1 Supplementary Information

2 Sea level budget residuals of the low degree harmonics of the

3 components

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5 In order to highlight the contribution of the different low degree harmonics in the sea level 6 budget residuals, we decomposed each of the components, restricted to their common 7 oceanic mask, in spherical harmonics and computed the sea level budget for different 8 combinations of these low degree harmonics. The sum of all components summed up to 9 degree 4 (Figure S1, top left panel) well reproduces the sea level budget residual map 10 characteristics with high residuals in the North Atlantic Ocean. Other panels of Figure S1 show 11 the residuals of the sea level budget with components summed up to degree 4, with one 12 harmonic signal corresponding to one (degree I, order m) combination. Table S1 provides the 13 root mean squares (RMS) for each case, computed over all oceans. Figure S1 and Table S1 14 show that residuals are strongly reduced in the North Atlantic Ocean when removing 15 harmonics 11m0 (geocenter term), 11m1, 12m1 (including the polar motion term), 13m2, 13m3 16 and I4m2. This means that these harmonics contain spurious signals in some of the sea level 17 budget components. Globally and in the North Atlantic Ocean, harmonics I1m0, I2m1 and I4m3 18 have the highest impact on the residuals.

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- 20 Figure S1: Sea level budget residual trends computed over January 2005 to June 2022 using
- the low degrees of each component up to degree 4, and subtracting each order/degree
- 22 contribution one by one.
- Table S1: Root mean square (RMS) of the residual trends computed using the low degrees of
 each component up to degree 4, and subtracting each order/degree contribution one by one.
 The RMS is computed over the global oceans and over the North Atlantic, South Atlantic,
 Indian and Pacific Oceans. Bold font indicates RMS values which are lower than 0.1 mm/yr
 below the value for the sum up to degree 4 without any subtraction (first line).

Component removed from the sum of all components up to degree 4	Residual trends RMS over oceans (mm/yr)					
	Global	North Atlantic	South Atlantic	Indian	Pacific	
None	0.94	2.11	1.00	0.55	0.64	
l1m0	0.87	1.86	0.87	0.54	0.65	
l1m1	0.92	1.91	1.18	0.60	0.60	
l2m0	0.94	2.11	0.99	0.51	0.65	
l2m1	0.74	1.50	0.48	0.69	0.56	

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l2m2	0.93	2.08	0.96	0.51	0.64
l3m0	0.92	2.01	0.92	0.59	0.64
l3m1	0.93	2.13	0.98	0.50	0.61
l3m2	0.93	1.93	0.76	0.58	0.76
l3m3	0.90	1.95	1.04	0.46	0.63
l4m0	0.94	2.08	1.04	0.61	0.62
l4m1	0.91	2.03	0.97	0.52	0.61
l4m2	0.90	2.03	1.16	0.43	0.52
l4m3	0.84	1.80	0.80	0.64	0.57
l4m4	0.93	2.07	1.03	0.47	0.65

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