An evaluation of ensemble return period estimates for Storm Kristin

Enabling risk quantification without catastrophe models

Toby Jones, Daniel Bannister & Matthew Priestley

Part of a wider project with David Stephenson & Adam Scaife

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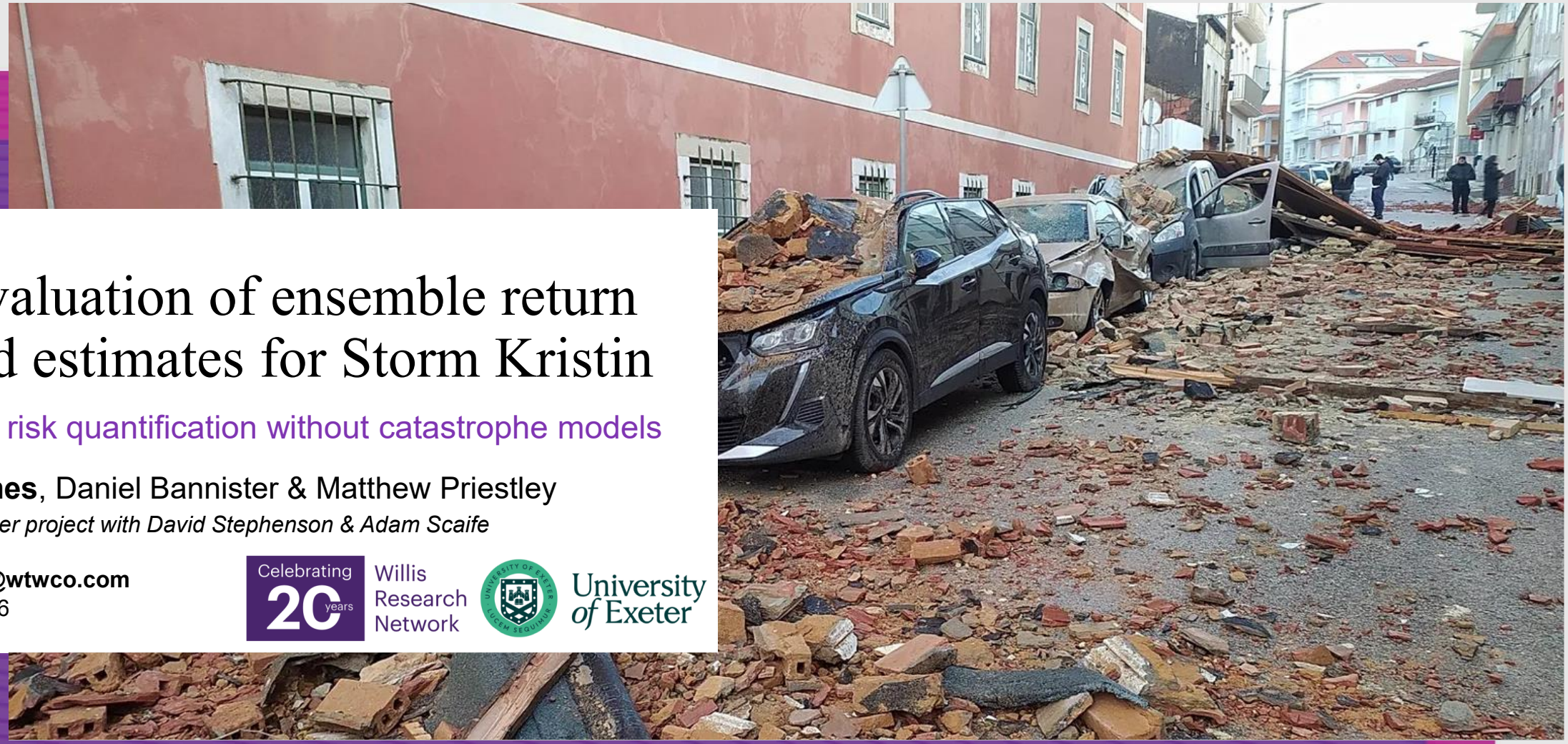
17 June 2026

Celebrating 20 years Willis Research Network

University of Exeter



wtw

One small(ish) request…

"Can you write an article about this Storm Kristin that's just happened?

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ARTICLE | WILLIS RESEARCH NETWORK NEWSLETTER

Storm Kristin and the challenge of quantifying European wind risk without catastrophe models

