

Supplementary information of  
**Evolution of the performances of radar altimetry missions from ERS-2 to Sentinel-3A over the Inner Niger Delta**

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**Table S1.** Results of the comparisons between *in situ* and altimetry water levels derived from ERS-2 mission: number of sample (N), correlation coefficient (R), determination coefficient (R<sup>2</sup>), and Root Mean Square Error (RMSE).

In situ station	Virtual station (VS)	Mission	Distance to <i>in situ</i> station (km)	River width at the VS (m)	N	R	R <sup>2</sup>	RMSE (m)
Diré	0932-a	ERS-2	10	810	65	0.57	0.33	1.38
Diré	0459-a	ERS-2	77	580	56	0.94	0.89	0.57
Mopti	0087-f	ERS-2	40	420	70	0.91	0.84	0.75
Mopti	0474-c	ERS-2	55	430	61	0.83	0.70	1.07
Tilembeya	0631-a	ERS-2	19	350	59	0.62	0.39	4.11
Tilembeya	0474-c	ERS-2	48	430	55	0.70	0.49	3.8
Douna	0173-a	ERS-2	28	510	58	0.95	0.91	0.68
Macina	0016-b	ERS-2	1	400	63	0.82	0.67	0.92
Kara	0631-a	ERS-2	18	420	59	0.95	0.91	0.52
Kara	0474-c	ERS-2	52	430	51	0.87	0.76	0.85
Kara	0087-f	ERS-2	62	420	60	0.9	0.82	0.71
Akka	0474-d	ERS-2	14	660	55	0.58	0.34	1.44
Akka	0545-a	ERS-2	71	880	64	0.83	0.69	1
Koryoumé	0459-a	ERS-2	7	580	52	0.95	0.9	0.55
Koryoumé	0388-a	ERS-2	50	650	67	0.96	0.91	0.57
Koryoumé	0917-a	ERS-2	91	730	61	0.94	0.88	0.6
Konna	0545-j	ERS-2	5	-	28	0.82	0.67	0.71
Konna	0545-k	ERS-2	2	310	28	0.98	0.96	0.33

Konna	0545-h	ERS-2	25	-	31	0.92	0.85	0.51
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**Table S2.** Results of the comparisons between *in situ* and altimetry water levels derived from ENVISAT mission: number of sample (N), correlation coefficient (R), determination coefficient (R<sup>2</sup>), and Root Mean Square Error (RMSE).

In situ station	Virtual station (VS)	Mission	Distance to <i>in situ</i> station (km)	River width at the VS (m)	N	R	R <sup>2</sup>	RMSE (m)
Toguéré	0087-j	ENVISAT	5	230	12	0.75	0.57	0.68
Toguéré	0087-i	ENVISAT	15	160	13	0.98	0.97	0.37
Sormé	0087-i	ENVISAT	28	160	13	0.92	0.86	0.58
Sormé	0087-h	ENVISAT	25	170	13	0.94	0.88	0.54
Sormé	0087-e	ENVISAT	23	180	13	0.95	0.9	0.51
Sormé	0474-g	ENVISAT	20	-	13	0.84	0.71	0.79
Sormé	0474-h	ENVISAT	18	150	13	0.87	0.76	0.76
Sévéri	0474-l	ENVISAT	79	-	7	0.92	0.86	0.55
Sévéri	0474-c	ENVISAT	80	430	7	0.95	0.91	0.41
Diondiori	0087-i	ENVISAT	30	160	13	0.97	0.94	0.41
Tou	0087-d	ENVISAT	13	-	8	0.94	0.88	0.58
Tou	0474-a	ENVISAT	80	220	10	0.79	0.64	1.2
Tou	0474-j	ENVISAT	9	260	13	0.98	0.96	0.33
Kakagnan	0474-h	ENVISAT	15	-	13	0.93	0.87	0.6
Sossobé	0474-n	ENVISAT	18	-	14	0.87	0.76	0.82
Douna	0173-a	ENVISAT	28	510	24	0.93	0.85	0.73
Macina	0016-b	ENVISAT	1	400	46	0.96	0.86	0.74
Diré	0932-a	ENVISAT	10	810	81	0.71	0.51	1.20
Diré	0001-a	ENVISAT	19	690	80	0.82	0.67	1.02
Diré	0459-a	ENVISAT	77	580	81	0.99	0.98	0.17
Mopti	0087-f	ENVISAT	40	420	72	0.99	0.98	0.3
Mopti	0474-c	ENVISAT	55	430	73	0.82	0.66	1.16
Tilembeya	0631-a	ENVISAT	19	420	25	0.88	0.77	0.89
Tilembeya	0474-c	ENVISAT	48	430	25	0.78	0.6	1.15
Kara	0631-a	ENVISAT	18	350	21	0.99	0.98	0.19
Kara	0474-c	ENVISAT	52	430	21	0.91	0.83	0.56
Kara	0087-f	ENVISAT	62	420	23	0.95	0.91	0.43
Akka	0474-d	ENVISAT	14	660	55	0.77	0.59	1.02
Akka	0545-a	ENVISAT	71	880	68	0.89	0.8	0.75
Koryoumé	0459-a	ENVISAT	7	580	69	0.99	0.98	0.2
Koryoumé	0388-a	ENVISAT	50	650	62	0.82	0.66	0.93
Koryoumé	0917-a	ENVISAT	91	730	69	0.94	0.88	0.57

