

## Joint projections of US East Coast sea level and storm surge using a novel flood index

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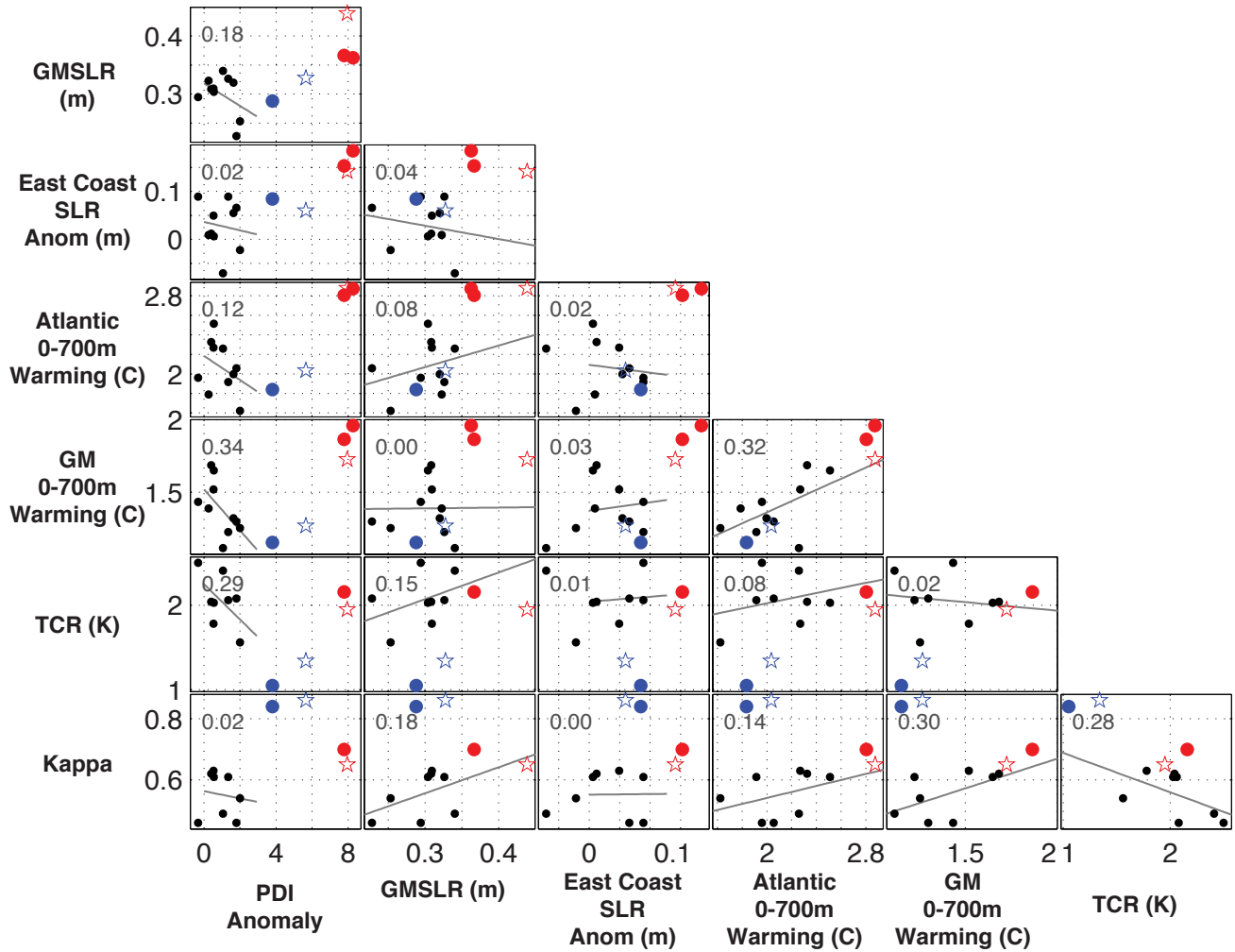
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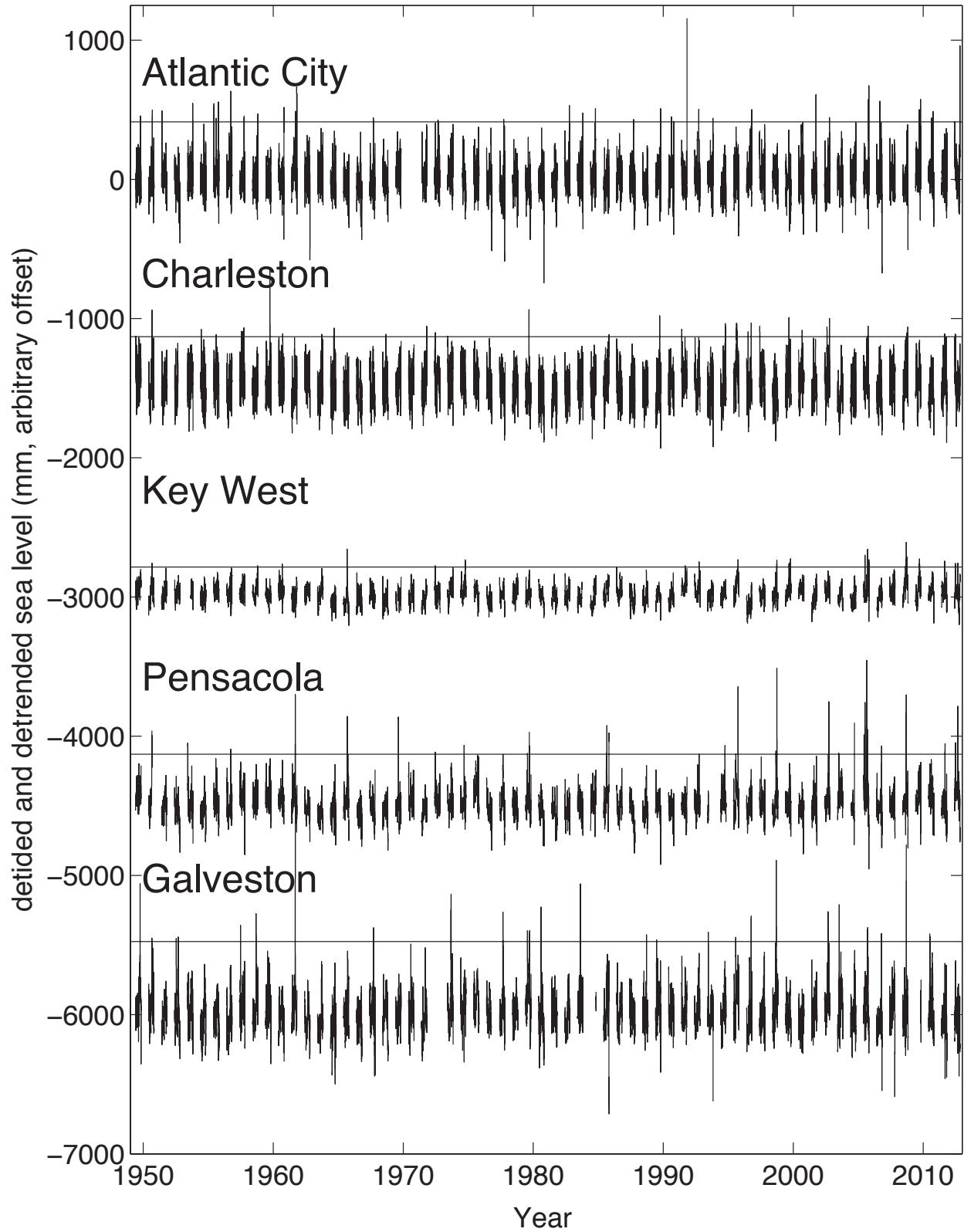
