



EC/FAO Programme on Information Systems to Improve Food Security Decision-Making in the European Neighborhood Policy (ENP) East Area

Proposal to improve crop forecasting in Armenia

Workshop, October 13, 2010

Armstatehydromet Service, Yerevan, Armenia

- WORKSHOP REPORT -

1. Background

This half day Workshop was jointly organized by Armstatehydromet (hereinafter: Hydromet) and FAO under the “*EC/FAO Programme on Information Systems to Improve Food Security Decision-Making in the European Neighborhood Policy (ENP) East Area*” on October 13, 2010. The Programme is financed by the European Commission and implemented by FAO. The Programme aims at improving food security by enhancing the national capacity to generate, analyze, communicate and mainstream more relevant and reliable information into policies and programmes. The Workshop took place in Hydromet’s meeting room.

2. Workshop Objectives

The objective of the workshop was to build consensus on the priorities to be addressed under the Programme to improve crop forecasting and the dissemination of information. This was achieved by presenting and discussing with stakeholders the options identified by an international consultant to improve crop forecasting and the dissemination of information to Marz Regional Centers.

The Workshop also provided an opportunity to present the potential of improved crop forecasting for food security policies and programmes to concerned staff from the Ministry of Agriculture (MoA). The Workshop was organized for the stakeholders of the Programme who are interested in agrometeorological forecasting, i.e. producers and users of agro-meteorological data, namely staff from the Ministry of Agriculture, Hydromet and the National Statistical Service (NSS). The Workshop was designed in such a way as to engage all participants in discussions and reflect on appropriate recommendations for all state institutions involved in crop forecasting activities in Armenia.

The international consultant, Bernard Tychon, was on a mission in Armenia for 10 days, from 6 to 15 October 2010. His tasks were the following:

- Review current activities related to agrometeorological forecasting and operational service in Hydromet and the dissemination of information (including through information products) to MoA;

- Identify weaknesses and limitations of current agro-meteorological forecasting and dissemination of information;
- Propose options for addressing users' demand and needs, taking into account the resources available under the Programme to improve capacity of Hydromet and MoA;
- Organize a Workshop to present and discuss with Hydromet and the users of agrometeorological information the options identified to address users' demand and needs;
- Finalize a proposal to provide support under the Programme with different options, integrating the comments received during the Workshop, with a budget and an agenda for implementation.

The agenda of the Workshop was established in consultation with the international consultant and Hydromet staff. It is provided in Annex 1.

All participants were provided with a package of documents:

- list of participants
- agenda
- brief description of the EC/FAO Programme
- hard copy of the presentation delivered by Nelly Arakelyan (HYROMET)
- hard copy of the presentation delivered by Bernard Tychon
- agrometeorological bulletin (produced by Hydromet)

3. Participation

The Workshop was attended by 26 participants, including the international consultant and the Country Coordinator. Participants belong to a number of national institutions: Ministry of Agriculture (represented by the Crop Production and Agricultural Planning Departments), National Statistical Service (Food Security Unit), Hydromet and the Armenian state Agricultural Academy.

The list of Workshop participants is presented in Annex 2.

4. Process

The Workshop was opened by a Welcoming speech of the Hydromet Director (presented by his Deputy, H. Melkonyan). He noted that the objectives of the Programme were similar to the activities of their Service. He also underlined the importance of the improvement of crop forecasting in Armenia.

- The first presentation was devoted to the EC/FAO Programme, its objectives, areas of intervention, main activities and expected results (M. Tapaltsyan, Country Coordinator). The Country Coordinator also thanked the Director of Hydromet for all the support provided to organize the Workshop.
- The next presentation on the use of agrometeorological data and delivery of information to the users was delivered by N. Arakelyan from Agrometeorological Forecasting Division. The presentation focused on the observation, products, problems and proposals on improvement of agromet forecasting. She presented the activities of their Division, the list of users and the ways of delivering the information to the users.

- The last presentation on options to improve crop forecasting in Armenia was made by B. Tychon. The presentation comprised 3 main parts: introduction to operational crop yield forecasting techniques (a new crop-forecasting system to be adjusted to Armenia, present status of the crop yield forecast in Armenia and proposed improvements).

The presentation of the international consultant is provided in Annex 3.

Each presentation was followed by an active discussion among Participants. The most active discussion followed the presentation of B. Tychon.

5. Main results and follow-up activities

The main options proposed by the consultant to improve crop forecasting and the dissemination of the information were the following:

- Organize an Interinstitutional Working Group, including MoA, Hydromet and NSS representatives, to strengthen the collaboration between the national institutions; this will allow improving communication and collaboration between Hydromet, MoA, farmers and other users of agrometeorological information.
- Introduce a new crop yield forecasting system; there is high demand and need for improving agrometeorological forecasts. A new system on crop forecasting was presented by the Consultant.
- Train relevant staff from MoA, Hydromet and NSS on a new crop yield forecasting system and remote sensing. Probably, 2-3 people from each institution.
- Post the Agrometeorological Bulletin currently developed by Hydromet on the Hydromet Website (www.meteo.am); this will ensure access to all users; there is currently quite a limited access to agrometeorological bulletins. For instance, Marz support centres do not receive the bulletins, which is missed opportunity.
- Increase the interest and capacity of Hydromet in Plant Diseases; the consultant has identified high need for using a prediction model for crop disease development while, according to MoA, 30% yield reductions were observed in years with high disease pressure (in case plant protection measures are not implemented in due course).
- Design booklets with recommendations to farmers in emergencies and unfavourable climatic conditions.
- Procure required relevant equipment (including both specific meteorological and IT equipment, e.g. a laptop for Hydrometeorological station) for Hydromet to improve agromet forecasting.

