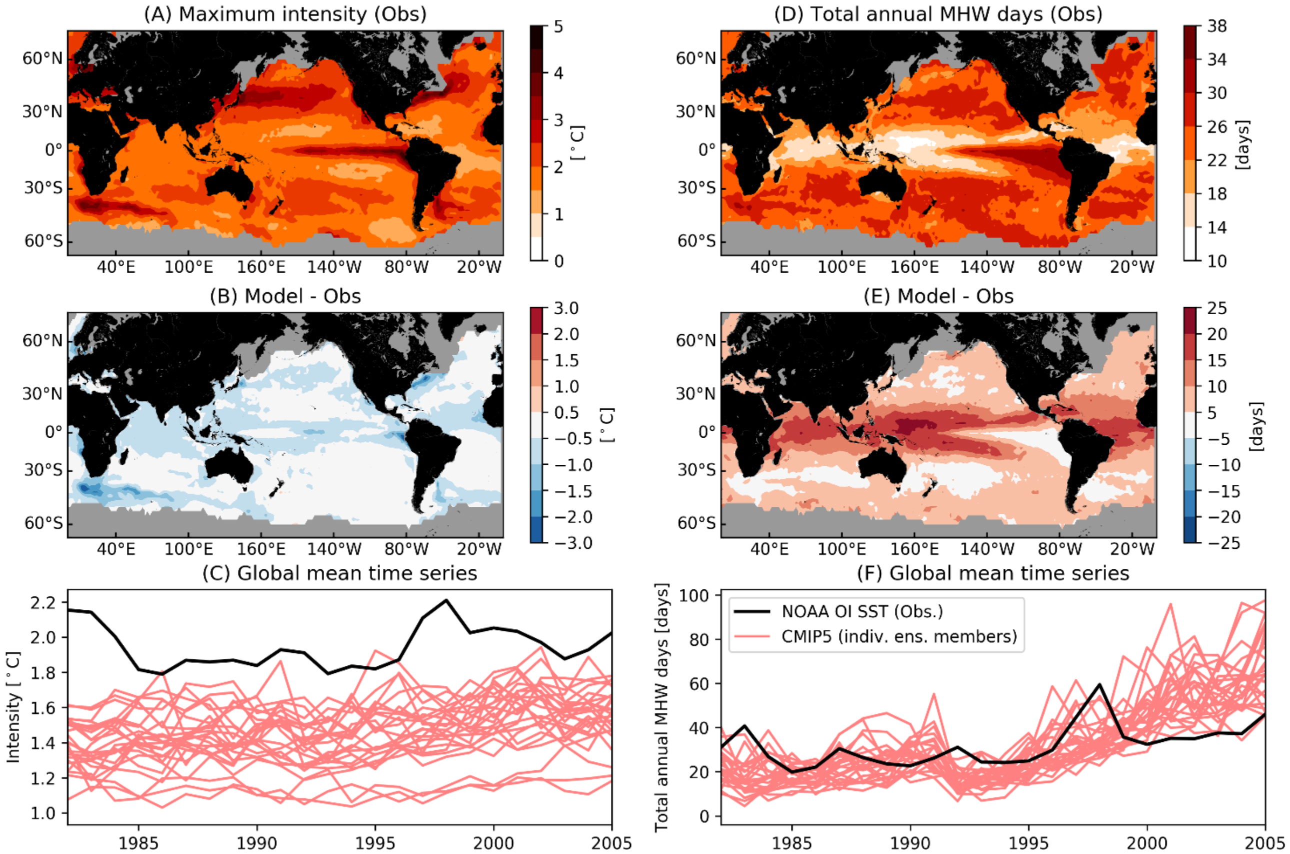
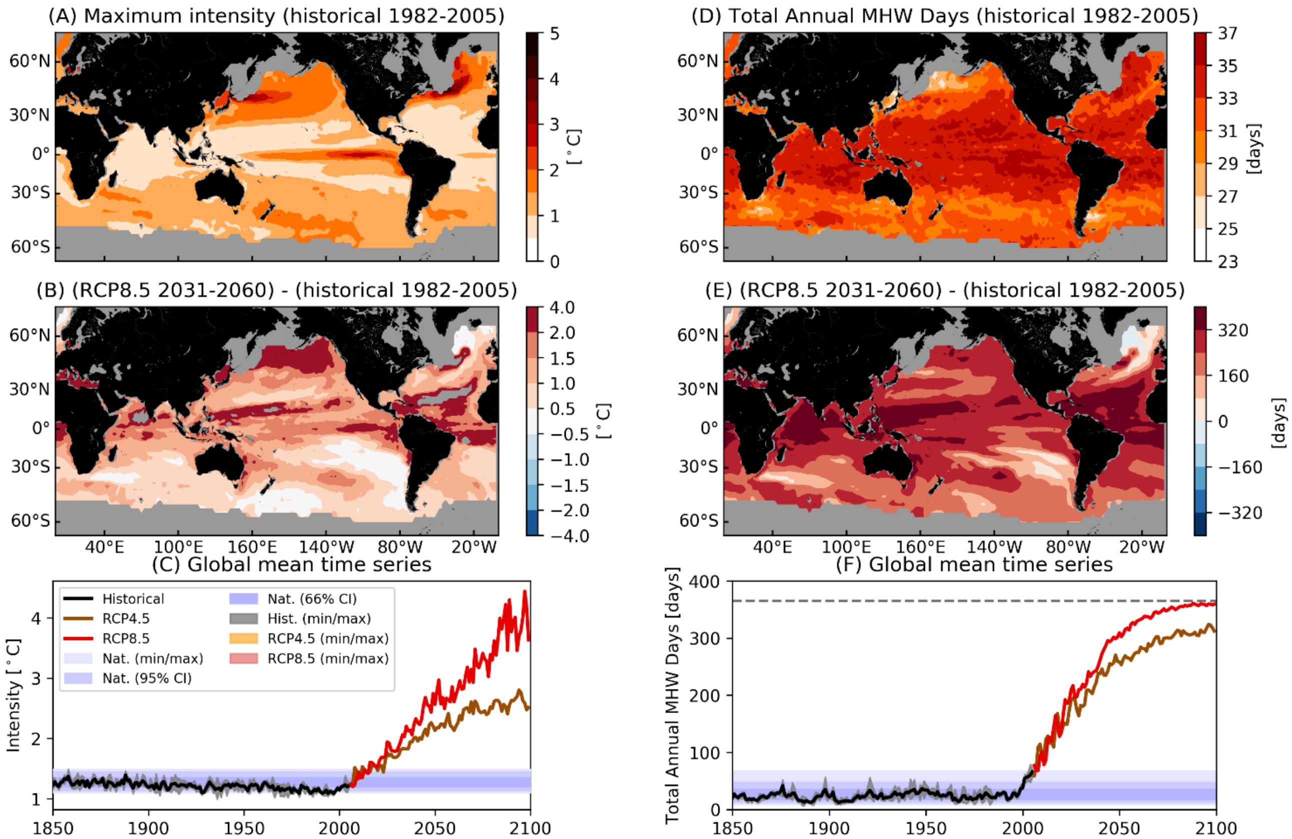
Supplementary Material

1 Supplementary Figures and Tables

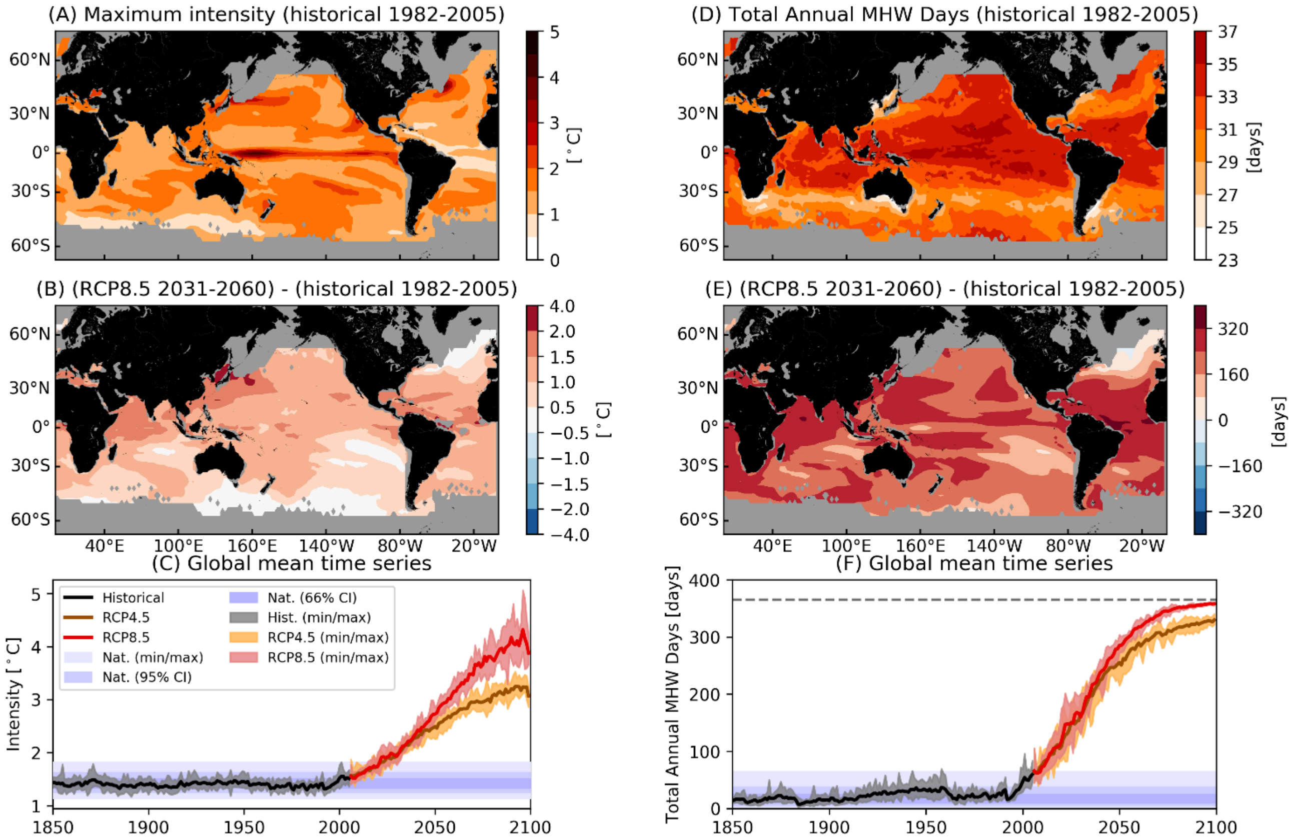
1.1 Supplementary Figures



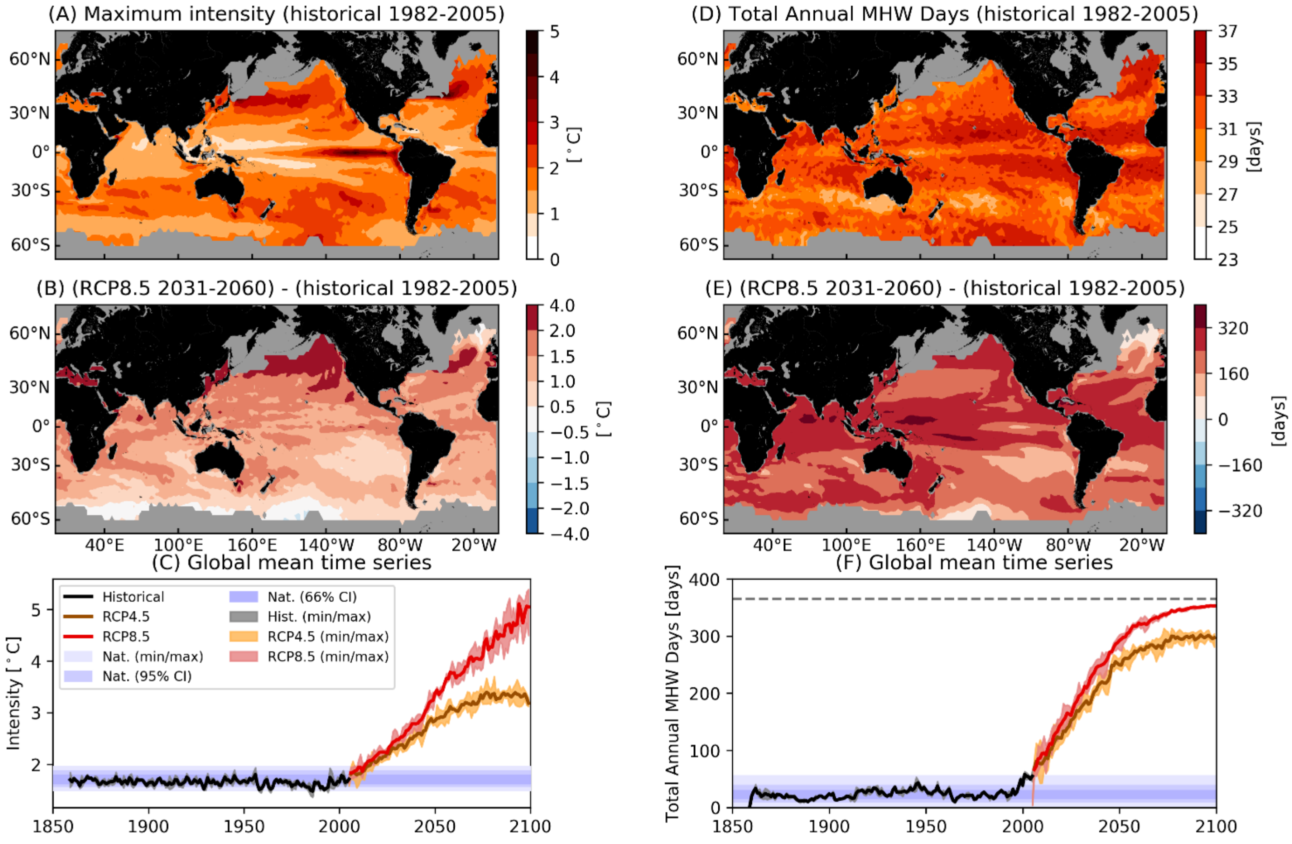
Supplementary Figure 1. Evaluation of CMIP5 historical simulations against observations. Results for