MedCOF Mediterranean Climate Outlook Forum 01/06/2022

Climate services

Prototypes for agriculture and forestry sectors

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2. *Euro-Mediterranean Center on Climate Changes, IAFES Division, Sassari 07100, Italy*
3. *National Research Council of Italy, Institute of Bioeconomy, Sassari 07100, Italy*

Climate services prototypes for agriculture and forestry sectors

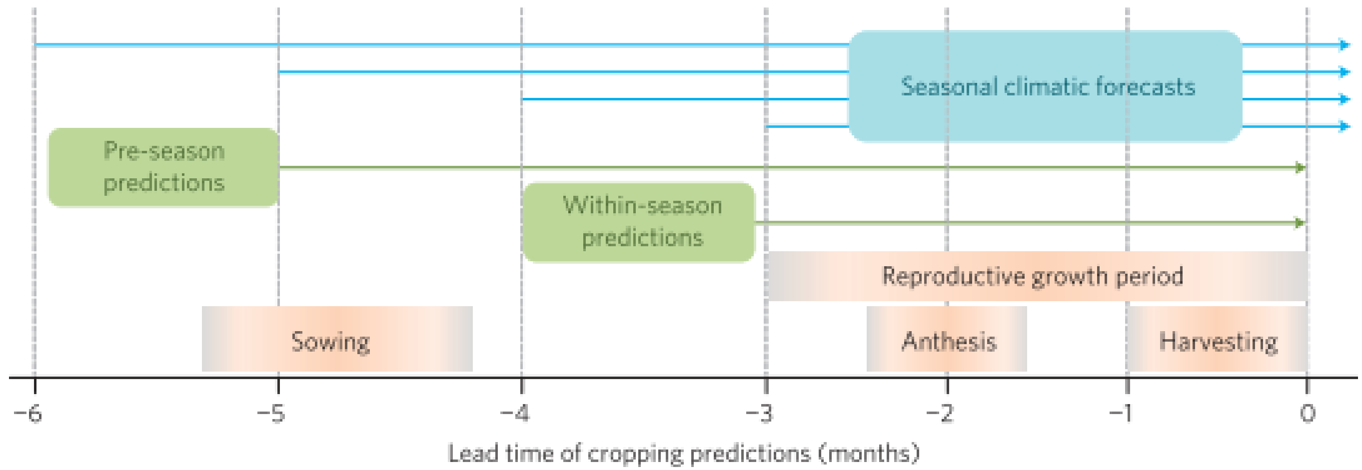


Figure 1 | Timing of cropping predictions. The cropping calendar illustrates the times at which the pre- and within-season predictions of crop failures and yield levels were conducted and the lead times of seasonal climatic forecasts on a monthly basis.

nature climate change — LETTERS

PUBLISHED ONLINE: 21 JULY 2013 | DOI: 10.1038/NCLIMATE1945

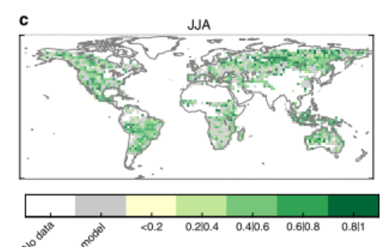
Prediction of seasonal climate-induced variations in global food production

Toshichika Iizumi[1]*, Hirofumi Sakuma[2,3], Masayuki Yokozawa[1], Jing-Jia Luo[4], Andrew J. Challinor[5,6], Molly E. Brown[7], Gen Sakurai[1] and Toshio Yamagata[3]

Skilful forecasting of global fire activity using seasonal climate predictions

Marco Turco[1], Sonia Jerez[2], Francisco J. Doblas-Reyes[3,4], Amir AghaKouchak[5], Maria Carmen Llasat[1] & Antonello Provenzale[6]

NATURE COMMUNICATIONS | (2018)9:2718 | DOI: 10.1038/s41467-018-05250-0 | www.nature.com/naturecommunications



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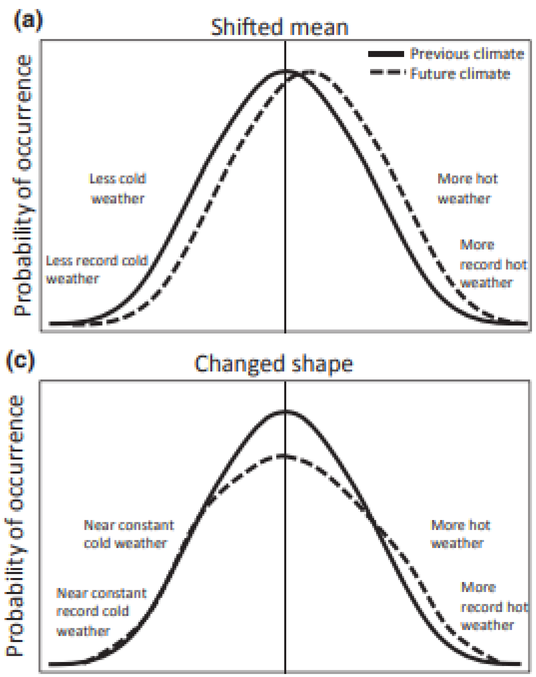
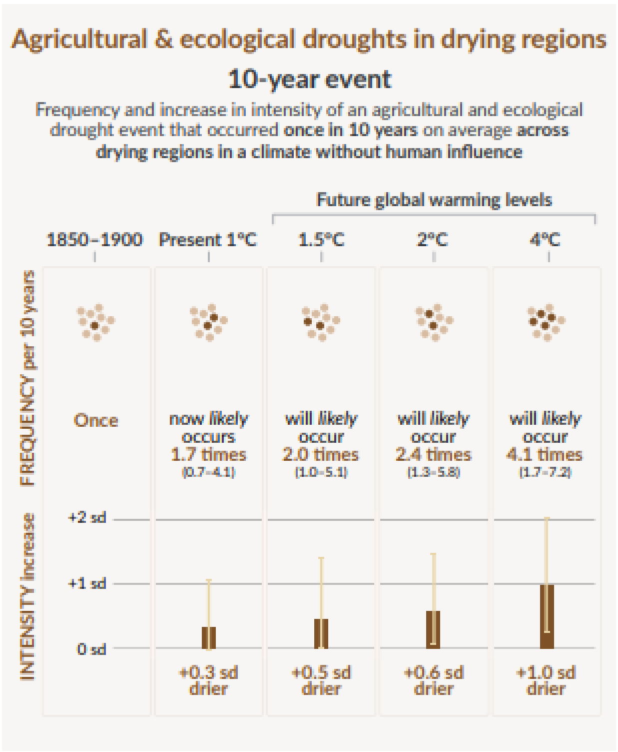


