The Added Value of Seasonal Climate Forecasting for Integrated Risk Management Decisions (SECLI-FIRM)

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Outline

- The Why, How and What of SECLi FIRM
- A selection of results by Work Package
- Summary and Perspectives
- What to look for in 2020

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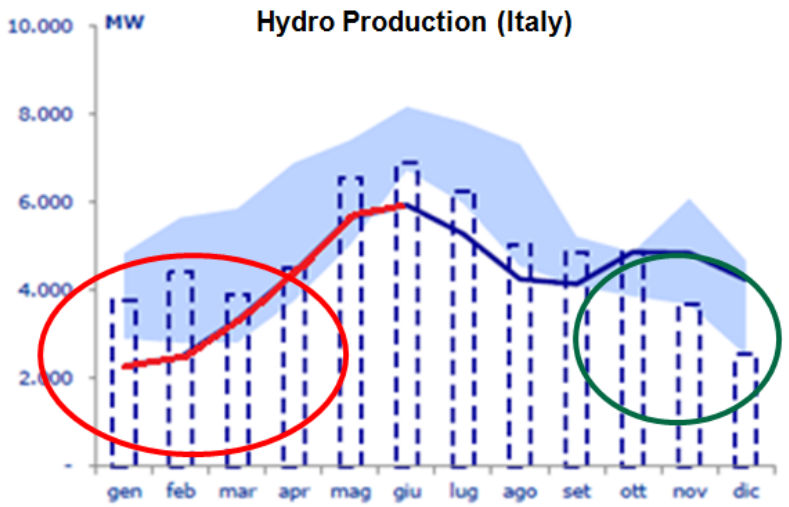
The Why



How's the next season going to be

In Winter 2015-16, a drought with an extremely dry fall and mild temperatures led to a critical deficit in hydro power production

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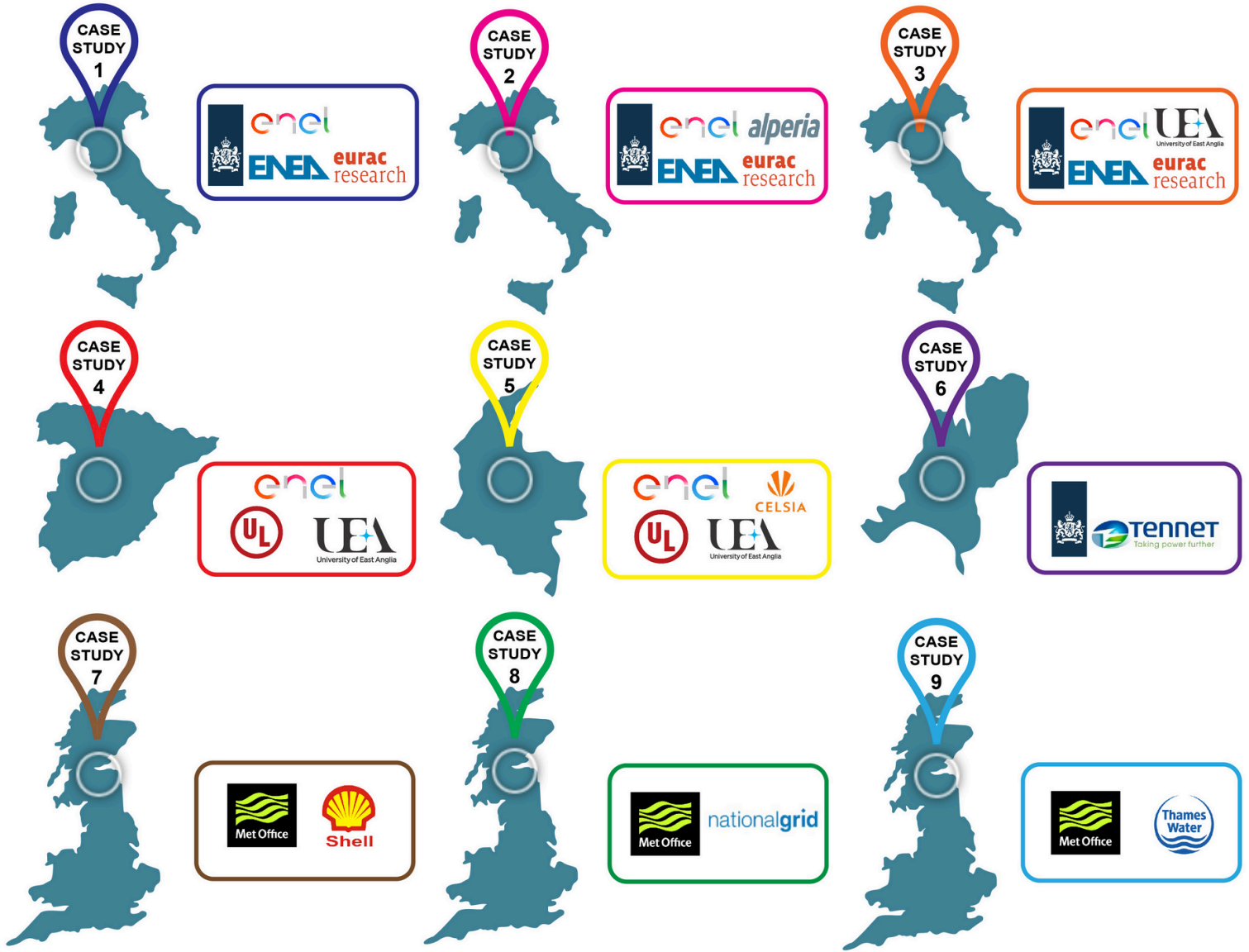
The How – Experiments

