

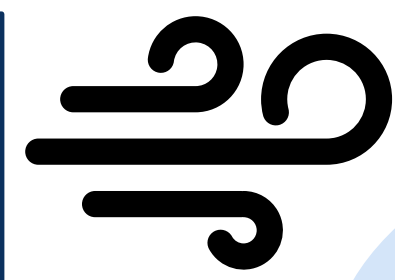
Reviewing ETC Climatology to Better Understand Present-Day Risk



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1. Motivation



Extra-tropical cyclone (ETC) frequency & intensity vary on several timescales of variability

Interannual

Decadal

Climate Change

Time-period

Season

Choice of dataset/model

There's not just one story when it comes to changes in ETCs over time

Region

Frequency, intensity, or loss?

Could a high-loss storm occur today? Here, we re-examine the Europe ETC climatology to better understand today's risk

2. Verisk's EU ETC Cat Model

- Verisk's current extra-tropical cyclone model for Europe is based on historical data from 1979 to 2015, and was released in 2018
- Data pre-1979 is not included as these data are less robust (e.g. Soci et al. 2024)
 - Fewer observations pre-satellite era and reanalysis datasets rely more on the model

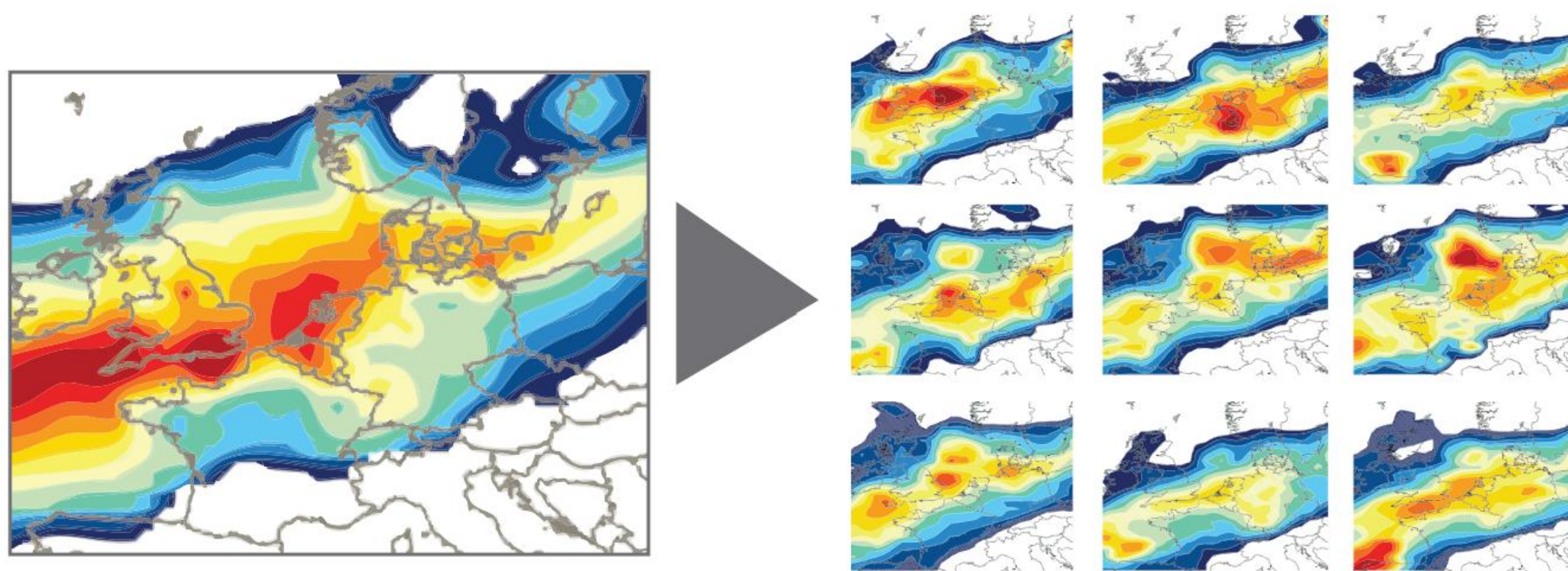


Figure 1: A historical seed storm from any year 1979–2015 is perturbed to create a set of realistic simulated stochastic storms. This gives us alternate views of history!

