Ocean Science

Supplement of

Regional sea level trend budget over 2004–2022

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S1. Trends and trend uncertainties of altimetry-based total sea level, components and budget residuals over 2004-2022

(a) Total sea level trend

(b) Total sea level uncertainties

(c) Manometric sea level trend

(d) Manometric sea level uncertainties

(e) Thermosteric sea level trend

(f) Thermosteric sea level uncertainties

(g) Halosteric sea level trend

(h) Halosteric sea level uncertainties

(i) Sea level budget residuals trend
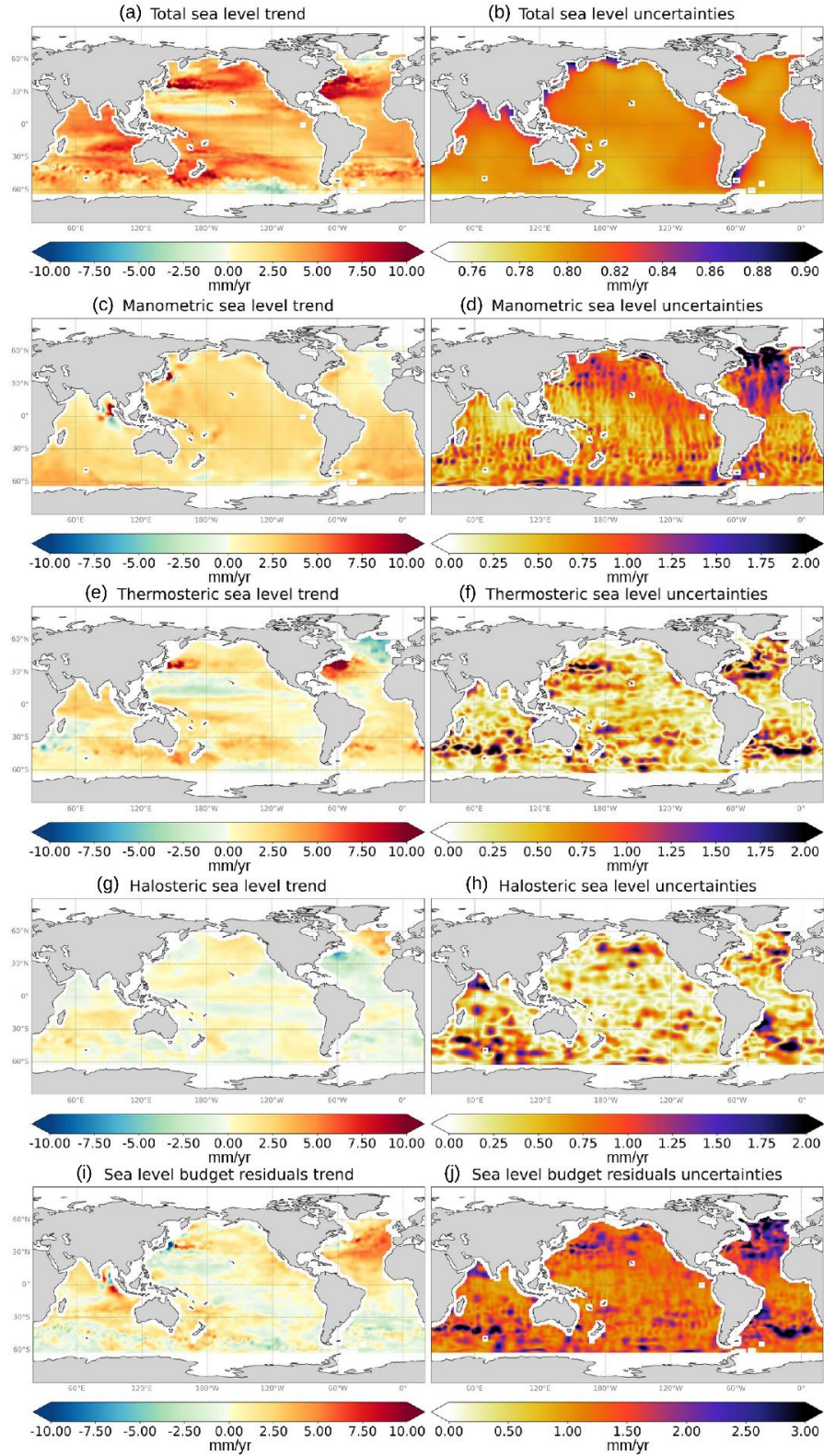
(j) Sea level budget residuals uncertainties

Figure S1: Trend map (left panels) and associated 1-sigma trend uncertainty map (right panels) over 2004-2022 for each term of the regional sea level budget: (a,b) Total altimetry-based sea level trends and associated trend uncertainties, (c,d) GRACE-based manometric component and associated trend uncertainties, (e,f) thermosteric component and associated trend uncertainties, (g,h) halosteric component and associated trend uncertainties, and (i,j) budget residuals and associated trend uncertainties.

