INTERNATIONAL MOUNTAIN CONFERENCE
SEPTEMBER 14 - 18 2025

>> SYNTHESIZE MOUNTAINS OF KNOWLEDGE <<

FS 3.135 Global and regional patterns of Elevation-Dependent Climate Change in the world's mountains

Elevation-Dependent Effects of Climate Change on Snowpack in Spanish Mountains

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CSIC

Water

Vegetation

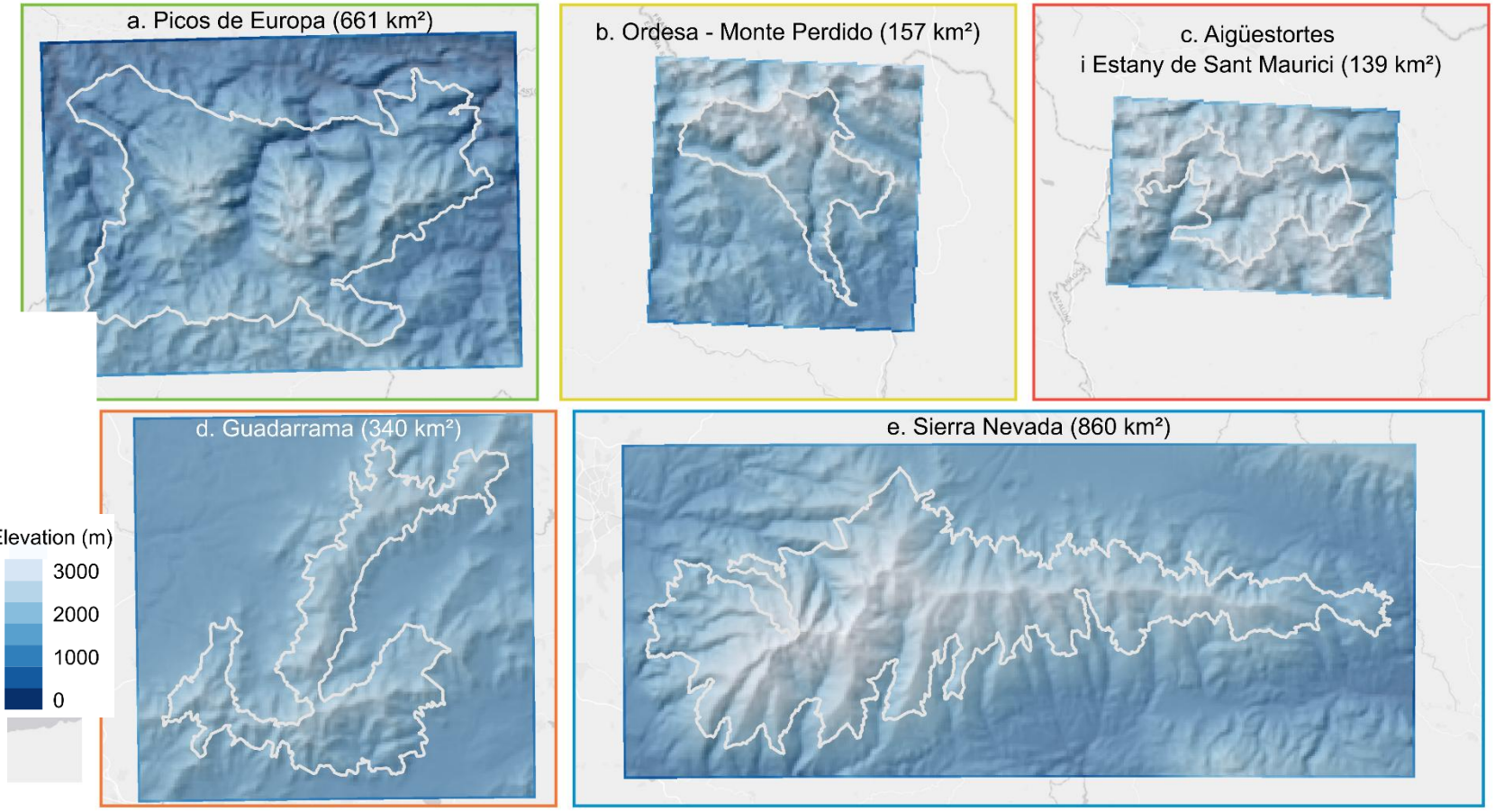
Fauna

Natural hazards

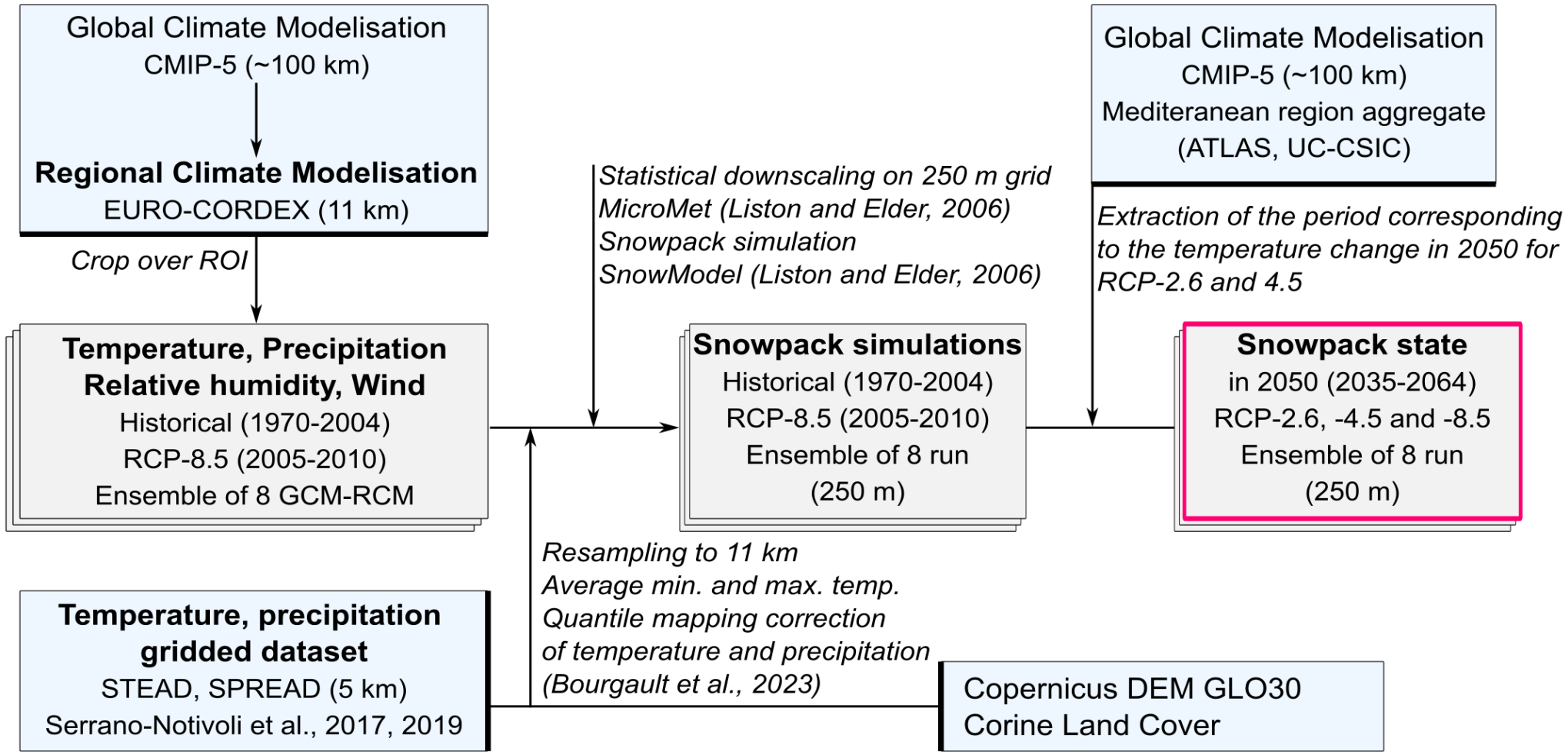
Tourism