NINE CASE STUDIES

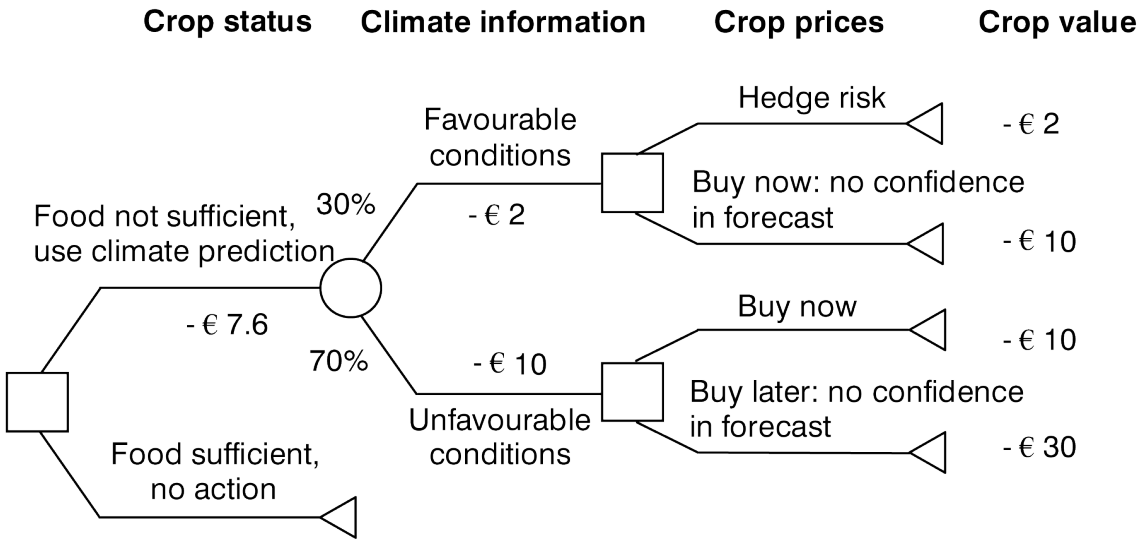
to improve seasonal climate forecast science applied to real decisions

The nine CSs represent recent seasons with anomalous climate conditions leading to problematic and quantifiable impacts for the energy and/or water industry over Europe (mainly) and Colombia. They have been co-designed by industrial and research partners

