Earth observation and space big data for a sustainable agriculture

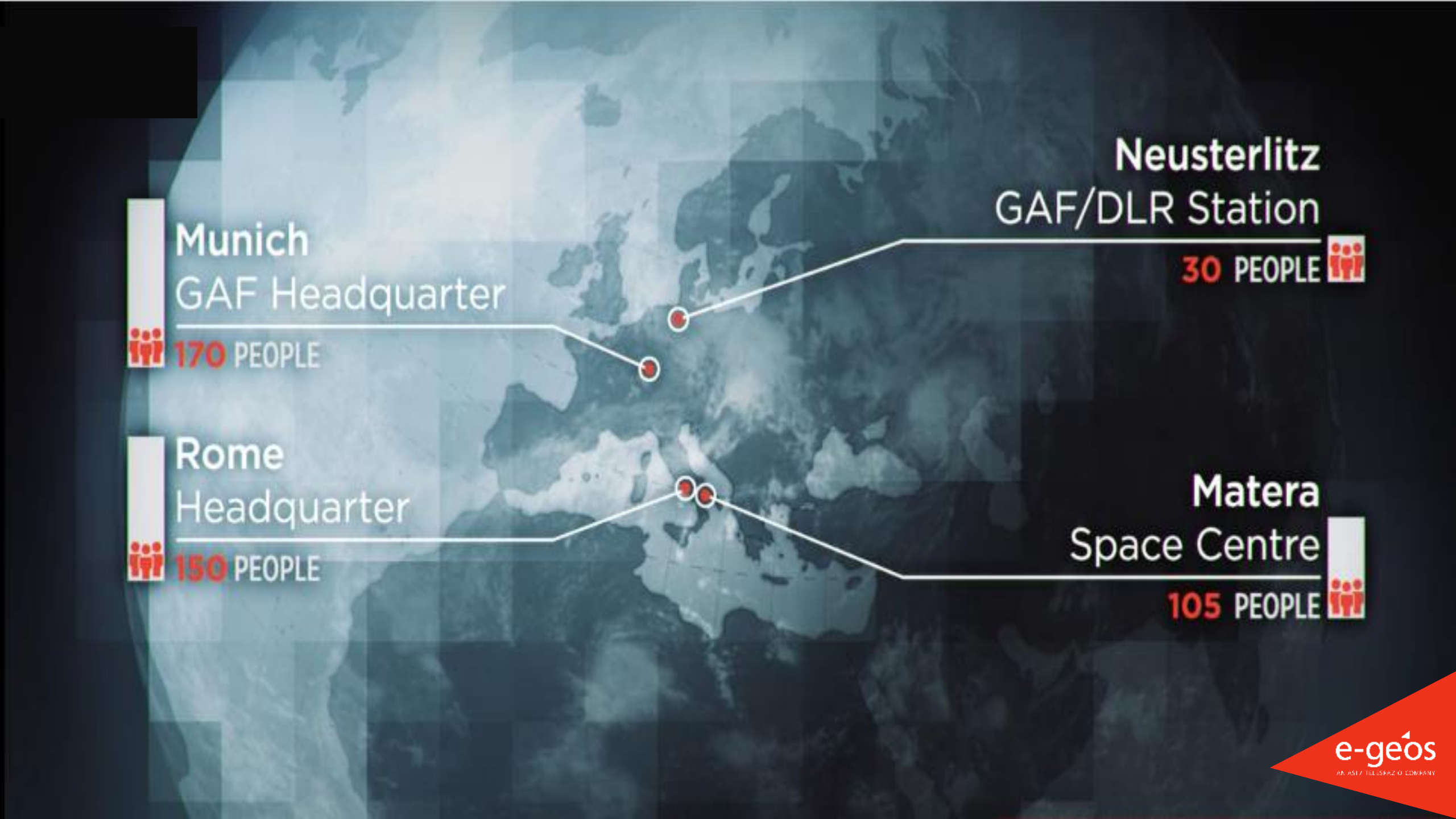
Massimo Claudio Comparini
Fabio Volpe
(e-Geos)

Segure World Foundation
SDA Bocconi School of Management | SEE Lab Space Economy Evolution
Space Policy Institute THE GEORGE WASHINGTON UNIVERSITY
EXPLORING THE HIDDEN ECONOMIC VALUE OF SPACE APPLICATIONS
September 5, 2019
e-geos

e-geos

We tailor Geoinformation Services & AI Earth Observation solutions for operational needs over land and sea, **based on multi sensors & geo–spatial data** combined with IoT **Big Data.**
We are **COSMO-SkyMed** constellation **exclusive commercial worldwide distributor**

