



The Response of CAM6 to Bias-Corrected Historical Ocean Observations

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Early-twentieth-century cold bias in ocean surface temperature observations

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 Check for updates

Sebastian Sippel^{1,2✉}, Elizabeth C. Kent³, Nicolai Meinshausen⁴, Duo Chan⁵, Christopher Kadow⁶, Raphael Neukom^{7,8}, Erich M. Fischer², Vincent Humphrey⁹, Robert Rohde¹⁰, Iris de Vries² & Reto Knutti²

The observed temperature record, which combines sea surface temperatures with near-surface air temperatures over land, is crucial for understanding climate variability and change^{1–4}. However, early records of global mean surface temperature are uncertain owing to changes in measurement technology and practice, partial

Sippel et al. (2024)

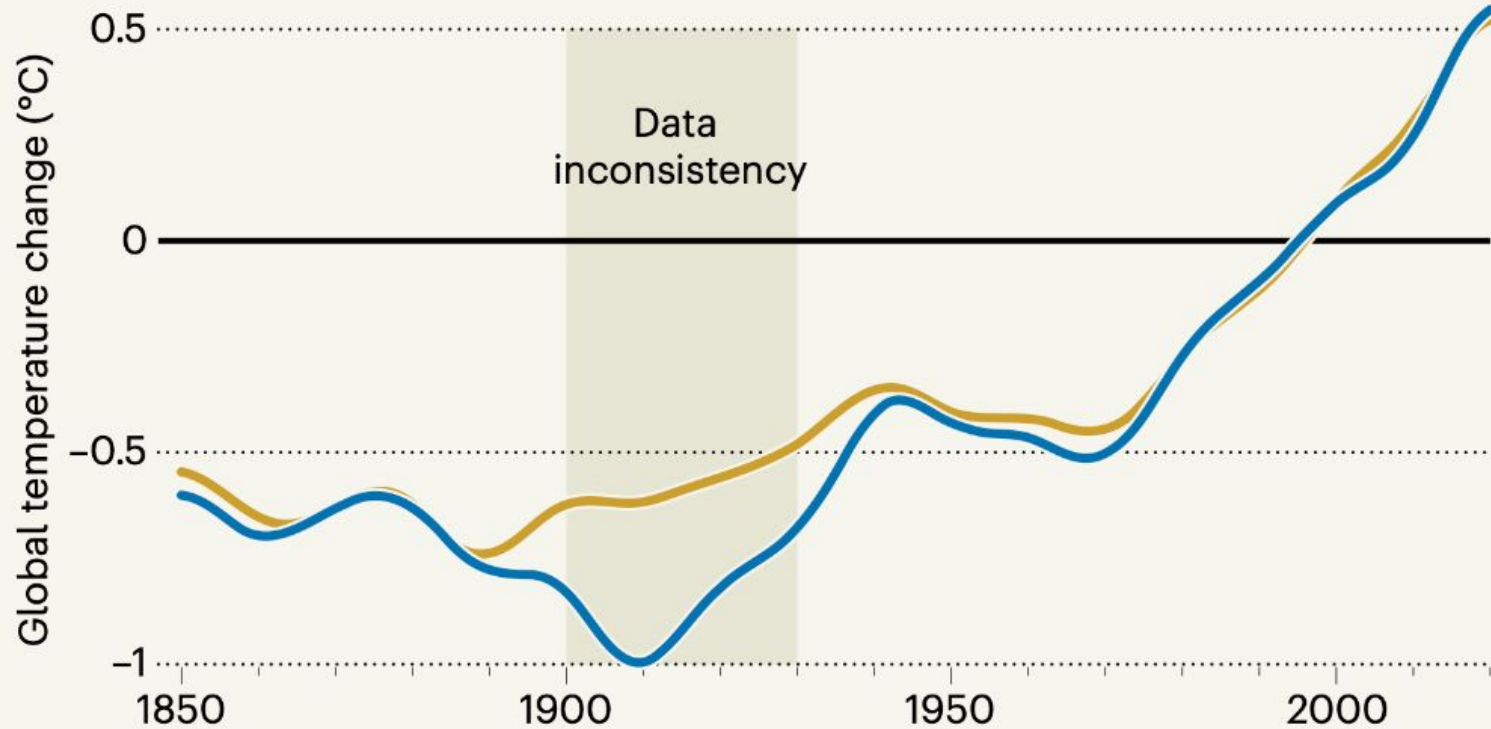


@ncar_cgd



a

- Inferred from land data
- Inferred from ocean data

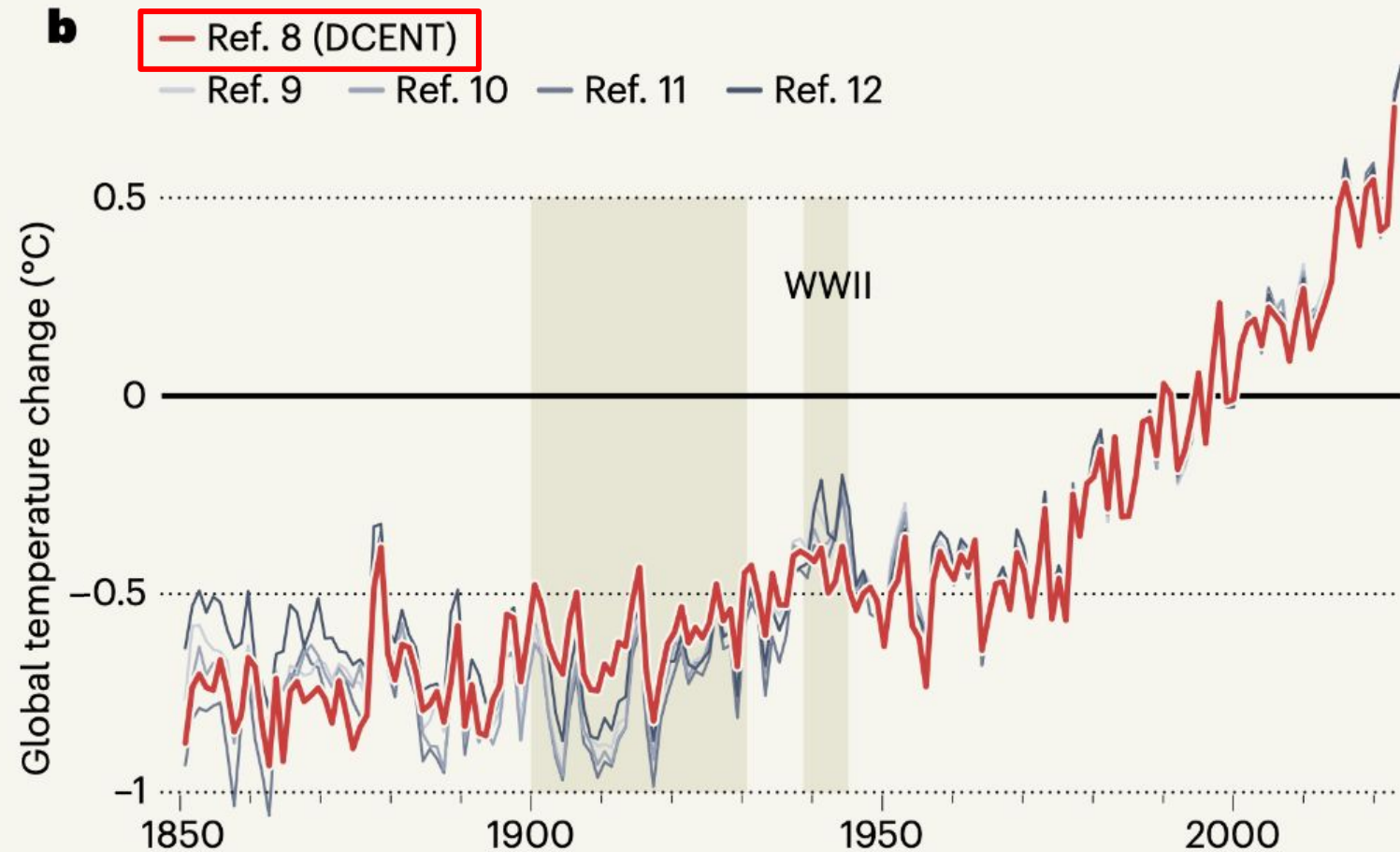


Sippel et al. (2024)



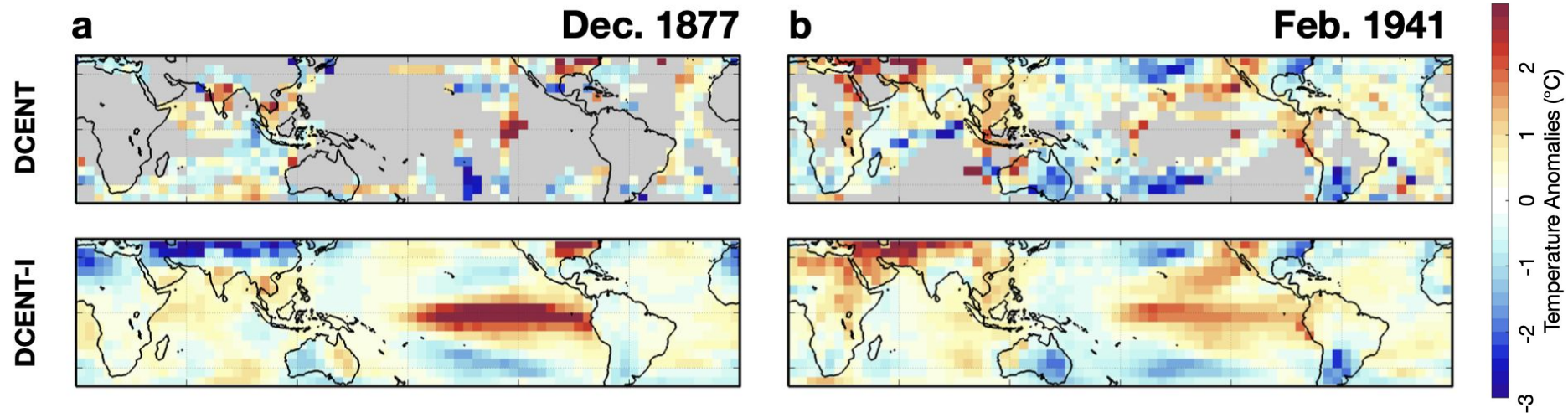
@ncar_cgd



b

Sippel et al. (2024)

Interpolated DCENT Now Available!



Chan et al. (*under review*)

Motivating Question

Does bias-correction of observed SST improve AMIP simulations of the early 20th century?

