Corporate solutions

Parametric Insurance or Agro Sector in Ukraine

October 2018

Presentation of AXA Global Parametrics

AXA Group's parametric insurance center of expertise

- **Ambitious goal to come-up with innovative solutions to mitigate the consequences of climate change…**
- **… and solve several pain points in P&C insurance (e.g. delays, affordability, complexity)**
- **Clients include corporations but also governments, international institutions, SMEs or individuals**
- **Global scope – already active on 5 continents and over 40 countries**
- **Many indexes possible including rainfall, temperature, crop yield, wind speed, wave height, and more**
- **Index based on the newest technology including satellite imagery**

Parametric Insurance: A new approach !

The Fundamentals based on three pillars

How does it work?

Parametric insurance is based on the use of an index to calculate the amount of compensation.

Simple

The pay-out modelling aims to closely mirror to the client's actual damages or financial losses to the chosen index.

Transparent

Since the payment amount is fixed in advance, it enables a much faster payment as no loss adjusters is required.

Faster

What data do we usually use in our contracts?

Weather stations, satellite imagery, and many others

- **Weather stations** can be used for parametric insurance contracts cover against named perils derived from climate:
  - Rainfall (Drought, Flash Flood, Excess of rain)
  - Temperature (Frost, Heat wave)
  - Wind (Hurricane)

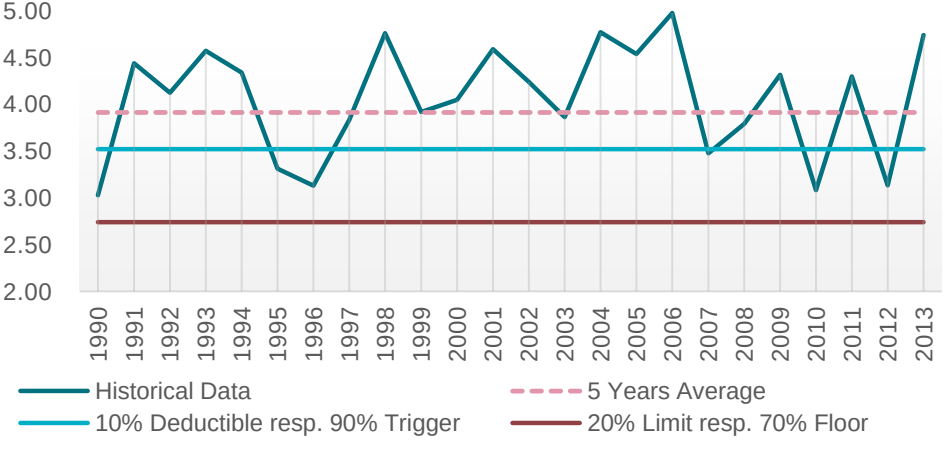
- **Index** based on official statistics and data. It allows to cover against all aggregated perils in a given risk peiod affecting for exemple:
  - Yield (all perils in a crop year affecting yield)
  - Quality (Hagberg, protein content, Sugar content)
  - Delays

- If weather stations are not reliable enough (low density, no historical data..) and there are no database, it is possible to use **Satellites** and measure weather parameters …
  - RFE (Rain Fall Estimate)
  - Drought index (evapotranspiration)
  - Vegetation index (NDVI)

Building a parametric cover

Key features and Methodology:

- Index based cover is an insurance product based on an reference index :
  - Structured based on third party official yield data
  - Clients can choose all parameters to set the structure: deductible, limit, maximum payout; benchmark yields
  - Pricing and settlement based on statistics. No additional proof of loss or farm visits are needed to verify the crop situation
  - Only three exclusions: war, terrorism, nuclear accident
- Pricing is based on statistical occurrence.
  - Estimated payoff : Burning cost on Line: 2.25 full payouts in 23 Years ▸ 2.25/23 = 9.78%



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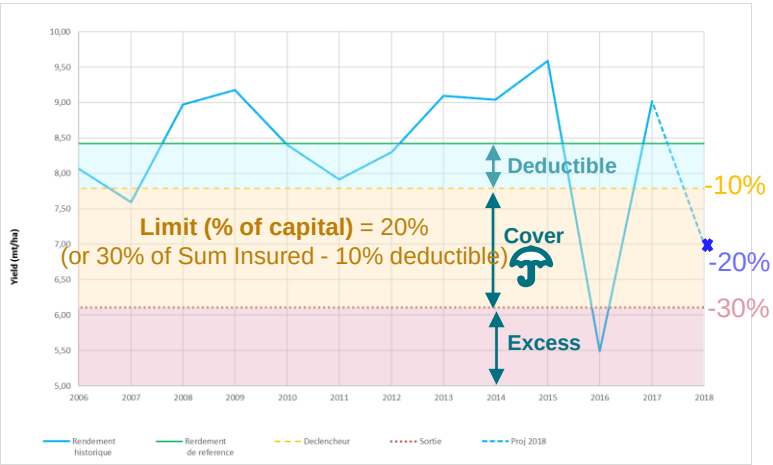
Case Study: Yield Index Cover for Grain Agro-holding

