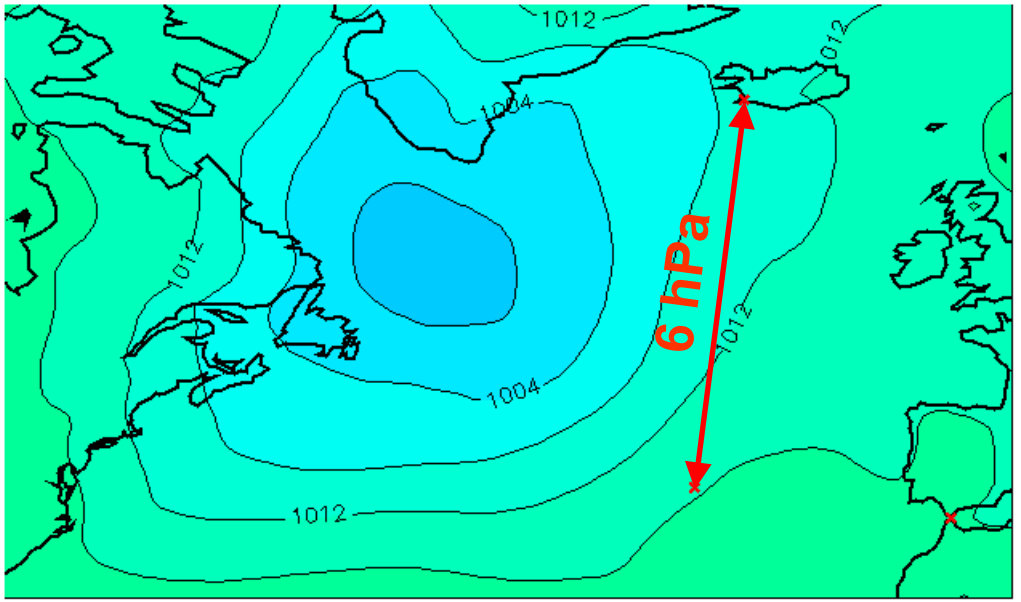
THE UNIVERSITY of EDINBURGH
GEOSCIENCES

NERC SCIENCE OF THE ENVIRONMENT

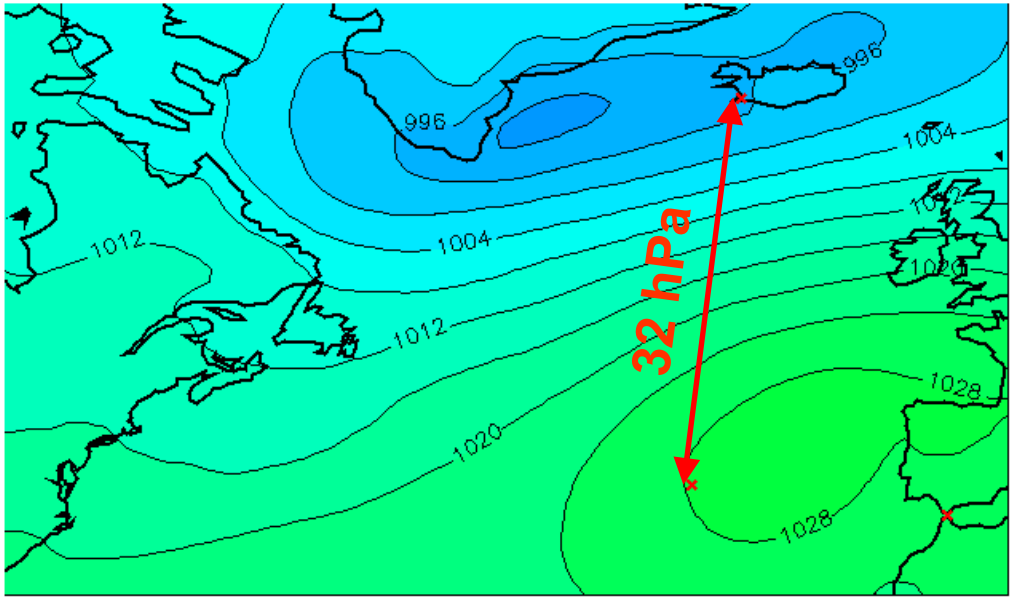
Scottish Snow Cover and the North Atlantic Oscillation

Michael Spencer & Richard Essery

What is the NAO?



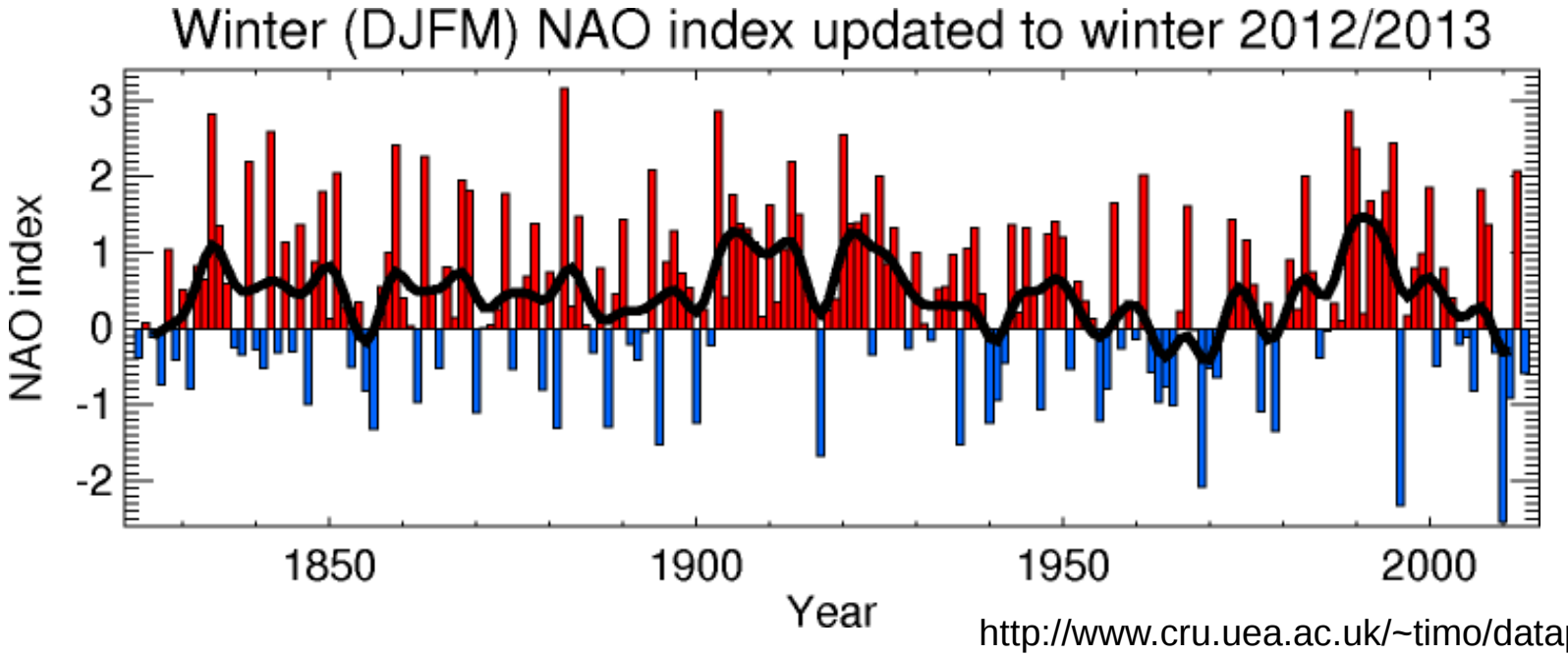
January 2010 mean



January 2012 mean

What is the NAO?

