

Supplementary material

Table S1. Information for the 142 maritime routes of the ship. For each route, the date, the ports of departure and destination (path), as well as from how many base stations it has been solved using the D-GNSS method (base) and whether it has been solved by the PPP method.

Day	Path	Data	Base st.	PPP	Day	Path	Data	Base st.	PPP
30									
January	Pat-Brin	valid	all	yes	11 April	Brin-Pat	corrupted	none	yes
31									
January	Brin-Pat	valid	all	yes	12 April	Pat-Brin	corrupted	none	yes
1									
February	Pat-Brin	valid	all	yes	13 April	Brin-Pat	corrupted	none	yes
2									
February	Brin-Pat	valid	all	yes	14 April	Pat-Brin	corrupted	none	yes
3									
February	Pat-Brin	valid	all	yes	15 April	Brin-Pat	corrupted	none	yes
4									
February	Brin-Pat	valid	all	yes	16 April	Pat-Brin	corrupted	none	yes
5									
February	Pat-Brin	valid	all	yes	17 April	Brin-Pat	corrupted	none	yes
6									
February	Brin-Pat	valid	all	yes	18 April	Pat-Brin	corrupted	none	yes
7									
February	Pat-Brin	valid	all	yes	19 April	Brin-Pat	corrupted	none	yes
8									
February	Brin-Pat	valid	all	yes	20 April	Pat-Brin	corrupted	none	yes
9									
February	Pat-Brin	valid	all	yes	21 April	Brin-Pat	corrupted	none	yes
10									
February	Brin-Pat	valid	all	yes	22 April	Pat-Brin	valid	all	yes
11									
February	Pat-Brin	valid	all	yes	23 April	Brin-Pat	valid	all	yes
12									
February	Brin-Pat	valid	all	yes	24 April	Pat-Brin	valid	all	yes
13-Feb-			all ex.						
15	Pat-Brin	valid	LECC	yes	25 April	Brin-Pat	valid	all	yes
14			all ex.						
February	Brin-Pat	valid	LECC	yes	26 April	Pat-Brin	valid	all	yes
15			all ex.						
February	Pat-Brin	valid	LECC	yes	27 April	Brin-Pat	valid	all	yes
16			all ex.						
February	Brin-Pat	valid	LECC	yes	28 April	Pat-Brin	valid	all	yes
17			all ex.						
February	Pat-Brin	valid	LECC	yes	29 April	Brin-Pat	valid	all	yes
18			all ex.						
February	Brin-Pat	valid	LECC	yes	30 April	Pat-Brin	valid	all	yes
19			all ex.						
February	Pat-Brin	valid	LECC	yes	1 May	Brin-Pat	valid	all	yes
20									
February	Brin-Pat	valid	all	yes	2 May	Pat-Brin	valid	all	yes
21-Feb-									
15	Pat-Brin	valid	all	yes	3 May	Brin-Pat	valid	all	yes
22									
February	Brin-Pat	valid	all	yes	4 May	Pat-Brin	valid	all	yes

