ROBUST – 'Enabling better management of UK multi-hazard risk'

Flooding & extreme wind

UKRI funded Fellowship
3yrs, 3 days/wk
'Weather the storm better'

Loughborough University

Met Office

SAYERS AND PARTNERS

AON AIR A Verisk Business

Willis Towers Watson

ROBUST: Objectives/work plan

1. With Sayers, impact modelling for flooding & extreme wind.
   2x 3-month placements

2. At the Bank of England, financial modelling & policy implications
   2x 3-month placements

3. With scientists, progress multi-hazard science (flooding & extreme wind)
   Workshop – 28th March

4. With stakeholders, create 'road maps' (i.e. create projects) translating science to impactful decisions [Co-RISK]
   10 interviews, 3x 1-day workshops

NERC datasets

SAYERS AND PARTNERS

- AquaCAT (flood)

Met Office

- UKCP18 (12 km, wind, precip.)

NetworkRail

highways england

WP3 Progress through collaboration

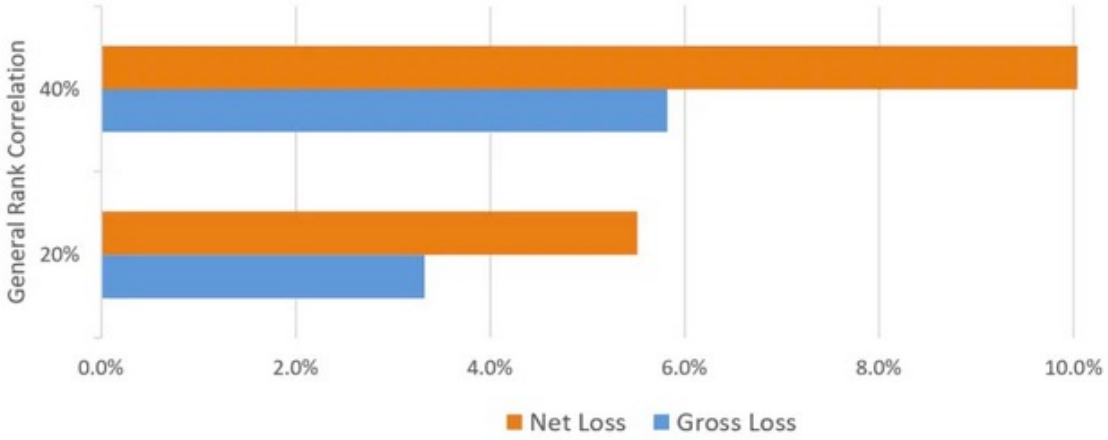
- Very good alignment with UKCGFI
- Collaborating with Hannah, Len and Paul
- Thank you!

CGFI
UK Centre for Greening Finance & Investment

My perspective (briefly) on where we are ….

https://bankunderground.co.uk/2021/04/08/its-windy-when-its-wet-why-uk-insurers-may-need-to-reassess-their-modelling-assumptions/

Chart 2: Indicative impact on a 1-in-200 year return period for gross and net AEP using correlation factors of 20% and 40%



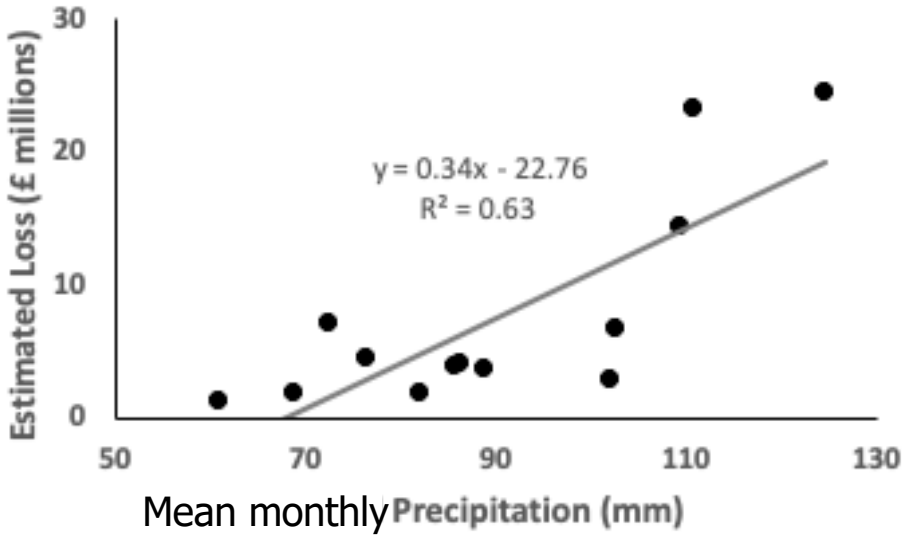
AON
AIR
A Verisk Business

'Bank Underground' feeds into General Insurance Stress Tests (GIST) 2022

Timescales: Building on what we know ….