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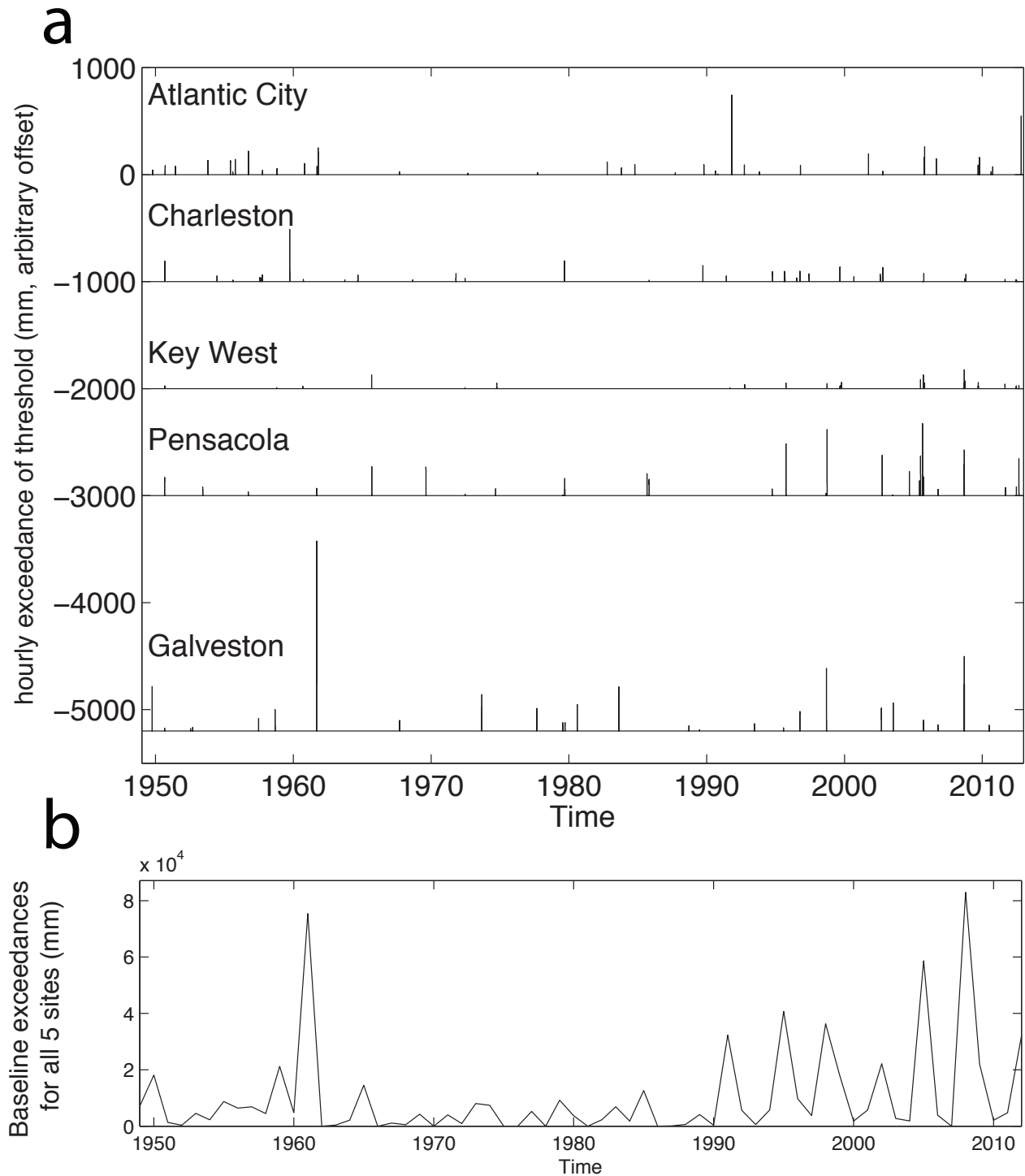
**Supplementary information: Joint projections of US East Coast  
sea level and storm surge using a novel flood index**



