

SI for “Outsize Influence of Central American Orography on Global Climate”

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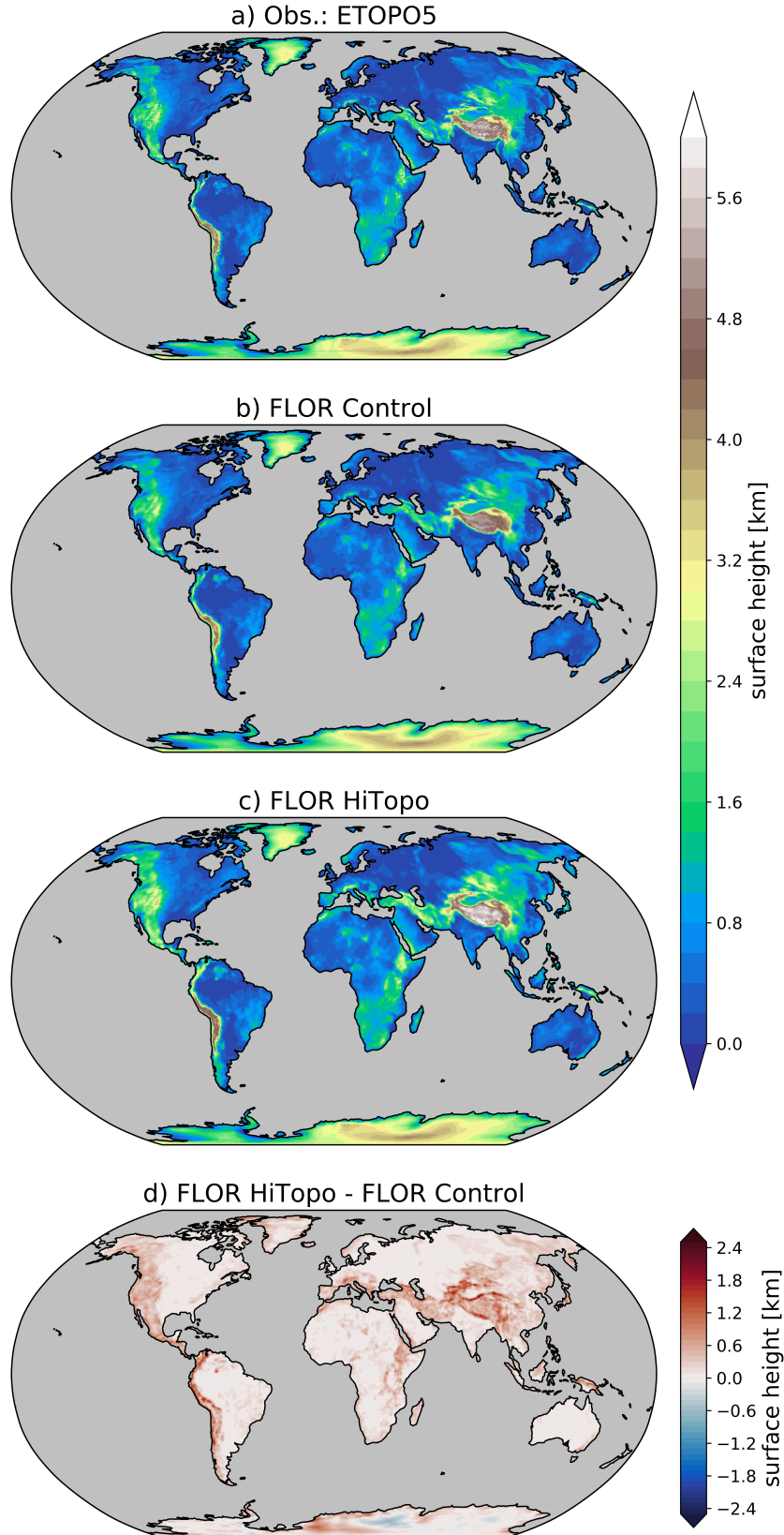


Figure S1. Surface height boundary conditions in observations compared to the **FLOR** simulations. From top to bottom, shown are the ETOPO5 5' resolution topography data (a), FLOR Control (b), FLOR HiTopo (c), and the difference between FLOR HiTopo and FLOR Control (d).