- Normalised sea level pressure difference
- Stations: Gibraltar (high) and Reykjavik (low)
- Positive NAO = warm wet winters
- Negative NAO = cold dry winters



http://www.cru.uea.ac.uk/~timo/datapages/naoi.htm

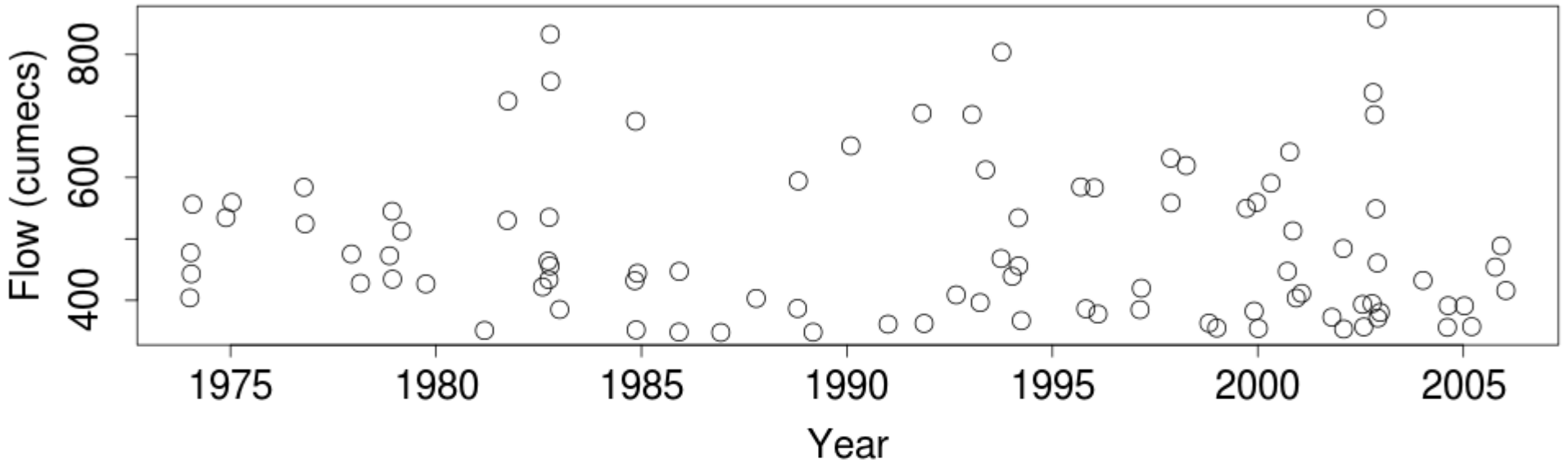
Scottish snow cover

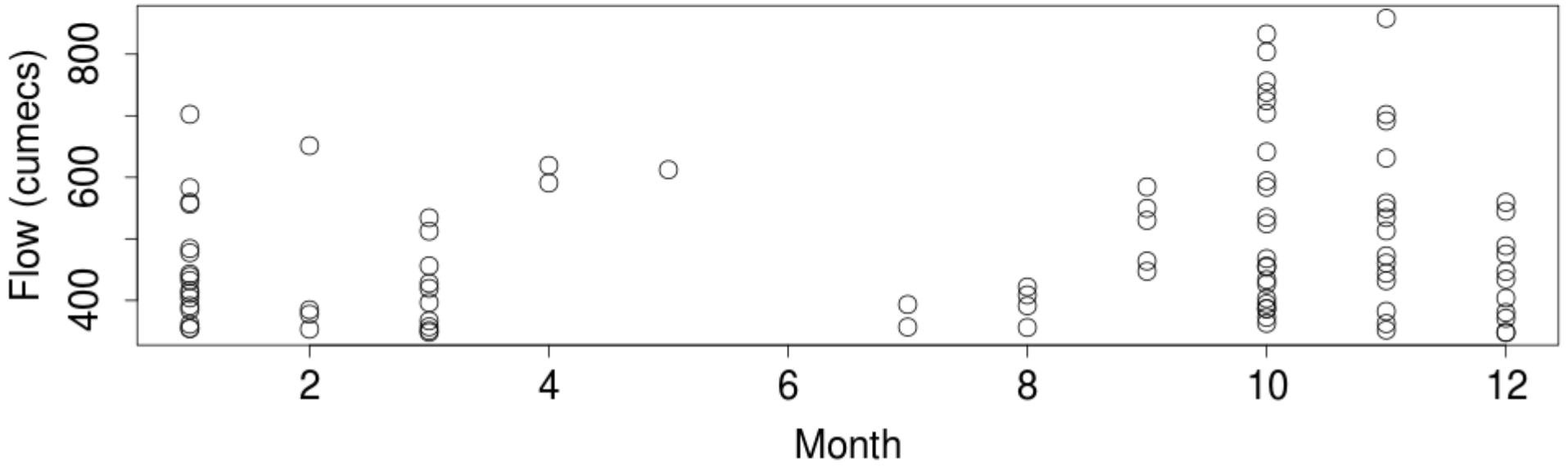
- Ephemeral in space and time
- Snow wet, sky cloudy – remote observation hard
- Important for water resources, ecology, land management, snow sports, etc..

