Supplementary Figures

Present-Day Methane Shortwave Absorption Mutes Surface Warming and Wetting Relative to Preindustrial Conditions

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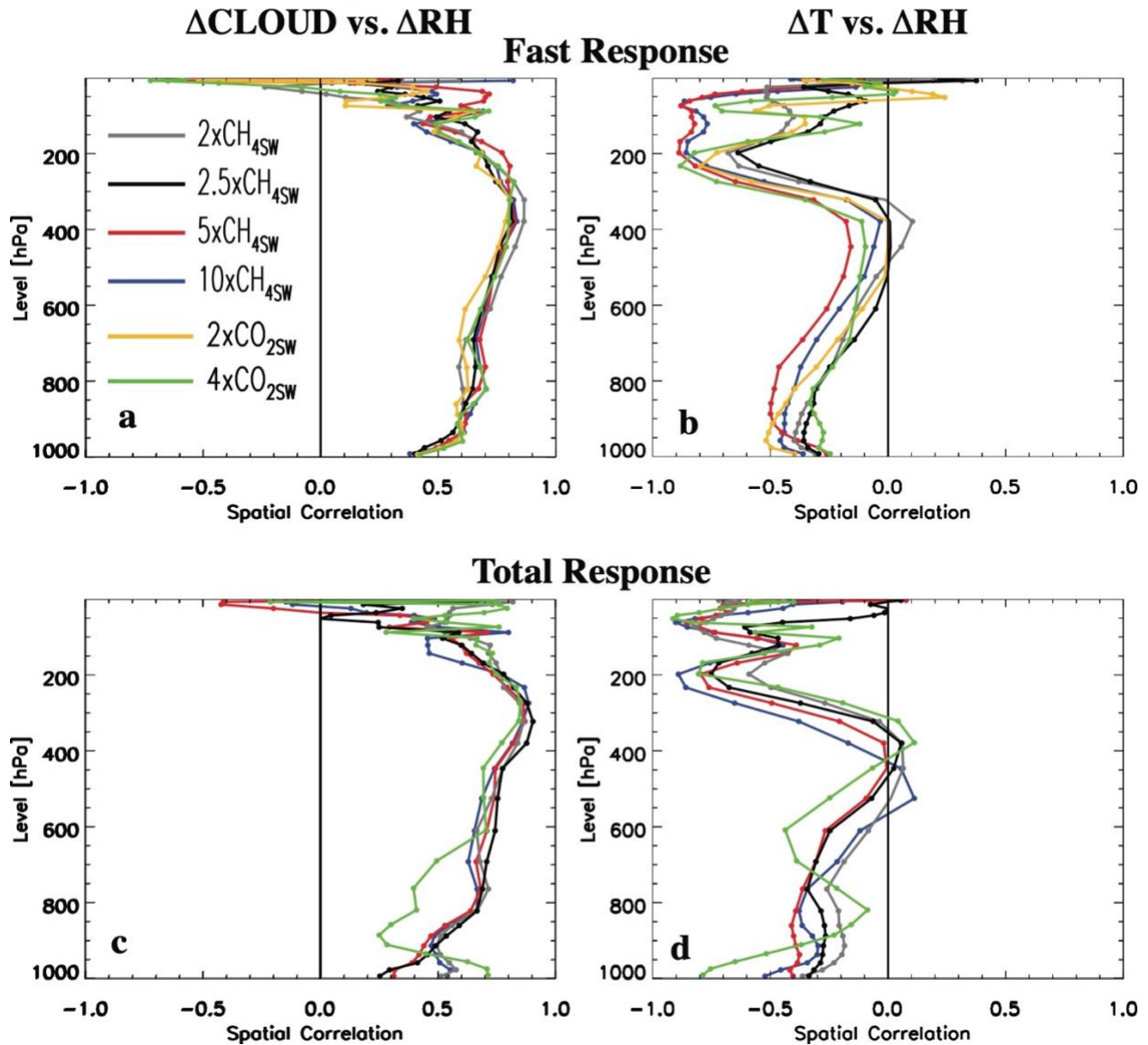[7]School of Earth and Environment, University of Leeds, Leeds, UK.