3. Frequency & Intensity of ETCs

How have EU-wide storm frequency and intensity (SSI) changed in last few decades? SSI=Storm Severity Index

Historical Frequency and Avg Annual SSI (colour and size)

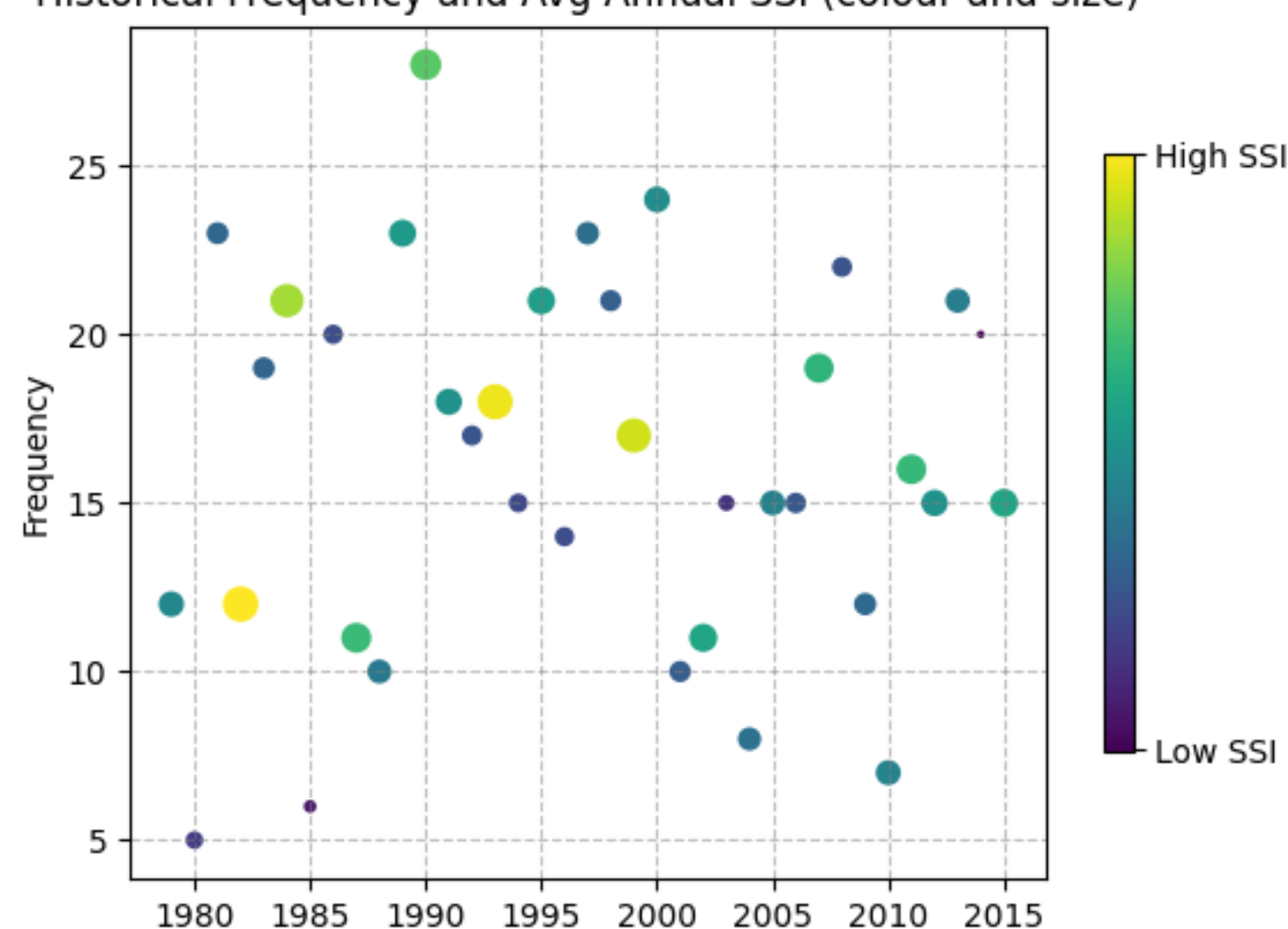


Figure 2: Timeseries of historical storm frequency (y-axis) and SSI (size and colour) for a Europe-wide domain, as tracked by Verisk's EU ETC model.

