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Joint Research Centre

Intra-seasonal performance of European Union wheat forecasts during extreme weather impacts

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European
Commission

JRC crop monitoring and yield forecasting

A quantitative yield forecast at national level for all major crops (>10.000 ha)

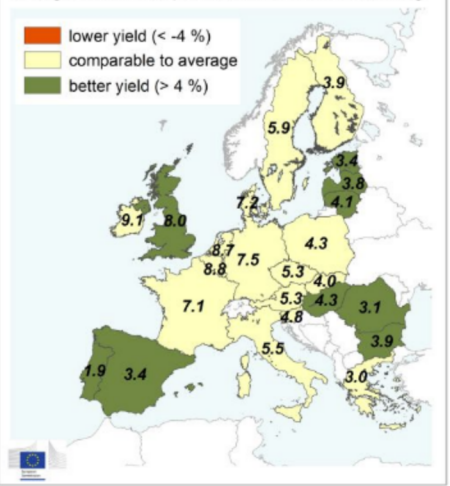


Bulletin of current and future agro-meteo conditions (EU level) and a detailed analysis for major crops (at national level)
Special Issue in AS

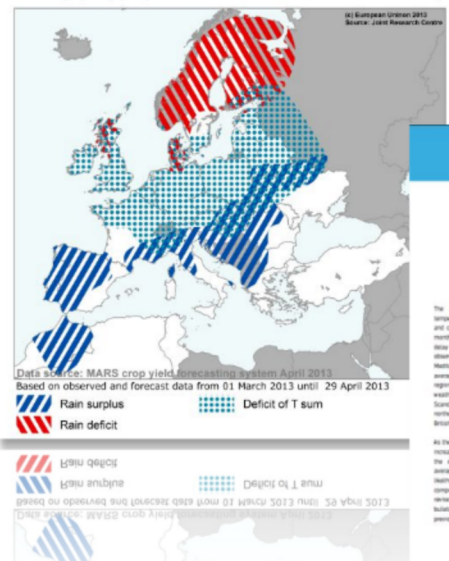
Crop	Yield t/ha				
	2012	MARS 2013 forecasts	Avg 5yrs	%13/12	%13/5yrs
TOTAL CEREALS	4.83	5.14	5.04	+6.3	+1.9
Total Wheat	5.17	5.39	5.37	+4.2	+0.3
soft wheat	5.41	5.63	5.63	+4.0	-0.1
durum wheat	3.15	3.31	3.21	+5.1	+3.2
Total Barley	4.35	4.48	4.38	+2.8	+2.2
spring barley	3.86	3.99	3.82	+3.1	+4.4
winter barley	5.23	5.27	5.11	+0.8	+3.2
Grain maize	5.91	6.96	6.97	+17.7	-0.1
Rye	3.70	3.53	3.33	-4.7	+5.9
Triticale	4.12	4.09	4.06	-0.7	+0.9
Other cereals	3.16	3.34	2.99	+5.6	+11.5
Rape and turnip rape	3.10	3.09	3.04	-0.1	+1.8
Potato	30.61	31.53	30.67	+3.0	+2.8
Sugar beet	70.35	71.06	70.01	+1.0	+1.5
Sunflower	1.65	1.80	1.82	+9.1	-1.2

Культура	2012	2013	2014	+13/12	+13/14
Зерновые	4,83	5,14	5,04	+6,3	+1,9
Пшеница	5,17	5,39	5,37	+4,2	+0,3
Ячмень	4,35	4,48	4,38	+2,8	+2,2
Репей и рапс	3,10	3,09	3,04	-0,1	+1,8
Остальные культуры	3,16	3,34	2,99	+5,6	+11,5
Тритикале	4,12	4,09	4,06	-0,7	+0,9
Рябь	3,70	3,53	3,33	-4,7	+5,9

Soft wheat - yield forecast 2013
Actual yield versus average yield 2008-2012
Yield figures 2013 are expressed in t/ha and rounded to 100 kg



AREAS OF CONCERN - EXTREME WEATHER EVENTS



Crop monitoring in Europe
MARS Bulletin Vol. 21 No. 4 (2013)

