

WP5 - INDICES TIME EVOLUTION AND RELATIONS WITH THE ATMOSPHERE



*European Research Area
for Climate Services*

Initial plans and status

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STAFF INVOLVEMENT/DURATION

- Pls
 - Richard Allan (r.p.allan@reading.ac.uk; @rpallanuk)
 - Len Shaffrey (l.c.shaffrey@reading.ac.uk; @Len_Shaffrey)
 - Emily Black (e.c.l.black@reading.ac.uk; @emily_black3)
 - Ed Hawkins (e.hawkins@reading.ac.uk; @ed_hawkins)
- PDRA to recruit, M10-M33 (starting June 2018)



Deliverables:

- **D5.1** Inventory and Catalogue of Indicators of circulation variability for comparison with the INDECIS-ISD (**M18**)
- **D5.2** Report on temporal evolution of the INDECIS-QCHDS and INDECIS-ISD, including the time-emergence of climate-change signals and relation with atmospheric patterns (**M24**)
- **D5.3** Report on the relation between INDECIS-QCHDS and INDECIS-ISD and atmospheric patterns (**M33**)

ISD - Indices and Sectorial Dataset

QCHDS - Quality Controlled & Homogenized Data Set



Indecis
Sectorial Climate Services

PLANS

- **Tasks:**

- Compilation of teleconnection indices, weather types, blocking patterns, Atmospheric Rivers/other indicators of atmospheric variability (M10-M13)
- Analysis of temporal evolution of the INDECIS-QCHDS & preliminary/additional datasets, including derived extremes (M14-M21)
- Analysis of temporal evolution of the INDECIS-ISD (M22-M28)
- Investigation of the physical links between atmospheric variability, extremes and sectorial indices, with special emphasis on drought, heatwaves and agriculture (M24-M33)
- Investigation of time-emergence of observed climate change signal relative to variability (M24-M33)

CONTRIBUTIONS

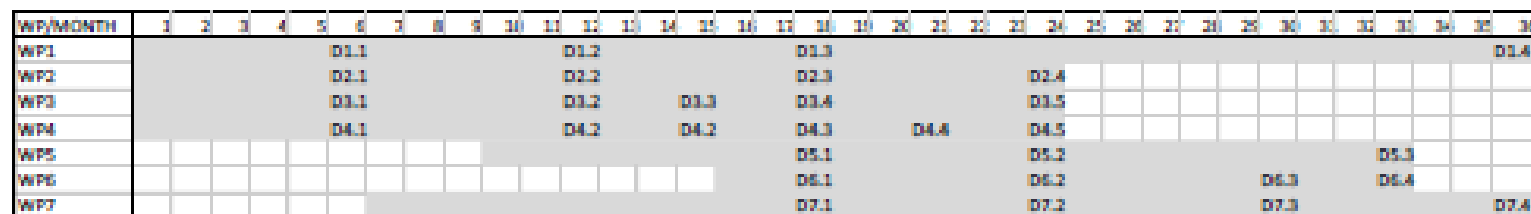


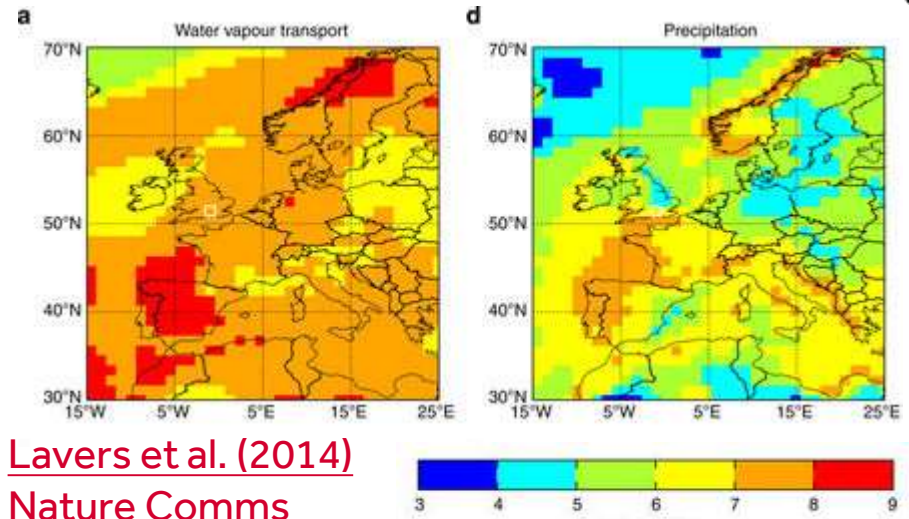
Figure 1. GANTT Diagram of Deliverables.

Table 1. Contributions (persons/month) to each Work Package by members of the consortium.