Mann-Kendall tests show few significant trends in frequency or SSI for Europe ETCs over the satellite era

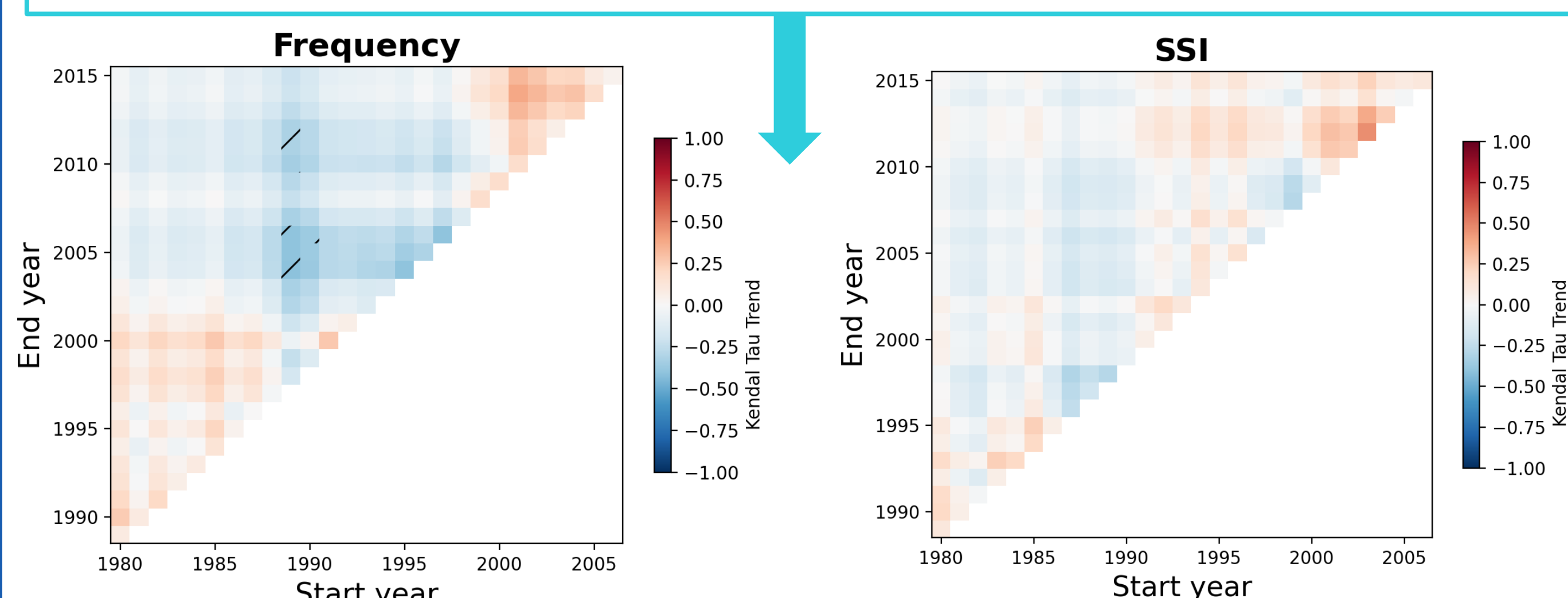
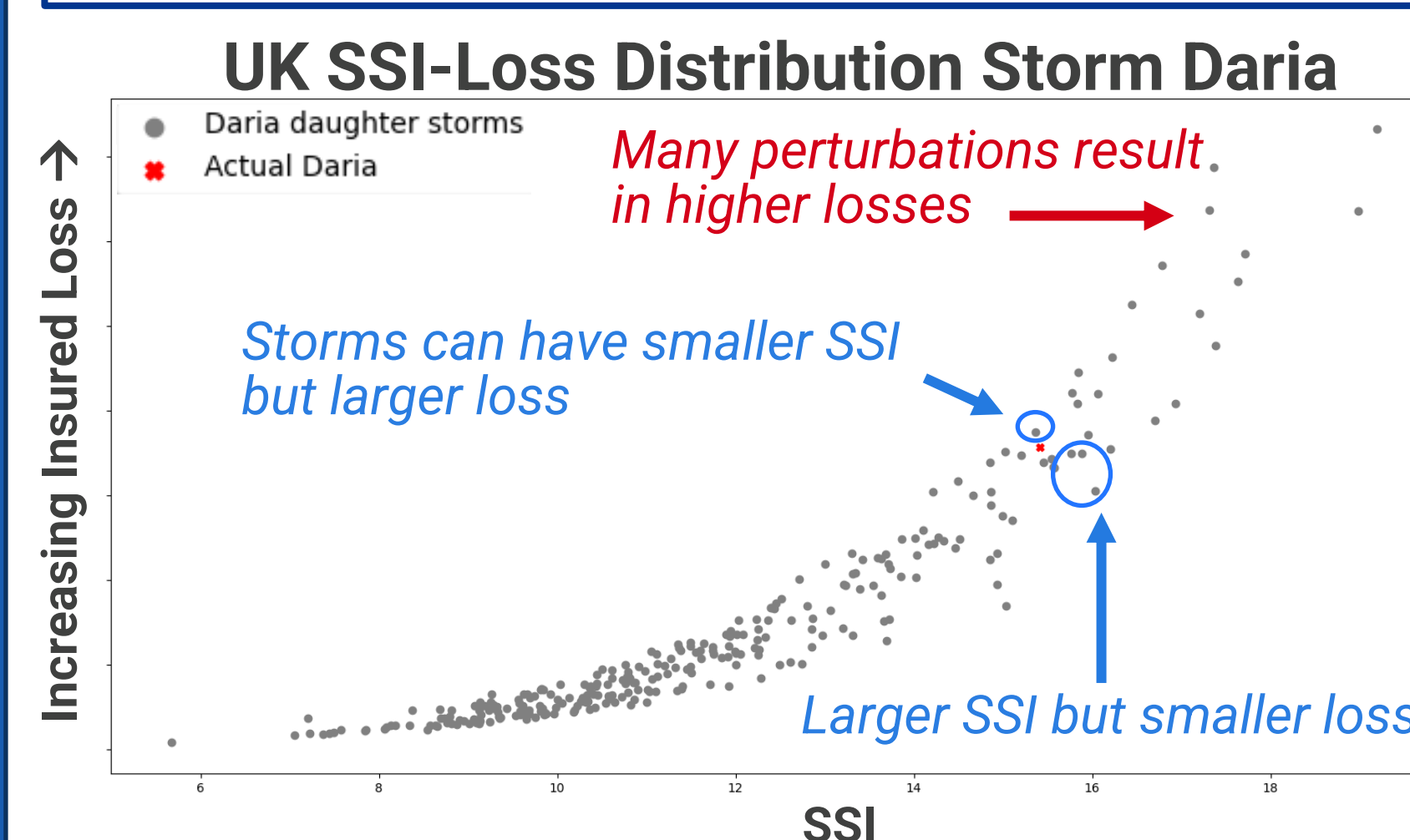