River Dee at Park

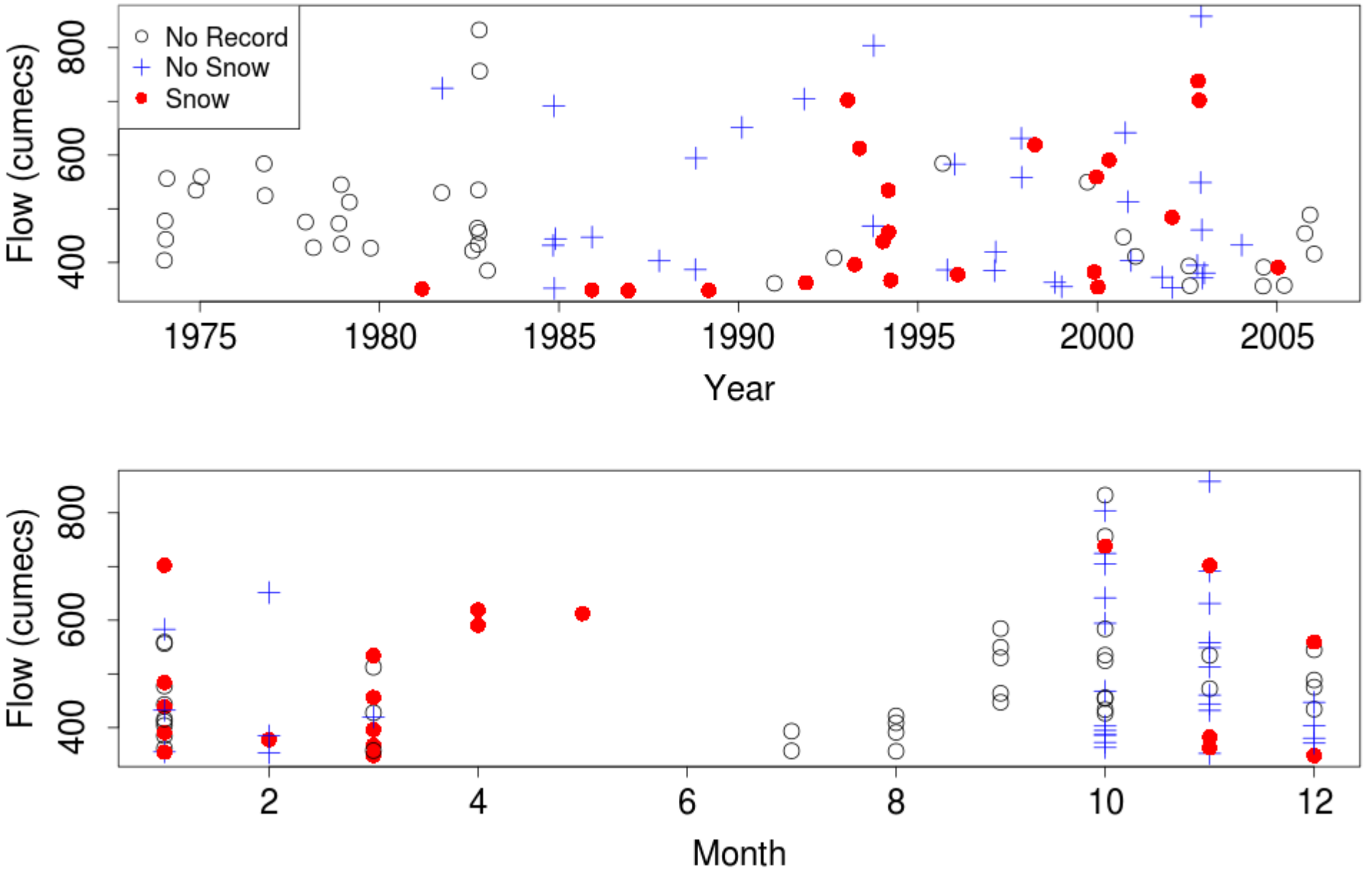
- Park gauging station
- Catchment 1844 km²
- Max alt. 1309 m
- Upstream of Aberdeen (pop. 220k)