23									
February	Pat-Brin	valid	all	yes	5 May	Brin-Pat	valid	all	yes
24									
February	Brin-Pat	valid	all	yes	6 May	Pat-Brin	valid	all	yes
25									
February	Pat-Brin	valid	all	yes	7 May	Brin-Pat	valid	all	yes
26									
February	Brin-Pat	valid	all	yes	8 May	Pat-Brin	valid	all	yes
27									
February	Pat-Brin	valid	all	yes	9 May	Brin-Pat	valid	all	yes
28									
February	Brin-Pat	valid	all	yes	10 May	Pat-Brin	valid	all	yes
1 March	Pat-Brin	valid	all	yes	11 May	Brin-Pat	valid	all	yes
2 March	Brin-Pat	valid	all	yes	12 May	Pat-Brin	valid	all	yes
3 March	Pat-Brin	valid	all	yes	13 May	Brin-Pat	valid	all	yes
4 March	Brin-Pat	valid	all	yes	14 May	Pat-Brin	valid	all	yes
5 March	Pat-Brin	valid	all	yes	15 May	Brin-Pat	valid	all	yes
6 March	Brin-Pat	valid	all	yes	16 May	Pat-Brin	valid	all	yes
7 March	Pat-Brin	valid	all	yes	17 May	Brin-Pat	valid	all	yes
8 March	Brin-Pat	valid	all	yes	18 May	Pat-Brin	valid	all	yes
9 March	Pat-Brin	valid	all	yes	19 May	Brin-Pat	valid	all	yes
10 March	Brin-Pat	valid	all	yes	20 May	Pat-Brin	valid	all	yes
11 March	Pat-Brin	valid	all	yes	21 May	Brin-Pat	valid	all	yes
12 March	Brin-Pat	valid	all	yes	22 May	Pat-Brin	corrupted	none	yes
13 March	Pat-Brin	valid	all	yes	23 May	Brin-Pat	valid	all	yes
14 March	Brin-Pat	valid	all	yes	24 May	Pat-Brin	valid	all	yes
15 March	Pat-Brin	valid	all	yes	25 May	Brin-Pat	valid	all	yes
16 March	Brin-Pat	valid	all	yes	26 May	Pat-Brin	valid	all	yes
17 March	Pat-Brin	valid	all	yes	27 May	Brin-Pat	valid	all	yes
18 March	Brin-Pat	valid	all	yes	28 May	Pat-Brin	valid	all	yes
19 March	Pat-Brin	valid	all	yes	29 May	Brin-Pat	valid	all	yes
20 March	Brin-Pat	valid	all	yes	30 May	Pat-Brin	valid	all	yes
21 March	Pat-Brin	valid	all	yes	31 May	Brin-Pat	valid	all	yes
22 March	Brin-Pat	corrupted	none	yes	1 June	Pat-Brin	valid	all	yes
23 March	Pat-Brin	corrupted	none	yes	2 June	Brin-Pat	valid	all	yes
24 March	Brin-Pat	corrupted	none	yes	3 June	Pat-Brin	valid	all	yes
25 March	Pat-Brin	corrupted	none	yes	4 June	Brin-Pat	valid	all	yes
26 March	Brin-Pat	corrupted	none	yes	5 June	Pat-Brin	valid	all	yes
27 March	Pat-Brin	corrupted	none	yes	6 June	Brin-Pat	valid	all	yes
28 March	Brin-Pat	corrupted	none	yes	7 June	Pat-Brin	valid	all	yes
29 March	Pat-Brin	corrupted	none	yes	8 June	Brin-Pat	valid	all	yes
30 March	Brin-Pat	corrupted	none	yes	9 June	Pat-Brin	valid	all	yes
31 March	Pat-Brin	corrupted	none	yes	10 June	Brin-Pat	valid	all	yes
1 April	Brin-Pat	corrupted	none	yes	11 June	Pat-Brin	valid	all	yes
2 April	Pat-Brin	corrupted	none	yes	12 June	Brin-Pat	valid	all	yes
3 April	Brin-Pat	corrupted	none	yes	13 June	Pat-Brin	valid	all	yes
4 April	Pat-Brin	corrupted	none	yes	14 June	Brin-Pat	valid	all	yes
5 April	Brin-Pat	corrupted	none	yes	15 June	Pat-Brin	valid	all	yes

6-Apr-15	Pat-Brin	corrupted	none	yes	16 June	Brin-Pat	valid	all	yes
7 April	Brin-Pat	corrupted	none	yes	17 June	Pat-Brin	valid	all	yes
8 April	Pat-Brin	corrupted	none	yes	18 June	Brin-Pat	valid	all	yes
9 April	Brin-Pat	corrupted	none	yes	19 June	Pat-Brin	valid	all	yes
10 April	Pat-Brin	corrupted	none	yes	20 June	Brin-Pat	valid	all	yes

Table S2. Indicative data from the ship's draughts at the points of the calculation (A and B) for the period from 30 January to 6 February and the correction of the Hs of the geometric altitude according to Figure 7.

Day	Port	h _A (cm)	h _B (cm)	h _s (cm)
30 January	Patra	143	122	127.25
30 January	Igoumenitsa	149	133	137
31 January	Brindisi	124	117	118.75
31 January	Igoumenitsa	132	128	129
1 February	Patra	139	128	130.75
1 February	Igoumenitsa	140	132	134
2 February	Brindisi	105	98	99.75
2 February	Igoumenitsa	99	95	96
3 February	Patra	132	121	123.75
3 February	Igoumenitsa	144	122	127.5
4 February	Brindisi	121	118	118.75
4 February	Igoumenitsa	97	97	97
5 February	Patra	113	105	107
5 February	Igoumenitsa	120	117	117.75
6 February	Brindisi	111	104	105.75
6 February	Igoumenitsa	119	111	113

Table S3. Extract from the total table with the calculated values at the ports of Patras and Brindisi.