WE SCAN THE EARTH **WE MONITOR THE CHANGES** **WE GIVE MAPS & REPORTS**


Munich
GAF Headquarter
170 PEOPLE
Rome
Headquarter
150 PEOPLE
Neusterlitz
GAF/DLR Station
30 PEOPLE
Matera
Space Centre
105 PEOPLE
e-geos

RLab

Satelliti e intelligenza artificiale

Come si ascolta dal cielo il respiro della Terra, per curarla

JAIME D'ALESSANDRO, *all'interno*

Intelligenza artificiale

Il grande occhio

Un progetto ambizioso: capire l'evoluzione del mondo grazie alle immagini trasmesse dai satelliti e analizzate dalle Ai. E stabilire come, dove e quando intervenire

di JAIME D'ALESSANDRO

L'approfondimento

Così si guarda il respiro della Terra

Investors Can Get an Eye in the Sky

By Bradley Hope

The latest technological innovation for data-hungry hedge funds is a fleet of five dozen shoe-box-size satellites.

A company called **Planet Labs** Inc. has launched a small constellation of what it calls "cubesats" that can deliver much more frequent imagery of economically sensitive spots than traditional satellites. Those spots include retailers' parking lots, oil-storage tanks or farmland.

The company, founded by three former NASA scientists, has now signed an agreement to supply data to ***Orbital Insight*** *Inc., which mines satellite imagery for trading tips for hedge funds.*

Until now, Orbital has relied on monthly or bimonthly imagery for its analysis. The deal with Planet Labs will give them access to weekly images at first.

Next year, if Planet Labs succeeds in a plan to launch an additional 40 or so cubesats, Orbital will have access to daily images of every piece of land on earth.

"Almost all economic activity is change," said Jimi Crawford, a former **Google** executive who founded Orbital.

TECNOLOGIA

I Big data arrivano dall'alto dei cieli

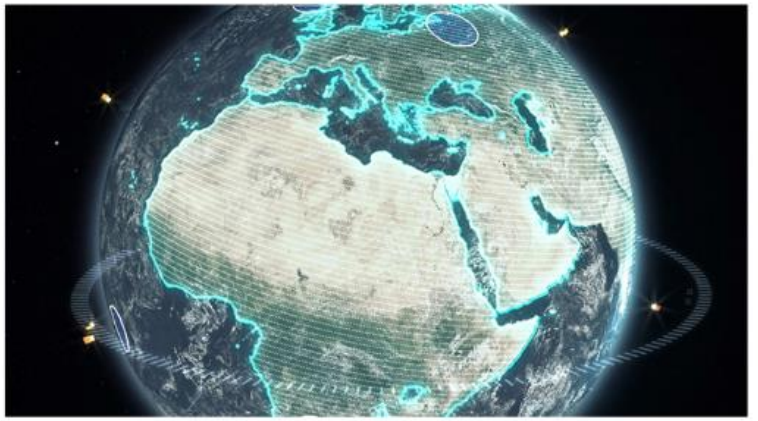
L'accordo di Leonardo con Spaceflights rafforza la presenza italiana nel settore dei minisatelliti, sempre più strategici e rilevanti per la raccolta di dati dallo spazio. Risoluzione, flessibilità e frequenza delle immagini sono i punti di forza della raccolta di informazioni visive che diventano un indubbio valore nella space economy emergente

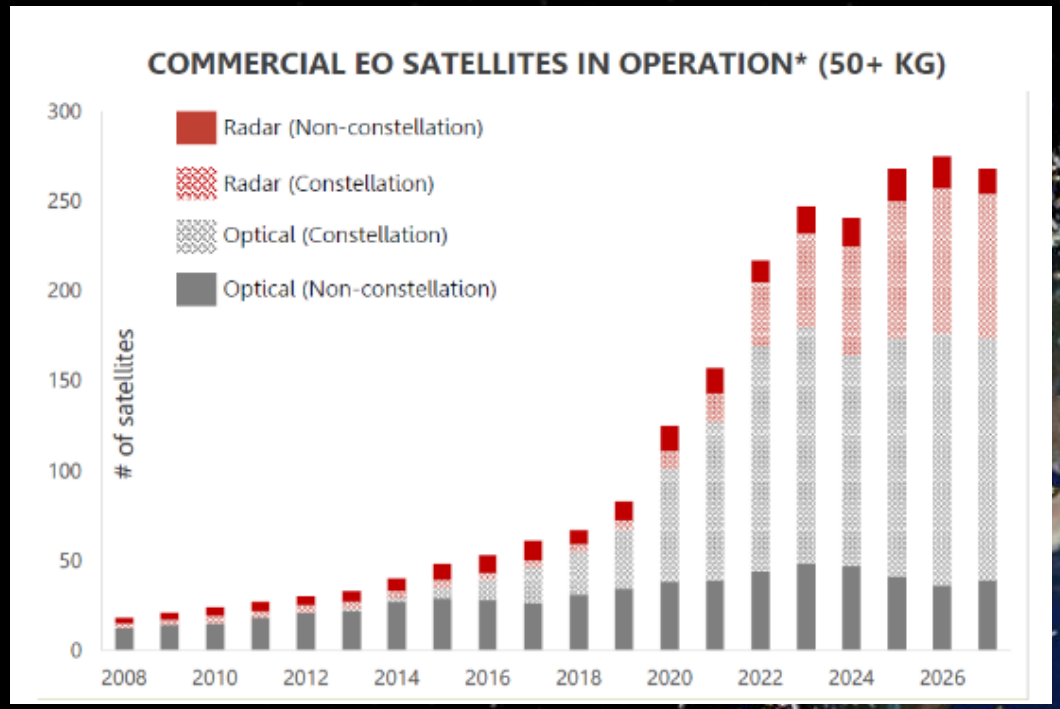
18/03/2018

Earth-i leads consortium to develop on-board processing for video imagery from space

By **News Desk** - July 18, 2018

SHARE Facebook Twitter





despite delay in some announced programs the number of EO satellites in orbit and the corresponding amount of generated data starts to grow fast ….

680

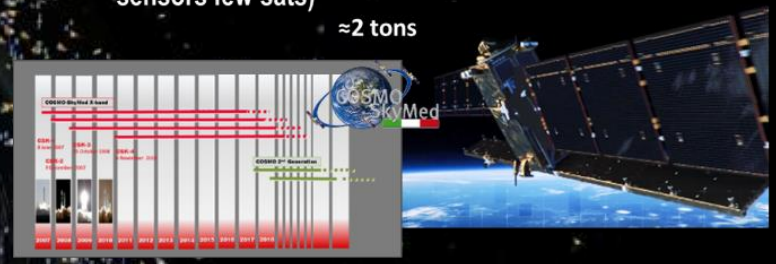
EO Satellite in orbit (2017)*

>1,740

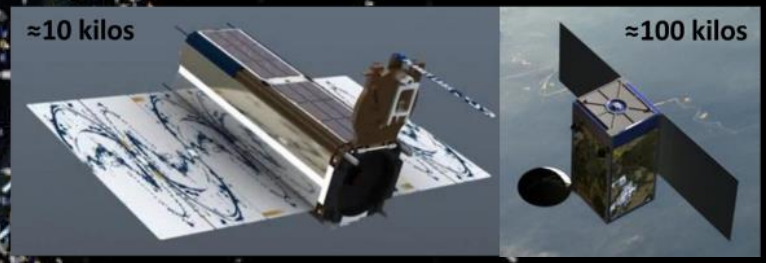
Satellite expected (2017 – 2024)

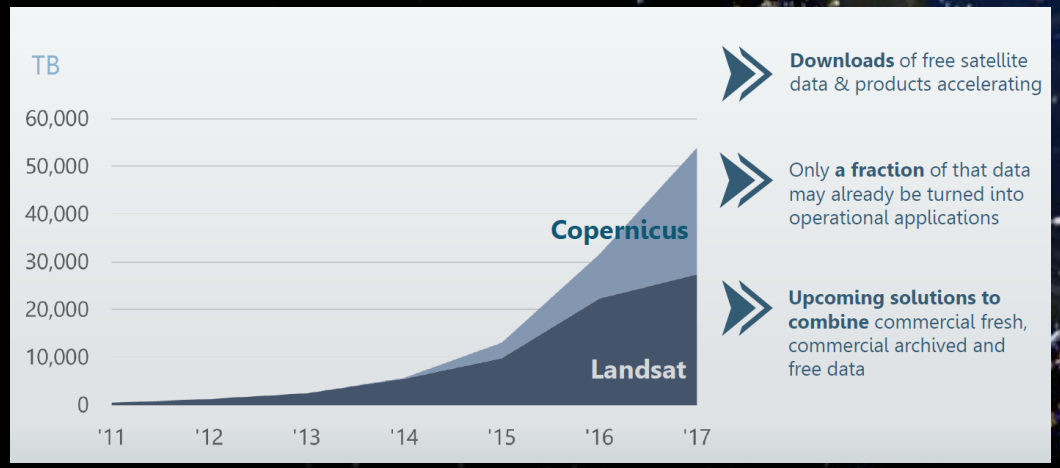
evolution of large infrastructure (high end sensors few sats)