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
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

S2. Sea level budget residuals of the low degree harmonics of the components

In order to highlight the contribution of the different low degree harmonics in the sea level budget residuals, we decomposed each of the components, restricted to their common oceanic mask, in spherical harmonics and computed the sea level budget for different combinations of these low degree harmonics. The sum of all components summed up to degree 4 (Figure S2, top left panel) well reproduces the sea level budget residual map characteristics with high residuals in the North Atlantic Ocean. Other panels of Figure S2 show the residuals of the sea level budget with components summed up to degree 4, with one harmonic signal corresponding to one (degree l, order m) combination. Table S1 provides the root mean squares (RMS) for each case, computed over all oceans. Figure S2 and Table S1 show that residuals are strongly reduced in the North Atlantic Ocean when removing harmonics l1m0 (geocenter term), l1m1, l2m1 (including the polar motion term), l3m2, l3m3 and l4m2. This means that these harmonics contain spurious signals in some of the sea level budget components. Globally and in the North Atlantic Ocean, harmonics l1m0, l2m1 and l4m3 have the highest impact on the residuals.
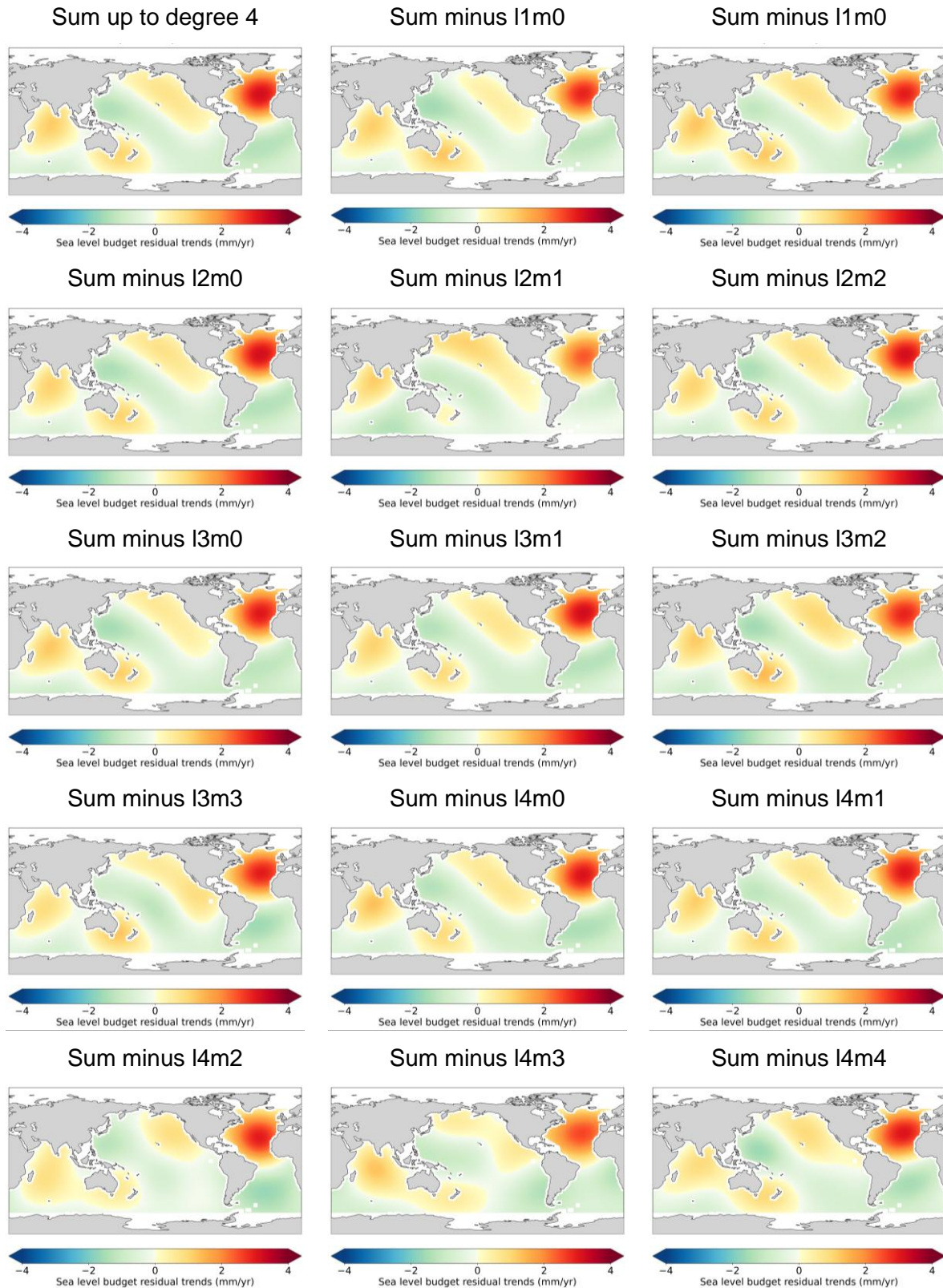
Figure S2: Sea level budget residual trends computed over January 2005 to June 2022 using the low degrees of each component up to degree 4, and subtracting each order/degree contribution one by one.