Glaciers

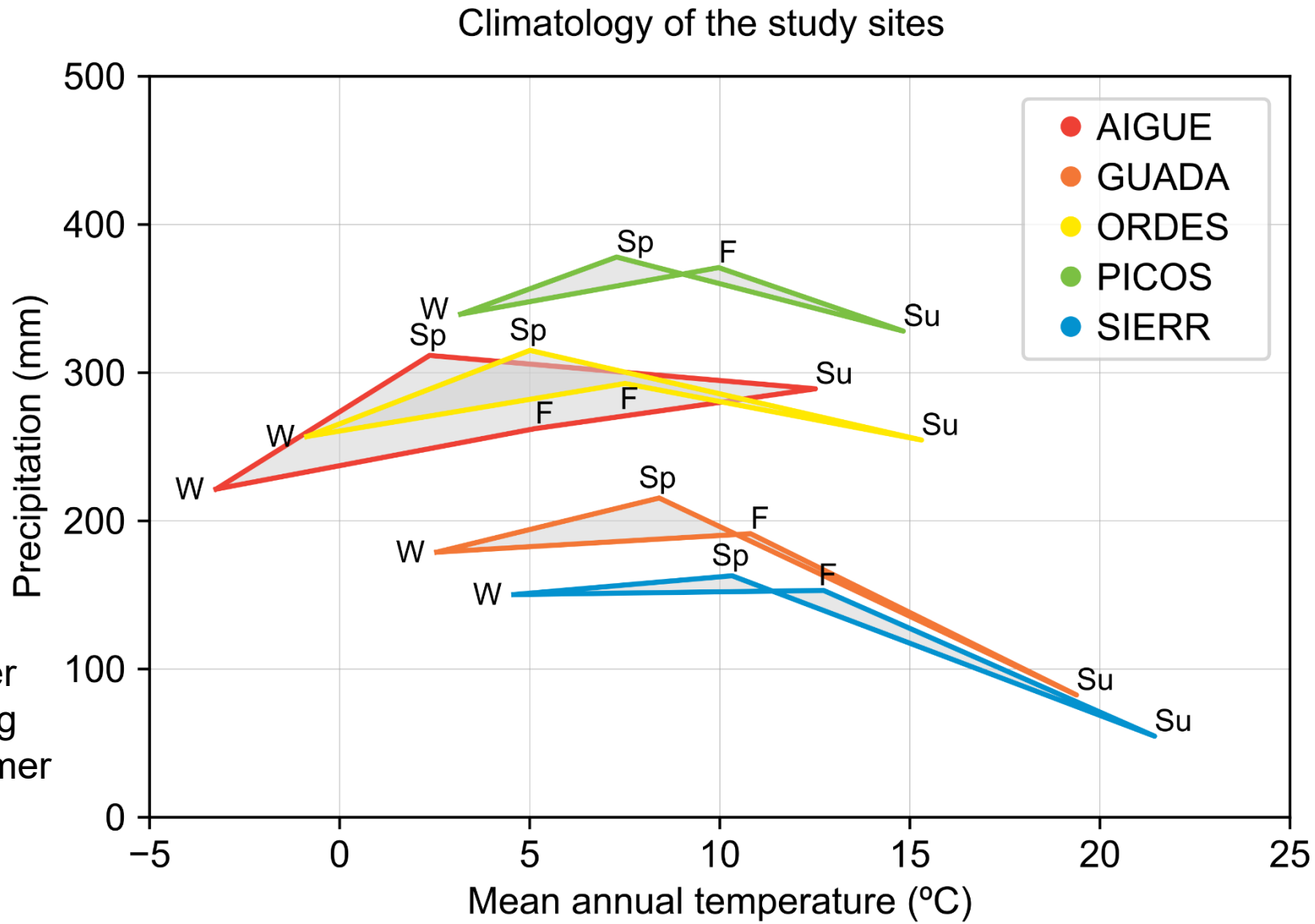

Picos
Ordesa
Aigüestortes
Guadarrama
Sierra Nevada

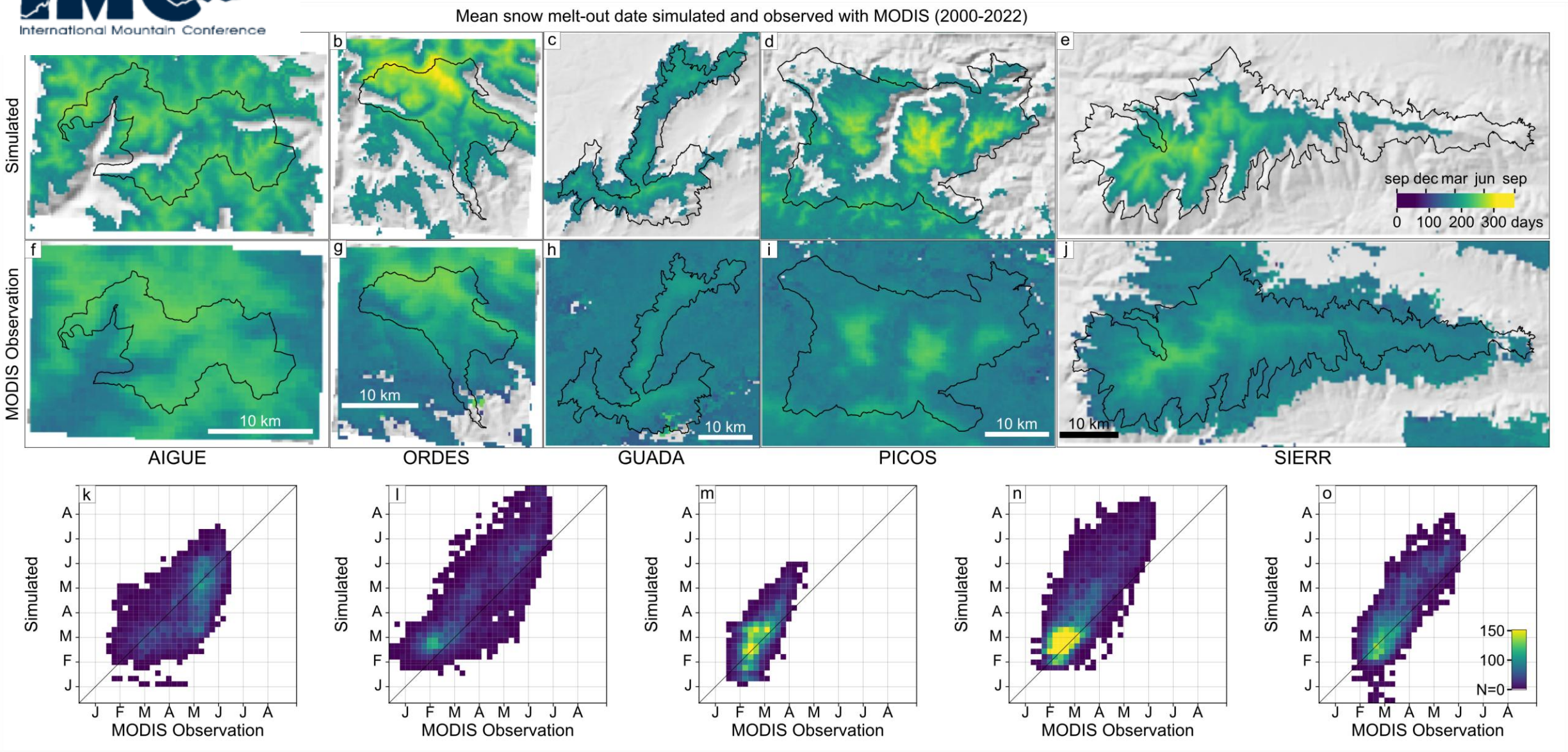

a. Picos de Europa (661 km²)
b. Ordesa - Monte Perdido (157 km²)
c. Aigüestortes
i Estany de Sant Maurici (139 km²)
d. Guadarrama (340 km²)
e. Sierra Nevada (860 km²)
Elevation (m)
3000
2000
1000
0

Objective: Simulate changes in snowpack in Spanish National Parks under different RCP scenarios for 2050, and assess how these changes vary with elevation.