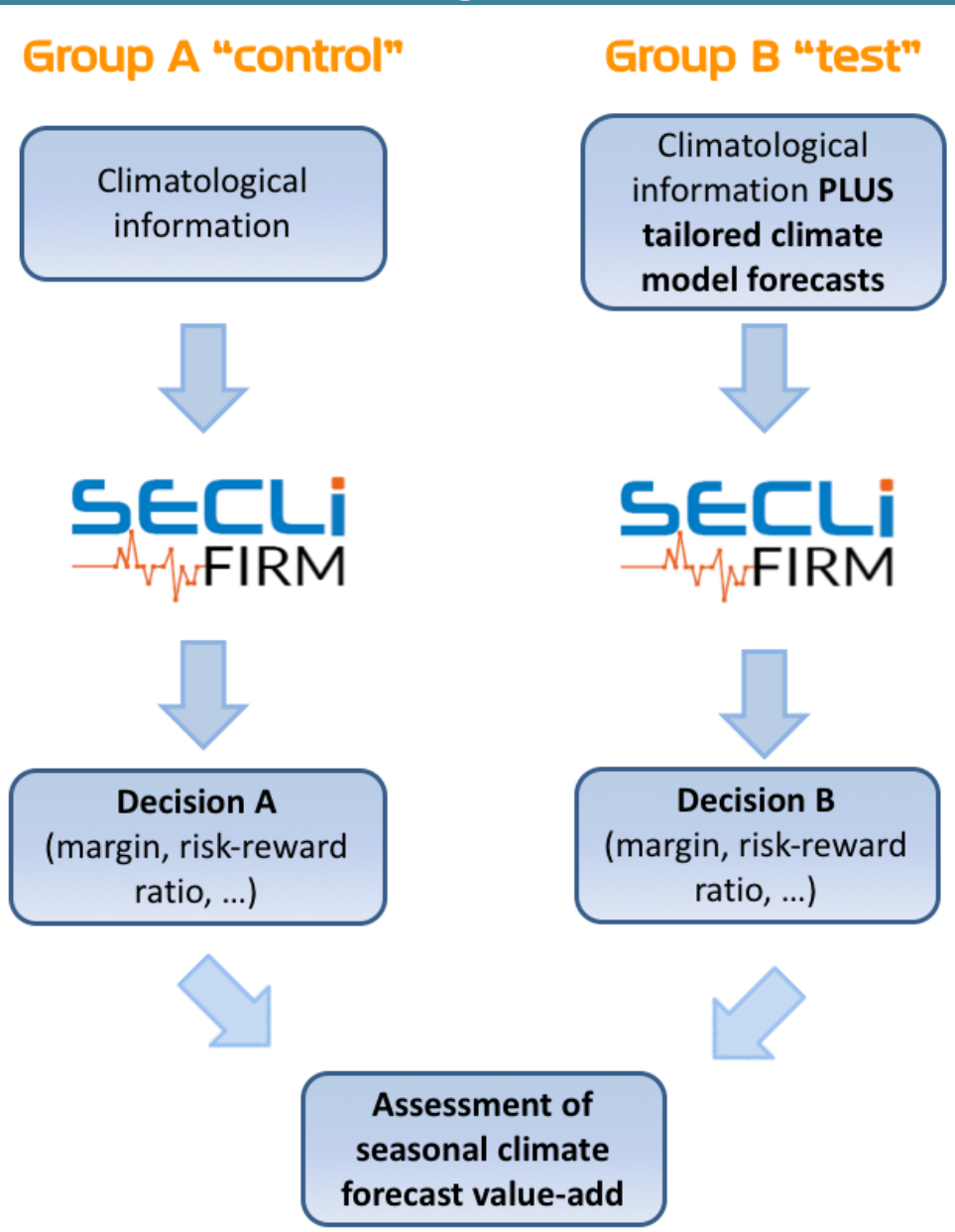


The How – Assessing the Value of Climate Forecasts using decision trees

Decision Theory (and Trees), Avoided Costs, Cost-benefit analyses

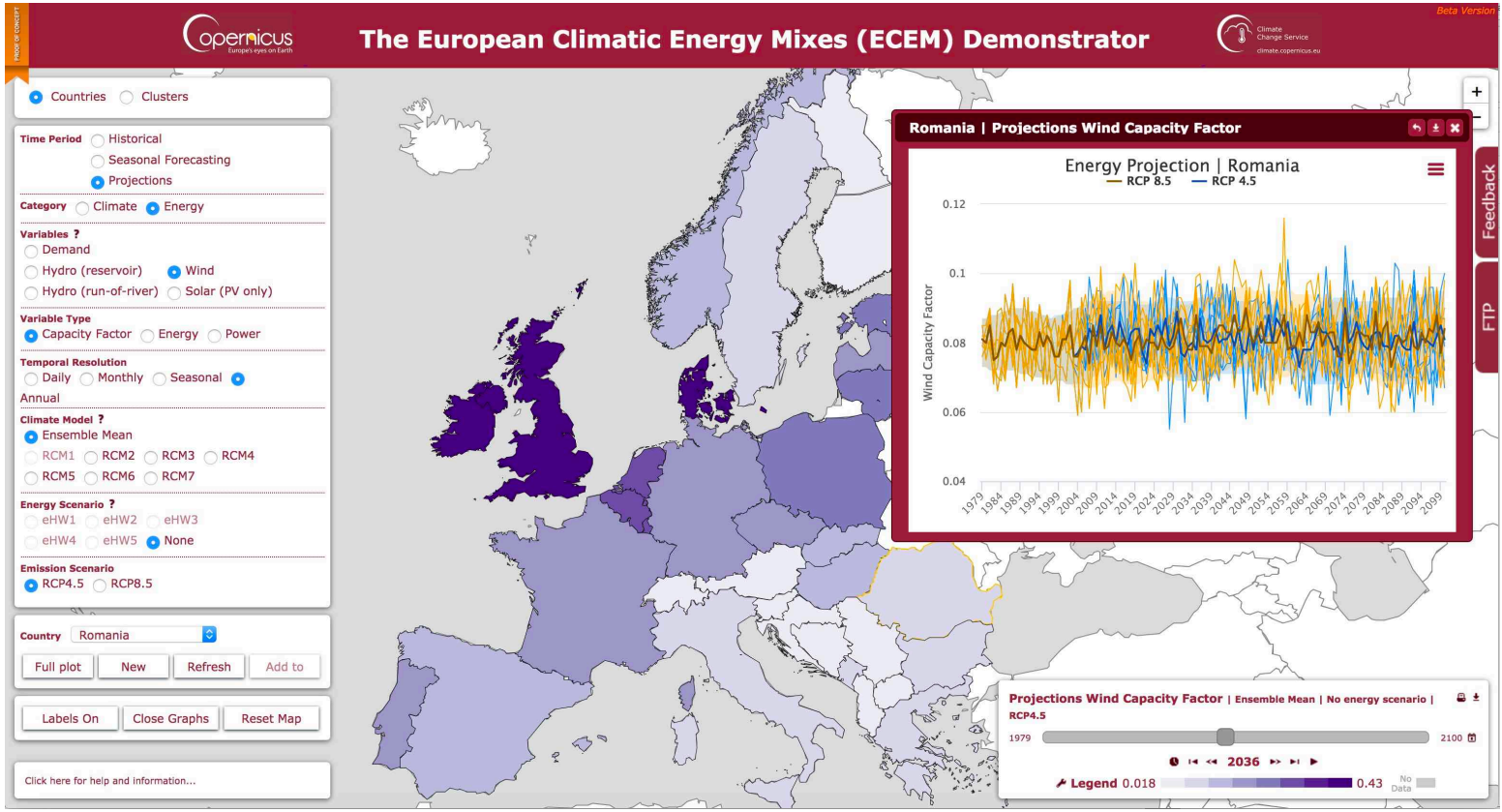


Harrison et al., 2007



The What

SECLI-FIRM will demonstrate how the use of improved seasonal climate forecasts can add socio-economic value to decision-making, in the energy sector, as well as in the water sector, with implications for other sectors



http://ecem.wemcouncil.org

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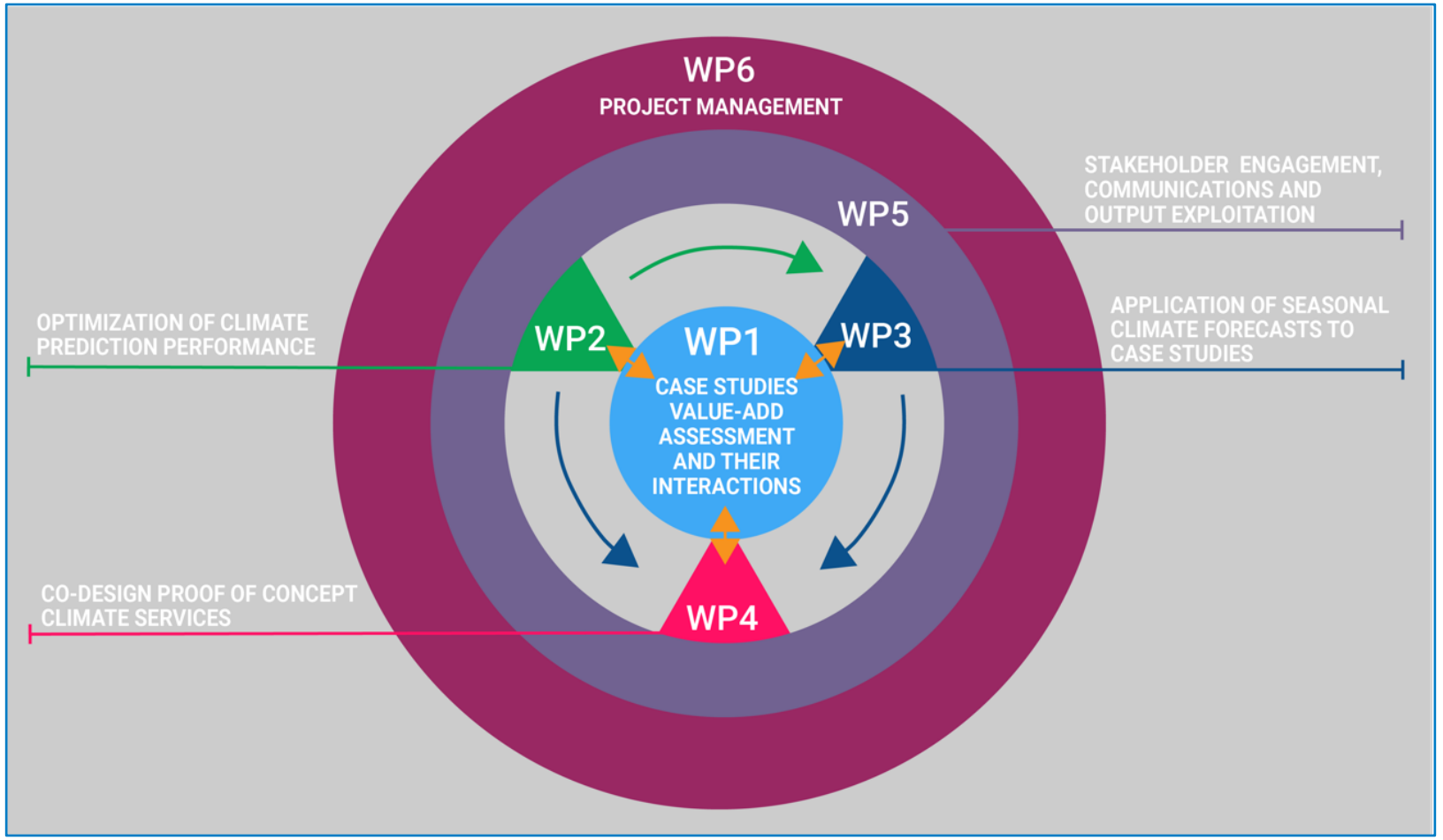
SECLI-FIRM structure