CESM2 Configuration

ERSST_AMIP (10 members)

SST: NOAA ERSSTv5 ($2^{\circ} \times 2^{\circ}$)

DCENT_AMIP (10 members)

SST: DCENT-I ($1^{\circ} \times 1^{\circ}$)

CESM2 Configuration

ERSST_AMIP (10 members)

SST: NOAA ERSSTv5 (2°x 2°)

DCENT_AMIP (10 members)

SST: DCENT-I (1°x 1°)

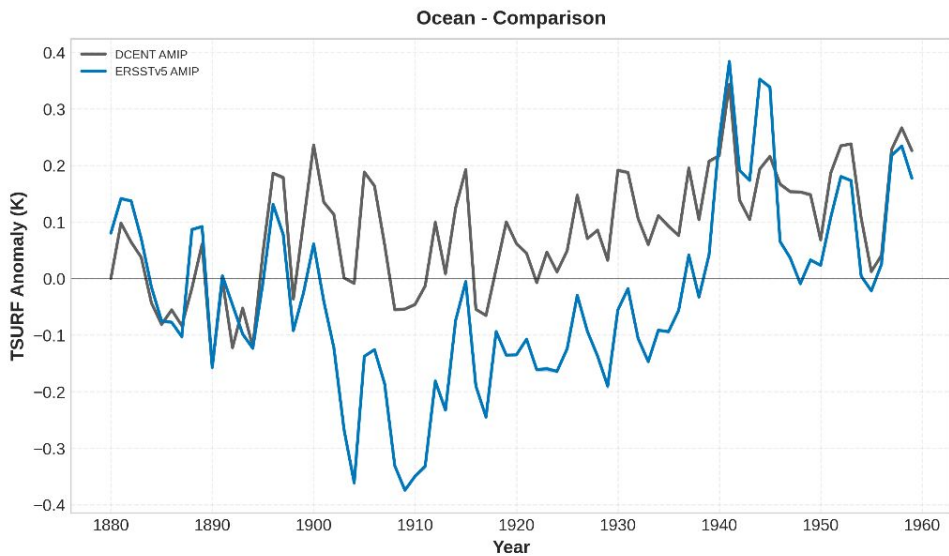
Model Version: CESM2.1.2 (Global AMIP)

Resolution: 0.9x1.25 (CESM nominal 1° grid)

Years: 1880-1959

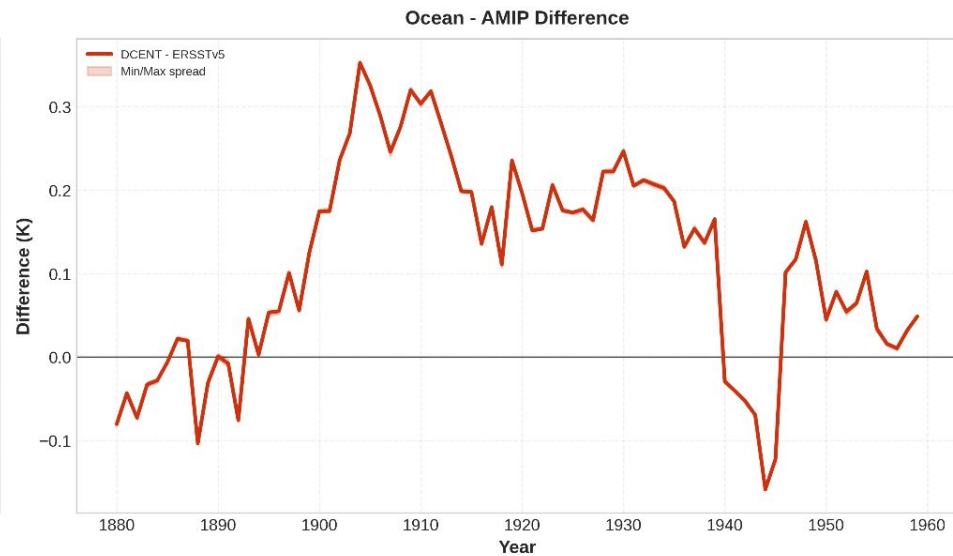
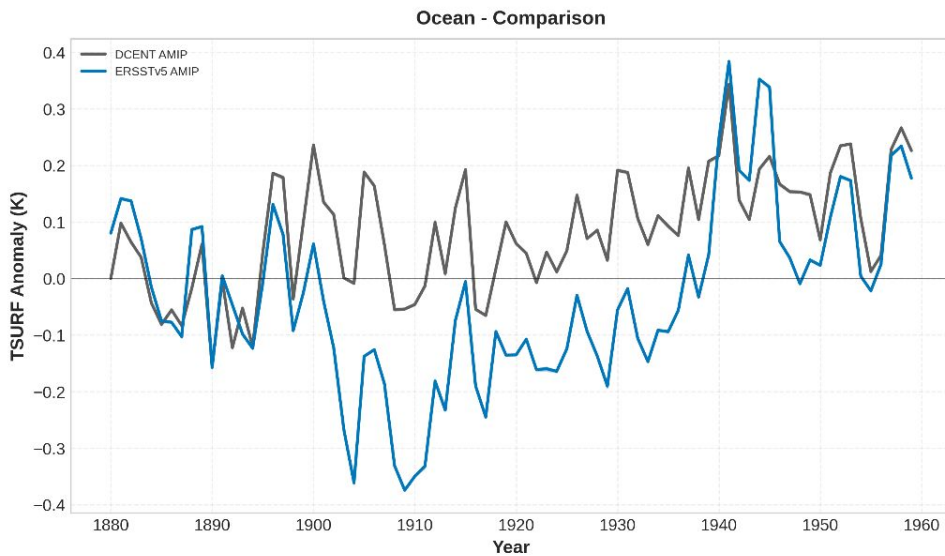
Compsets: FHIST_BGC (Global_AMIP)

How different are the global SST forcings?