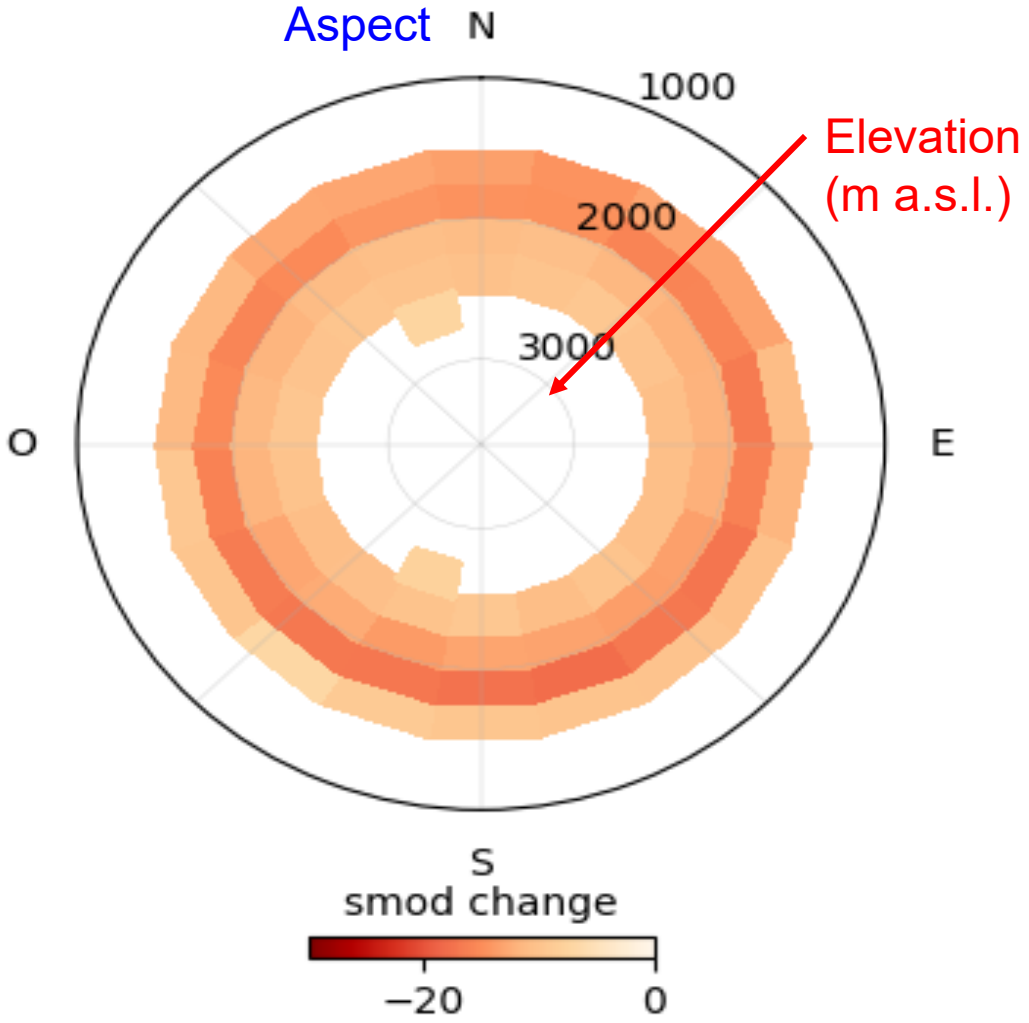
W: Winter
Sp: Spring
Su: Summer
F: Fall




Mean snow melt-out date simulated and observed with MODIS (2000-2022)
Simulated
MODIS Observation
sep dec mar jun sep
0 100 200 300 days
10 km
AIGUE
ORDES
GUADA
PICOS
SIERR
Simulated
MODIS Observation
J F M A M J J A
A J J M A M F J
150
100
N=0

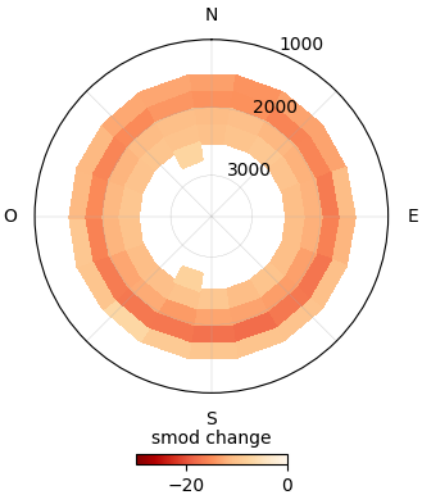
Advance of Melt out date dSMOD (in days) RCP 4.5 for 2050

