Supplement of: An Integrated Marine Data Collection for the German Bight – Part II: Tides, Salinity and Waves (1996 – 2015 CE)

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S1 Observational Data

The model has been validated using extensive measurements all over the North Sea. Measurements in the German Bight can be requested at the local authorities (WSV, BfG, BSH). Measurements in the Dutch administrative borders are available from Rijkswaterstaat (https://waterinfo.rws.nl/), in the UK from BODC (https://www.bodc.ac.uk/data/) and in France from SHOM (https://data.shom.fr/) free of charge.

S2 Current Velocity Hodographs

A hodograph is a scatterplot of the north- and eastward current velocity component at one point of time. Hodographs were first introduced to track particles and atoms in a predefined coordinate space, which makes them applicable for any vector data in earth sciences. Therefore, the time axis of model and observation are synchronized and then scattered into hodographs in Figure for measurement (obs) and model (pred). Samples are colored according to their scatter density.

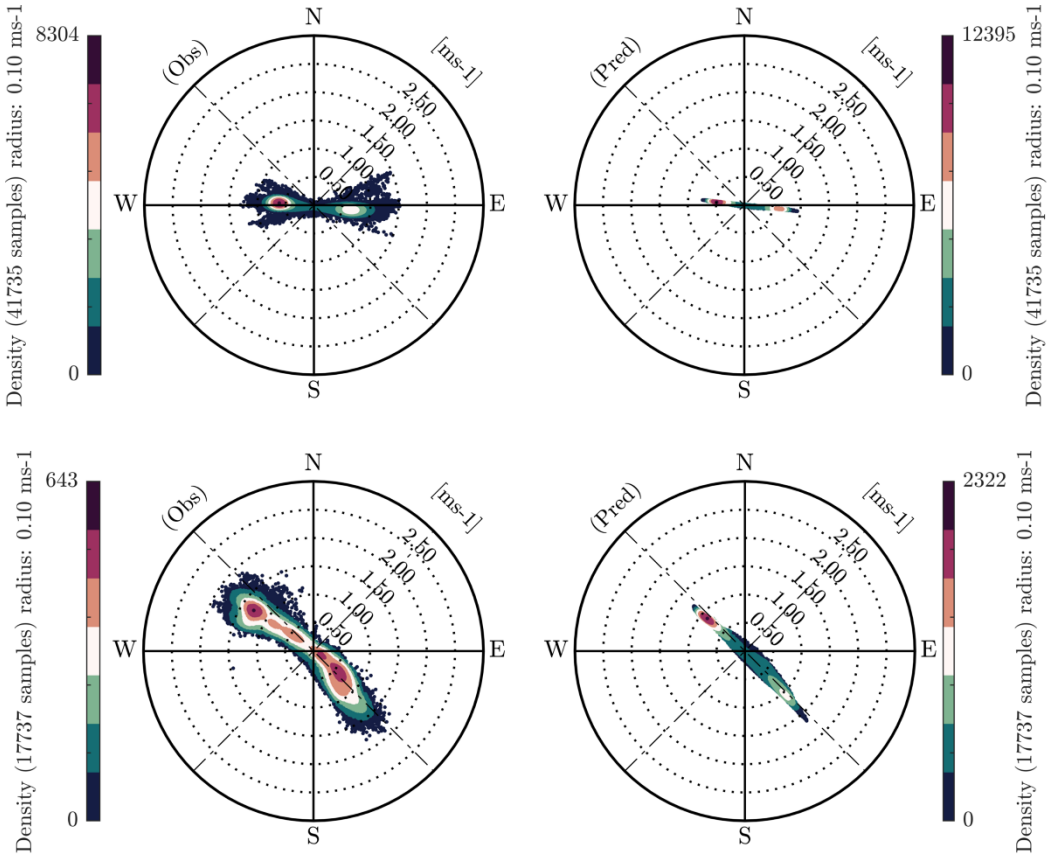

Figure S1: Hodograph of current velocity at LZ1 (top) and LZ4 (bottom). Samples are colored according to sample density.