Thornton et al, 2014



IPCC sixth report, 2021

Seasonal forecasts potentialities

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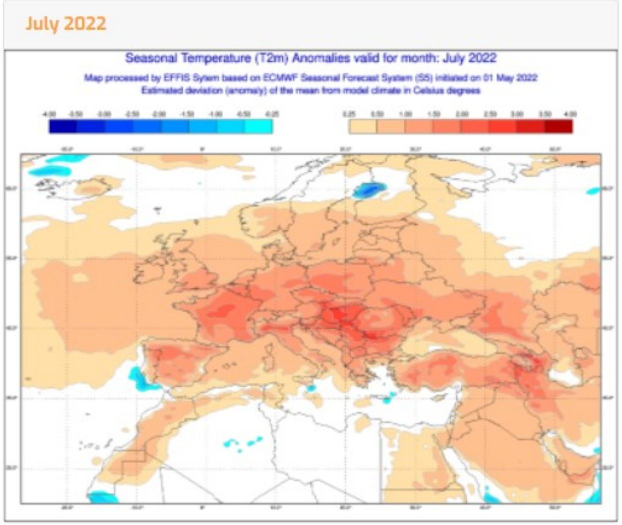
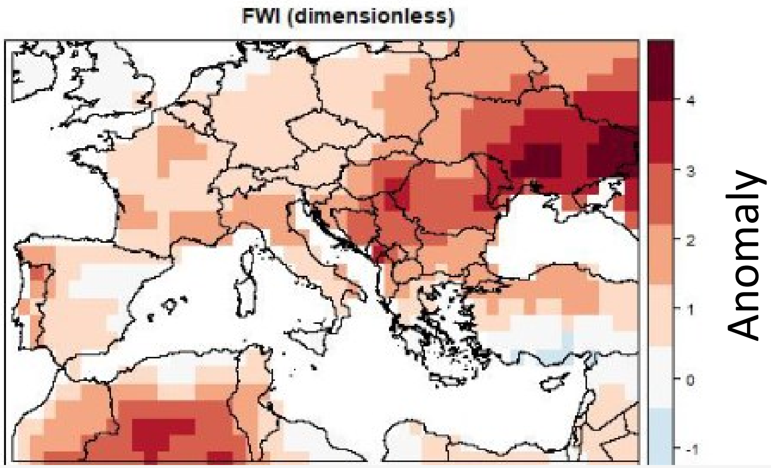
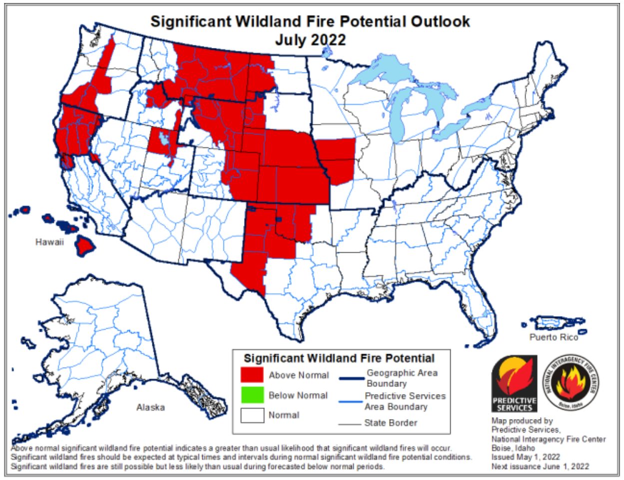
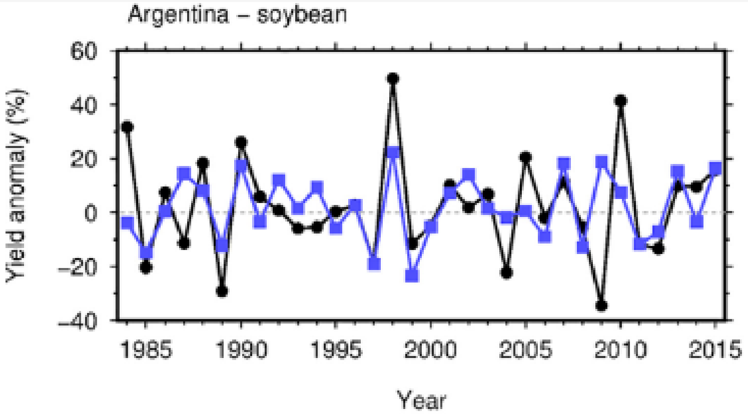




Forecasted period: spring-summer 2020, initialization time: 1st march 2020 **AgroForInForecast (preliminary version)**





T. Iizumi et al. Climate Services 11 (2018) 13–23

Types of applications

Climate services prototypes for agriculture and forestry sectors

J. Bedia et al. / Climate Services 9 (2018) 101–110

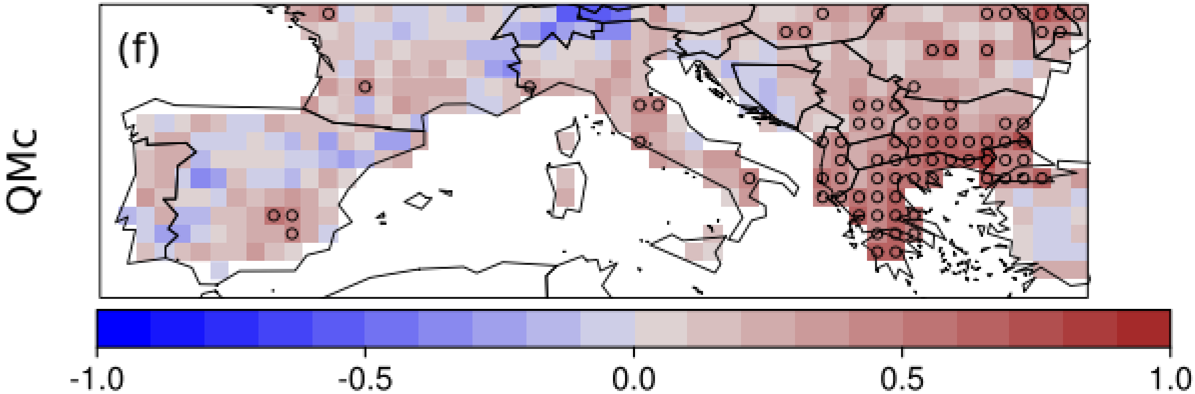


Fig. 3. ROC Skill Score of the System4 FWI predictions

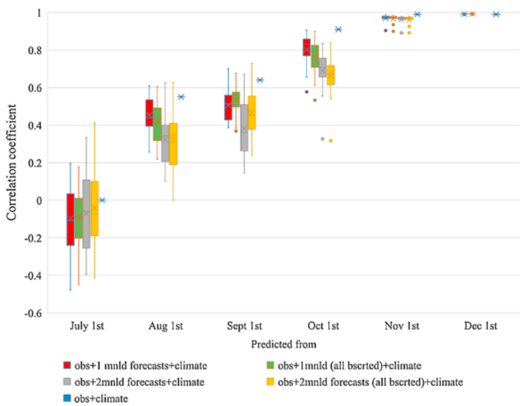


Fig. 4. Correlation coefficient between simulated yield using CFSv2 forecasts (all members) and yield simulated using weather station data from Janakpur

P.K. Jha et al. Agricultural and Forest Meteorology 265 (2019) 349–358

Validation is necessary

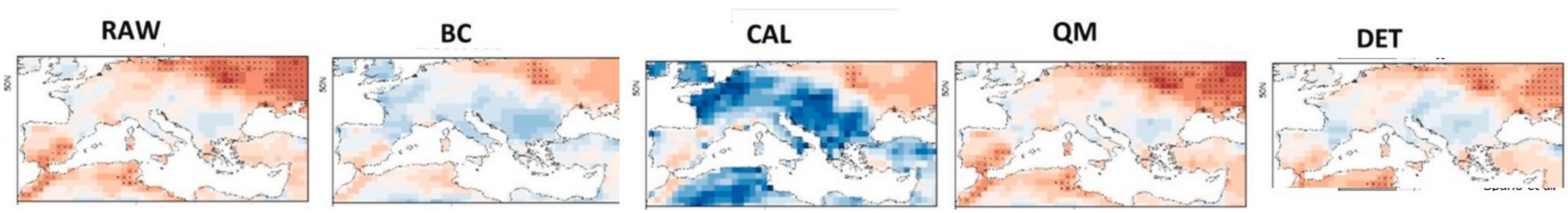
Climate services prototypes for agriculture and forestry sectors

Geoscientific Model Development Discussions

The CSTools (v4.0) Toolbox: from Climate Forecasts to Climate Forecast Information