Initial indications are/were that effects continue from daily weather to longer time-scales, and into impacts

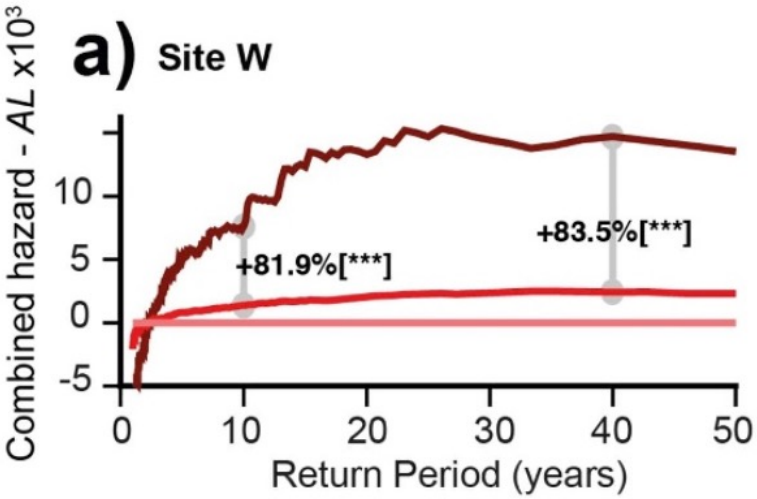
- Since systematic seasonal relationship between flooding and extreme wind in the UK was first demonstrated [by pushing various data to their limit] (Matthews, 2014; Hillier et al, 2015) the picture has continue to solidify.
- Some selected, impact-focussed snippets are:

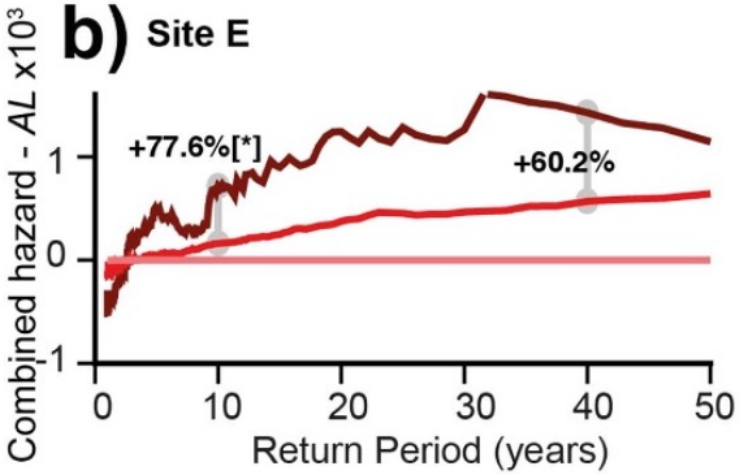


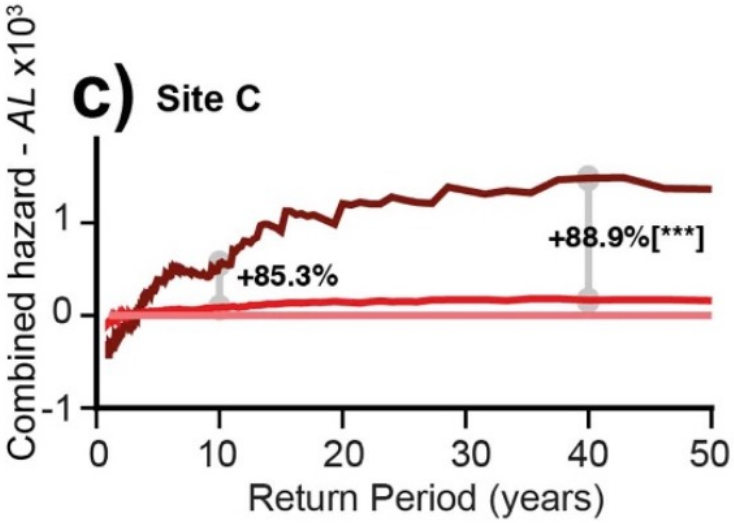
Simple climate-related measures appear to be related to impact across winter (Oct-Mar) (Hillier & Dixon, 2020)

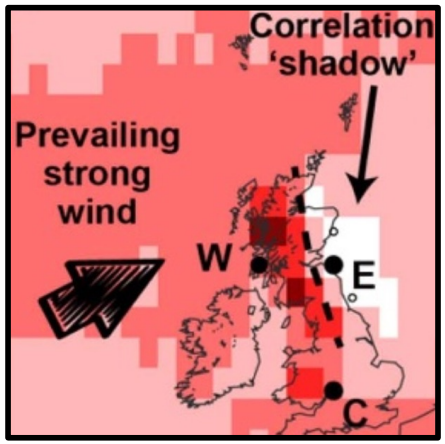
Data 2006-2018 only !
(But, it's high-quality data)

Timescales: Building on what we know ….



