



AMS
American Meteorological Society

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>).

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Supporting Information

Evolution of the global coupled climate response to Arctic sea ice loss during 1990-2090 and its contribution to climate change

Lantao Sun*

Cooperative Institute for Research in Environmental Sciences,

University of Colorado at Boulder and NOAA Earth System Research Laboratory

Physical Sciences Division, Boulder CO

Michael Alexander

NOAA Earth System Research Laboratory Physical Sciences Division, Boulder CO

Clara Deser

National Center for Atmospheric Research Climate & Global Dynamics, Boulder CO

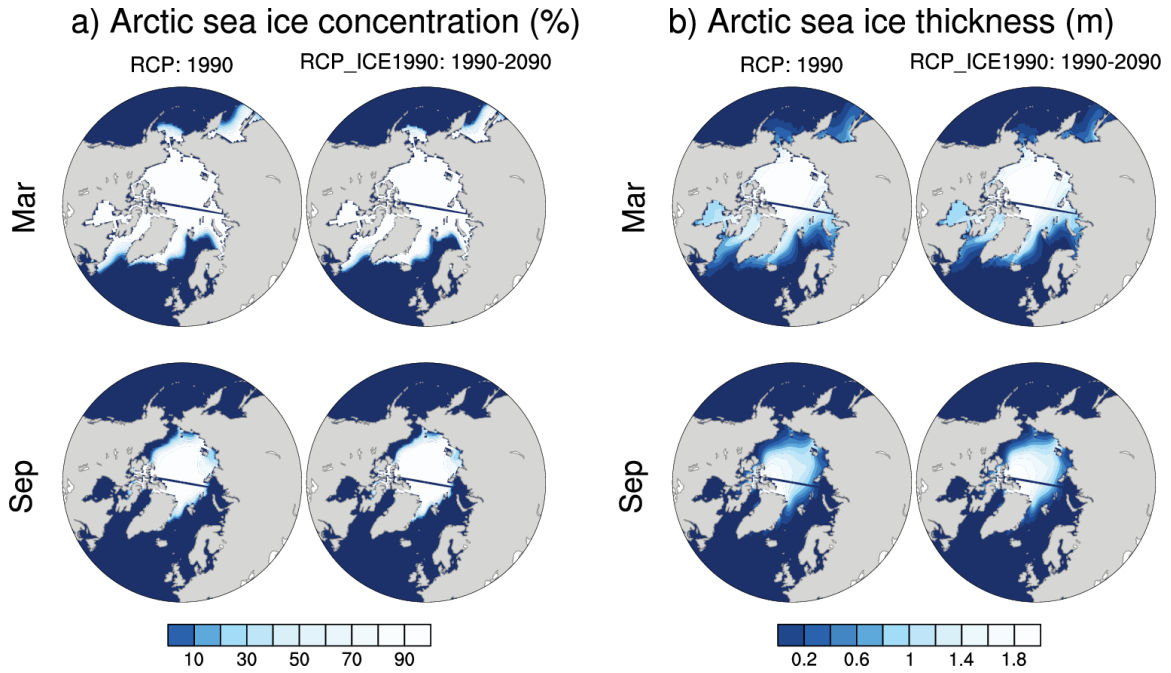
March 5, 2018

Submitted to *J. Climate*

Revised June 20, 2018

* *Corresponding author:* Dr. Lantao Sun, Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder and NOAA Earth System Research Laboratory, R/PSD1, 325 Broadway, Boulder, CO 80305. lantao.sun@noaa.gov.