By Daniel Bannister, Toby Jones and Matthew Priestley | March 5, 2026

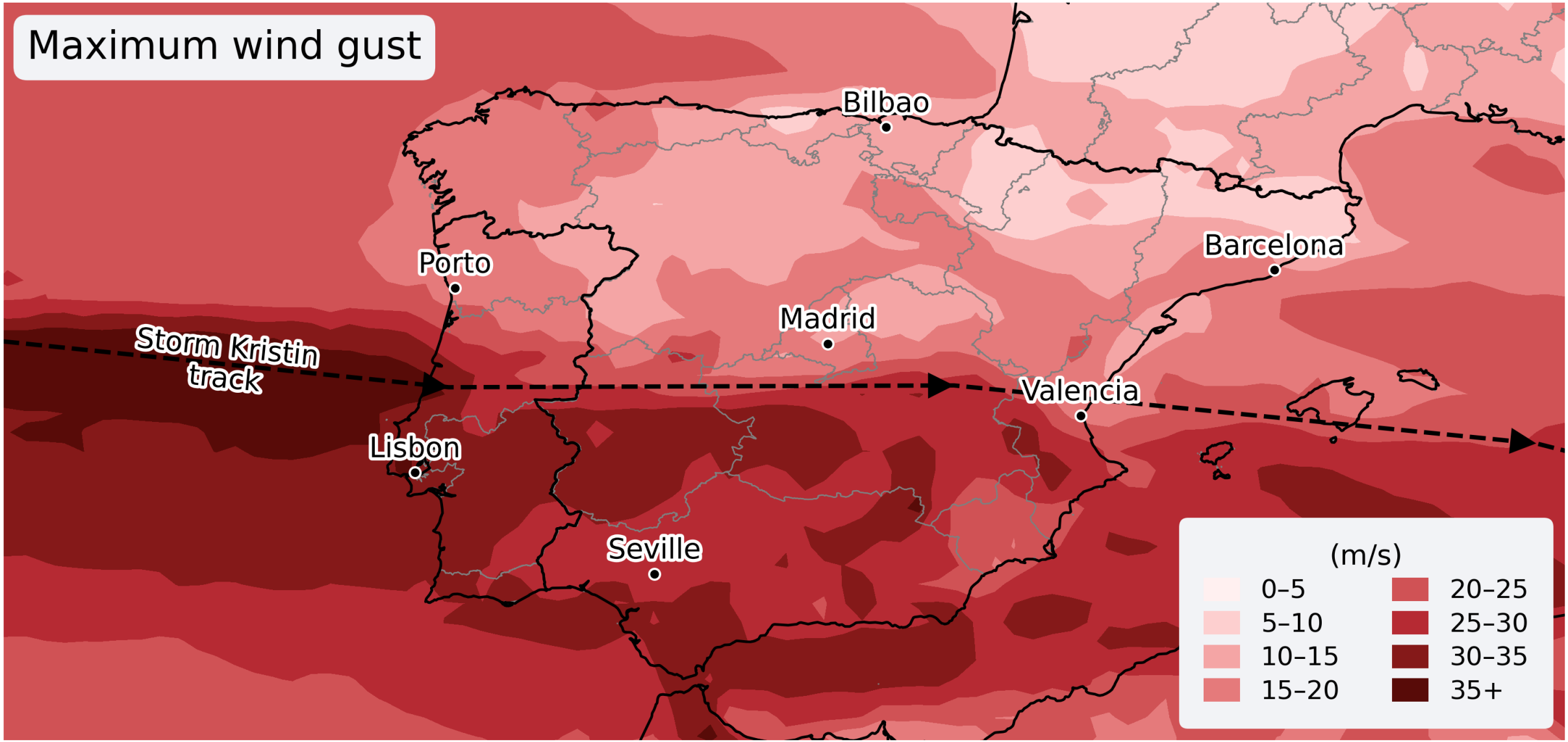
Storm Kristin delivered one-in-50-year wind gusts across Portugal. This event reminds us that North Atlantic windstorms can be severe even in regions where the risk is not covered by catastrophe models.