Picos de Europa NP

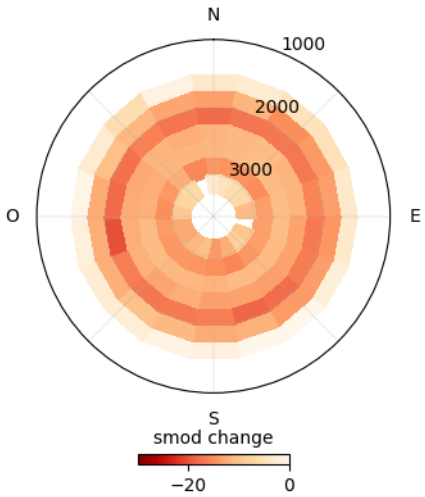


Advance of Melt out date dSMOD (in days) RCP 4.5 for 2050

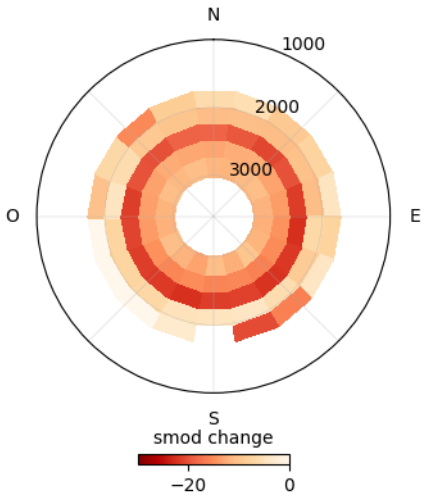
Picos



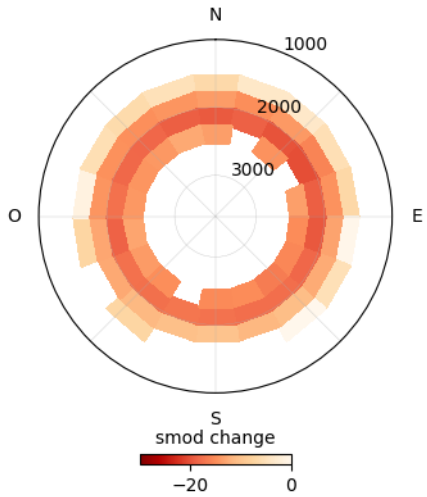
Ordesa



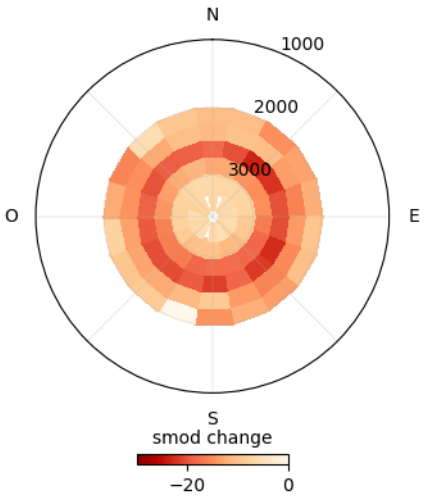
Aigües Tortes



Guadarrama

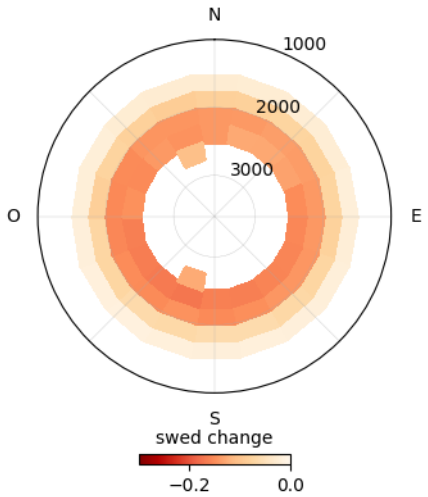


Sierra Nevada



Reduction of average Winter-Spring SWE (dSWE, m w.e.), RCP for 4.5

Picos



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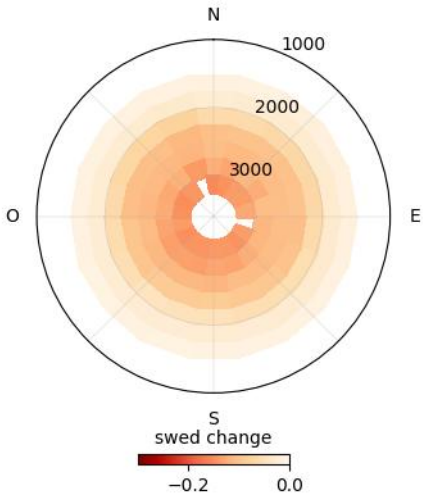
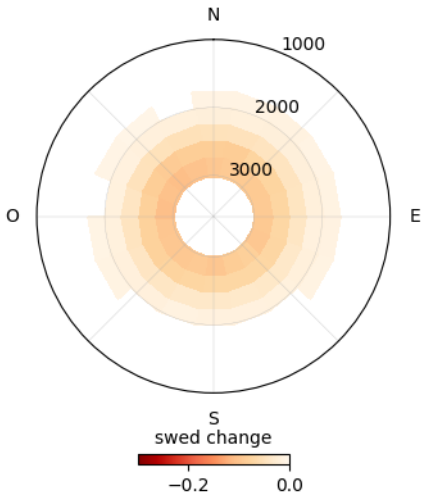
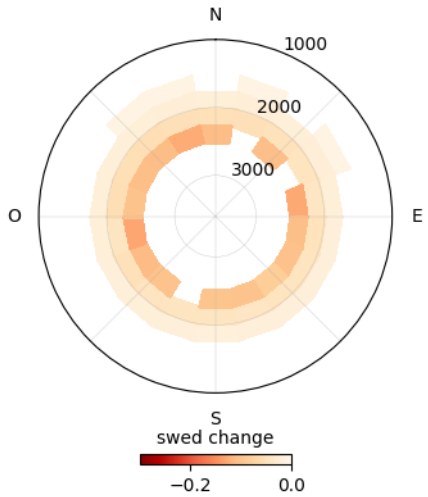


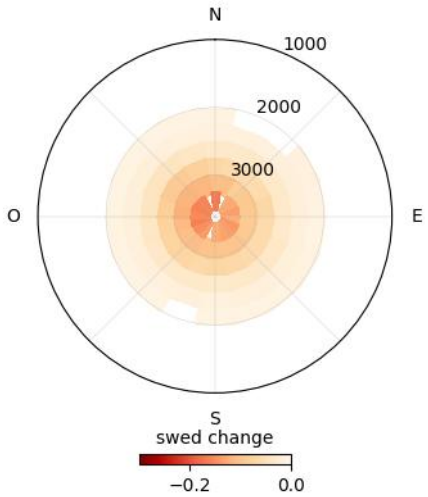
Aigües Tortes



Guadarrama

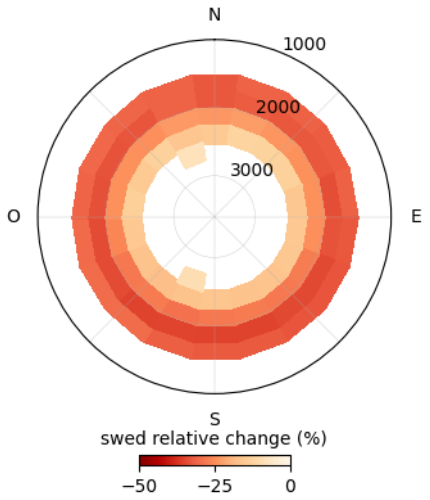


Sierra Nevada



Reduction of SWE relative to mean SWE (%), RCP 45 for 2050

Picos



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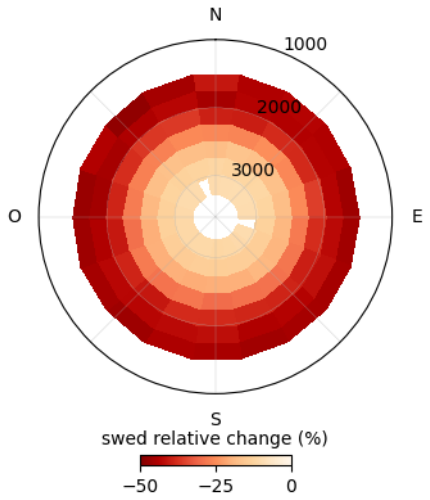
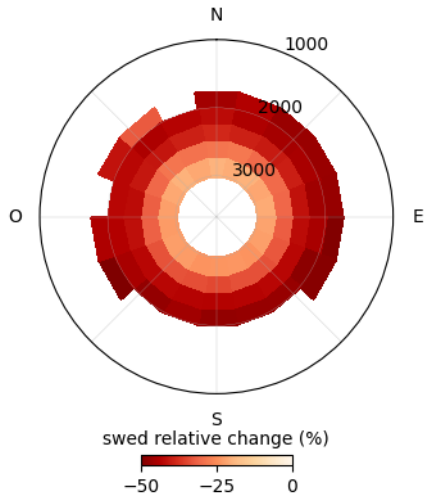
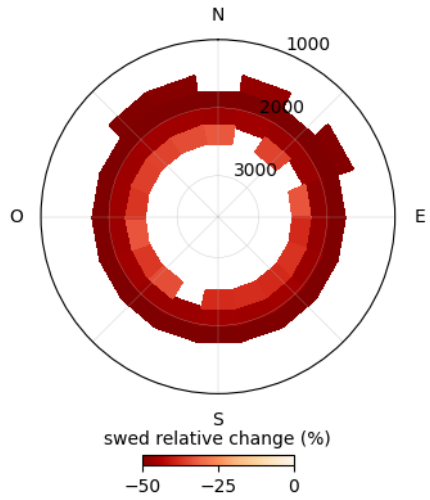


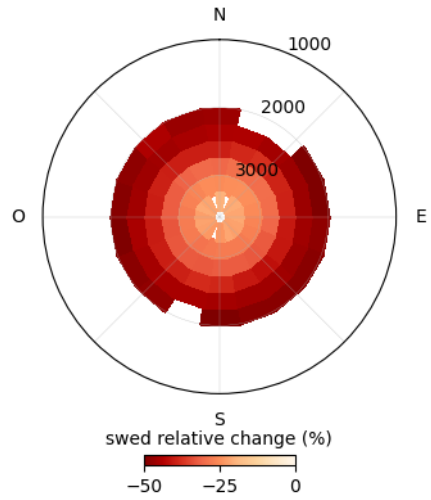
Aigües Tortes



Guadarrama

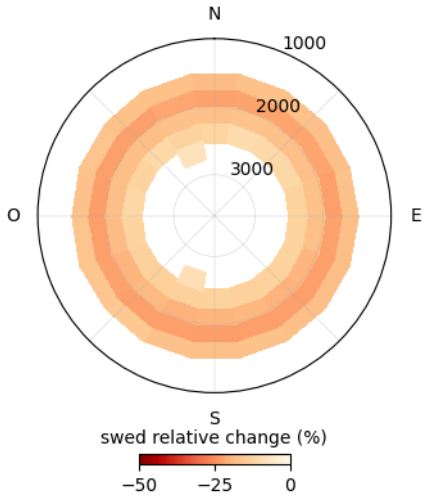


Sierra Nevada



Reduction of annual Peak SWE (%) RCP 45

Picos



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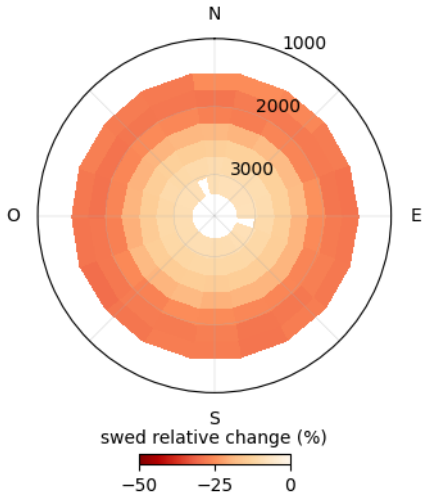
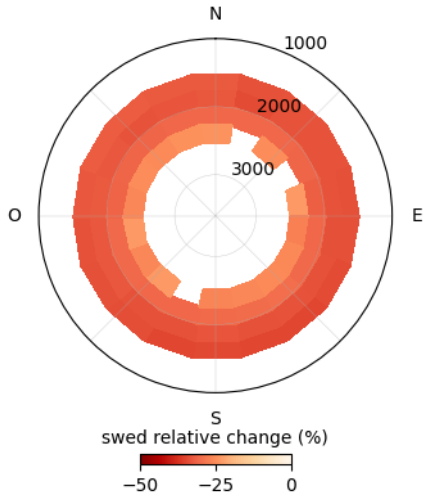
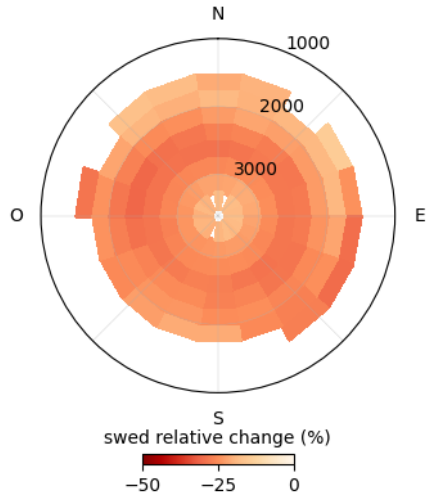