Area Yield Index

Illustration of Area Yield Index

- **Illustration:**



Benchmark = 5 year average (2012-2016) = 8,4 Mt/ha

- **Area Yield Index**
  - Area yield index based solution is used to cover against a decrease in production due to any adverse weather conditions using the historical yield as reference for the specific area to be insured.
  - Area Yield index gives thus a good indication for the trend in a given area suffering from extreme-macro-events in heterogenous geographies (Drought, Extreme frost; Heat Wave) or abnormal weather pattern changes in homogenous geographies.

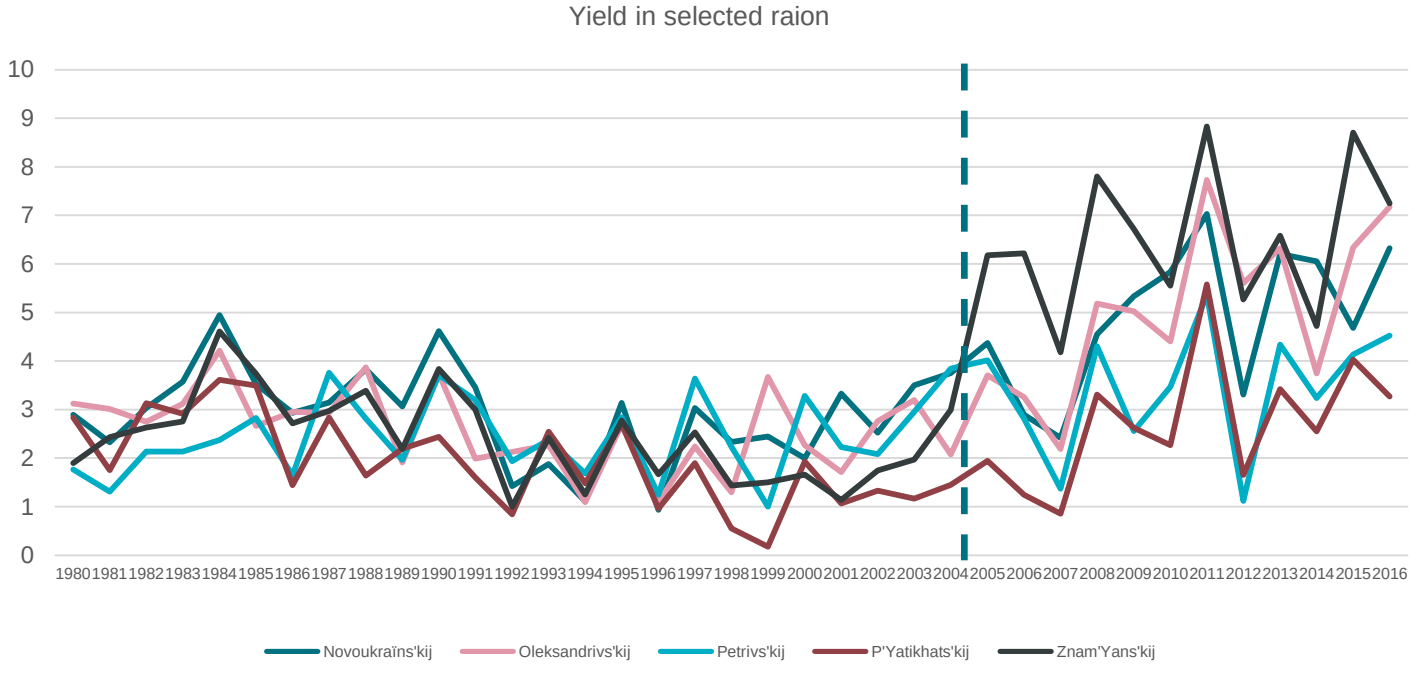
- **Insurance rationale:**
  - Possible to obtain statistics at the county level in Ukraine hence at the very granular level limiting basis risk.
  - What is important is not the yield but the Year on Year on variation i.e. if the yields of the client are higher than the area/region, it is not underinsured since we first calculate the % drop in yields in the respective area/region, and then apply this drop to the higher expected yield of our client.