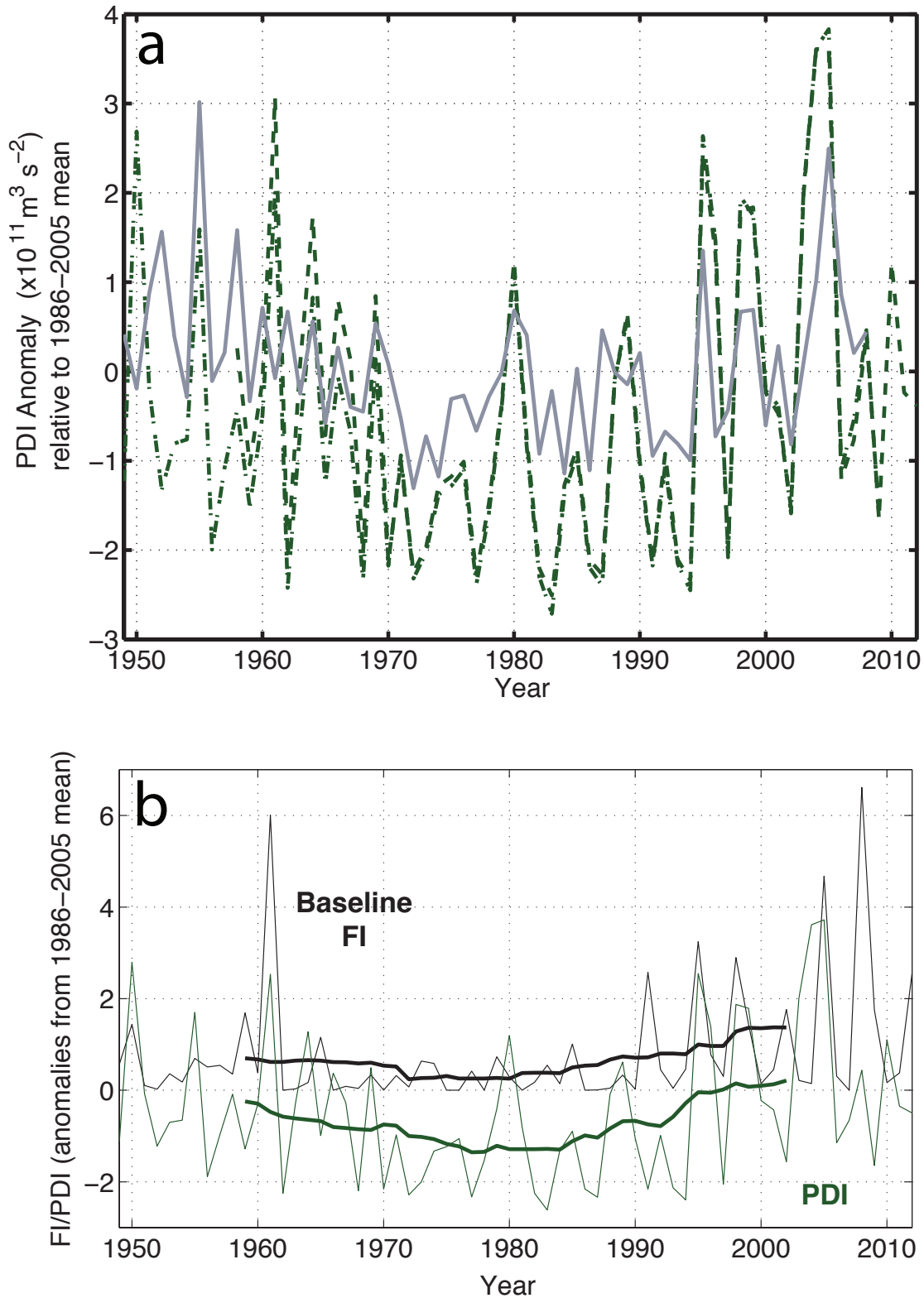
**Supplementary Figure S 1.** Pairwise scatter plots of additional AOGCM quantities for RCP 8.5. As Fig. 3 in main text, except GFDL-CM3 is denoted with a red star, GFDL-ESM2M is denoted with a blue star. TCR = transient climate response; Kappa = ocean heat uptake efficiency; TCR and Kappa are from Kuhlbrodt and Gregory (2012).



