Investigating the changing characteristics of precipitation in the mid- to high-latitudes
An example from Norway

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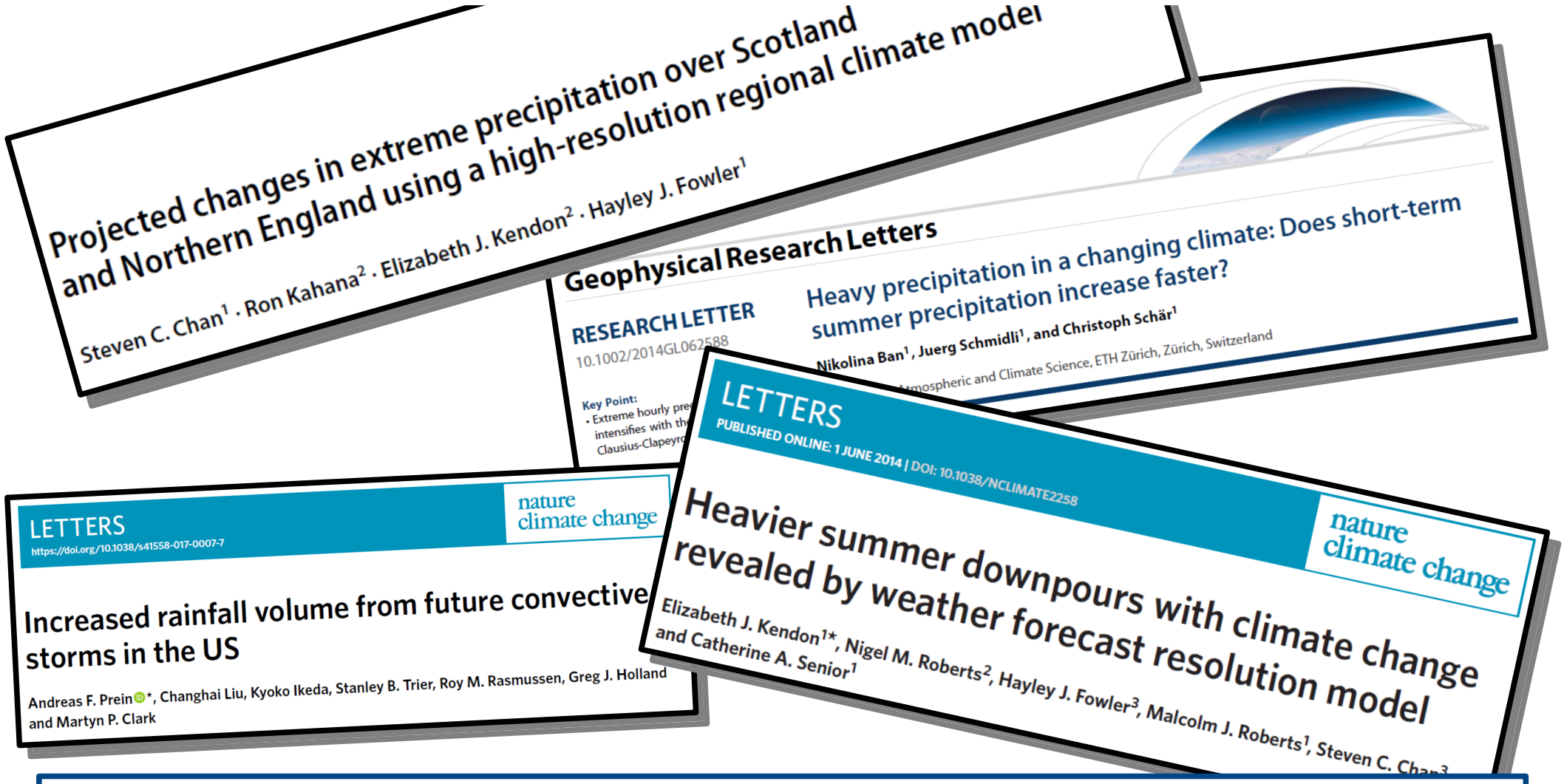
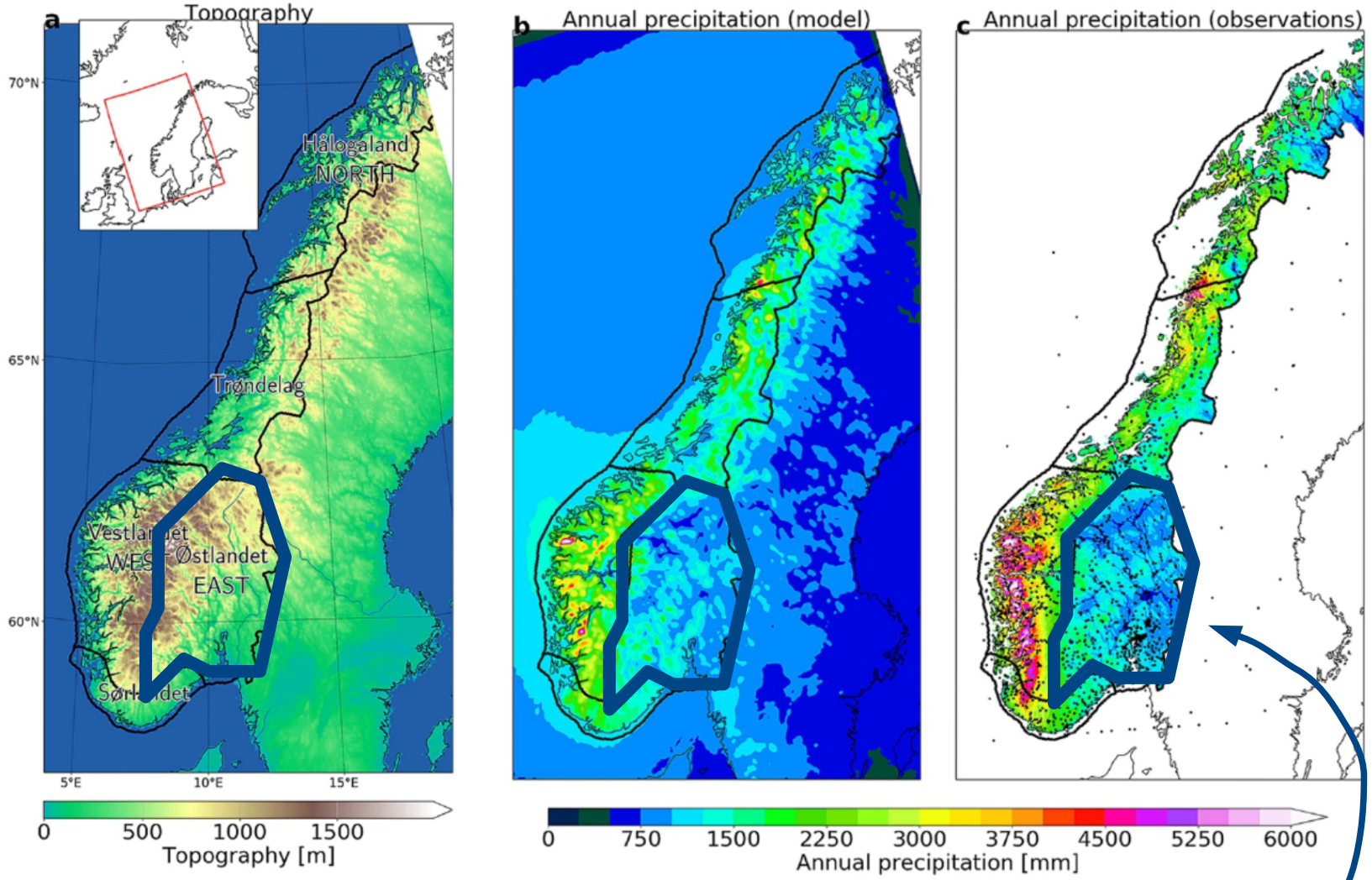
Introduction