- **Claims settlement**
  - → Calculation of net indemnity following the publication of results
  - → Possibility of down payment after semi-definitive results

- **Best use for:**
  - → Homogenous area
  - → The smaller the reference, the closer the index

Area Yield Crop Insurance

Ukraine administrative cut and yield trend for crops



Building a parametric cover

Structuring: Individual vs portfolio

INDIVIDUAL APPROACH

- Cover separately each risk within each region e.g. wheat in region B.
- Full cover

GEOGRAPHICAL PORTFOLIO

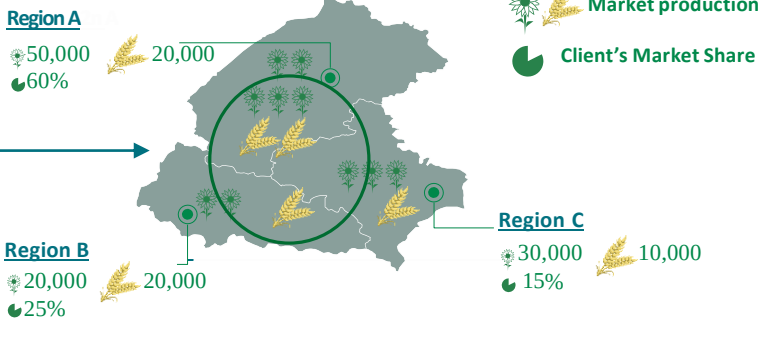
- Cover all risk in a given area, wheat and sunflower in region B
- Risk type diversification : Crop types can compensate against each other

RISK TYPE PORTFOLIO

- Insure all risk type accross region e.g. Corn in the region A, B and C
- Spatial diversification : Region an can compensate against each other

Administrative cut:

- Ukraine is 603,628 km2
- 24 regions/oblast
- 476 raions
- 1 raion is in average = 1,200km2 (or a square of 30*40km) = 120,000ha



Area Yield Crop Insurance

A tailored made structure

Elements to communicate to the insurer:

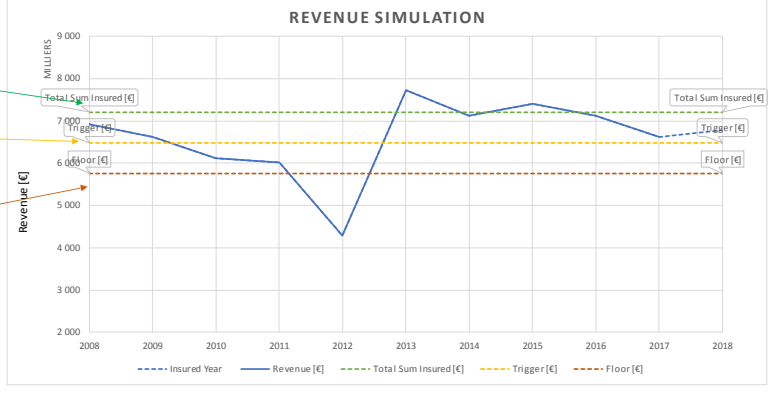
Insured perimeter				
Selected Region	**Oblast X**	**Raion Y**	**Oblast X**	**Raion Y**
Selected crop:	Winter Wheat	Spring Barley	Corn	Sunflower
Surface (Ha) by region	500	850	750	600
Official yield reference (Mt/ha)	5,14	3,55	6,13	2,42
Client yield forecast (MT/Ha)	2,4	4,5	6,21	3
Insured margin (USD/MT)	140	260	300	500
Capital insured (USD)	1 944 000	1 759 500	450 000	900 000

Structure			
Options	**Option 1**	**Option 2**	**Option 3**
Deductible [% below ref]	10%	15%	20%
Exit [% below ref]	40%	45%	50%
Limit [$]			

Case Study of index based yield insurance

Case for Spring and winter crop in Pavlograd

Total Sum Insured [€]	7 200 000
Deductible [% below Ref]	10%
Trigger [€]	6 480 000
Deductible [€]	720 000
Floor [% below Ref]	15%
Floor [€]	5 760 000
Max payout [€]	1 440 000



Historical Payout on current conditions

Total Sum Insured [€]	7 200 000
Trigger [€]	6 480 000
Floor [€]	5 760 000

		Revenue [€]	Compensation [€]
Year	2008	6 927 747	0
	2009	6 619 072	0
	2010	6 109 513	370 487
	2011	6 018 998	461 002
	2012	4 290 954	720 000
	2013	7 722 897	0
	2014	7 127 892	0
	2015	7 401 058	0
	2016	7 125 009	
	2017	6 623 145	0
Insured Year	2018	6 777 450	0

Historical Crop Values [€]

Crop		Spring wheat	Sunflower	Rapeseed
Location		Pavlograd	Pavlograd	Pavlograd
Client Sum Insured [€]		3 600 000	1 800 000	1 800 000
Insured Year	**2018**	**5 042 017**	**882 353**	**853 081**

Historical Yields [€]

Crop		Spring wheat	Sunflower	Rapeseed
Location		Pavlograd	Pavlograd	Pavlograd
Reference Yield 5Y		3,57	2,04	2,11
Insured Year	**2018**	**5,00**	**1,00**	**1,00**