Delayed crop cycle in large parts of Europe

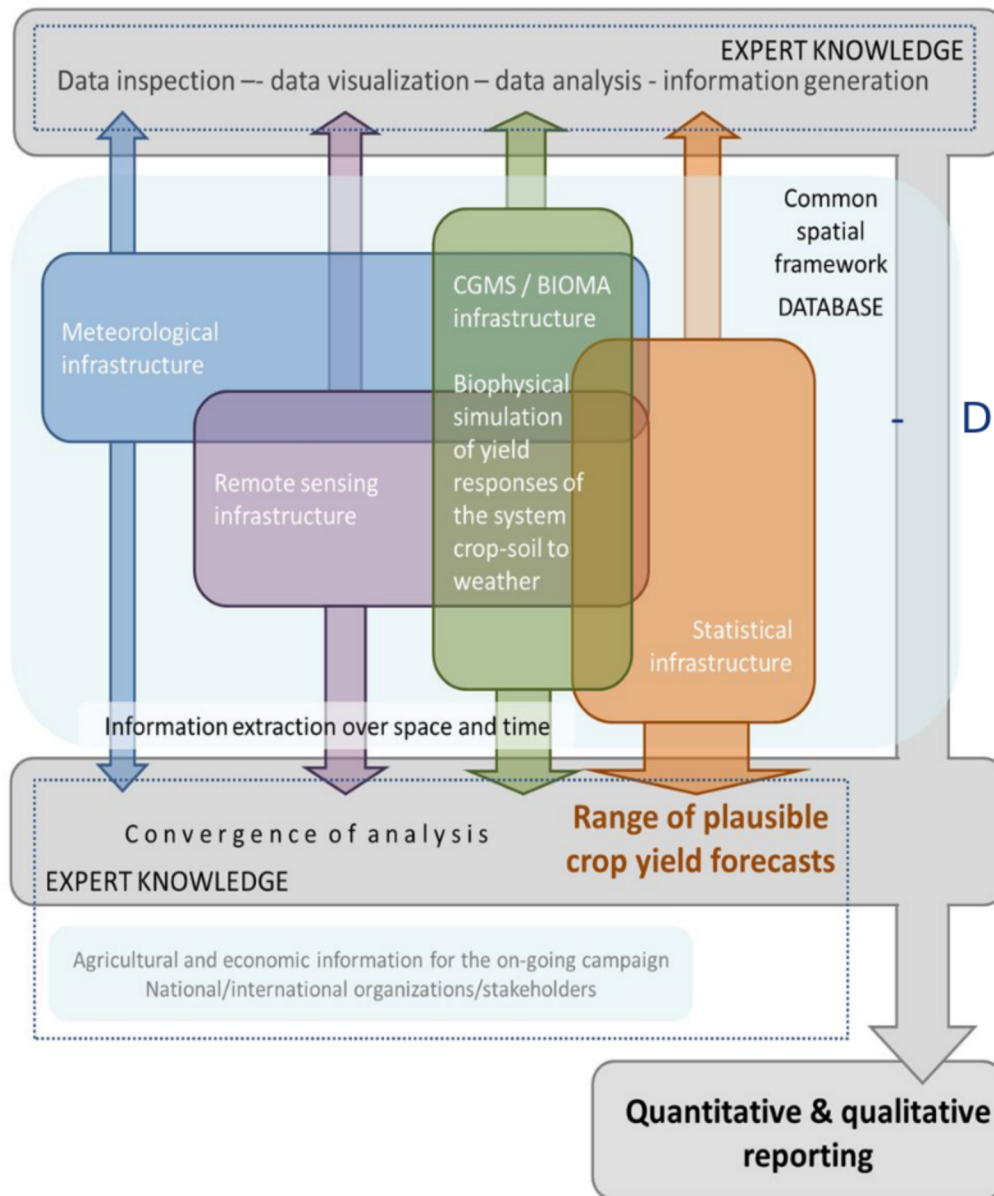
The start of spring has been characterised by temperatures below the long-term average in northern and central Europe, and March was one of the coldest months in our reports. As a consequence, a significant delay in winter crop development and spring sowing was observed in most of Europe with the exception of the Mediterranean region and around the Black Sea. Above-average precipitation was recorded in the Mediterranean region and parts of western Europe. Over-normalised weather conditions occurred in Denmark, southern Scandinavia, the Benelux countries, northern France, northern Germany and the north-western part of the British Isles.