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WP1: Digging deeper into user requirements

Case Study	Climate events	Sectoral challenges and opportunities	Climatic variables (absolute values, anomalies and probability of occurrence)	Time step, time averaging and time horizon	Co-designers
CS2	Dry winters in **Northern Italy** Main focus: November 2015 to April 2016 in Alps and Apennines	Energy Generation: • Anticipating gas price movements in the market in a context of low hydroelectric power production and changing demand net of total renewables.	tmp2m, w10m, tp, sf, sdp, sdn, irr, water balance, T850, GPH500, MSLP. Teleconnection indexes: ENSO, NAO, AO, SCAND, East Atlantic.	Daily/weekly (when available from seasonal forecasts providers) or monthly. One month lead seasonal forecasts (issued 1st day of each month).	**ENEL**, KNMI, ENEA, EURAC, Alperia

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WP1: Formalising the evaluation of value of seasonal forecasts

Menu of Economic Assessment Methods to Choose from:

- DECISION THEORY MODELS
- AVOIDED COSTS
- ECONOMETRIC MODELS
- CONTINGENT VALUATION
- PARTIAL AND GENERAL EQUILIBRIUM MODELS
- OTHER ALTERNATIVE METHODS

Case-study partners identify where their current decision-making approaches sit within this framework.

Case-study partners use decision trees to help (a) illustrate key decision processes, especially climate-driven ones; (b) identify points/nodes where SECLI-FIRM data can be integrated and its value assessed.

Case-study partners consider the relative merits of alternative decision evaluation approaches.

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WP2: A portfolio of research approaches

WP2 optimizes and exploits seasonal climate prediction performance for key climate variables considered in the nine case studies though a range of approaches

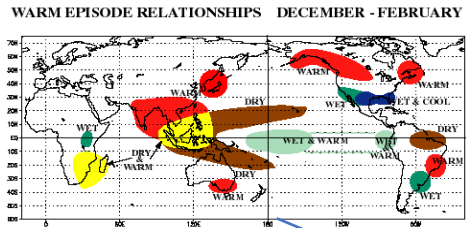
MME FORECASTS

Task 2.1

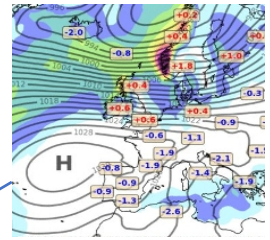
WP2

Optimization of climate prediction performance

Exploit teleconnected vs. locally-forced signal (Task 2.2)

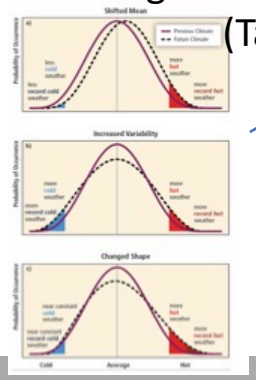


Predictability of weather regimes (Task 2.3)



Engage International prediction community (Task 2.6)

Prediction of high-risk events (Task 2.5)



Statistical downscaling (Task 2.4)

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WP2: Creation of an extensive seasonal climate forecast database

Model	Latest System	Horiz. Res.	Temporal Res.	# Ens. members: hindcast/forecasts	Hindcast Period	Ensemble Generation
ECMWF	5	1º x 1º	Daily/Monthly	25/51	1993-2016	Burst
UKMO	14	1º x 1º	Daily/Monthly	28/60	1993-2016	Lagged
MF	6	1º x 1º	Monthly	15/51	1993-2016	Mixed
DWD	2	1º x 1º	Monthly	30/50	1993-2016	Burst
CMCC	3	1º x 1º	Monthly	40/50	1993-2016	Burst
NASA	2	1º x 1º	Monthly	4/10	1981-2016	Lagged
CCMA	2	1º x 1º	Monthly	10/10	1981-2018	Burst
CCSM4	4	1º x 1º	Daily/Monthly	10/10	1982-2016	Burst
NCEP	2	1º x 1º	Monthly	28/28	1982-2018	Lagged
GFDL	B1	1º x 1º	Monthly	12/12	1980-2018	Burst
JMA	5	1º x 1º	Monthly	10/10	1993-2016	Burst

We have created a database with the output of about 10 seasonal climate forecast systems at both monthly and higher resolution time scales, and at 1x1 deg globally, as well as ERA5 reanalysis as a reference, for a current total of 10+ TB

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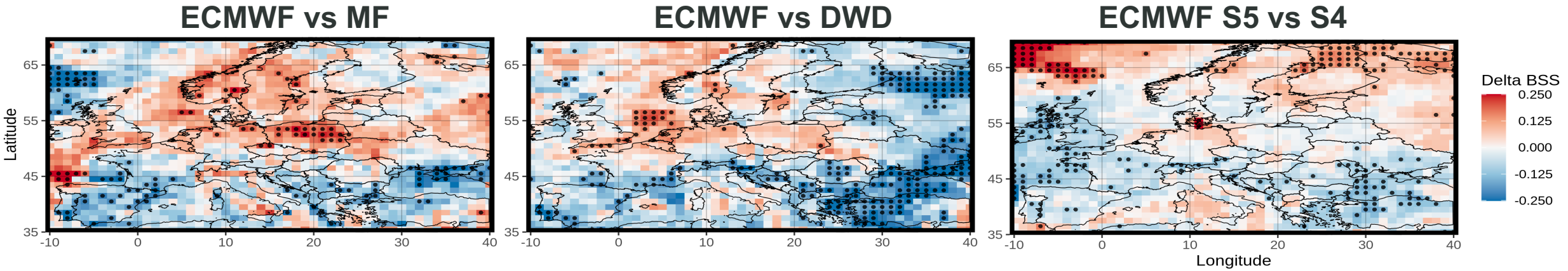
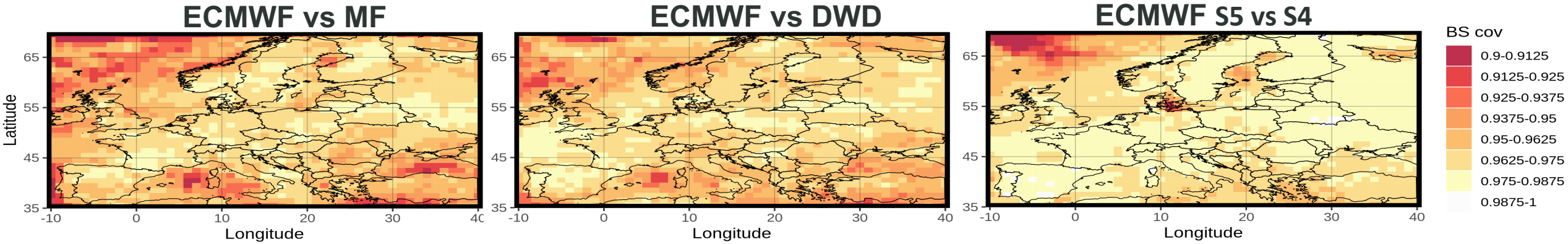
WP2: SF performance of Winter Temperature