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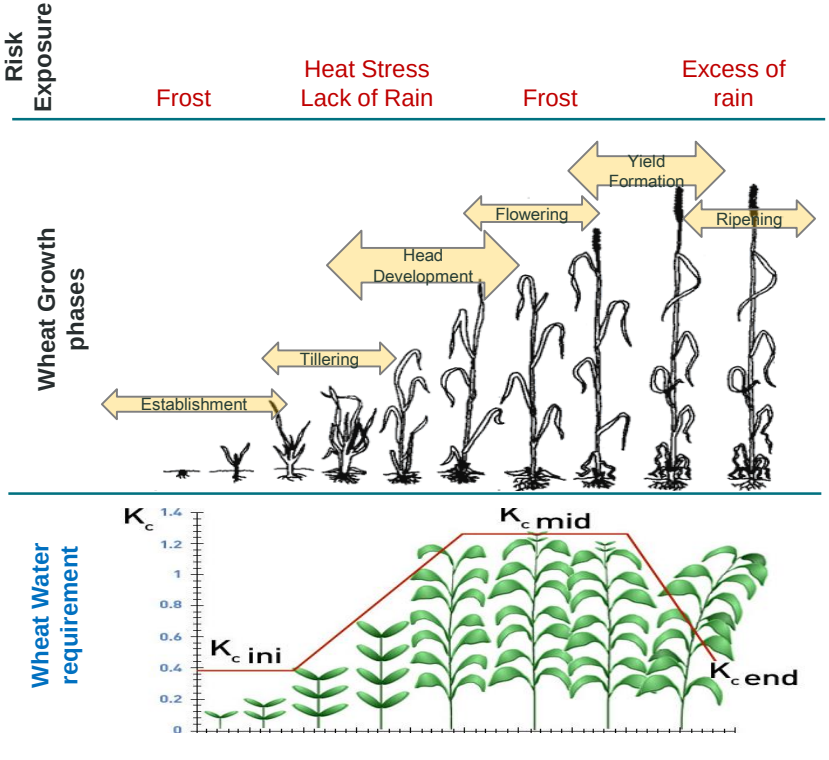
Case Study: Drought cover

Weather Index

Key features

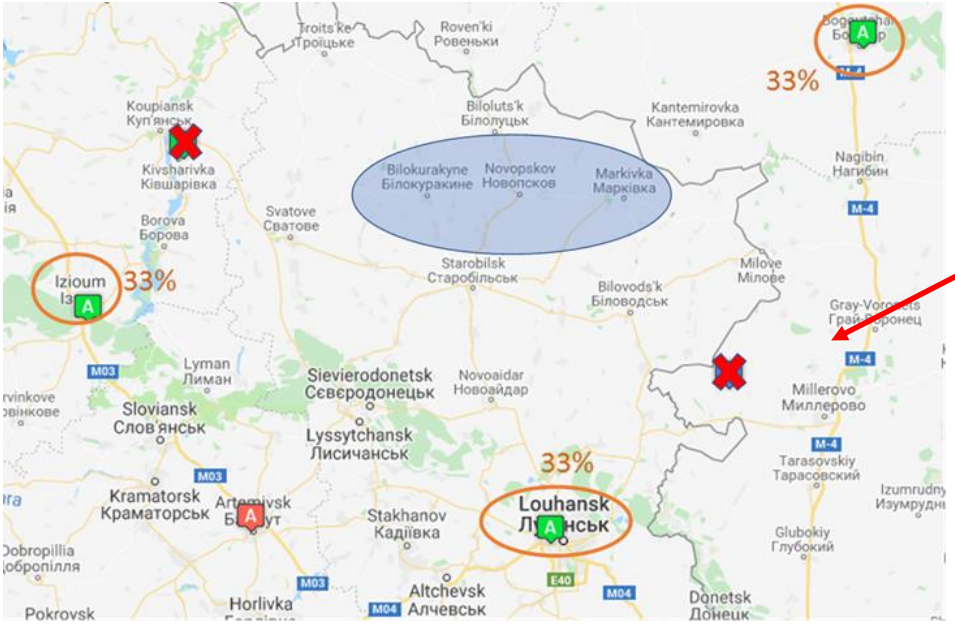
- Weather index:
  - Weather events offers cover against weather events such as drought, strong winds, flashfloods, excess heat or excess rainfall can impact production quantity or crop quality.
  - Structure needs to be adapted to the plant climatic sensitivity
- Methodology
  - Weather index is structured purely using certain weather parameters as recorded by a weather station.
  - Pay out is triggered when a certain weather parameter exceeds its pre-agreed level. It does not take into account actual crop losses thus creating a certain basis risk
  - Clients can choose a tailor-made structure (trigger, risk periods) that best meets their needs
  - Settlement is based on third-party weather station data or satellite data, no additional proof of loss or farm visits are needed to verify the crop situation