Harbor ellipsoid height in m (static solution - PPP)			
Day	Patra	Day	Brindisi
30 January	27.18	31 January	40.88
1 February	27.62	2 February	41.32
3 February	27.79	4 February	41.49
5 February	27.18	6 February	40.88
7 February	26.96	8 February	40.66
9 February	27.22	10 February	40.92
11 February	27.50	12 February	41.20
13 February	26.90	14 February	40.60
15 February	27.26	16 February	40.96
17 February	27.74	18 February	41.44
19 February	26.71	20 February	40.41
21 February	27.71	22 February	41.41
23 February	26.96	24 February	40.66
25 February	27.18	26 February	40.88
27 February	27.14	28 February	40.84
1 March	26.36	2 March	40.06
3 March	27.31	4 March	41.01
5 March	27.40	6 March	41.10
7 March	27.21	8 March	40.91
9 March	27.31	10 March	41.01
11 March	27.22	12 March	40.92
13 March	26.87	14 March	40.57
15 March	27.40	16 March	41.10
17 March	27.55	18 March	41.25

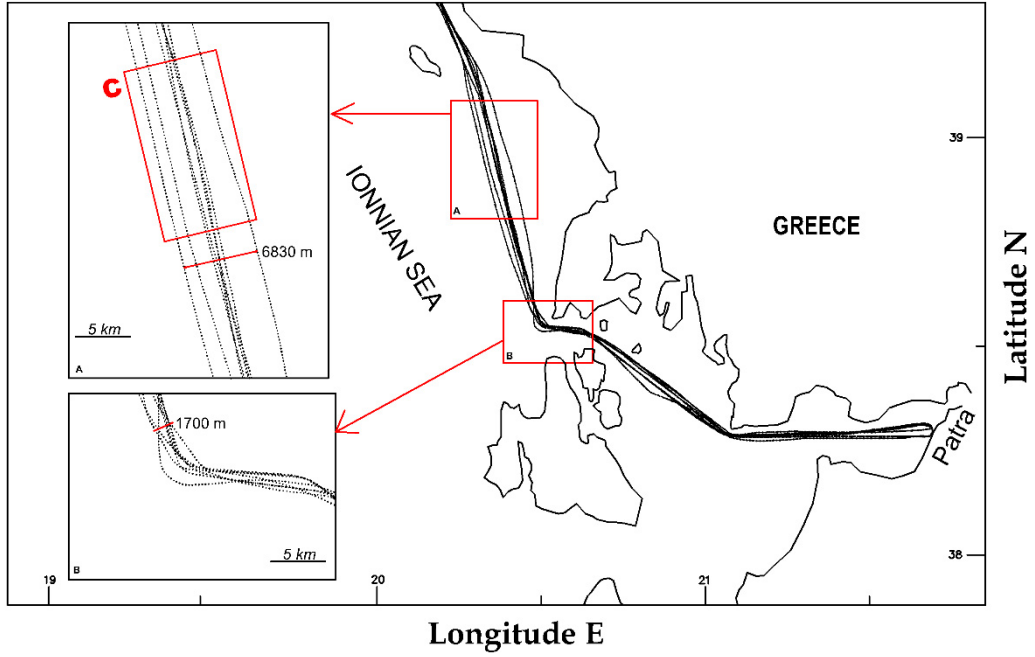


Figure S1. Map depicting the multiple paths of our records. We focus on two areas A and B, where we observe different spreading of the routes. In area A, where we have open sea and the ship is not required to maneuver, we have differences in the order of even 7km, while in the relatively closed area B, the distances are much smaller (1.700m). The 8 paths (11/2-19/2) shown in the figure are consecutive and are reported in codes ID 13-21 (see Table SM1).