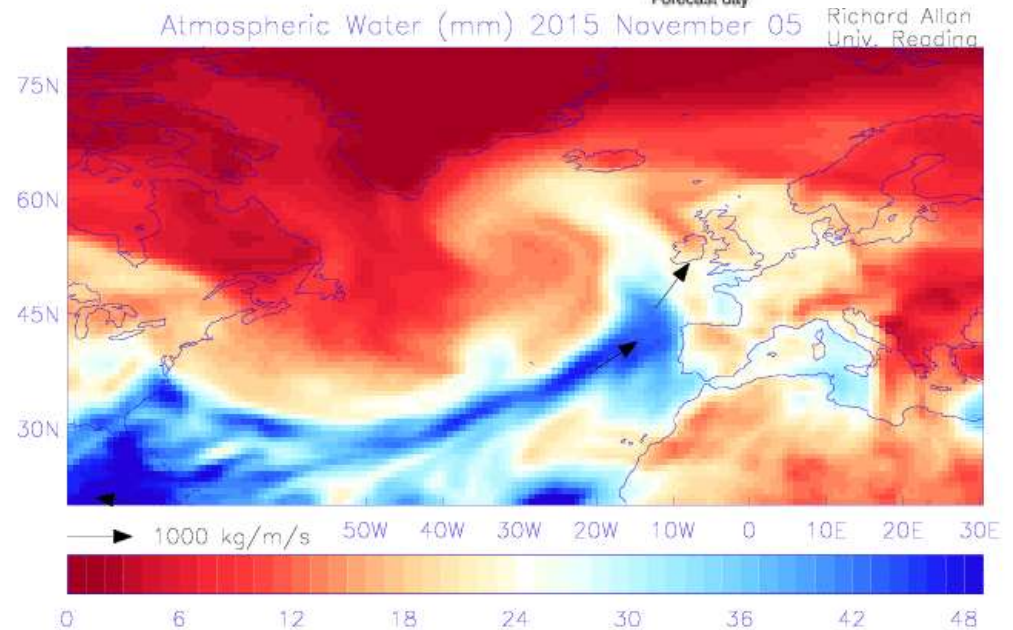
WP	URV-C3	UREAD	FMI	BRGM/D3E	IRPI(CNR-DTA)	UC/IHC	SMHI	MÉT EIREANN	AEMET	BSC	FFCUL	CZECHGLOBE	KNMI	RMI	METEORO	IPE/CSIC
1	36						1								1	
2	12	*			17		1	4	6	18			6		1	2
3	66				17		5	4	24	12	13	20	6		0	
4	60	3	25	1	17	32			3	37		24			2	105
5		40			17	75			3	39	16			10	2	
6		10	52	24		41		4		48		10			15	
7	78		25	1	10				54		11				2	8

MOISTURE TRANSPORT & EXTREME RAINFALL

- Example impact relevant metric e.g. Atmospheric Rivers
- Moisture transport linked with flooding
- Promising applications in forecasting and climate prediction
- Energy transport metrics can also be explored (e.g. role in drought/heatwave).
- Links to atmospheric circulation patterns e.g. [Brown \(2017\) IJOC](#)

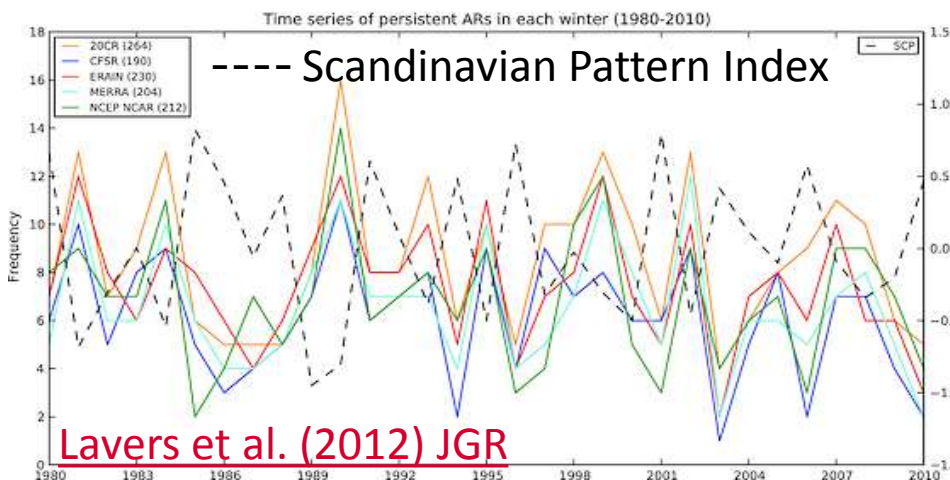
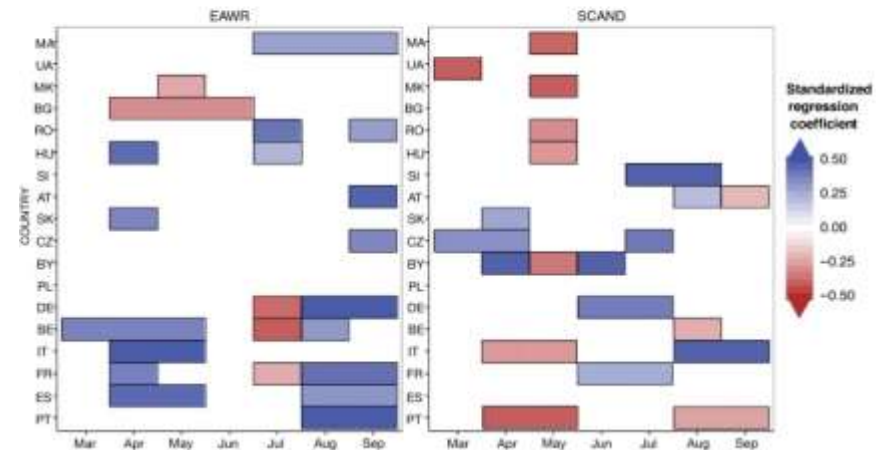
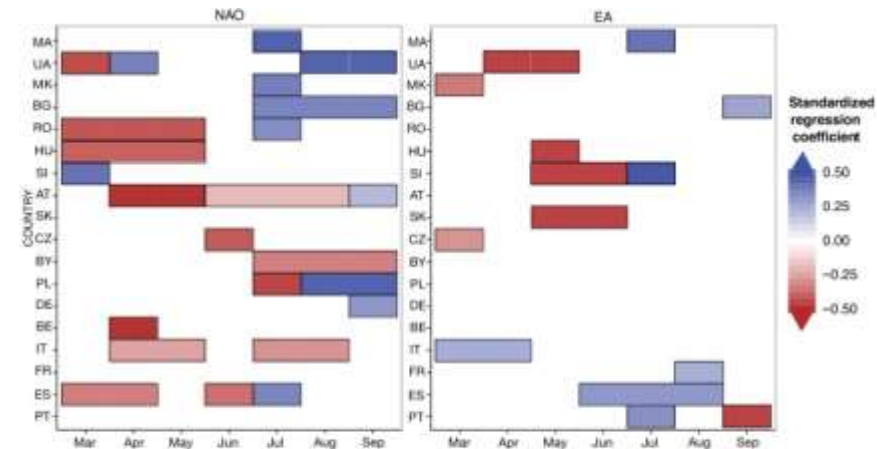