The implementation of these recommendations will result in mitigating the negative impacts of climate vagaries and generating positive impacts. It will also assist the decision-makers in better planning their activities to support farmers.

The Workshop clearly showed that there is a strong interest from the national institutions in improving crop yield forecasting. The participants agreed with the recommendations of the international consultant. The options proposed were explained in details. Improving crop forecasting is based on a system concept which will have to be adapted to the Armenian context. It will require a strong investment from Hydromet and a partnership with MoA (and with NSS at the beginning at least). All parties are now informed of the proposal and there is a consensus on the options proposed by the consultant. This is the main result of the Workshop.

Based on the mission of the international consultant and the inputs provided by Workshop participants, Programme staff will finalize a proposal, integrating the comments received during the Workshop, with a budget and an agenda for implementation.

Annex 1: Workshop Agenda

13⁰⁰ – Snacks, sandwiches, beverage

14⁰⁰- Opening speech, Levon Vardanyan, Hydromet, Director (Presented by Hamlet Melkonyan, Deputy Director)

14¹⁵ - Presentation on Programme, Mane Tapaltsyan, EC/ FAO Programme on Food Security Information Systems to Improve Decision Making in East area, Country Coordinator

14⁴⁰ – Presentation on Use of Agrometeorological data and Delivery of Information to the users, Nelly Arakelyan, Hydromet, Agrometeorological Forecasting Division

15¹⁵ - Proposals on Improvement of Crop Forecasting in Armenia, Bernard Tychon, Liege University, Professor, Agrometeorologist

17⁰⁰ - Discussions

17⁴⁵ - Visit to the Divisions of Hydromet

Annex 2. List of Workshop Participants

- 1. L. Vardanyan**, RA Ministry of Emergency, Armstatehydromet, Director
- 2. H. Melkonyan**, RA Ministry of Emergency, Armstatehydromet, Deputy Director
- 3. Z. Petrosyan**, Armstatehydromet Operational Hydrometeorological Centre, Head
- 4. V. Grigoryan**, Advisor to the Arstatehydromet, Director
- 5. D. Avagyan**, European Commission (not attended)
- 6. M. Tapaltsyan**, EC/ FAO Programme on Food Security Information Systems, Country Coordinator
- 7. L. Grigoryan**, Agrometeorological Forecasts, Head of Division
- 8. N. Hakobyan**, Hydrometeorological Center of Information and Marketing Division, Head
- 9. L. Simonyan**, Agrometeorology Division, Head
- 10. N. Arakelyan**, Agrometeorological Forecasts Division, Leading Specialist
- 11. K. Yesayan**, RA Ministry of Agriculture, Horticulture Division, Head
- 12. G. Harutyunyan**, RA Ministry of Agriculture, Land Management and Use Division, Head
- 13. H. Lemberyan**, RA Ministry of Agriculture, Agricultural Planning Division, Head
- 14. A. Petrosyan**, RA Ministry of Agriculture, Agricultural Planning Division, Chief Specialist
- 15. A. Hakobjanyan**, RA National Statistical Service, Food Security Division, Head
- 16. L. Aleksanyan**, Agricultural Support Marz Center of Armavir, Head
- 17. Kh. Mkrtychyan**, Agricultural Support Marz Center of Aragotsotn, Head
- 18. G. Yeghiazaryan**, Agrogitaspur Department, Armenian State Agricultural Academy
- 19. B. Zakaryan**, Armstatehydromet, Hydrography Division, Head
- 20. G. Surenyan**, Meteorological Forecasts Division, Head
- 21. A. Hovsepyan**, Climate Research Division, Head
- 22. D. Hovhannisyan**, Climatology Division, Head
- 23. V. Badalyan**, Agrometeorological Division, Chief Specialist

A few more specialists from Operational Hydrometeorological Centre, Hydrometeorological Center of Information and Marketing, Climate Research Division, Climatology Division of Armstatehydromet were also present at the Workshop.

Crop yield forecasting proposal for Armenia

Bernard TYCHON
(Bernard.Tychon@ulg.ac.be)
FAO Consultant
Hydromet, Yerervan, 13 October 2010

Content

- Operational Crop yield forecasting techniques
- Present status of the Crop Yield Forecast in Armenia
- Proposed improvements
- Conclusions

Operational crop yield forecasting techniques

Objectives of crop production and crop yield forecasting systems

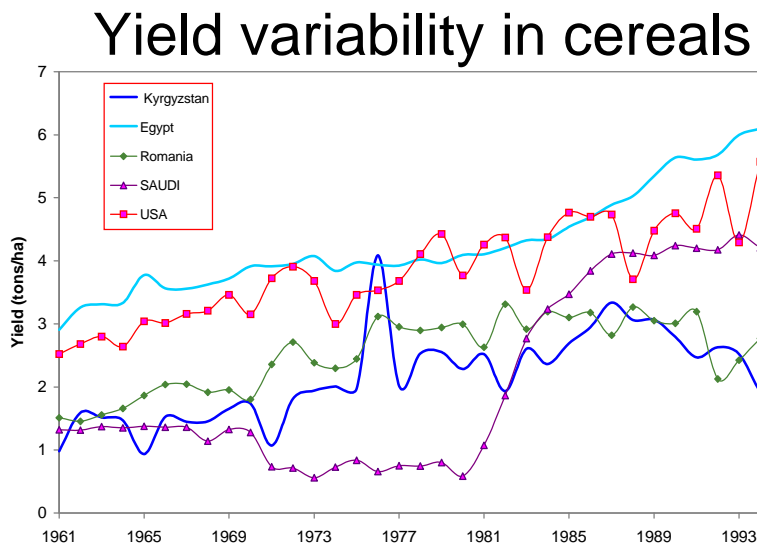
- Pricing
 - Market stability
 - Food security
 - Control of supply
- } data in real time!