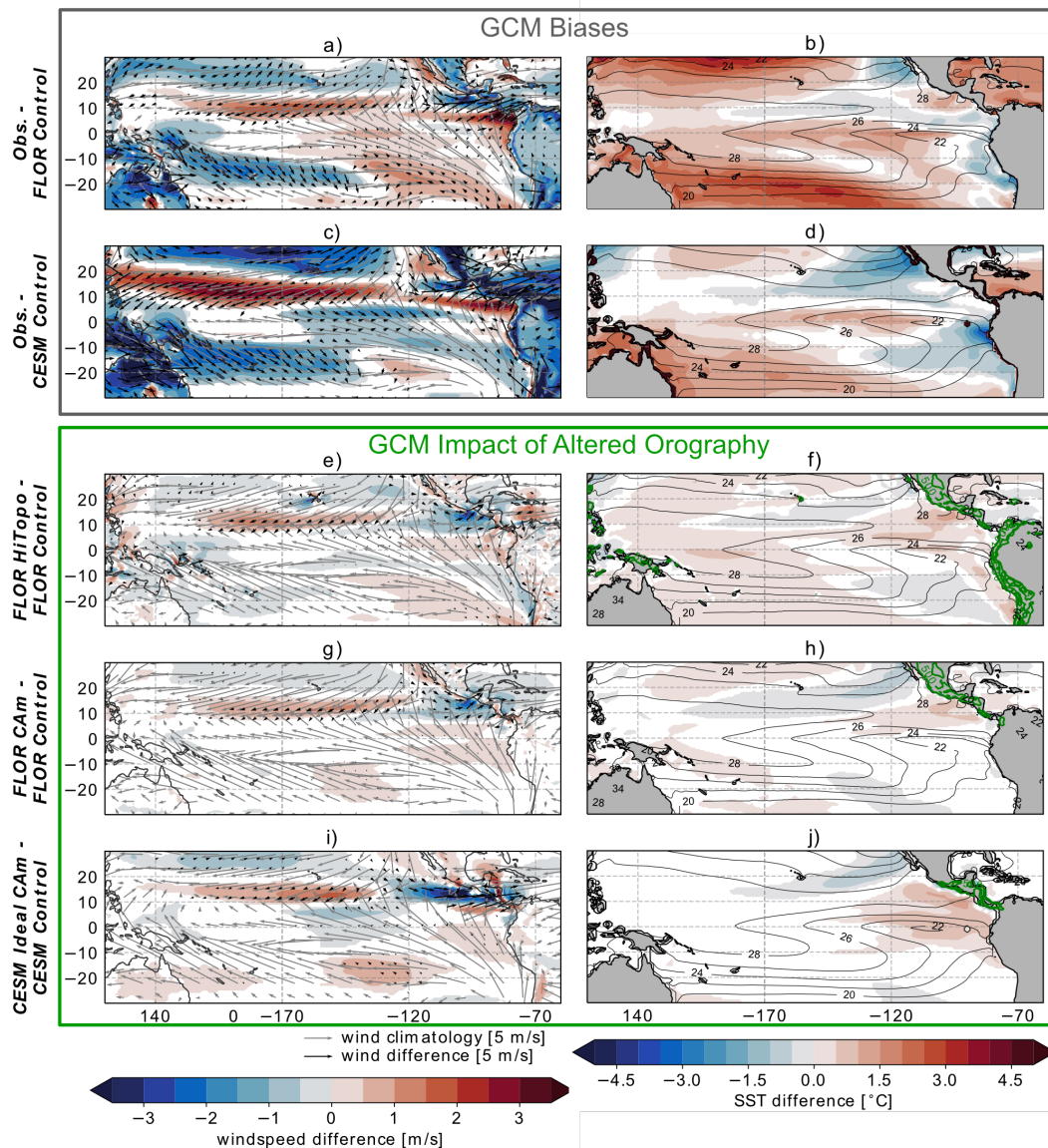


Figure S2. As in Fig. 2 but for September–November (SON): influence of orography on tropical Pacific winds and SSTs for SON. SON average wind vectors and speeds are shown in the left column (a,c,e,g,i), with windspeed differences shaded, wind differences in black vectors, and the relevant Control wind climatology in grey vectors. Wind data is taken from the lowest atmospheric level available in the 3-D data (~ 950 hPa) from the MERRA-2 reanalysis (Obs.), FLOR output, or CESM output. SON average SSTs are shown in the right column (b,d,f,h,j) with SST differences shaded, and Control/Obs. climatology in black contours. The observed SST data is HadISST. In the lower right-column panels (f,h,j) the difference in the surface height boundary conditions between the relevant perturbation simulations and Control simulations is contoured in green. In all panels, differences that are not significant at a 90% level based on a two-sided t -test are masked out (i.e. are white for the filled contours, and do not appear for the vectors).