[Lavers et al. \(2014\)](#)
[Nature Comms](#)



CLIMATE METRIC LINKS TO CIRCULATION INDEX

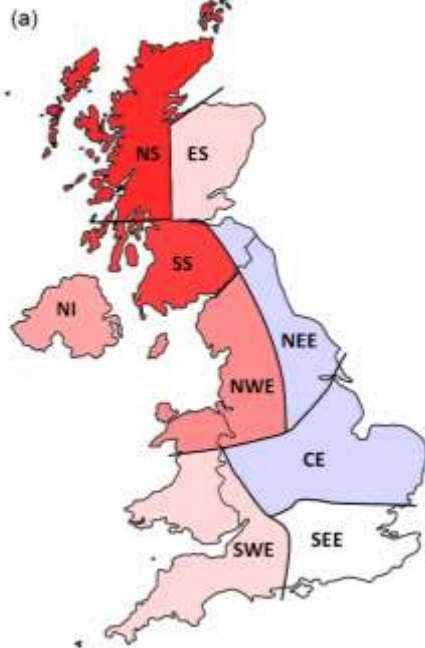
- Standard evaluation of INDECIS-QCHDS/ISDs:
- Temporal variability/trends and links to circulation pattern indices (e.g. NAO, EA, EAWR, SCAND) e.g. [Ummenhofer et al. \(2017\) GRL](#)
- What is physical basis?



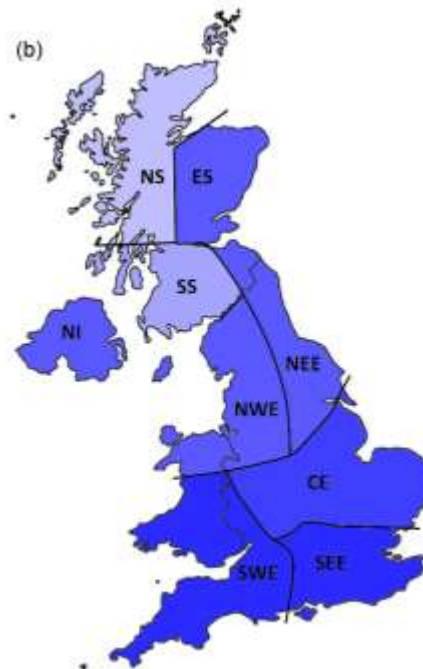
[Ceglar et al. \(2017\) AFM](#)