S3 Validation wave parameters at Elbe buoy

Table S1: RMSE of the significant wave height (H_{m0}), mean wave period (T_{m02}), peak period (T_p), mean wave direction (Θ_m) and completeness of measured significant wave height for selected years at Elbe buoy. n/a=not applicable for this study

Location	completeness H_{m0} in %	RMSE H_{m0} in m		RMSE T_{m02} in s		RMSE T_p in s		RMSE Θ_m in deg	
		SWAN	UnK	SWAN	UnK	SWAN	UnK	SWAN	UnK
1996	3	0.24	0.49	1.19	1.41	1.70	1.86	n/a	
1997	2	0.19	0.29	1.30	1.39	1.65	1.76	n/a	
1998	4	0.17	0.34	1.07	1.20	1.38	1.57	n/a	
1999	1	0.28	0.86	1.04	1.66	1.33	1.79	n/a	
2000	1	0.24	0.83	1.19	1.72	1.73	1.73	n/a	
2001	0	0.21	0.37	1.19	1.31	1.38	1.29	n/a	
2002	1	0.20	0.33	1.33	1.23	1.55	1.44	n/a	
2003	47	0.19	0.37	1.28	1.41	1.82	1.95	n/a	
2004	85	0.19	0.39	1.21	1.40	1.44	1.69	n/a	
2005	40	0.21	0.37	1.22	1.47	1.39	1.69	n/a	
2006	78	0.21	0.35	1.14	1.28	1.46	1.65	40.8	49.9
2007	89	0.20	0.40	1.10	1.27	1.53	1.76	40.6	50.2
2008	89	0.20	0.38	1.18	1.37	1.95	2.21	40.7	51.2
2009	94	0.19	0.37	1.15	1.29	1.82	2.14	38.4	50.6
2010	96	0.19	0.34	1.13	1.25	1.99	2.12	39.6	48.3
2011	0	n/a		1.13	1.31	1.76	1.98	n/a	47.4
2012	1	n/a	n/a	1.01	1.24	1.77	1.77	36.7	47.0
2013	50	0.2	0.38	0.87	1.01	1.35	1.58	35.7	46.5
2014	50	0.25	0.35	.63	0.95	1.27	1.49	35.6	49.8
2015	47	0.28	0.39	0.75	1.01	0.99	1.38	27.2	44.7

S4 Validation wave parameters at NSB-II buoy

Table S2: RMSE of the significant wave height (H_{m0}), mean wave period (T_{m02}), peak period (T_p), mean wave direction (Θ_m) and completeness of measured significant wave height for selected years at NSB-II. n/a=not applicable for this study

Location	completeness H_{m0} in %	RMSE H_{m0} in m		RMSE T_{m02} in s		RMSE T_p in s		RMSE Θ_m in deg	
		SWAN	UnK	SWAN	UnK	SWAN	UnK	SWAN	UnK
1996	0	n/a	0.63	n/a	1.55	n/a	2.13	n/a	42.4
1997	3	0.22	0.54	1.47	1.67	2.53	2.45	43.4	46.9
1998	2	0.30	0.62	1.10	1.54	1.30	1.58	36.6	43.1
1999	3	0.27	0.66	1.18	1.57	1.93	2.16	41.4	48.6
2000	5	0.30	0.69	1.44	1.82	2.14	1.98	n/a	
2001	1	0.44	0.85	1.72	2.15	2.38	2.50	n/a	
2002	1	0.25	0.61	0.91	1.24	1.72	2.01	n/a	
2003	4	0.59	1.10	1.03	1.37	1.77	1.68	37.2	37.2
2004	5	0.32	0.74	1.27	1.76	1.87	2.00	33.4	39.7
2005	14	0.33	0.62	1.15	1.57	1.70	1.70	37.6	39.3
2006	39	0.30	0.55	1.00	1.26	2.05	2.10	37.77	41.3
2007	25	0.39	0.74	0.86	1.18	2.15	2.27	37.8	42.5
2008	25	0.31	0.74	1.15	1.39	2.50	2.41	44.0	47.5
2009	2	0.30	0.76	0.86	1.28	1.87	1.68	27.5	34.9
2010	48	0.29	0.63	0.87	1.18	1.83	1.90	35.8	40.8
2011	64	0.34	0.72	1.01	1.26	2.34	2.36	n/a	40.4
2012	26	0.32	0.77	0.97	1.28	2.59	2.70	34.9	38.1
2013	0	n/a							
2014	0	n/a							
2015	0	n/a							

S5 Frequency of Occurrence Diagram at NF10

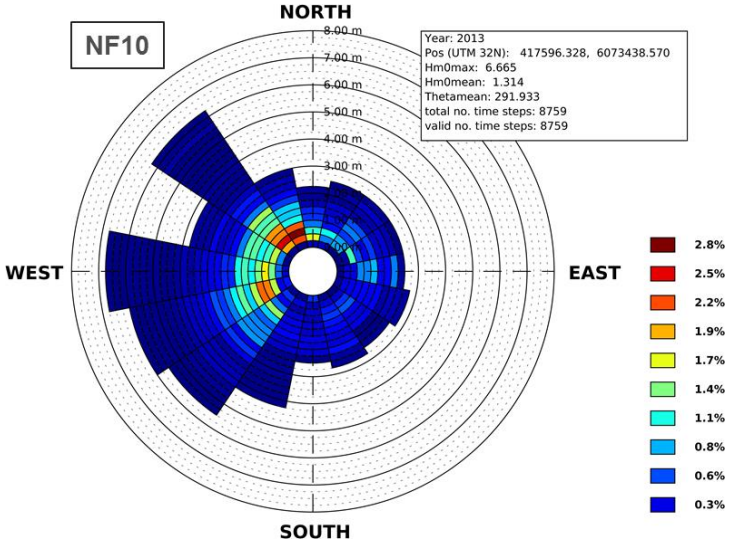

Figure S2: Frequency of occurrence (in %) of the significant wave height and mean wave direction at the selected location "NF10" near the North Frisian Island of Sylt in the simulation year 2013 (SWAN).

S6 Exemplary SWAN 2d-Wave Spectrum During Storm "Xaver"

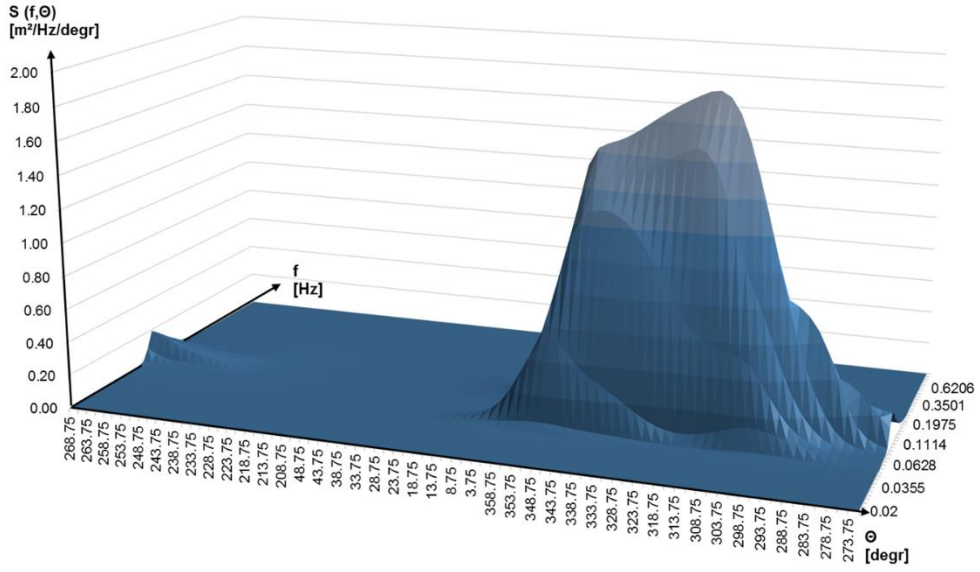

Figure S3: SWAN wave spectrum near FINO1 during storm "Xaver" in on 5th December, 2013, 22:00 UTC.