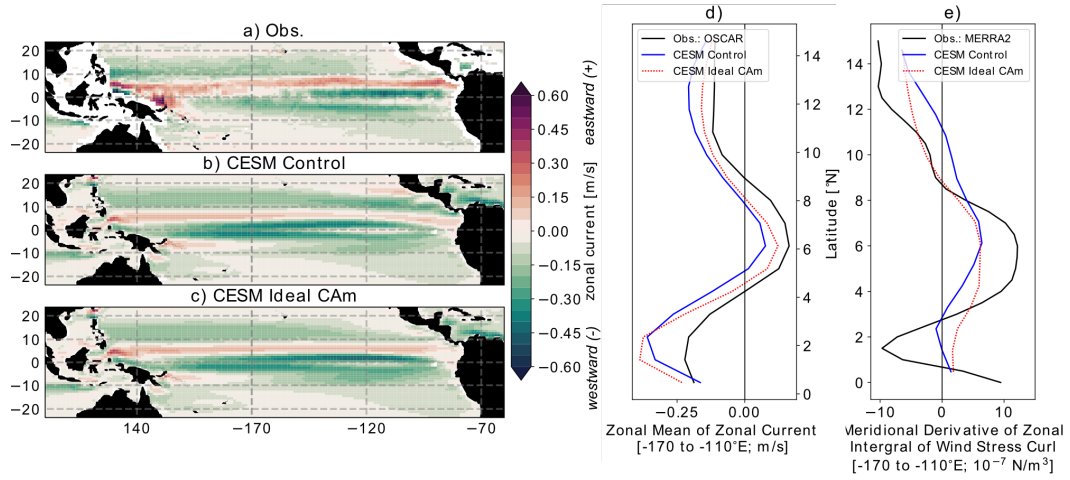


Figure S3. As in Fig. 3 but for CESM: zonal currents and related winds in CESM. Time mean zonal currents across the tropical Pacific are shaded for observations (OSCAR; a), CESM Control (b), and CESM Ideal CAM (c). Before plotting, the OSCAR data ($0.33^\circ \times 0.33^\circ$) is regridded to the FLOR ocean grid. To highlight and understand changes in the north equatorial counter current (NECC), zonal means of these zonal currents are plotted for the northern tropics (d), and compared to the meridional derivatives of the zonal integrals of wind stress curl (e); in (d) and (e) observations are plotted in black, CESM Control is blue, and CESM Ideal CAM is dashed red.