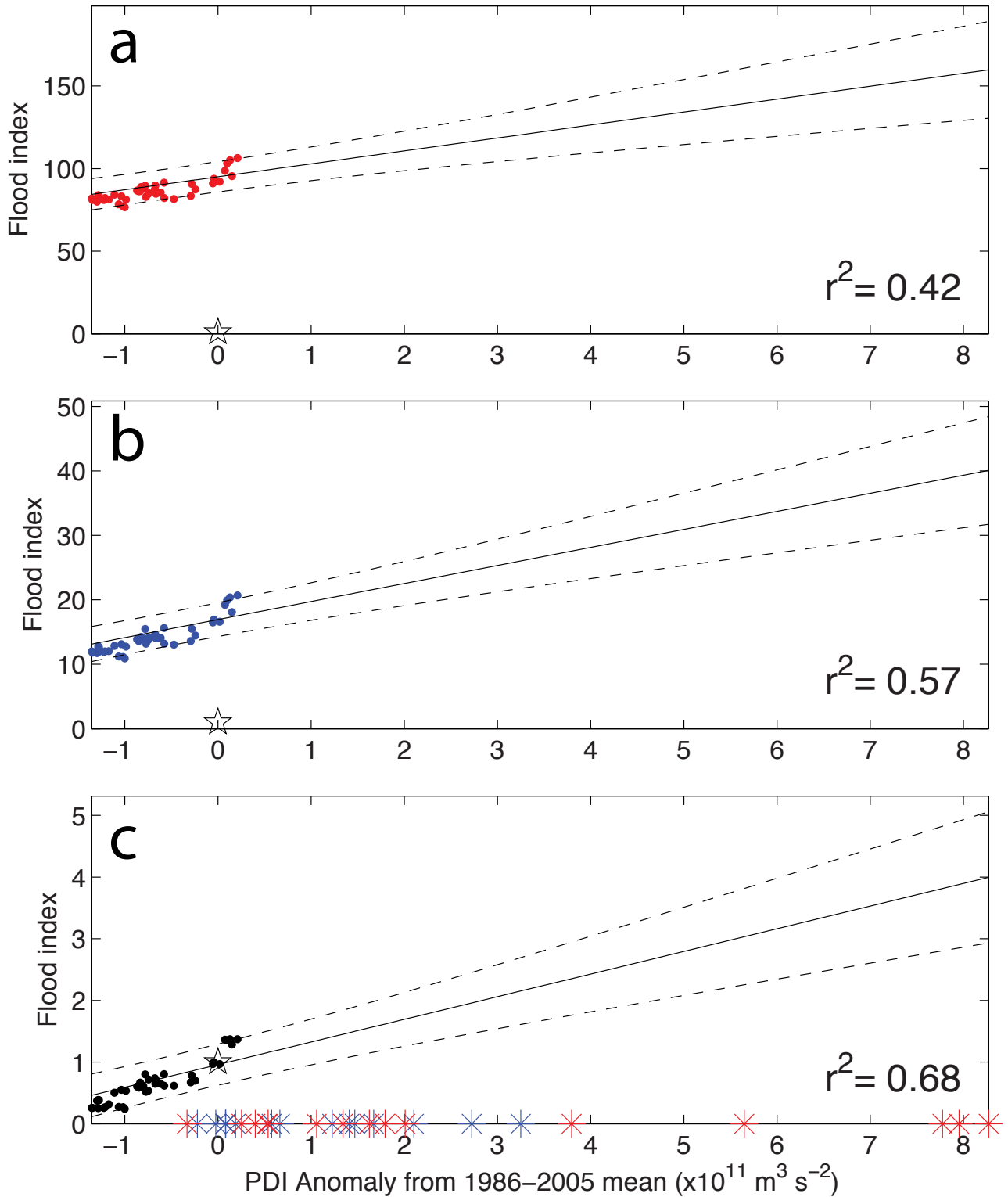
**Supplementary Figure S 2.** Processed June-October tide gauge records from University of Hawaii sea level center (in mm). Horizontal lines are the 99.5th percentile values at each gauge after detiding and removal of the linear sea level trend and the annual cycle.