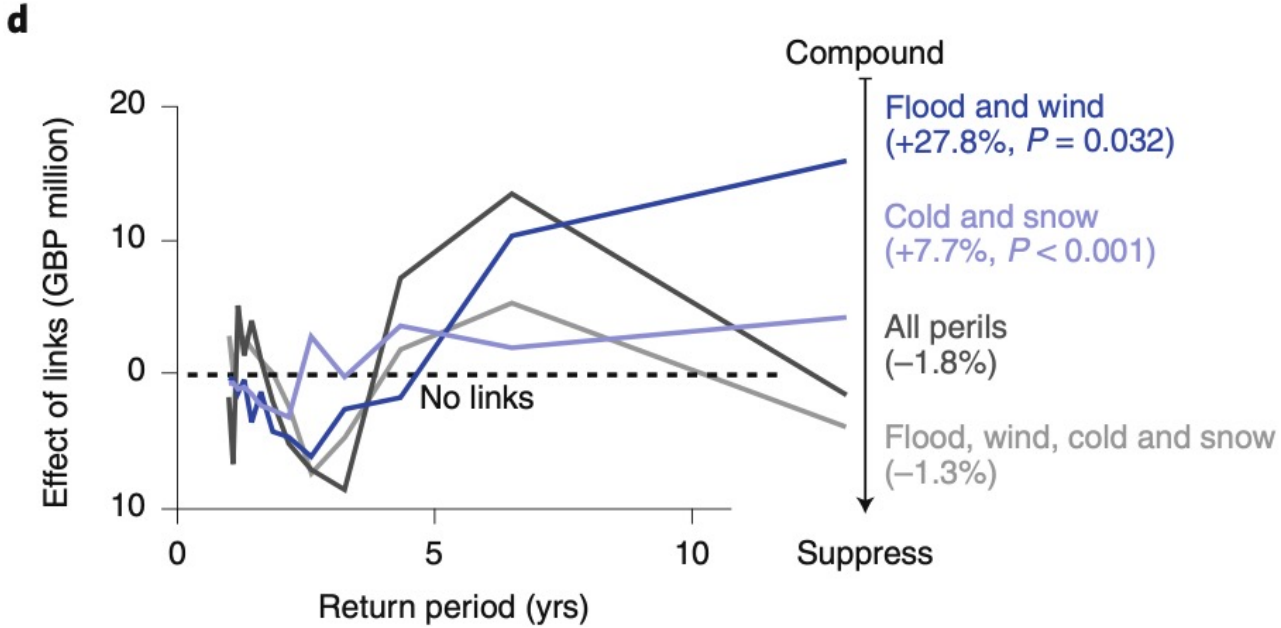




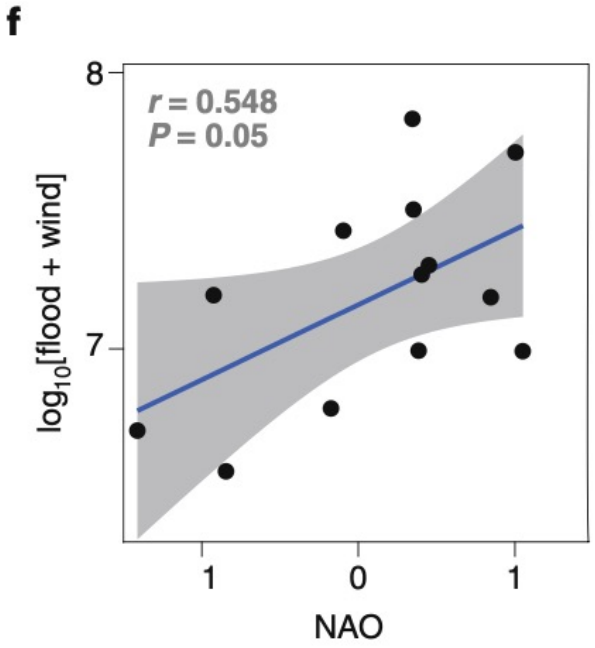


In terms of AEP 'losses' (precip./wind proxies), effects over 72h seem to dominate (SEAS5, UNSEEN method). This is consistent with a number of other recent studies looking at hours, days, weeks ….