Dynamic processes leading to precipitation formation are **explicit.**

Can we use this to build **process understanding in future precipitation changes** ?

Study region



This presentation focuses on Eastern Norway
Drier, more continental climate

Study setup

WRF convection-permitting simulations

3km resolution

Historical :

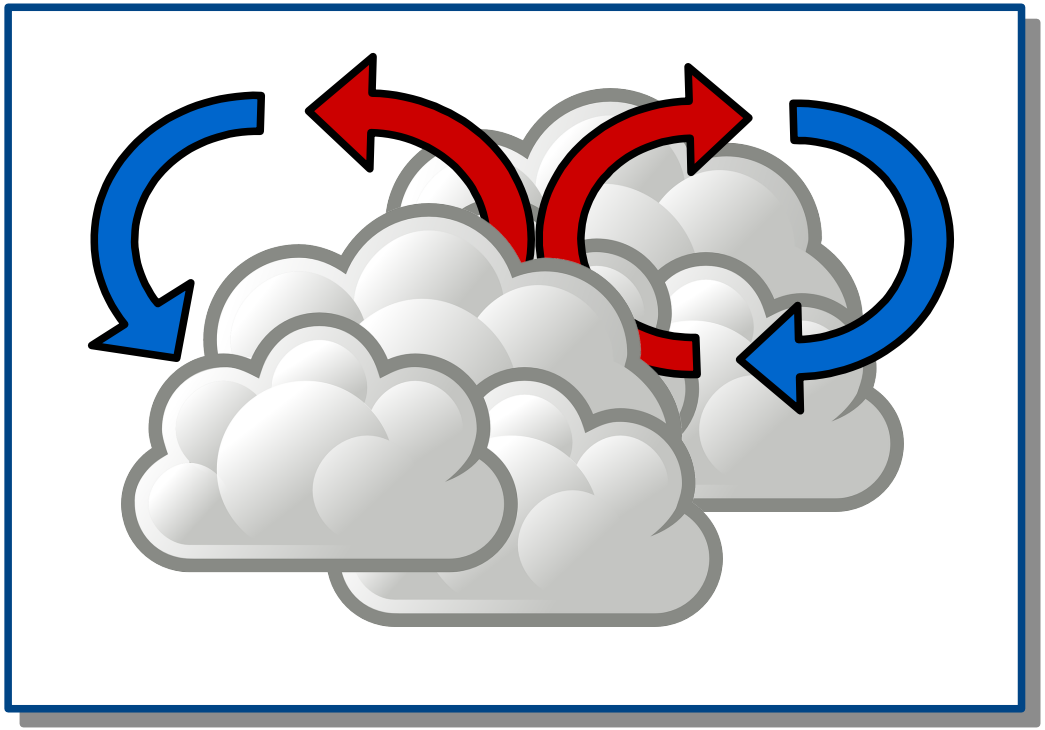
Forced by ERA-Interim

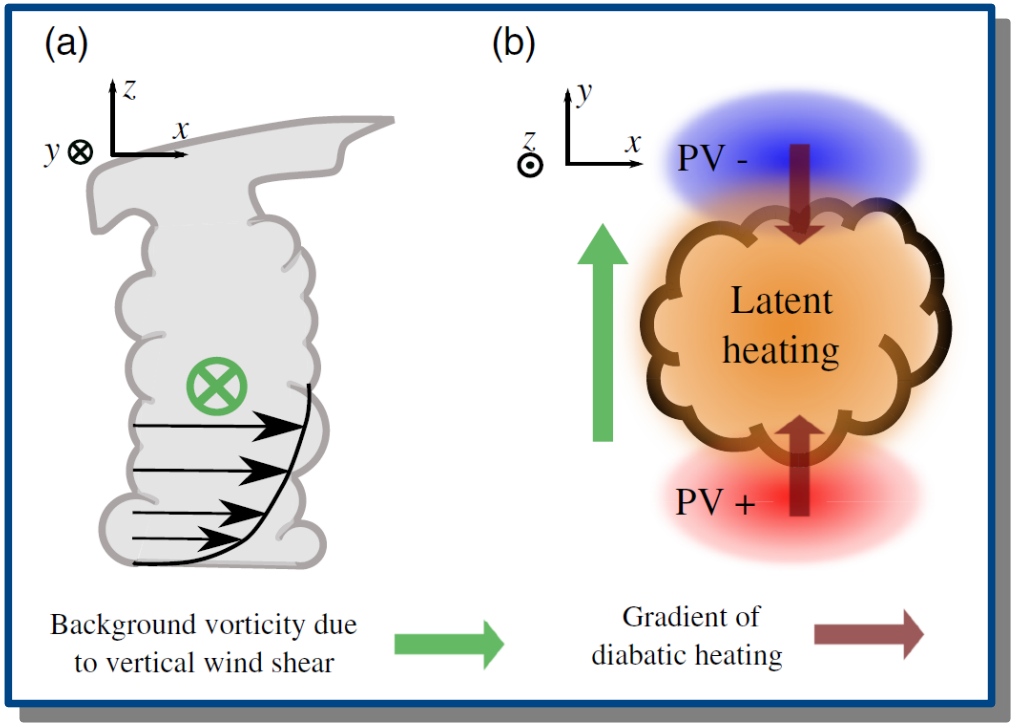
1996-2005

Pseudo-global warming :