Aigües Tortes

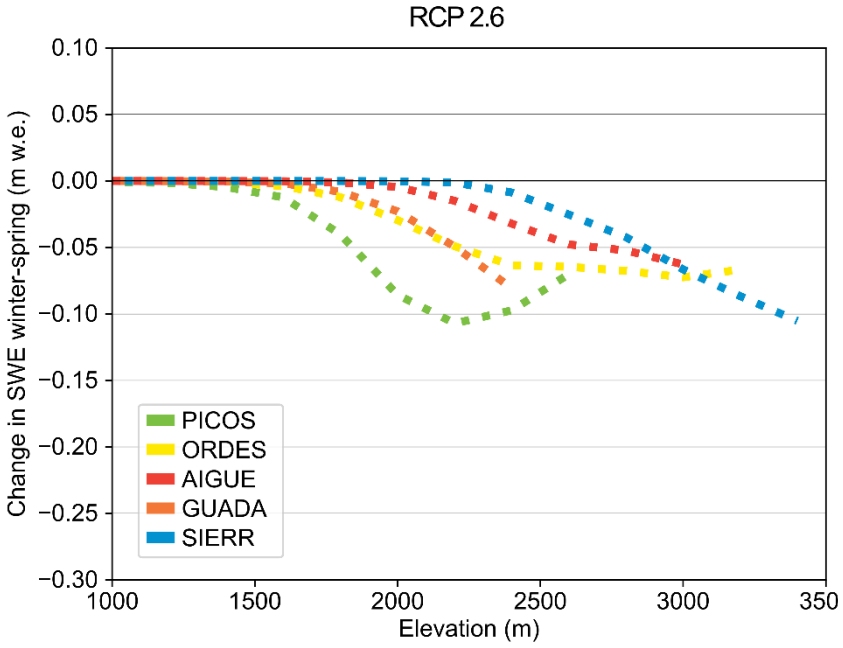
Guadarrama

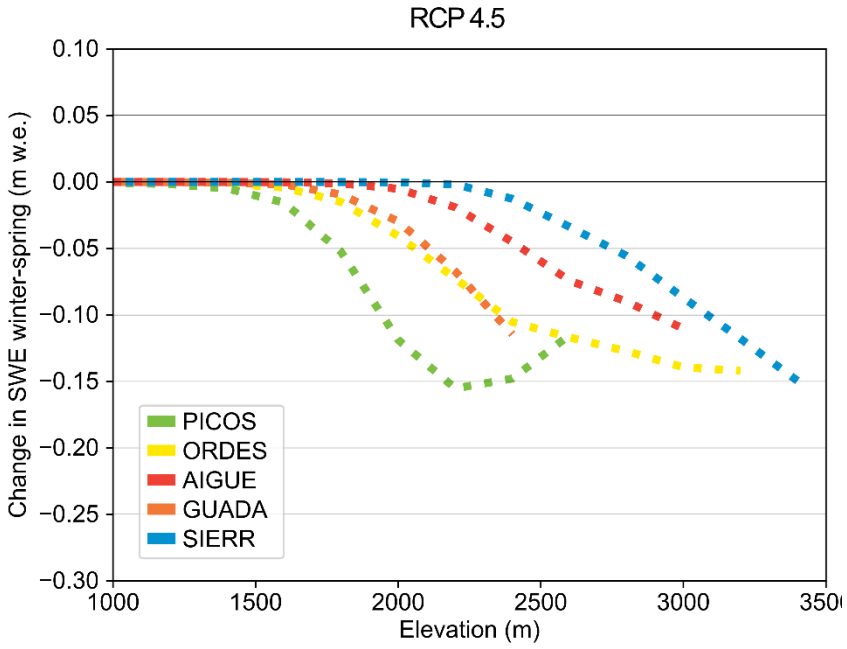


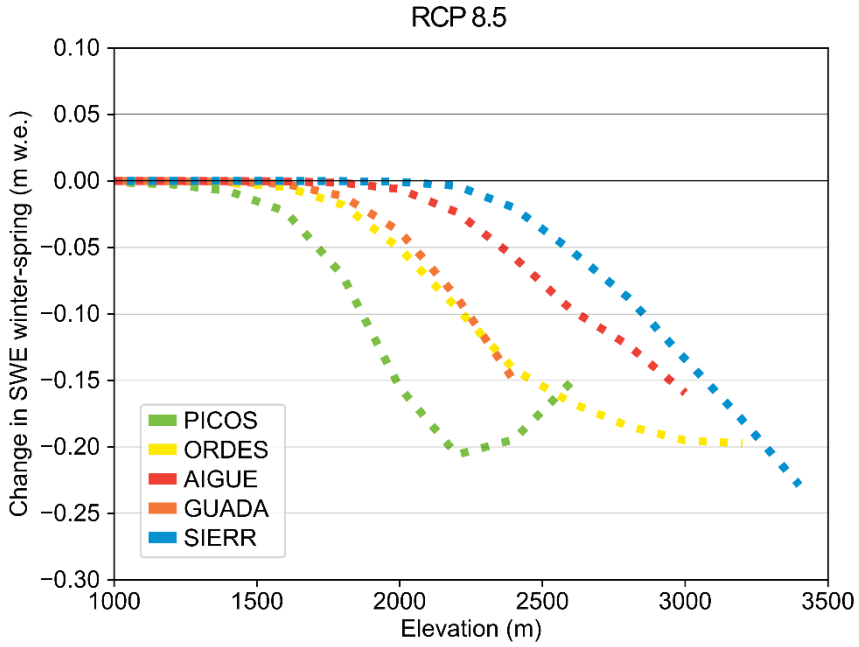
Sierra Nevada



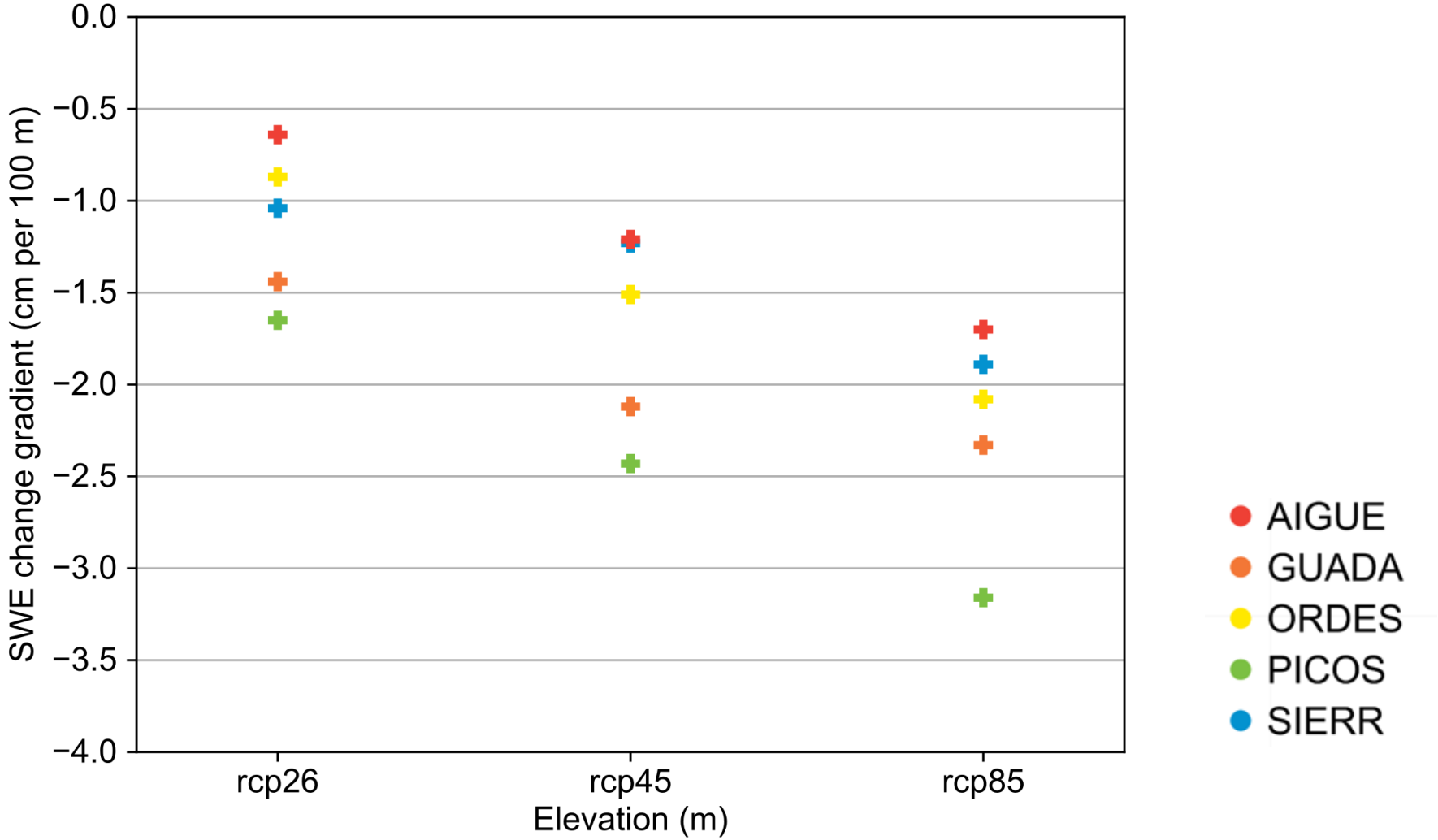
Change in SWE (m w.e.) for all Parks (RCP 2.5, 4.5 and 8.5 for 2050)



