

f051fries[001-006]: Friesche Zeegat (the Netherlands)

Purpose

The purpose of this test is to verify the wave model in a complex bathymetry in the field with tidal currents.

Situation

The Friesche Zeegat is located between the islands of Ameland and Schiermonnikoog in the North of the Netherlands. The bathymetry, in the computational domain of 15 km × 25 km, is rather complex, with the water depth varying from about 2 m over the shoals at high tide to about 15 m in the tidal channels (Figure 1). As the waves penetrate from the North Sea through the tidal gap, they refract out of the channels, across the shoals of the tidal flats. Behind the barrier islands, the waves completely reverse their direction due to refraction and waves are regenerated by the local wind. It appears that the offshore waves (at least for the case considered here) hardly penetrate into the interior region because of the strong filtering effect of the shallow flats in the centre of the tidal gap. The current velocities and water levels that are used in the computations have been obtained with the WAQUA circulation model (Les, 1996). The wind velocity and direction have been recorded at the observation station 'Huibertgat', located north of Schiermonnikoog (not shown in Figure 1).

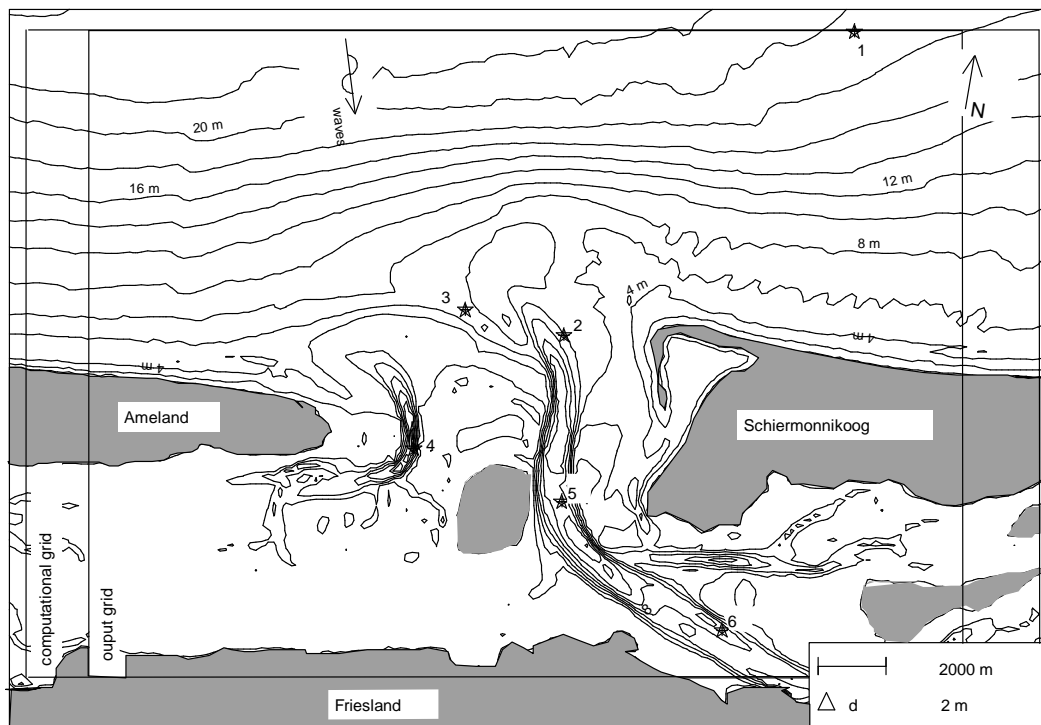


Figure 1 Bathymetry of the Friesche Zeegat (the Netherlands) with the locations of the observation stations

The observation stations: (1) SON, (2) NWG, (3) OWG, (4) PIG, (5) ENG and (6) RHO.