River Dee at Park

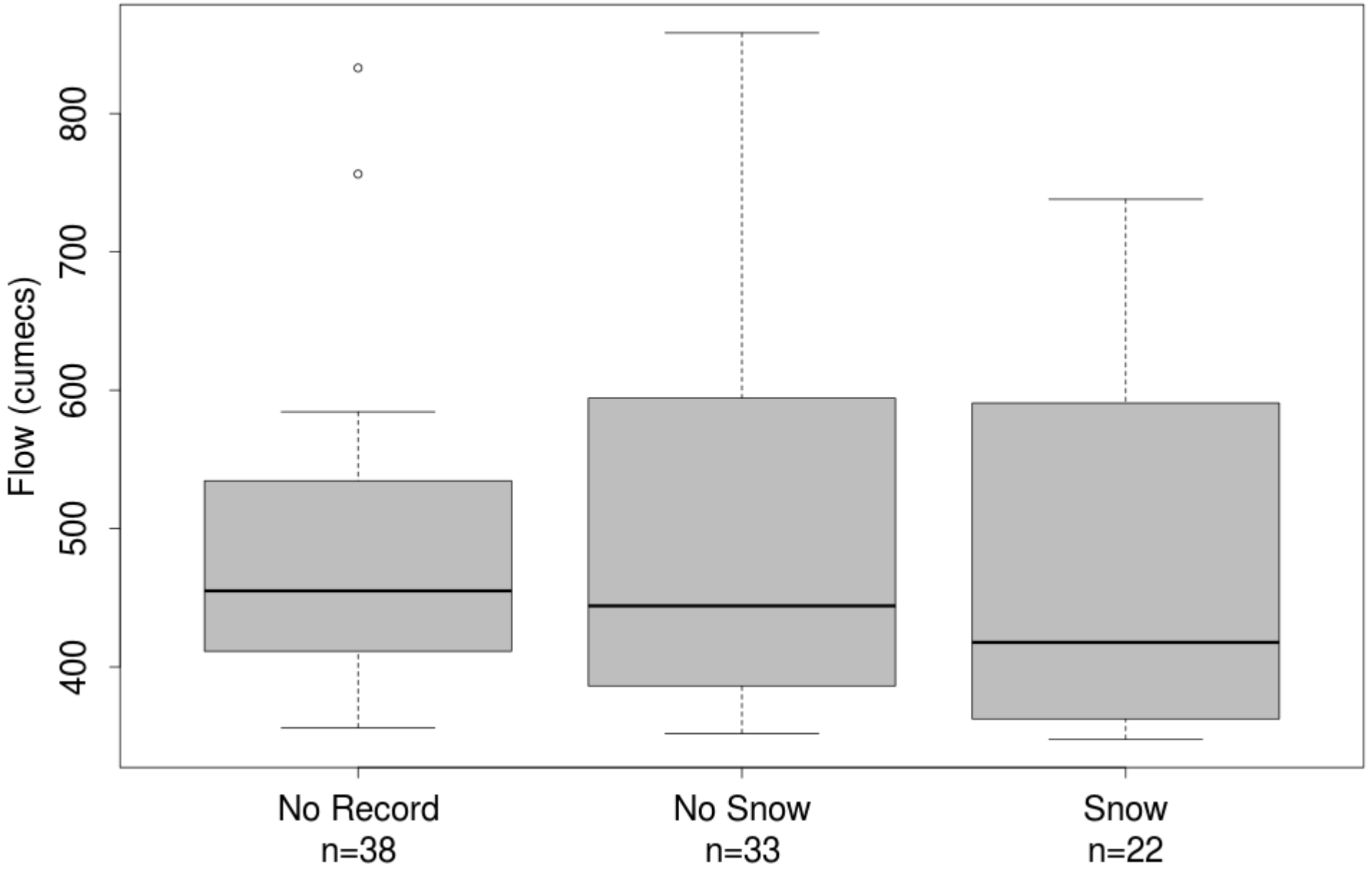




River Dee at Park



River Dee at Park



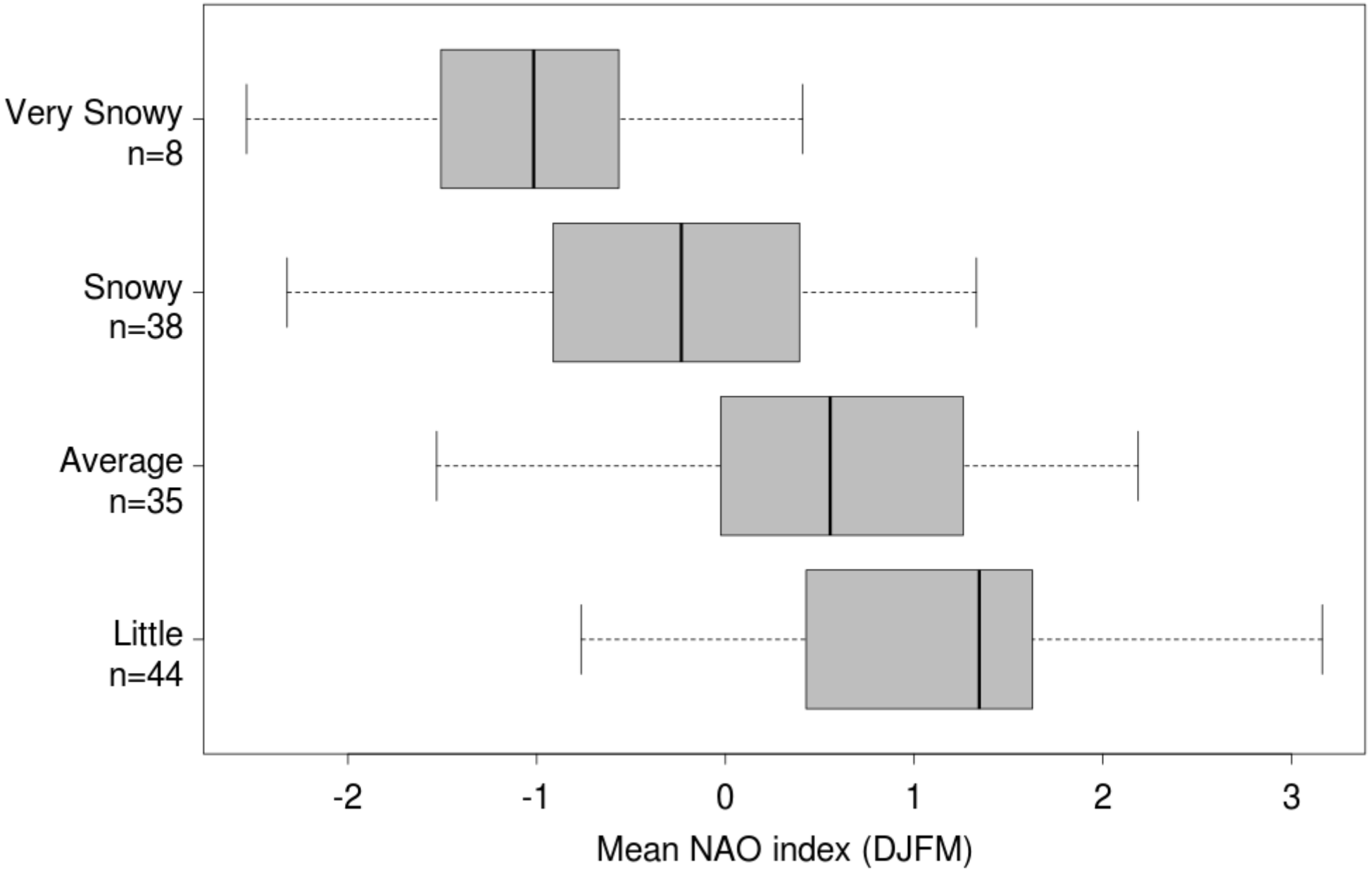
Scottish snow data

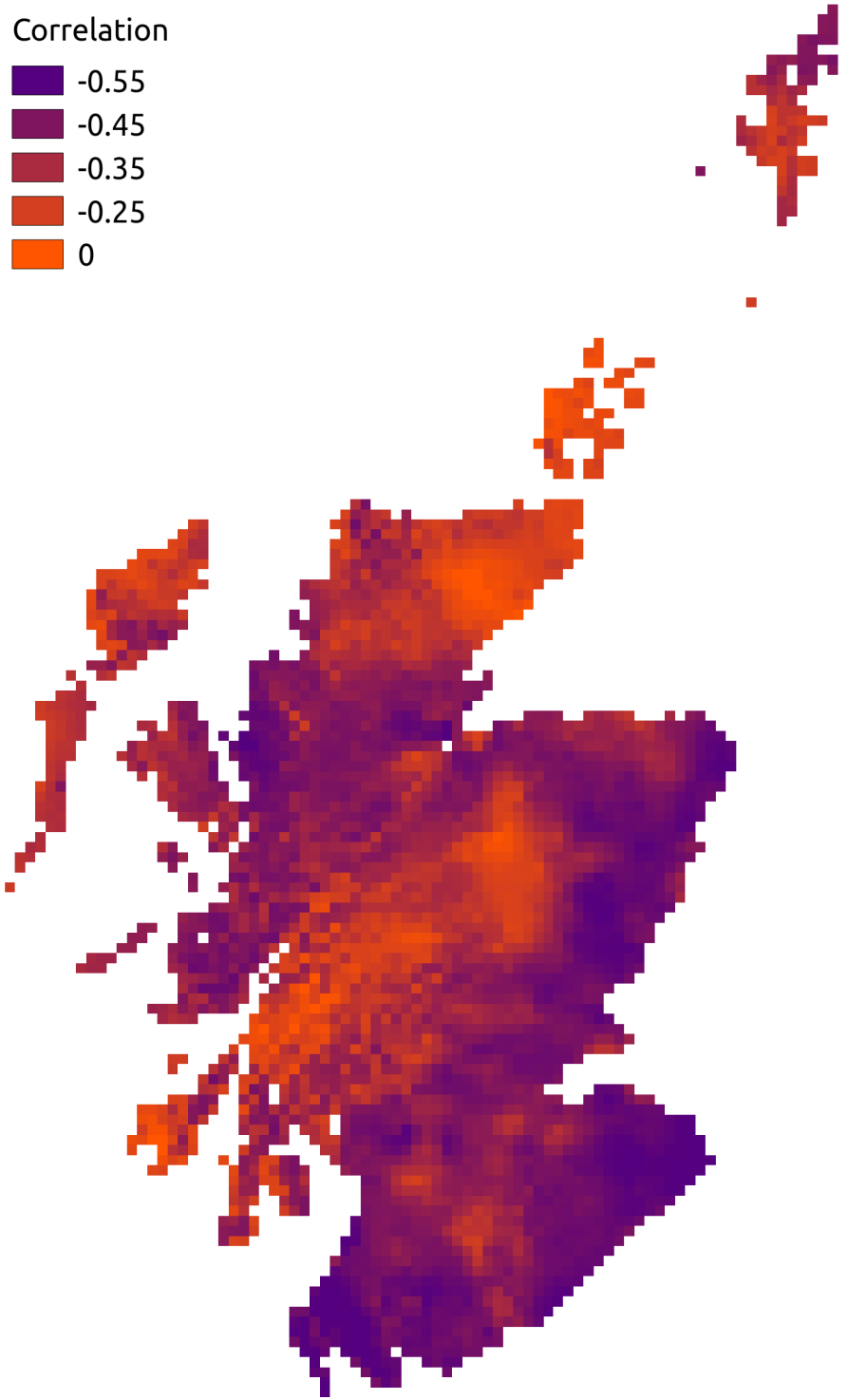
- Bonacina snow catalogue, 1875-2011
- Met Office snow lying at station, 1856-ongoing
- Met Office snow lying grid (UKCP09), 1971-2006
- MODIS satellite snow cover, 2000-ongoing
- Snow Survey of Great Britain (SSGB), 1945-2007