Timescales: Building on what we know ….



Tentative, seasonal evidence that co-occurrence effects extremes in actual losses (at least no indication it doesn't)

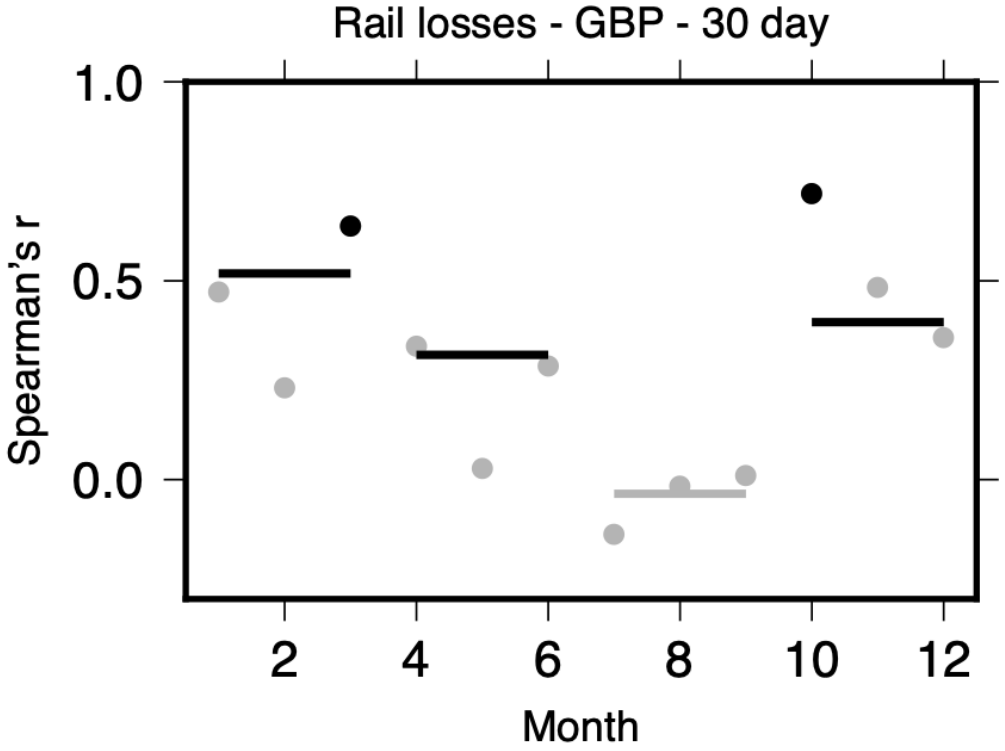


Plausible, climatic drivers at seasonal scale.

(Hillier et al, 2020)

Timescales: Building on what we know ….

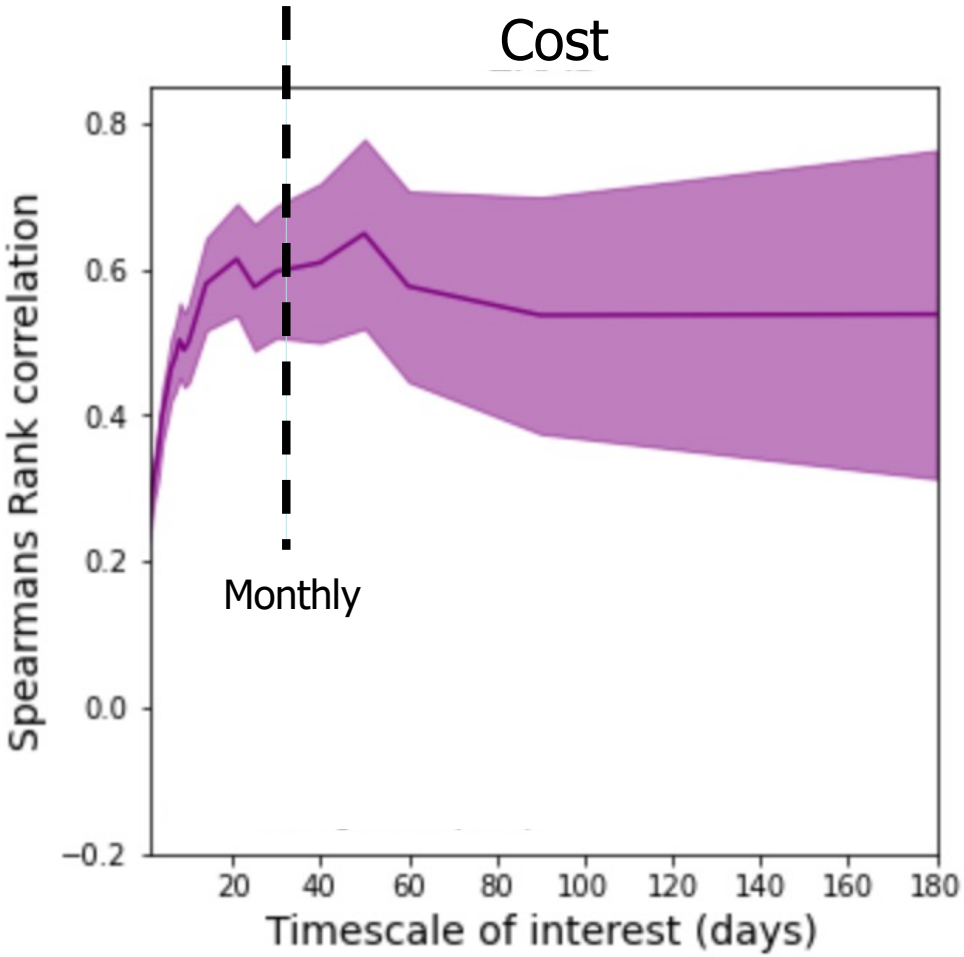
Hannah has reported on the work we've been doing, including the step towards impact with the CEH flow modelling. This is a little more using the Network Rail data.

