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Rain-on-snow responses to warmer Pyrenees: a sensitivity analysis using a physically based snow hydrological model

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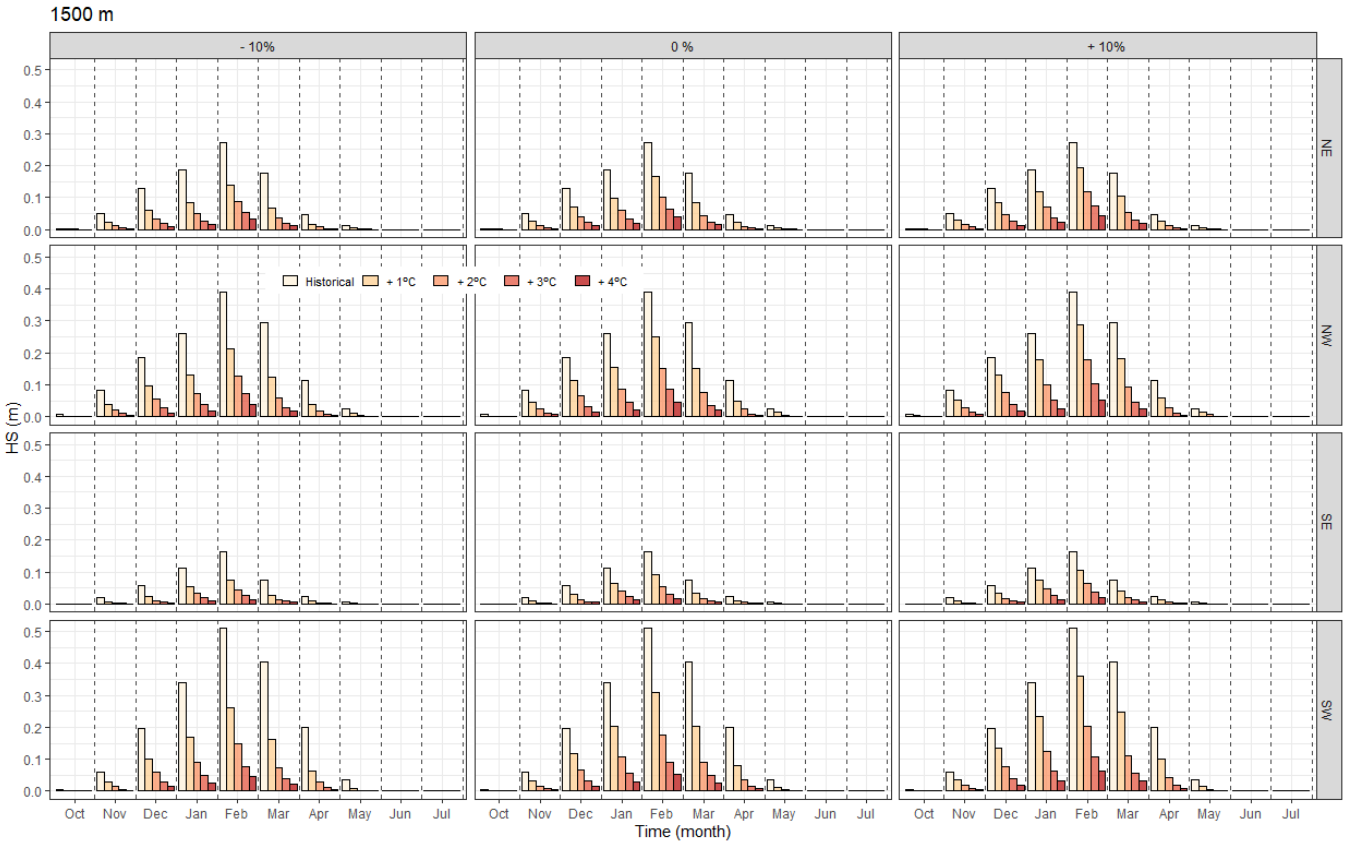

Figure S1. Height of snow (HS) monthly variation at 1500 m for the historical climate period (1980 – 2019) and different increments of temperature (colors) grouped by sector and precipitation changes (boxes).