intensity are shown on the left (A, B, C) and for total MHW days on the right (D, E, F). (A,D) Mean MHW properties from the observations (NOAA OI SST V2) for the period 1982-2005. (B,E) Difference between the mean MHW properties from the multi-model mean and the observations (calculated over 1982-2005). (C,F) Annual time series of MHW properties for observations (black) and individual model ensemble members, for their historical runs (red), for the period 1982-2005.



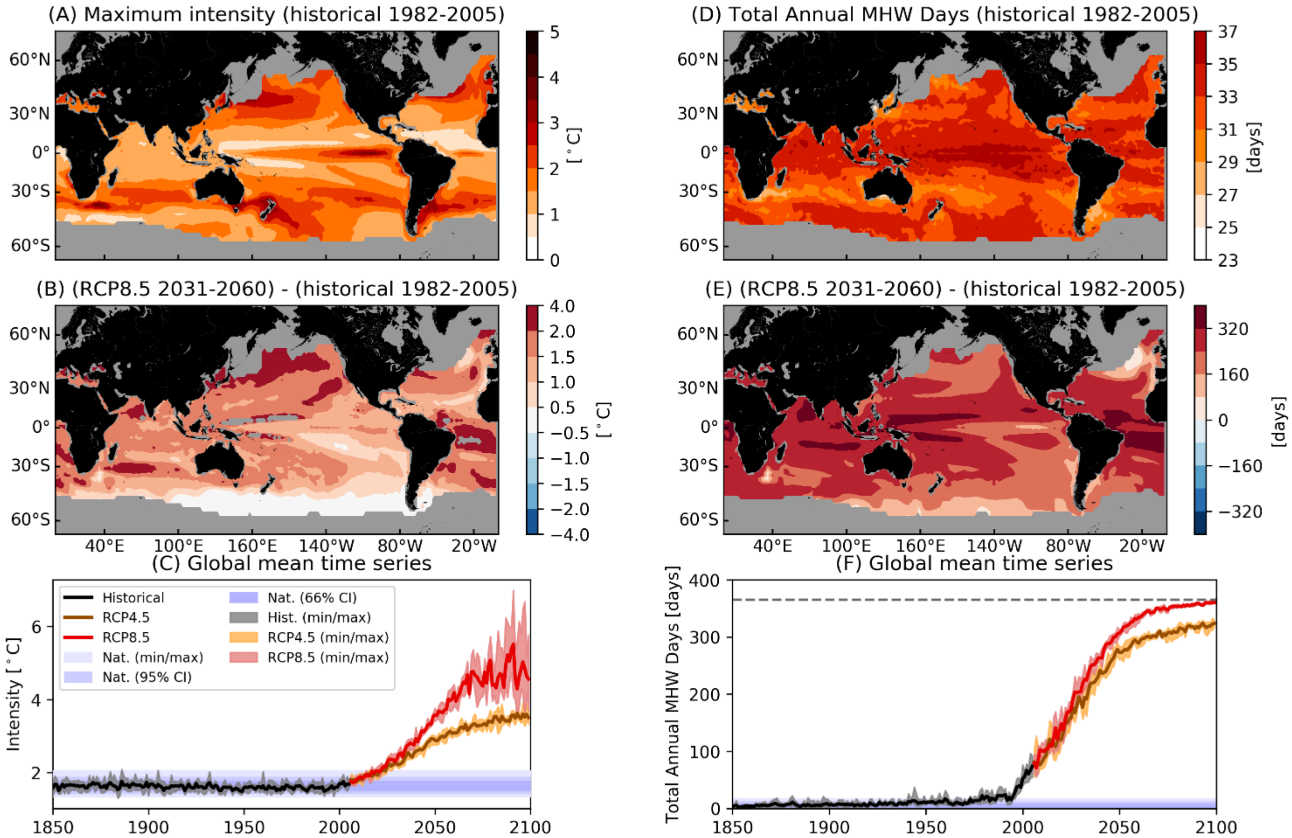
Supplementary Figure 2. Projected changes to marine heatwaves, based on ACCESS 1.3. (A,D) Mean MHW properties from the historical period 1961-1990. (B,E) Change between RCP8.5 (averaged over 