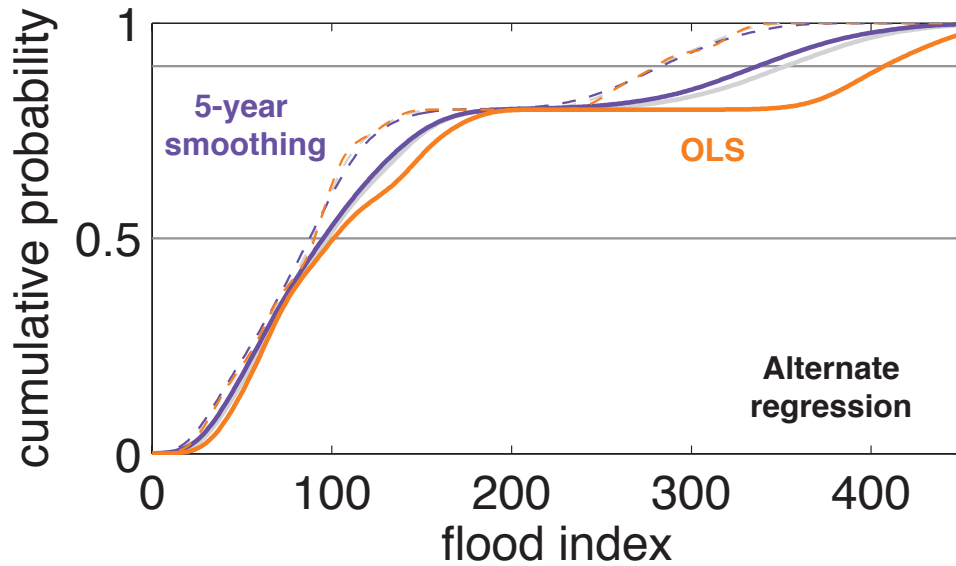
**Supplementary Figure S 3.** (a) Hourly exceedances of 99.5th percentile threshold at all sites over the period 1949-2012. (b) annual exceedances summed over all sites shown in (a).