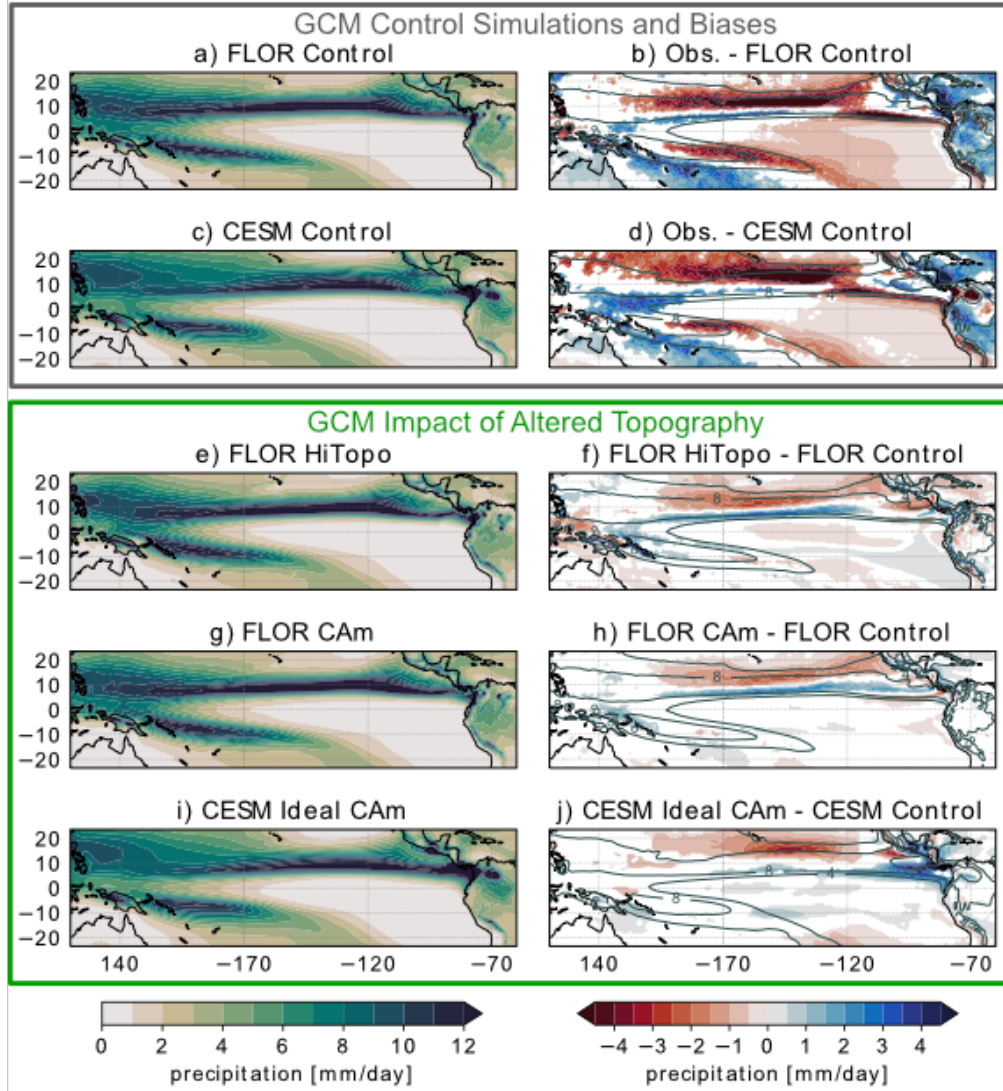


Figure S4. As in Fig. 4 but for SON: influence of high topography on precipitation in the tropical Pacific for SON. The left column shows SON seasonal mean precipitation over the tropical Pacific for each of the model runs– FLOR Control (a), CESM Control (c), FLOR HiTopo (e), FLOR CAM (g), and CESM Ideal CAM (i). The right column shows differences between SON seasonal mean precipitation for observations vs. Control simulations– Obs. vs. FLOR Control (b), Obs. vs. CESM Control (d)– and altered topography vs. Control simulations– FLOR HiTopo vs. FLOR Control (f), FLOR CAM vs. FLOR Control (h), CESM Ideal CAM vs. CESM Control (j). In these right column difference panels (b,d,f,h,j), the corresponding FLOR or CESM Control simulation SON precipitation climatology is contoured in dark gray-green, with contour labels in mm/day. In the right panels, differences that are not significant at a 90% level based on a two-sided t -test are masked white.