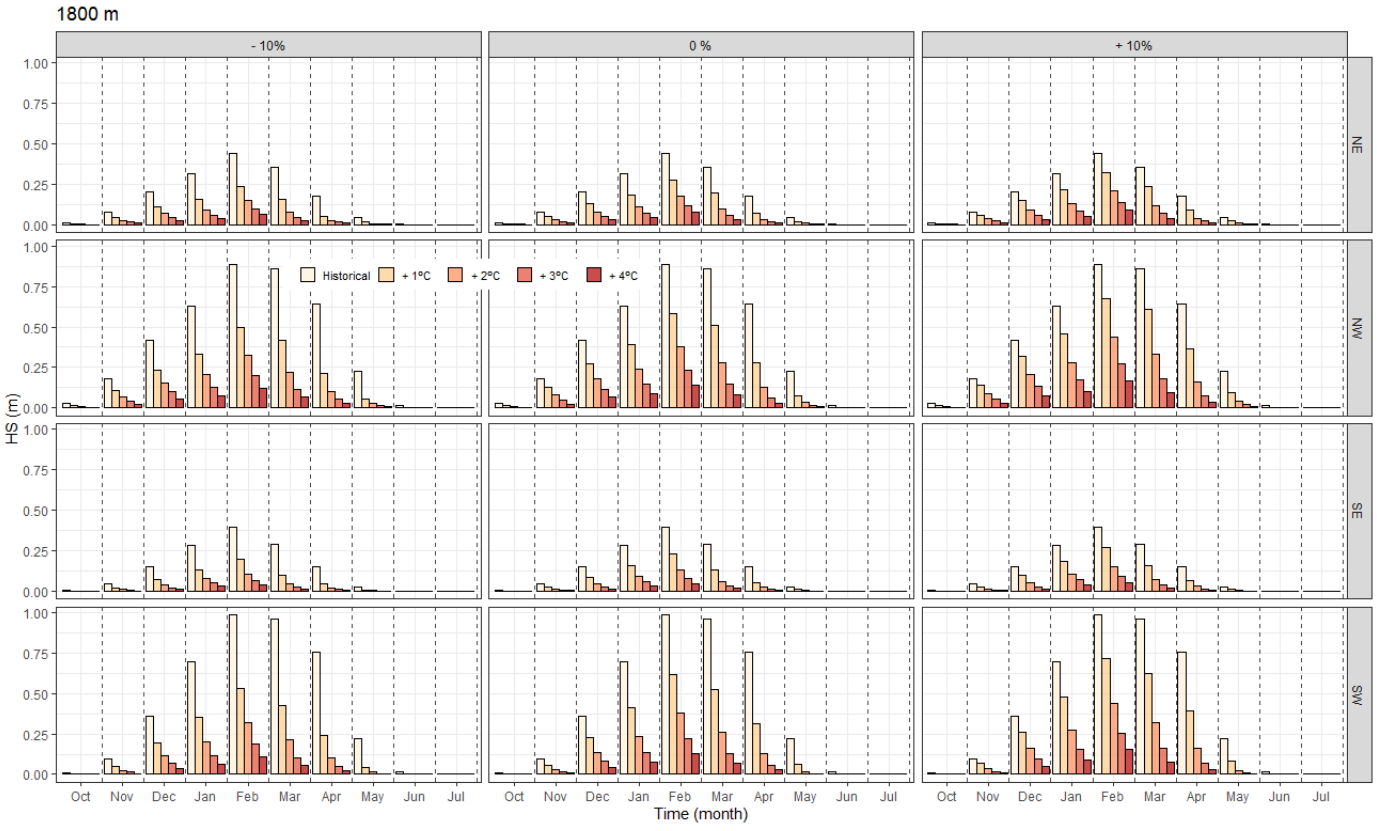

Figure S2. Height of snow (HS) monthly variation at 1800 m for the historical climate period (1980 – 2019) and different increments of temperature (colors) grouped by sector and precipitation changes (boxes).