The geographical situation of the Friesche Zeegat was selected, because observations are available of conditions with tidal currents (maximum speed of about 1 m/s). These currents were computed with a fair degree of detail. Three cases are being considered. Time, wind speed and direction are shown in Table 1. Water levels and currents are available in digital format in the testcase directory. Since the measurement data varies rapidly in time, it has been decided to create three new cases (f051fries004 – f051fries006) that have identical model input, but the measurement data is from one hour later. See Table 1. Hence, the model input of case f051fries001 is identical to that of f051fries004, etc.

f051fries Friesche Zeegat (the Netherlands)

Case nr.	Date/Time	Wind (U_{10}) [m/s]	Direction [°]	Observations (time)
001	09-10-1992 / 05:00 hrs	11.5	310	5:00 hrs
002	09-10-1992 / 08:00 hrs	10	280	8:00 hrs
003	09-10-1992 / 11:00 hrs	11.5	290	11:00 hrs
004	09-10-1992 / 05:00 hrs	11.5	310	6:00 hrs
005	09-10-1992 / 08:00 hrs	10	280	9:00 hrs
006	09-10-1992 / 11:00 hrs	11.5	290	12:00 hrs

Table 1 Physical parameters for case f051fries. Wind direction according to nautical convention. Time in UTC.

These specific cases have been selected, because (a) at these times, relatively high waves were observed (significant wave height about 3 m), generated by a storm in the northern North Sea, (b) during the period of these observations the wind speed was nearly constant, (c) the frequency spectrum was uni-modal and (d) both tidal currents and water levels were measured (to verify hydrodynamic computation). Case f051fries001 (f051fries004) represents a case with a strong flood current while case f051fries002 (f051fries005) and f051fries003 (f051fries006) represent a high water (with practically no current) and an ebb current case respectively.

Comparison

Comparisons are made for energy density spectra, significant wave height H_{m0} and mean wave period T_{m01} . (e.g. Dunsbergen, 1995b)

Default model commands

COMPUTATIONAL GRID										
1D/2D		XPC		YPC		ALPC		XLENC		YLENC
2D		185305		599939		10		31000		18800
ΔX	ΔY	DIR1		DIR2		Δθ	FLOW	FHIGH	MSC	
250	200	0°		360°		10°	0.05209	1.0	24	
PHYSICS										
GEN	BREAK	FRIC	TRIADS	QUAD	WCAP	REFRAC	FSHIFT	SETUP		
3	on	on	on	on	on	on	on	off		
BOUNDARY CONDITIONS										
	TYPE	BOU	C/V	P/R	NAME OF FILE					
001	side	N	con	read boundary from file	'f051fries001.bnd'					
002	side	N	con	read boundary from file	'f051fries002.bnd'					
003	side	N	con	read boundary from file	'f051fries003.bnd'					
004	side	N	con	read boundary from file	'f051fries004.bnd'					
005	side	N	con	read boundary from file	'f051fries005.bnd'					
006	side	N	con	read boundary from file	'f051fries006.bnd'					
BOTTOM:										
WIND:										
CURRENT:										
WATER LEVEL:										
01	'f051fries001.bot'		U_{10} : 11.5 m/s		θ_w : 310°		'f051fries001.cur'		'f051fries001.lev'	
02	'f051fries002.bot'		U_{10} : 10 m/s		θ_w : 280°		'f051fries002.cur'		'f051fries002.lev'	
03	'f051fries003.bot'		U_{10} : 11.5 m/s		θ_w : 290°		'f051fries003.cur'		'f051fries003.lev'	
004	'f051fries004.bot'		U_{10} : 11.5 m/s		θ_w : 310°		'f051fries004.cur'		'f051fries004.lev'	
005	'f051fries005.bot'		U_{10} : 10 m/s		θ_w : 280°		'f051fries005.cur'		'f051fries005.lev'	
006	'f051fries006.bot'		U_{10} : 11.5 m/s		θ_w : 290°		'f051fries006.cur'		'f051fries006.lev'	

References

Dunsbergen, D.W., 1995b: Verification set Friesche Zeegat -October 1, 1992- November 17, 1992-, Rep. RIKZ-95.035, Ministry of Transport, Public works and Water Management, Den Haag, The Netherlands

Les, B.A.J., 1996: Flow computations in the Friesche Zeegat (Stromingsberekeningen in het Friesche Zeegat, in Dutch) M.Sc.-thesis, Delft University of Technology, Department of Civil Engineering, The Netherlands

Acknowledgements

Data courtesy of J.H. Andorka Gal and J.G. de Ronde of the Dutch Ministry of Public Works and Coastal Management (RIKZ), Den Haag, the Netherlands.