Perturbation corresponding to *2035-2065 under RCP8.5*

Precipitation separation algorithm





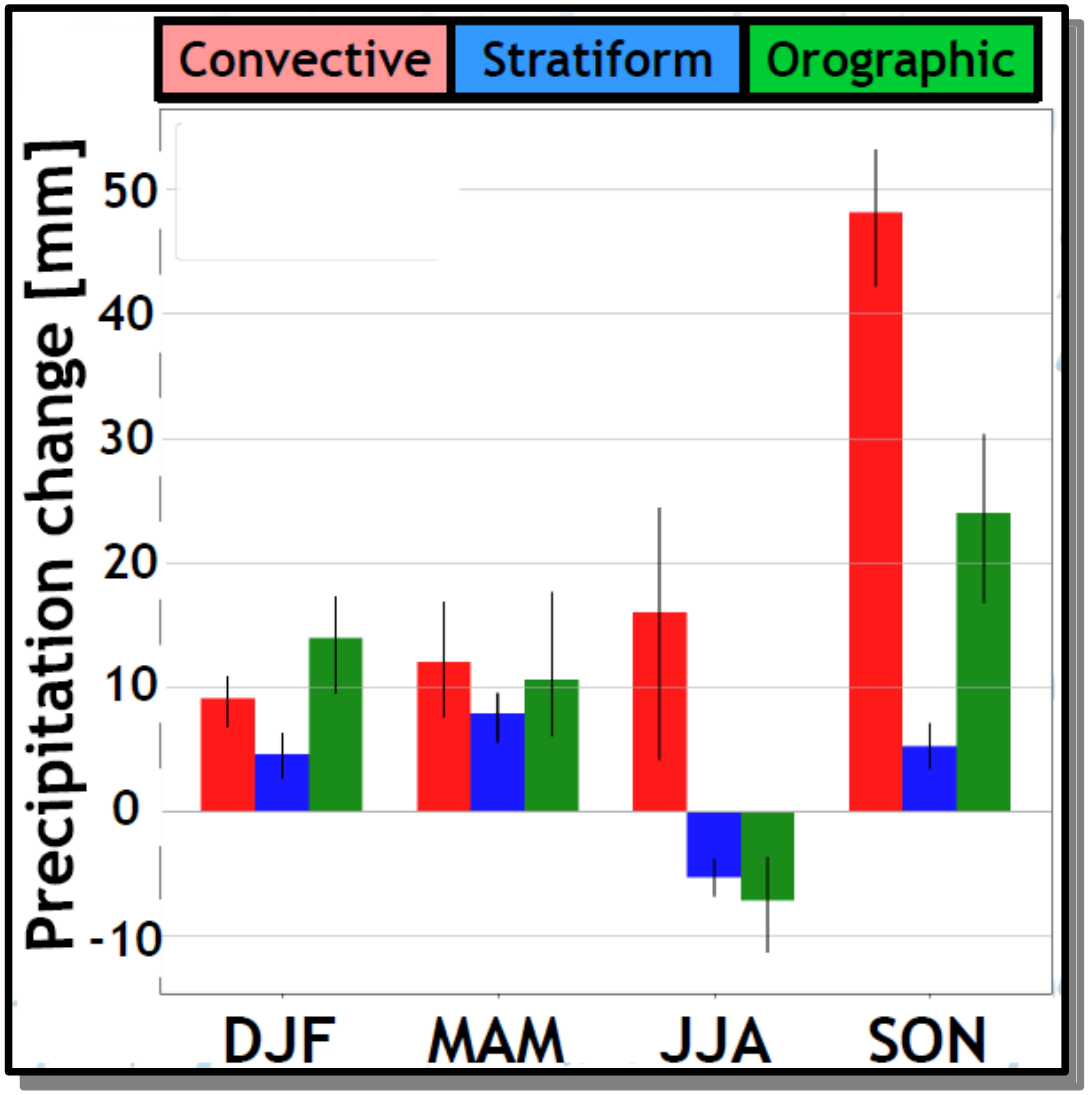
Over flat terrain

Over complex terrain

Algorithm described in : Poujol, B., Sobolowski, S. P., Mooney, P. A., & Berthou, S. (2020). A physically based precipitation separation algorithm for convection-permitting models over complex topography. Quarterly Journal of the Royal Meteorological Society, 146(727), 748-761.