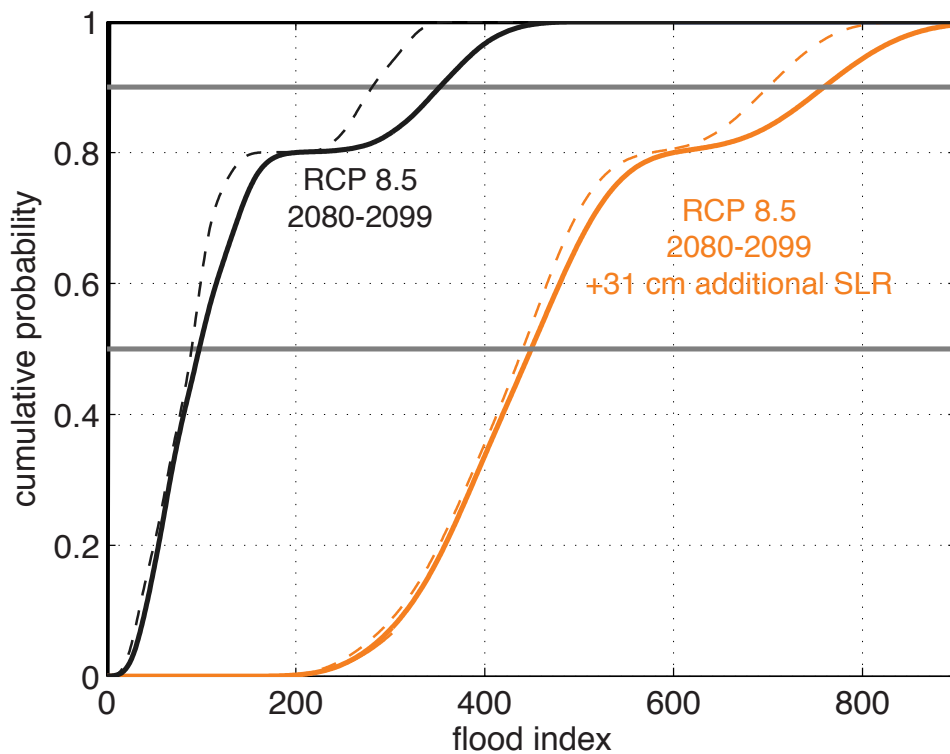
**Supplementary Figure S 4.** (a) Annual PDI anomaly from the 1986–2005 mean as derived from Landsea et al. (2013) (green dashed), Emanuel (2007) (green dot-dashed), and the relative SST proxy (grey). (b) Time series of observed “hybrid” PDI (green line; the thick line indicates the 20-year running mean) and flood index (black line; the thick line indicates the 20-year running mean).



