



Supplemental Material

[© Copyright 2018 American Meteorological Society](#)

Permission to use figures, tables, and brief excerpts from this work in scientific and educational works is hereby granted provided that the source is acknowledged. Any use of material in this work that is determined to be “fair use” under Section 107 of the U.S. Copyright Act or that satisfies the conditions specified in Section 108 of the U.S. Copyright Act (17 USC §108) does not require the AMS’s permission. Republication, systematic reproduction, posting in electronic form, such as on a website or in a searchable database, or other uses of this material, except as exempted by the above statement, requires written permission or a license from the AMS. All AMS journals and monograph publications are registered with the Copyright Clearance Center (<http://www.copyright.com>). Questions about permission to use materials for which AMS holds the copyright can also be directed to permissions@ametsoc.org. Additional details are provided in the AMS Copyright Policy statement, available on the AMS website (<http://www.ametsoc.org/CopyrightInformation>).

Supplemental Material for: Robust responses of the Sahelian hydrological cycle to global warming

Spencer A. Hill, Yi Ming, and Ming Zhao

Correspondence: shill@atmos.ucla.edu

This document contains the following figures:

1. Figure S1: Sahel region-mean meridional MSE advection profiles and its components in the GFDL models, in the control simulations and in response to the imposed uniform SST warming (analogous to Figure 4 in the main text)
2. Figure S2: Same as Figure S1, but for CMIP5 models (analogous to Figure 5 in the main text)
3. Figure S3: Sahel region-mean zonal MSE advection profiles in the GFDL models, in the control simulations and in response to the imposed uniform SST warming (analogous to Figure 4 in the main text)
4. Figure S4: Same as Figure S1, but for CMIP5 models (analogous to Figure 5 in the main text)
5. Figure S5: Sahel region-mean convective mass flux profiles in those GFDL models for which it is available, in the control simulations and in response to the imposed uniform SST warming
6. Figure S6: Interannual covariances in observations and in the AMIP simulations of AM2.1, AM3, and HiRAM of Sahel region-mean precipitation with surface radiative fluxes (analogous to Figures 10-12 of the main text, combined)