UK WINTER RAINFALL AND CIRCULATION

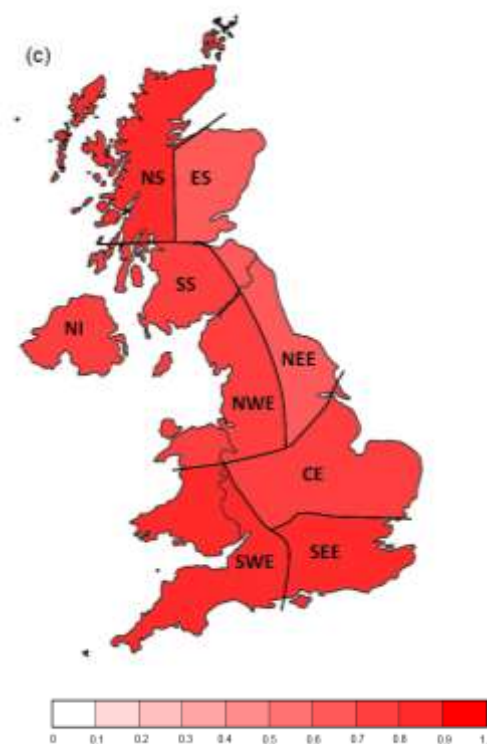
North Atlantic Oscillation



East Atlantic Pattern



Combined model



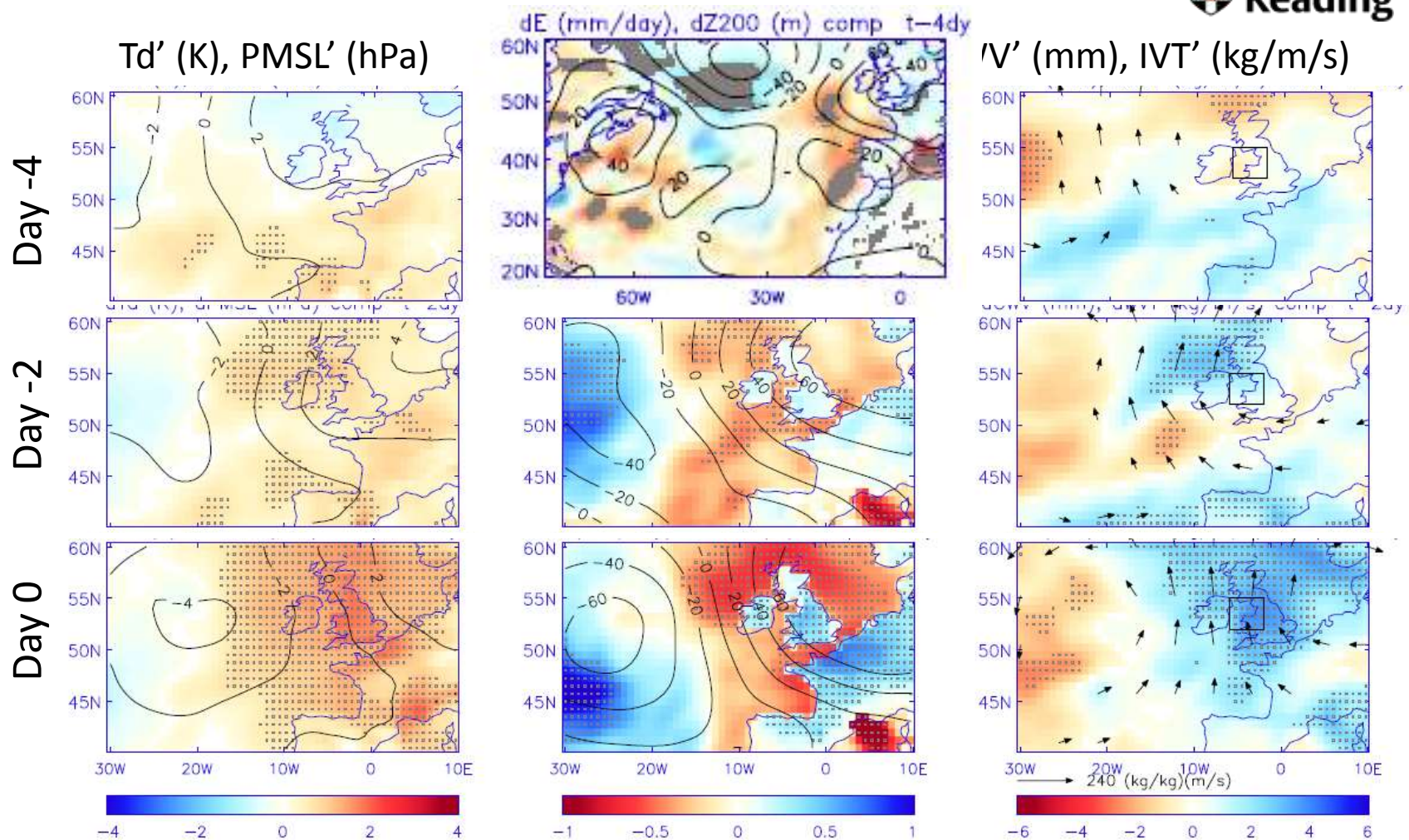
- Regional correlations of DJF precipitation with the two pressure indices (NAO and EAP) and a multiple linear regression model:

$$P_{lin} = a_i \text{MSLP}_{NAO} + b_i \text{MSLP}_{EAP} + c_i$$

- Based on observation data from 1931-1991 (training period)

