a011refra[001]: Refraction

Purpose

The purpose of this test is to validate depth-induced refraction.

Situation

An infinitely long plane beach with parallel depth contours (slope 1:200) is considered. The x-axis is normal to the depth contours (see Figure 1). At a water depth of 20m, monochromatic, uni-directional waves enter the model area. At the up-wave boundary the incoming waves propagate at an angle of 30° relative to the positive x-axis. The distance of the up-wave boundary to the water line is 4000 m. The incident wave height H_i and period T_i are 1 m and 10 s respectively. Ambient currents and wind are absent.
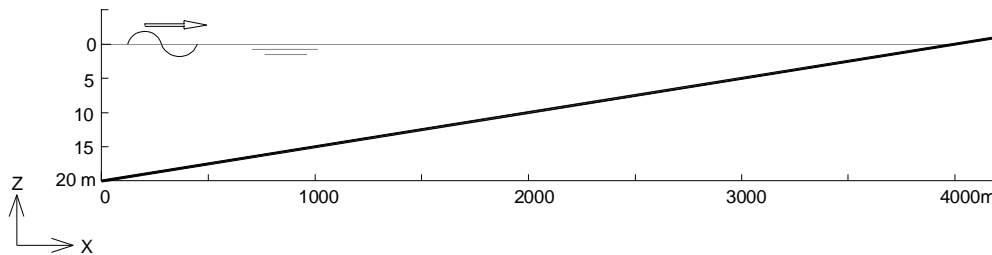

Figure 1 Refraction on a infinitely long beach (30[o] incident wave direction)

Comparison

Comparison is being made with the analytical solution along a line perpendicular to the depth contours. This is calculated with (see Mei, 1983):

$$\frac{H^2}{H_i^2} = \frac{c_{g,i}}{c_g} \frac{\cos(\theta_i)}{\cos(\theta)} \tag{A1.1}$$

where the wave direction θ is calculated with Snell's law:

$$\frac{\sin\theta_i}{c_i} = \frac{\sin\theta}{c} \tag{A1.2}$$

Comparison is made for wave height, wave period and wave direction.

Default model commands

	COMPUTATIONAL GRID					
	1D/2D	XPC	YPC	ALPC	XLENC	YLENC
001	2D	0	0	0	20000	4000
	ΔX	ΔY	DIR1	DIR2	Δθ	FLOW	FHIGH	MSC
	800	40	80°	130°	0.5°	0.05	0.25	40
	PHYSICS							
	GEN	BREAK	FRIC	TRIADS	QUAD	WCAP	REFRAC	FSHIFT	SETUP
	off	off	off	off	off	off	on	off	off
	BOUNDARY CONDITIONS								
	TYPE	BOU	C/V	P/R	SHAPE	PE/ME	DSPR	HS	PER	PDIR	DD
001	side	S	con	par	Gauss 0.01	peak	power	1	10	120°	500
	BOTTOM:		WIND:		CURRENT:		WATER LEVEL:	
001	'a011refra001.bot'		-		-		-	

References

Mei, C.C., 1983: *The applied dynamics of ocean surface waves,* Wiley, New York, 740 p.

Acknowledgements