Parque das Gaivotas

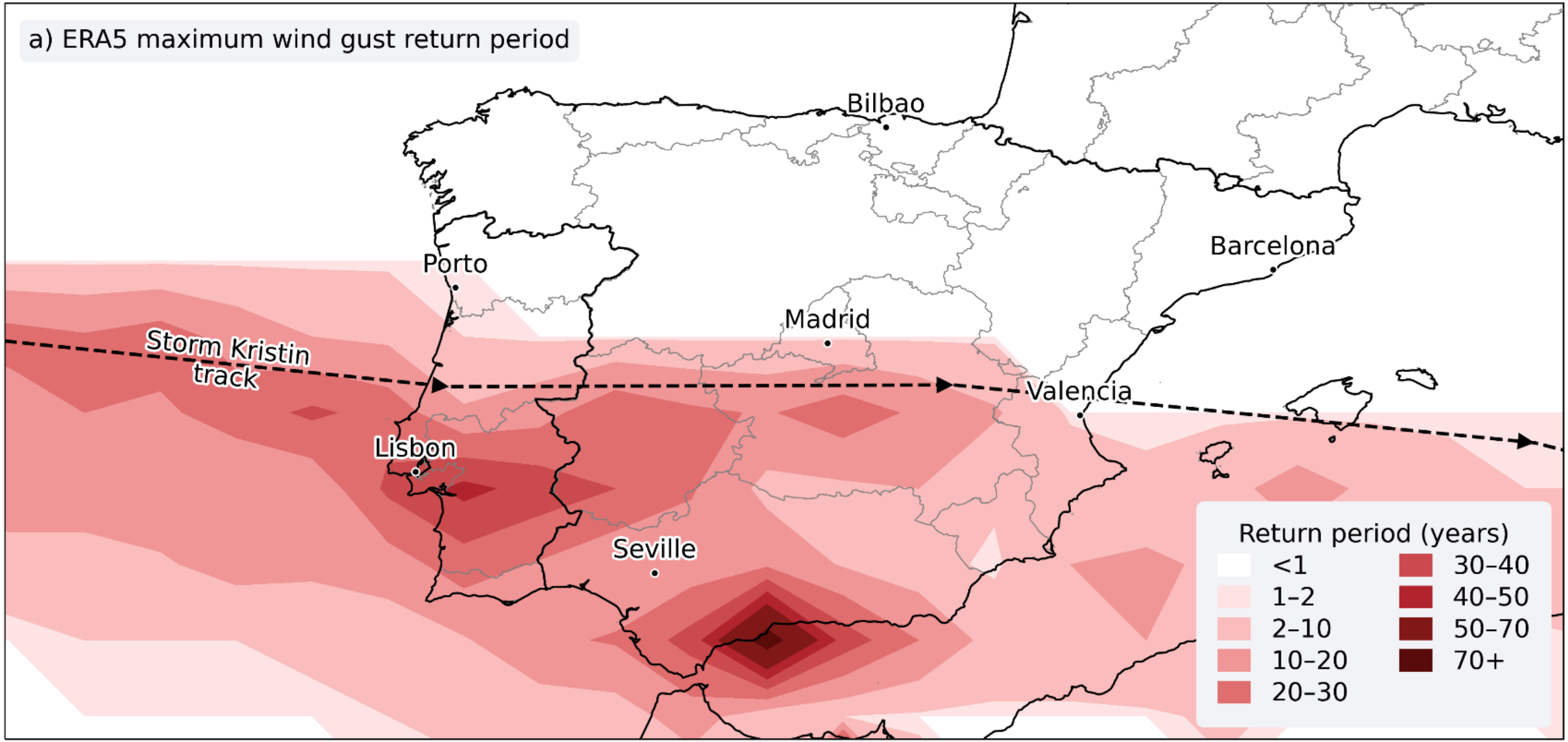
Airport near Coimbra

Woodlands near Leiria

Centre of Leiria



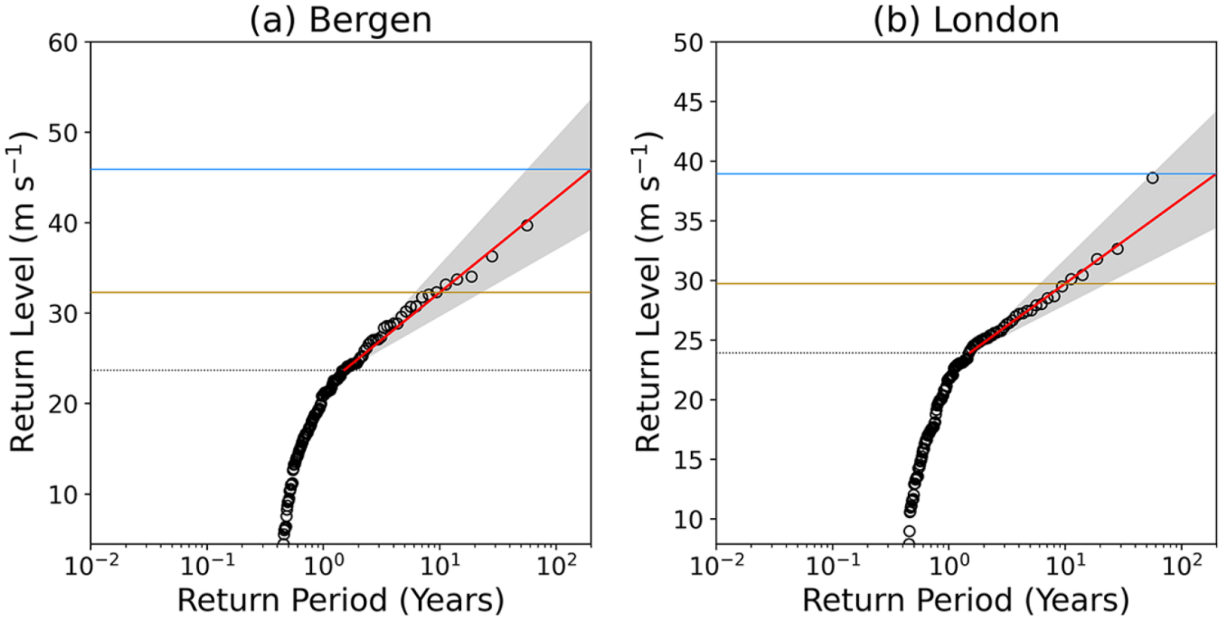
Reconstructed maximum wind gusts associated with Storm Kristin's track from ERA5 reanalysis.



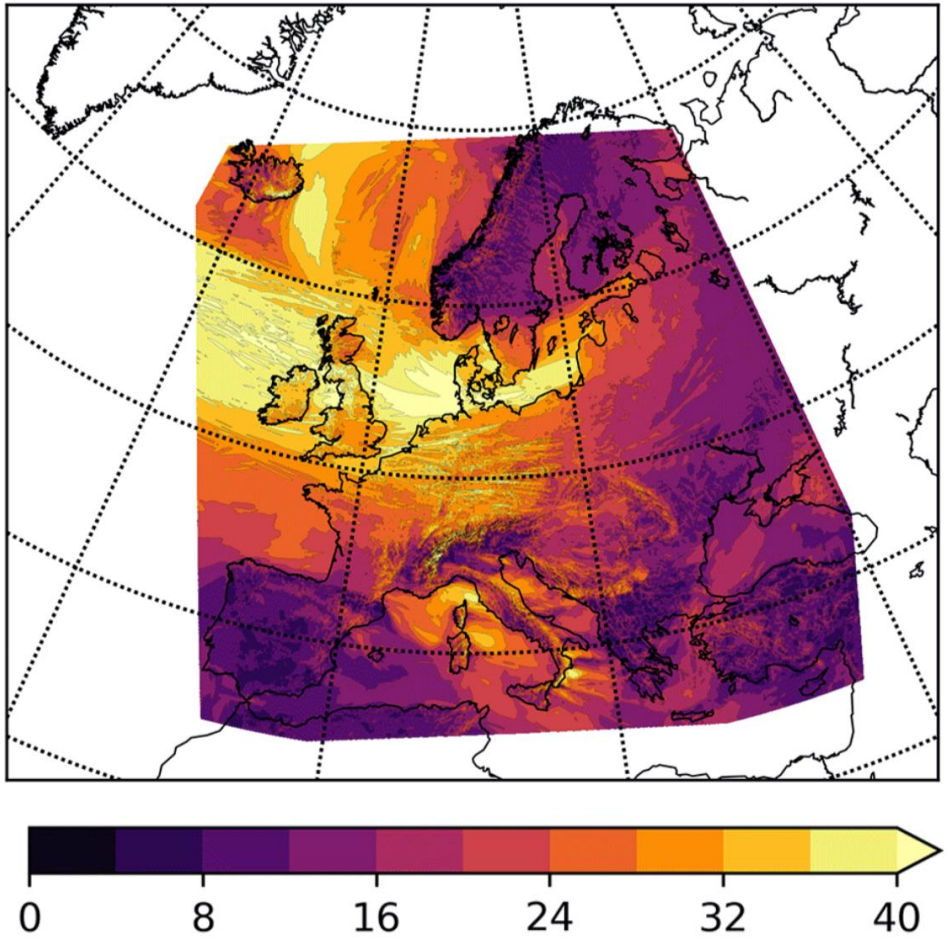
Estimated return period of Storm Kristin's winds using ERA5 reanalysis (1979-2026) and the model from Priestley et al. (2023)