**Table S3.** Results of the comparisons between *in situ* and altimetry water levels derived from SARAL mission: number of sample (N), correlation coefficient (R), determination coefficient (R<sup>2</sup>), and Root Mean Square Error (RMSE).

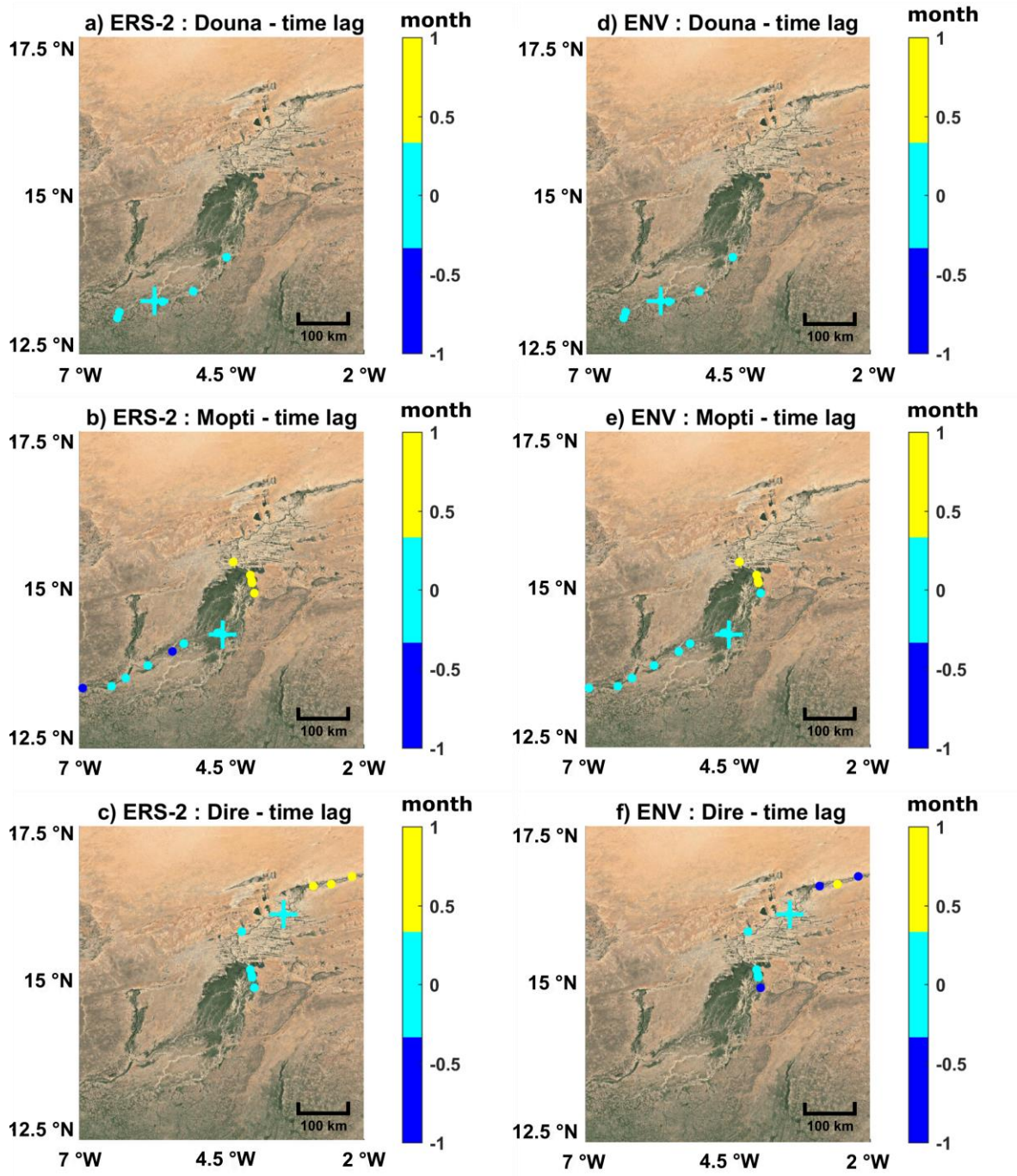
In situ station	Virtual station (VS)	Mission	Distance to <i>in situ</i> station (km)	River width at the VS (m)	N	R	R <sup>2</sup>	RMSE (m)
Diré	0932-a	SARAL	10	810	15	0.98	0.97	0.36
Diré	0001-a	SARAL	19	690	16	0.71	0.51	1.2
Diré	0459-a	SARAL	77	580	16	0.98	0.96	0.33
Mopti	0087-f	SARAL	40	420	23	0.99	0.98	0.34
Mopti	0474-c	SARAL	55	430	18	0.98	0.97	0.39
Macina	0016-b	SARAL	1	400	6	0.99	0.98	0.49
Akka	0474-d	SARAL	14	660	24	0.8	0.64	1.1
Akka	0545-a	SARAL	71	880	26	0.98	0.96	0.41
Koryoumé	0459-a	SARAL	7	580	28	0.99	0.98	0.19
Koryoumé	0388-a	SARAL	50	650	26	0.85	0.72	0.87
Koryoumé	0917-a	SARAL	91	730	27	0.94	0.88	0.58
Kirango	0560-b	SARAL	26	1,360	12	0.74	0.55	1.43
Kirango	0717-d	SARAL	55	640	14	0.96	0.93	0.87
Kirango	0173-c	SARAL	34	610	10	0.99	0.99	0.17