Scottish snow data

- Bonacina snow catalogue, 1875-2011
- Met Office snow lying at station, 1856-ongoing
- Met Office snow lying grid (UKCP09), 1971-2006
- MODIS satellite snow cover, 2000-ongoing
- Snow Survey of Great Britain (SSGB), 1945-2007

Bonacina snowiness index

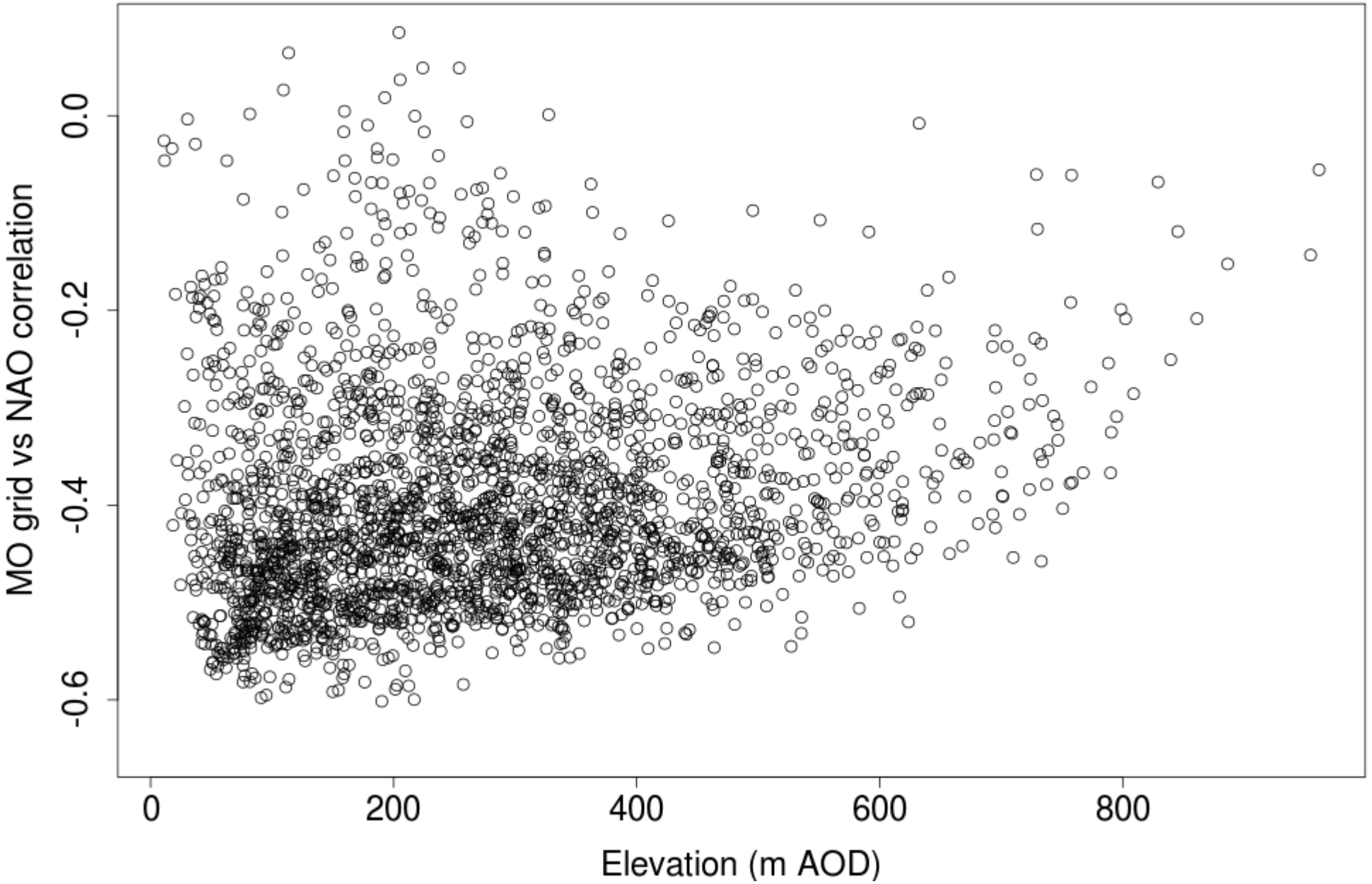




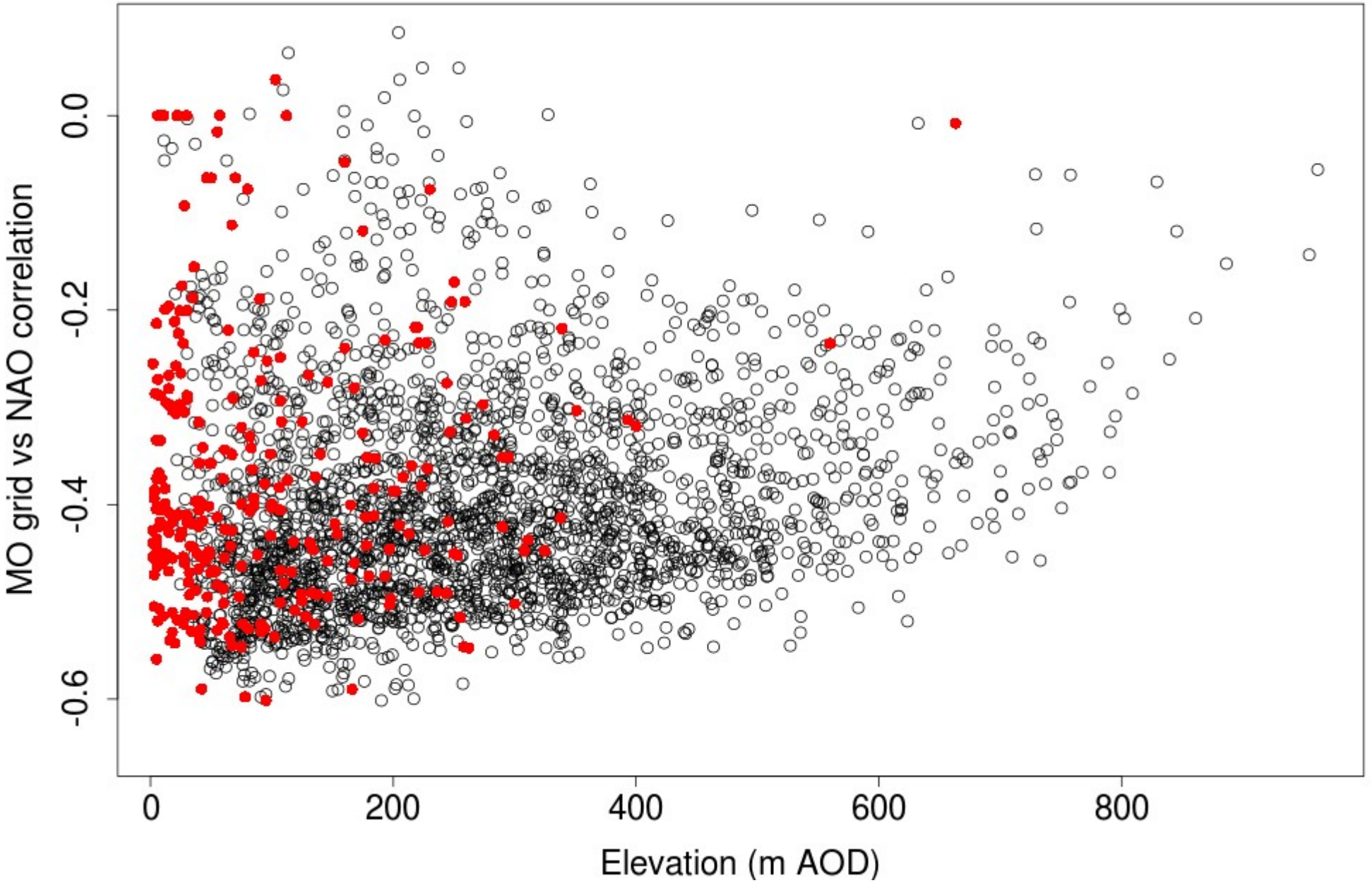
Spatial correlation

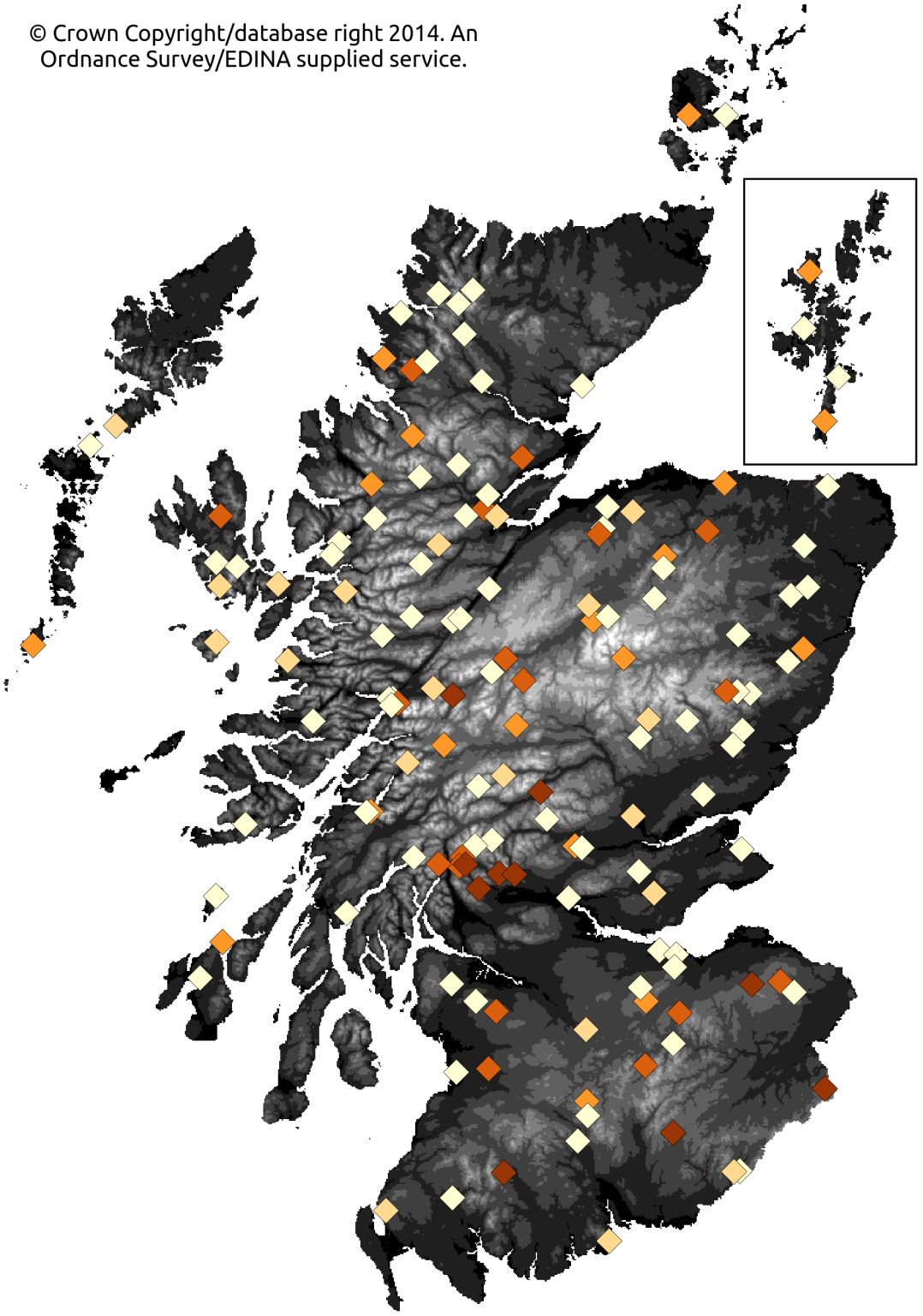
- Better at coasts
- East is better
- Possibly better further South

Explained by elevation?



Explained by elevation?