S3. EOF Decomposition of the gridded residual time series (with the GRACE SH-based manometric component)
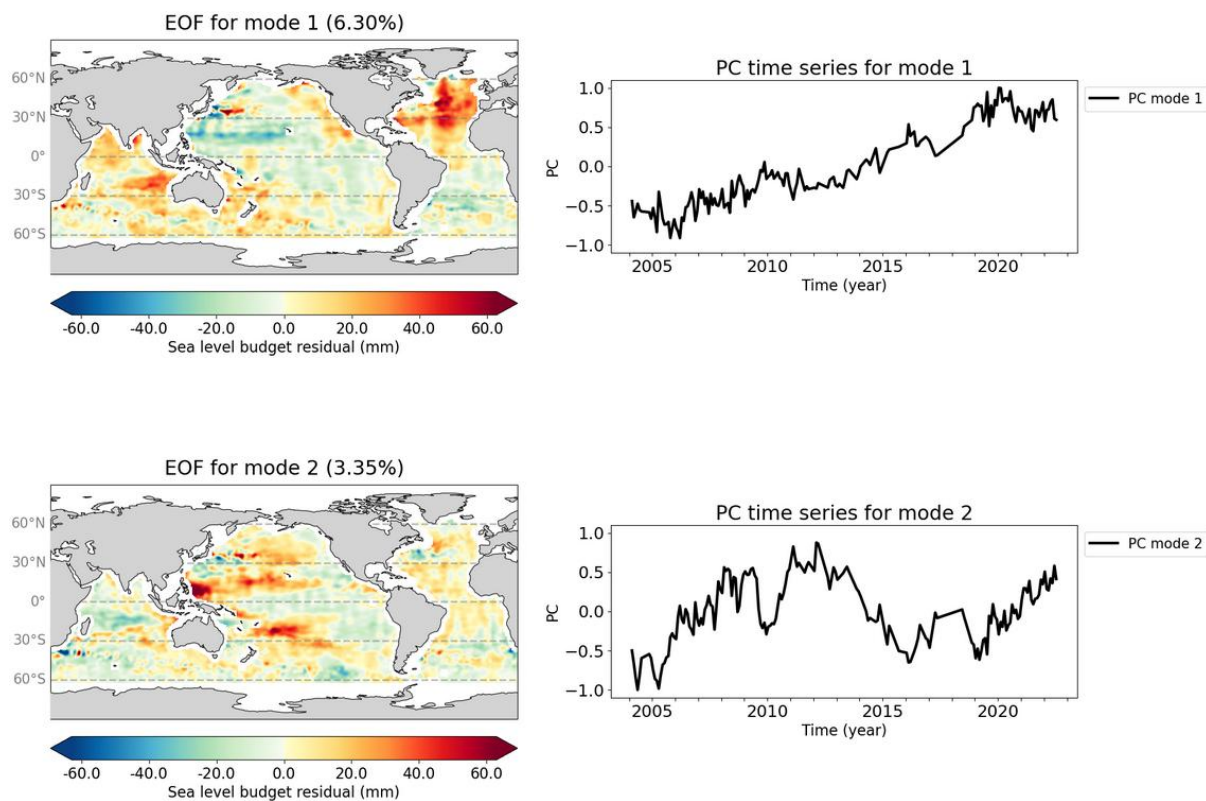

Figure S3: Modes 1 and 2 of the EOF decomposition over 2004-2022 of the gridded residual time series (with the GRACE SH manometric component). The left panels are the spatial maps while the right panels are the associated principal components (PC).