1	Supporting Information
2	Evolution of the global coupled climate response to Arctic sea ice loss
3	during 1990-2090 and its contribution to climate change
4	
5	Lantao Sun*
6	Cooperative Institute for Research in Environmental Sciences,
7	University of Colorado at Boulder and NOAA Earth System Research Laboratory
8	Physical Sciences Division, Boulder CO
9	Michael Alexander
10	NOAA Earth System Research Laboratory Physical Sciences Division, Boulder CO
11	Clara Deser
12	National Center for Atmospheric Research Climate & Global Dynamics, Boulder CO
13	
14	
15	March 5, 2018
16	Submitted to J. Climate
17	Revised June 20, 2018
18	
19	
20	* Corresponding author: Dr. Lantao Sun, Cooperative Institute for Research in
21	Environmental Sciences, University of Colorado at Boulder and NOAA Earth System
22	Research Laboratory, R/PSD1, 325 Broadway, Boulder, CO 80305.
23	lantao.sun@noaa.gov.



25 26 27 28 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 29 (bottom). (b) As in (a), but for the sea ice thickness (m). White lines are due to polar projections 30 on tripolar grids.



32 33 34 Figure S2: As in Fig. 2, but for the average over 2011-2050.



36

Figure S3: (a) Monthly change of the Arctic rain (mm day⁻¹) responses in Δ ICE (blue bars) and

 ΔRCP (black bars) averaged over 2051-2090. (b) As in (a), but for the Arctic snow responses. (d)

Seasonal cycle of the fraction (%) of $\Delta ICE/\Delta RCP$ for rain (solid line) and snow (dashed line).



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 .



45 Figure S5: Evolution of September Arctic (defined as the region of Arctic sea ice extent in
46 March) atmospheric surface energy flux (W m²; positive upward) response in ΔICE.



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



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



56 57 58 59 **Figure S7**: As in Fig. 6, but for the precipitation minus evaporation (P-E; kg m⁻² sec⁻¹) response in Δ ICE and Δ RCP.



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.



66 67 68 **Figure S9**: Time evolution of the fraction (%) of $\Delta ICE/\Delta RCP$ for tropical (10·S-23.5·N) SST and precipitation.