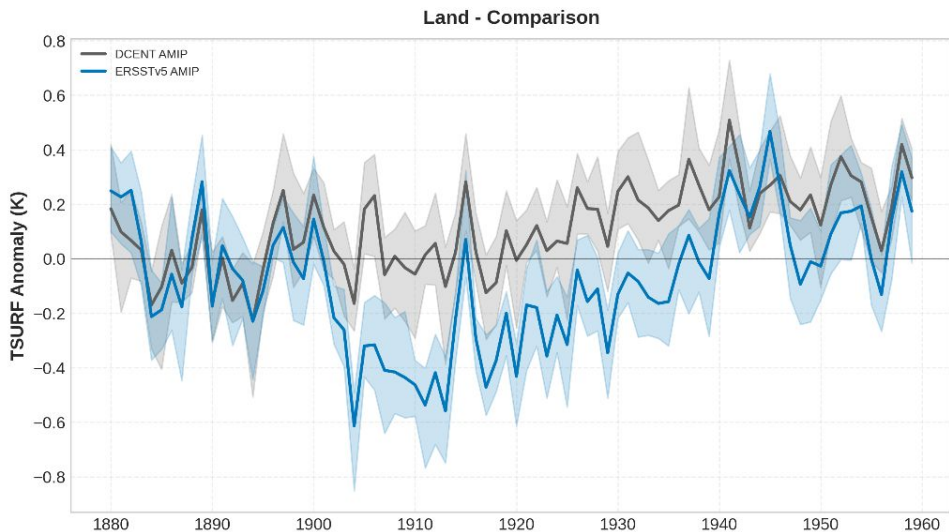
1880-1899 Climatology

How different are the global SST forcings?



1880-1899 Climatology

What are the resulting land-only annual means?



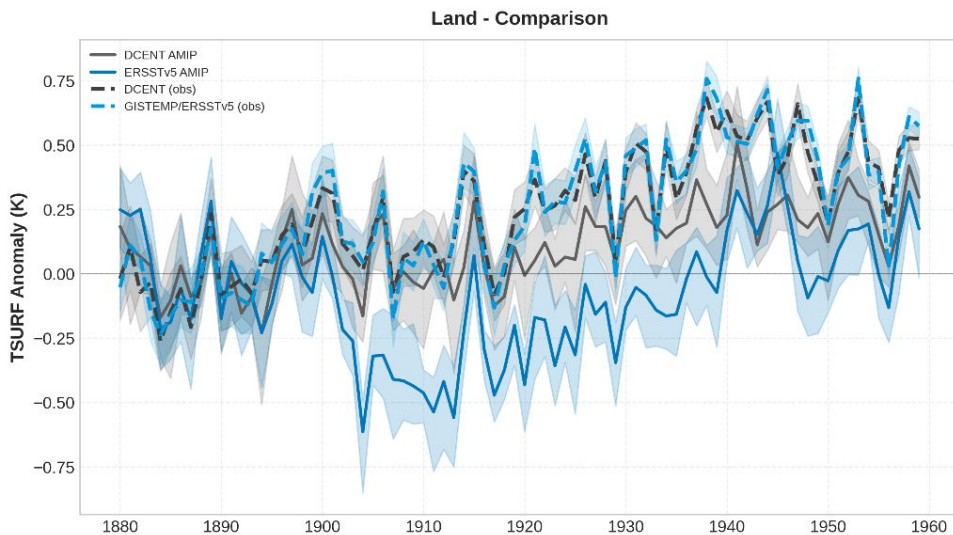
1880-1899 Climatology



@ncar_cgd

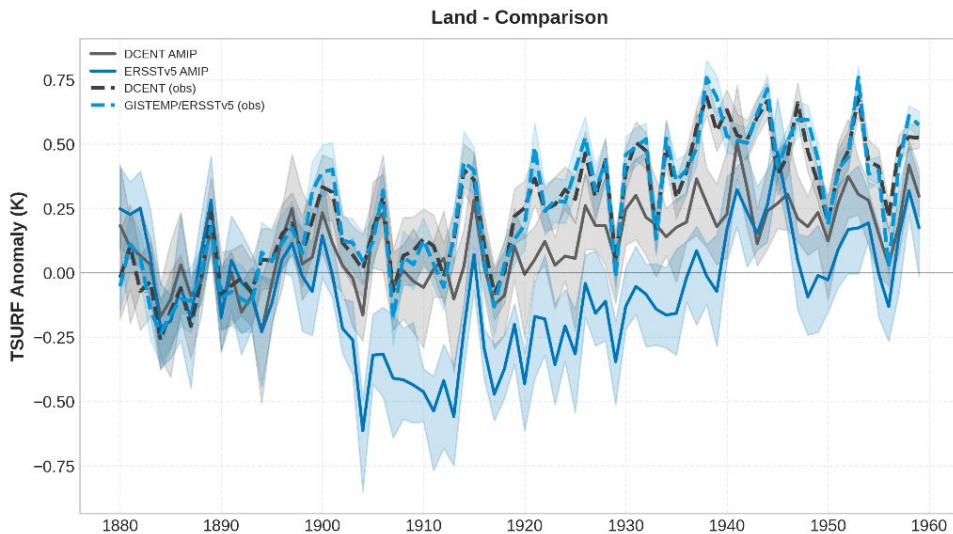


How do they compare with observations?



1880-1899 Climatology

How do they compare with observations?

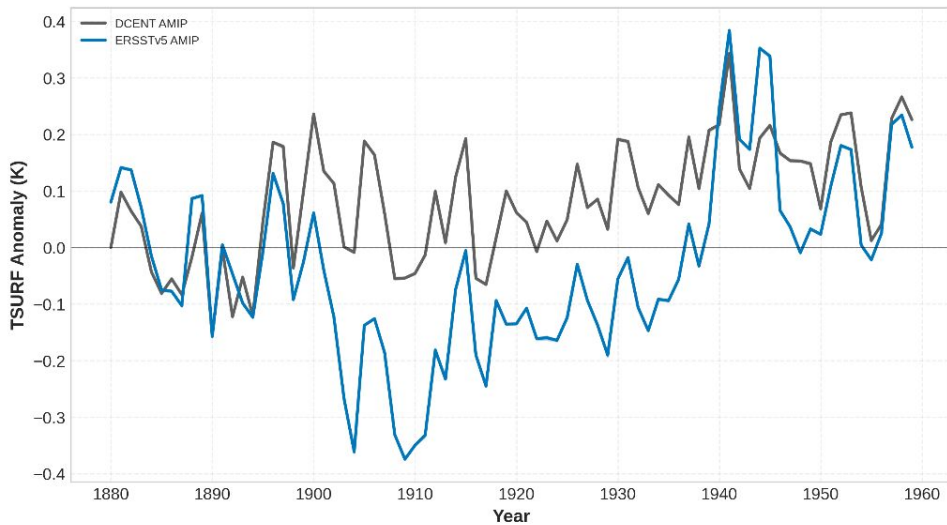


DCENT_AMIP better follows both the trend and variability of observed land temperature!

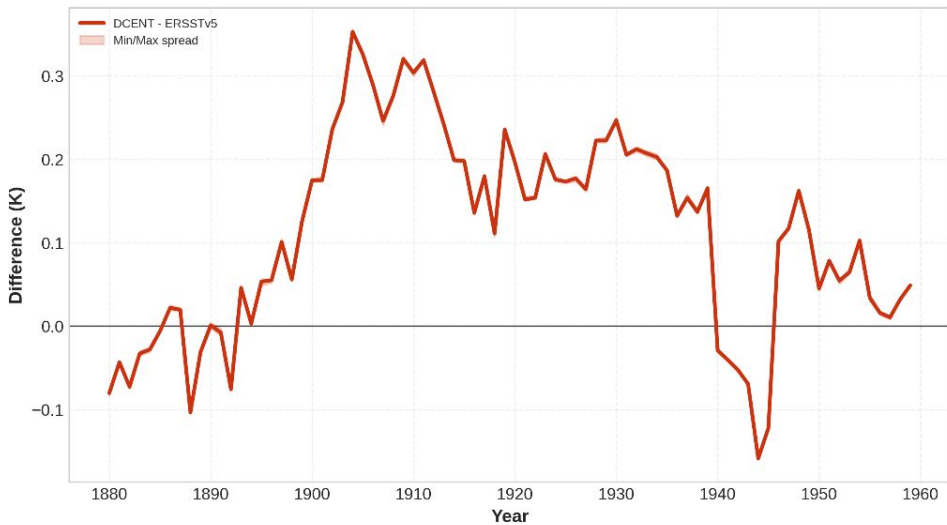
1880-1899 Climatology

How are global climatologies affected?