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Contents of this file:
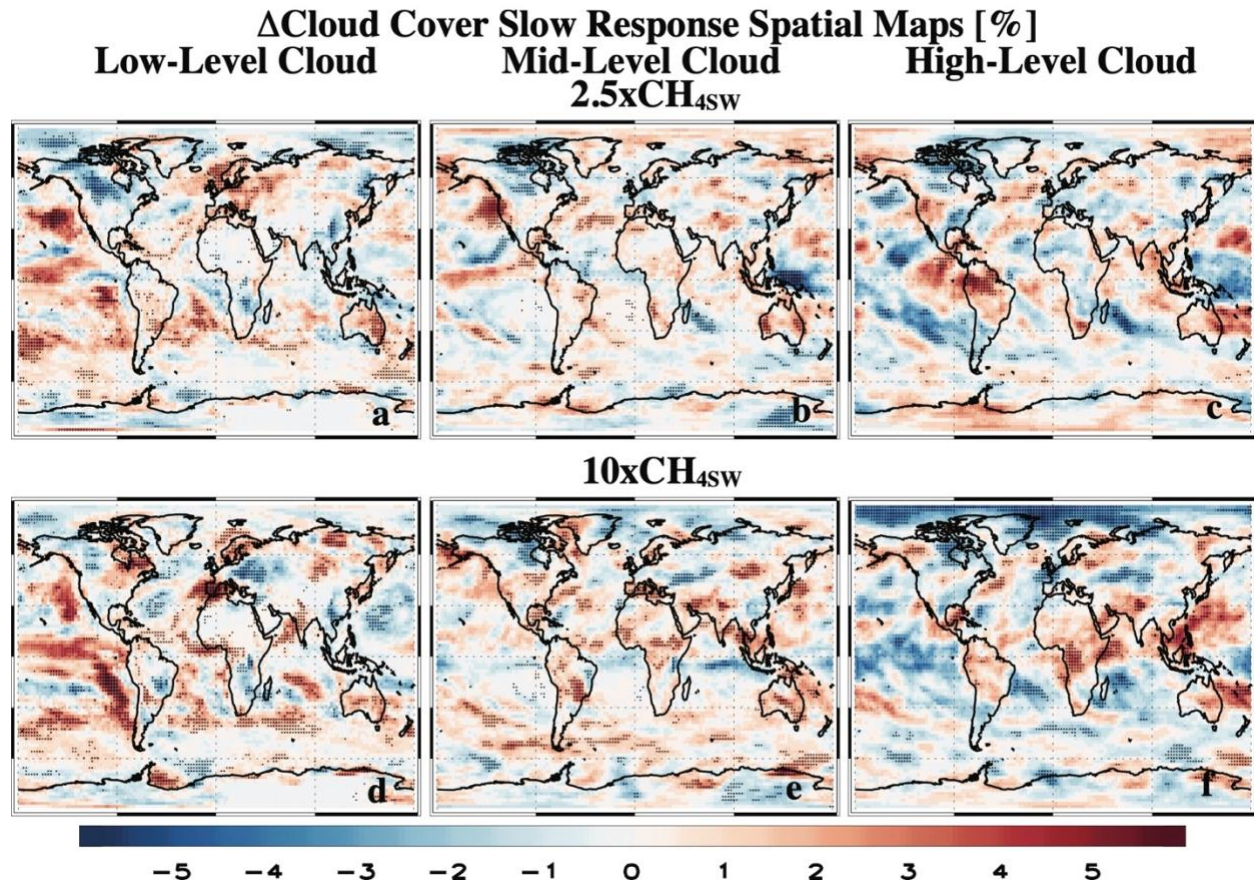Supplementary Figures 1-5