How have you got a 70 year return period, from <50 years of data?

All return periods estimated using the wind gust model described in Priestley et al. (2023).



Statistical model fits to the WISC footprints for gridpoints near London (a) and Bergen (b). From Priestley et al. (2023)



Example of WISC footprint wind gusts (for Storm Daria, Jan.1990) used to fit the statistical model in Priestley et al. (2023). Units are m/s.

Two initialisations: ERA5 values from Sep. & Oct. 1993-2016.

↓

Models validated against ERA5's gust & MSLP values

↓

Failed

Meteo France ***System 8***
CMCC ***SPS3.5***
DWD ***GCFS2.1***

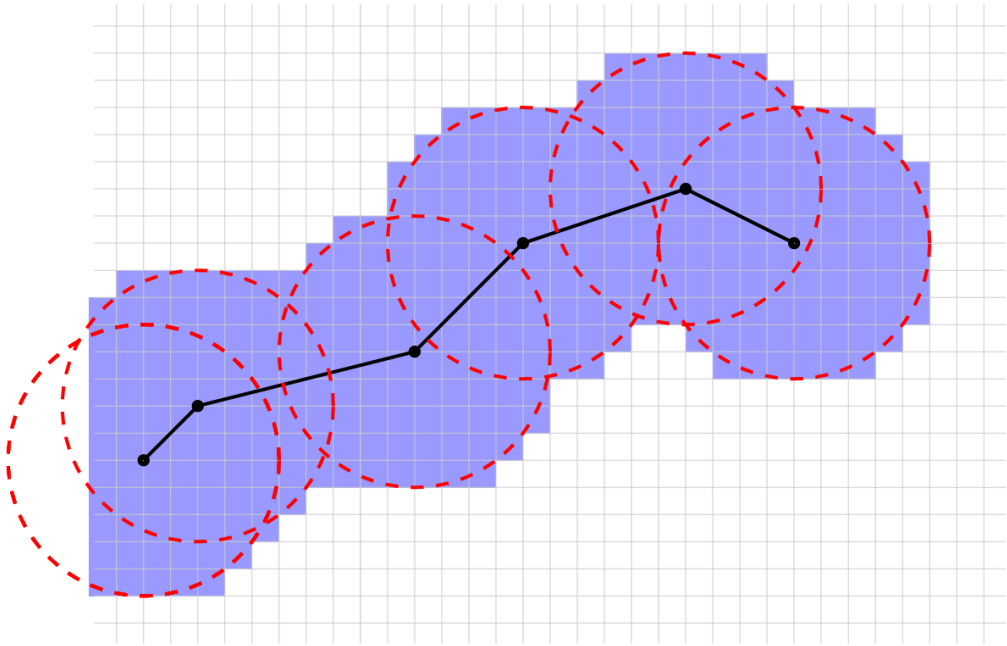
Passed

Met. Office ***GloSEA6***
ECMWF ***SEAS5***

↓

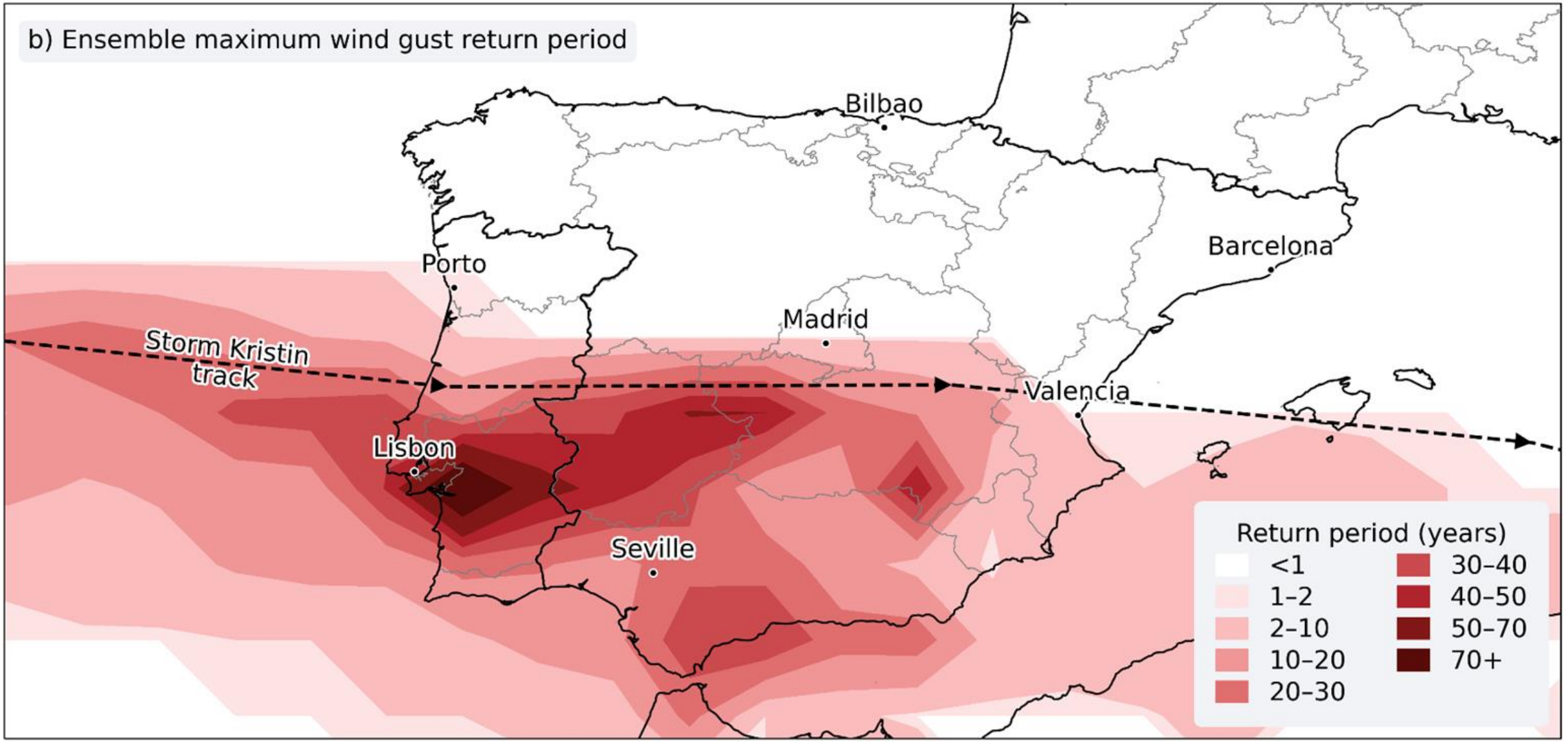
2,544

plausible winters

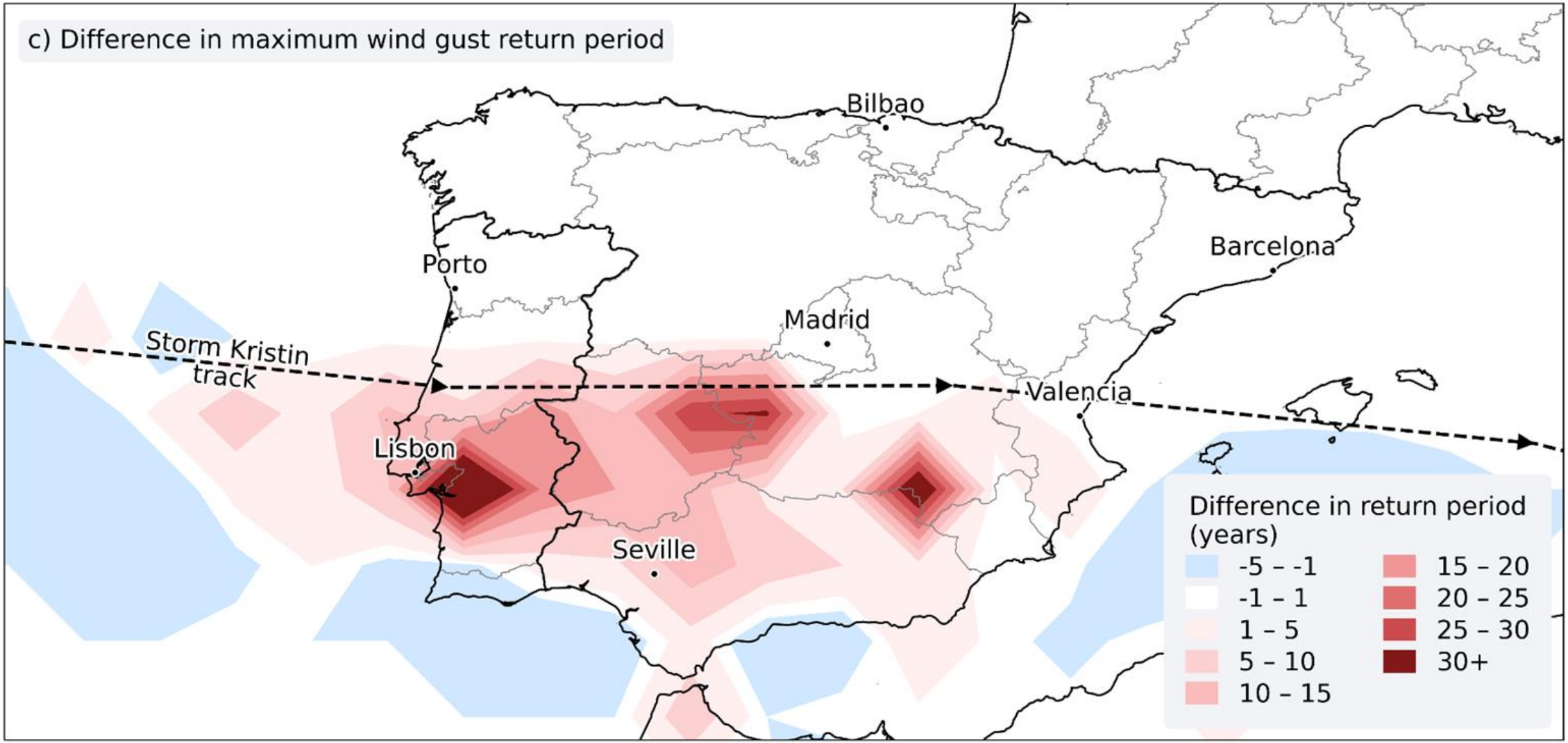


For each ensemble winter:

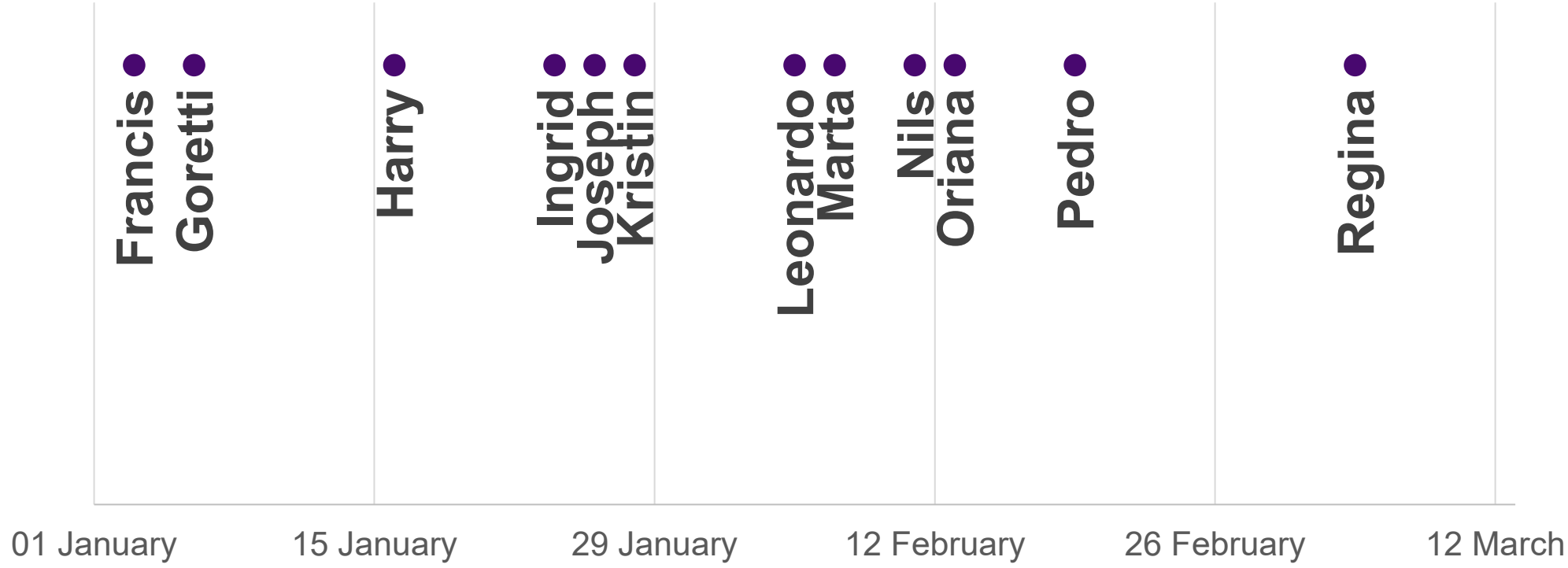
- Storms tracked using Hodges (1994) tracking algorithm.
- 10° radius used associate a gridpoint's gust values to each storm.

