Supplemental Material for:

Subseasonal-to-seasonal forecast skill in the California Current System and its connection to coastal Kelvin waves

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Tide gauge measurements

The tide gauge data used for verifying GLORYS are maintained by the Joint Archive for Sea Level (JASL), which is a partnership between the University of Hawaii Sea Level Center (UHSLC) and the National Centers for Environmental Information (NCEI). Here, we utilize the Research Quality Data Set (RQDS) available at: http://ilikai.soest.hawaii.edu/UHSLC/jasl.html. These observations are not assimilated in GLORYS and therefore offer an independent metric by which to verify the reanalysis. The monthly mean GLORYS and tide gauge anomalies used for Figure 2 and Table 1 are relative to a long-term monthly mean climatology from 1993-2018. The daily mean GLORYS and tide gauge anomalies used for Table 1 were calculated by removing the first three harmonics of the seasonal cycle over the same time period. Correlation significance between the two data sets was determined using a Student's t-test with a 95% confidence interval.

Kelvin wave index phase composites

In order to validate that each pair of EOFs discussed in Section 3.2 represent KWs propagating along our pathway, we define the phase relationship at time step *t* between each set of PC1 and PC2 as:

$$Phase(t) = \tan^{-1}\left(\frac{PC2(t)}{PC1(t)}\right) \quad (2)$$

The resulting timeseries depict phases ranging from 0˚-360˚ that describe the physical location of the propagating waves as they move through time. Analogous to the various MJO indices (e.g., Kiladis et al. 2014), these phases can be further subdivided into eight equal 45˚ segments. We then compute composites of GLORYS filtered SSH anomalies, compositing when each index is greater than 1 in each phase (Figure S2).

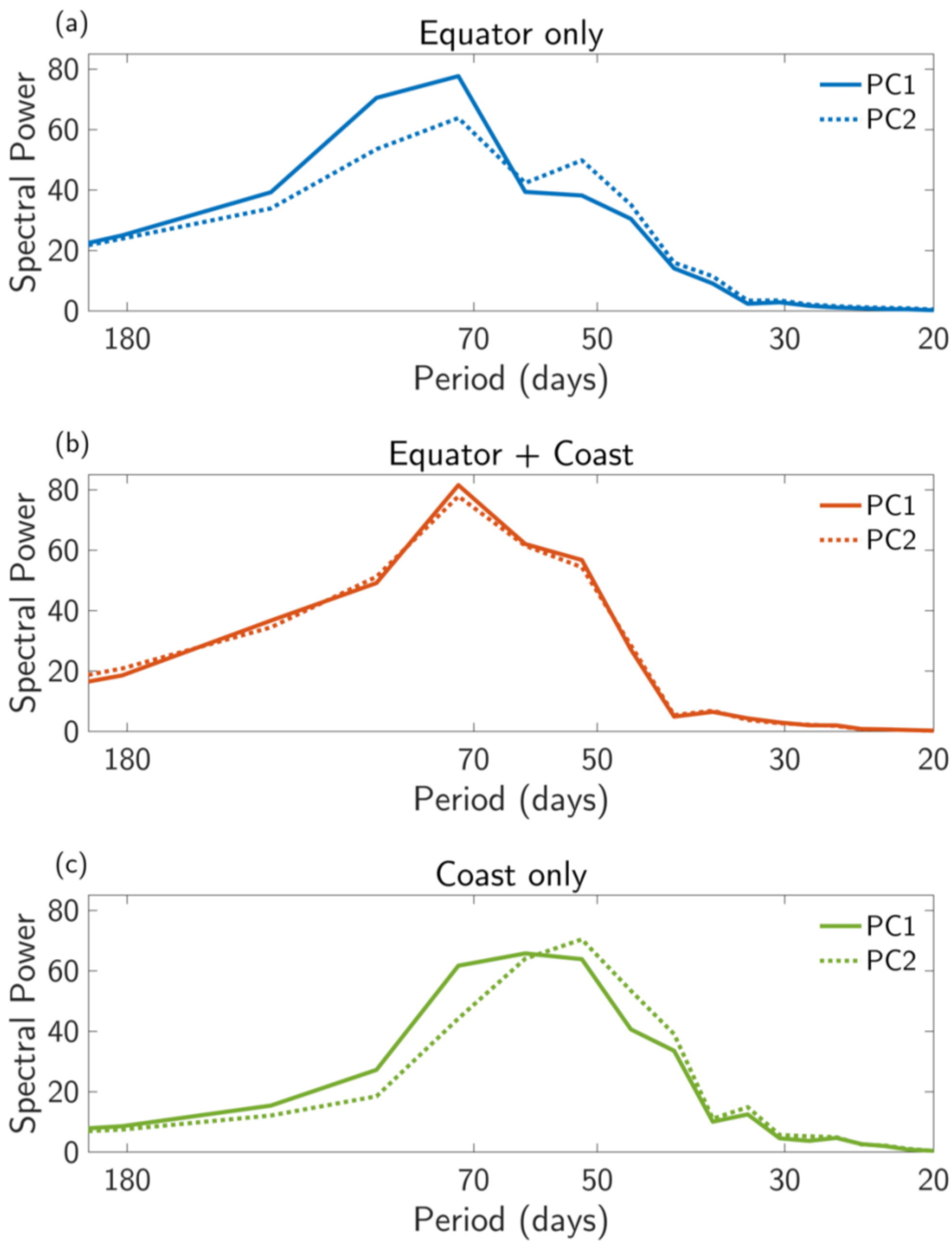

Figure S1 Power spectra of each PC1 and PC2 pairing from the (a) Equator only, (b) Equator + Coast, and (c) Coast only EOF analyses.