AMIP Ocean Global Annual Means

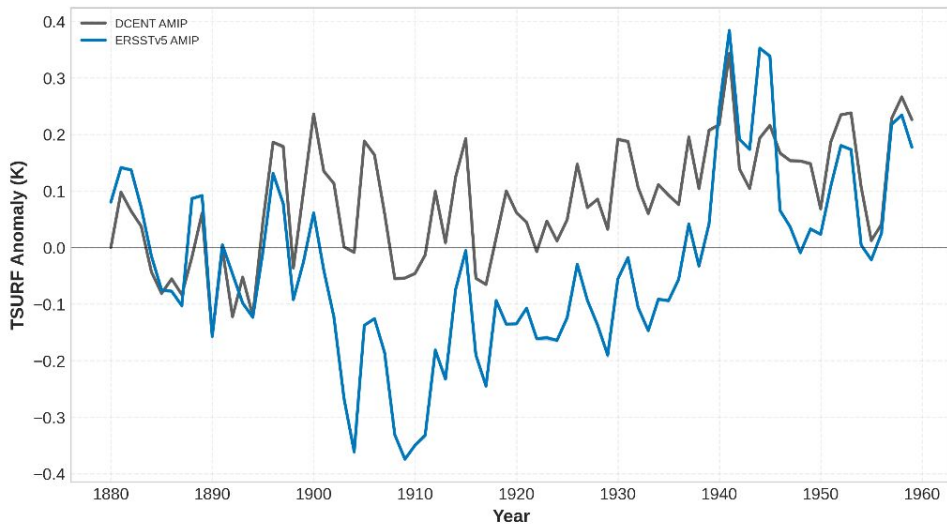


DCENT_AMIP - ERSST_AMIP

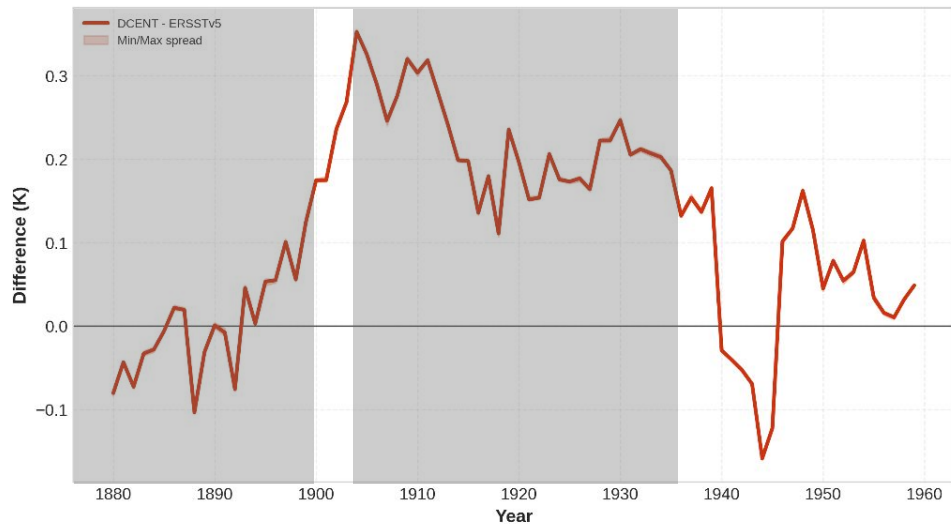


How are global climatologies affected?

AMIP Ocean Global Annual Means



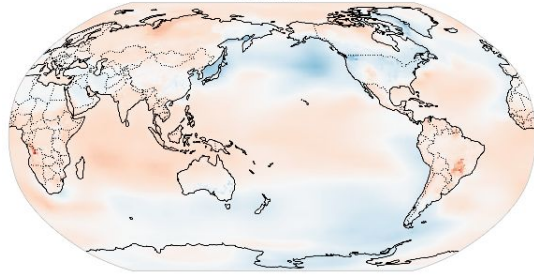
DCENT_AMIP - ERSST_AMIP



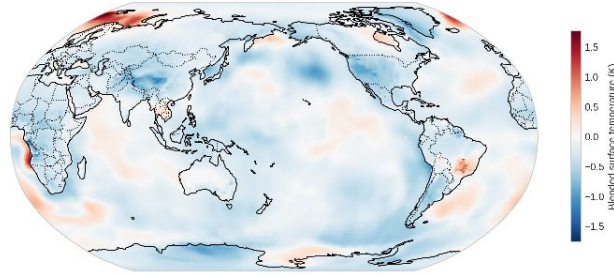
Calculate difference of these epochs!

(Early 20 Cen) - (Late 19 Cen)

DCENT Temp

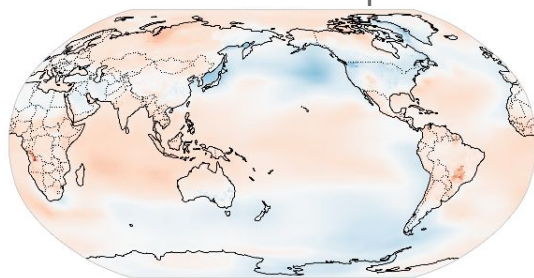


ERSST Temp

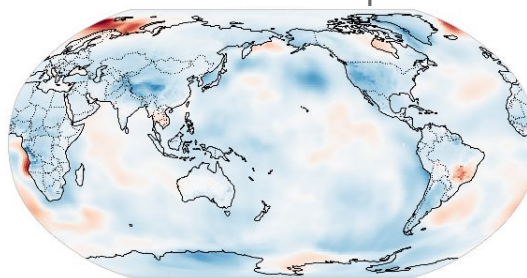


(Early 20 Cen) - (Late 19 Cen)

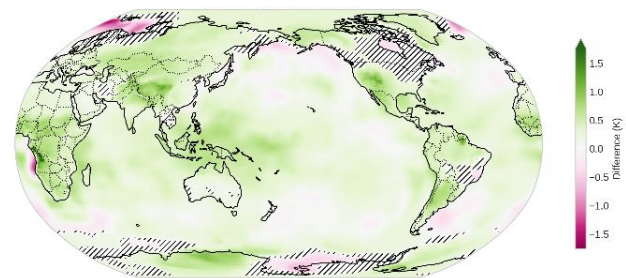
DCENT Temp



ERSST Temp

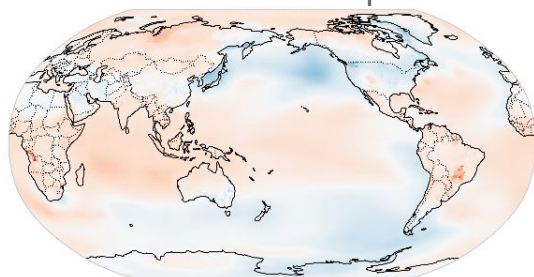


DCENT-ERSST

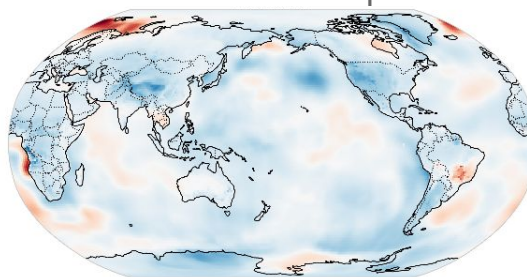


(Early 20 Cen) - (Late 19 Cen)