EU-15	Cereals balance sheet:Marketing year: 2002/2003										(Mio t) EUR 15
	Common wheat	Barley	Durum	Maize	Rye	Sorghum	Oats	Triticale	Others		
Beginning stocks (01.07.2002)											
Market	12.7	7.3	1.0	5.3	1.0	0.0	0.6	0.6	0.1		28.5
Intervention	0.5	2.5	0.0	0.0	5.1	0.0	0.0	0.0	0.0		8.1
Total	13.2	9.8	1.0	5.3	6.1	0.0	0.6	0.6	0.1		36.6
Usable production	93.9	47.7	9.4	40.0	4.7	0.7	6.8	5.2	0.7		209.2
Import	6.2	0.1	0.4	3.0	0.0	0.1	0.0	0.0	0.0		10.0
TOTAL AVAILABILITIES	113.2	57.6	10.9	48.3	10.8	0.8	7.4	5.8	1.0		255.8
USE											
- Human	33.0	0.0	7.0	2.5	1.5	0.2	1.3	0.0	0.0		45.5
- Seed	2.9	2.0	0.8	0.2	0.2	0.0	0.3	0.2	0.2		6.8
- Industrial	6.3	7.4	0.0	4.4	0.2	0.0	0.2	0.0	0.1		18.6
-Ultra peripheral islands	0.3	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0		0.9
- Animal feed	41.6	31.8	1.0	32.0	2.0	0.7	4.1	4.8	0.4		118.4
TOTAL USE	84.1	41.4	8.8	39.5	3.9	0.8	5.9	5.0	0.7		190.0
Solde disponible	29.2	16.2	2.1	8.8	6.9	0.0	1.5	0.8	0.3		65.8
Export (1)	16.5	9.0	0.9	2.3 *	1.5	0.0	0.7	0.0	0.0		30.9
End stocks (30.06.2003)											
Market	12.7	6.7	1.2	6.5	1.0	0.0	0.8	0.8	0.3		29.9
Intervention	0.0	0.5	0.0	0.0	4.4	0.0	0.0	0.0	0.0		5.0
Total	12.7	7.2	1.2	6.5	5.4	0.0	0.8	0.8	0.3		34.9
Change in stocks	-0.5	-2.6	0.1	1.2	-0.7	0.0	0.2	0.2	0.2		-1.8
Change in public stocks	-0.5	-2.0	0.0	0.0	-0.7	0.0	0.0	0.0	0.0		-3.1
(1) Grains equivalent. *) Maize includes 1.8 mio. t processed products and animal feed											
Maximum W T O: 2002/2003					ESTIMATED EXPORT QUANTITIES					2002/2003	
Wheat incl. durum	14.438 mio t +0,5 mio t food aid				17.40 mio t (food aid included and refund-free)						
Coarse grains	10.8432 mio t.(inclu. 0,4 mio t potato starch)				13.50 mio t (inclu 1.8 mio t maize products, but excl. 0,4 mio t potato starch)						

Basic relation

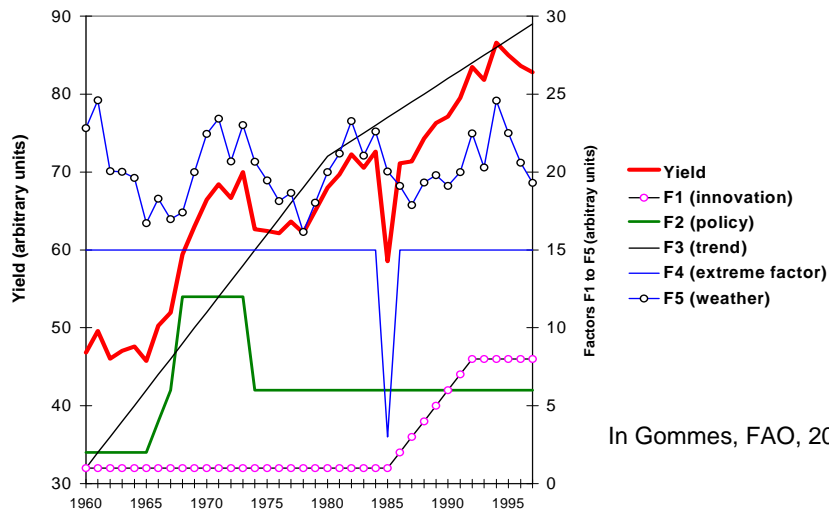
$$\text{Production} = \text{Yield} \times \text{Area}$$