- Example , phenologic stage of winter wheat



Weather based insurance

Drought cover for winter and spring crops in the Luhansk oblast



Thee stations are available in the region:

Name	Lat	Long	Alt	Weight
Bogucar	49.933	40.567	83	33,33%
Izium	49.183	37.300	77	33,33%
Luhans'K	46.433	30.767	42	33.33%

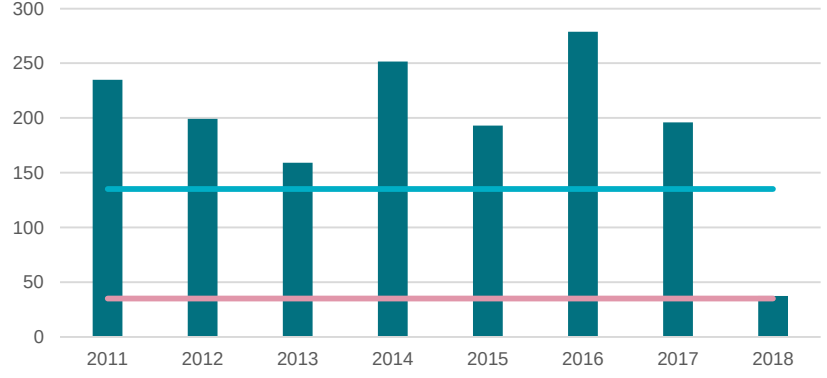
Weather Index

Drought cover- Crop Season

- **Identified Risk**
  - Crop water need during the initial stage is estimated at 50 percent of the crop water need during the mid - season stage
  - During the crop development stage the crop water need gradually increases from 50% of the maximum crop water need to the maximum crop water need.

- **Insurance rational**
  - During the risk period, we sum rainfall measured at the station.
  - If total cumulated rainfall are below the trigger, the insurance starts paying.

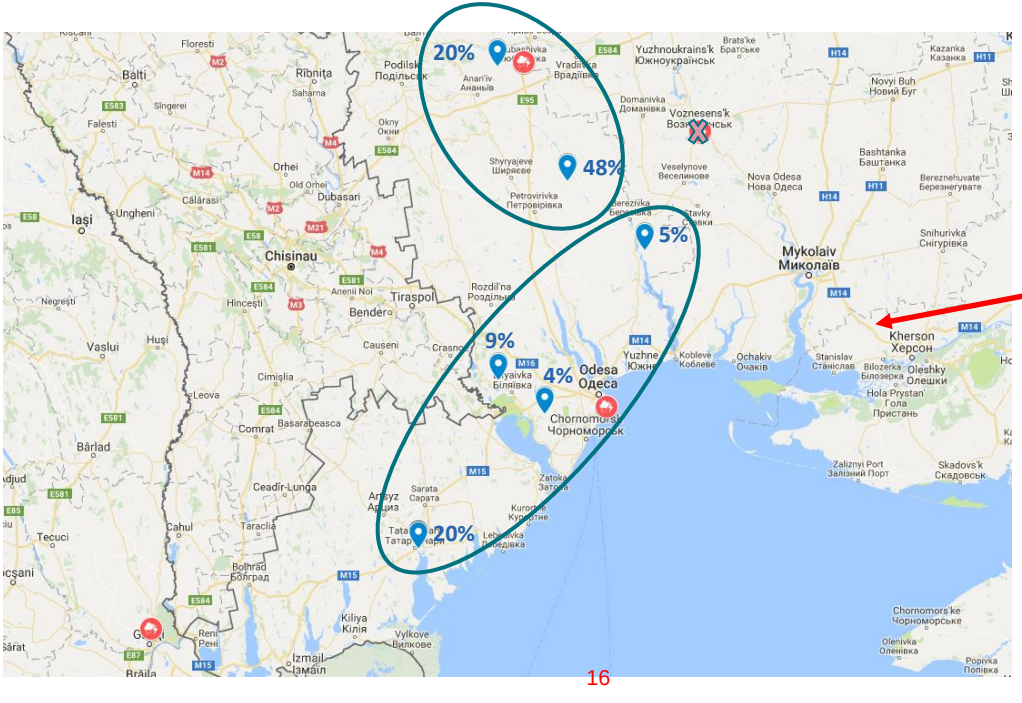
Illustration: Cumulated Rainfall April - August



Insurance cover	
Insured Risk	Drought
Index Type	Daily cumulated rainfall (Daily rainfall above 20mm are not counted)
Reference Weather Station	Combined Weather Station
Insured location	Luhansk oblast, Ukraine
Risk period	April 15th to August 31st, 2018
Trigger	Cumulated rainfall < 135mm
Exit	Cumulated rainfall = 35mm
Tick	Linear with EUR 40,000 per mm
Limit	EUR 4,0000,000

