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Conservation of heat and mass in P-SKRIPS version 1: the coupled atmosphere–ice–ocean model of the Ross Sea

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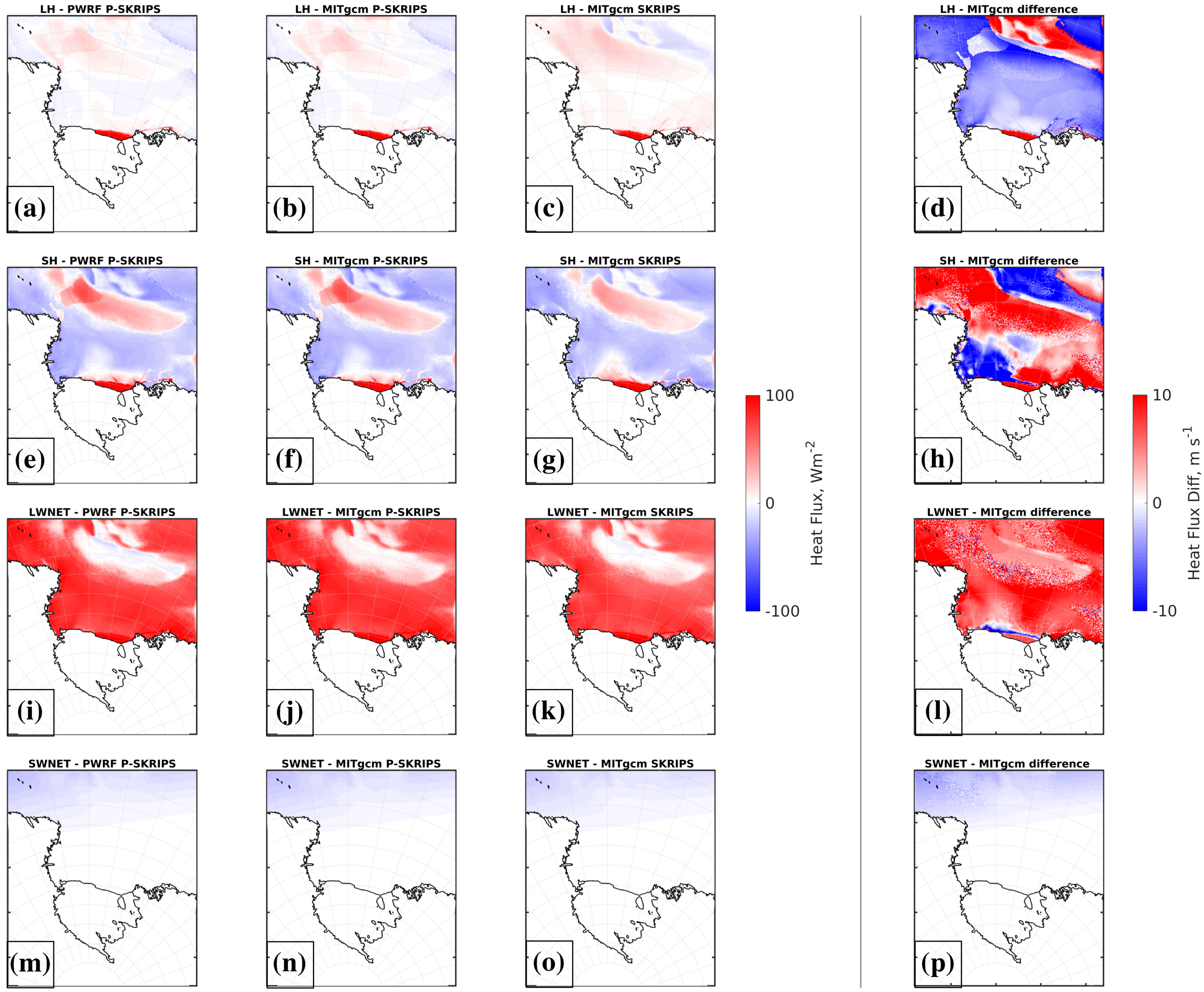

Fig. S1. Same as Figure 4, but for August 2016 experiments.