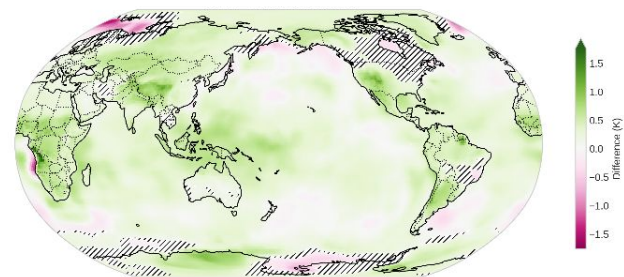
DCENT Temp



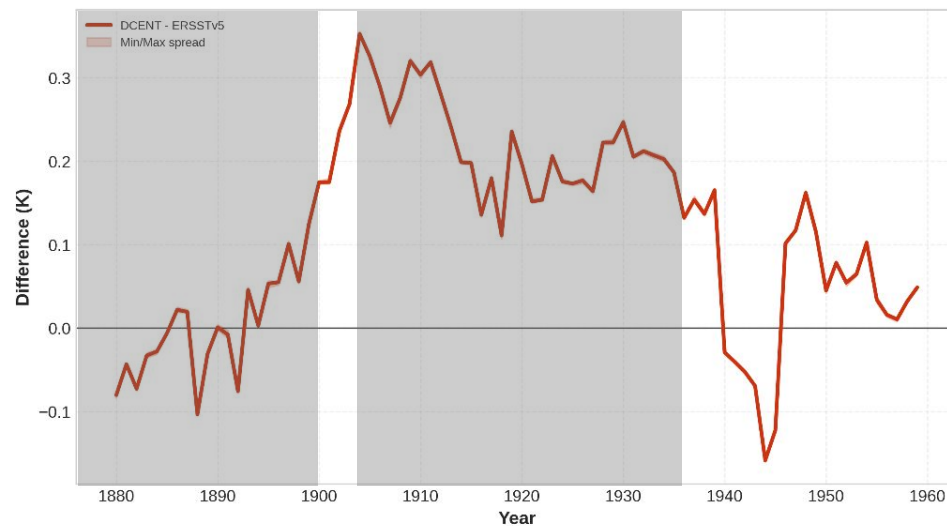
ERSST Temp



DCENT-ERSST

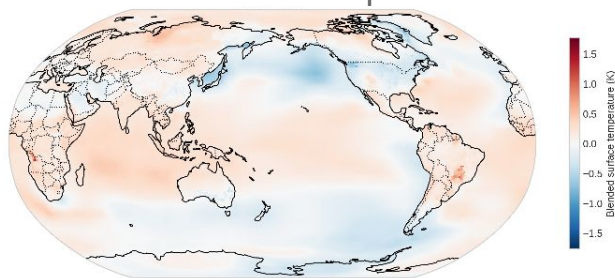


DCENT_AMIP - ERSST_AMIP

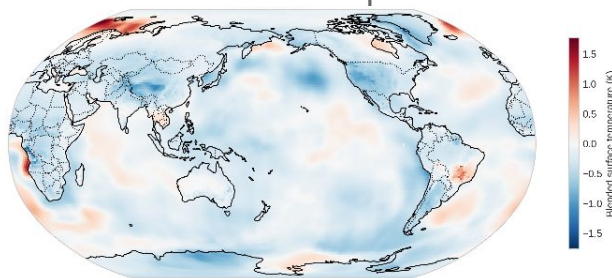


(Early 20 Cen) - (Late 19 Cen)