Baker et al. (2017) IJOC - to appear

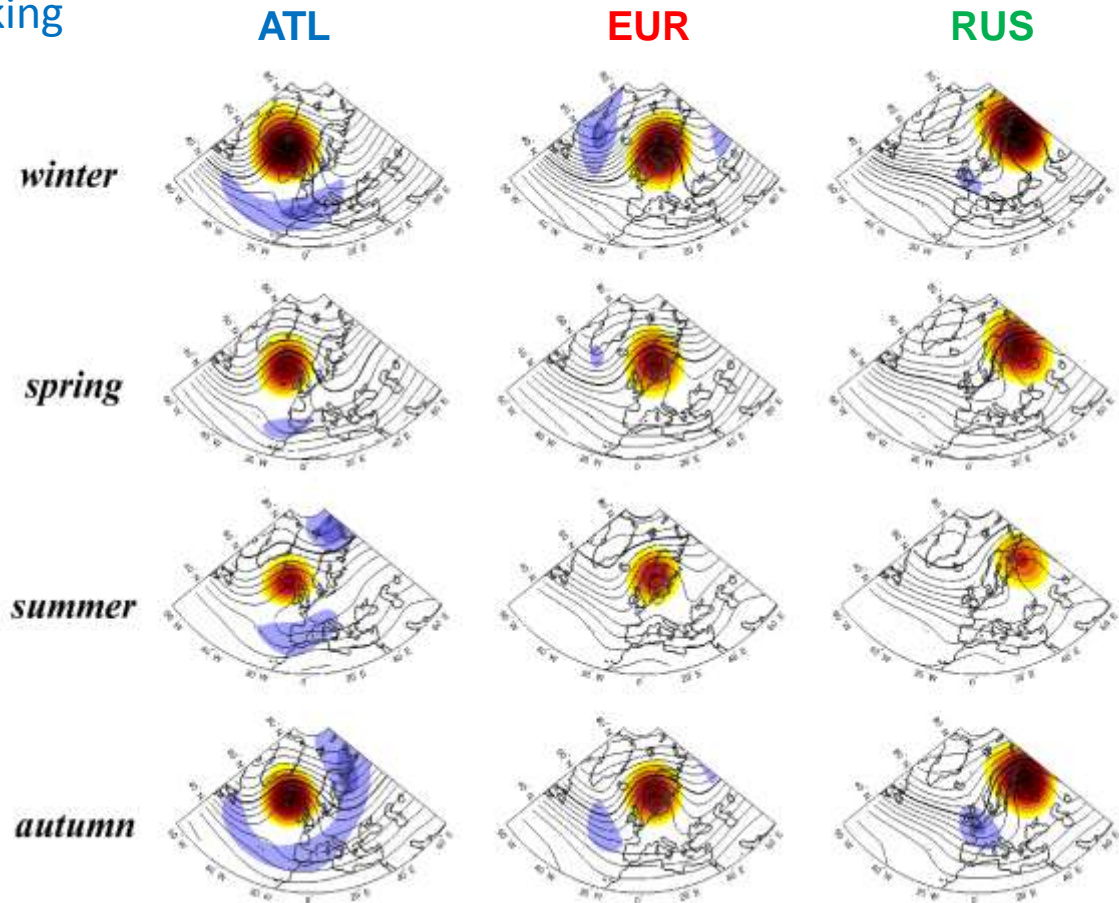
SUMMER COMPOSITES (TOP 25 EVENTS NW)



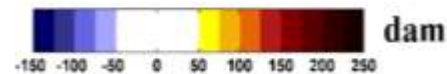
Atmospheric precursors to heavy 3hr summer rainfall events ([Blenkinsop et al. 2016](#))
- extends daily analysis ([Allan et al. 2015](#); [Champion et al. 2015](#))

MORE ADVANCED METRICS (RICARDO TRIGO)

Spatial signature of blocking



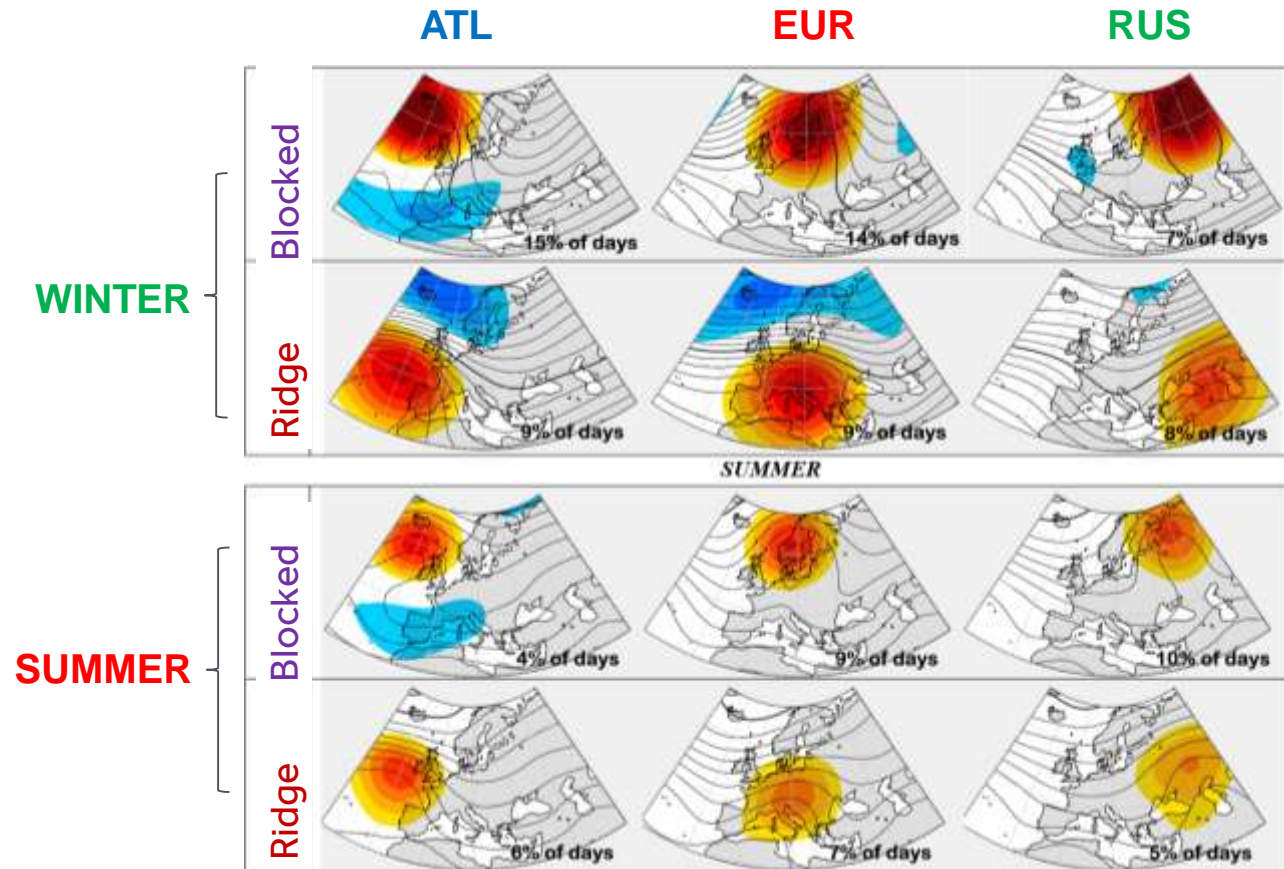
Sousa et al. 2017 Clim. Dyn.



