Supplementary Material

# Supplementary Tables

**Supplementary Table 1**. Trends, tidal datums, and extremes associated with the water levels from observations, CORA, and GLORYS12 (only trends). Trends in monthly sea level anomalies during 1993–2020 are shown with units of mm yr-1 and m. For the observations and CORA, water level characteristics are as follows: tidal datums (MSL and MHHW; both for the epochs 1983–2001 and 2002–2020) and 2% exceedance threshold of daily maximum water levels with respect to MHHW (2002–2020). Datums and extremes are calculated if at least five years are available in the epoch (see Table 1). Locations with water level gauges assimilated by CORA (plus signs next to the names); locations with less than 10 years of data (indicated by asterisks) are assessed only for trends.

**Supplementary Table 2**. Performance metrics of GLORYS12 and CORA compared to observations. The evaluation is for monthly (both reanalyses) and hourly (CORA only) variability as described by the SD, ACC (monthly only), RMSE, and r (hourly only). Plus signs next to the location names indicate if water level gauges were assimilated by CORA. Locations with less than 10 years of observations are not assessed for these metrics.

# Supplementary Figures

**Supplementary Figure 1**. Long-term linear trend in monthly anomalies (mm yr-1) at model nodes (color bar shading) and water level gauges (circles are assimilated and squares are not assimilated in CORA). Water level gauges with incomplete records during 1993–2020 are indicated by dotted markers. Triangles indicate assimilated water level gauges with records shorter than 10 years. The maps show (A) the entire domain, (B) southern FL, and (C) southeastern FL (note the finer color bar scale). Black arrows in B and C indicate the Virginia Key and Lake Worth water level gauges and the white arrow in B indicates the Trident Pier gauge.

**Supplementary Figure 2**. The monthly annual cycle for (A) observations, (B) GLORYS12 nearest the water level gauges, (C) CORA at assimilated water level gauges, and (D) CORA at non-assimilated water level gauges. Blue and yellow lines refer to the East and Gulf Coast locations, respectively. Thick solid (dashed) lines indicate East (Gulf) Coast averages. Annual cycles are normalized to have a mean of zero.

**Supplementary Figure 3**. Occurrence of the daily highest water levels with respect to MHHW. Panel I (top) represents observations and Panel II (bottom) represents CORA for (A) Boston, (B) Newport, (C) The Battery, (D) Sewells Point, (E) Charleston, (F) Virginia Key, (G) Grand Isle, and (H) Galveston Pier 21. Dashed black, blue, and red lines represent the 2% exceedance level, 20th highest water level, and the NOAA minor flood threshold, respectively. The NOAA minor flood threshold, from Appendix I of Sweet et al. (2018), is adjusted from being relative to the 1983–2001 epoch to instead the 2002–2020 epoch. The epoch adjustment is performed by adding to the previous flood threshold the difference between MHHW datums, i.e., MHHW (1983–2001) minus MHHW (2002–2020), so that the new threshold is relative to MHHW during the more recent epoch.

**Supplementary Figure 4**. Hourly water levels and non-tidal residuals (m) for observations and CORA. Gray lines represent water level gauges and blue lines represent CORA for (A) Boston, (B) Newport, (C) The Battery, (D) Sewells Point, (E) Charleston, (F) Southbank Riverwalk, (G) Virginia Key, (H) Grand Isle, and (I) Galveston Pier 21. Water levels with respect to the MHHW datums are shown for October 15-November 15, 2012 (left panels), and the non-tidal residuals are shown for six days centered on October 29, 2012 (right panels; Hurricane Sandy landfall).

**Supplementary Figure 5**. Annual occurrence of extreme water levels according to the 2% exceedance threshold with respect to MHHW for locations on the Gulf and East Coasts, based on detrended water levels. (A) Results from observations (years with unavailable data for a location are gray). (B) Results from CORA (locations not assessed for 2% exceedance are gray; Supplementary Table 1). Color shading indicates the number of days per year when the maximum water level is above the 2% exceedance threshold at a particular location. Numbers on the y-axes indicate every fifth location (see Table 1 for the water level gauge names). Locations are organized by latitude and region, with the northernmost (East Coast) at the top and a dashed line separating the Gulf Coast at the bottom. (C) Regionally averaged annual occurrence of extreme water level days: Solid (dashed) lines are for the East (Gulf) Coast and gray (blue) colors are for the observations (CORA).