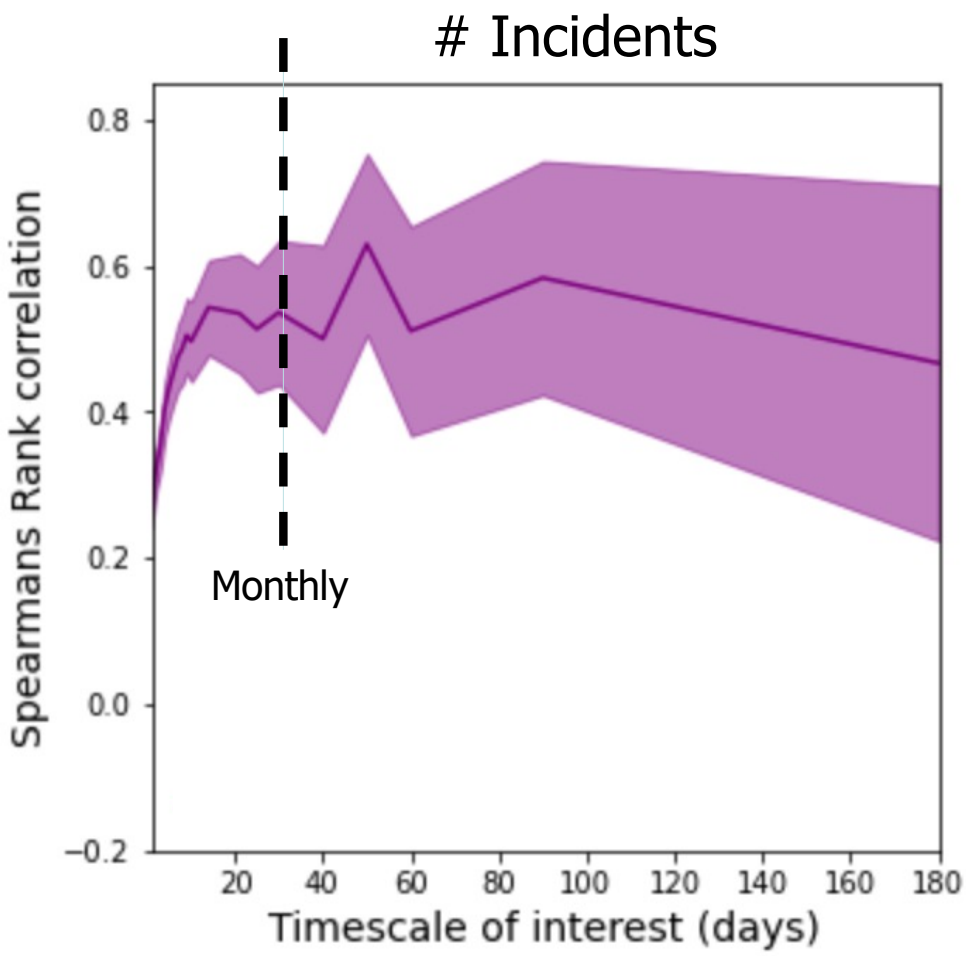


Correlation at 30-90 days varies by season, and is low July-Sept.