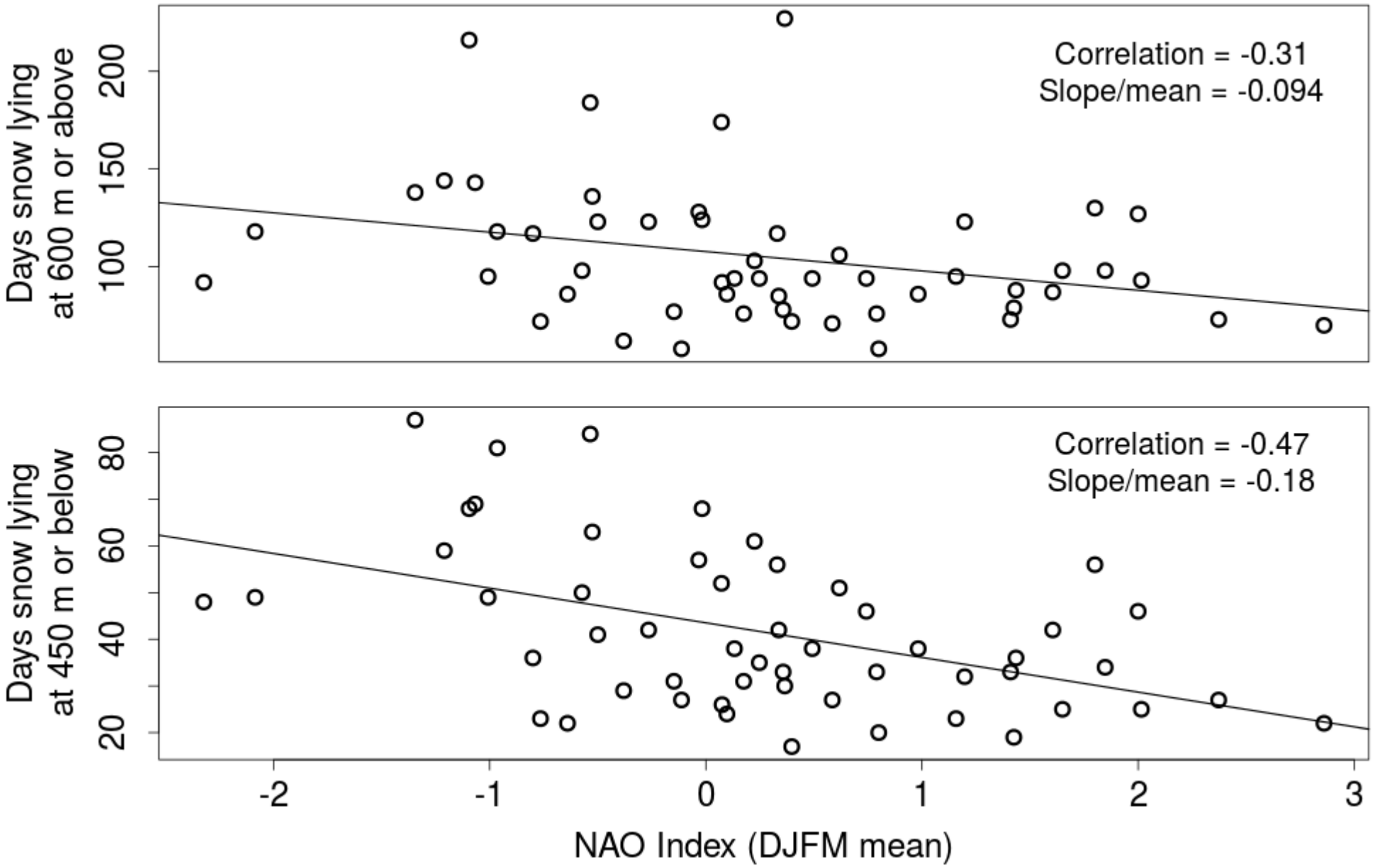




Snow Survey of Great Britain

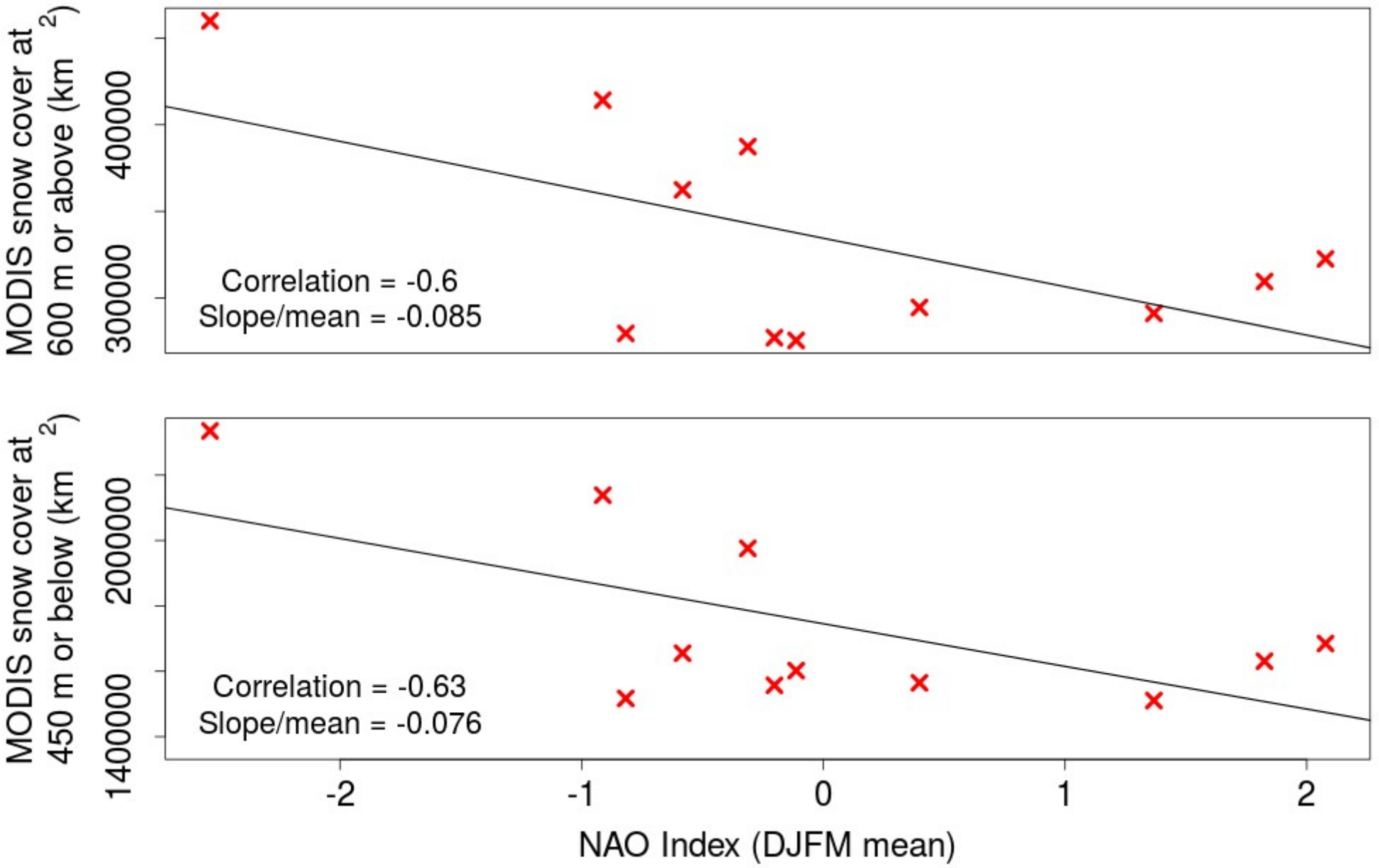
- Volunteer collected
- 1945-2007
- 145 sites
- See poster