Figure 3: Kendall Tau trend (blue decreasing, red increasing) for (left) frequency, and (right) SSI. Each grid box represents a range of years between a start year (x-axis) and end year (y-axis). Hatching shows where the trend is statistically significant (if any).

4. Insured Losses

How sensitive are historical losses to perturbations in storm track and intensity?



Slight changes to the track and wind gust intensities can significantly alter the insured loss

Figure 4: SSI (x-axis) and loss (y-axis; linear) distribution for perturbations of Storm Daria (1990) over the UK. The red marker is actual Daria as modelled by Verisk, and each grey marker an individual stochastic perturbation.

Using our perturbations of historical storms, we see potential for recent years to have very high losses

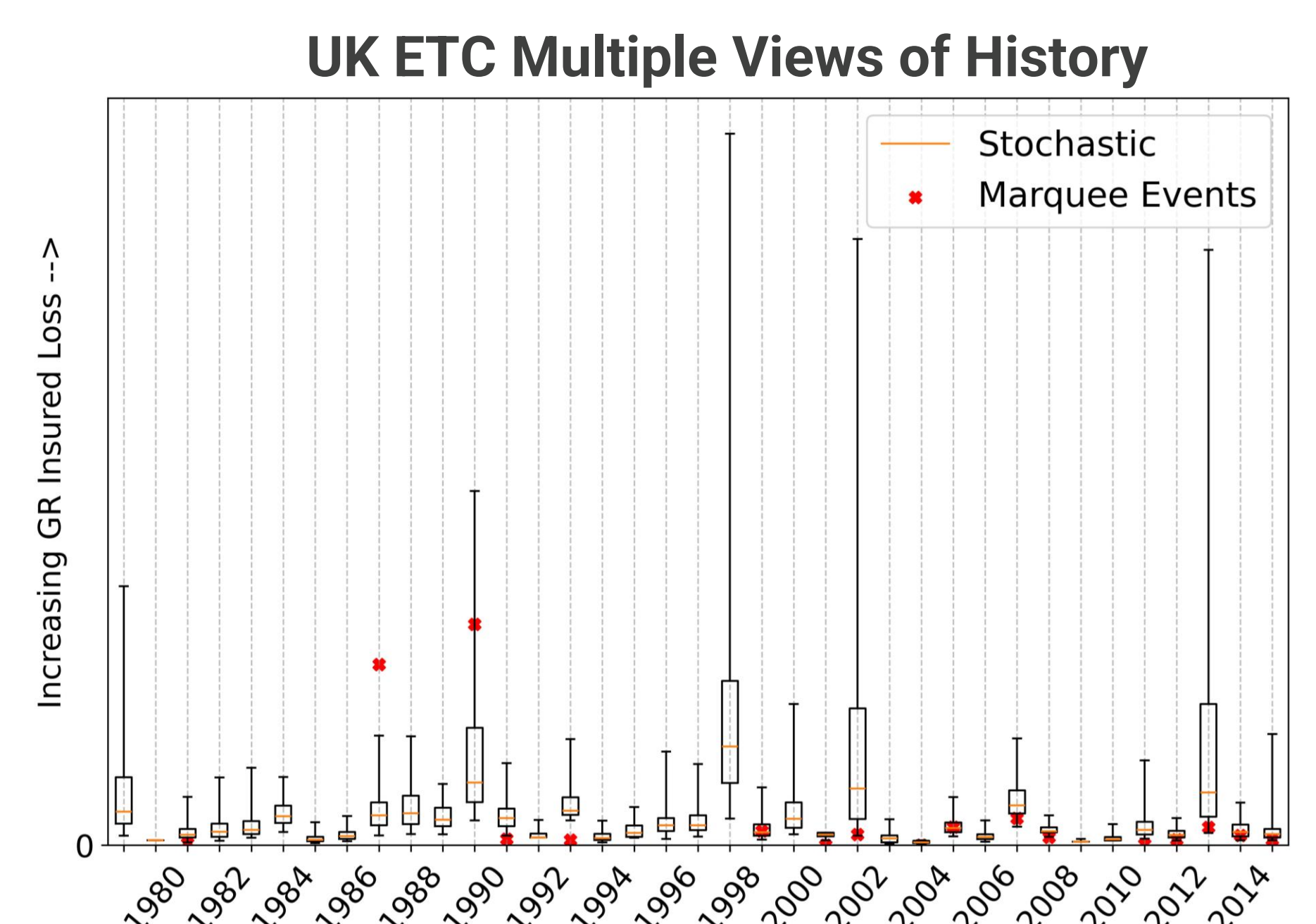


Figure 5: Annual maximum gross insured loss for varying views of history. Red markers represent select marquee events in history as they occurred. Boxplots are stochastic perturbations based on 1000 random seed storm mappings of each year. The y-axis scale is linear, and the boxplots show the 2nd–98th percentile of the distribution.

5. Takeaway Points

- Clearly, trends in ETC activity are complex, as there are different stories to be had. Trends influenced by:
 - Scale
 - Metric (hazard/loss)
 - Dataset/model
- Stories on ETC trends informing risk management decisions should align on these factors and consider significance
- Future: Analyse robustness of longer datasets (e.g. Sangelantoni et al. 2025) → ERA5 going back to 1940

References

- Soci, C., Hersbach, H., Simmons, A., Poli, P., Bell, B., Berrisford, P., et al. (2024) The ERA5 global reanalysis from 1940 to 2022. *Quarterly Journal of the Royal Meteorological Society*, 150(764), 4014–4048. Available from: <https://doi.org/10.1002/qj.4803>
- Sangelantoni, L., Tibaldi, S., Cavicchia, L., Scoccimarro, E., Vidale, P. L., Hodges, K., Mavel, V., Almansì, M., Cagnazzo, C., and Almond, S.: A novel European windstorm dataset based on ERA5 reanalysis from 1940 to present, *EGU sphere* [preprint], <https://doi.org/10.5194/egusphere-2024-4157>, 2025.