Importantly, this means the correlation is *not* a reporting artefact (e.g. as in ABI data)

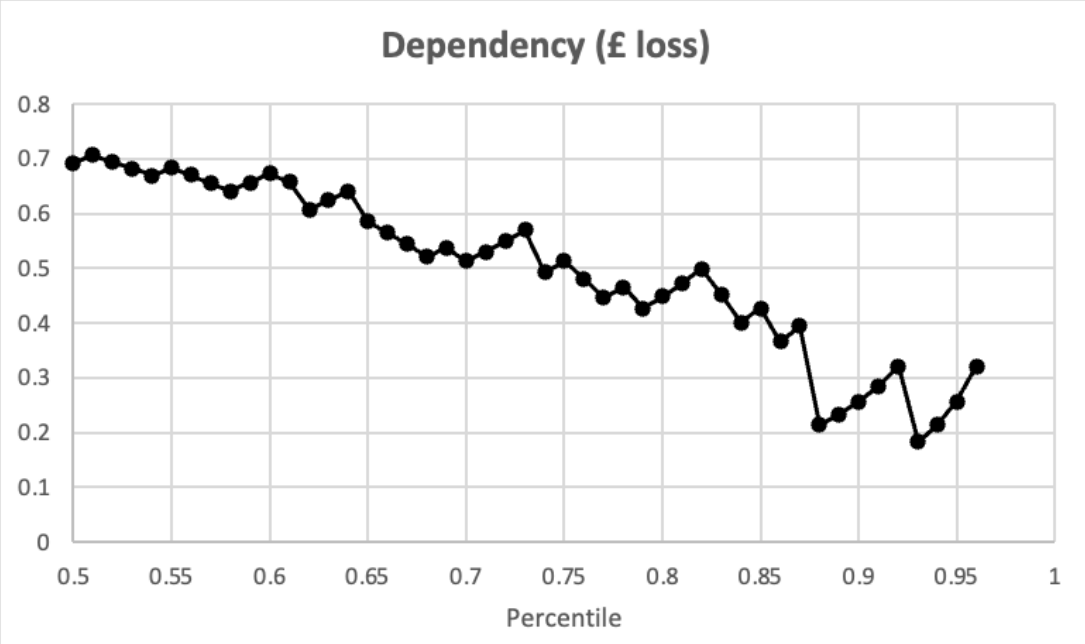
Timescales: Building on what we know ….





- Network rail losses, correlation between flooding and wind.
- Substantive correlation across many time-scales
- Similar to river flow & gusts. Strong pluvial influence?

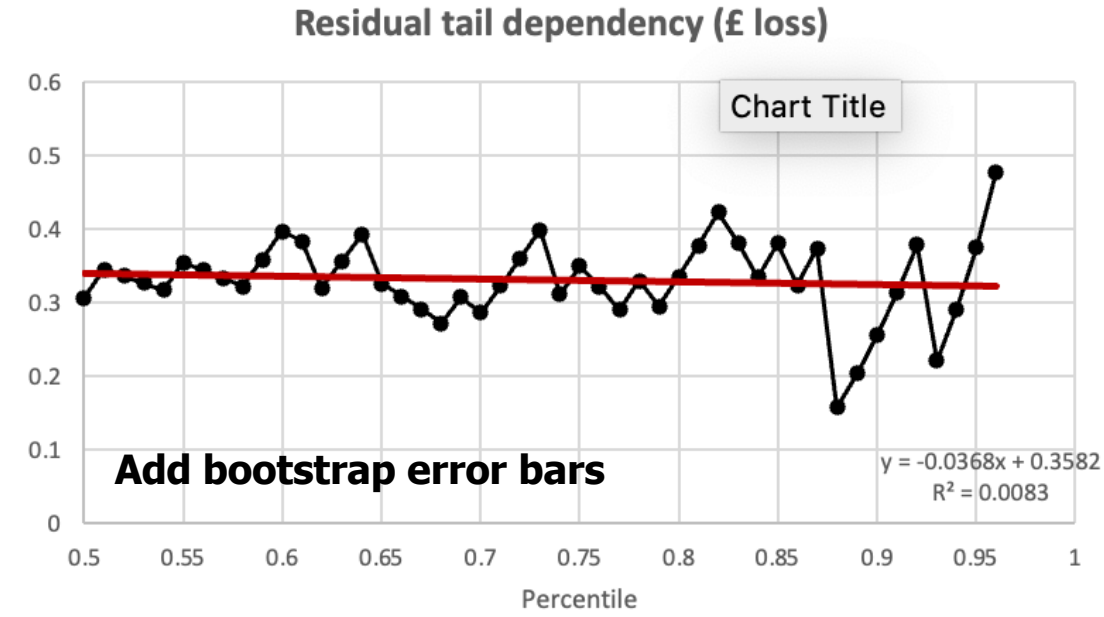
Timescales: Building on what we know ….