2031-2060) and historical (averaged over 1961-1990). (C,D) Annual time series for historical (black), RCP4.5 (brown) and RCP8.5 (red) simulations. When there is more than one ensemble member, the grey, red and brown shaded regions show the maximum range between individual ensemble members. The blue shaded areas show the expected range of natural variability based on a 66% confidence interval (darkest blue), 95% confidence interval (medium blue), and full min-to-max range (lightest blue) of the historicalNat runs (1850-2005). Results presented for intensity (A, B, C) and for total MHW days (D, E, F).



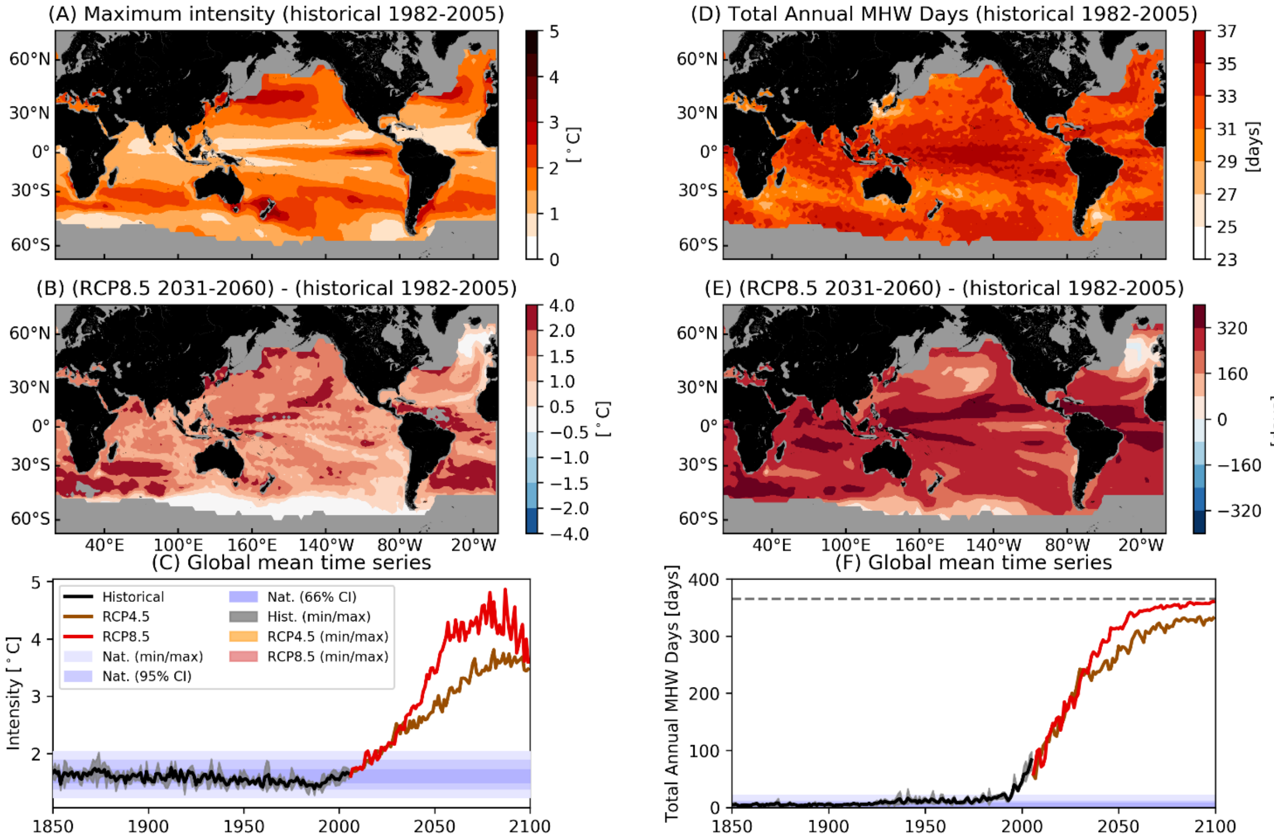
Supplementary Figure 3. As in Supp. Fig. 2 but for CSIRO Mk3.6.0.