Yield assessment



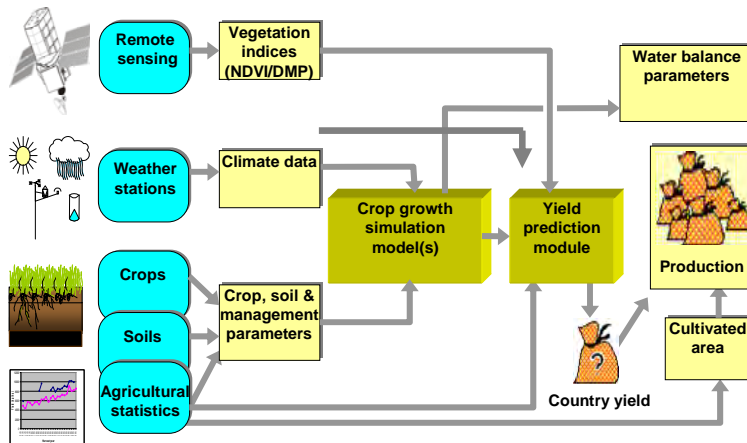
Gommes, FAO, 2003

Yield factors of variability



In Gommès, FAO, 2003

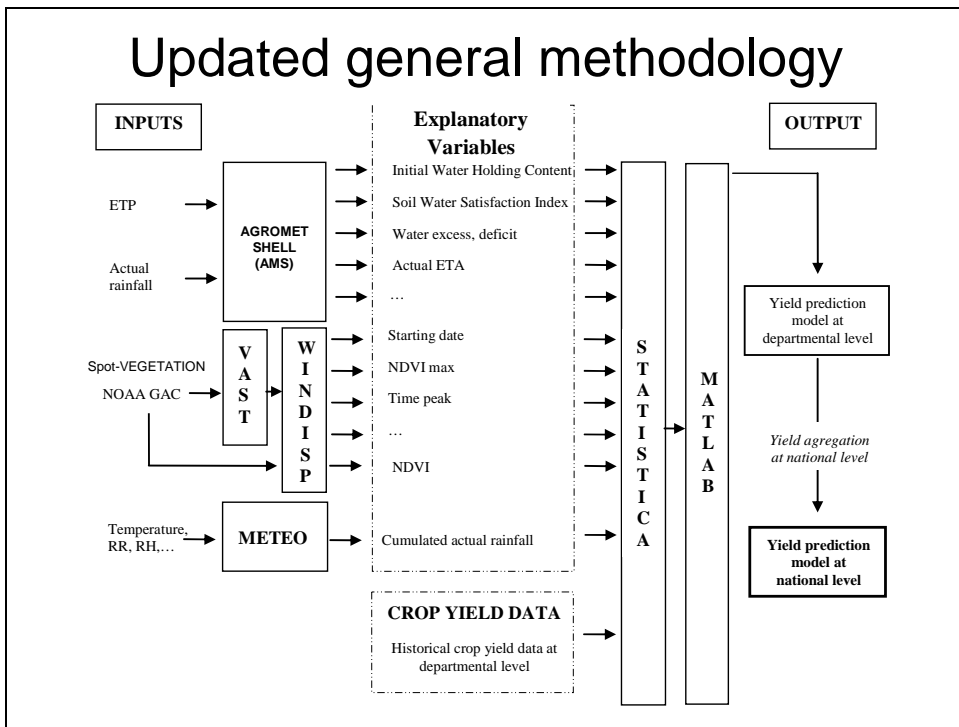
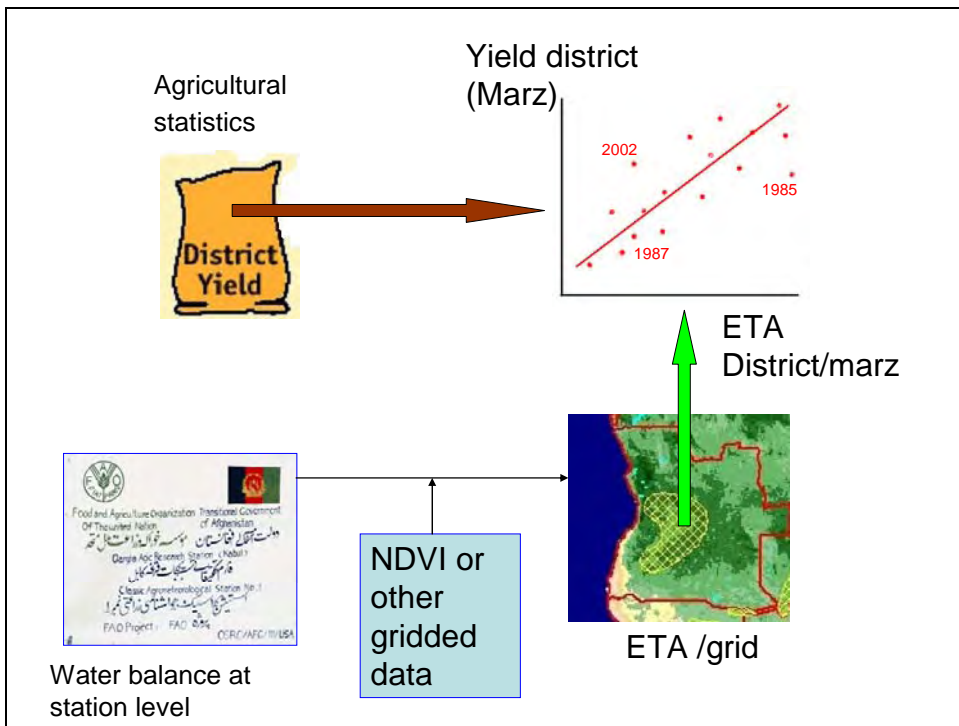
Crop monitoring & Yield forecasting: General Flowchart