Indecis
Sectorial Climate Services

MORE ADVANCED METRICS (RICARDO TRIGO)

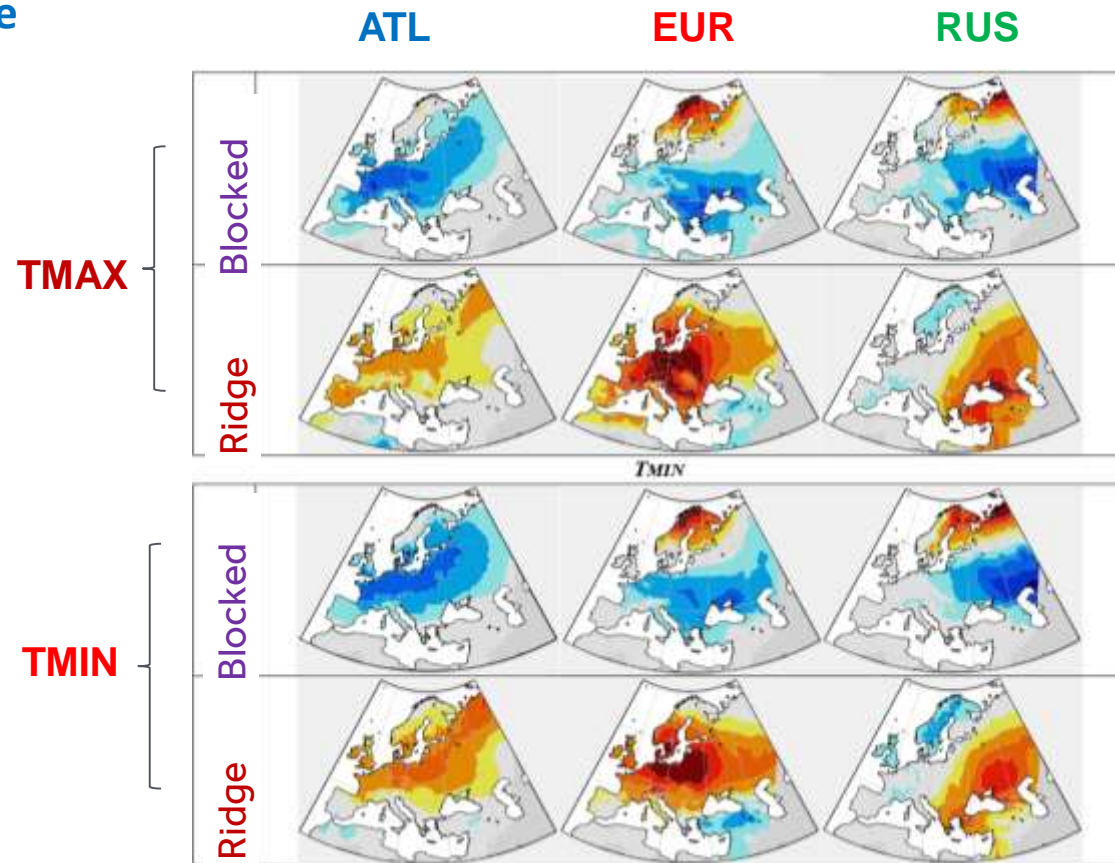
Spatial signature of Blocking vs Ridge



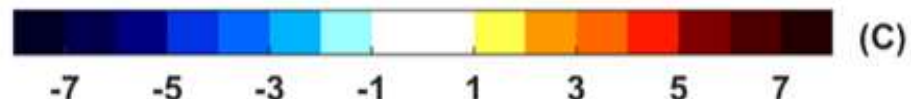
Sousa et al. 2017 Clim. Dyn.