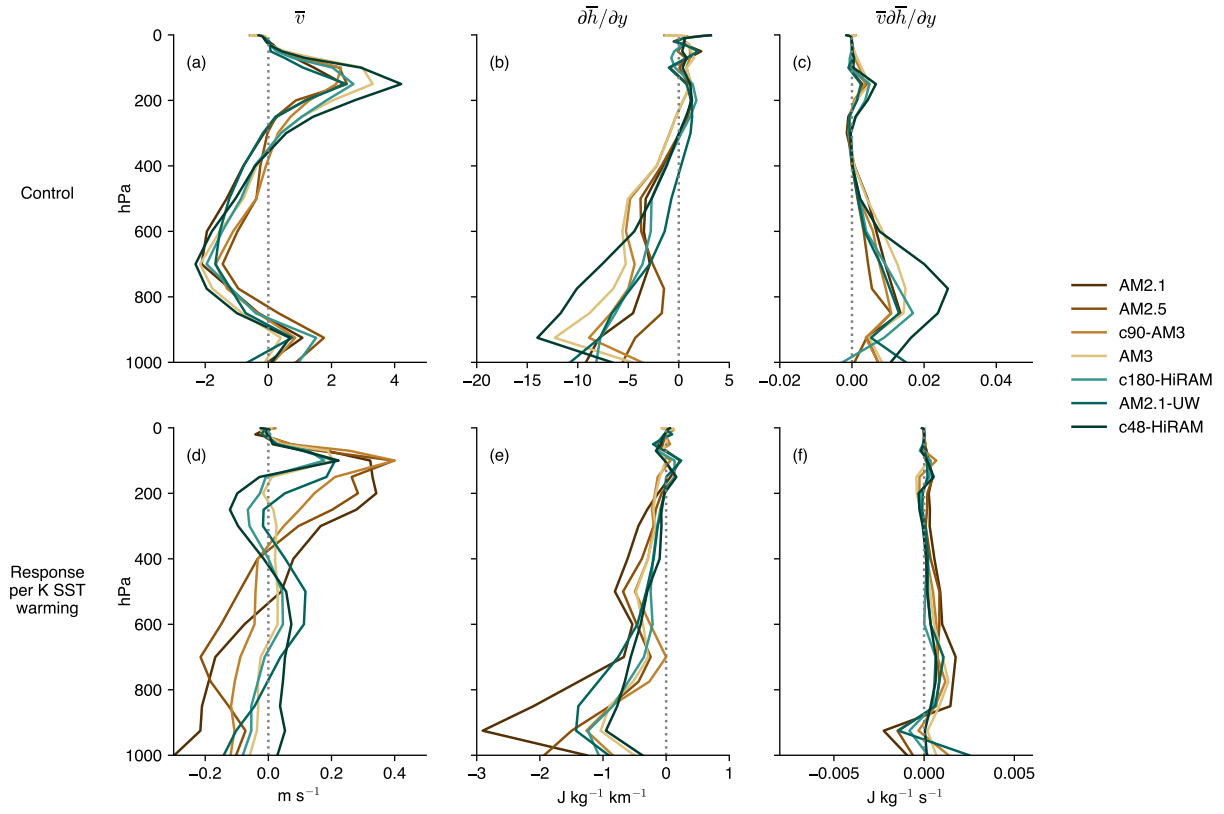


Figure S1: Meridional advection terms. This figure is identical to Figure 4 of the main text, except that in the right column horizontal (meridional plus zonal) advection is replaced by meridional advection.

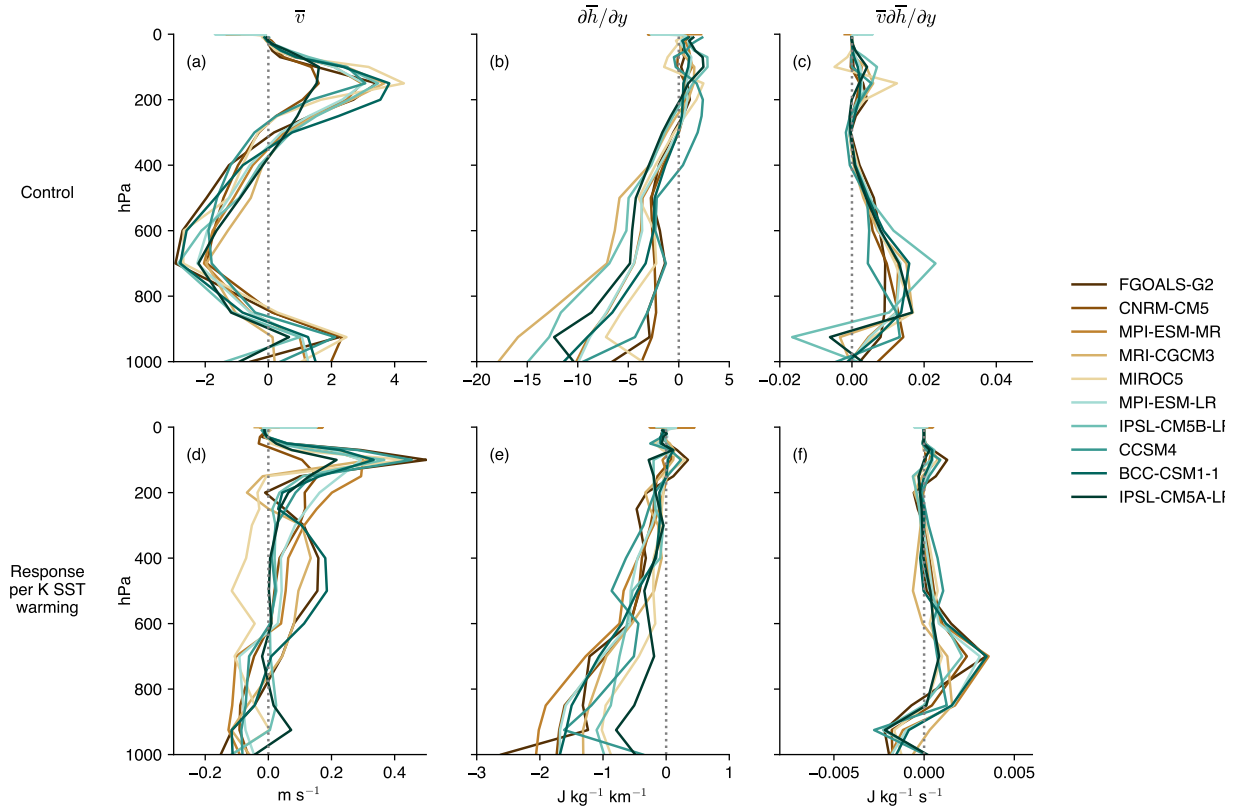


Figure S2: As in Figure S1, but for the CMIP5 models.