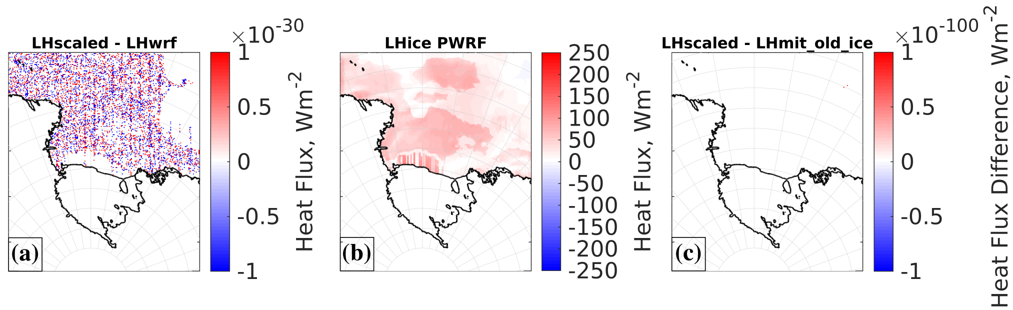

Fig. S2. Same as Figure 6, but for August 2016 experiments.

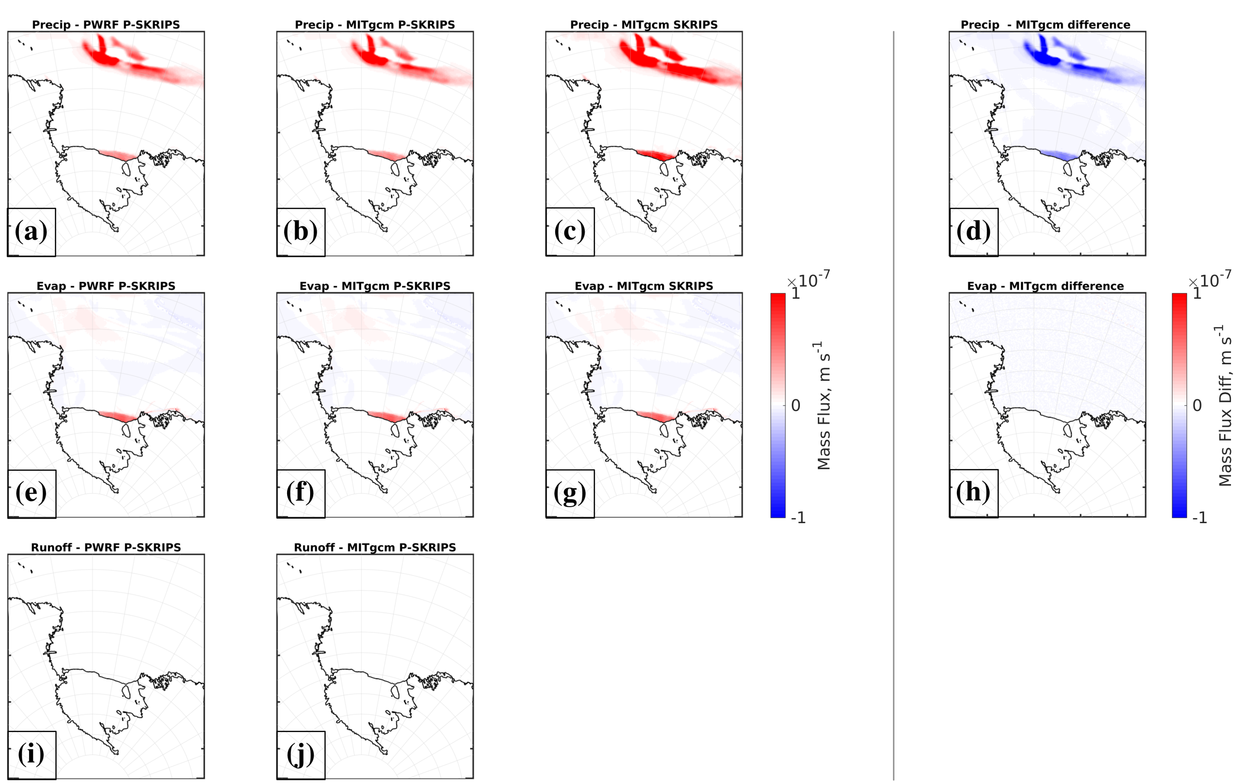

Fig. S3. Same as Figure 7, but for August 2016 experiments.