**Table S4.** Results of the comparisons between *in situ* and altimetry water levels derived from Jason-1, 2 and 3 mission: number of sample (N), correlation coefficient (R), determination coefficient (R<sup>2</sup>), and Root Mean Square Error (RMSE).

In situ station	Virtual station (VS)	Mission	Distance to <i>in situ</i> station (km)	River width at the VS (m)	N	R	R <sup>2</sup>	RMSE (m)
Tonka	046-d	Jason-1	8	1,470	85	0.80	0.64	1.02
Douna	085-a	Jason-1	10	680	46	0.68	0.47	1.24
Macina	085-b	Jason-1	21	1,050	147	0.89	0.79	0.81
Tonka	046-d	Jason-2	8	1,470	72	0.9	0.81	0.8
Macina	085-b	Jason-2	21	1,050	37	0.98	0.97	0.38
Kirango	085-b	Jason-2	70	1,050	62	0.99	0.98	0.29
Macina	085-b	Jason-3	21	1,050	45	0.99	0.99	0.18
Kirango	085-b	Jason-3	70	1,050	50	0.99	0.98	0.25

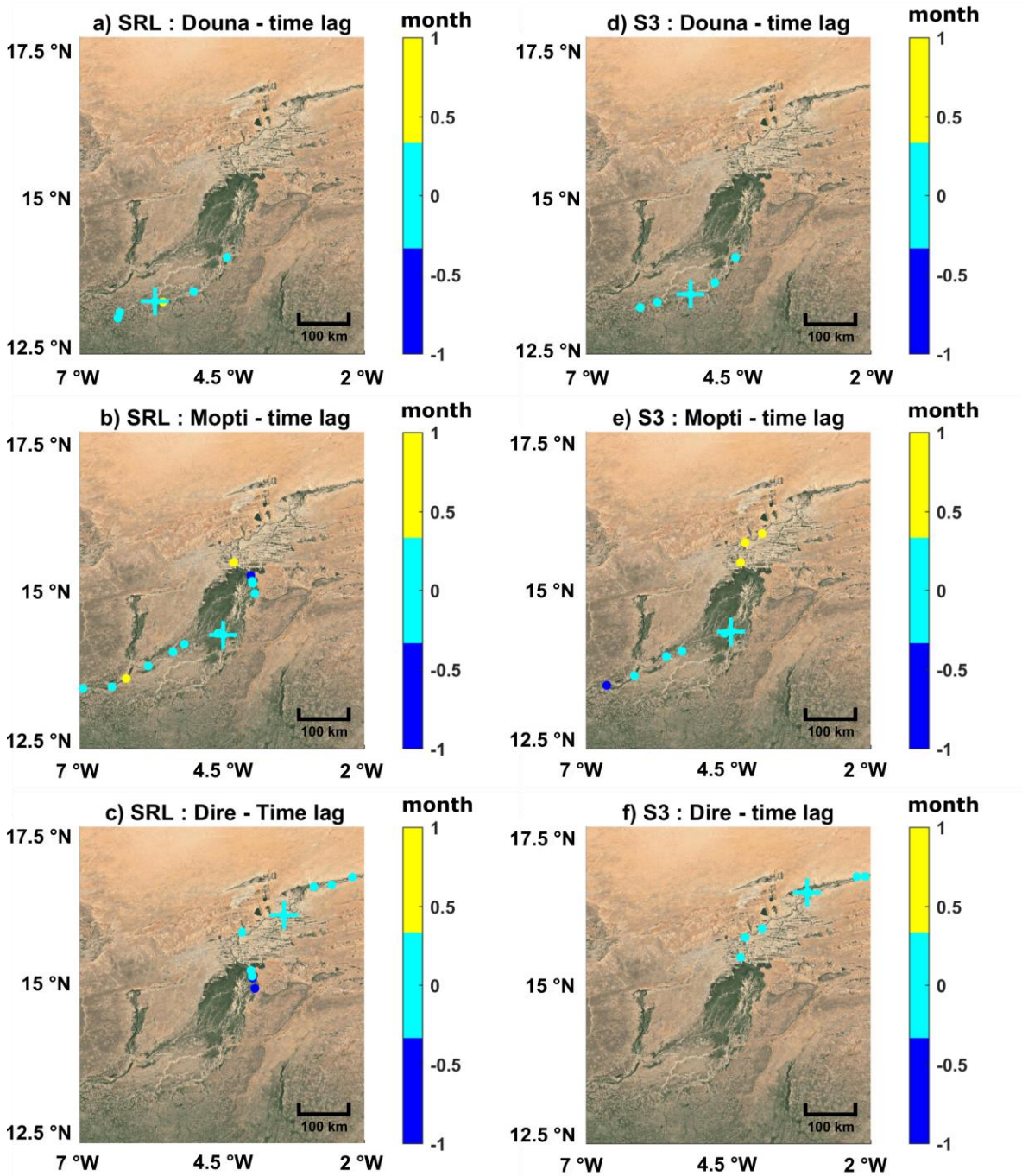
**Table S5.** Results of the comparisons between *in situ* and altimetry water levels derived from Sentinel-3A mission: number of sample (N), correlation coefficient (R), determination coefficient (R<sup>2</sup>), and Root Mean Square Error (RMSE).

In situ station	Virtual station (VS)	Mission	Distance to <i>in situ</i> station (km)	River width at the VS (m)	N	R	R <sup>2</sup>	RMSE (m)
Macina	8-b	Sentinel-3A	29	380	13	0.9	0.99	0.16
Macina	157-b	Sentinel-3A	110	2,570	12	0.94	0.87	1.7
Macina	214-b	Sentinel-3A	8	1,080	14	0.99	0.99	0.21
Mopti	271-a	Sentinel-3A	12	410	12	0.97	0.94	0.57
Macina	336-a	Sentinel-3A	162	1,340	13	0.97	0.95	0.55
Akka	65-i	Sentinel-3A	10	620	3	0.99	0.99	0.9
Akka	65-j	Sentinel-3A	50	1,750	3	0.99	0.99	0.7
Akka	328-a	Sentinel-3A	95	960	4	0.76	0.59	0.9
Koryoumé	1-a	Sentinel-3A	24	3,690	10	0.97	0.95	0.47
Koryoumé	57-a	Sentinel-3A	81	890	10	0.95	0.9	0.61
Koryoumé	122-a	Sentinel-3A	20	3,760	11	0.95	0.91	0.59
Koryoumé	179-a	Sentinel-3A	103	1,270	9	0.93	0.87	0.66
Kirango	8-b	Sentinel-3A	60	820	15	0.98	0.97	0.32
Kirango	100-a	Sentinel-3A	123	1,170	15	0.99	0.98	0.33
Kirango	157-b	Sentinel-3A	21	2,320	14	0.89	0.79	1.58
Kirango	336-a	Sentinel-3A	78	1,170	14	0.99	0.98	0.45



**Figure S1.** Time-lag (in months) corresponding to maxima of cross-correlation between time series of water levels derived from ERS-2 (left) and ENVISAT (right) data in the IND for three different VS near Douna (a and d), Mopti (b and e) and Diré (c and f). Light blue crosses symbolize the VS chosen as reference (auto-correlation of 1 and time-lag null).





**Figure S2.** Time-lag (in months) corresponding to maxima of cross-correlation between time series of water levels derived from SARAL (left) and SENTINEL-3A (right) data in the IND for three different VS near Douna (a and d), Mopti (b and e) and Diré (c and f). Light blue crosses symbolize the VS chosen as reference (auto-correlation of 1 and time-lag null).