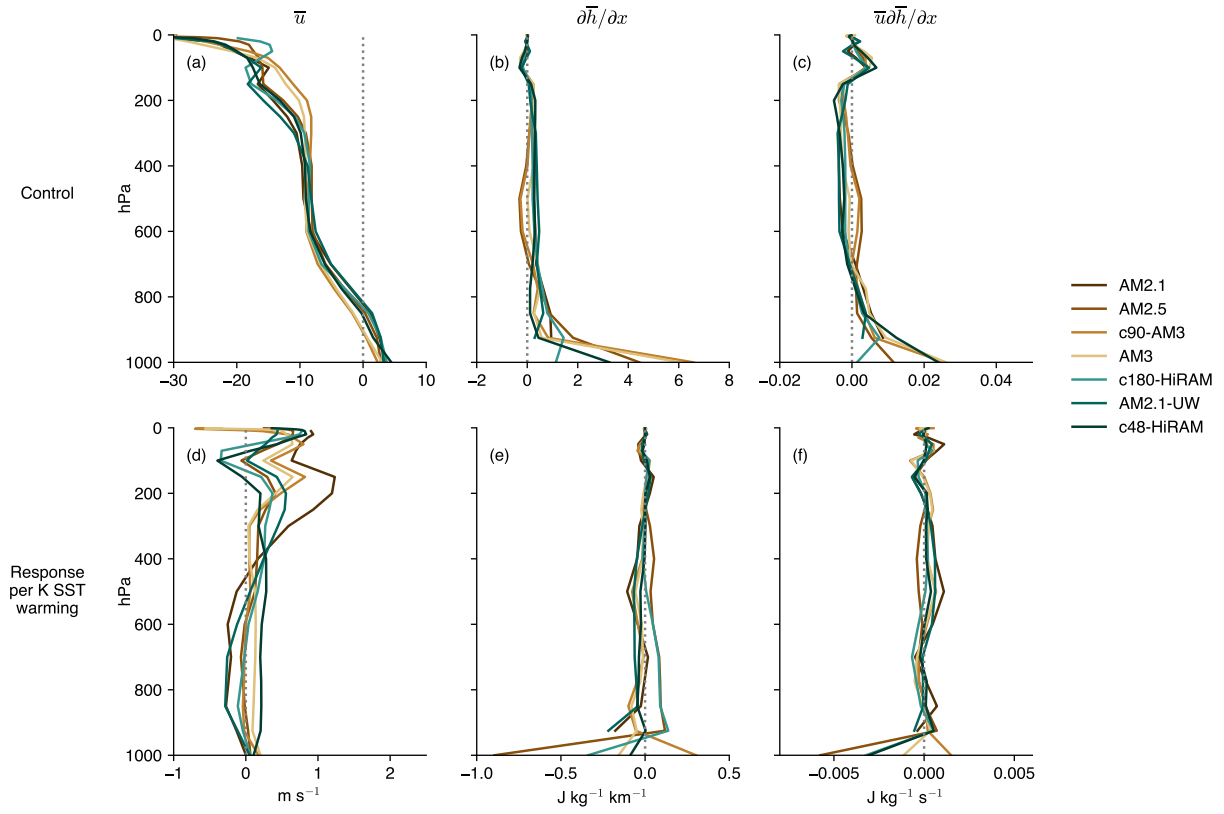


Figure S3: Zonal advection terms. For ease of comparison with the meridional advection profiles, the horizontal axis spacing in panels (c) and (f) are identical to the corresponding panels of Figures 4 and 5 of the main text.