Table S1. Sign definition of each flux, in each model component. ↓ indicates defined positive downward, ↑ indicates defined positive upward.

		MITgcm exf	MITgcm seaice	PWRF
HEAT	latent heat	↓	↑	↑
	sensible heat	↓	↑	↑
	short wave net	↑	↓	↓
	long wave net	↑	↑	↓
MASS	evaporation	↑	-	↑
	precipitation	↓	-	↓
	sea ice runoff	↓	-	↓
	land runoff	↓	-	↓

Table S2. Statistics presenting the mean value and biases through the coupling interface in the SKRIPS case. The variables are integrated over the whole simulation and through the entire domain (from Figures 8 and S4)

	January			August		
	Mean value	Mean bias	Max bias	Mean value	Mean bias	Max bias
Latent heat [W]	$2.69e^{13}$	$5.08e^{12}$	$2.31e^{13}$	$7.31e^{12}$	$7.61e^{12}$	$1.41e^{13}$
Sensible heat [W]	$1.68e^{13}$	$9.10e^{12}$	$5.62e^{13}$	$-1.61e^{13}$	$1.51e^{13}$	$5.13e^{13}$
Long wave net [W]	$8.88e^{13}$	$1.71e^{13}$	$7.03e^{13}$	$1.16e^{14}$	$1.34e^{13}$	$2.49e^{13}$
Short wave net [W]	$-3.94e^{14}$	$3.64e^{13}$	$9.48e^{13}$	$-7.54e^{12}$	$1.31e^{12}$	$1.48e^{13}$

Table S3. Statistics presenting the mean value for the different variables in Figures 8 and S4 in January for both the SKRIPS and the P-SKRIPS simulations, as well as the mean values for the differences between the PWRF and the MITgcm variables for each of these simulations. The variables are integrated over the whole simulation and through the entire domain.

simulation JAN	LH [W]	SH [W]	LWNET [W]	SWNET [W]	Prec. $[m^3 s^{-1}]$	Evap. $[m^3 s^{-1}]$	Runoff $m^3 s^{-1}]$
SKRIPS	$2.69e^{13}$	$1.68e^{13}$	$8.87e^{13}$	$-3.93e^{14}$	$7.74e^{4}$	$1.03e^{4}$	PWRF $1.09e^{4}$
P-SKRIPS	$2.44e^{13}$	$1.20e^{13}$	$9.19e^{13}$	$-3.92e^{14}$	$3.69e^{4}$	$9.38e^{3}$	MITgcm $1.13e^{4}$
SKRIPS difference	$-2.74e^{12}$	$-2.89e^{12}$	$1.71e^{13}$	$1.e^{13}$	-0.0036	$5.33e^{-5}$	diff $7.18e^{-5}$
P-SKRIPS difference	$7.87e^{7}$	$2.38e^{8}$	-2.64^{11}	$1.44e^{11}$	-0.0019	$-3.40e^{-5}$	