As the season advances crop model simulations are being encouraged used to forecast winter results. In general, the current prospects for the 2013 yield remain average. While in northern and central Europe the likelihood of reaching full crop potential is somewhat compromised by the long deficit, it is still too early to draw the forecasts that have been made in the previous Bulletin based on the temporal trends and averages of previous years.

Country	2012	2013	2014	+13/12	+13/14
Belgium	5.17	5.39	5.37	+4.2	+0.3
Denmark	3.70	3.53	3.33	-4.7	+5.9
France	4.12	4.09	4.06	-0.7	+0.9
Germany	3.16	3.34	2.99	+5.6	+11.5
Italy	5.91	6.96	6.97	+17.7	-0.1



MARS Crop Yield Forecasting System



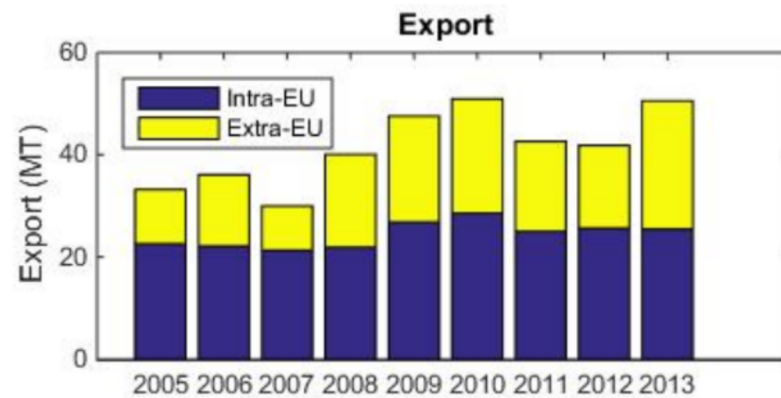
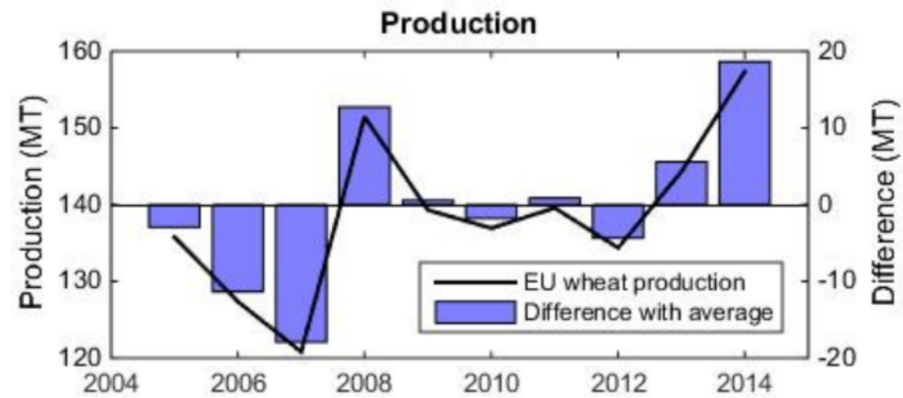
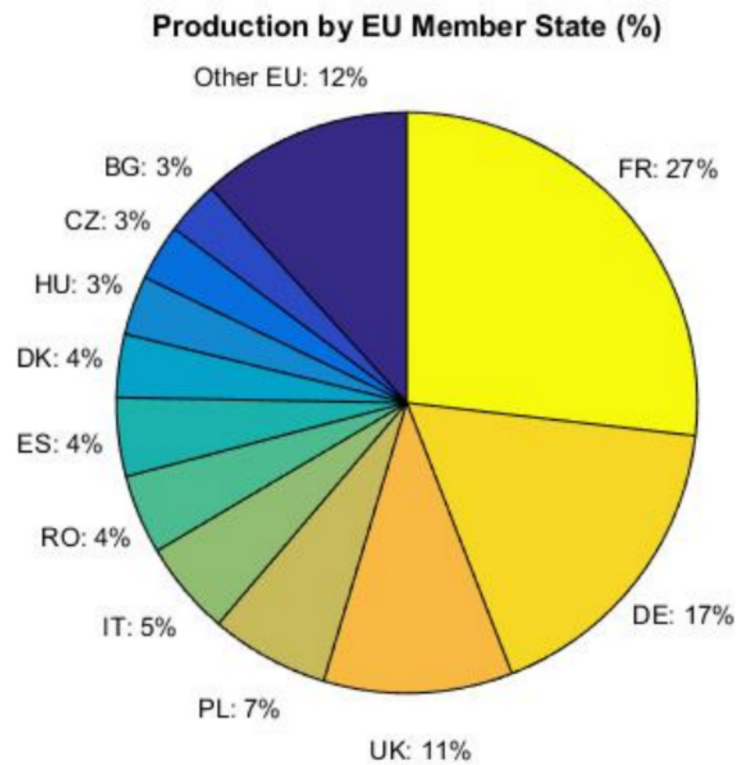
MCYFS

A model and data driven decision support system

- Analyst is key
- System is data demanding
- Does not provide a unique answer
- from input data to model used:
 - expert decision

- Outsourced and JRC internal costs in the order of 1.5 Mill Euro per year to cover Europe

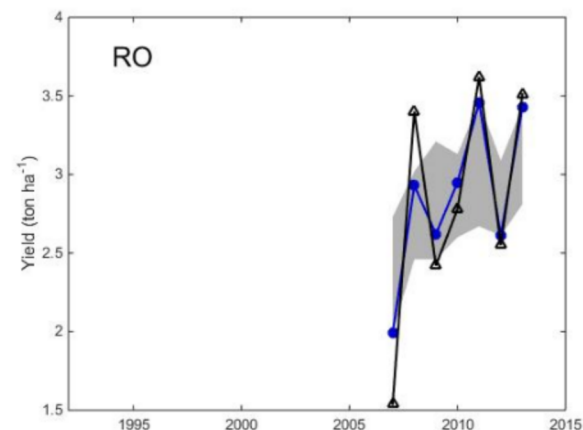
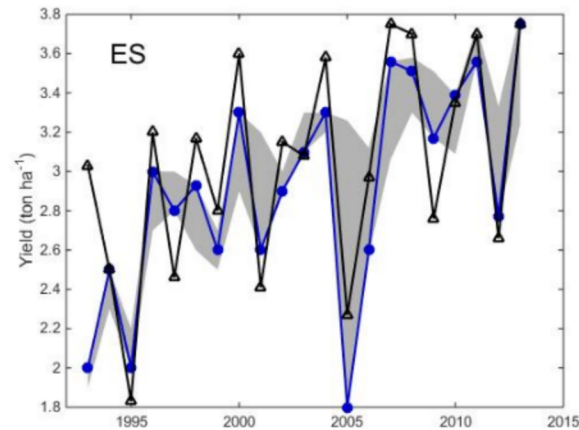
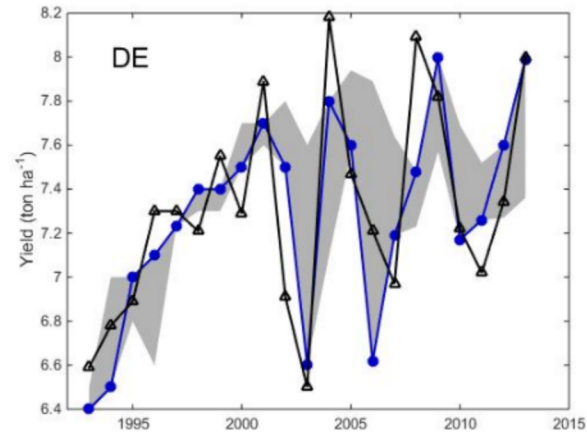
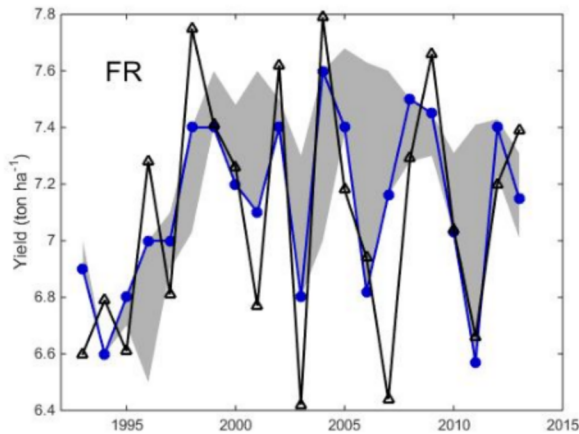
Why?