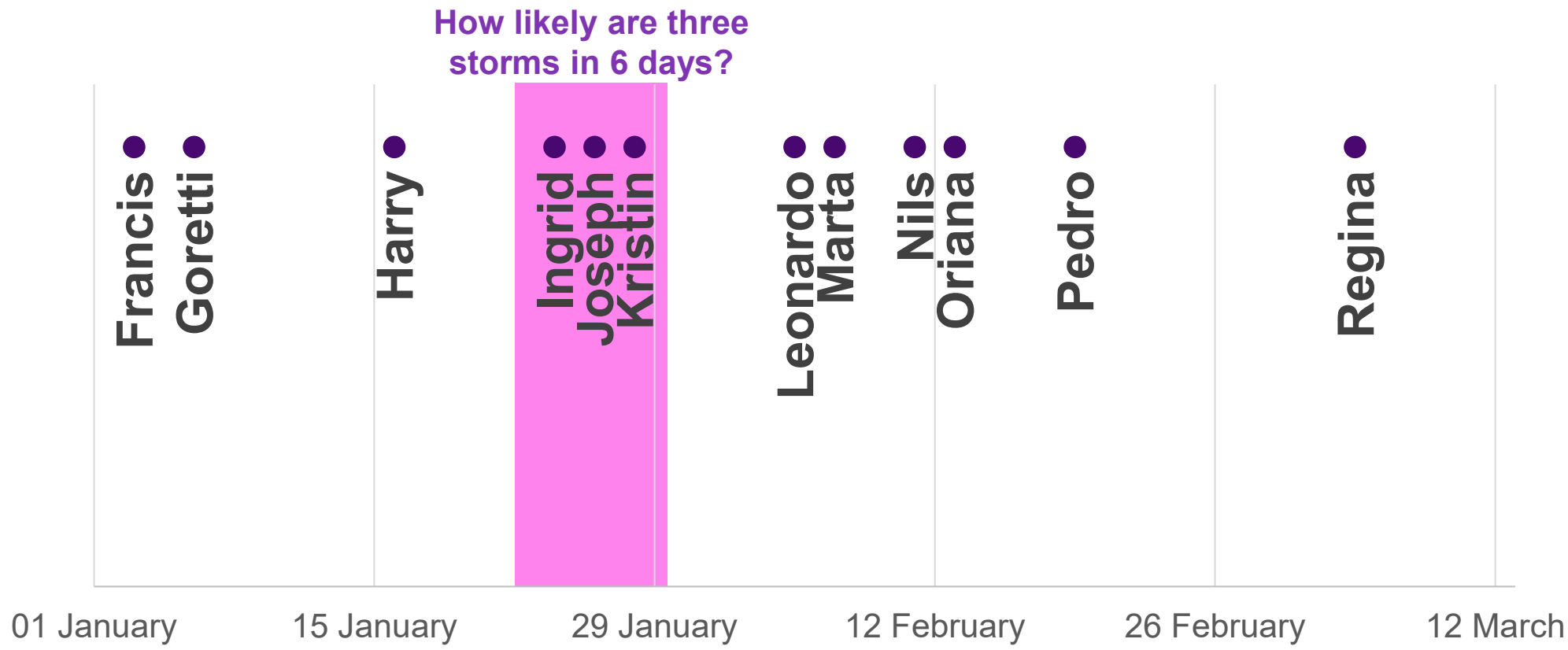


Estimated return period of Storm Kristin's winds using climate model ensemble. (2544 DJF winters) and the model from Priestley et al. (2023)



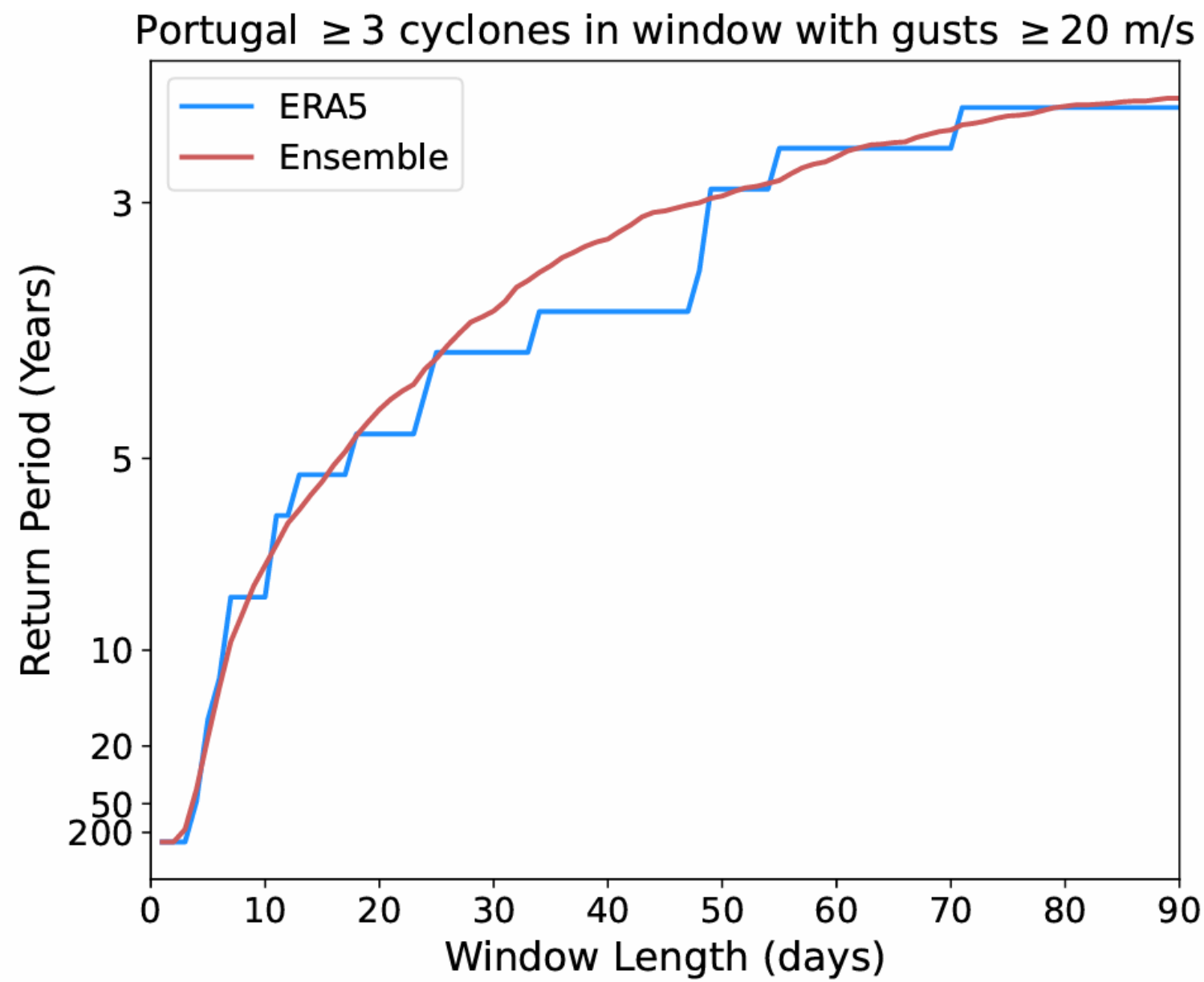
Difference in Kristin's estimated return period between the two methods (Ensemble – ERA5)