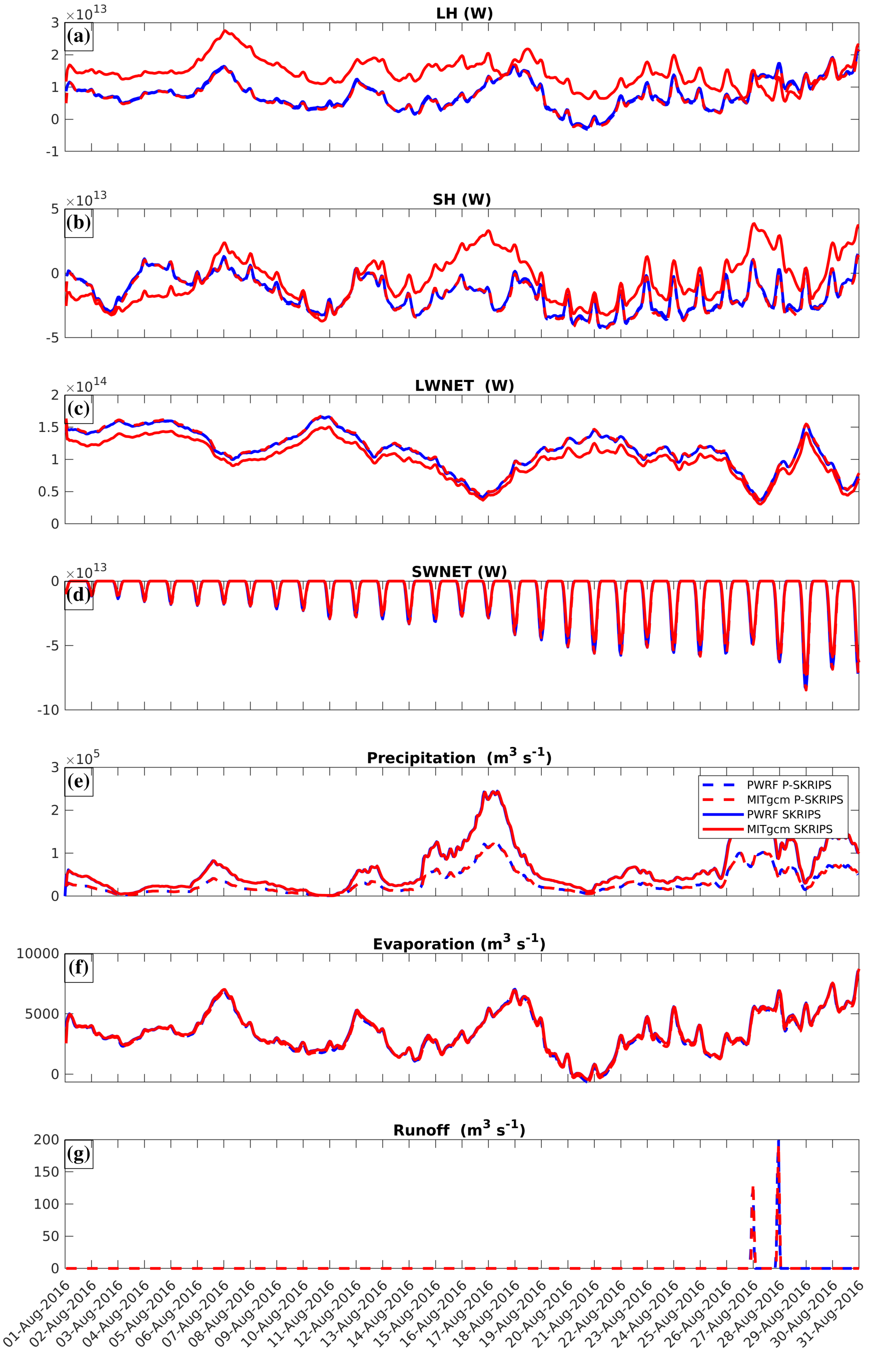

Fig. S4. Same as Figure 8, but for August 2016 experiments.