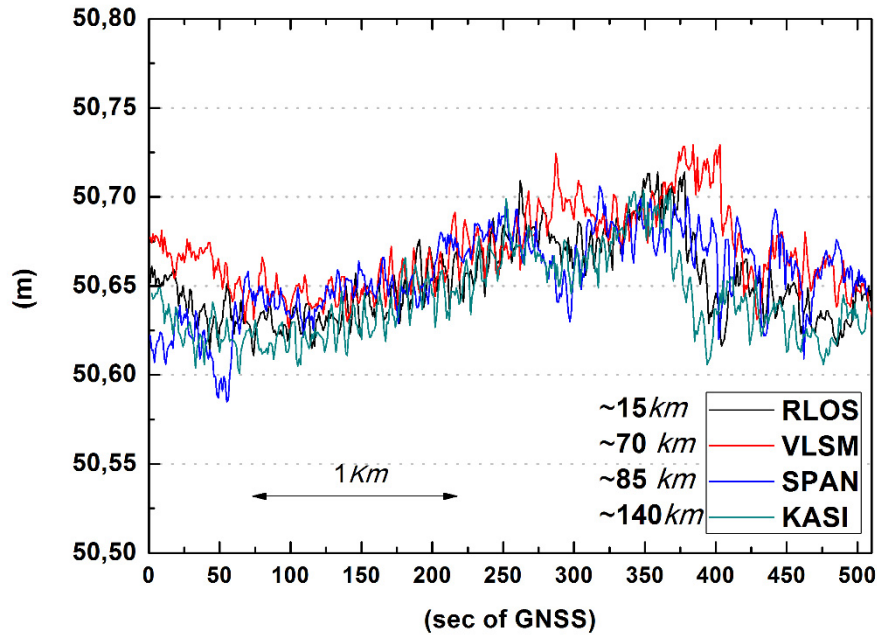


Figure S2. Resolves part of the route from different base stations. The section mentioned here concerns the commencement of the route at the Patraikos Gulf near the port of Patra (Point (a) in Figure 4). The base stations used and their distances from point (a) are illustrated (see also Figure 4). An indicative length inside the part of the route presented is illustrated.