BSS lower tercile



Probabilistic Independency



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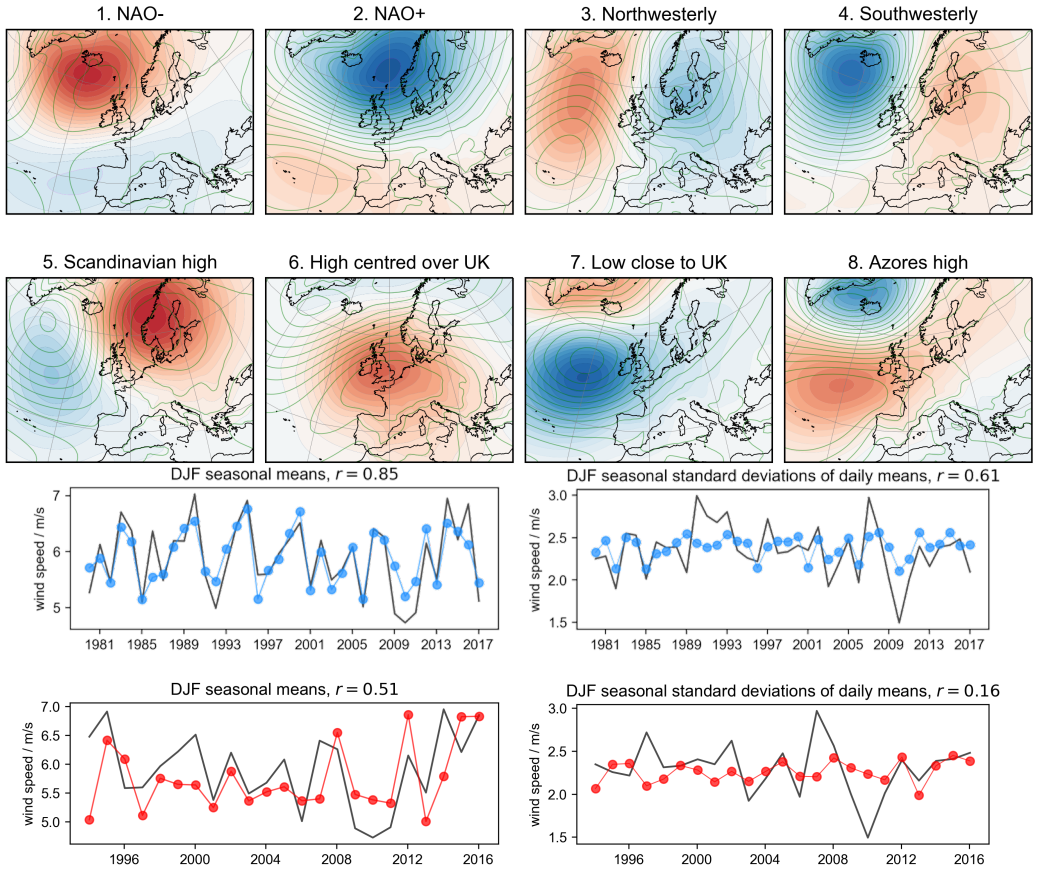
WP3: Weather Types

- Using weather types to try to improve UK demand forecasts (CS 8)
- CS 8 reference is an observational climatology
  → aim here is to produce a shifted+scaled distribution for the winter representing the forecast climate
- Use **forecast daily MSLP** → sequence of WTs during the winter
  - Observed wind (etc) response to WTs gives the wind forecast
- Method **works in principle** for wind, and mean temperature & precipitation
- **In practice**, GloSea5 only has skill in NAO-like WTs (#1 & #2)
  → Skill limited to wind speed only (+no better than using NAO itself)



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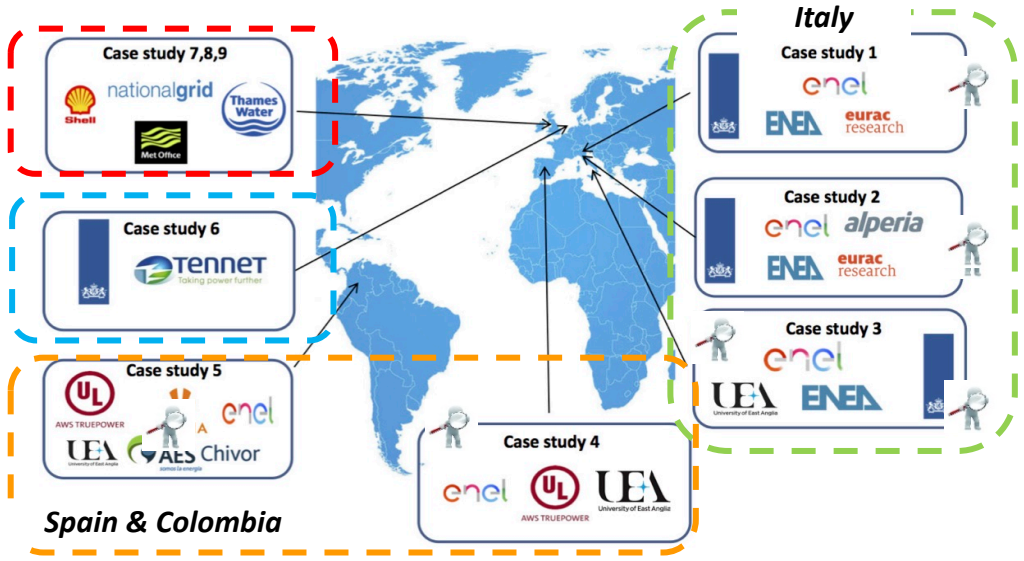
WP3: Who and what

	Case Study	Climate events	Geography	Sectoral impact	Co-designers
Italy	CS1	Heat Wave 2015, and other similar extremes	Southern Europe	Energy –Thermal electricity plant cooling, demand model uncertainty	**ENEL**, ENEA, EURAC, KNMI
Italy	CS2	Dry Winter 2015-16 and other similar extremes	Northern Italy	Energy –Hydroelectric power production	**ENEL**, KNMI, ENEA, EURAC, Alperia
Italy	CS3	Strong Winds March 2016 and other similar extreme	Southern Italy	Energy – Wind power production	**ENEL**, ENEA, KNMI, UEA
Spain & Colombia	CS4	Extreme Winds 2014-15 and other similar extremes	Spain	Energy – Wind power production and balancing	**AWS**, MO, ENEL
Spain & Colombia	CS5	Strong El Niños	South America	Energy – Hydroelectric power production and other RE	**AWS**, UEA, AES Chivor, Celsia, ENEL
	CS6	Low Winds	North Sea	Energy – Offshore operations and maintenance planning	**TenneT**, KNMI



Case Study	Climate events	Geography	Sectoral impact	Co-designers
CS7	Severe climate events in 'shoulder' months	North Sea	Energy – Offshore operations and maintenance planning	**Shell**, MO
CS8	Anomalous winter conditions	UK	Energy – Winter electricity demand	**National Grid**, MO
CS9	Dry Spring and Summers	UK	Water – Water use restrictions	**Thames Water**, MO

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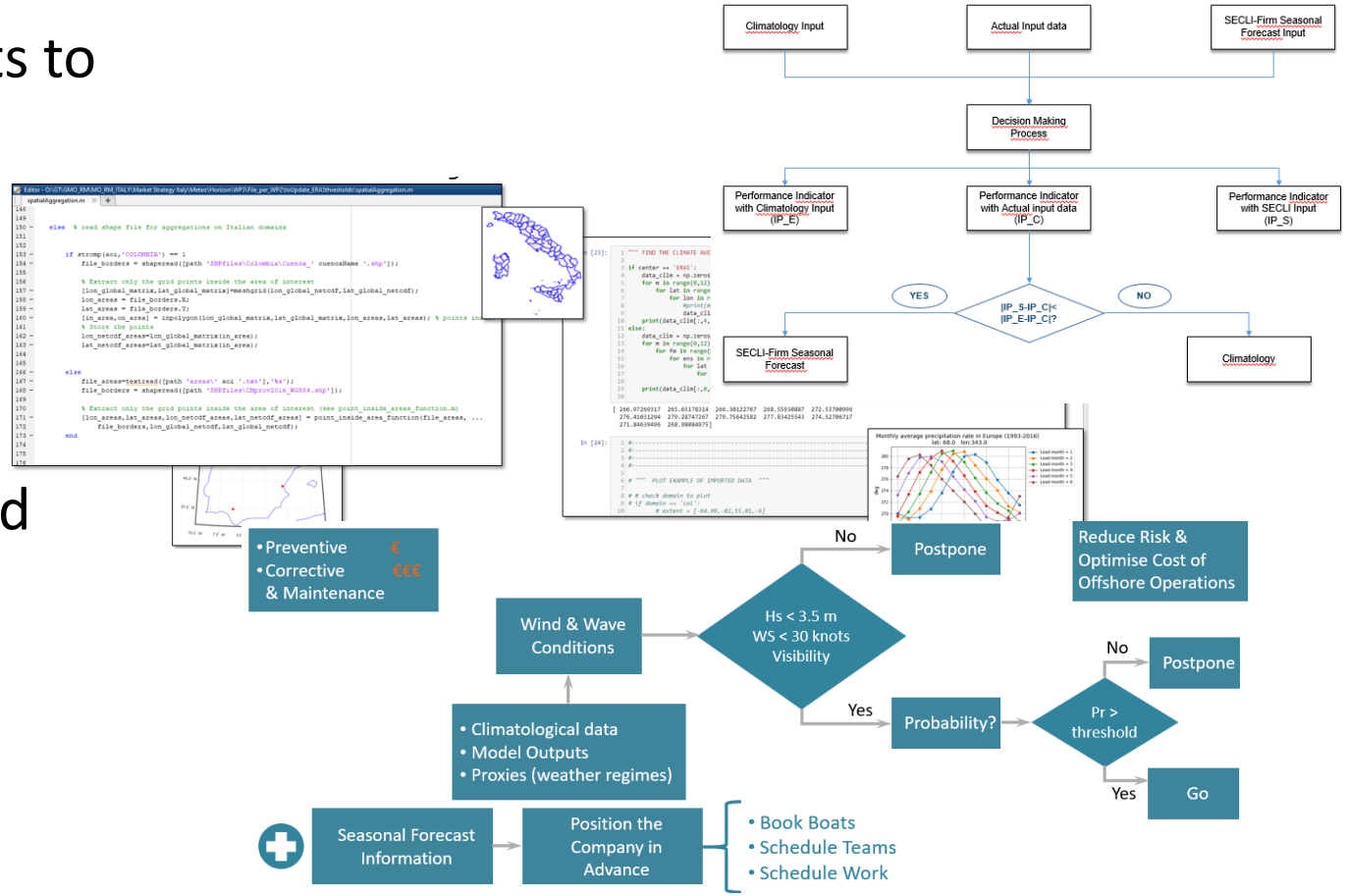
WP3: Ensuring a strong foundation for effective CSs

- Introduction of the probabilistic forecasts to business decision processes
- Formalisation of the business processes: Decision Trees
- Development of tools to produce tailored data
- Application of climatic indexes (eg Standardized Precipitation Index, SPI)



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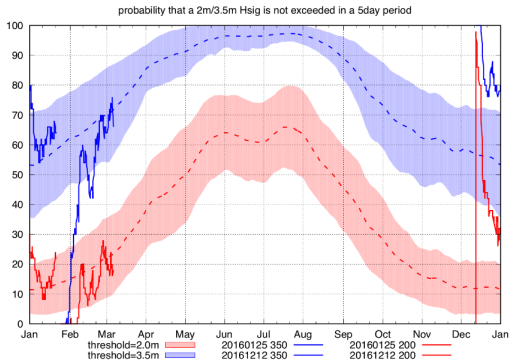
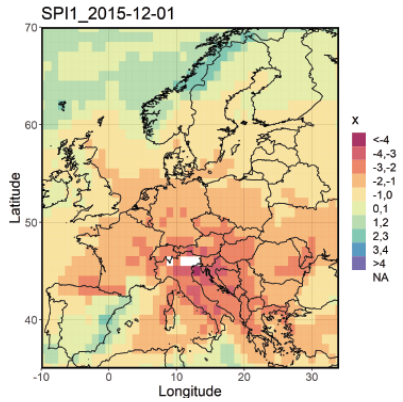
WP3: A portfolio of results