Núria Pérez-Zanón [1], Louis-Philippe Caron [1,2], Silvia Terzago [3], Bert Van Schaeybroeck [4], Llorenç Lledó [1], Nicolau Manubens [1], Emmanuel Roulin [4], M. Carmen Alvarez-Castro [5], Lauriane Batté [6], Carlos Delgado-Torres [1], Marta Domínguez [7], Jost von Hardenberg [8,3], Eroteida Sánchez-García [7], Verónica Torralba [1], Deborah Verfaillie [9]

Downscaling	CST_Analogs*, CST_RainFarm*, CST_RFTemp, CST_AdamontAnalogs, CST_AnalogsPredictors
Correction	CST_BEI_Weighting*, CST_BiasCorrection, CST_Calibration, CST_QuantileMapping, CST_DynBiasCorrection



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Post-processing according to the objectives

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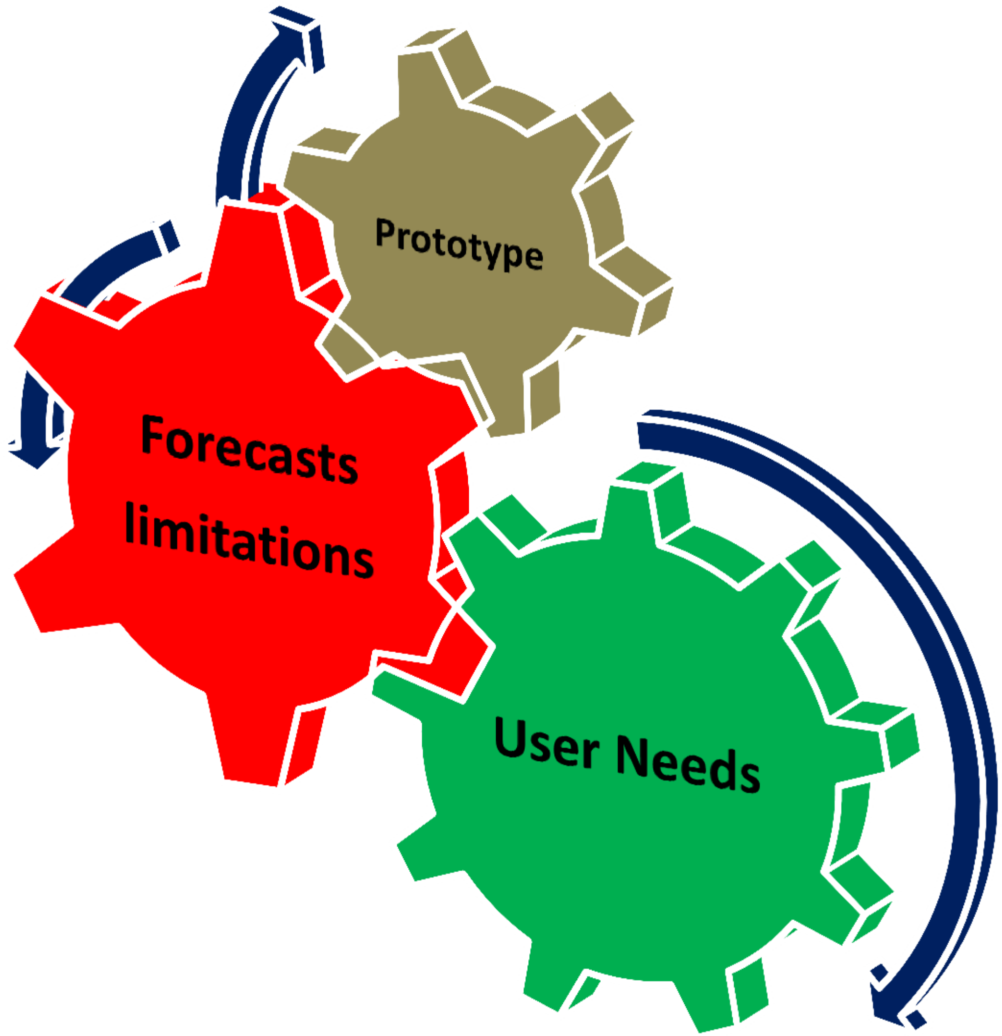
Co-Design



The role of co-design

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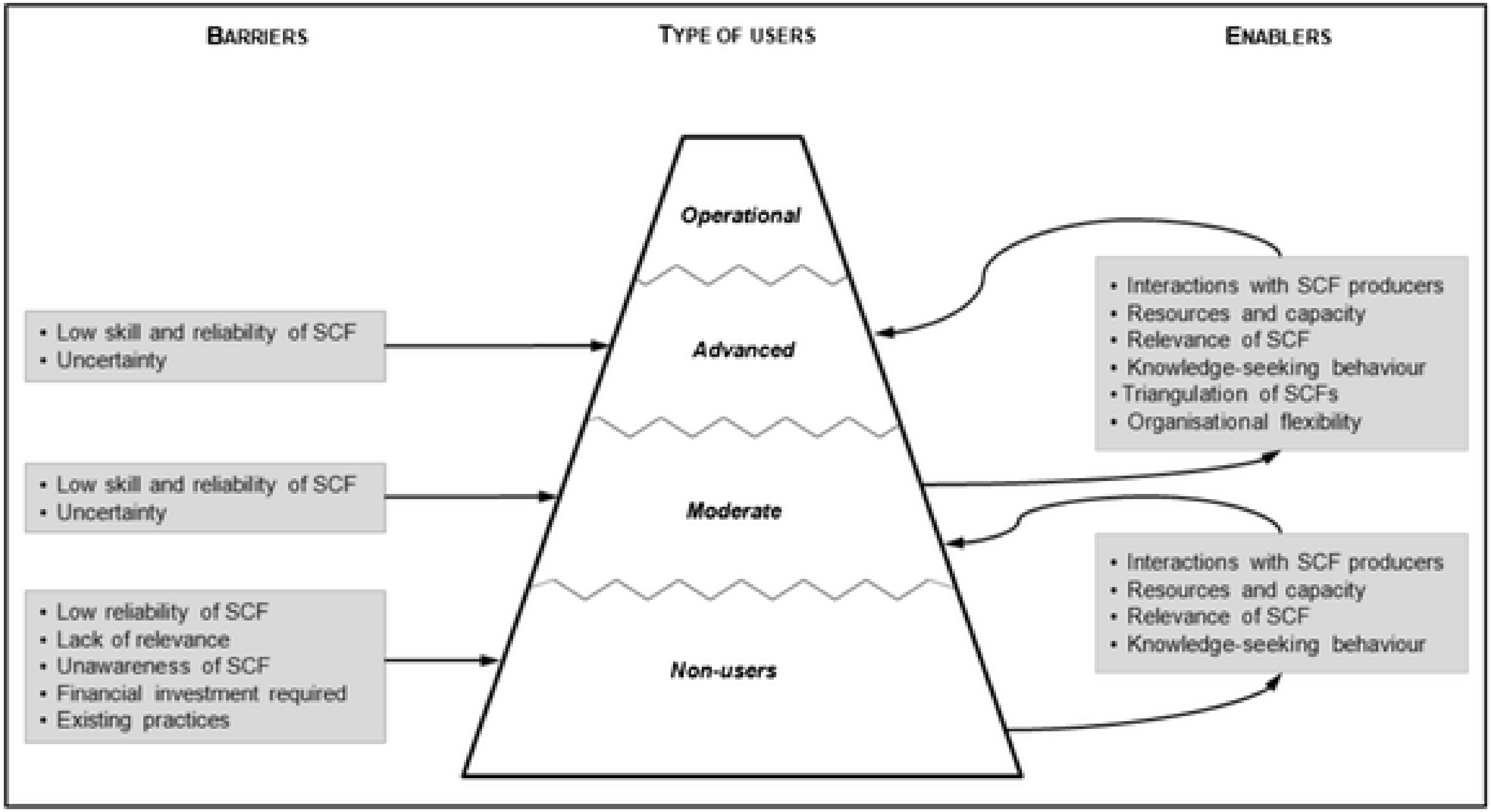

Climatic Change (2016) 137:89–103
DOI 10.1007/s10584-016-1671-8

Barriers and enablers to the use of seasonal climate forecasts amongst organisations in Europe

Marta Bruno Soares[1] · Suraje Dessai[1]

Types of users

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MEDSCOPE
MEDiterranean Services Chain based On climate PrEdictions

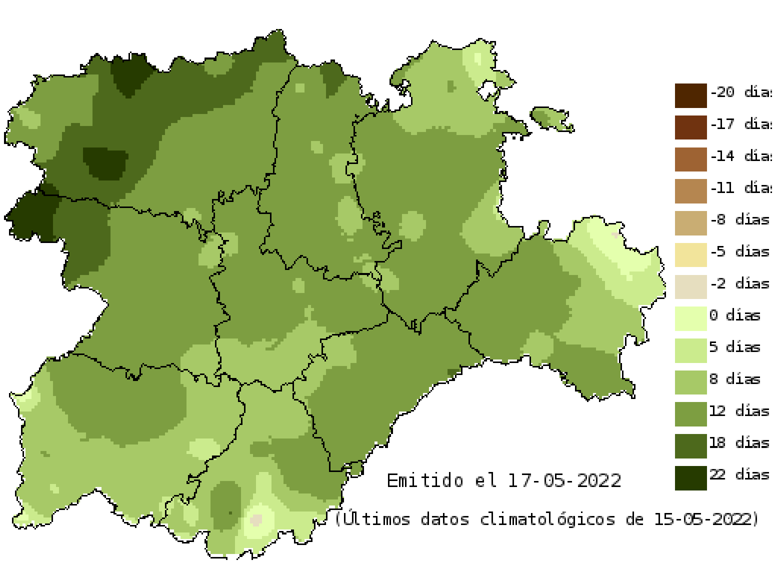
INSTITUTO TECNOLÓGICO AGRARIO

AEMet
Agencia Estatal de Meteorología

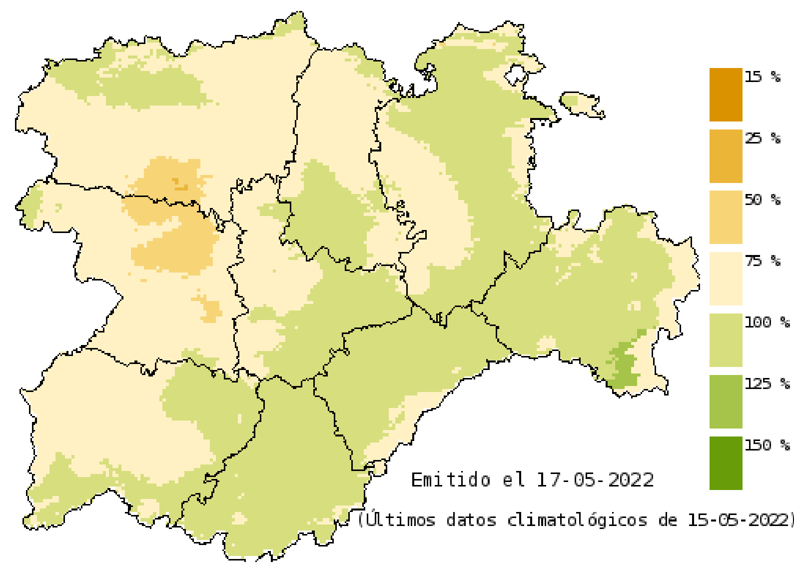
http://cosechas.itacyl.es/

Seasonal forecasts for estimation of cereal yield in Castilla y León

AQUACROP
Version 4.0 now available for download



días de adelanto del trigo (RESPECTO A NORMAL)



% trigo esperado respecto al promedio de 30 años

AEMET prototype

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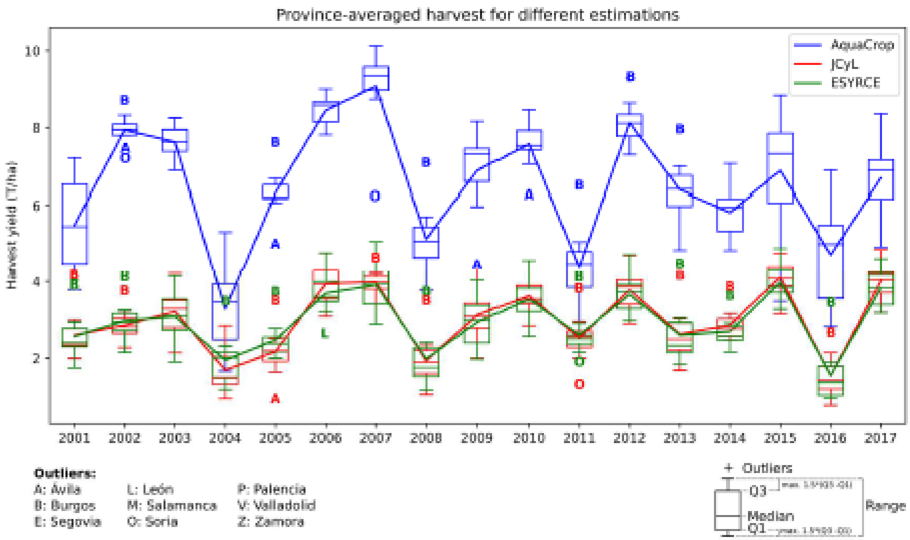


Figure 12: Time series of cereal harvest over Castilla y León region coming from Aquacrop reference experiment (blue), ESYRCE (green) and JCYL (red) databases. Boxplots represent the spread between different values at province level.

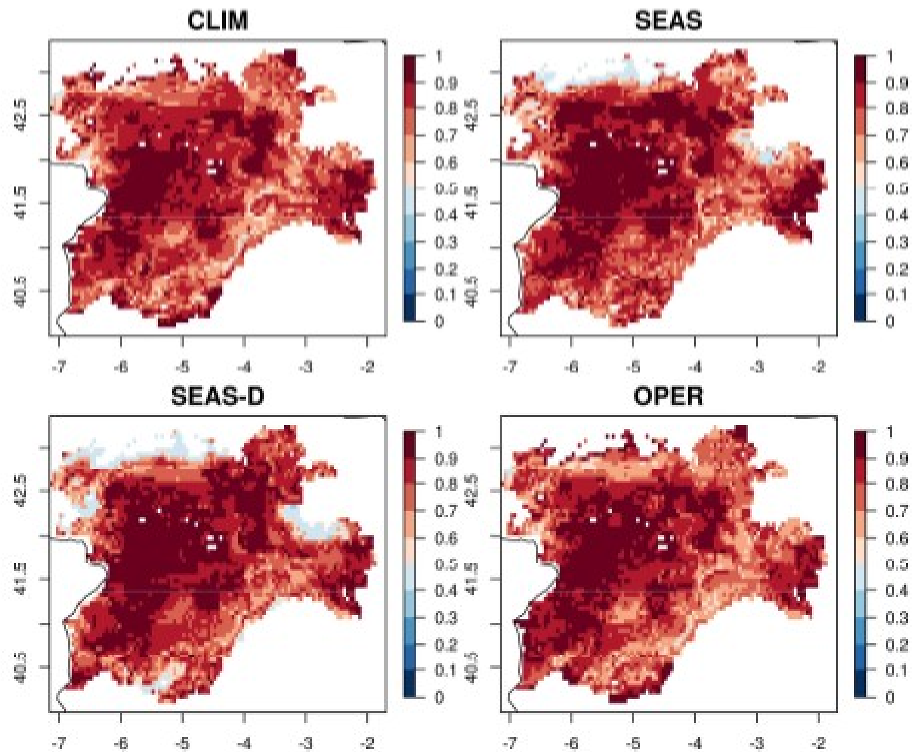


Figure 6: Maps of ROC area for lower and upper wheat yield tercile forecasts (reference simulations have been used as observations) over 1995-2018 hindcast period for the different experiments: CLIM (left-top), SEAS (right-top) , SEAS-D (left-bottom) and OPER (right-bottom)