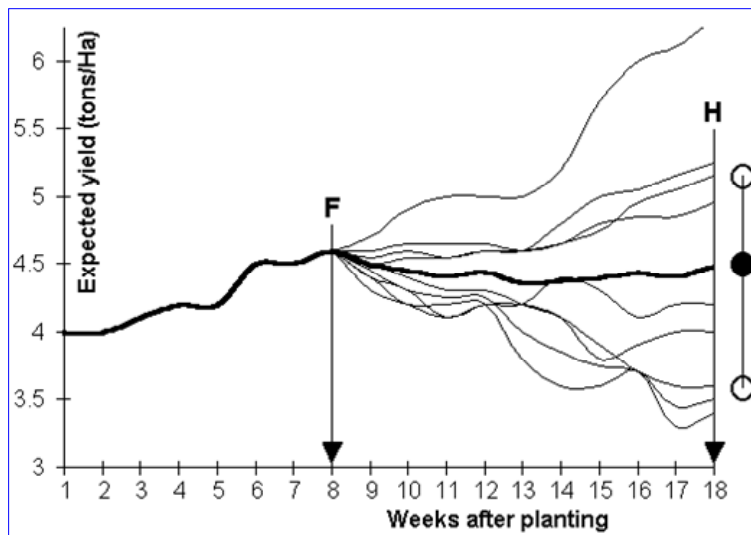
FAO, modified

Estimates for each YEAR x REGION x CROP on:

- Yield = $f_{cal}(4 \text{ types of Indicators})$
Trend, Meteorology, Crop growth model, Remote Sensing
- Production = Yield x Area



Yield and forthcoming weather...



Present status of the Crop Yield
Forecasting in Armenia

- Information provided by Hydromet
 - Field observations
 - Meteorological data (3-hourly data)
 - Phenological data (bi-weekly data)
 - Dense agromet observation network (36 stations !)
 - Crop yield forecasting for major crops
 - Winter wheat, Barley, Apricots, Grape, Onion + Pasture/Grassland
 - Based on agromet models developed a long time ago (input data = temperature, rainfall, development stage, most of the time)

- Information provided by Ministry of Agriculture (MoA)
 - Based on agricultural research/advise centers field observations (Mars Centers)
 - Crop Yield Forecast based on expertise inside the MoA

Communication

By email or telephone to

- MoA
- Private companies (Beer, Sugar,...)

Proposed improvements

Proposal

- Communication improvement:
 - Set up of a multidisciplinary working group combining Hydromet and MoA expertise in order to provide an improved yield assessment/forecast of major crops (sharing of data and experiences)
 - Ten daily meeting/Monthly meeting/Emergency meeting
 - Led by Hydromet or another rotating management
 - Website development (Hydromet activities show-case with a connection to MoA website)

Proposal

- Technical improvements:
 - Adopt the Crop Yield Forecasting (CYF) general methodology applied in many countries by adapting it to the Armenian context
 - Integrate remote sensing data into the Armenian CYF system
 - Improve spatial interpolation through adapted interpolation techniques, especially for crop development stages
 - Develop plant diseases model for plant protection activities that are also crucial for crop yield forecasting
 - Consider extreme events in the crop yield forecast (early frost, hail, locusts invasion,...)

Methodology

4 types of explanatory variables

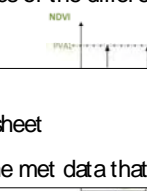
Agrometeorological factors

Meteorological factors

RS derived factors

Other factors

Chronos metrics
 NDVI image processing tool
 → Calculation of metrics of the difference



With a spreadsheet
 → Sum of some met data that

Input data:
 - 10-daily NDVI time series for the considered period

AgrometShell
 FAO Tool
 → Simulation of Crop specific soil water balance and calculation of a set of parameters.

Input data:
 - Rainfall
 - Potential Evapotranspiration
 - Phenological parameters