**Supplementary Figure S 5.** Twenty-year smoothed FI and  $1\sigma$  uncertainty (dashed lines) for: a) 5-site averaged SLR from the median model in RCP 8.5 (GFDL-ESM2G, 37 cm, in red); b) 5-site averaged SLR from the median model in RCP 2.6 (GFDL-ESM2G, 21 cm, in blue); c) no SLR; black. Asterisks in (c) indicate the 2080–2099 PDI from the RCP 2.6 (blue) and RCP 8.5 (red) models. The star indicates the 1986–2005 mean flood index (1) and PDI anomaly (0).



**Supplementary Figure S 6.** As Fig. 5 in the main text. Orange lines show FI derived using an ordinary least squares regression; the purple lines show FI derived using generalized least squares regression and a 5-year smoothing period for FI and PDI. The analysis in the main text (grey lines) uses generalized least squares regression with 20-year smoothing.



**Supplementary Figure S 7.** As Fig. 4 in the main text, with an additional sea level contribution of 31 cm to all models, corresponding to the median freshwater exchange contribution to SLR for RCP 8.5 at Charleston, SC from the analysis of Kopp et al. 2014. The analysis in the main text (using only oceanographic sources of SLR) is shown with black lines.



RCP 2.6	Atlantic City	Charleston	Key West	Pensacola	Galveston	Mean SLR	PDI anom
mri-cgcm3	0.11	0.12	0.14	0.14	0.14	0.13	1.4
canesm2	0.21	0.19	0.17	0.15	0.15	0.17	2.1
cnrm-cm5	0.22	0.18	0.15	0.14	0.13	0.16	0.2
ipsl-cm5a-mr	0.15	0.14	0.15	0.14	0.14	0.14	0.1
ipsl-cm5a-lr	0.14	0.13	0.14	0.14	0.14	0.14	-0.2
ccsm4	0.15	0.14	0.16	0.17	0.16	0.16	0.1
csiro-mk3-6-0	0.34	0.25	0.20	0.20	0.19	0.24	0.6
gfdl-esm2g	0.24	0.21	0.21	0.19	0.20	0.21	0.7
noresm1-m	0.23	0.21	0.21	0.21	0.21	0.21	1.5
hadgem2-es	0.25	0.22	0.22	0.24	0.24	0.23	0.0
gfdl-esm2m	0.22	0.20	0.20	0.19	0.19	0.20	1.2
mpi-esm-lr	0.21	0.19	0.21	0.20	0.20	0.20	0.1
miroc-esm	0.41	0.32	0.29	0.26	0.27	0.31	1.7
miroc-esm-chem	0.38	0.31	0.29	0.26	0.27	0.30	3.3
gfdl-cm3	0.46	0.32	0.30	0.36	0.35	0.36	2.7
Ens. Mean	0.25	0.21	0.20	0.20	0.20	0.21	1.1
Ens. SD	0.11	0.07	0.05	0.06	0.06	0.07	1.1