Memory effect on system inertia

AEMET prototype

Climate services prototypes for agriculture and forestry sectors

TESTING THE PROTOTYPE: Seasonal Forecasting of EcoClimatic Indicators

Forecasted period: spring-summer 2020, initialization time: 1st march 2020

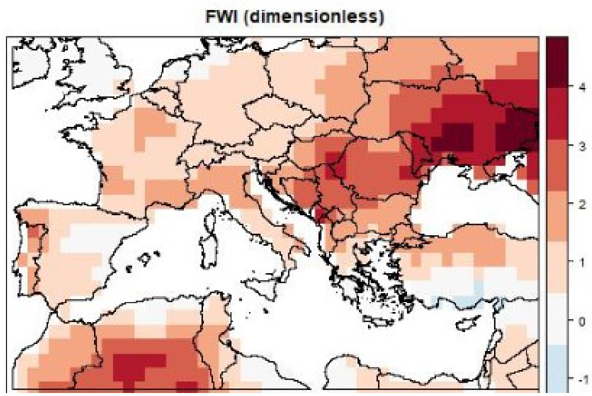
Select EcoClimatic Indicators

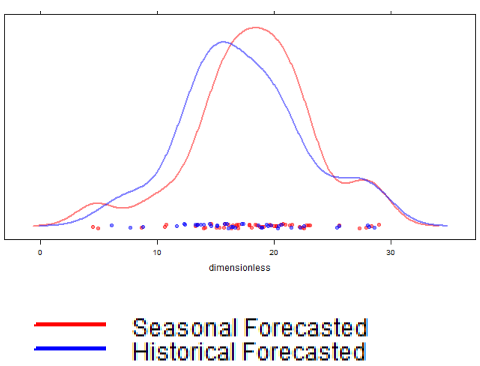
- ○ Potential soil moisture deficit (PSMD)
- ○ Consecutive dry days (CDD)
- ◉ Fire weather index (FWI)
- ○ Potential evapotranspiration (ET0)
- ○ Growing degree days (GDD)

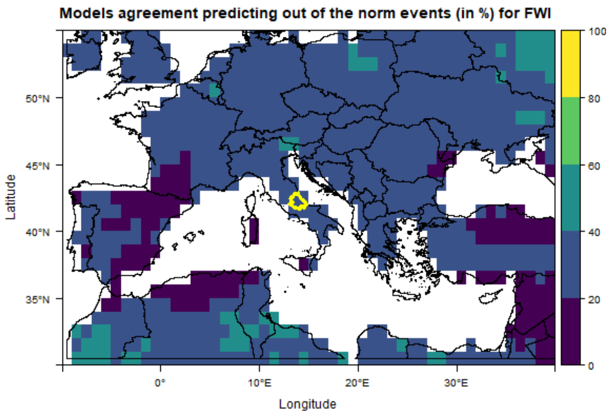
PSMD and ETO, accumulated for the period JJLA.CDD maximum number of days during JJLA. FWI mean value for the period JJLA.GDD accumulated degree days for AMJ.

Select a region of interest

Abruzzo ▾







J. Costa-Saura et al. *Agricultural and Forest Meteorology 319 (2022) 1089..*

Forecast accurracy for Abruzzo is 0.09 (from -1 to 1)

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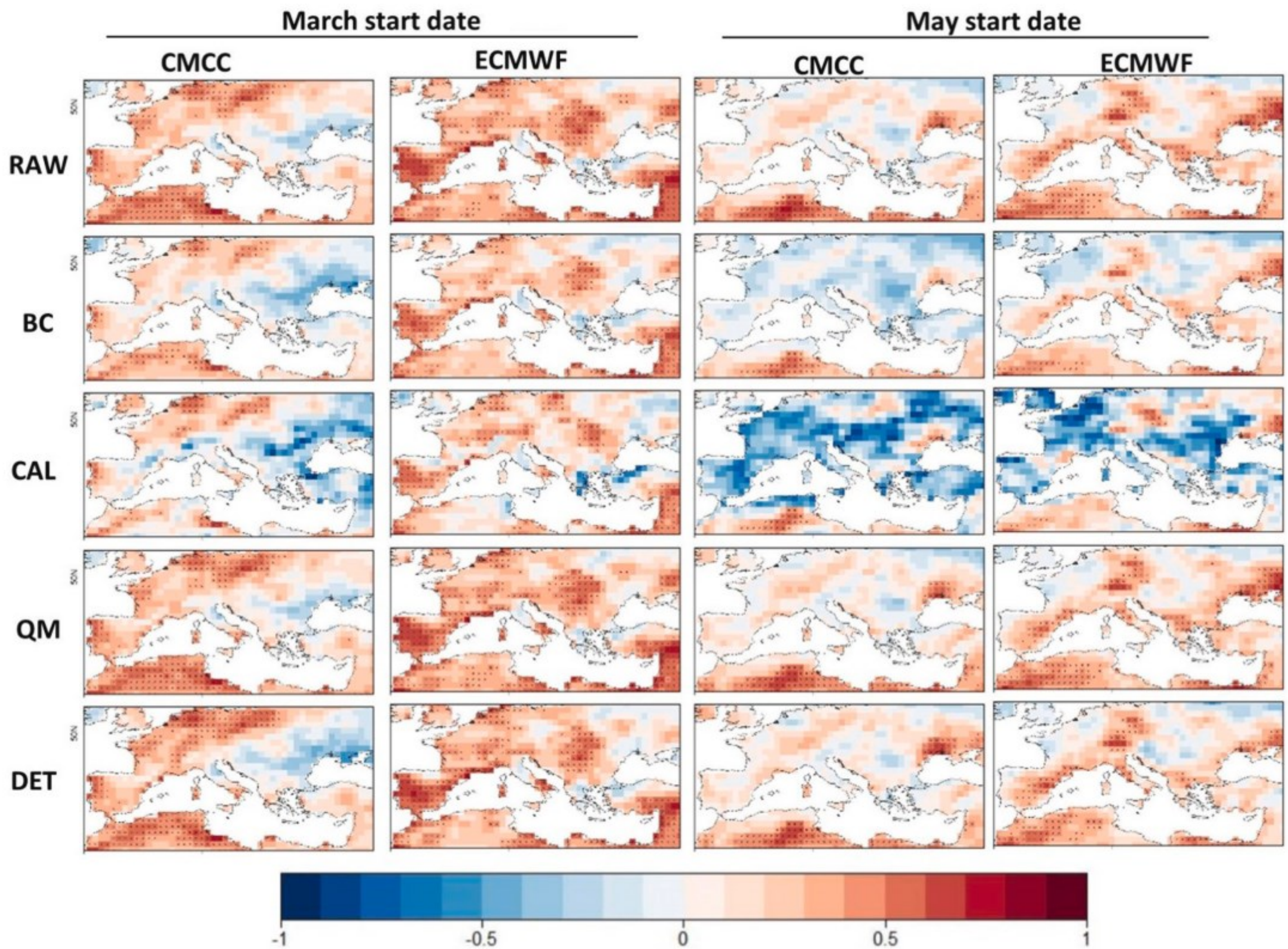

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Fig. 4. Time series correlations (1993-2015) between the hindcast ensemble mean and observations (ERA5 reanalysis) for Potential Soil Moisture Deficit (PSMD) using ACC metric. Checked cells indicate a significant correlation (p-value < 0.05).