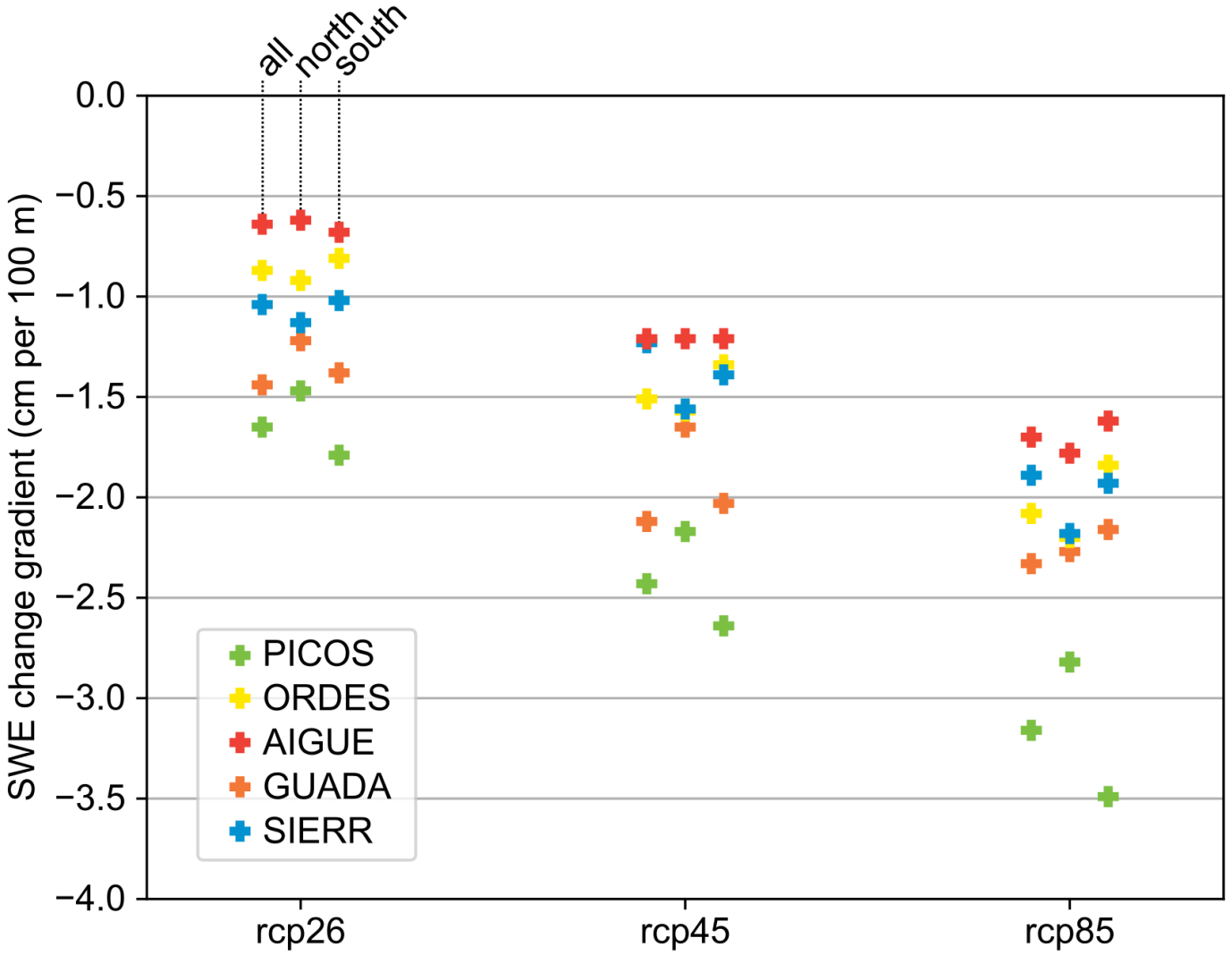




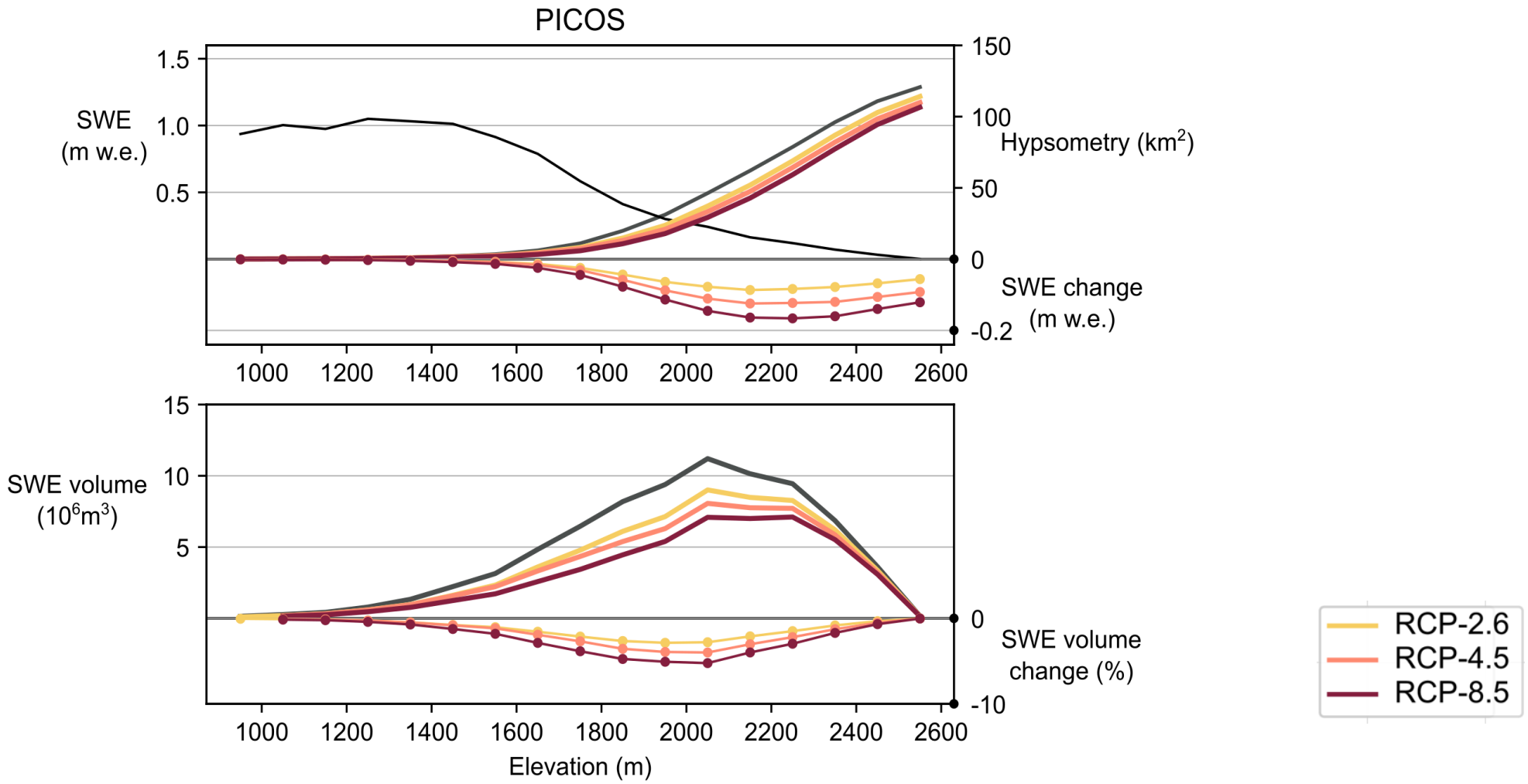
Gradient of change in SWE for all Parks (RCP 45)