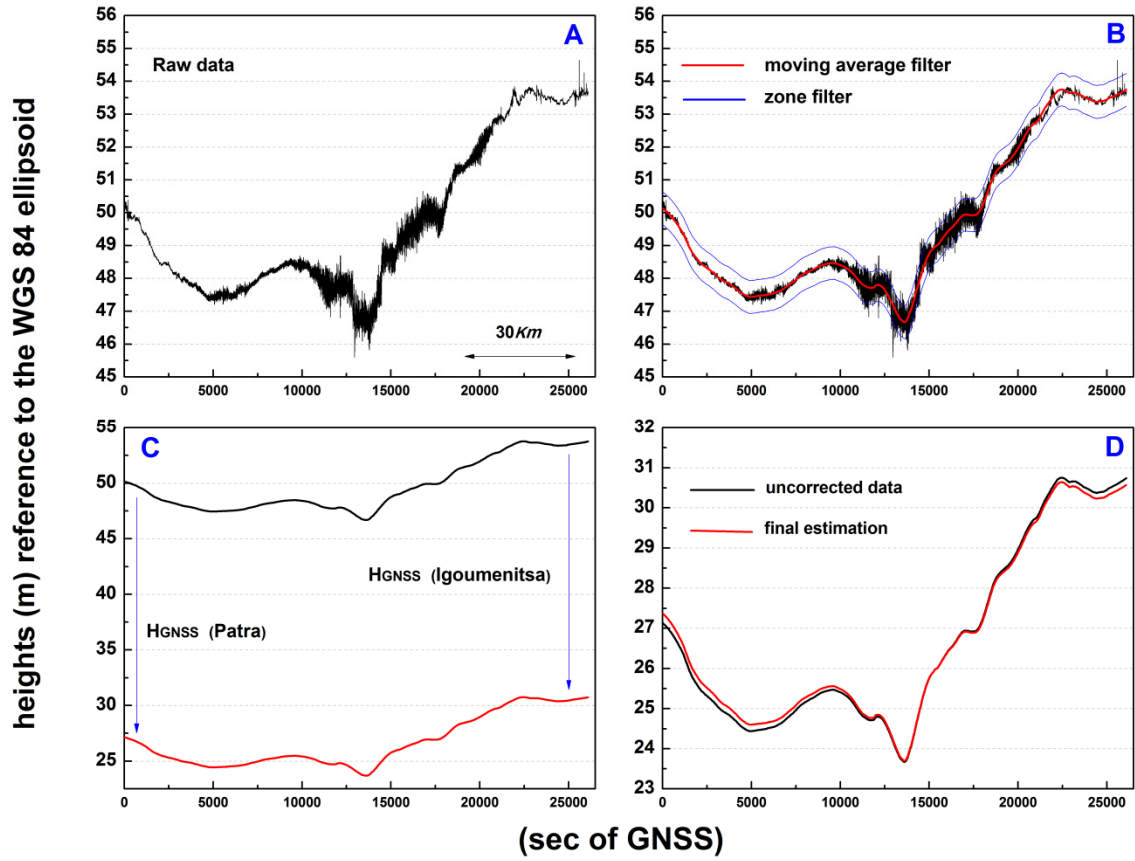


Figure S3. Illustration of the Patras - Igoumenitsa route with code ID3 (see Table SM1). (A) It concerns the raw data of the GNSS altitude during the route as they emerged from the PPP solution. (B) It concerns the raw data, the curve of mean values (red curve) obtained by applying the Savitzky-Golay moving average filter and the two curves (light blue) indicating the limiting values imposed by the band filter. (C) h_{GNSS} receiver elevation correction at port check points described in section 3.2. (D) Linear correction based on deviations of measured port levels from the medium marine level (linear tidal correction described in section 3.3).

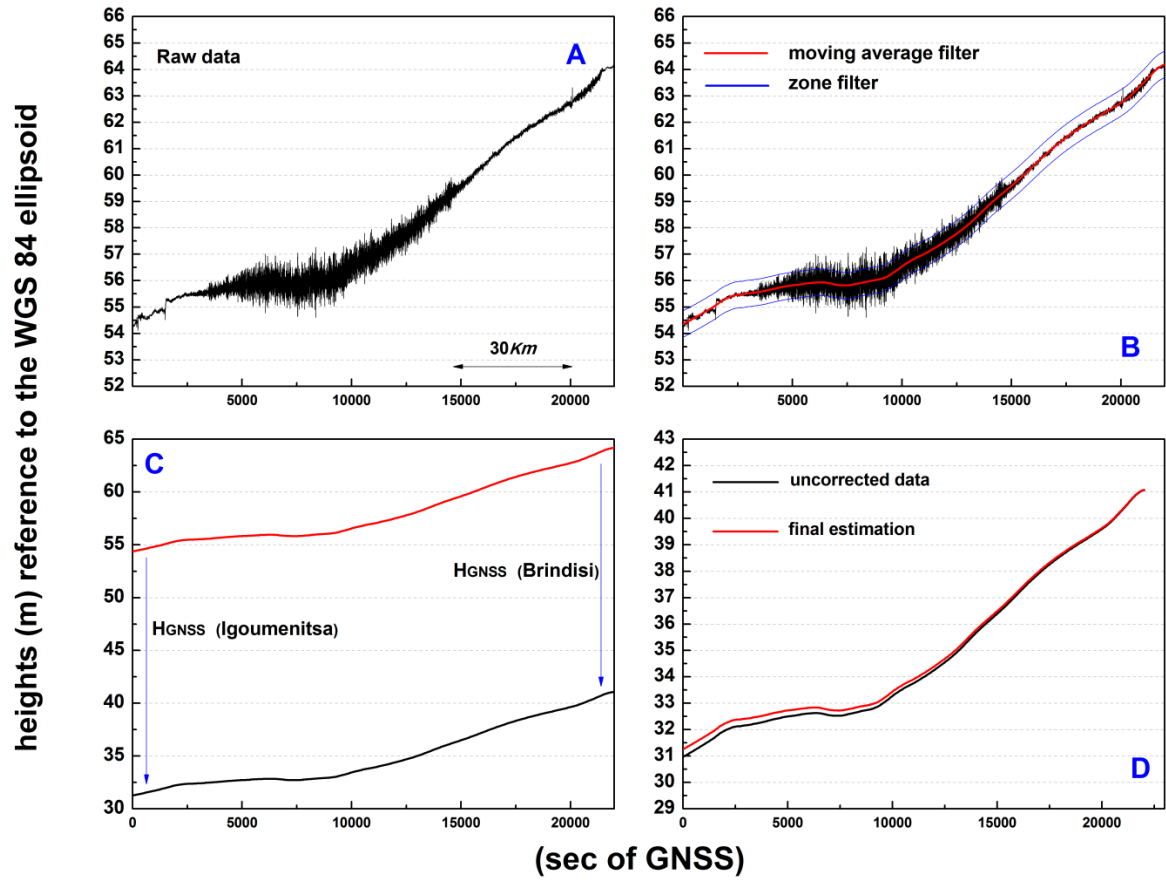


Figure S4. Illustration of the Patras - Igoumenitsa route with code ID11 (see Table SM1). (A) It concerns the raw data of the GNSS altitude during the route as they emerged from the PPP solution. (B) It concerns the raw data, the curve of mean values (red curve) obtained by applying the Savitzky-Golay moving average filter and the two curves (light blue) indicating the limiting values imposed by the band filter. (C) h_{GNSS} receiver elevation correction at port check points described in section 3.2. (D) Linear correction based on deviations of measured port levels from the medium marine level (linear tidal correction described in section 3.3).