At 30 days (i.e. monthly), there is an indication that correlation may exist at extremes.

Both for GBP and *n*.

[Remember that a generally dependent relationship can also be asymptotically independent!]

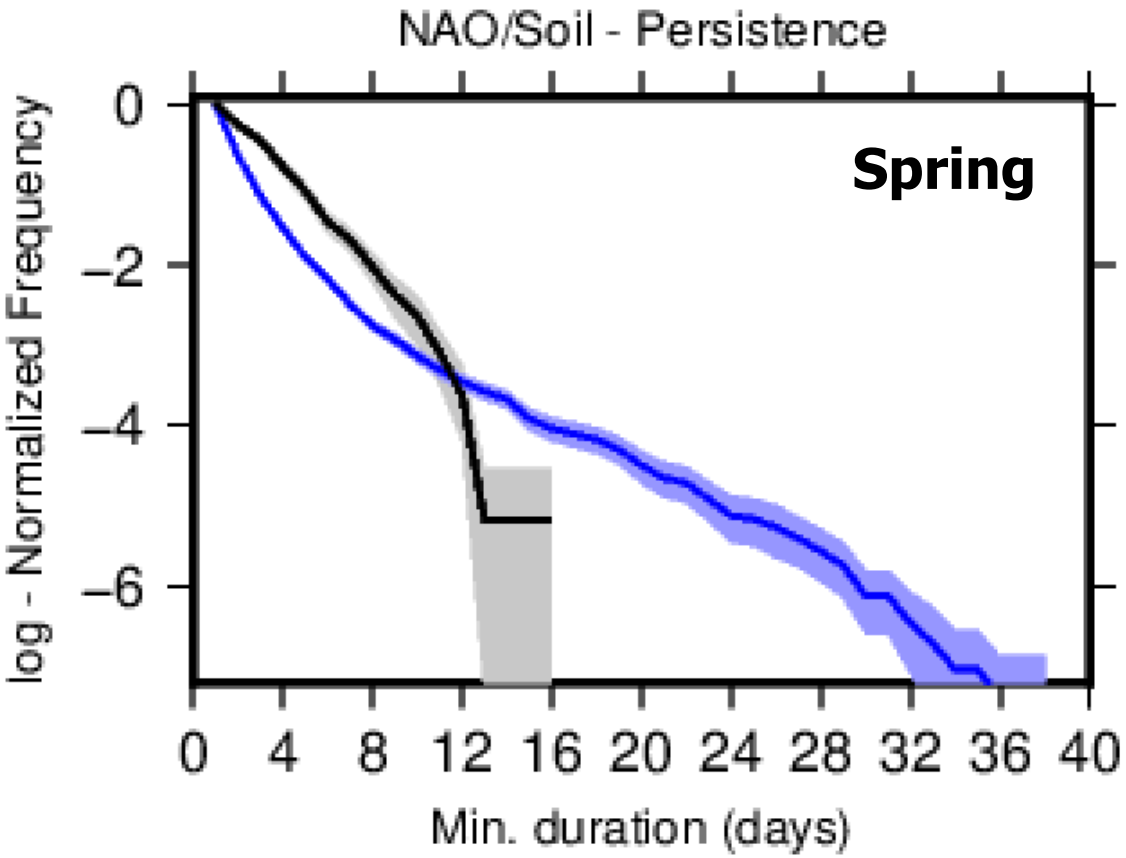


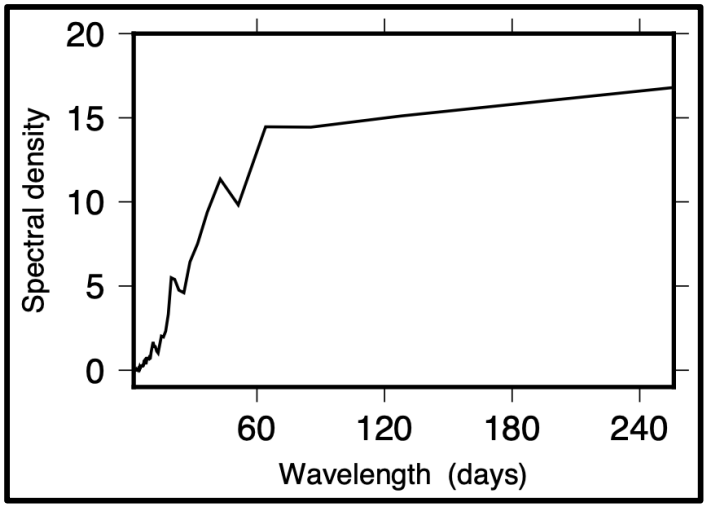
Going forwards, my focus will be on impactful events / footprints; i.e. events set (e.g. in UKCP18) and driving processes