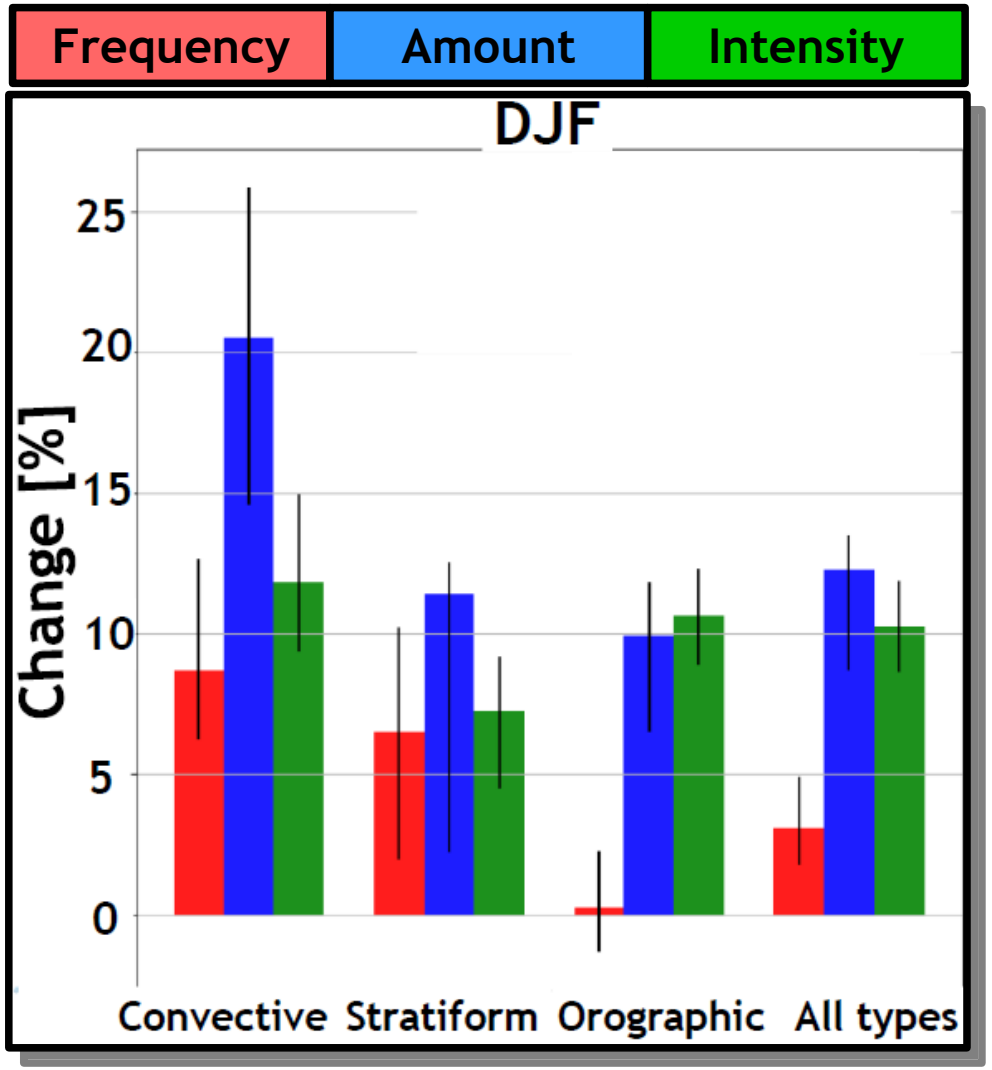
NB : In the results histograms that follow, wind speed was taken at 500hPa instead of 700hPa for estimating upwind vertical velocity, which is not exactly the algorithm version described in the above paper.