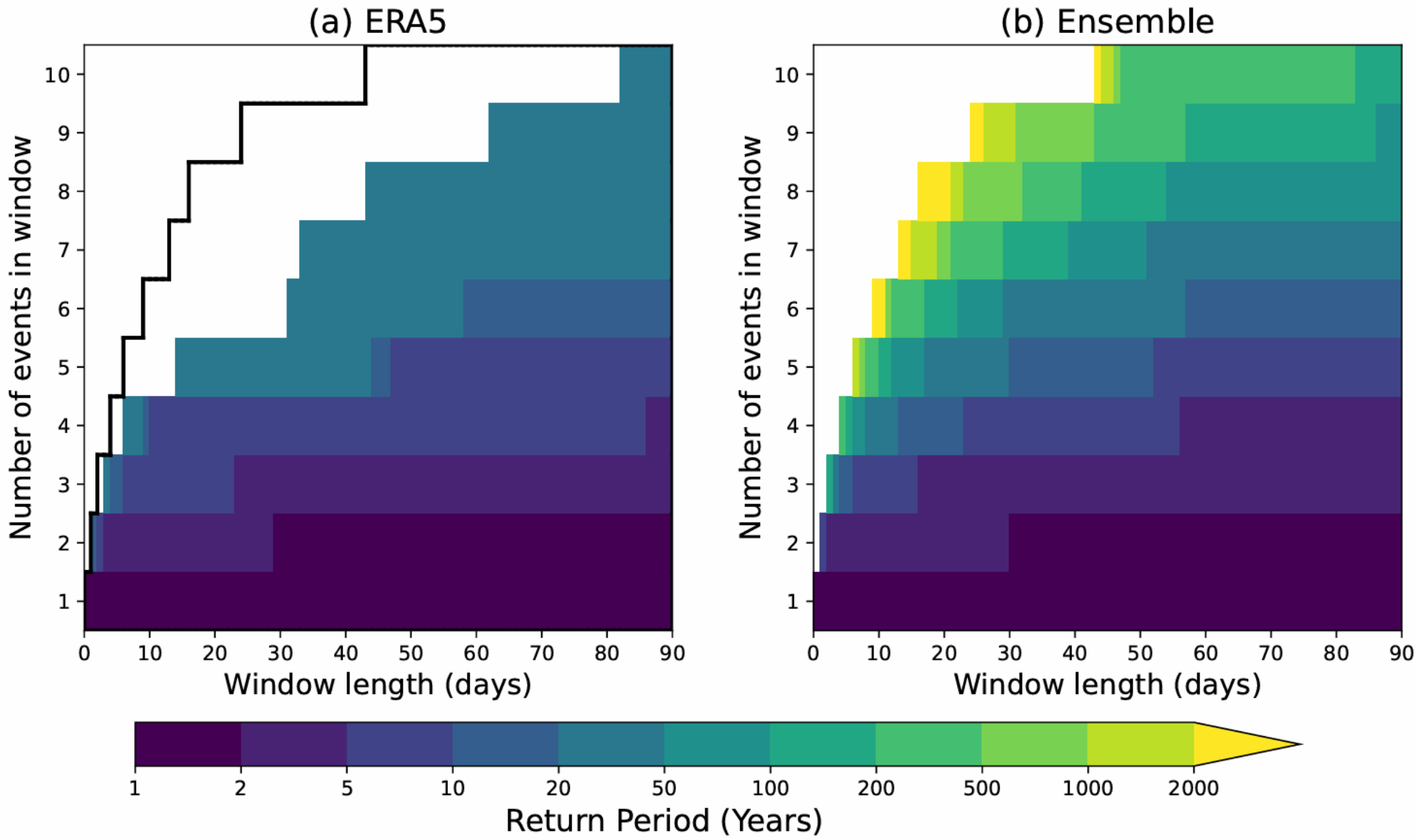


Window Length	ERA5 RP (years)	Ensemble RP (years)
3 days	*Unobserved*	149.6
4 days	47.0	35.8
5 days	15.7	18.0
6 days	11.8	12.2
1 week	7.8	9.4
2 weeks	5.2	5.4
4 weeks	3.9	3.6
Entire Winter	2.6	2.5

Estimated return periods of at least 3 strong storms (wind gusts ≥20m/s) occurring over different window lengths for ERA5 and the ensemble.



Estimated return periods of at least 3 strong storms occurring over different window lengths for ERA5 (blue) and the ensemble (red).



Estimated return periods of Y strong storms (wind gusts ≥20m/s) occurring over a window length of X for ERA5 (a) and the ensemble (b). Black line in panel a shows the extent of matrix in panel b.

Summary

- Ensemble reveals the limitations with relying on reanalysis data for estimating return periods.
- Storm Kristin's winds were a ~1-in-50 year event, but the 3 storm cluster was a ~1-in-12 year event.
- Ensemble says 6 **strong** storms in 10 days is plausible, we have only observed this in 30 days.

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Celebrating 20 years Willis Research Network

University of Exeter

This work is part of the Willis Research Network's collaboration with the University of Exeter, now in it's 20th year.

We are using ensembles to investigate plausible windstorm extremes and their drivers, with future work coming soon.

Contact: **m.priestley@exeter.ac.uk**

This work will soon be submitted to *RMetS Weather,* but some results are currently available online: