

# Supplementary Materials: The role of sea state to the morphological changes of Prasonisi tombolo, Rhodes Island, Greece

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## Description of the Wave Events Extraction Methodology via the Use of Wind and Wave Data

Initially, the swell criterion is applied to the datasets, e.g., based on the Thompson et al., (1985) classification, to discriminate swell seas from wind seas. Specifically, wind seas usually have an offshore peak wave steepness higher than 0.025, whereas swells are lower than 0.025.

Then, two methods are used for the extraction of events: the first one (Method A) refers to swell events and the second one (Method B) refers to wind-wave events.

### Method A: Extraction of Swell Events

**Step 1:** Accumulate all successive values of swell data between two wind-wave events in the same swell event.

**Step 2:** Calculate the mean values of the wave data belonging to the same swell event for each wave parameter in order to represent the event by using Equations 1 to 6.

$$\bar{H}_{mo} = \frac{\sum_{i=1}^N H_i}{N}, H_i = H_{mo}(t), t \in [t_1, t_2] \quad (1)$$

$$\bar{T}_p = \frac{\sum_{i=1}^N T_i}{N}, T_i = T_p(t), t \in [t_1, t_2] \quad (2)$$

$$D = \sum_{i=1}^N \Delta t \quad (3)$$

$$\overline{MWD} = \begin{cases} \text{atan}\left(\frac{s_a}{c_a}\right), & \text{if } s_a > 0 \text{ and } c_a > 0 \\ \text{atan}\left(\frac{s_a}{c_a}\right) + \pi, & \text{if } c_a < 0 \\ \text{atan}\left(\frac{s_a}{c_a}\right) + 2\pi, & \text{if } s_a < 0 \text{ and } c_a > 0 \end{cases} \quad (4)$$

$$\text{where } s_a = \sum_{i=1}^N \sin(D_i), D_i = MWD(t), t \in [t_1, t_2] \quad (5)$$

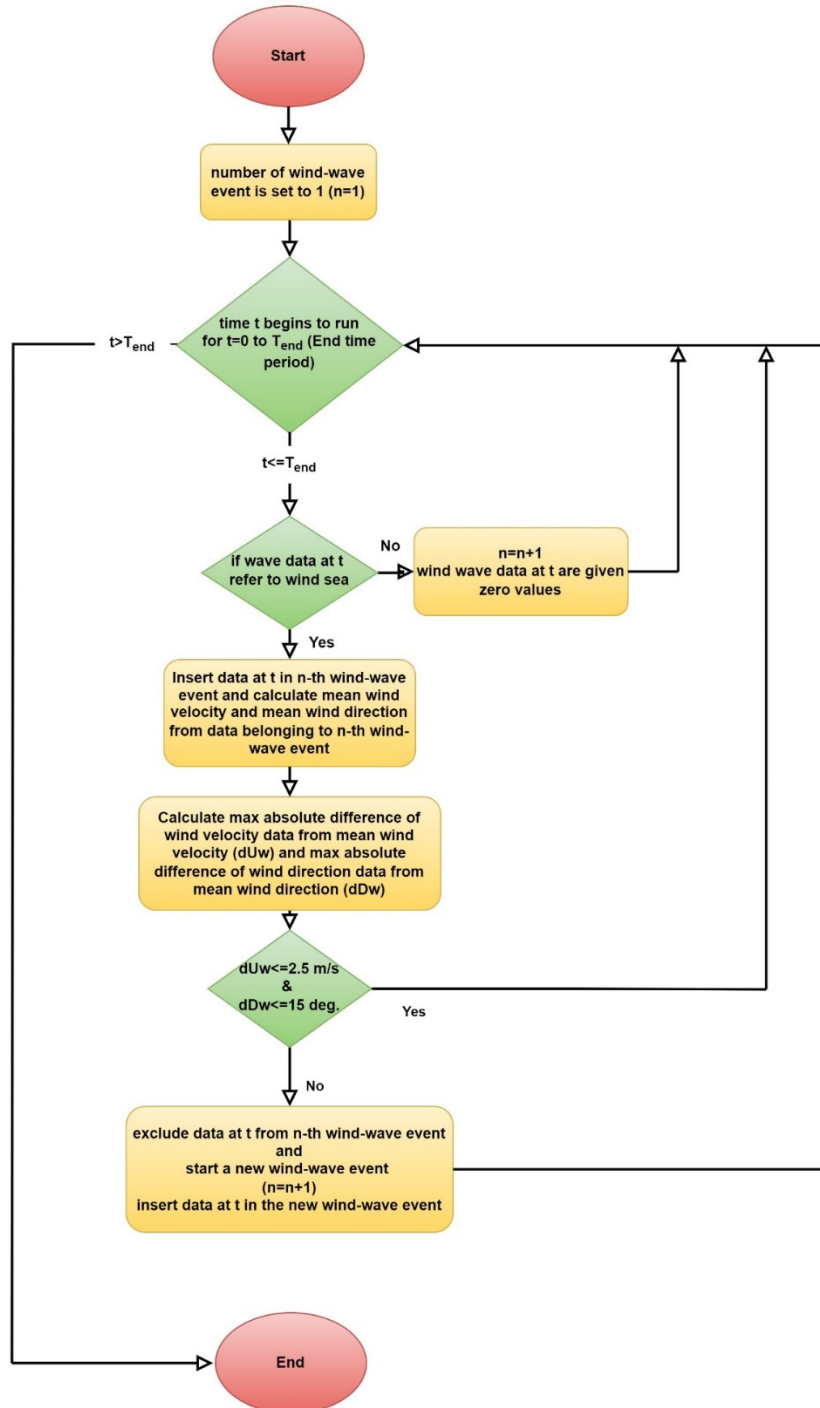
$$c_a = \sum_{i=1}^N \cos(D_i), D_i = MWD(t), t \in [t_1, t_2] \quad (6)$$

where  $\bar{H}_{mo}$ ,  $\bar{T}_p$ , are the mean values of the successive data of the significant wave heights  $H_i$ , and peak wave periods  $T_i$ , respectively, included in each swell event,  $N$  is the number of successive data, and  $t$  is a discrete variable here for time. Additionally,  $\Delta t$  is the time resolution of the dataset used and  $D$  is the duration of a swell event, the time interval of which is  $[t_1, t_2]$ . Additionally,  $\overline{MWD}$  is the mean value of the successive data of the mean wave direction  $D_i$  included in each swell event.

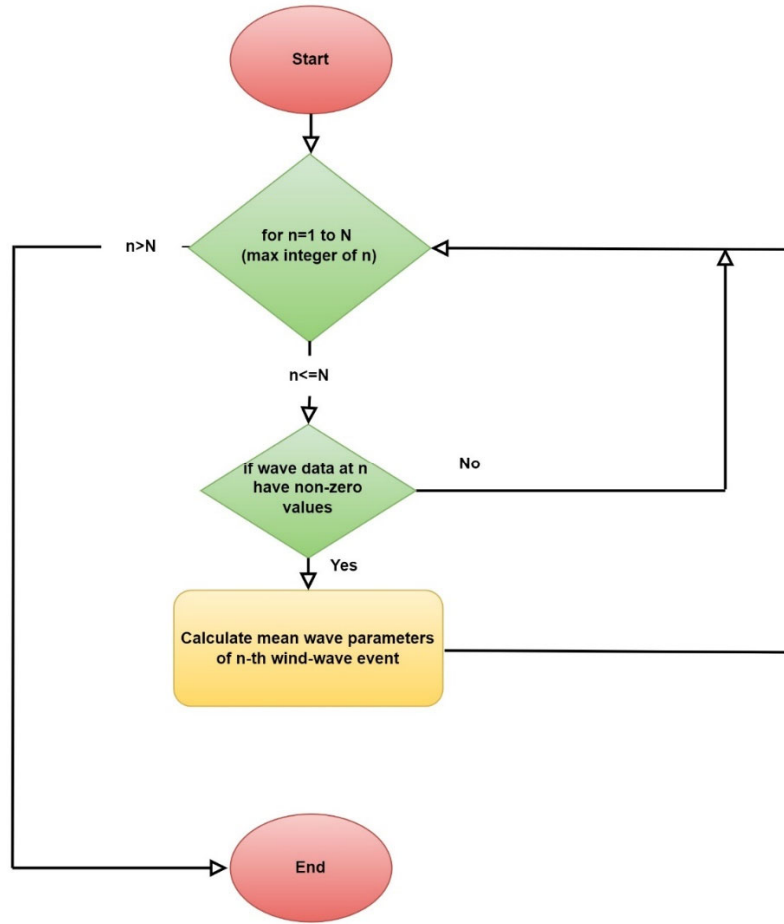
### Method B: Extraction of Wind-Wave Events

Referring to Method B, two flowcharts are presented in Figures S1 and S2, describing the process for the extraction of wind-wave events

via the use of wind and wave data. In particular, Figure S1 presents the process for wind–wave event extraction and Figure S2 presents the process for the representation of wind–wave events by their mean wave parameters. It is noted that the process for wind–wave event extraction is initially applied, and the representation of wind–wave events by their mean wave parameters (apply Equations 1 to 6) is applied next.



**Figure S1.** The process for wind–wave event extraction from wind and wave data.



**Figure S2.** The process for the representation of wind-wave events by their mean wave parameters.

### Example of Application

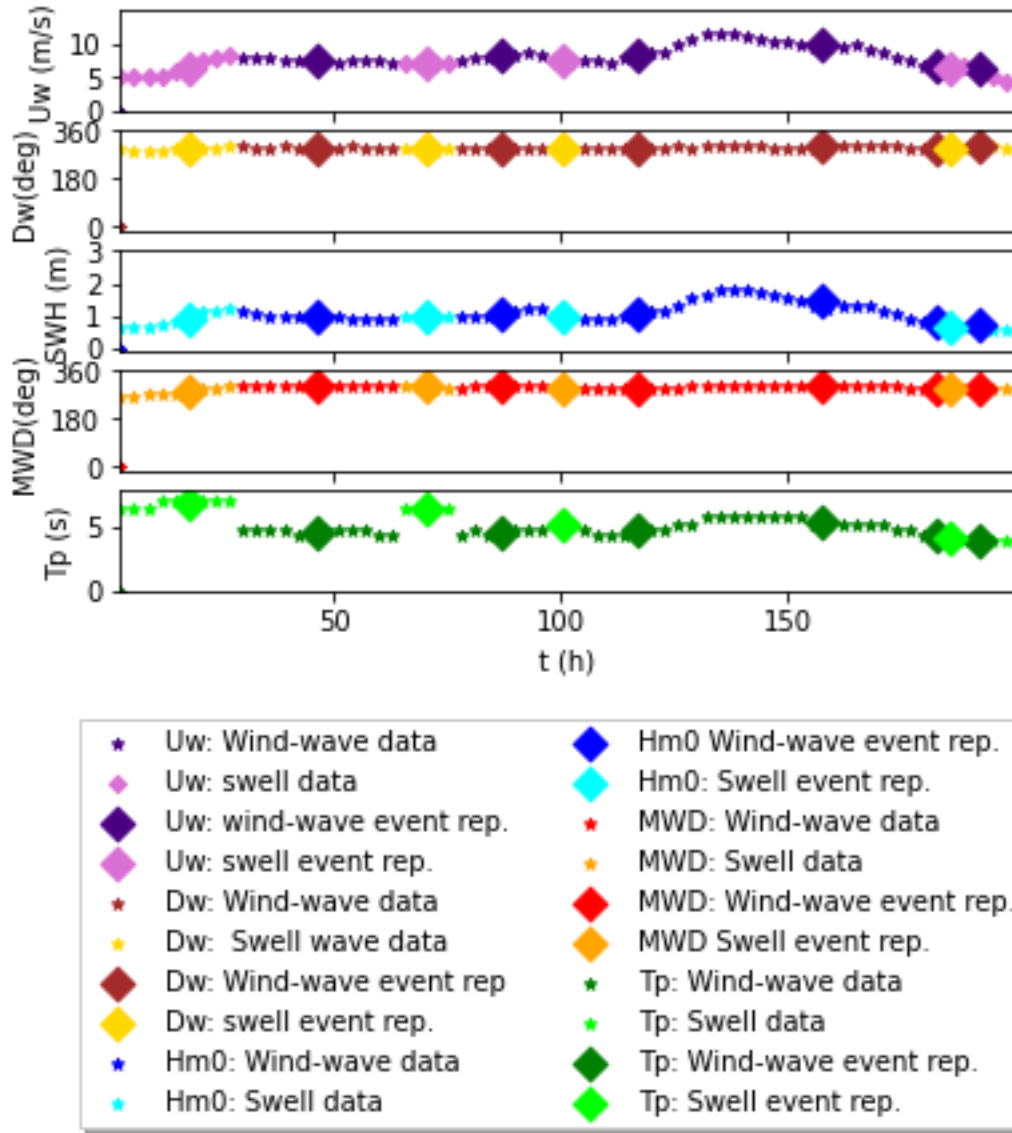
The above method is then applied to a short dataset (see Table S1) of wind and wave data, obtained from the Wave and Wind Atlas of the Hellenic Seas. In Figure S3, the extracted wind-wave and swell scenarios of the dataset (see Table S1) are presented as the mean values of their data, while in Table S2 the characteristic values of the extracted wind-wave events and swell events of the dataset are presented.

**Table S1.** Example of wind and wave dataset.

t (s)	Uw (m/s)	Dw (deg.)	Hm0 (m)	Tp (s)	MWD (deg.)
3	5.49	294.17	0.68	7.01	266.89
6	5.33	290.64	0.68	6.37	267.17
9	5.14	288.23	0.67	6.37	268.38
12	5.02	285.51	0.68	6.37	269.93
15	5.23	286.78	0.72	7.01	271.71
18	6.04	294.06	0.79	7.01	276.71
21	7.03	299.13	0.99	7.01	289.1
24	7.48	298.75	1.12	7.01	295.41
27	7.85	298.5	1.16	7.01	297.64
30	8.22	300.22	1.19	7.01	299.19
33	8.14	300.53	1.12	4.79	300.24
36	8.09	299.06	1.06	4.79	300.49
39	7.84	299.08	0.99	4.79	300.92

42	7.58	299.28	0.95	4.79	301.27
45	7.66	297.69	0.95	4.35	301.29
48	7.87	294.75	0.97	4.35	300.59
51	7.58	294.55	0.97	4.79	299.96
54	7.2	298.27	0.94	4.79	300.33
57	7.44	299.95	0.93	4.79	301.31
60	7.54	298.42	0.9	4.79	301.58
63	7.53	297.96	0.9	4.35	302.09
66	7.15	295.84	0.9	4.35	301.85
69	7.14	292.72	0.94	6.37	301.29
72	7.23	290.1	0.98	6.37	300.22
75	7.03	288.81	0.98	6.37	298.56
78	7.01	291.31	0.94	6.37	297.12
81	7.71	296.19	0.96	4.35	298.03
84	7.85	295.97	0.95	4.79	299.31
87	7.95	295.39	0.97	4.35	300.41
90	8.05	296.11	1.04	4.35	301.44
93	8.49	295.21	1.17	4.79	301.68
96	8.77	295.04	1.21	4.79	300.74
99	8.54	298.04	1.21	4.79	300.44
102	7.67	296.19	1.05	5.27	299.5
105	7.61	290.92	0.96	5.27	296.98
108	7.64	291.36	0.91	4.79	296.29
111	7.4	291.48	0.88	4.35	296.4
114	7.26	291.27	0.88	4.35	296.81
117	7.79	290.58	0.95	4.35	296.96
120	8.54	290.88	1.07	4.35	296.31
123	8.61	292.9	1.13	4.79	295.7
126	8.89	295.77	1.14	4.79	295.64
129	10.09	299.25	1.33	5.27	298.92
132	10.94	299.11	1.51	5.27	300.63
135	11.48	299.86	1.66	5.79	301.86
138	11.55	301.91	1.77	5.79	303.48
141	11.51	301.31	1.81	5.79	303.8
144	11.28	300.72	1.79	5.79	303.23
147	10.85	300.33	1.71	5.79	302.85
150	10.56	297.93	1.63	5.79	301.8
153	10.29	296.63	1.52	5.79	301.1
156	10.12	294.62	1.43	5.79	299.83
159	9.77	295.97	1.31	5.27	299.62
162	9.6	298.33	1.26	5.27	300.51
165	9.77	299.3	1.28	5.27	301.63
168	9.83	299.86	1.31	5.27	301.71
171	9.37	301.92	1.27	5.27	301.56
174	8.58	302.58	1.17	5.27	301.27
177	7.93	299.87	1.02	4.79	299.76
180	7.6	296.87	0.9	4.79	298.44
183	6.86	296.45	0.79	4.35	298
186	5.95	296	0.62	4.35	296.89
189	6.01	296.12	0.58	4.35	295.49
192	6.66	298.74	0.61	3.96	296.16
195	6.48	303.06	0.7	3.96	298.5

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**Figure S3.** Wind velocity (Uw), wind direction (Dw), significant wave height (Hm0), mean wave direction (MWD), spectral peak wave period (Tp), and representative characteristics of wave scenarios covering a subset of time period for swell and wind seas, extracted from the methodology applied.

**Table S2.** Characteristic values of the extracted wind-wave events and swell events of the dataset (see Table S1, Figure S3).

Wave event type	t (s)	Duration (hr)	Uw wave event (m/s)	Dw wave event (deg)	Hm0 (m)	Tp (s)	MWD (deg)
swell	15	30	6.28	293.60	0.87	6.818	280.17
wind wave	48	36	7.64	297.95	0.97	4.64	300.99
swell	72	12	7.10	290.74	0.96	6.37	299.30
wind wave	88.5	21	8.19	295.99	1.07	4.60	300.29
swell	102	6	7.64	293.56	1.01	5.27	298.24
wind wave	118.5	27	8.57	293.62	1.09	4.70	297.07
wind wave	156	48	10.01	299.25	1.43	5.47	301.40
wind wave	181.5	3	6.86	296.45	0.79	4.35	298.00
swell	186	9	6.21	296.95	0.60	4.22	296.18
wind wave	193.5	3	6.48	303.06	0.7	3.96	298.50