CH$_{4SW}$ and CO$_{2SW}$ Spatial Response Correlations At Pressure Levels


Supplementary Figure 1. CH$_{4SW}$ and CO$_{2SW}$ spatial response correlations at each pressure level. Annual mean spatial correlations at each pressure level for (a, c) ΔCLOUD versus ΔRH; and (b, d) ΔT versus ΔRH for (a-b) the fast response and (c-d) the total response for 2xCH$_{4SW}$ (gray); 2.5xCH$_{4SW}$ (black); 5xCH$_{4SW}$ (red); 10xCH$_{4SW}$ (blue); 2xCO$_{2SW}$ (gold); and 4xCO$_{2SW}$ (green). A significant correlation at the 90% confidence level, based on a standard t-test, is denoted by solid dots. Climatologically fixed SST simulations are used to estimate the fast responses. Total climate responses are estimated using from coupled ocean-atmosphere CESM2 simulations. 2xCO$_2$ coupled simulations were not performed (i.e., no gold line in panels c-d).
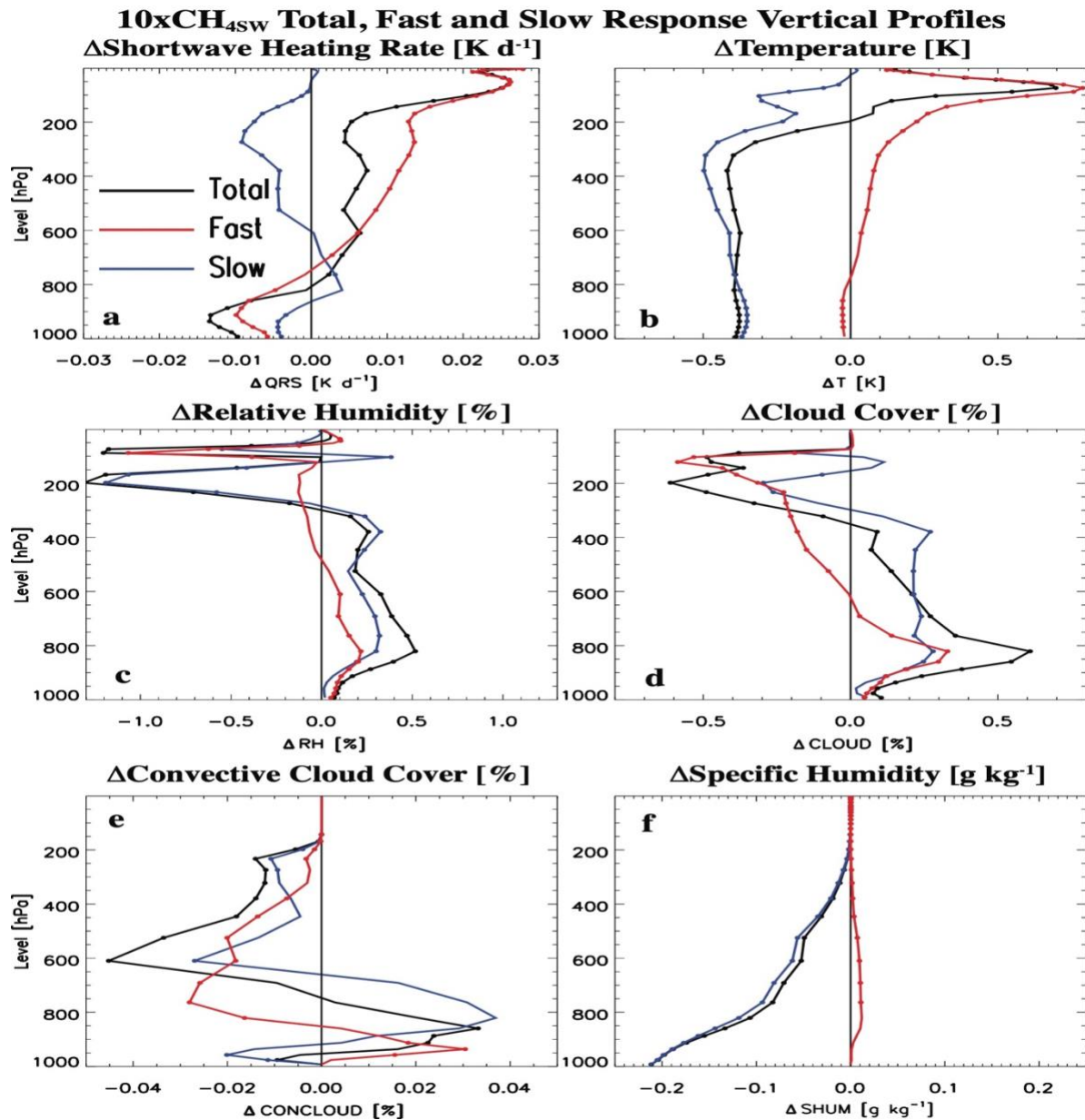
ΔCloud Cover Fast Response Spatial Maps [%]
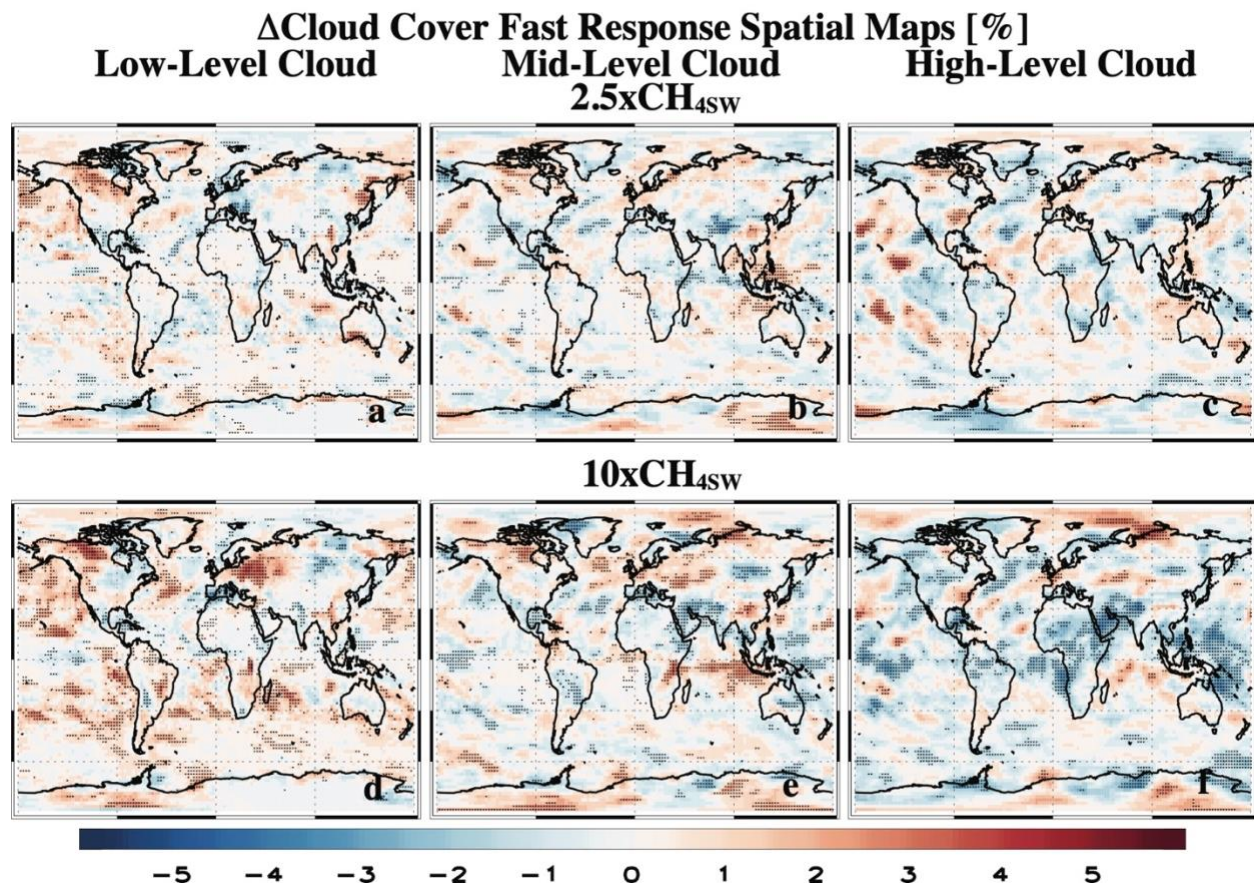
Supplementary Figure 2. Spatial cloud cover fast responses under 2.5xCH$_{4SW}$ and 10xCH$_{4SW}$. Annual mean global mean spatial fast responses of (a, c) low-cloud cover; (b, e) mid-level cloud cover; and (c, f) high-level cloud cover under (a-c) 2.5xCH$_{4SW}$ and (d-f) 10xCH$_{4SW}$. A significant response at the 90% confidence level, based on a standard t-test, is denoted by solid dots. Fast responses are estimated from the fixed climatological sea surface temperature simulations. Units are %.