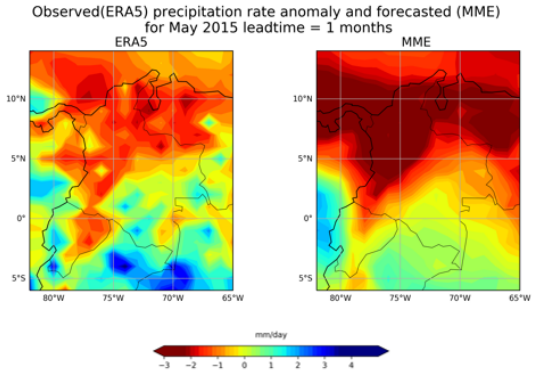
CS6: Studies on wave regimes over North Sea

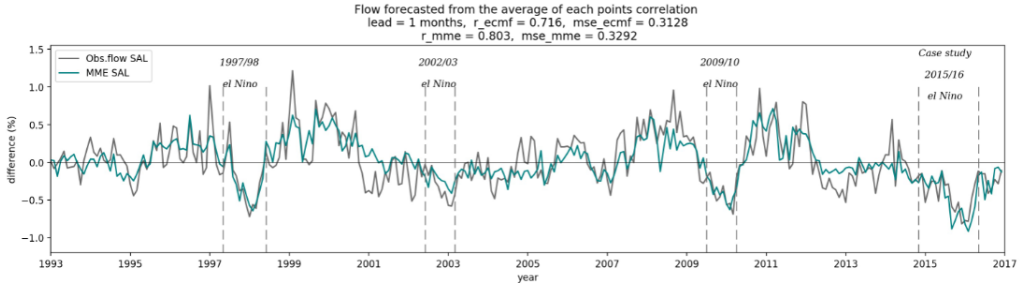


CS2: SPI of December 2015

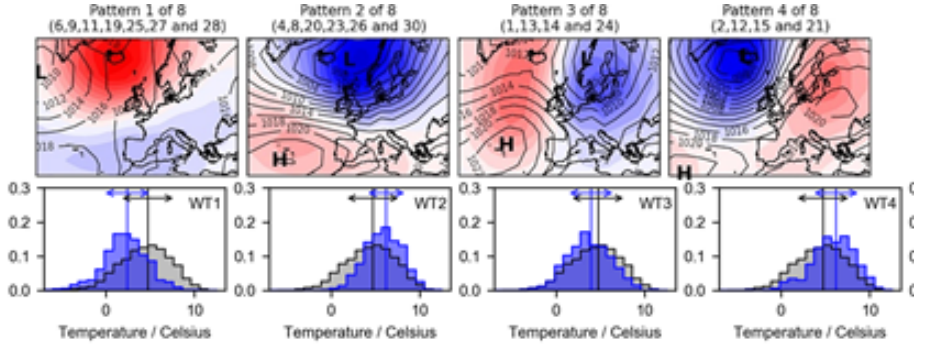
CSs 1-3: Specific seasonal data tailoring over CS domains

	Main variable	Secondary variables	
Input Weather	$tp_{33\%}$	$t2m(tp_{33\%})$	$w10m(tp_{33\%})$
	$tp_{50\%}$	$t2m(tp_{50\%})$	$w10m(tp_{50\%})$
	$tp_{66\%}$	$t2m(tp_{66\%})$	$w10m(tp_{66\%})$
Spatial Aggregation			
	Alp&Apennines	Italy / Alp&Apennines	Southern Itay (Sud+Csud+Sici+Sard)





CS5: Studies on ENSO regimes



CS8: A tailoring technique for energy demand

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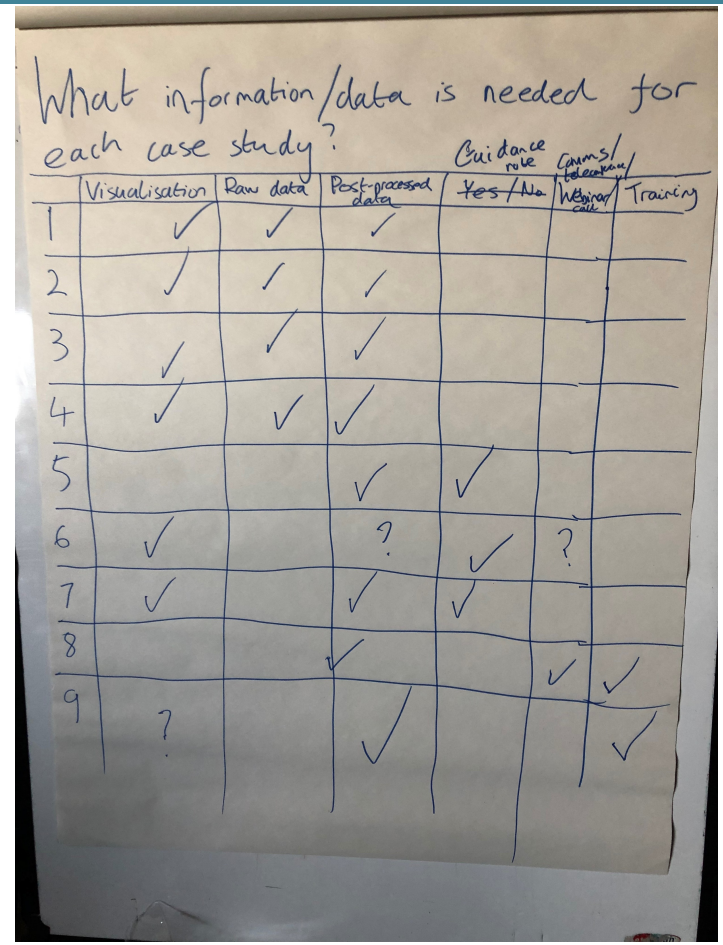
WP4: Initial Planning

- Visualisation is required across multiple work packages
  - CSs 1-4 together, CSs 6-7 together
  - ‘Visualisation’ can mean lots of different things
  - How do we incorporate decision trees/processes into the service design?