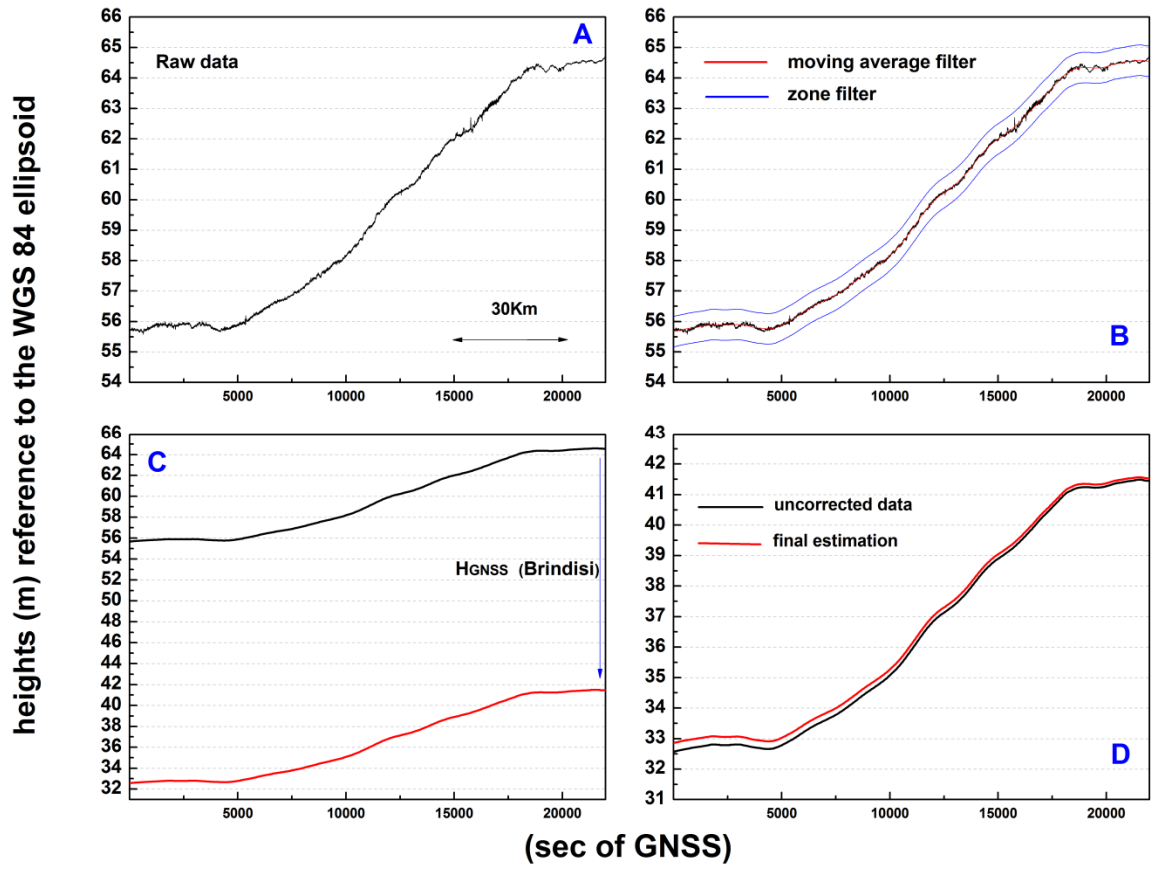


Figure S5. Illustration of the Patras - Igoumenitsa route with code ID141 (see Table SM1). (A) It concerns the raw data of the GNSS altitude during the route as they emerged from the PPP solution. (B) It concerns the raw data, the curve of mean values (red curve) obtained by applying the Savitzky-Golay moving average filter and the two curves (light blue) indicating the limiting values imposed by the band filter. (C) h_{GNSS} receiver elevation correction at port check points described in section 3.2. (D) Linear correction based on deviations of measured port levels from the medium marine level (linear tidal correction described in section 3.3).