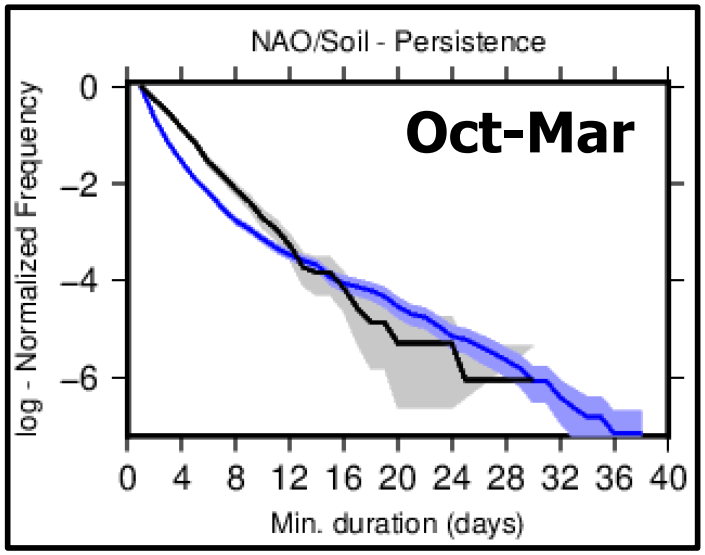
[I promised NERC a joint UK event set for FL & WS]

Timescales: Building on what we know ….

'memory' and persistence.







Soil saturation (blue) in the UK can cause conditions for flooding beyond the persistence of distinctly high NAO (grey). Both >1 after normalization, winter (Oct-Mar). Even if we know NAO has a seasonal-scale energy …..

Towards a conceptual model (or at least a 'straw man' version for the ongoing work to build on)

Weather

Strongest co-occurrence (**r = 0.7-0.8**) for weather related variables over a few days, related to individual atmospheric events.

Hazard & Impact

River flow and wind extremes co-occur most strongly (**r = 0.6-0.7**) over windows up to 40-60 days, involving clusters of storms and persistent soil saturation.

Implications

After ~10 days, impacts co-occur is lower, but sustained (**r = 0.3-0.6**) so becomes increasingly important in terms of implications as events continue to build up

Fast/brief events, or sub-storm (hours)

Storm (e.g. ETC)

~Daily (**1-3 days**)

Precipitation, V_{max}

Storm sequences

4-15 days (weeks)

Flow, V_{max}^3

'Memory' in catchment saturation

up to ~60 days?

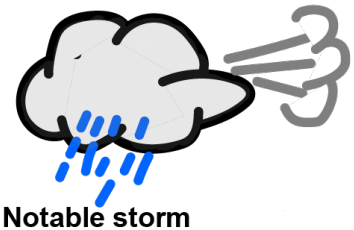
Impact & impact proxies - SSI, FSI

Large -scale drivers?

Seasonal

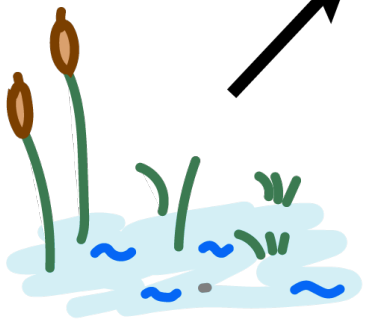
e.g. solvency

Less well understood

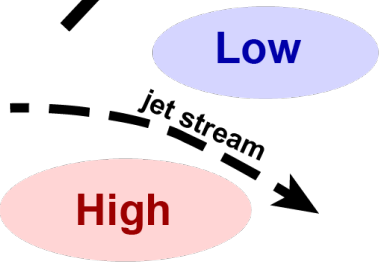


Notable storm

Storm 'cluster', each event may have a different character



Catchment saturation



Large-scale drivers (e.g. teleconnections)

Hillier et al (2015)
De Luca (2017)
Hillier & Dixon (2020)
Owens et al (2021)

THE END

THANK YOU

Questions please!