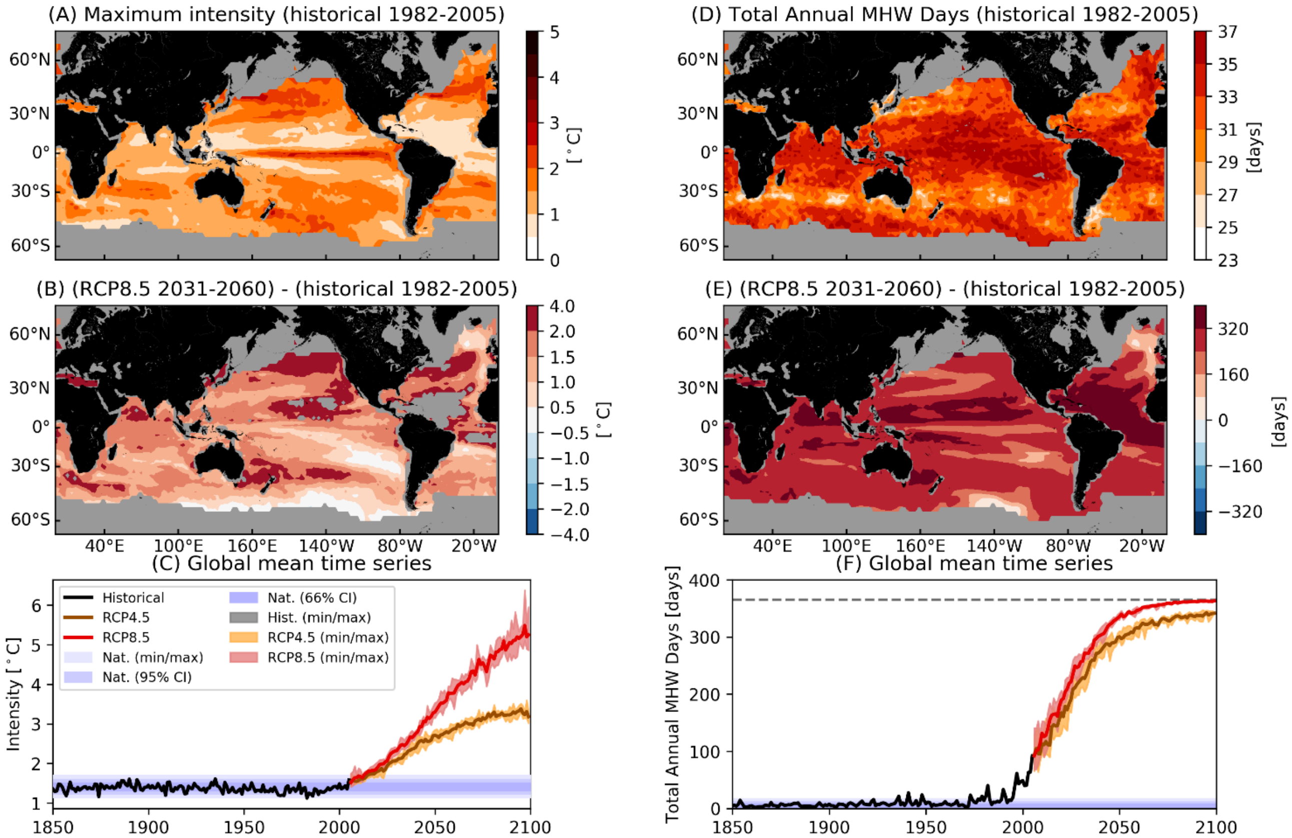
Supplementary Figure 4. As in Supp. Fig. 2 but for HadGEM2-ES.