Results



Large dependence on the precipitation type

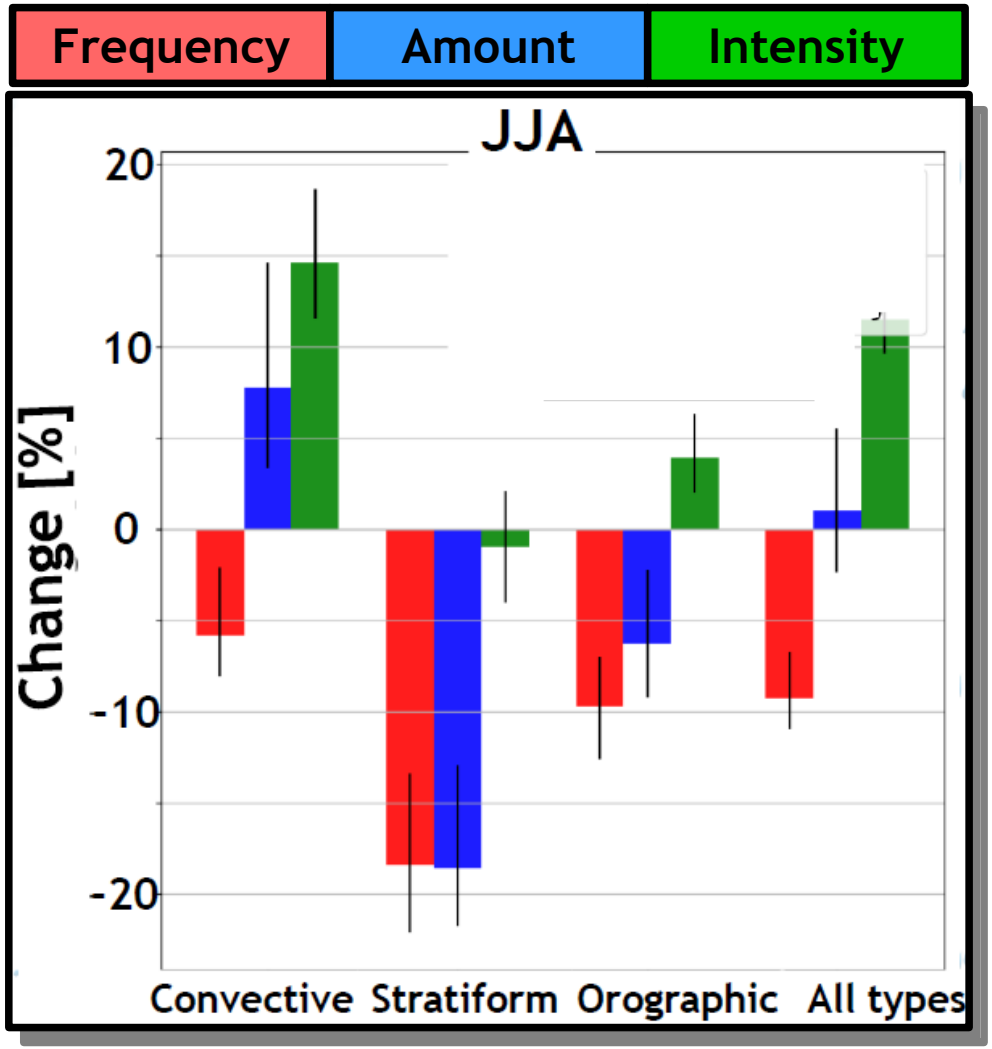
Results



Increase in precipitation intensity (close to CC scaling)