Snow Survey of Great Britain

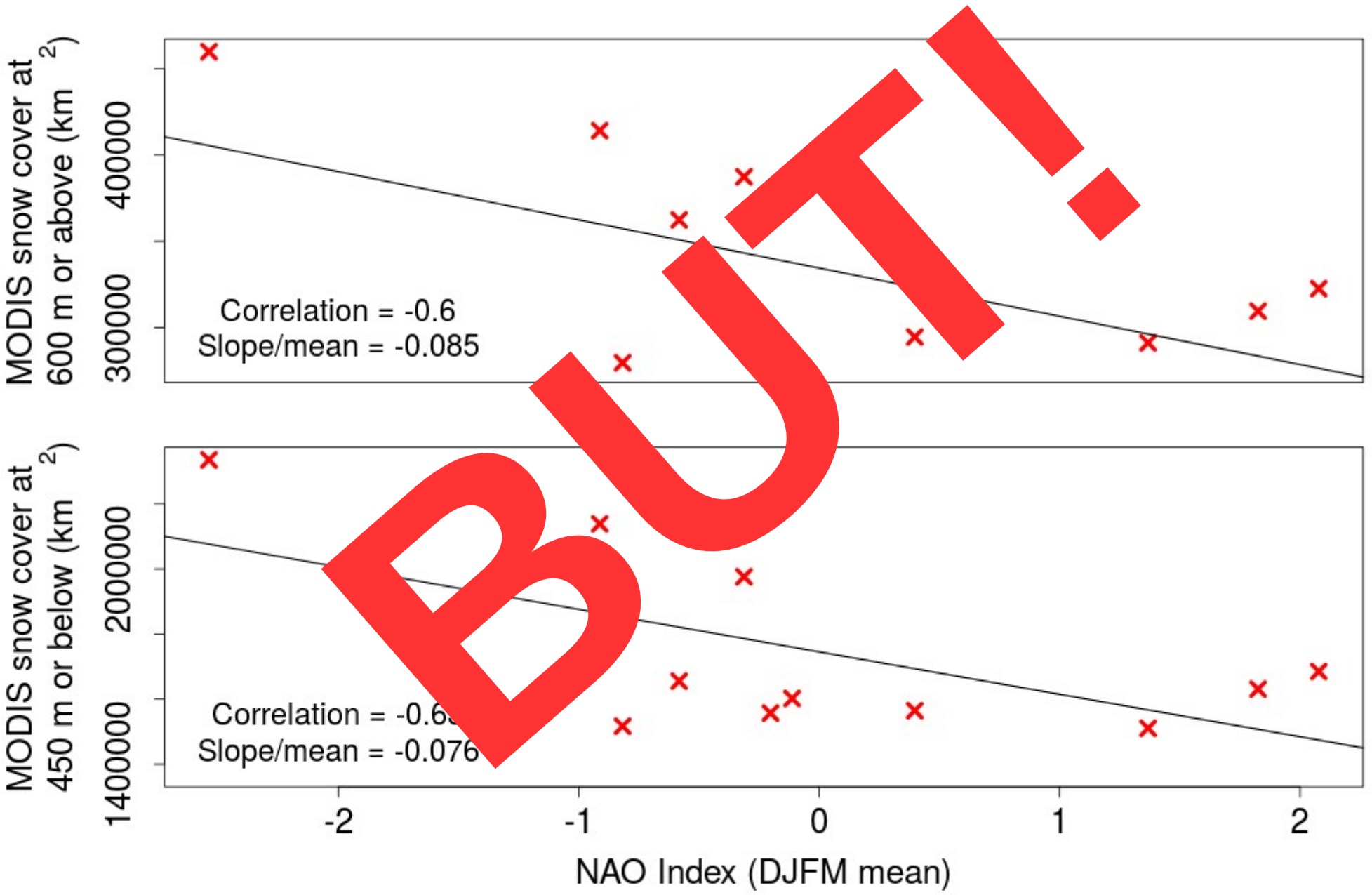


Recent winters

MODIS satellite snow cover



MODIS satellite snow cover



BUT!

Conclusions

- Negative NAO = More snow, generally
- Cloud causes observation problems
- NAO probably has larger influence at lower elevations
- 8 – 18% change in snow cover per NAO 'unit'

THE UNIVERSITY of EDINBURGH
GEOSCIENCES

NERC SCIENCE OF THE ENVIRONMENT

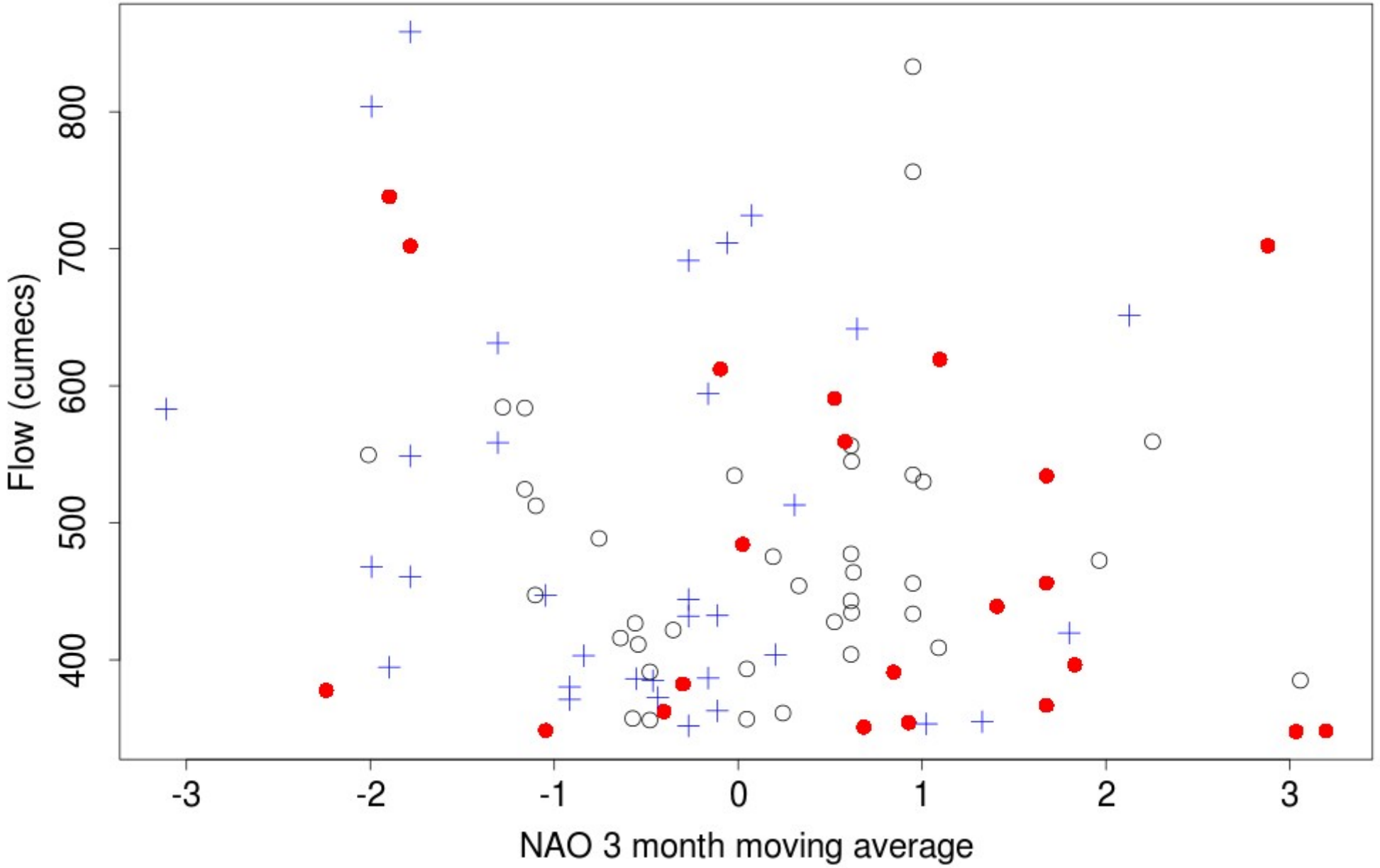
Many thanks, any questions?

Email: m.spencer@ed.ac.uk
Twitter: @MikeRSpencer
Blog: http://scottishsnow.wordpress.com/

What next?

- Degree day modelling
- MODIS cloud
- MODIS spatial trends
- Met Office station lying data
- …
- Write thesis!

Flow vs NAO


Flow (cumecs)
400
500
600
700
800
-3
-2
-1
0
1
2
3
NAO 3 month moving average