MORE ADVANCED METRICS (RICARDO TRIGO)

Impact of Blocking/Ridge
(Winter)

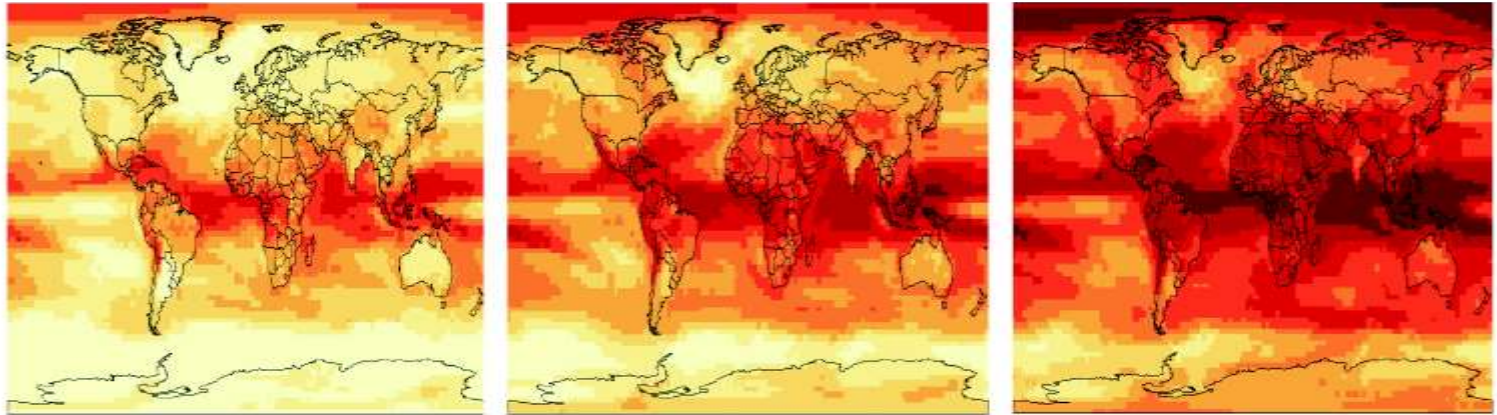


Sousa et al. 2017 Clim. Dyn.



TIME EMERGENCE OF CLIMATE SIGNALS

Signal-to-noise ratio at end of 21st century (RCP4.5, multi-model quantiles)



16th percentile CMIP5 ensemble

50th percentile CMIP5 ensemble

84th percentile CMIP5 ensemble

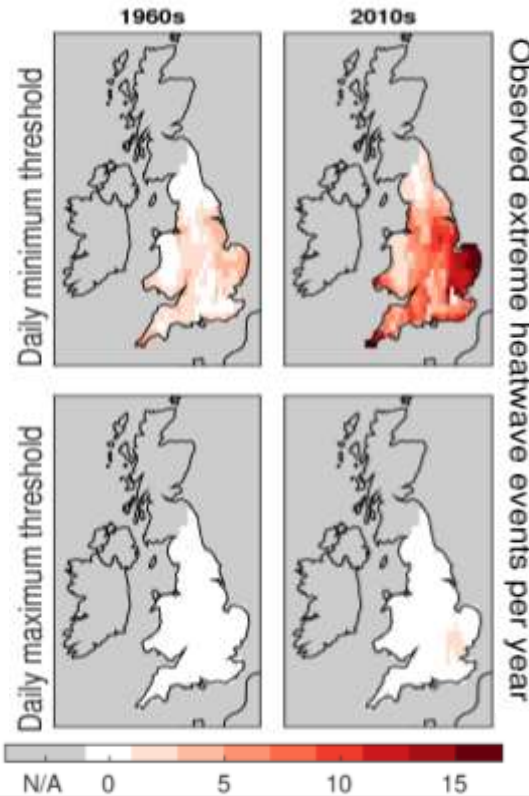
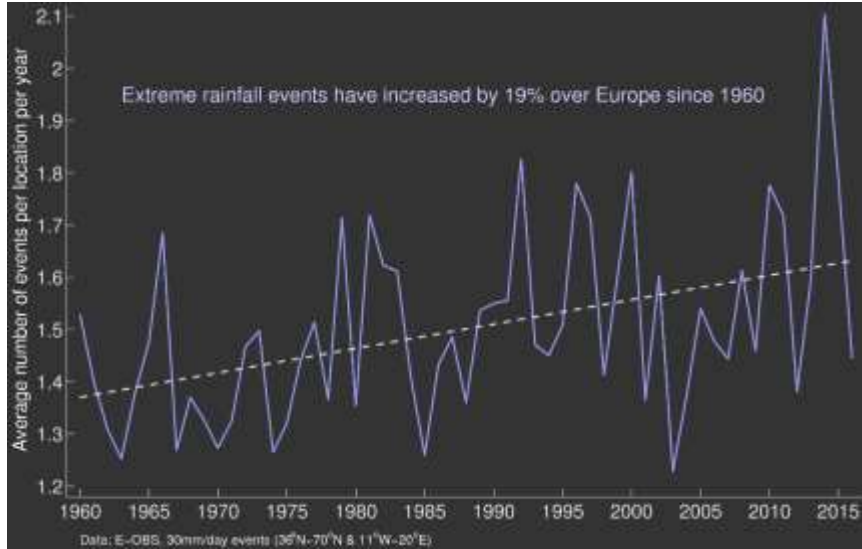