Weather based insurance

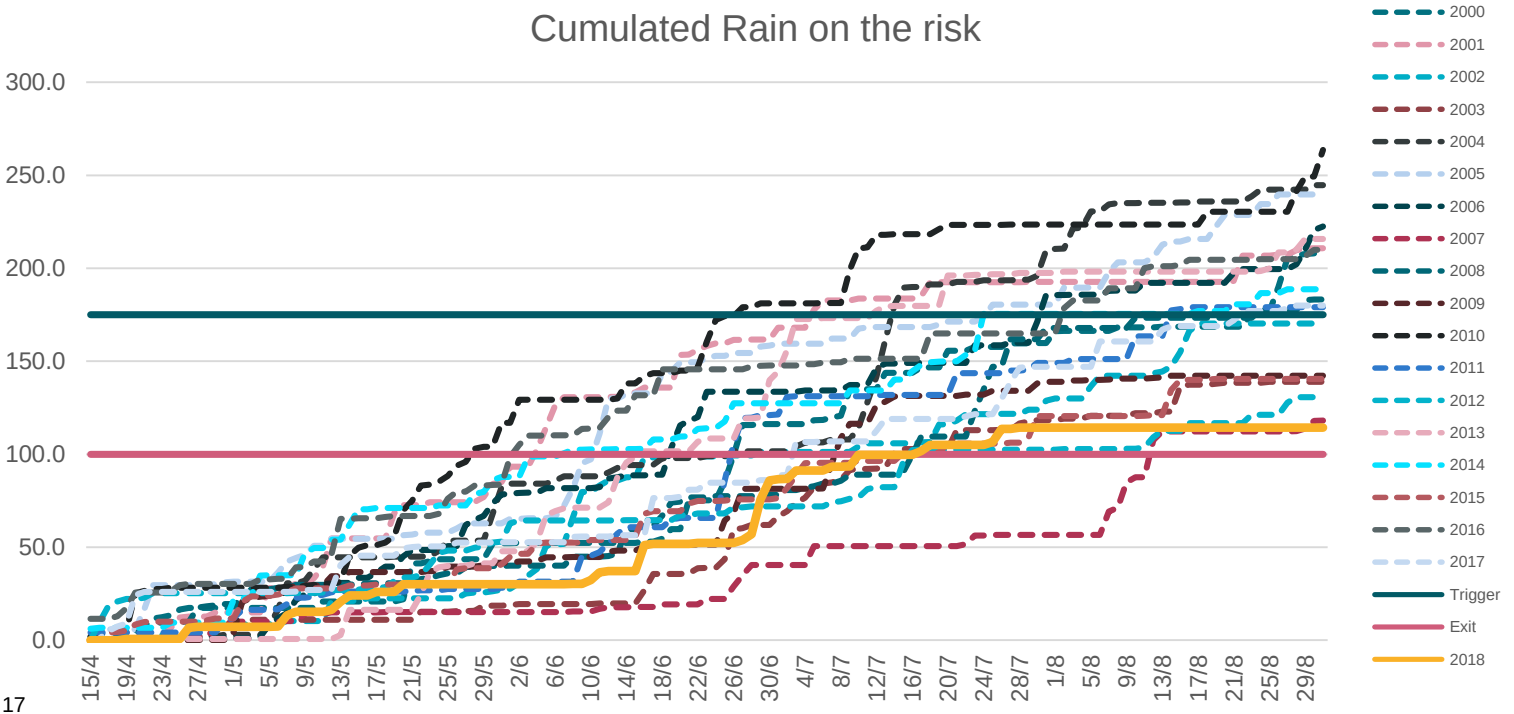
Drought cover for winter and spring crops in the Odessa oblast



Thee stations are available in the region:

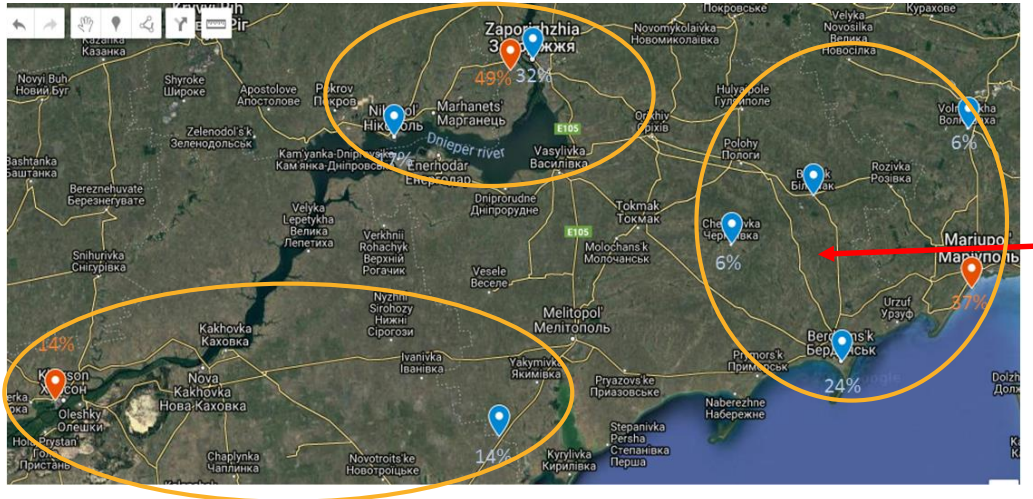
Name	Lat	Long	Alt	Weight
Liubashivk	47.8500	30.2667	181 m	68%
Odesa	46.433	30.767	42	32%