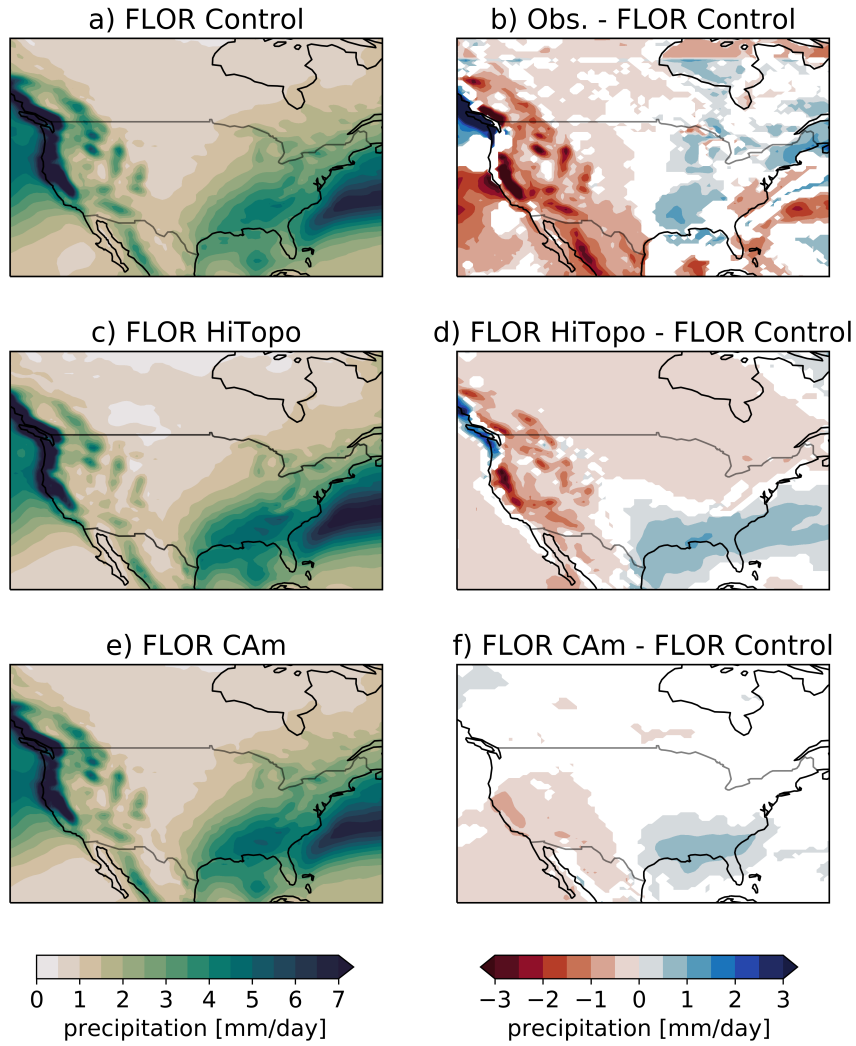


Figure S5. Influence of high orography on precipitation across North America for December-February (DJF). The left column shows DJF seasonal mean precipitation over North America for each of the FLOR model runs– FLOR Control (a), FLOR HiTopo (c), and FLOR CAM (e). The right column shows the difference in DJF seasonal mean precipitation for observations vs. FLOR Control (b), FLOR HiTopo vs. FLOR Control (d), and FLOR CAM vs. FLOR Control (f). In the right panels, differences that are not significant at a 90% level based on a two-sided *t*-test are masked white.

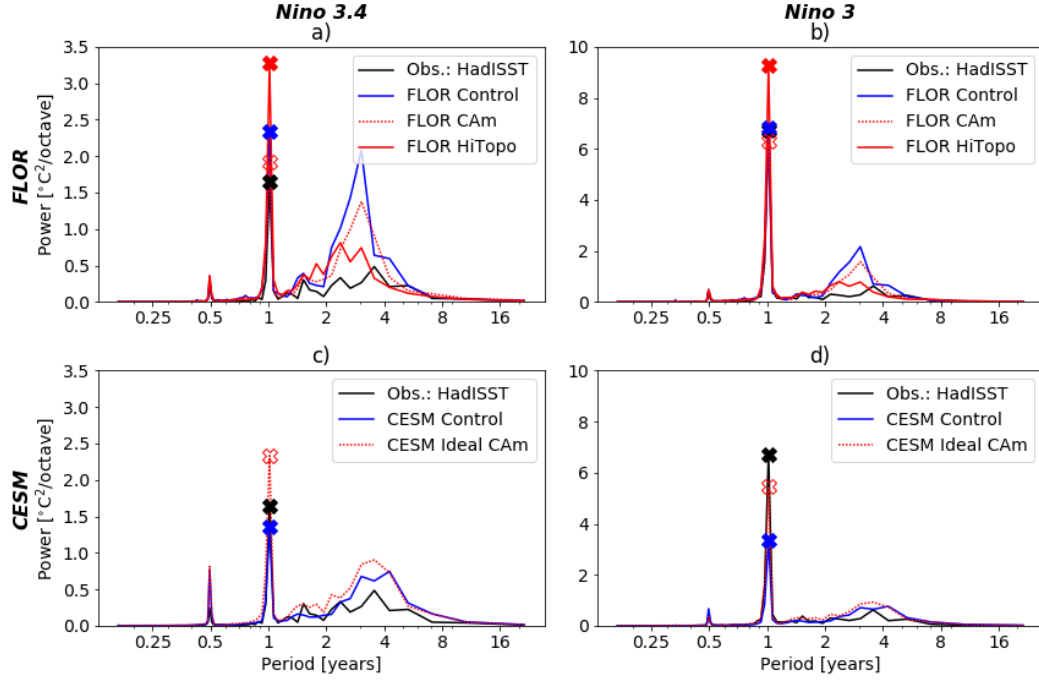


Figure S6. ENSO power spectra for GCM simulations and observations. Power spectra of the Niño 3.4 (left column), and Niño 3 (right column) SST anomalies. In all panels HadISST observations are shown in black; in the top panels, FLOR Control is blue, FLOR CAM is dashed red, and FLOR HiTopo is solid red; in the bottom panels, CESM Control is blue and CESM Ideal CAM is dashed red. The power at annual frequencies is highlighted with "X" symbols, with colors corresponding to the lines.