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Methodology

4 types of explanatory variables

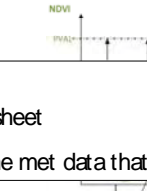
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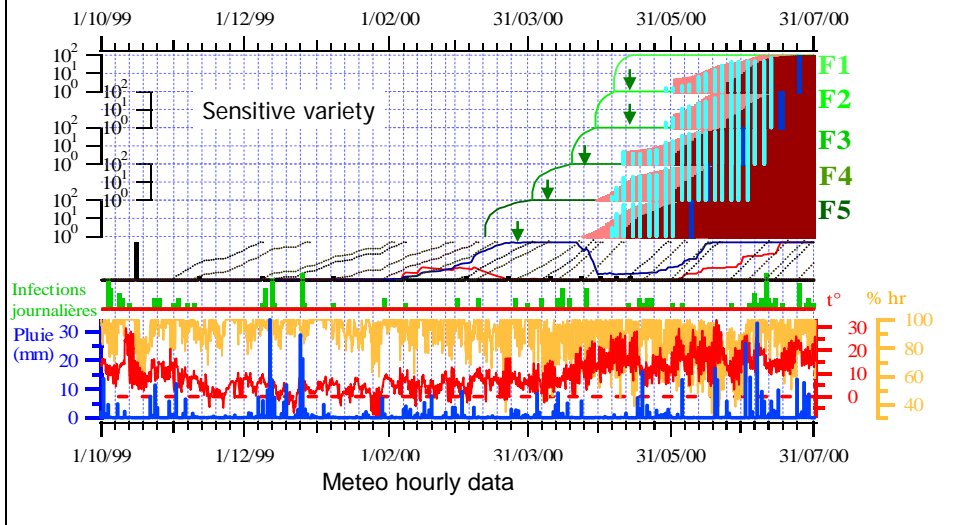
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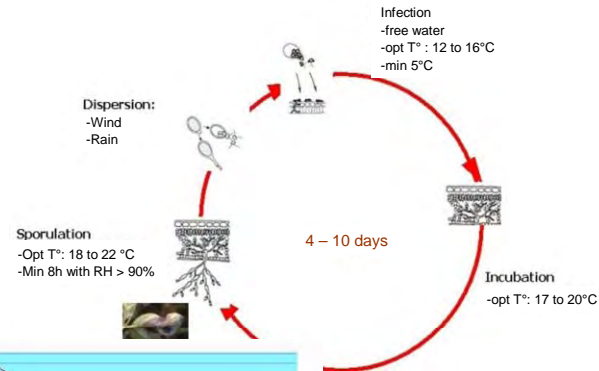
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Crop diseases model

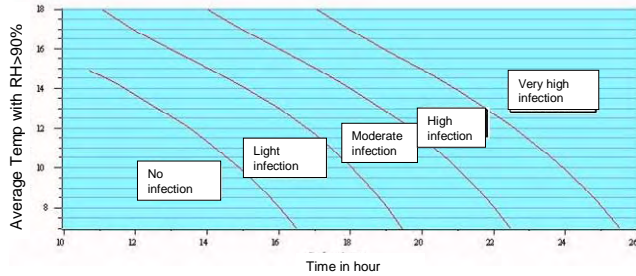
Case of W. Wheat (Septoriosis) – Proculture model

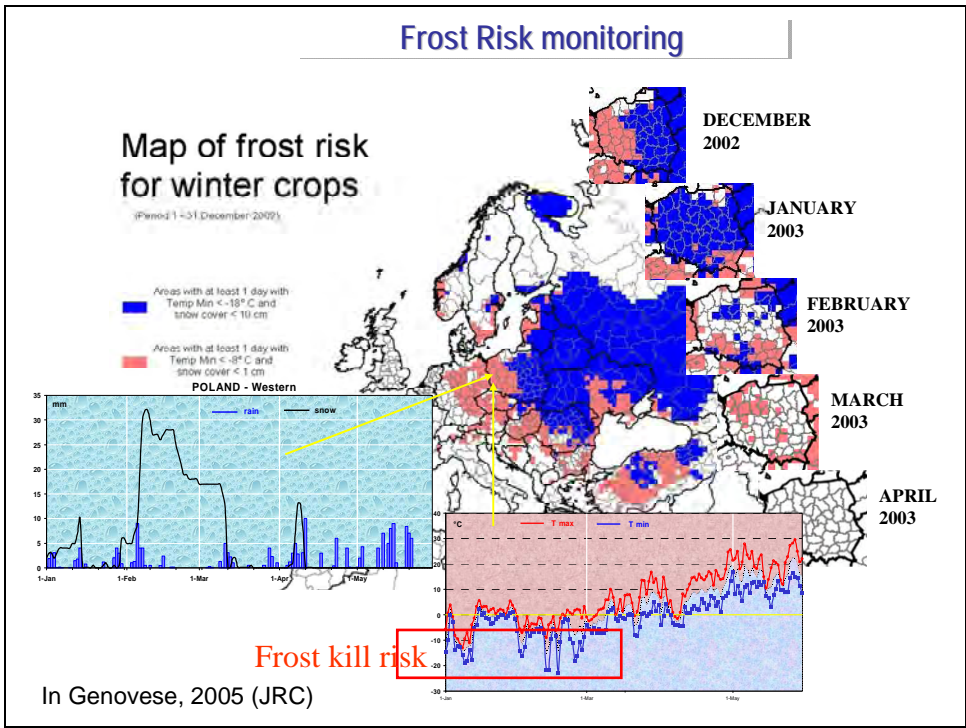
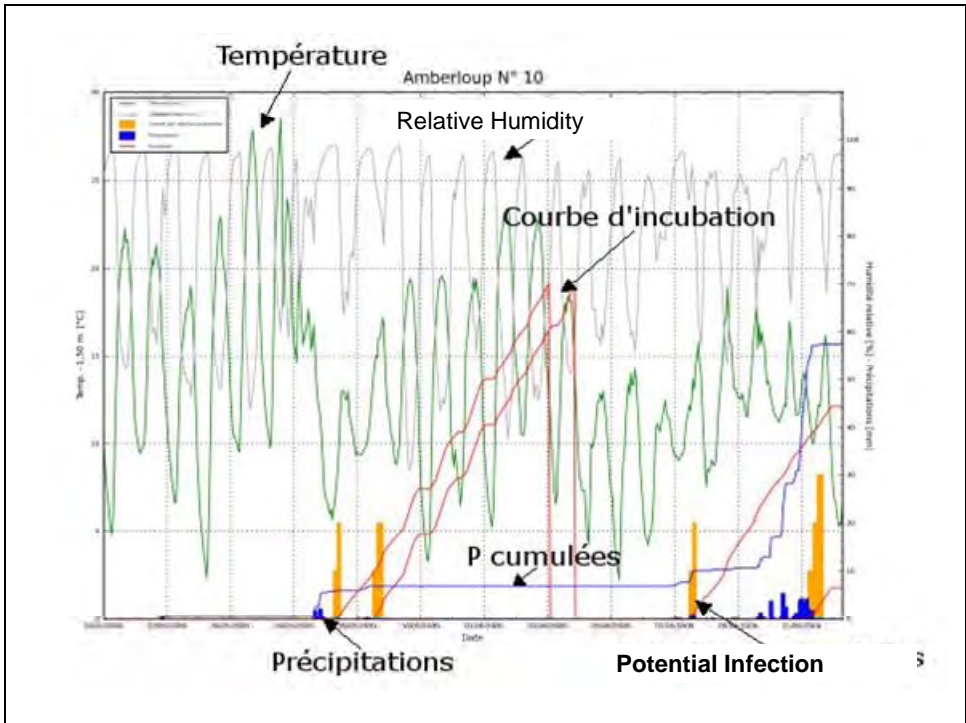