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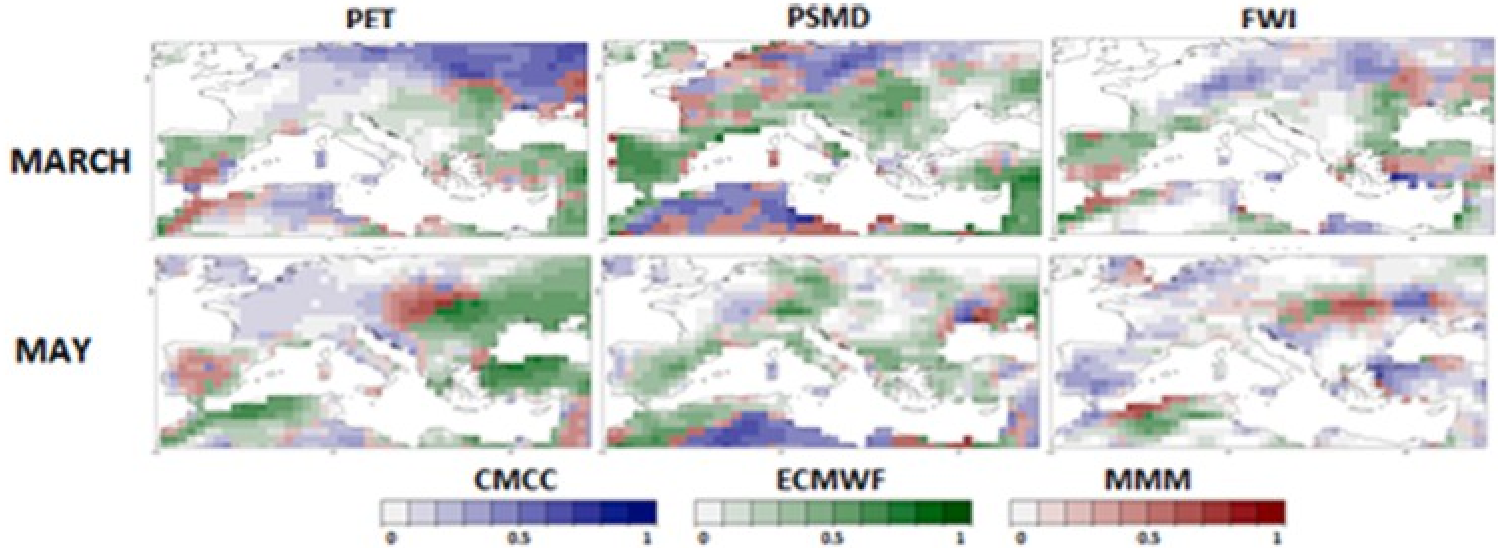

Fig. 6. Anomaly correlation coefficient (ACC) between SPSs and ERA5 for both forecast start dates after QM corrections. The figure shows the greatest ACC among mo

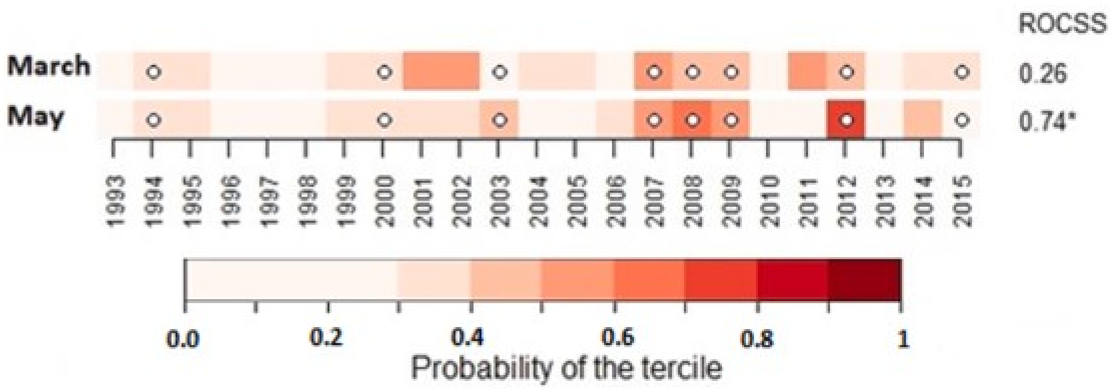

Fig. 8. Forecast skill of PET (ECMWF SPS and QM) for a selected area in central-eastern Europe (see red rectangle in Fig.3) using both start dates. Colours represent the probability of the upper tercile according to the hindcast, whereas white dots represent the observed tercile.

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AgroMetInfo
par
INRAE
METEO FRANCE

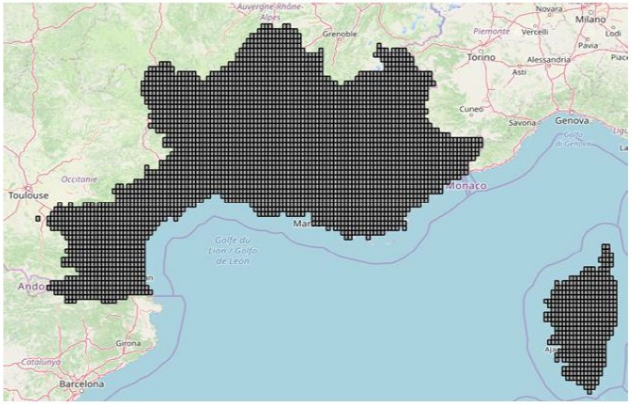


Figure 1: The Prométhée area

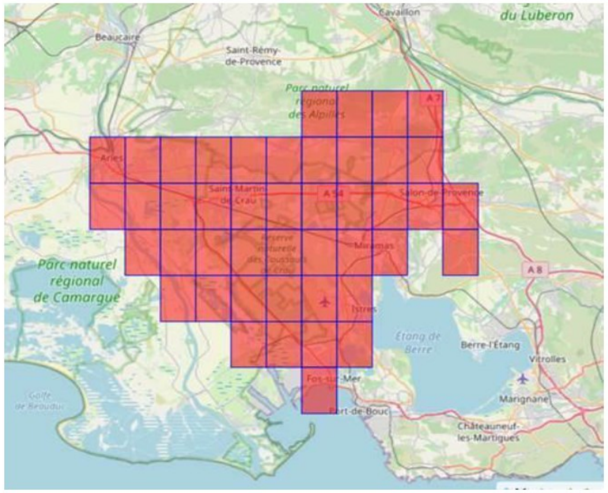
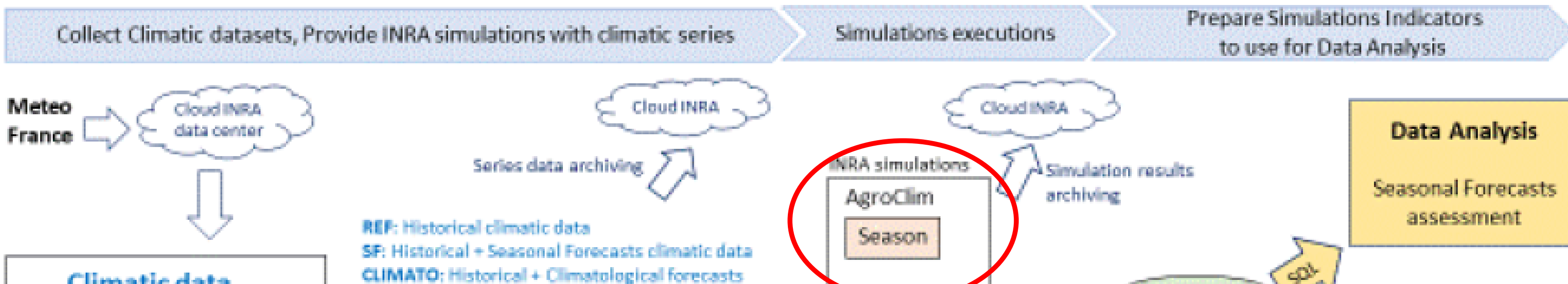


Figure 2: The Crau plain

INRAE prototype

Climate services prototypes for agriculture and forestry sectors



drain	Rain (mm)	Number of rainy days with rainfall > 0.5 mm	Monthly	Days	Impact on crop yield and development, quality May-June : tree species (peach, apricot) and durum wheat. July - August Grapevine	There is not necessarily a solution (currently) Later we can imagine that we will identify technical solutions to mitigate impacts (Shading, Irrigation)
draindef	Rain (mm)	Number of dry days with rainfall <= 0.5 mm	Monthly	Days		
dtmoy25	Temperature (°C)	Number of days with daily mean temperature > 25 °C	Monthly	Days		
dtmax35	Temperature (°C)	Number of days with daily maximal temperature > 35 °C	Monthly	Days		

25 SF scenarios per year
25 CLIMATO scenarios per year

Figure 3 : The MedScope INRAE workflow.