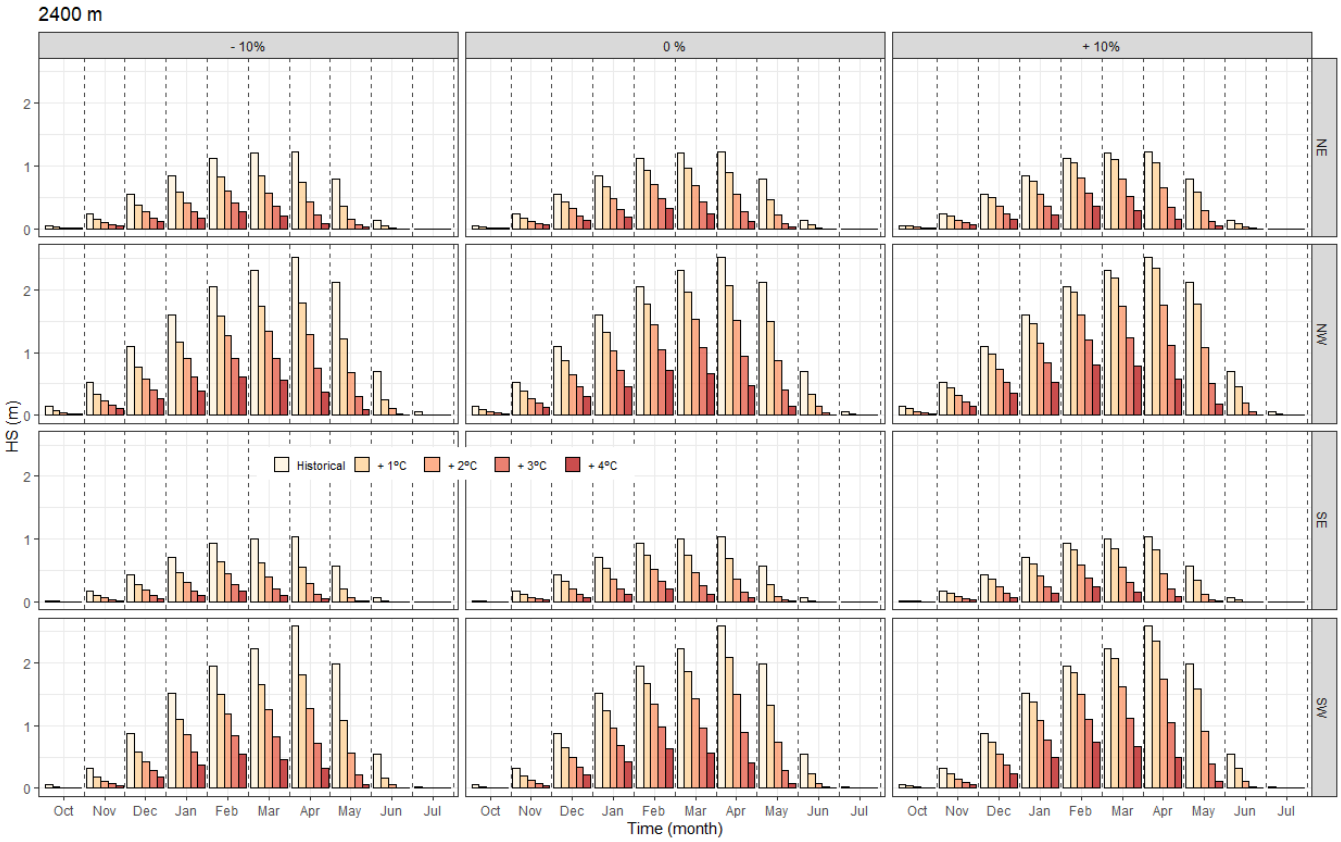

Figure S3. Height of snow (HS) monthly variation at 2400 m for the historical climate period (1980 – 2019) and different increments of temperature (colors) grouped by sector and precipitation changes (boxes).