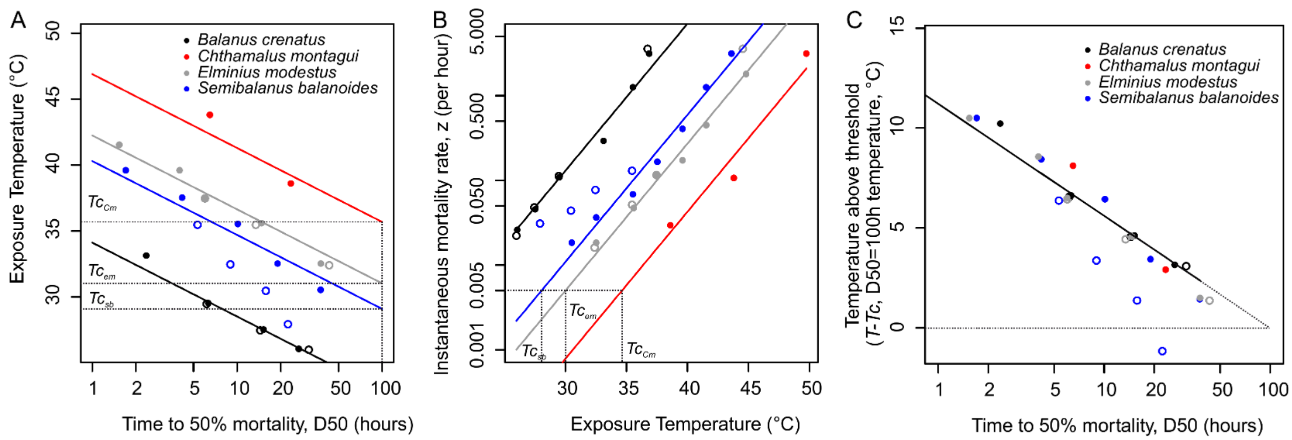
Supplementary Figure 5. As in Supp. Fig. 2 but for IPSL-CM5A-LR.



Supplementary Figure 6. As in Supp. Fig. 2 but for IPSL-CM5A-MR.



Supplementary Figure 7. As in Supp. Fig. 2 but for CanESM2.



Supplementary Figure 8. (A) Survival times of intertidal barnacles exposed to extreme water temperatures (*T*), expressed as time to 50% mortality (*D50*). Closed symbols show summer-acclimated and open symbols show winter-acclimated populations. Greater tolerance for high temperatures can be seen in summer-acclimated *Semibalanus balanoides*. (B) Barnacles were shown to have an exponential mortality (Foster 1969), and so equivalent instantaneous mortality rate, *z*, was derived as log(0.5)/*D50* and shown here plotted against the absolute temperature of exposure. (C) Temperatures anomalies for each species were identified relative to a threshold (i.e. a zero anomaly; defined as the temperature giving 50% mortality after 100 hours of exposure) shown here plotted against time to 50% mortality (*D50*). It is the data as presented in (C), along with theoretical lines for instantaneous mortality rates of *z* = 0.5, 0.8 and 0.9, which are plotted in the MHW intensity-duration phase space of Figure 5B of the main text. Lines in A and B show regressions fitted to summer-acclimated barnacles. A: T = 34.12 (±0.33) -2.43 (±0.10) log(D50) + (*C. montagui* 12.77 (±0.54); *Elminius modestus* 8.12 (±0.44); *Semibalanus balanoides* 6.18 (±0.43)), $R^2 = 0.98$. B: log(z) = -14.05 (±0.33) + 0.40 (±0.02) T°C + (*C. montagui* -5.11 (±0.54); *Elminius modestus* 3.26 (±0.21); *Semibalanus balanoides* -2.47 (±0.20)), $R^2 = 0.97$. Line in C shows regression fitted to all species together. Data were digitized from plots in Foster (1969).