INRAE prototype

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MEDSCOPE
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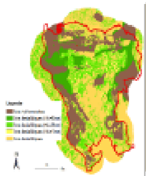
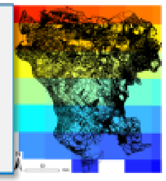
Collect Climatic datasets, Provide INRA simulations with climatic series → Simulations executions → Prepare Simulations Indicators to use for Data Analysis



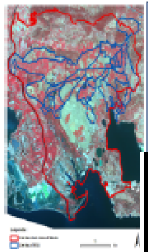
Carte des Sols fonctionnelle

Climat spatialisé



Scénarios climatiques
Prévisions saisonnières & décennales

Modélisation → **Indicateurs**



Pratiques agricoles

Prairies, grandes cultures | **Vergers, zone humide,** | **Coussouls (steppe)**

Irrigatio
doses=f(so

Dévelo
LAI Ser

Géométri

n

ppe

Grassland yield Grass C1, C2 and C3	Maximal and minimal Temperature, Rainfall, Radiation, Wind, Relative Humidity	Dry biomass of harvested grass, averaged over the surface of interest (grid)	per cuts (3 within the season)	t/ha	Optimization of grass production	Choice of the harvest date to optimize the overall grass production of two successive production periods.
Wheat yield (Wheat)	Maximal and minimal Temperature, Rainfall, Radiation,	dry biomass of harvested grain	1 per season	t/ha	production storage, price anticipation, fertlization	fertlization, trade price, silo management

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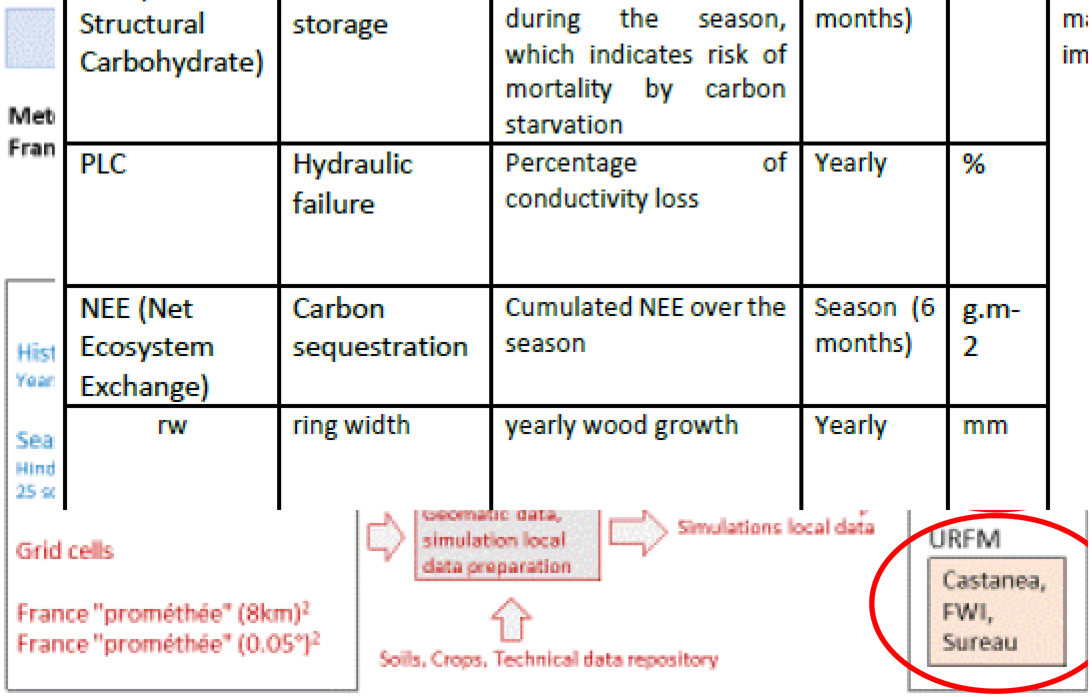
NSC (Non Structural Carbohydrate)	Carbon storage	Minimum value of NSC during the season, which indicates risk of mortality by carbon starvation	Season (6 months)	%	Fo ma im
PLC	Hydraulic failure	Percentage of conductivity loss	Yearly	%	
NEE (Net Ecosystem Exchange)	Carbon sequestration	Cumulated NEE over the season	Season (6 months)	g.m-2	
rw	ring width	yearly wood growth	Yearly	mm	



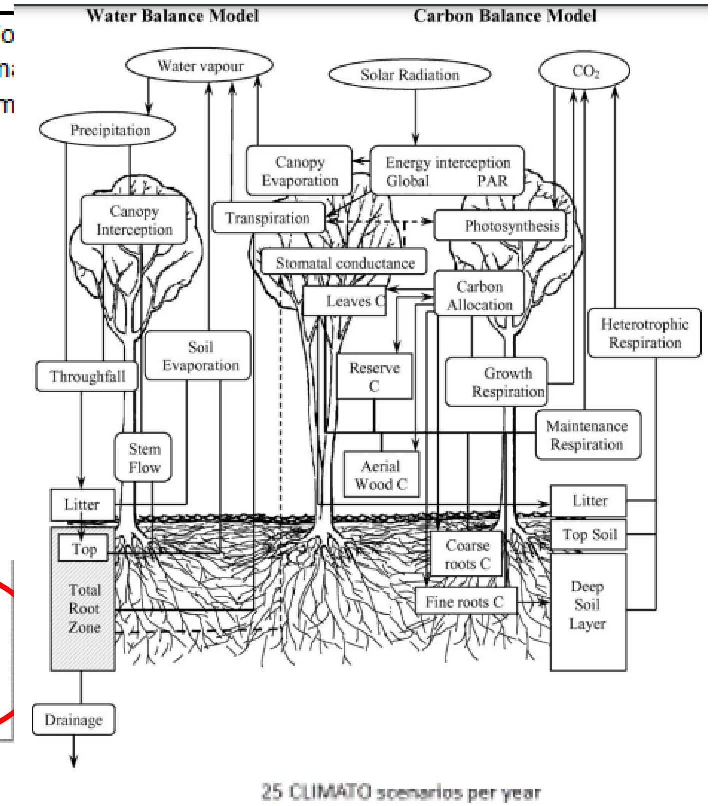


Figure 3 : The MedScope INRAE workflow.