Phytophthora Infestans (Mildew) on Potato

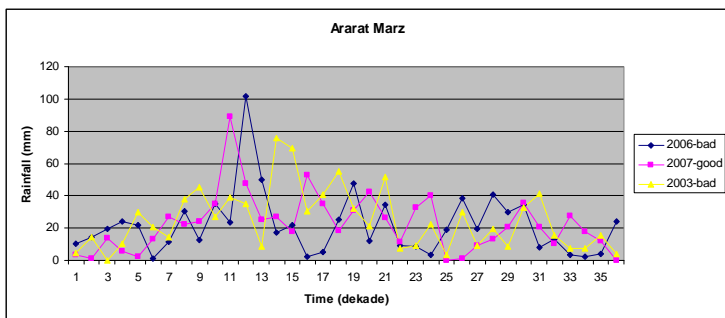


Guntz-Divoux curves

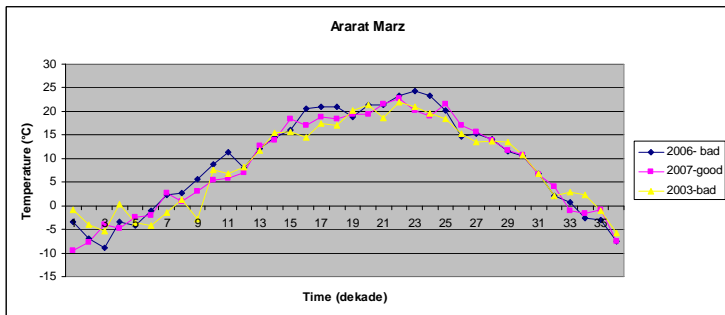




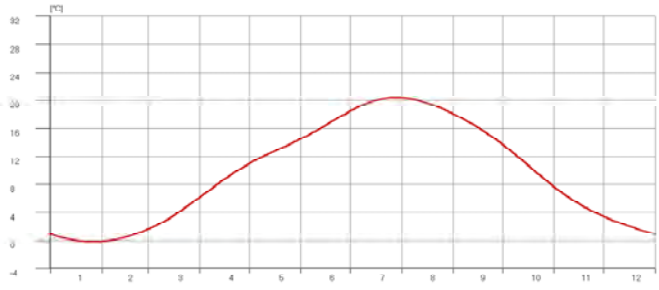
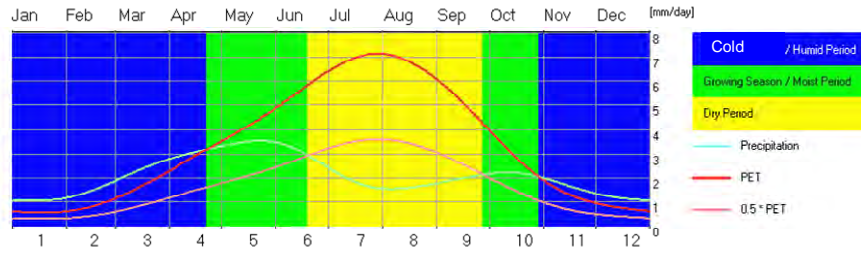
Example for Armenia



