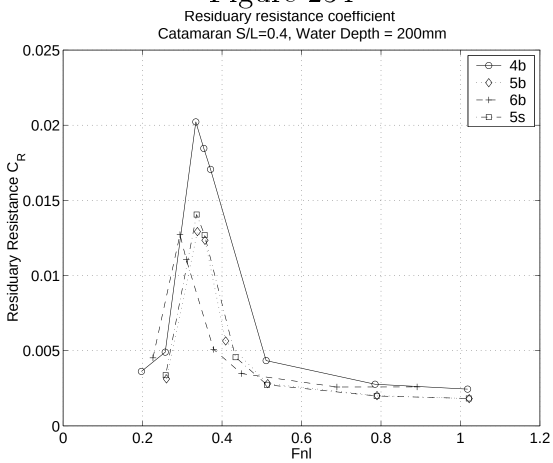

Figure 236