INRAE prototype

Climate services prototypes for agriculture and forestry sectors

		AUC 1st T	AUC 3rd T	AUC 1st Q	AUC 5th Q	ACC
Grass	C1	0.839	0.820	0.866	0.828	0.740
Grass	C2	0.541	0.589	0.574	0.637	0.155
Grass	C3	0.460	0.447	0.463	0.430	-0.070
Wheat		0.960	0.960	0.954	0.965	0.940

INRAE prototype

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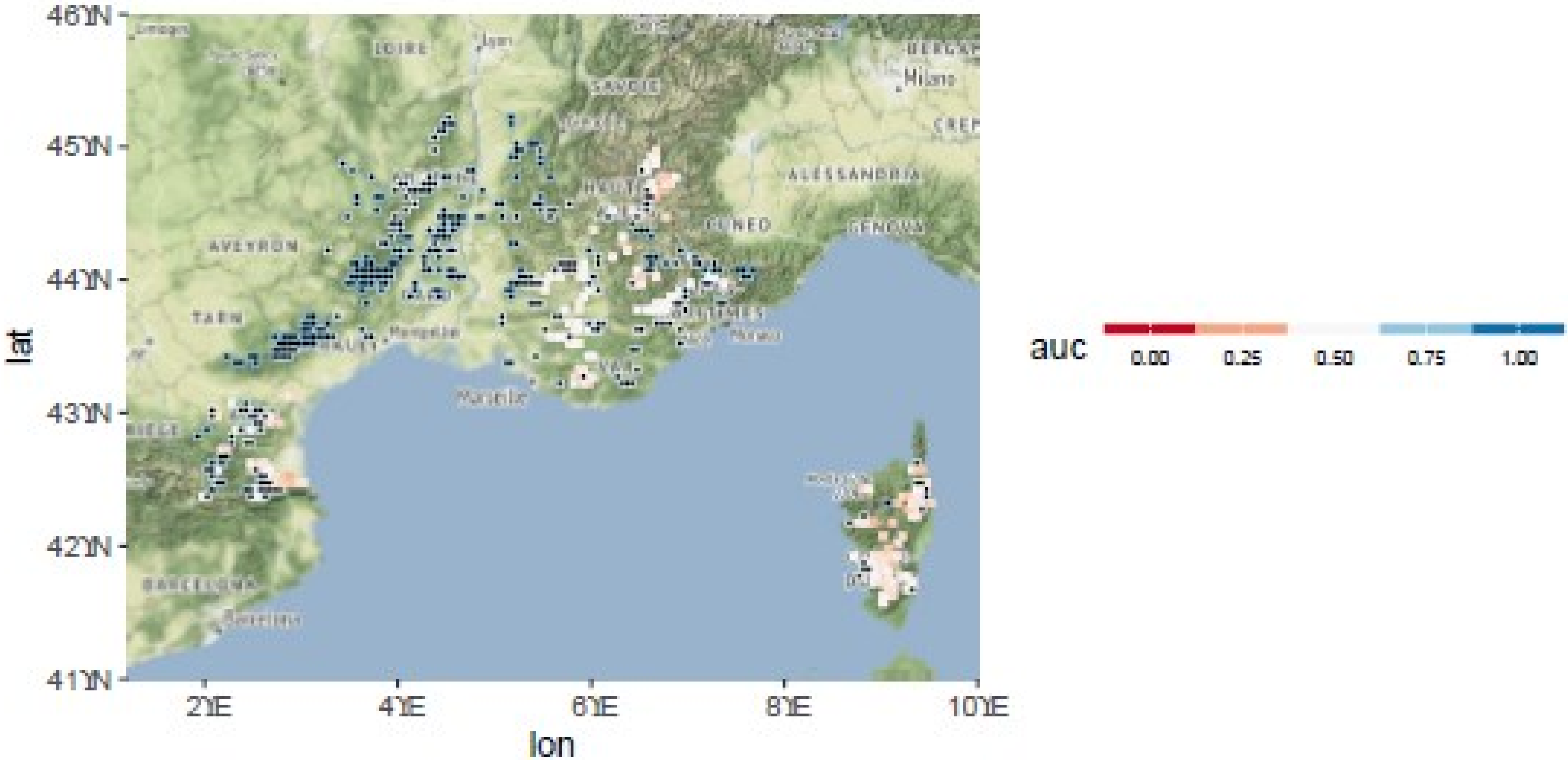

Figure 29: Spatial value of AUC (first tercile) for NSC of Fagus sylvatica with low Soil Water Capacity

INRAE prototype

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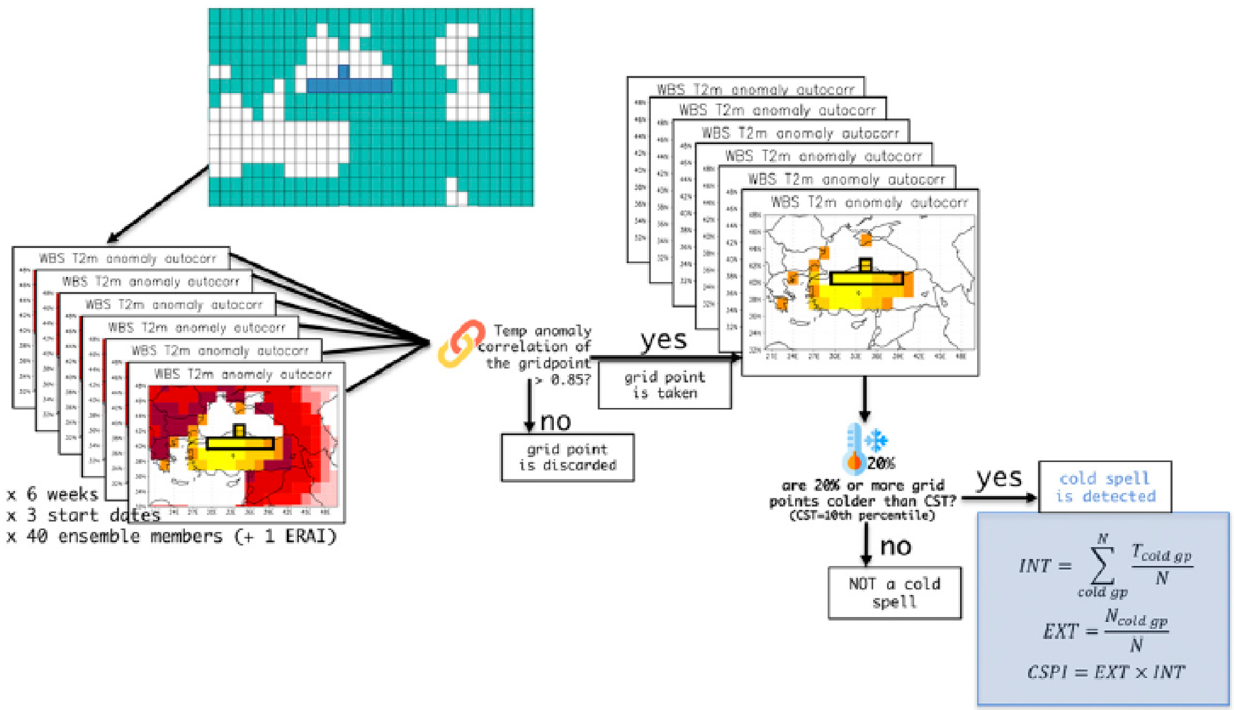
Multimodel Subseasonal Forecasts of Spring Cold Spells: Potential Value for the Hazelnut Agribusiness

STEFANO MATERIA,[a] ÁNGEL G. MUÑOZ,[b] M. CARMEN ÁLVAREZ-CASTRO,[a] SIMON J. MASON,[b] FREDERIC VITART,[c] AND SILVIO GUALDI[a,d]

[a] CSP Division, Centro Euro-Mediterraneo sui Cambiamenti Climatici, Bologna, Italy



Concluding remarks

Different types of applications:

- Raw climate variables
- Complex indicators
- Process based models

Good practices:

- Assessing accuracy
- Assessing accuracy
- Assessing accuracy

Thank you for your attention

costa.saura@cmcc.it

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