ΔCloud Cover Slow Response Spatial Maps [%]

Low-Level Cloud   Mid-Level Cloud   High-Level Cloud

2.5xCH$_{4SW}$

10xCH$_{4SW}$

Supplementary Figure 3. Spatial cloud cover slow responses under 2.5xCH$_{4SW}$ and 10xCH$_{4SW}$. Annual mean global mean spatial slow responses of (a, c) low-cloud cover; (b, e) mid-level cloud cover; and (c, f) high-level cloud cover under (a-c) 2.5xCH$_{4SW}$ and (d-f) 10xCH$_{4SW}$. A significant response at the 90% confidence level, based on a standard t-test, is denoted by solid dots. Slow responses are estimated as the difference of the total response minus the fast response. Units are %.
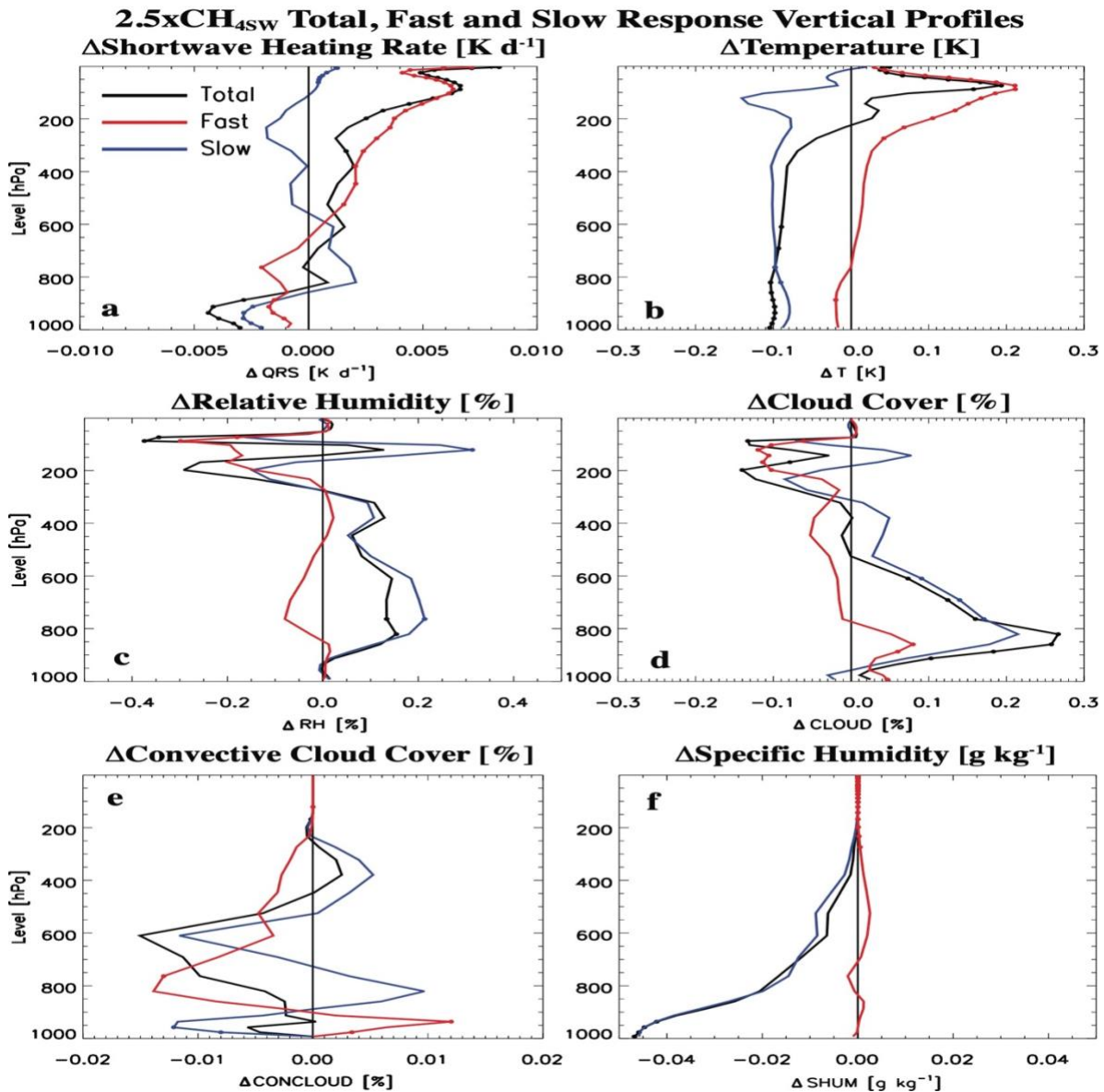
Supplementary Figure 4. 2.5xCH4SW total, fast and slow vertical profile responses. 2.5xCH4SW annual mean global mean vertical response profiles of (a) shortwave heating rate (QRS; units are K d^{-1}); (b) air temperature (T; units are K); and (c) relative humidity (RH; units are %); (d) cloud cover (CLOUD; units are %); (e) convective cloud cover (CONCLOUD; units are %); and (f) specific humidity (SHUM; units are g kg^{-1}) for the total (black); fast (red) and slow (blue) response. A significant response at the 90% confidence level, based on a standard t-test, is denoted by solid dots. Climatologically fixed SST simulations are used to estimate the fast responses. Total climate responses are estimated using from coupled ocean-atmosphere CESM2 simulations. The slow response is estimated as the difference of the total response minus the fast response.

Supplementary Figure 5. 10xCH$_{4SW}$ total, fast and slow vertical profile responses. 10xCH$_{4SW}$ annual mean global mean vertical response profiles of (a) shortwave heating rate (QRS; units are K d^{-1}); (b) air temperature (T; units are K); and (c) relative humidity (RH; units are %); (d) cloud cover (CLOUD; units are %); (e) convective cloud cover (CONCLOUD; units are %); and (f) specific humidity (SHUM; units are g kg^{-1}) for the total (black); fast (red) and slow (blue) response. A significant response at the 90% confidence level, based on a standard t-test, is denoted by solid dots. Climatologically fixed SST simulations are used to estimate the fast responses. Total climate responses are estimated using from coupled ocean-atmosphere CESM2 simulations. The slow response is estimated as the difference of the total response minus the fast response.