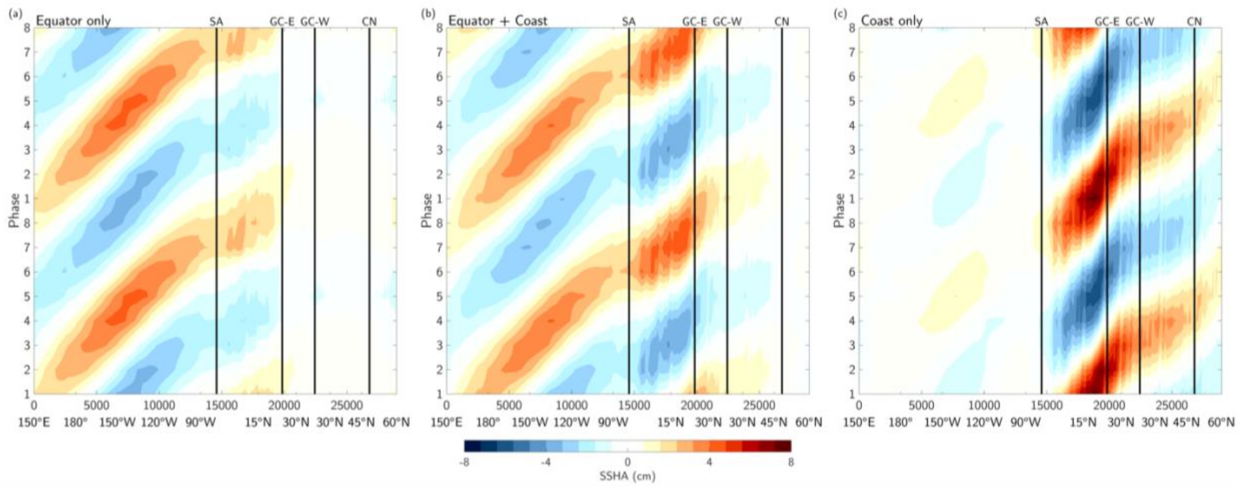

Figure S2 Wavenumber and time filtered SSH anomalies (cm) composited on the eight phases of the (a) E-KW index, (b) EC-KW index, and (c) C-KW index when the amplitude of each respective index was also greater than or equal to 1. Patterns were repeated along the y-axis for clarity. Upper x-axis marks the distance along the pathway in kilometers. Lower x-axis marks the approximate latitude/longitude coordinates at select locations along the path.