□ EU internal market & extra-EU market

Accuracy of end-of-campaign forecasts

—●— Final forecast —▲— Reported — Forecast range



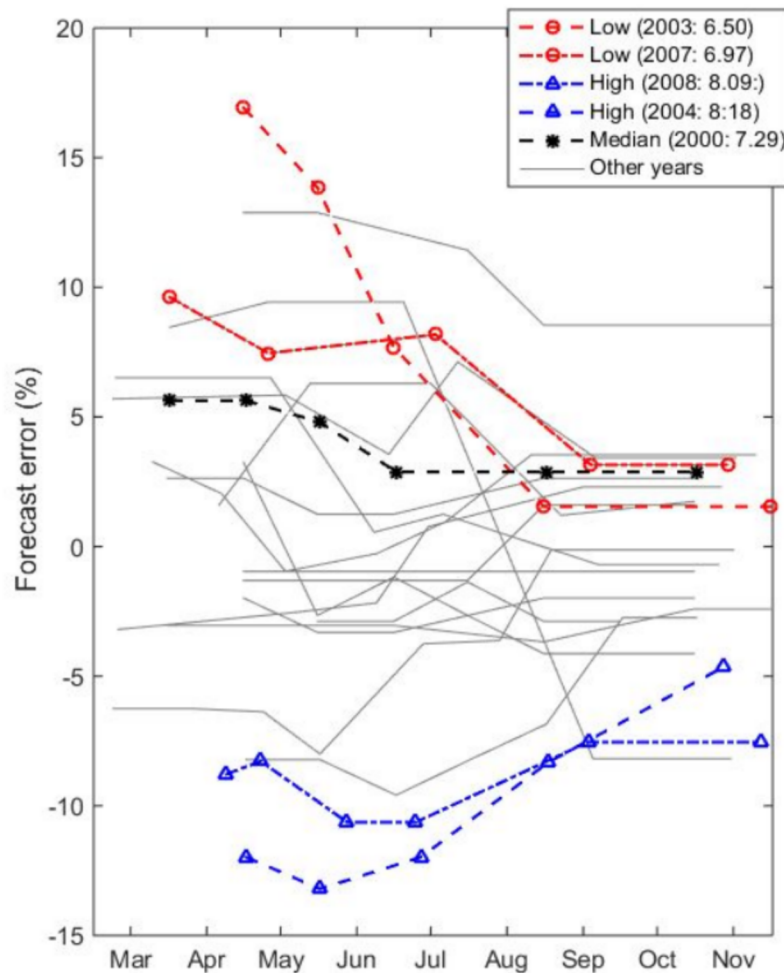
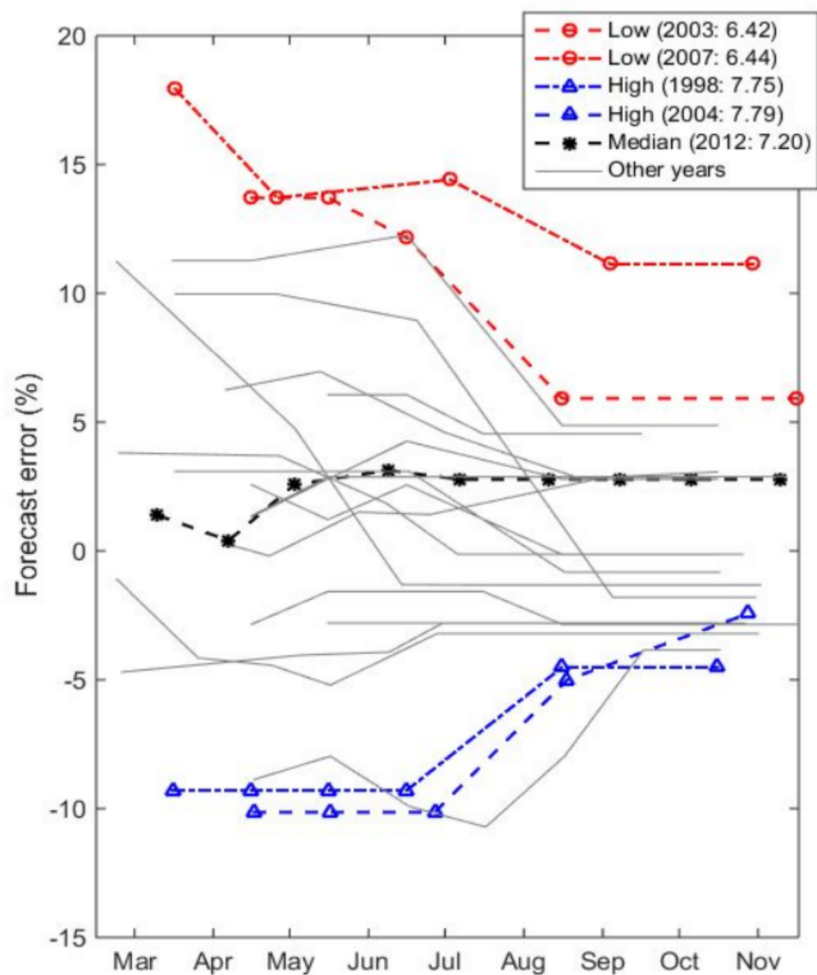
Soft wheat

- Trend dominant <2000
- Forecasting range has increased...
- Forecasting range smaller than reported range...
- Forecasting challenge has increased... (?)

Intra-seasonal performance - wheat

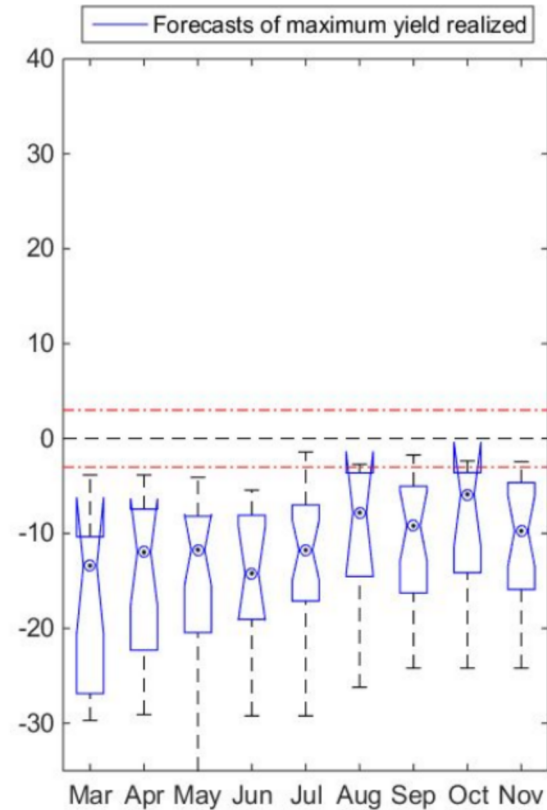
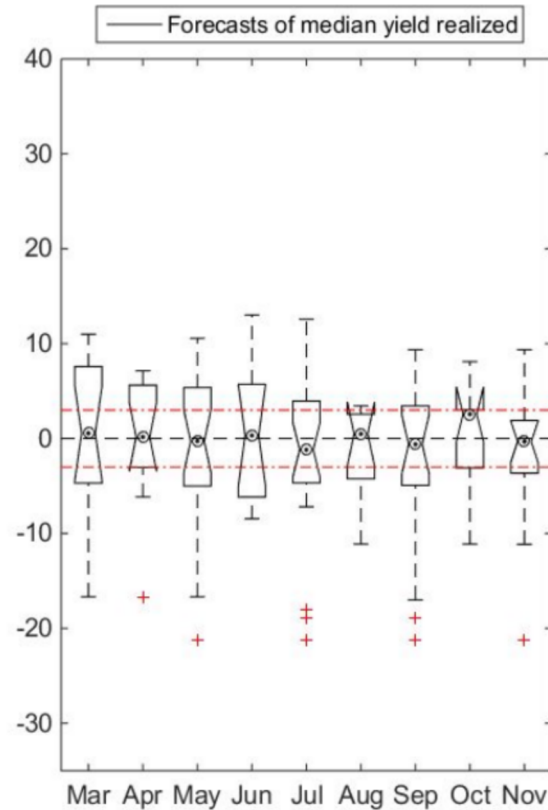
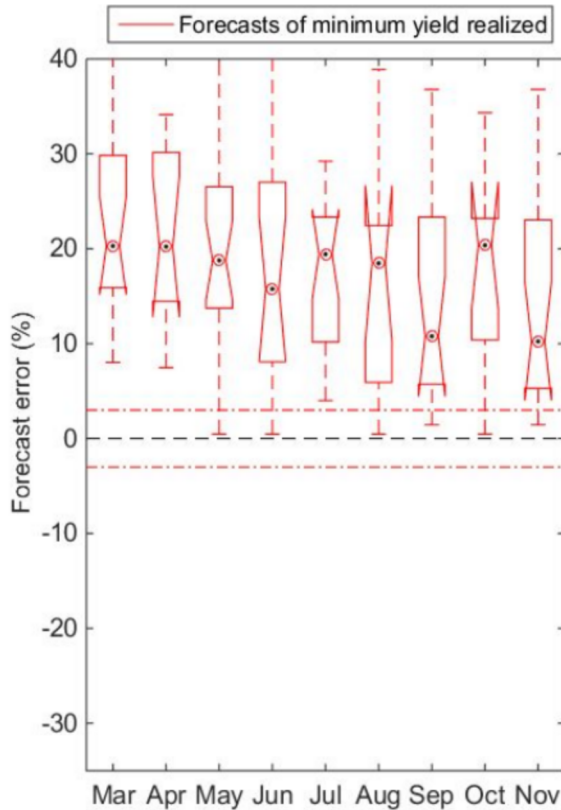
France

Germany



Performance during extreme years

All countries > analysts' feedback



Improvements not obvious (but see next slide)

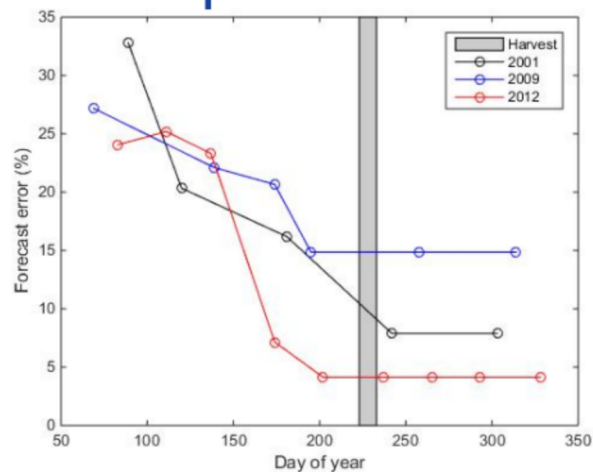
No problem predicting the median yield! ;)

Improvements but
 Underestimations

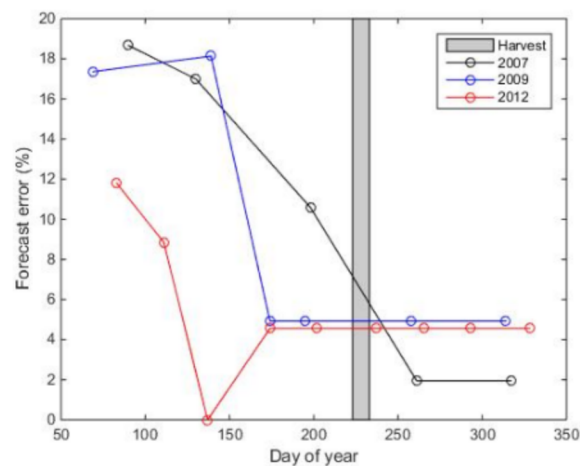
Lead time in water-limited countries

Low yields during dry years

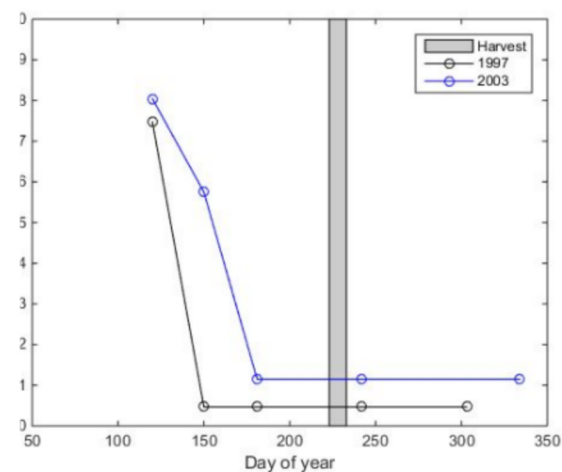
Spain



Hungary



Italy



Crop model captures water stress...


Way forward - smart regional approaches

Form5

Region France

AggregatedForecastLinkedForecasts

Yield



200 km
200 mi

Drag a column header here to group by that column

Region	Region Code	Crop	Forecasted Value
	FR82	soft wheat	3.83
	FR63	soft wheat	5.38
	FR42	soft wheat	7.41
	FR43	soft wheat	6.66
	FR61	soft wheat	5.67
	FR72	soft wheat	5.94
	FR71	soft wheat	6.17
	FR25	soft wheat	7.48
	FR10	soft wheat	8.1
	FR62	soft wheat	5.46
	FR41	soft wheat	6.99
	FR23	soft wheat	8.67
	FR30	soft wheat	8.8
	FR52	soft wheat	7.34
	FR26	soft wheat	6.73
	FR51	soft wheat	7.01
	FR53	soft wheat	6.69
	FR21	soft wheat	7.9
	FR22	soft wheat	8.72
	FR24	soft wheat	7.05

Forecast default type: Trend fore

Show regional forecasts

Forecasted value: 7.34984475314506

NewInnerRegionForecast

- Create CST Regressions
- Best Regression
- Create Regressions on Residuals
- Create Scenarios
- Create Trends
- Create Averages

Current overall forecast value: 7.35

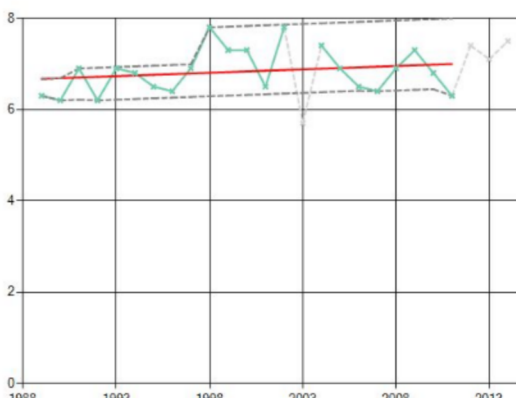
Current regional forecast value: 7.05

New overall forecast value: 7.4

New regional forecast value:

Aggregated forecast using regional forecasts

Centre - soft wheat - Multiple regression on



Avail. trends: linear1989

Start year: 1989

End year: 2011

Trend type: Linear

Trend values:

- 1989 - 6.3
- 1990 - 6.2
- 1991 - 6.9
- 1992 - 6.2
- 1993 - 6.9
- 1994 - 6.8
- 1995 - 6.5
- 1996 - 6.4
- 1997 - 6.9
- 1998 - 7.8
- 1999 - 7.3
- 2000 - 7.3
- 2001 - 6.5
- 2002 - 7.8
- 2003 - 5.7
- 2004 - 7.4
- 2005 - 6.9
- 2006 - 6.5
- 2007 - 6.4
- 2008 - 6.9
- 2009 - 7.3
- 2010 - 6.8

--- original stat values — Linear --- minimum --- maximum

— Centre - soft wheat

Save

Sel	Model Name	Indicator	Simulated Crop	Date
<input type="checkbox"/>	Agg CGMS 12 weather	Climatic water balance no number of ti...	Arable Land	
<input checked="" type="checkbox"/>	CGMS 08 Wofost model indicators	Development stage	SoftWheat	17 dk
<input checked="" type="checkbox"/>	CGMS 08 Wofost model indicators	Potential Biomass	SoftWheat	18 dk
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Potential Storage organs	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Water Limited Biomass	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Water Limited Storage organs	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Soil Moisture	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Total Water Requirement	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Total Water Consumption	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Potential Leaf Area Index	SoftWheat	
<input type="checkbox"/>	CGMS 08 Wofost model indicators	Water Limited Leaf Area Index	SoftWheat	

Forecasted value:

R-squared:

Regression coefficients used:

VAR Run Task Chan

9 Not time consuming - automated



Talking points

- Mechanisms to translate research into operational crop yield forecasting
- Research activities that contribute to improve forecasts
 - Understand better the relationship of current predictors with past yield variability
 - Identify complementary predictors (e.g. new predictors)
 - Improve current components (e.g. improve the crop model simulations)
 - Improve statistical techniques (e.g. regression techniques)
- Explore new forecasting approaches (e.g. social media based, regional level)
- New ways needed to think about unprecedented extreme impacts (e.g. France 2016)
- Use Copernicus Sentinels (yield but also crop area mapping) in combination with new data sources (e.g. increasingly available LPIS farmers' declarations)
- Role of the analyst – analyst independent forecasts (e.g. see Canadian Crop Yield Forecaster)

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