Monitoring during risk period and Year Comparison



Weather based insurance – Drought during sowing time

Drought cover for winter and spring crops in the Zaporizhia oblast



Thee stations are available in the region:

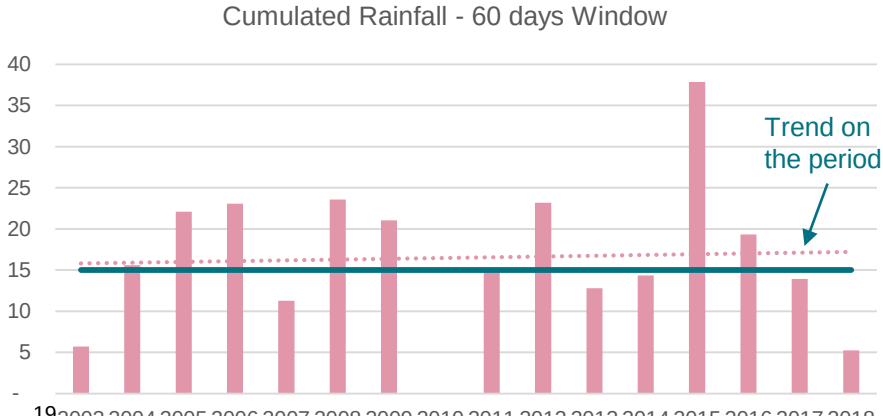
Name	Lat	Long	Alt	Weight
Kherson	46.633	32.567	47	14%
Mariupol	47.033	37.500	68	37%
Zaporizhzhia	47.800	35.017	107	49%

Weather Index

Drought cover- Short Drought (Ideal for sowing time)

- **Identified Risk**
  - Crop water need during the initial stage is estimated at 50 percent of the crop water need during the mid - season stage
  - During the crop development stage the crop water need gradually increases from 50% of the maximum crop water need to the maximum crop water need.

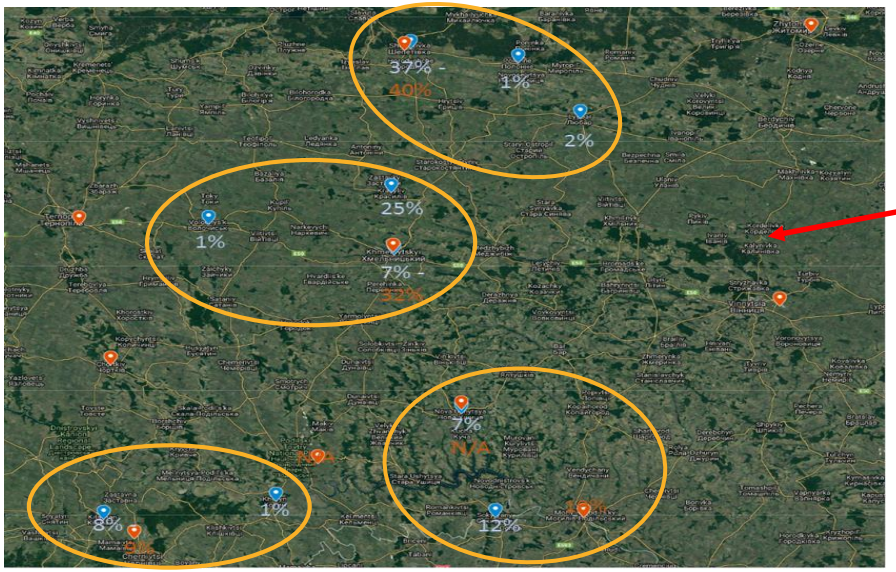
- **Insurance rational**
  - During the risk period, we sum rainfall measured at the station.
  - If total cumulated rainfall are below the trigger, the insurance starts paying.