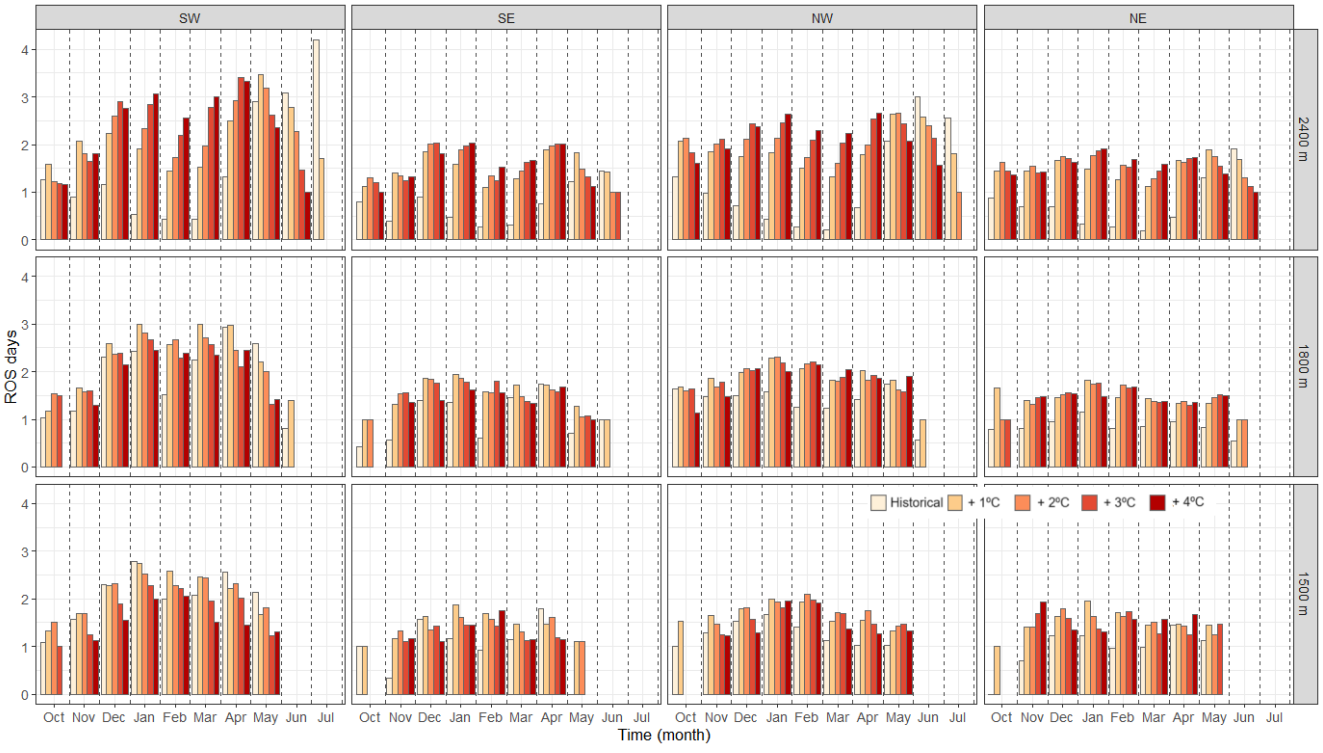

Figure S4. ROS frequency (days). Data are presented for the historical climate period (1980 – 2019) with different increments of temperature (colors), grouped by month (x-axis), elevations and sectors (boxes). Data represent the average of the simulated precipitation changes (ranging from -10% to + 10%, with increments of 10%).