More frequent wintertime convection

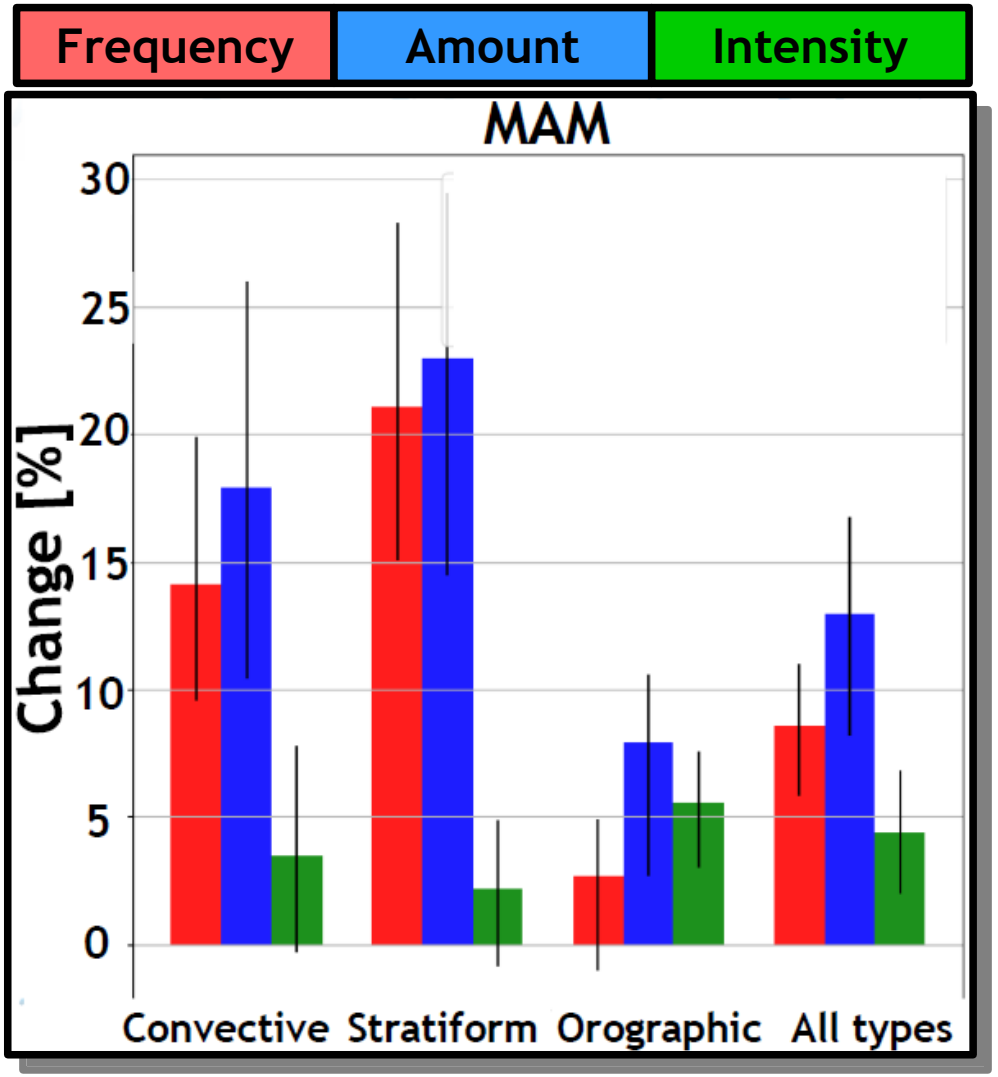
Results



Increase in convective precip intensity (larger CAPE)

Decrease in precipitation frequency (drier, larger CIN)