0 1.6 2.2 2.8 3.6 4.4 5.4 6.7 9.0 25.5

[Frame et al. 2017](#)

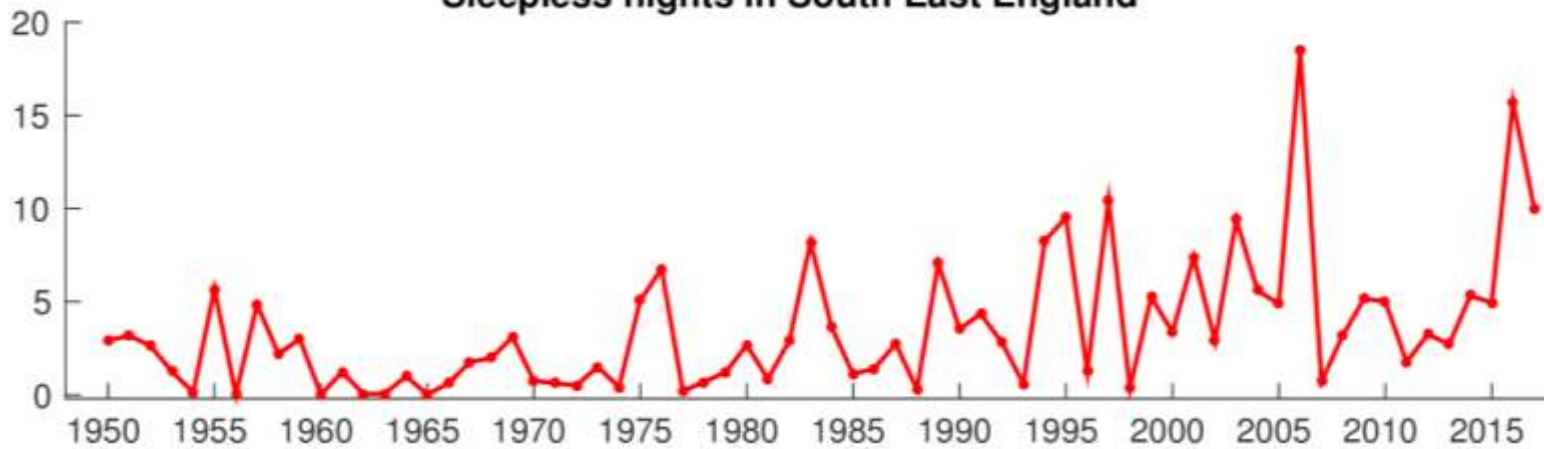
Standard (top) & “cartograms”
(maps distorted by local
population density, bottom)
Slide from Ed Hawkins

TIME EMERGENCE OF CLIMATE SIGNALS



Slide from Ed Hawkins

Sleepless nights in South East England



SUMMARY UNIVERSITY OF READING WP5

- Indices Time Evolution and Relations with the Atmosphere (inc. lag/lead)
- Includes investigating trends and time emergence of climate signals
- Project Linkages:
 - Provide feedback on Indices developed in WP2-4 including through initial analysis of preliminary products
 - exploit/provide input to reanalysis/model-based products through WP6
 - Develop further inter-project linkages (this meeting and early 2018)
- Resources primarily available June 2018 – May 2020
- Particular emphasis on rainfall extremes including links to atmospheric moisture but also drought and opportunities to link with energy sector through Emily Black/David Brayshaw (also e.g. Jerez et al. 2013)
- Also emphasis on influence of blocking patterns via Ricardo Trigo et al.

WP5 ACTION LIST

- Project tasks/deliverables as proposal
- Meet with UK partners to discuss plans; begin recruiting process (15/2/2018, UREAD)
- Send email early 2018 to WP5 list (once finalised) to coordinate activities (15/2/2018, UREAD/IRPI/UC-IHC/AEMET/BSC/FFCUL/RMI/METEORO)
- Begin developing initial list of atmospheric circulation metrics (15/6/2018, as above)
- Ed Hawkins to liaise with WP2 on datarescue/Scotland data (15/4/2018, UREAD/KNMI)
- Specifically link with (to note, not formal actions):
 - David Brayshaw (Reading) on energy sector
 - Ricardo Trigo (FFCUL) on atmospheric blocking/ridge patterns
 - Liliana Vela (Meteo-RO) on reanalysis/WP6 + time emergence
 - Jose Gutierrez (UC-IFCA) on ability of seasonal forecast models to capture patterns of relevance to indices/impacts
 - Sergio Vincente-Serrano (IPE/CSIC) moisture/energy flux diagnostics
 - Gerard der Schrier (KNMI) further datasets to suggest for WP5 (e.g. hourly rainfall, TOA radiation, UK newspaper clippings re 1921 drought)
 - Enric Aguilar (URV) Consider Tourism as case study