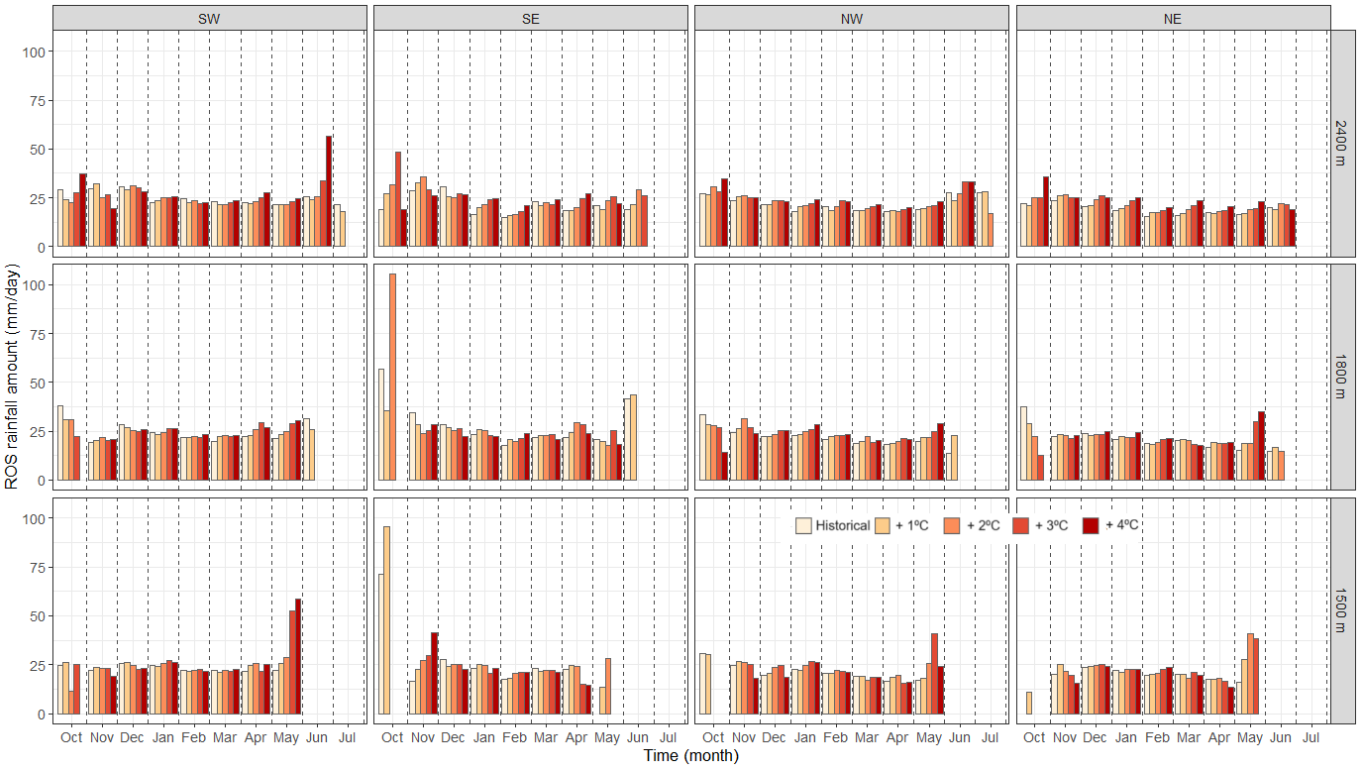

Figure S5. Average ROS rainfall amount (mm/day). Data are presented for the historical climate period (1980 – 2019) with different increments of temperature (colors), grouped by month (x-axis), elevations and sectors (boxes). Data represent the average of the simulated precipitation changes (ranging from -10% to + 10%, with increments of 10%).