- All case studies incorporate some form of post-processed data

- Fixed guidance note to accompany forecast could limit human involvement. It therefore needs:
  - To be integrated with decision trees
  - Understanding of range of decision makers’ expertise
  - Learning material around using complex graphs
  - To be co-designed and delivered through training (e.g. users need to be comfortable in the use of probabilistic information)



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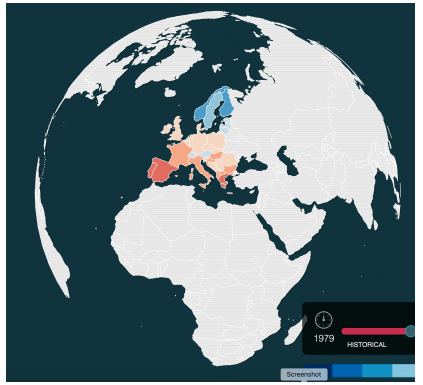
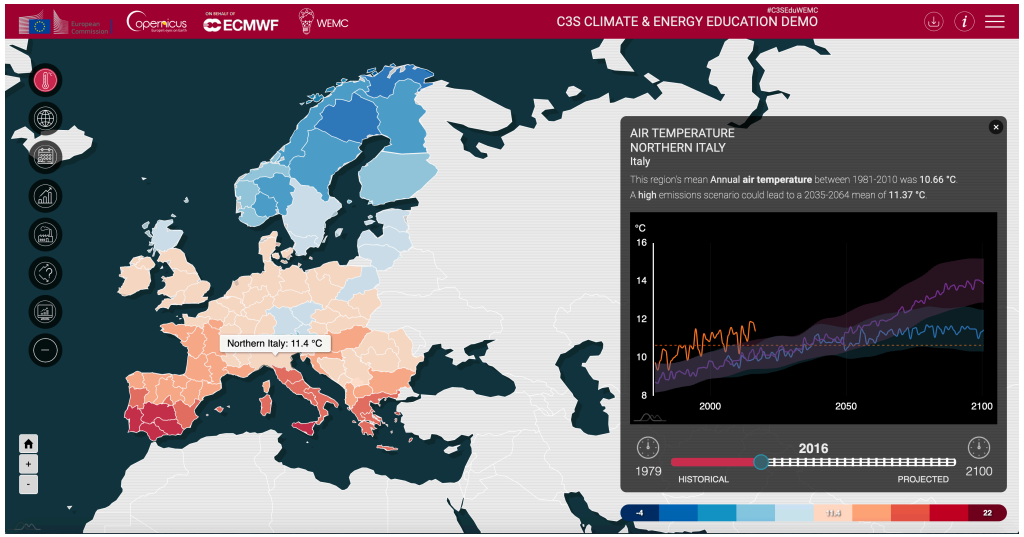
WP4: Current focus

- Identifying/clarifying the method and style of forecast delivery
  - Co-design with case study partners
  - Thinking about how to incorporate learning from decision trees into trial climate service
- Recognising the IP produced by the project and how we can use it to transition from research to operations/commercial opportunities
- Structure of D4.1 (basis of design of operational products)
  - Decision process
  - Delivery tools (app platform, visualisation)
  - Identify obstacles/contingencies
  - Evaluation process and work plan
- Holding a Stakeholder Workshop on 14th May 2020
  - Present status of prototype service
  - Seek feedback on the co-design process





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WP5: Videos

Find out what SECLI-FIRM is all about

Discover SECLI-FIRM Case Study 7

Coming up: Case Study 1 video, followed by all the other CSs

http://www.secli-firm.eu/

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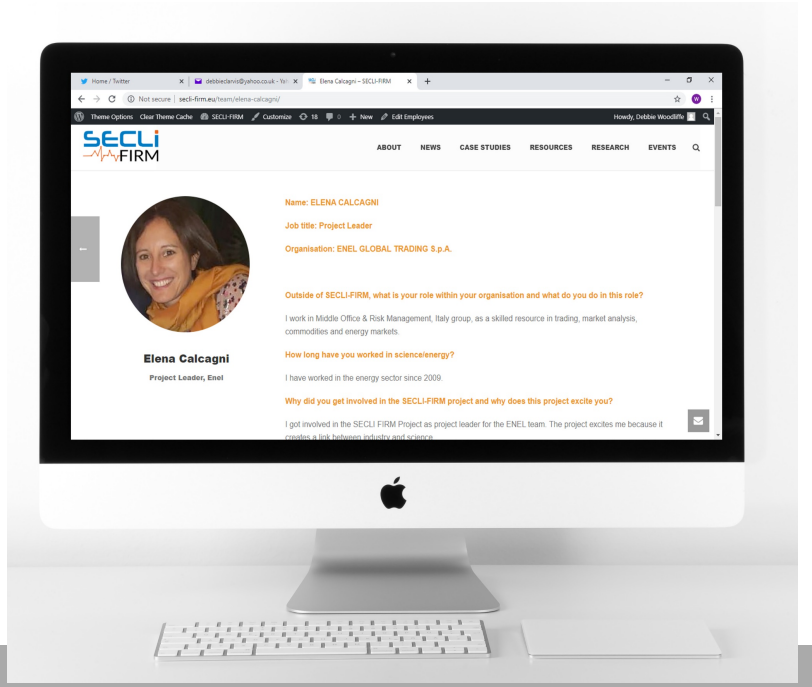
WP5: In conversation

- Stakeholder workshops: www.secli-firm.eu/events/
- News items and newsletters: www.secli-firm.eu/news/
- Social media: **@SECLI_FIRM** **#SECLIFIRM** **SECLI-FIRM**
- Partners interviews: www.secli-firm.eu/team-members/



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Key SECLI-FIRM pillars

1

Multi-model combinations of seasonal climate forecasts, to enhance the forecast skill for specific industry user-defined questions

2

Case study examples of the quantified economic benefits, to assess the added value of seasonal forecasts

3

Proof of concept climate service; for potential post-project adoption on a commercial basis

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SECLI FIRM

Challenges and Successes

Expectations and terminology in an inter-disciplinary environment

Developed an effective framework for exchanges between scientific community and users

Development of a comprehensive multi-model dataset

Reached a pragmatic compromise between initial requests and technical limitations

Matching the appropriate science with individual case studies

Enhanced fertilization across scientific tasks and Case Studies, with a broad portfolio of solutions

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What to look for in 2020

- A new partner! METEO FRANCE
- A stakeholder workshop – Brussels, 14th May 2020
- Finalization of Case Studies based on probabilistic seasonal climate forecasts, and evaluation of their value add
- Advanced development of Climate Services Trials

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Thank you for your attention

If you would like to know more about the SECLI-FIRM project, please visit:
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