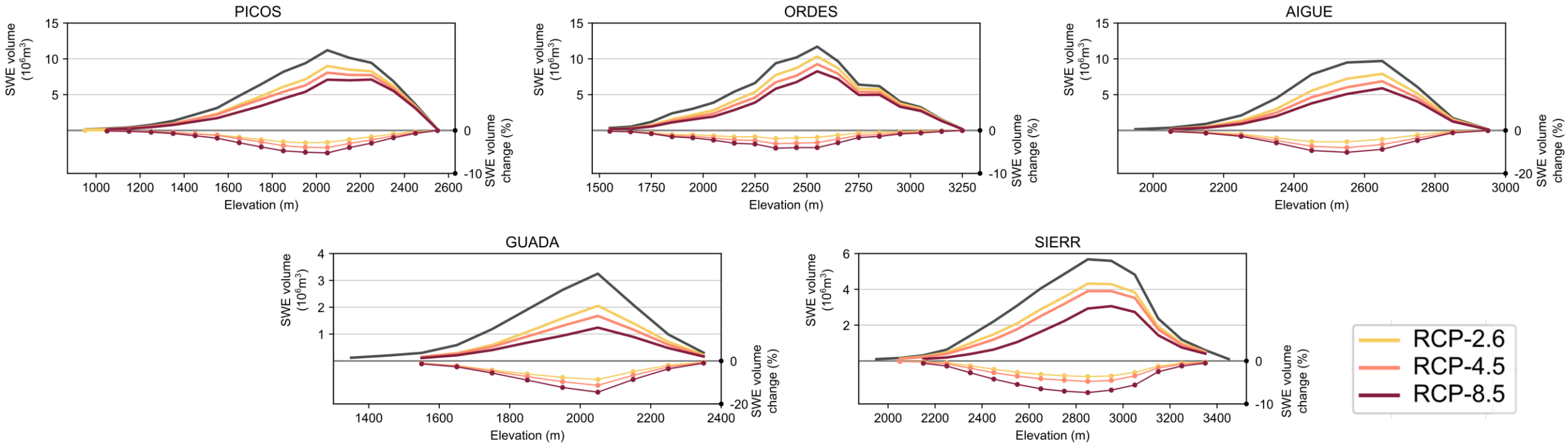
Gradient of change in SWE for all Parks (RCP 45)



Present and future SWE stock by elevation bands



Present and future SWE stock by elevation bands



Conclusions

• Snowmelt will come earlier, and SWE will decrease noticeably in Spanish National Parks, even under moderate RCPs by 2050.

•Changes in snowpack strongly depend on elevation. Absolute losses are bigger at high elevations, but percentage-wise, lower elevations show larger relative changes.

•Snow declines faster and lapse rates of change are steeper on south-facing slopes under warmer climates. More research is needed to explain differences among Parks.

•The shape of the mountains (hypsometry) really matter to spot areas with the most snow reserves and to estimate changes in total snow stocks. The detected snow hotspots deserve particular attention

Thanks!

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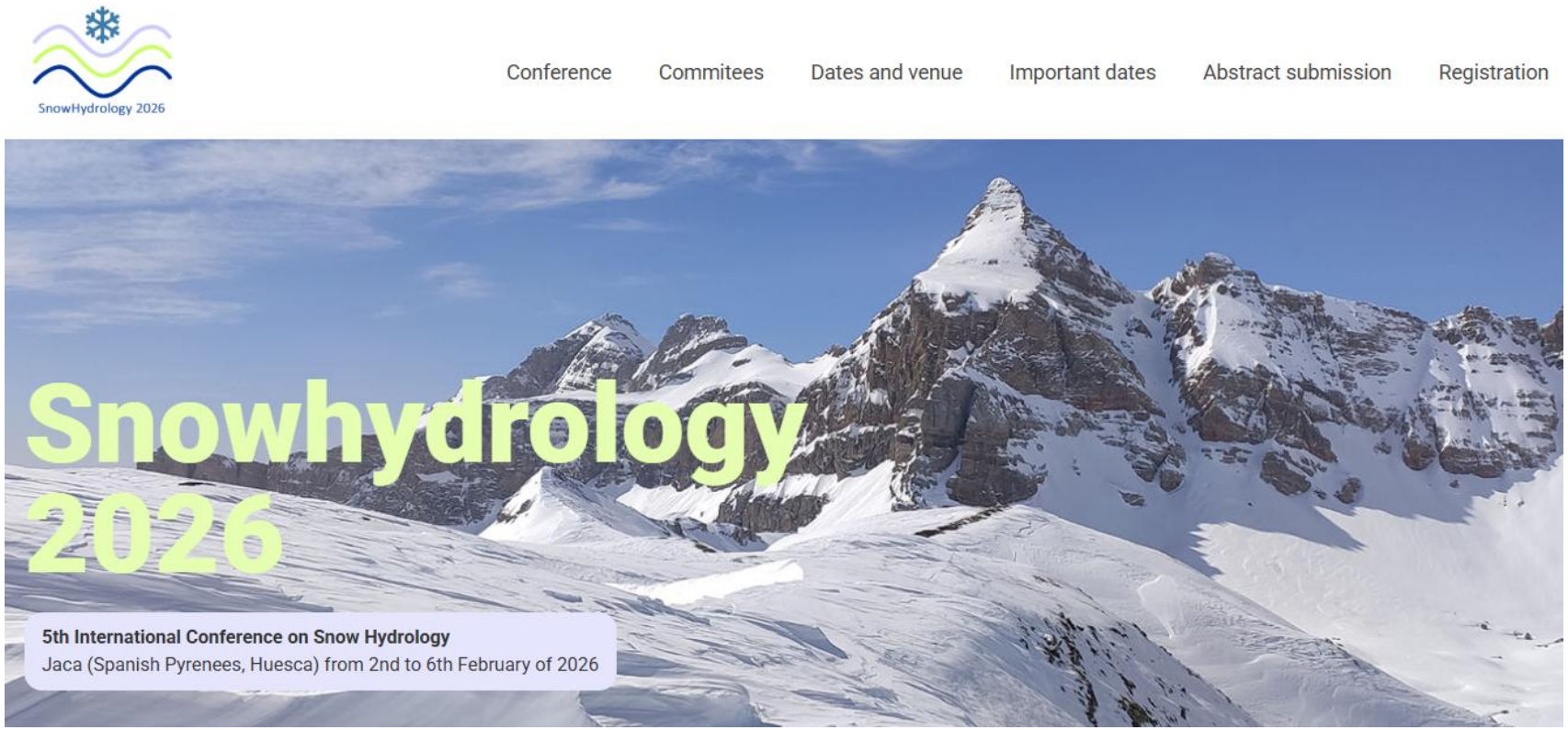
Abstract submission deadline: October 10th

https://snowhydro.unirioja.es/

2-6 February 2026, Jaca, Pyreenees



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