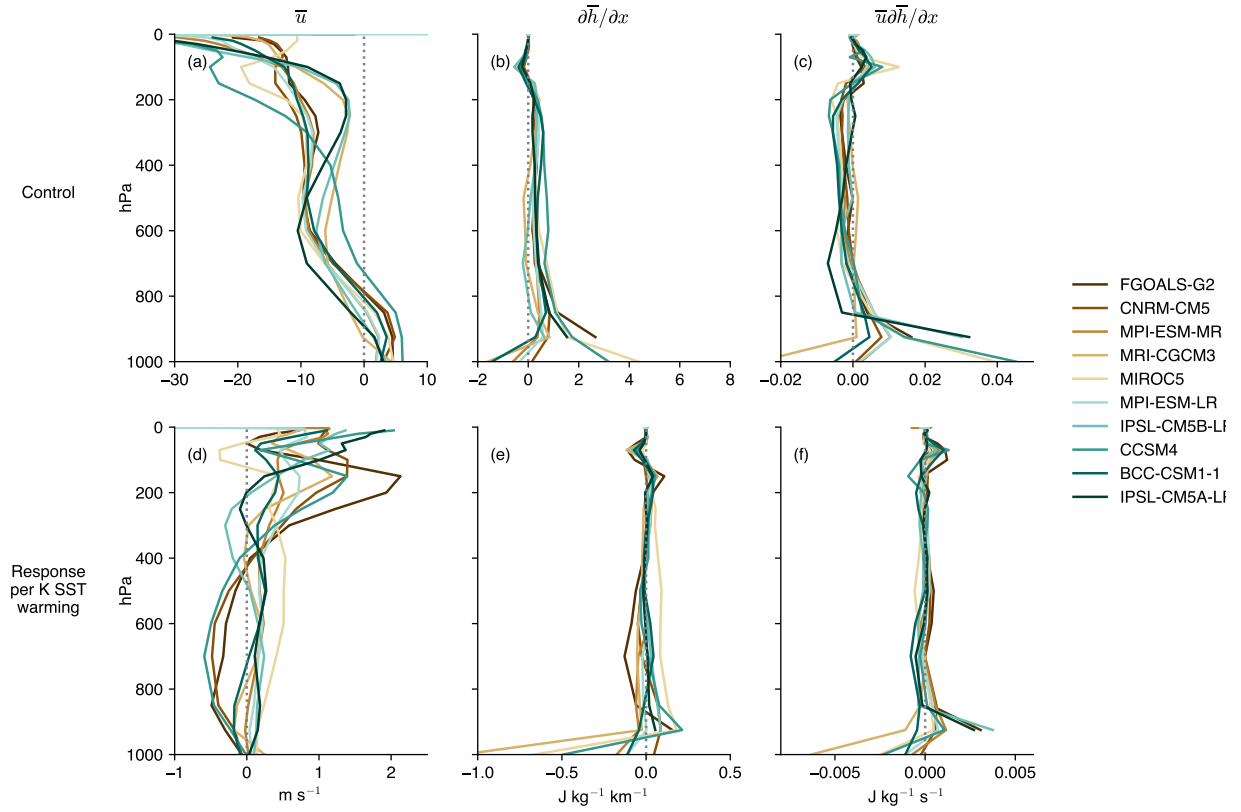


Figure S4: As in Figure S3, but for the CMIP5 models.

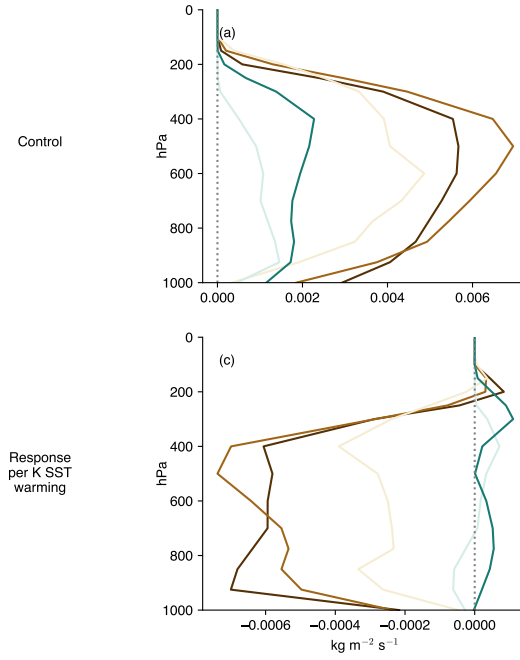


Figure S5: Sahel region-mean JAS convective mass flux profiles, in $\text{kg m}^{-2} \text{s}^{-1}$, in those GFDL models for which the data was available, in (a) the control simulation and (b) response per degree of imposed SST warming. Curves from brown to green: AM2.1, AM2.5, AM3, c180-HiRAM, and c48-HiRAM.

Figure S6 (on following page): Sahel region-mean (vertical axis) surface radiative flux and its components, in W m^{-2} and signed positive downward, as a function of (horizontal axis) precipitation, in mm day^{-1} . Columns from left to right: CERES-EBAF and CRU observational data; AM2.1 AMIP simulation; AM3 AMIP simulation, and c180-HiRAM AMIP simulation. Rows from top to bottom: all-sky net surface radiative flux, clear-sky net surface radiative flux, cloudy-sky surface radiative flux, cloudy-sky surface LW radiative flux, cloudy-sky surface SW radiative flux. Each dot represents a single year, and the overlaid gray line is the linear best fit. Also printed in each panel is the square of the Pearson correlation coefficient (r^2), the corresponding p -value based on a two-sided Student's t -test assuming each year is independent, and the slope of the best fit line, in W m^{-2} per mm day^{-1} . Red squares in (b)-(c) denote the equilibrium response in the uniform 2 K SST warming simulation in mm day^{-1} (not normalized by the SST warming). Compare to Figures 10-12 of the main text.