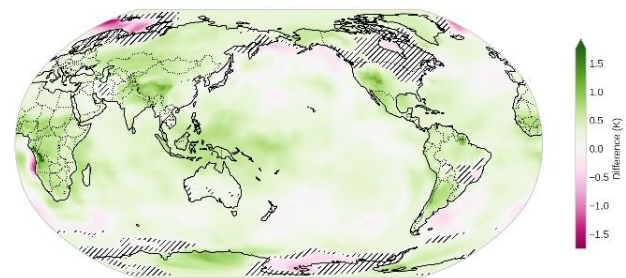
DCENT Temp



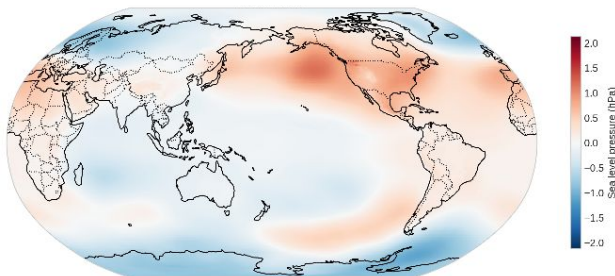
ERSST Temp



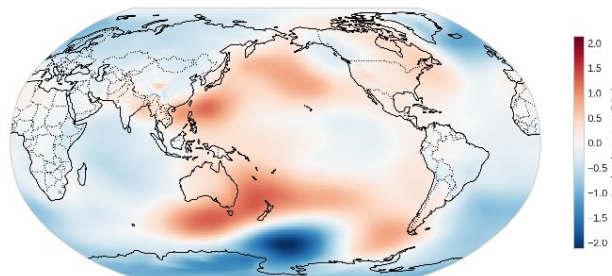
DCENT-ERSST



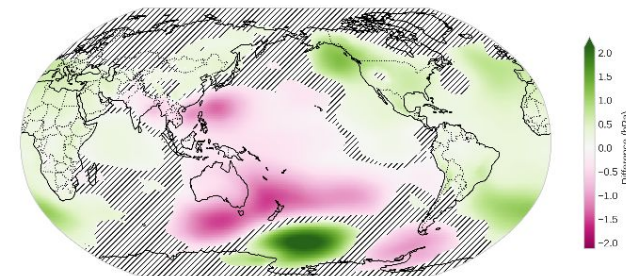
DCENT PSL



ERSST PSL

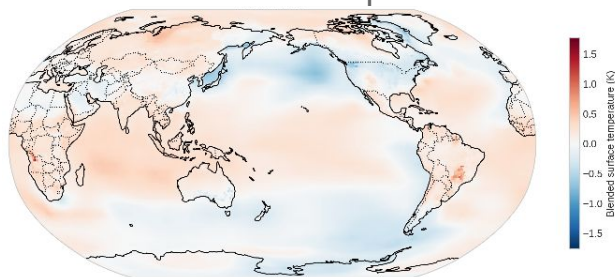


DCENT-ERSST

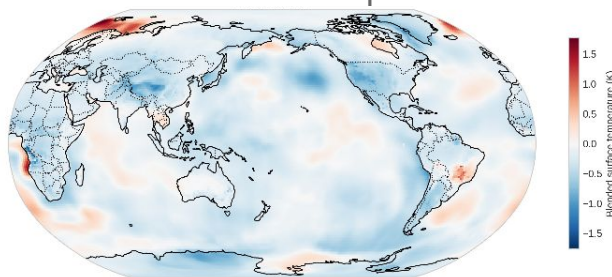


(Early 20 Cen) - (Late 19 Cen)

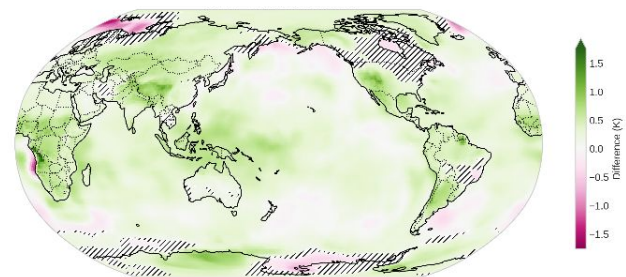
DCENT Temp



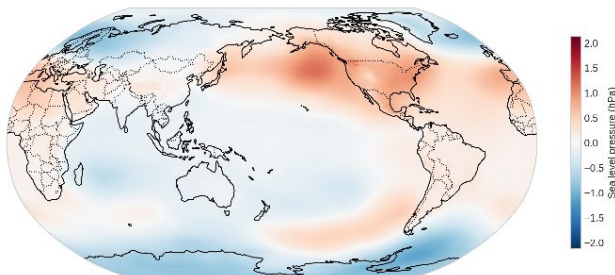
ERSST Temp



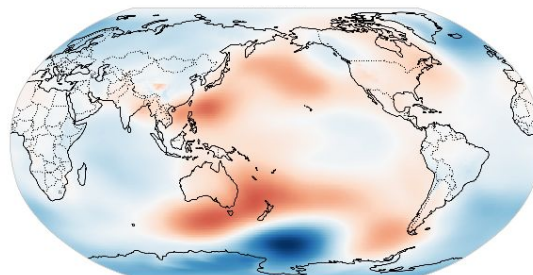
DCENT-ERSST



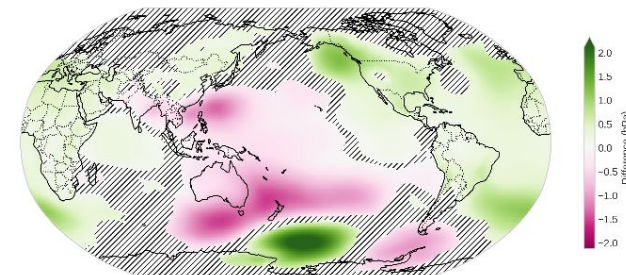
DCENT PSL



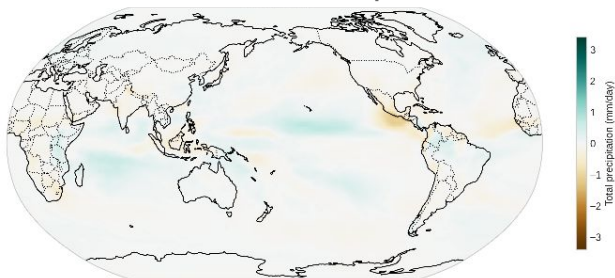
ERSST PSL



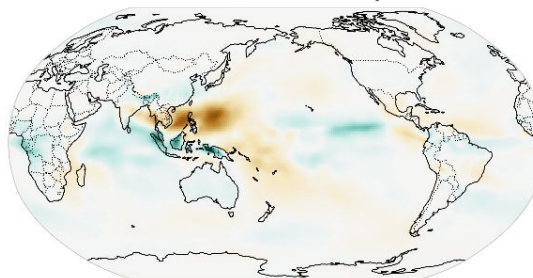
DCENT-ERSST



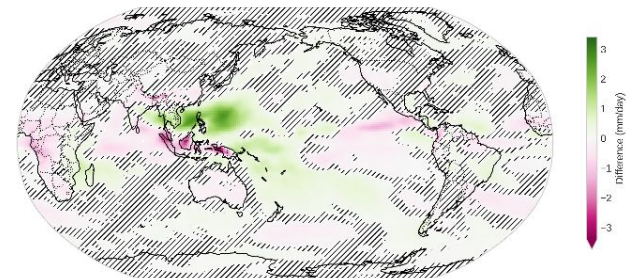
DCENT Precip



ERSST Precip



DCENT-ERSST



Does bias-correction of observed SST improve AMIP simulations of the early 20th century?

Yes for global mean annual temperature!

- Better reproduction of land-only global mean
- Minimal decadal variability consistent with (Haustein et al. 2019)

To be determined for regional patterns, other variables

- Significant differences in mean circulation and hydroclimate
- Difficult to compare with observations in the early 20th century