24



25

26

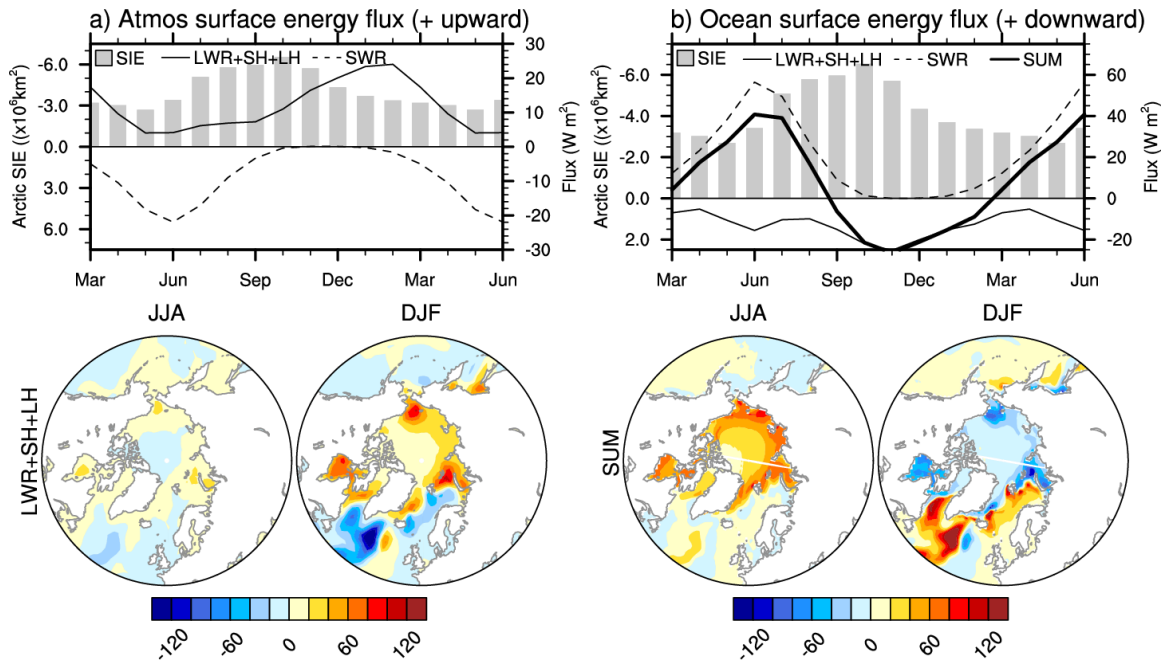
27

28

29

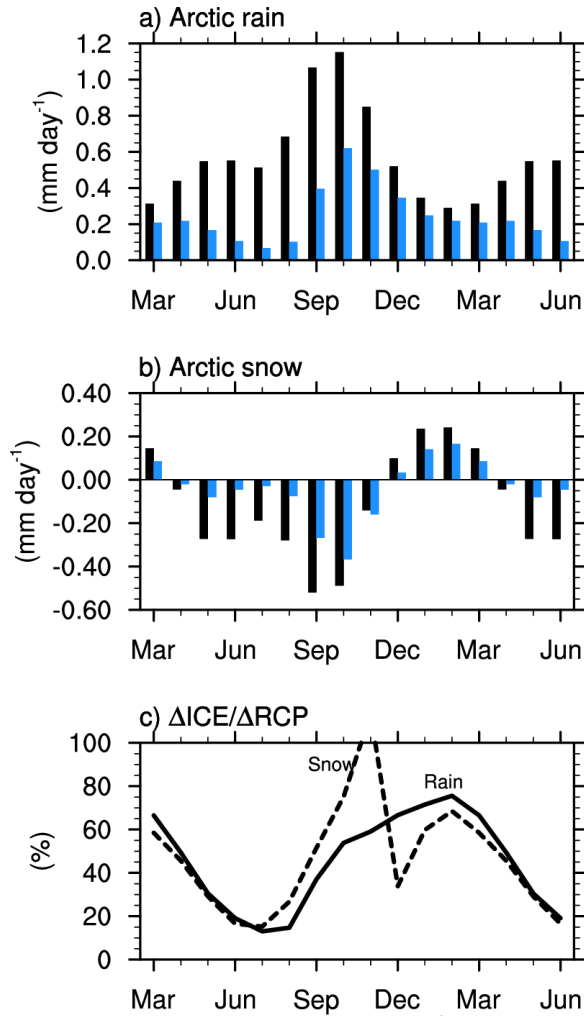
30

Figure S1: (a) Arctic sea ice concentration (%) for RCP year 1990 condition (left) and RCP-ICE1990 year 1990-2090 averaged condition (right) in March (top) and September (bottom). (b) As in (a), but for the sea ice thickness (m). White lines are due to polar projections on tripolar grids.

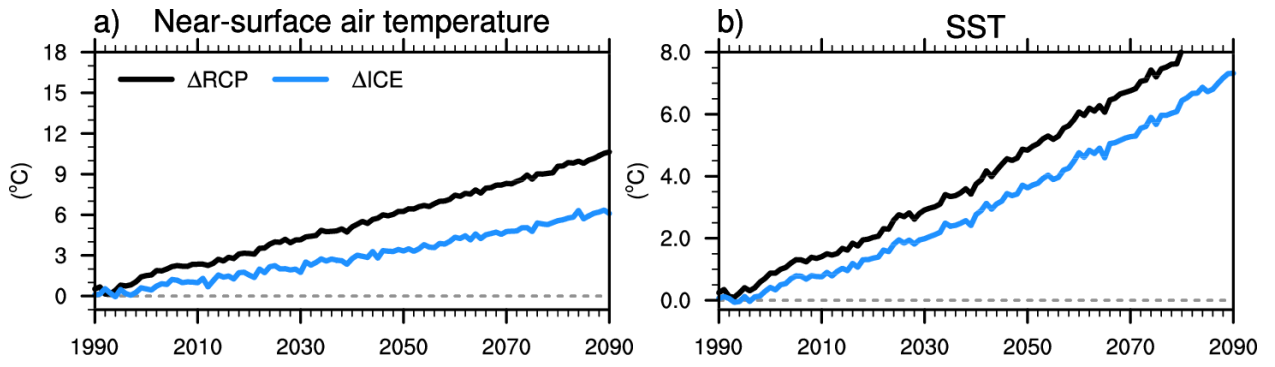


31
32
33
34

Figure S2: As in Fig. 2, but for the average over 2011-2050.



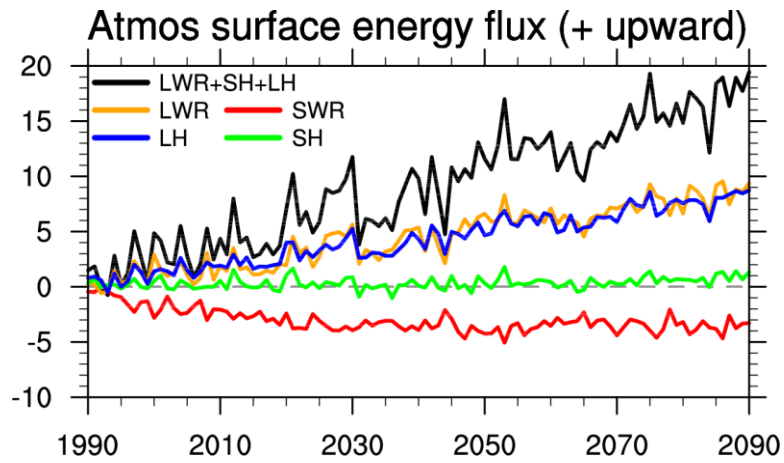
35
 36 **Figure S3:** (a) Monthly change of the Arctic rain (mm day^{-1}) responses in ΔICE (blue bars) and
 37 ΔRCP (black bars) averaged over 2051-2090. (b) As in (a), but for the Arctic snow responses. (d)
 38 Seasonal cycle of the fraction (%) of $\Delta\text{ICE}/\Delta\text{RCP}$ for rain (solid line) and snow (dashed line).
 39



40

41 **Figure S4:** Evolution of September Arctic (defined as the region of Arctic sea ice extent in
 42 March) surface air temperature and SST responses in ΔICE and ΔRCP.

43



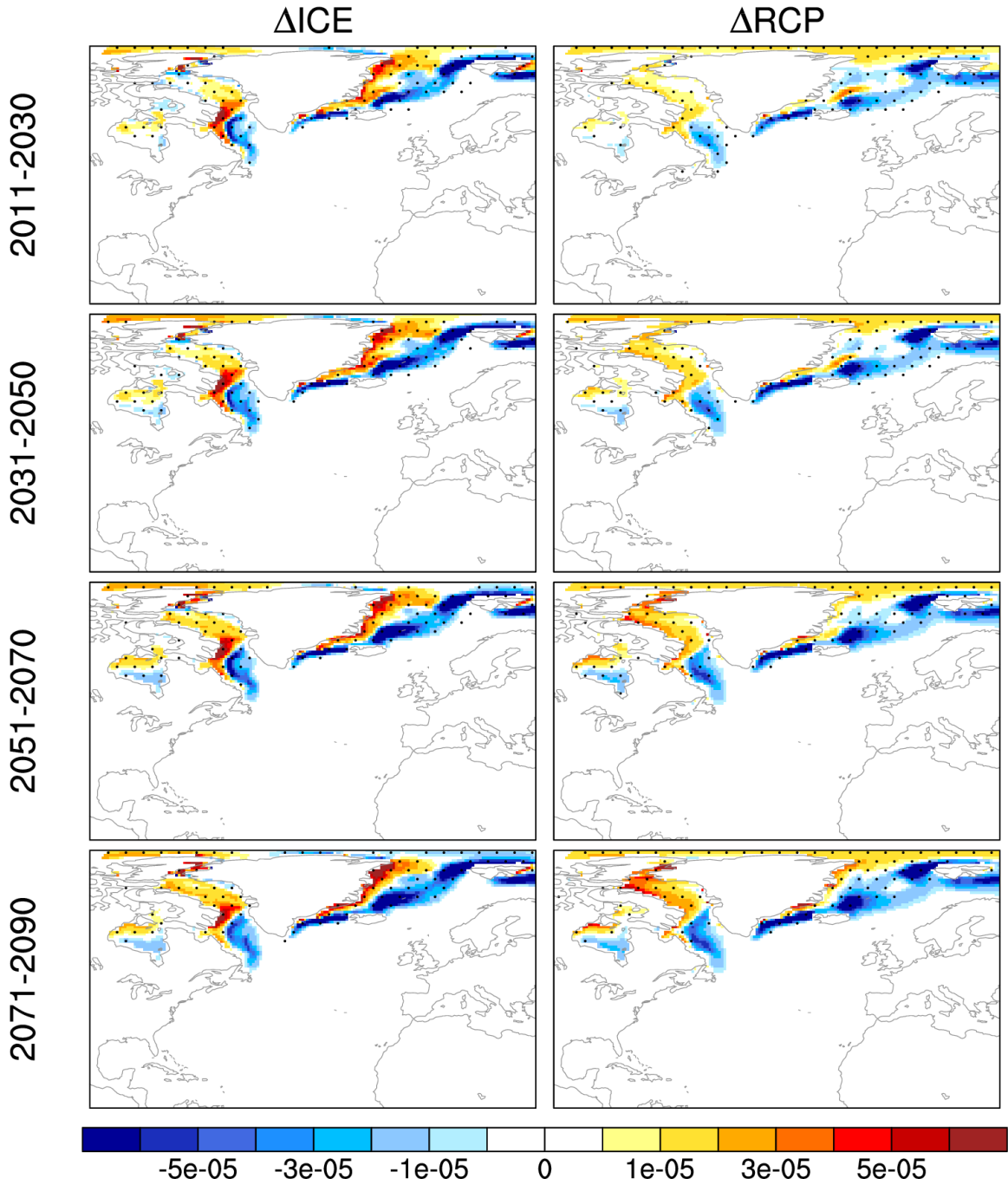
44

45 **Figure S5:** Evolution of September Arctic (defined as the region of Arctic sea ice extent in
 46 March) atmospheric surface energy flux (W m^{-2} ; positive upward) response in ΔICE .

47

48

Water flux transferred with sea ice melt/form (>0 enters ocean)



49
50
51
52
53
54

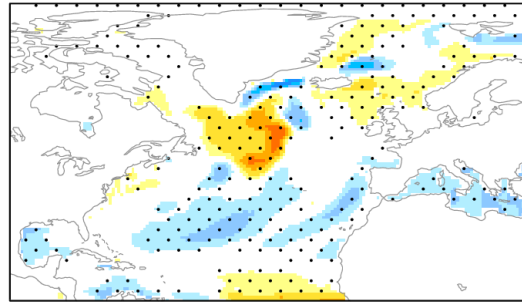
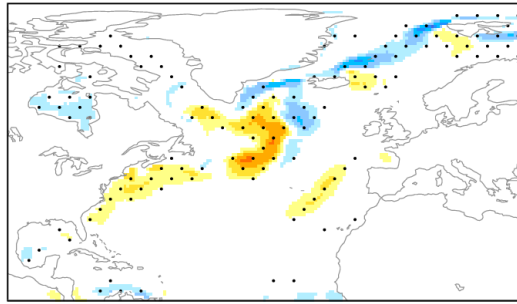
Figure S6: As in Fig. 6, but for the response of water flux transferred with sea ice melt/form ($\text{kg m}^{-2} \text{sec}^{-1}$) in Δ ICE and Δ RCP.

Precipitation minus Evaporation (P-E)

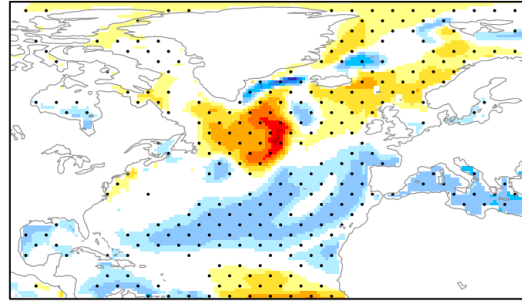
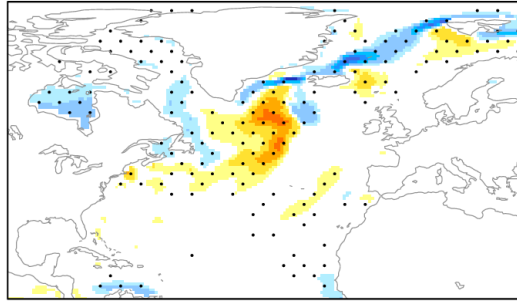
Δ ICE

Δ RCP

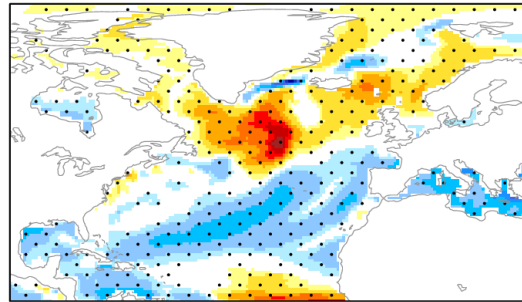
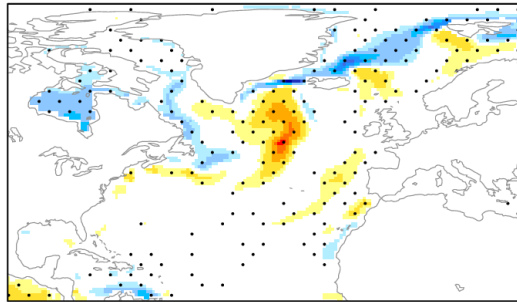
2011-2030



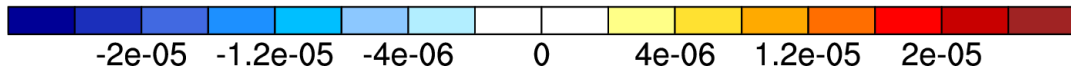
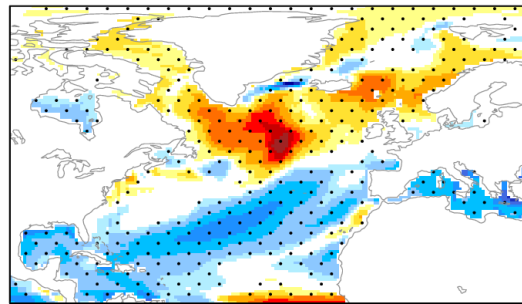
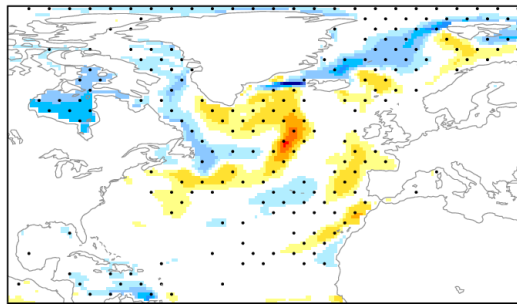
2031-2050