Insurance cover	
Insured Risk	Short Period Drought – Sowing time
Index Type	60 days period cumulated rainfall (Daily rainfall below 5mm - above 20mm are not counted)
Reference Weather Station	Combined Weather Station
Insured location	Zaporizhia oblast, Ukraine
Risk period	April 15th to June 30th, 2018
Trigger	Cumulated rainfall on 60 days < 15mm
Exit	Cumulated rainfall on 60 days =0mm
Tick	Linear with EUR 1,000,000 per mm
Limit	EUR 15,000,000

Weather based insurance – Drought during sowing time

Drought cover for winter and spring crops in the Shepetivka and KhmelnytsKy oblast



Thee stations are available in the region:

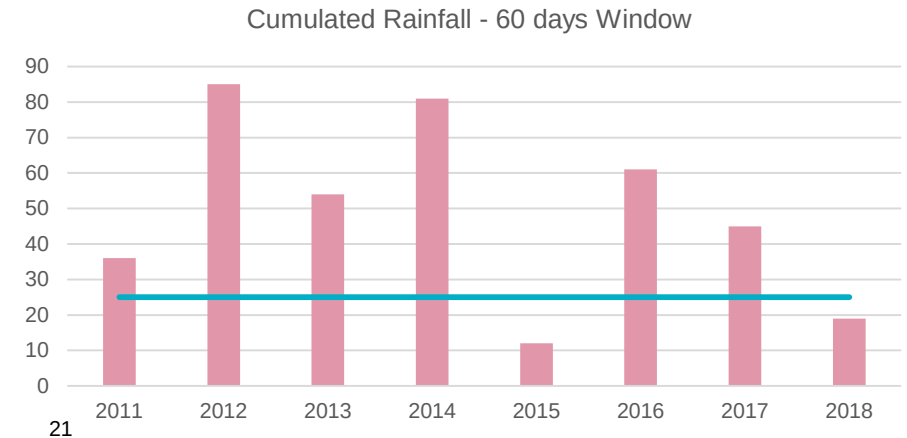
Name	Lat	Long	Alt	Weight
Chernovsty	48.367	25.900	242	9%
Khmelnytsky	49.433	26.983	350	32,44%
Mohyliv-Podilsky	48.450	27.783	77	18,61%
Shepetivka	50.167	27.033	277	39,69%

Weather Index

Drought cover- Short Drought

- **Identified Risk**
  - Crop water need during the initial stage is estimated at 50 percent of the crop water need during the mid - season stage
  - During the crop development stage the crop water need gradually increases from 50% of the maximum crop water need to the maximum crop water need.

- **Insurance rational**
  - During the risk period, we sum rainfall measured at the station.
  - If total cumulated rainfall are below the trigger, the insurance starts paying.



Insurance cover	
Insured Risk	Short Period Drought
Index Type	60 days period cumulated rainfall (Daily rainfall below 5mm - above 20mm are not counted)
Reference Weather Station	Combined Weather Station
Insured location	Shepetivka and KhmelnytsKy oblast, Ukraine
Risk period	April 15th to August 31st, 2018
Trigger	Cumulated rainfall on 60 days < 25mm
Exit	Cumulated rainfall on 60 days =0mm
Tick	Linear with EUR 40,000 per mm
Limit	EUR 1,200,000

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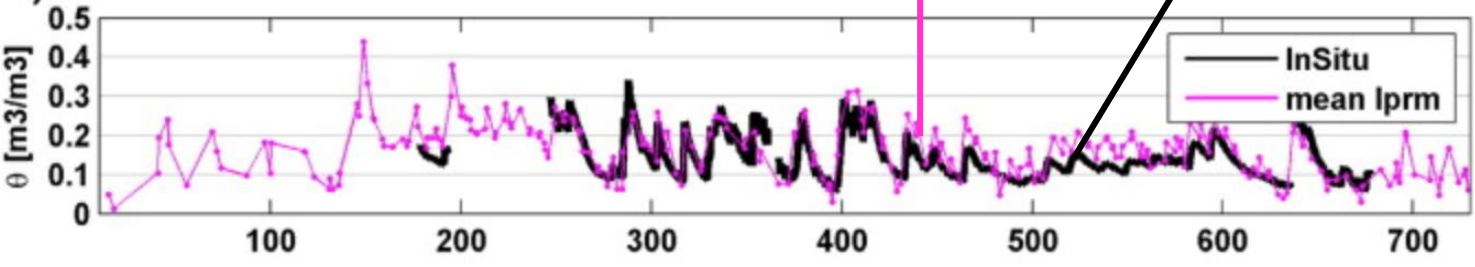
Soil Moisture!

Remote Sensing

Soil Moisture

- Detailed information on vulnerable water resources
- Predictor for vegetation growth, floods and droughts
- Improvement of weather forecast
- Technical Specification:
  - Most reliable system for soil moisture monitoring (ESA/NASA)
  - Systems sensitive to moisture content of first 10 cm of the soil
  - (Sub) daily observations, all weather proof (no problems with clouds)
  - Global coverage, 40 years of data
  - Scientific soil moisture retrieval algorithm



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