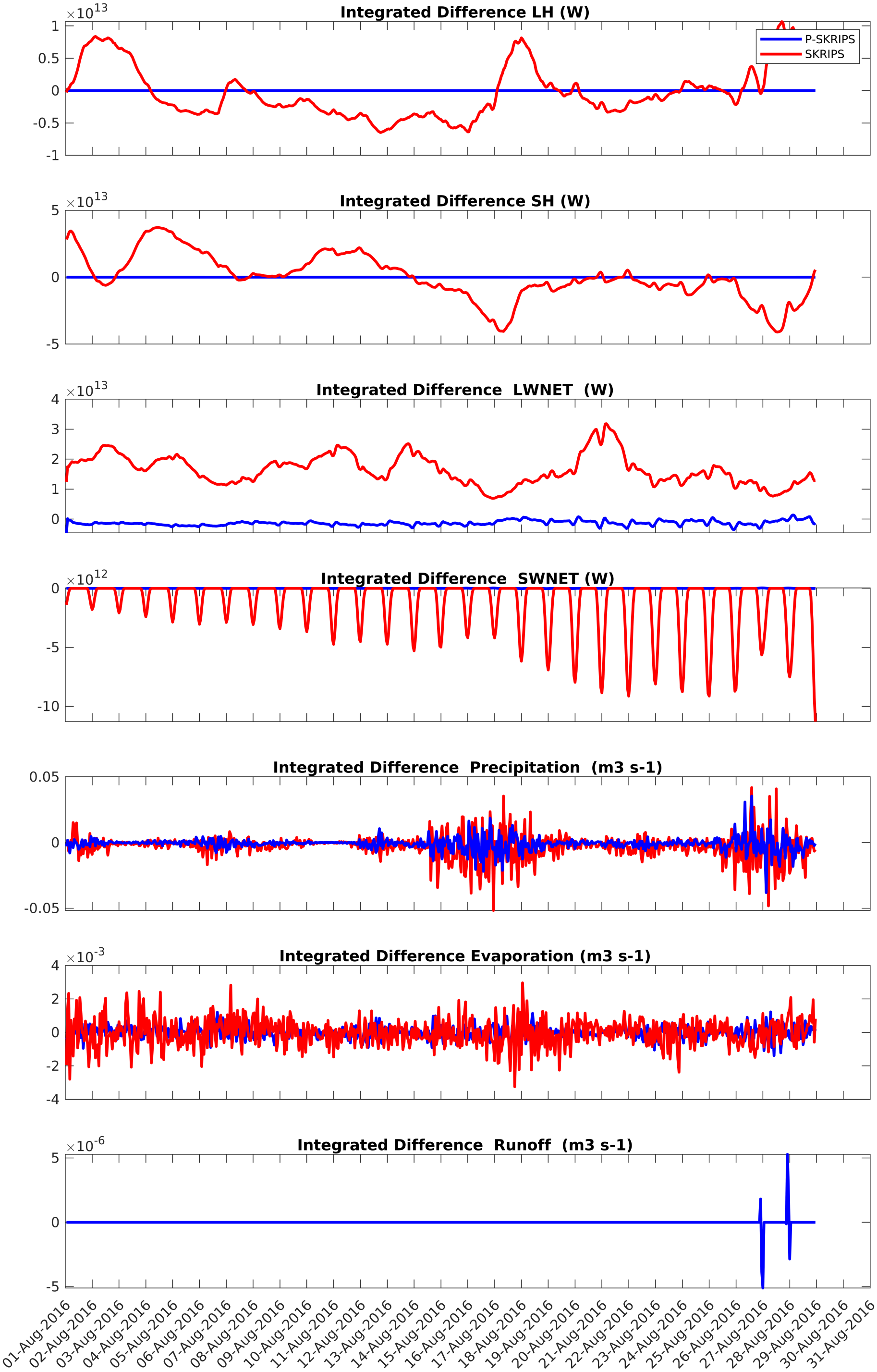

Fig. S5. Same as Figure 9, but for August 2016 experiments.

Table S4. Statistics presenting the mean value for the different variables in Figures 8 and S4 in January for both the SKRIPS and the P-SKRIPS simulations, as well as the mean values for the differences between the PWRF and the MITgcm variables for each of these simulations. The variables are integrated over the whole simulation and through the entire domain.

simulation AUG	LH [W]	SH [W]	LWNET [W]	SWNET [W]	Prec. [m^3s^{-1}]	Evap. [m^3s^{-1}]	Runoff m^3s^{-1}]
SKRIPS	$2.06e^{13}$	$-5.83e^{12}$	$1.24e^{14}$	$-9.19e^{12}$	$7.02e^{4}$	$8.46e^{3}$	PWRF 0.99
P-SKRIPS	$7.42e^{12}$	$-1.69e^{13}$	$1.14e^{14}$	$-8.21e^{12}$	$3.27e^{4}$	$3.34e^{3}$	MITgcm 0.99
SKRIPS difference	$-1.77e^{11}$	$-8.24e^{10}$	$1.64e^{13}$	$-1.14e^{12}$	-0.0029	$-1.1e^{-5}$	diff $-4.15e^{-9}$
P-SKRIPS difference	$5.85e^{7}$	$1.46e^{8}$	$-1.29e^{12}$	$6.24e^{8}$	$-9.71e^{-4}$	$6.84e^{-6}$	