2051-2070

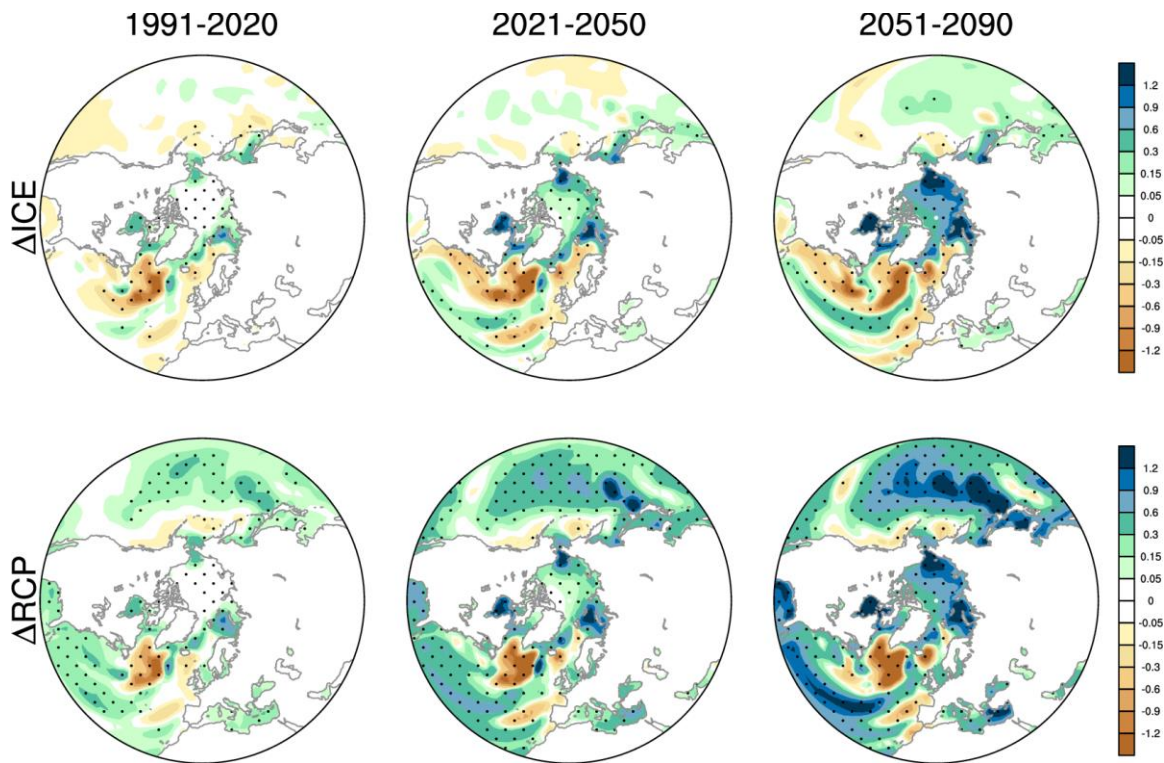


2071-2090



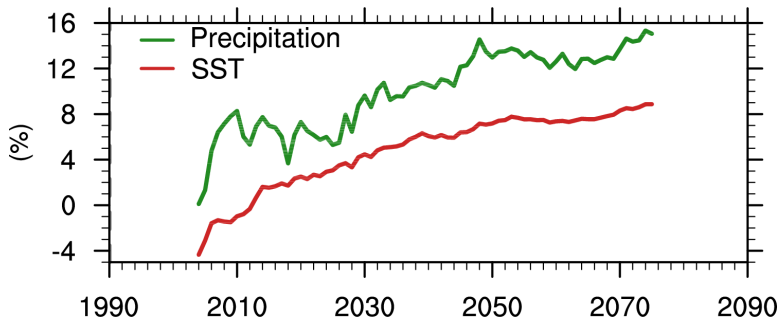
55
56
57
58
59

Figure S7: As in Fig. 6, but for the precipitation minus evaporation (P-E; $\text{kg m}^{-2} \text{sec}^{-1}$) response in Δ ICE and Δ RCP.



60
61
62
63
64

Figure S8: As in Fig. 9, but for the winter atmospheric evaporation rate (mm day^{-1}) responses. Stipplings denote the 95% statistical significance based on two-sided student's t-test.



65
66
67
68

Figure S9: Time evolution of the fraction (%) of $\Delta\text{ICE}/\Delta\text{RCP}$ for tropical (10°S - 23.5°N) SST and precipitation.