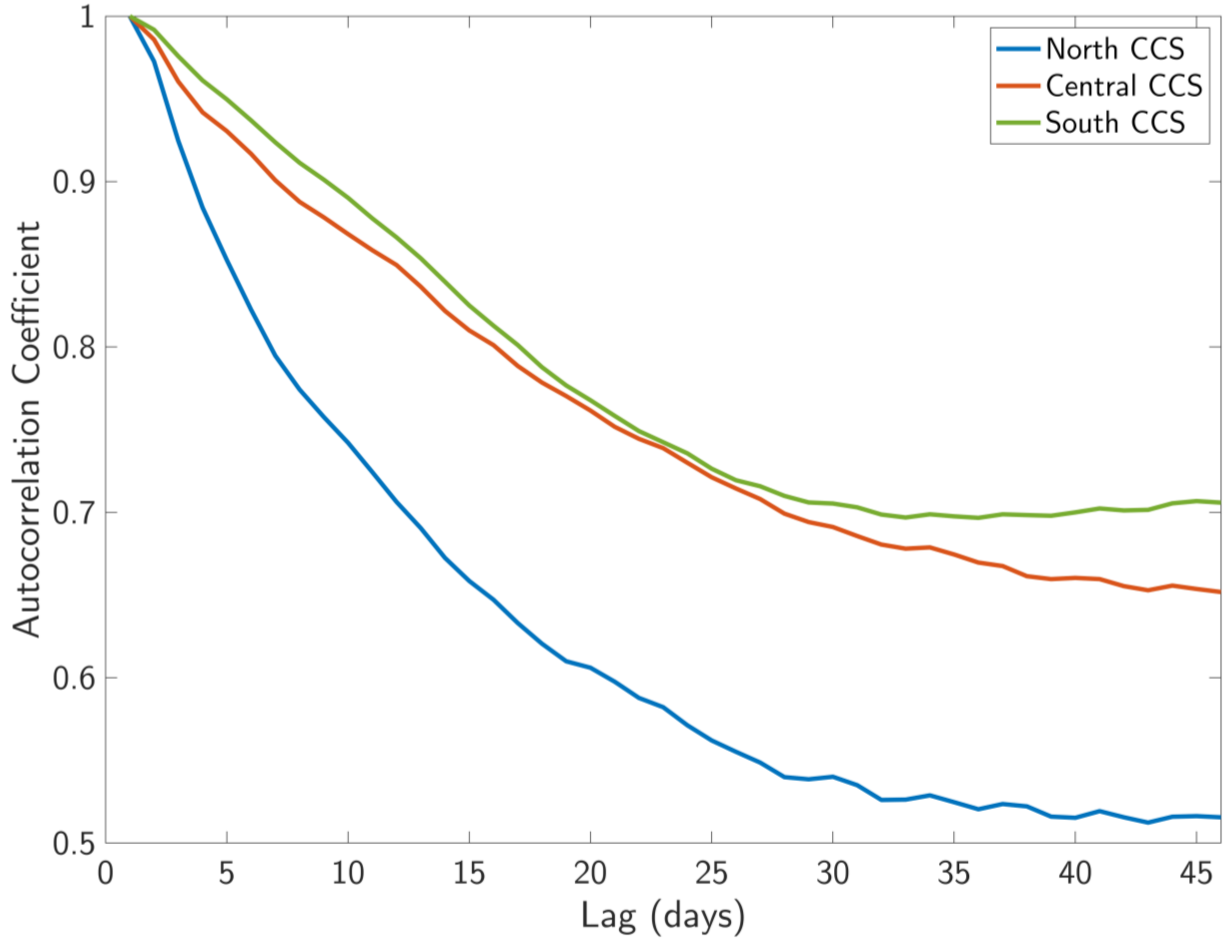

Figure S3 Autocorrelation functions of unfiltered GLORYS SSH anomalies averaged in the North CCS (blue), Central CCS (orange), and South CCS (green).

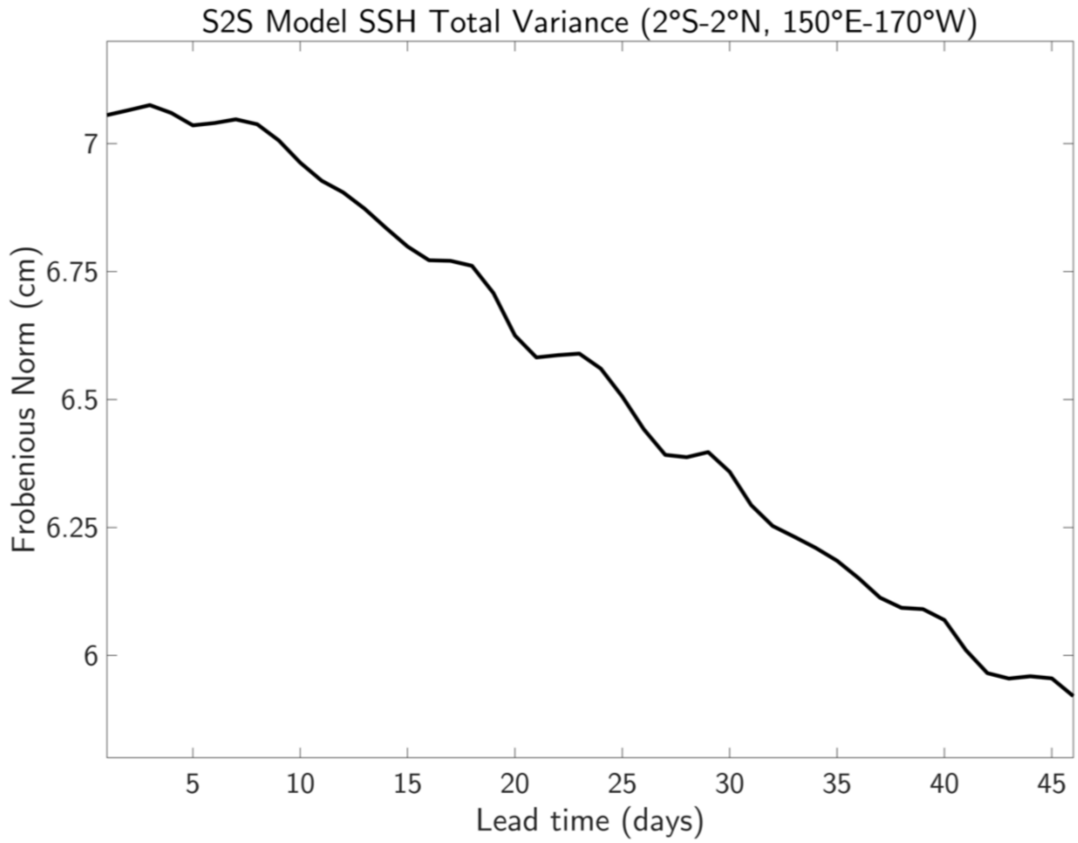

Figure S4 The Frobenious Norm (i.e., the total variance) of S2S SSH anomalies as a function of lead time in the domain (2˚S-2˚N, 150˚E-170˚W).