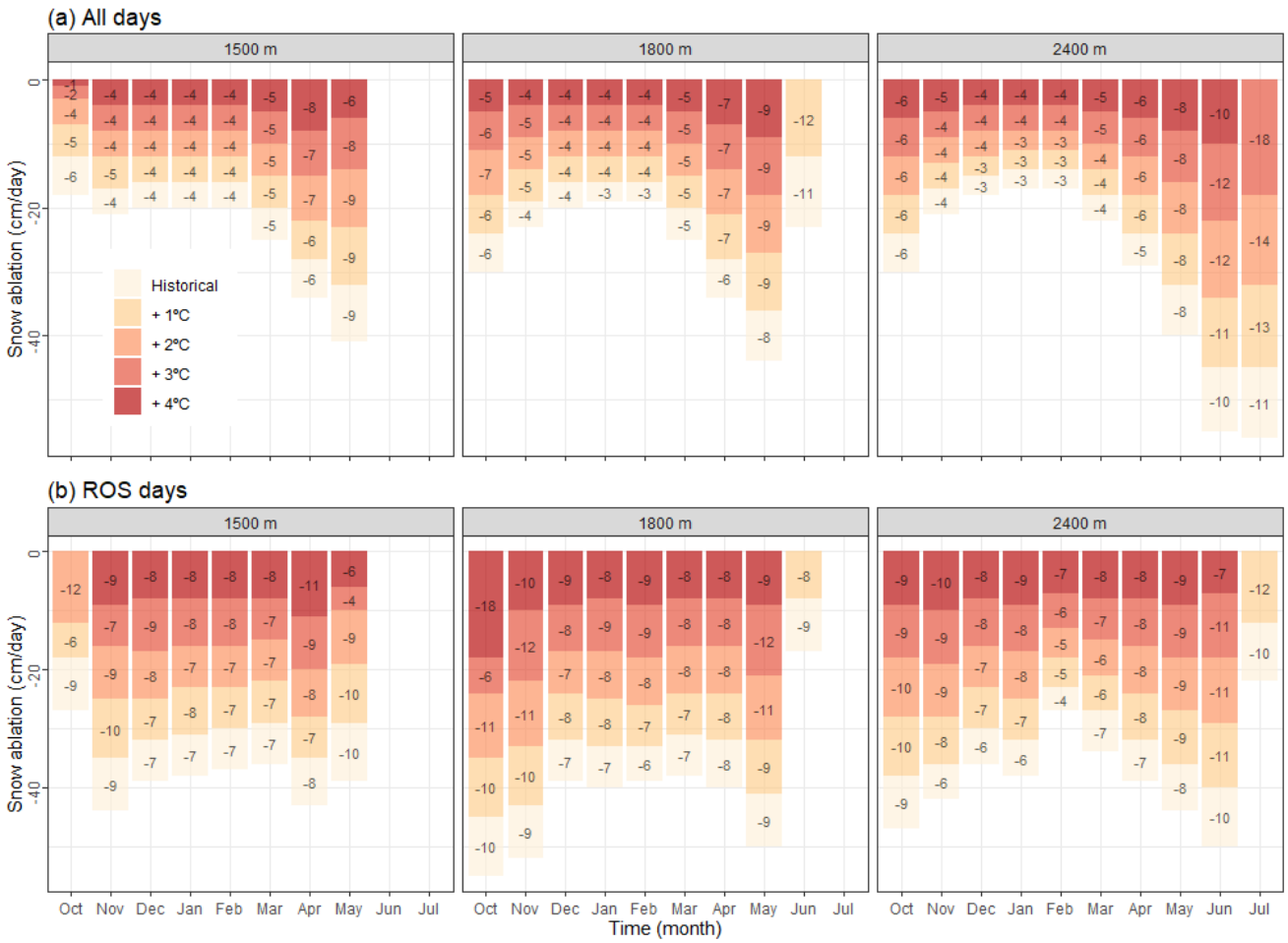

Figure S6. (a) All days and (b) ROS days average daily snow ablation (cm/day).

Table S1. FSM2 configuration implemented in this work.

FSM2 Physics and driving data options	**Configuration name**	**Fortran compilation number**
Albedo	Prognostic age function	2
Snow conductivity	Function of density	1
Snow density	Function of overburden	2
Turbulent exchange	Richardson number atmospheric stability adjustment	1
Snow hydrology	Gravitational drainage	2
Snow cover fraction	Linear function of snow depth	1

Table S2. ROS frequency, rainfall intensity and snow ablation average anomalies per ºC over the historical climate period.

Elevation	Sector	ROS rainfall amount	ROS frequency	ROS albation
1500 m	SW	+2.5	0	+0.5
	SE	+4.7	0	-0.2
	NW	+3.8	0	-0.2
	NE	+4.7	0	-0.3
1800 m	SW	+2.5	0	+0.8
	SE	+5.2	0	+0.1
	NW	+3.7	0	+0.4
	NE	+5.0	0	+0.4
2400 m	SW	+5.2	1	+0.4
	SE	+6.4	1	+0.1
	NW	+5.3	1	+0.5
	NE	+6	0	+0.7