**Supplementary Table S 1.** Summary sea level change (m) and PDI anomaly ( $\times 10^{11} \text{ m}^3\text{s}^{-2}$ ) projections (2080-2099 mean - 1986-2005 mean) from each of the 15 CMIP5 models for RCP 2.6.

RCP 8.5	Atlantic City	Charleston	Key West	Pensacola	Galveston	Mean SLR	PDI anom
mri-cgcm3	0.21	0.22	0.25	0.24	0.23	0.23	2.0
canesm2	0.35	0.28	0.25	0.23	0.23	0.27	1.1
cnrm-cm5	0.40	0.32	0.24	0.26	0.25	0.29	1.8
ipsl-cm5a-mr	0.31	0.30	0.33	0.31	0.30	0.31	0.5
ipsl-cm5a-lr	0.33	0.32	0.33	0.31	0.30	0.32	0.4
ccsm4	0.36	0.29	0.33	0.34	0.33	0.33	0.3
csiro-mk3-6-0	0.50	0.39	0.32	0.30	0.29	0.36	0.5
gfdl-esm2g	0.44	0.38	0.36	0.33	0.35	0.37	3.8
noresm1-m	0.43	0.37	0.36	0.36	0.36	0.37	1.6
hadgem2-es	0.45	0.37	0.33	0.39	0.38	0.38	-0.3
gfdl-esm2m	0.51	0.36	0.33	0.36	0.37	0.39	5.6
mpi-esm-lr	0.46	0.40	0.42	0.40	0.40	0.41	1.3
miroc-esm	0.68	0.53	0.50	0.44	0.45	0.52	7.8
miroc-esm-chem	0.66	0.56	0.52	0.49	0.50	0.55	8.3
gfdl-cm3	0.83	0.52	0.45	0.55	0.55	0.58	8.0
Ens. Mean	0.46	0.37	0.35	0.35	0.35	0.38	2.8
Ens. SD	0.16	0.10	0.09	0.09	0.09	0.10	3.1

**Supplementary Table S 2.** Summary sea level change (m) and PDI anomaly ( $\times 10^{11} \text{ m}^3\text{s}^{-2}$ ) projections (2080-2099 mean - 1986-2005 mean) from each of the 15 CMIP5 models for RCP 8.5.

simulation	$\overline{r_{hist,GLS}^2}$	$\overline{r_{hist,OLS}^2}$	$\overline{r_{GLS}^2}$	$\overline{r_{OLS}^2}$
baseline	0.68	0.86	0.50	0.74
99th	0.63	0.83	0.39	0.71
99.9th	0.69	0.83	0.74	0.84
daily max	0.60	0.78	0.45	0.68
squared exc.	0.66	0.83	0.66	0.80
8 locations	0.68	0.80	0.52	0.79
4 locations	0.73	0.85	0.57	0.75
not normalized	0.82	0.86	0.17	0.72
5y smooth	0.36	0.37	0.21	0.22

**Supplementary Table S 3.** Goodness of fit for the PDI/FI regression for the cases examined in Fig. 5 and Supplemental Fig. S6. For each case, four  $r^2$  values are shown. The first is for the GLS regression over the observed 1949-2012 period. The second is the value obtained over the observed period for an OLS regression. The third column is the mean  $r^2$  value obtained for a GLS regression for all 31 SLR scenarios. The fourth is for all sea level rise scenarios based on an OLS regression.