Example of weather conditions for 3 years in one Marz of Armenia

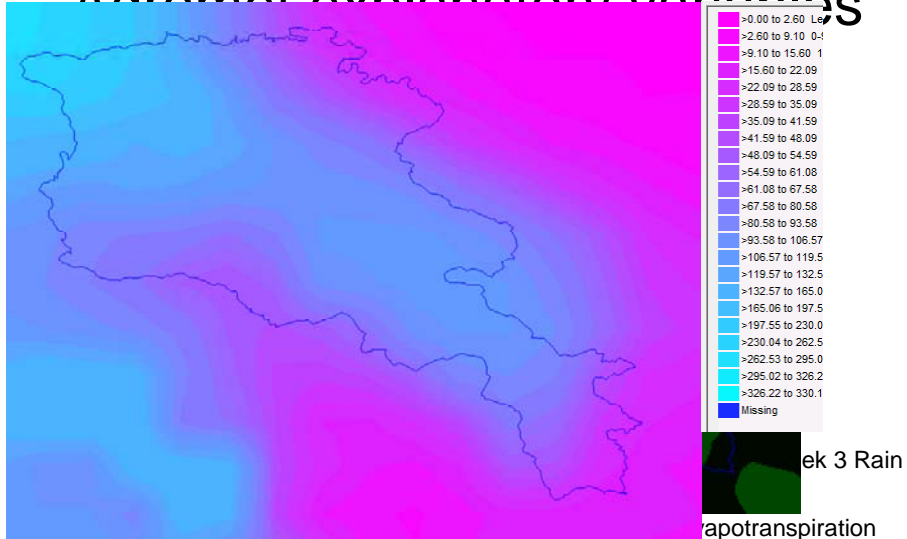


Erevan



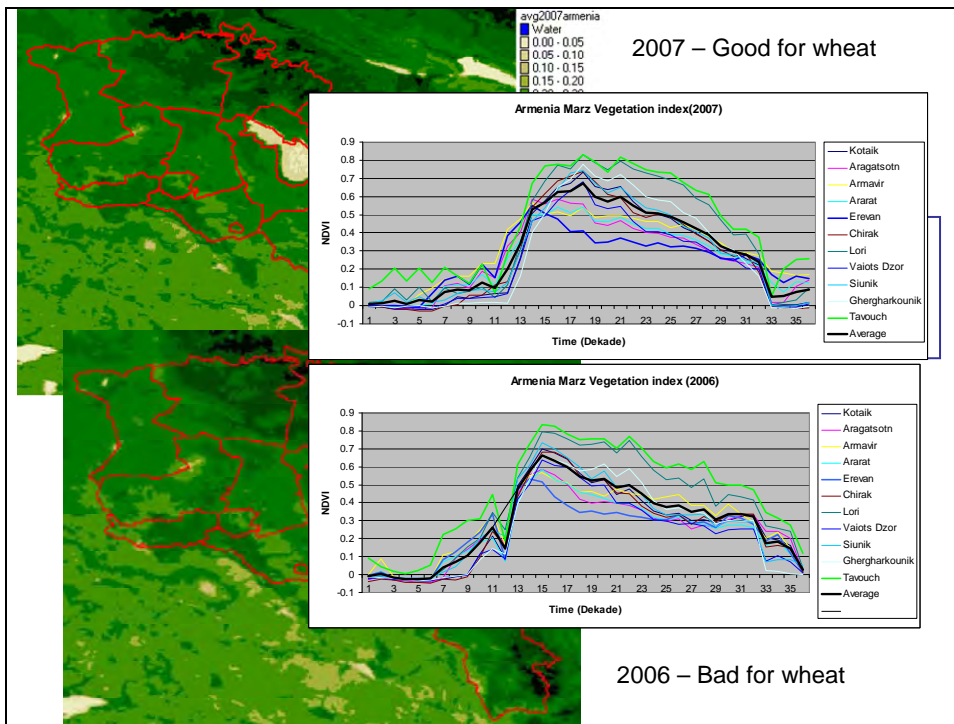
Temperature
(Average)
In NewLocClim

A crop explanatory variables



Water excess during wheat crop growth period (2006)

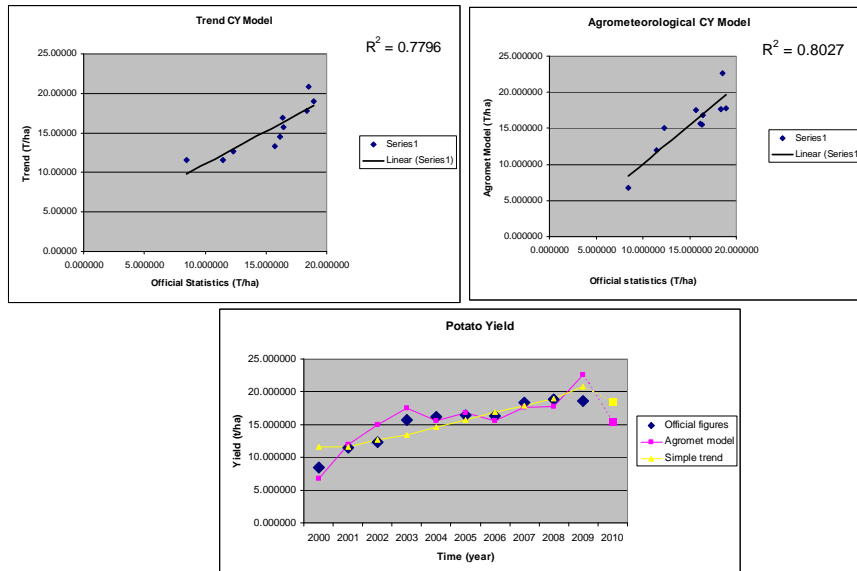
Wheat 2006



First trial for potato

- Simplification:
 - 10 years of data (meteo, RS, agricultural statistics)
 - 1 station per Marz
 - 1 single model for the whole country
 - Agrometeo and Remote sensing explanatory variables only
 - 26 potential explanatory variables
 - 4 variables retained after statistical analyses:
 - WEXy, ETAf, SVAL and SLOP

Potato Yield Forecast Model Cross Validation Results



Conclusions

- Create a CYF working group including both Hydromet and MoA
- Train experts from both institutions in new agrometeorological tools (team building and capacity building)
- Adapt the General CYF flowchart to Armenia in order to provide the first CYF before 20 months
- Equip both teams with hardware and software material
- Acquire 3 automatic weather stations for plant disease forecasting and early warning
- Website?