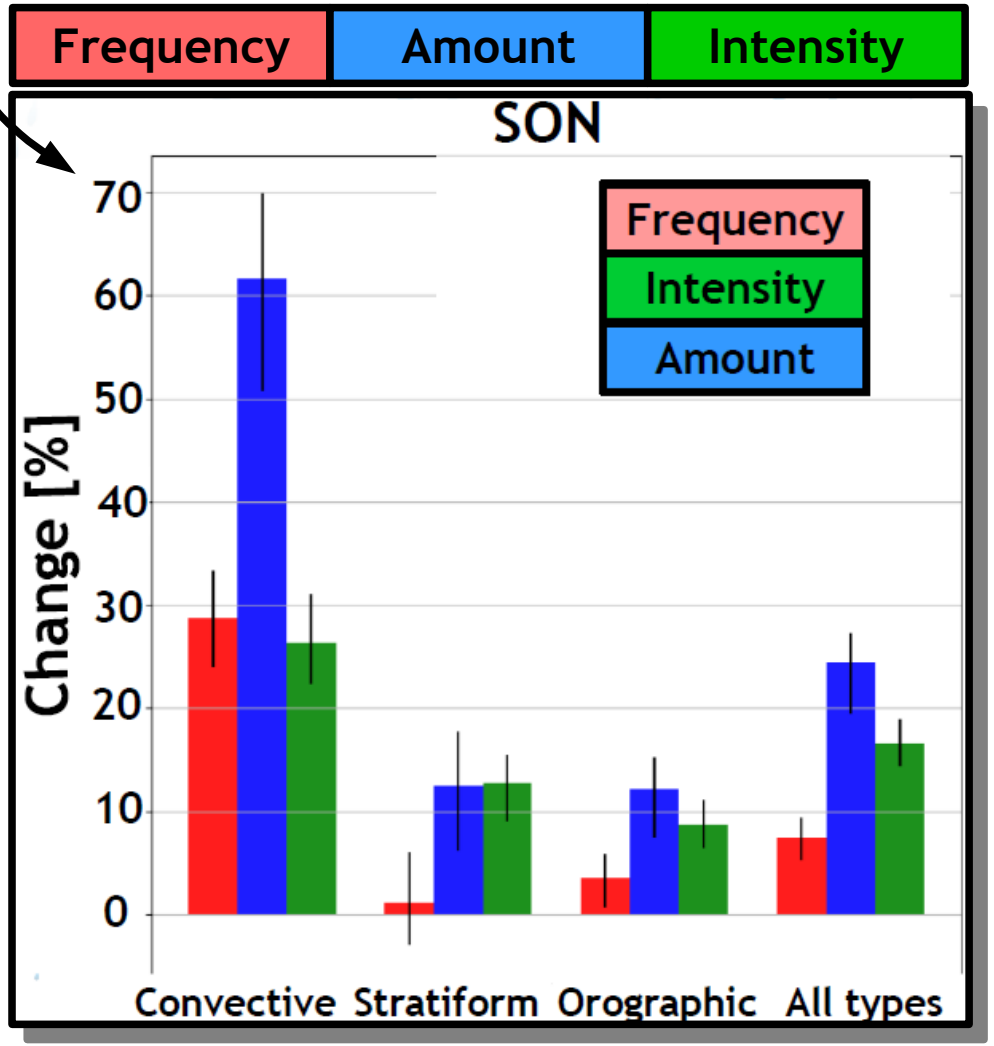
Results



More frequent
spring convection

Results

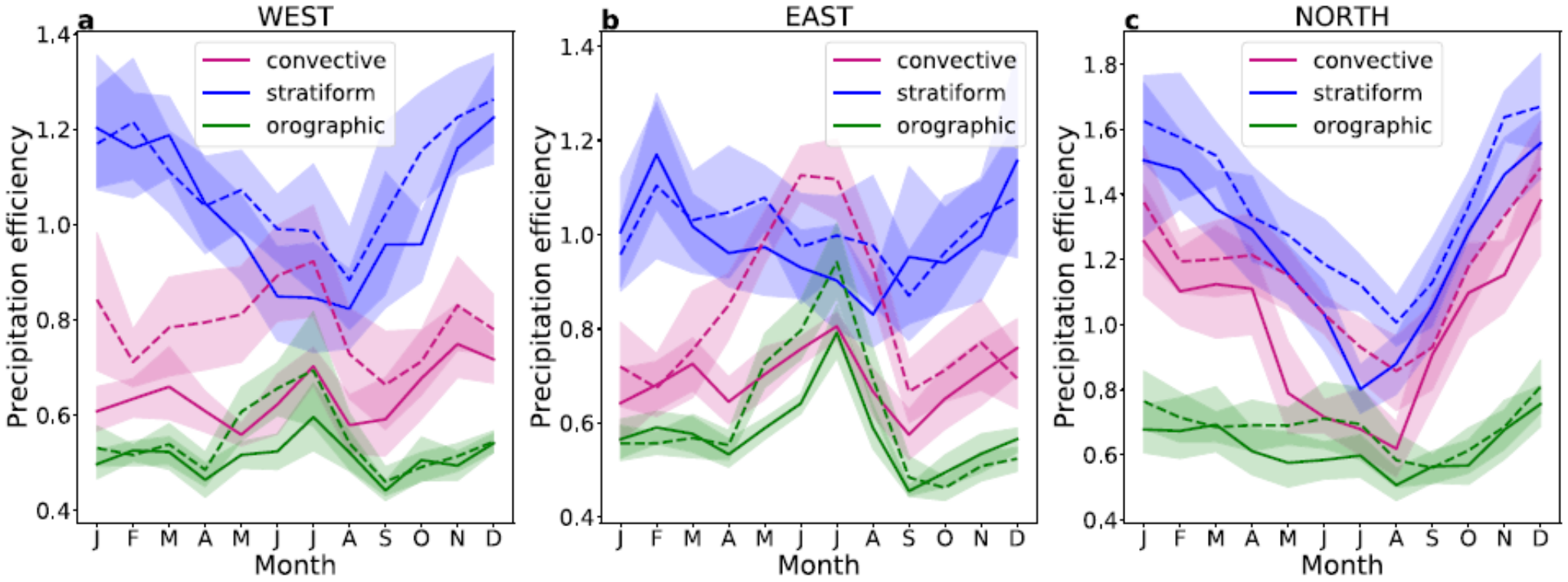
Note the scale



Intensification of convection (well above CC scaling)

Also more frequent autumn convection

Results



Clear increases in summertime convective precipitation efficiency

Conclusions

Large dependence of future precipitation changes on the precipitation type

Brings possible insight into the processes

Currently applied over other European mountain ranges with complex terrain

Figures for other subregions, precipitation distributions :

Poujol, B., Mooney, P. A., & Sobolowski, S. P. (2021). *Physical processes driving intensification of future precipitation in the mid-to high latitudes*. Environmental Research Letters, 16(3), 034051.

Same method on the Alpine region : Torge Lorenz's talk at end of the session