≈2 tons



emerging constellations (low end sensors/many sats)





Downloads of free satellite data & products accelerating

Only **a fraction** of that data may already be turned into operational applications

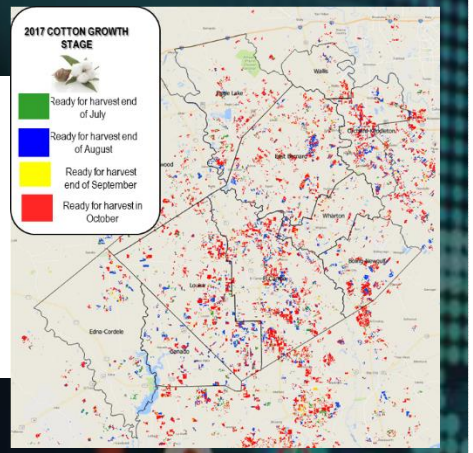
Upcoming solutions to combine commercial fresh, commercial archived and free data

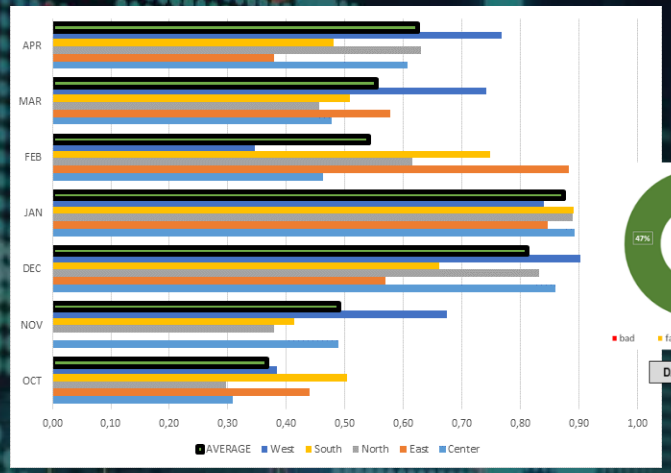
use of EO data is exponentially growing and large potential through analytics exists to feed new information driven services

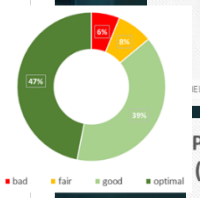
e-geos

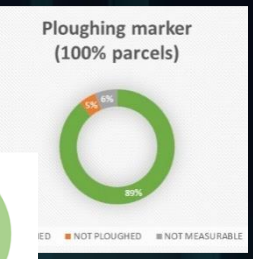
Geo Spatial paradigms and Business Models are fast changing

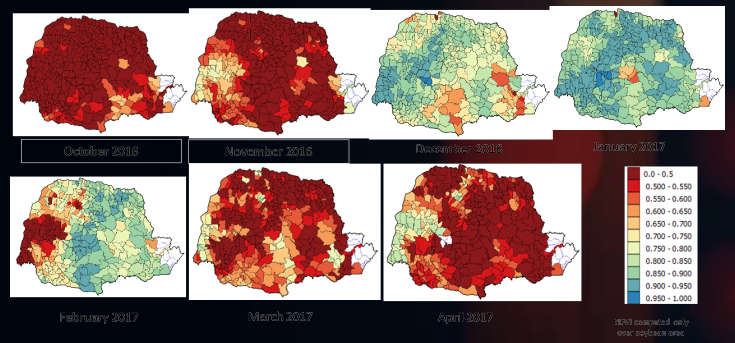
- Data, more and more, are just a part of the game
  - High temporal resolution to complement high and very high spatial resolution sensors
  - Federation of space assets through smart multi missions tasking platforms
- EO data definitive entered in the wider Big Data Analytics & IoT game
- Convergence in the data analytics and AI business for the EO
- Advanced algorithms, ML/DL/AI techniques are essential to address the Information driven market push for timely delivery of reports/insights

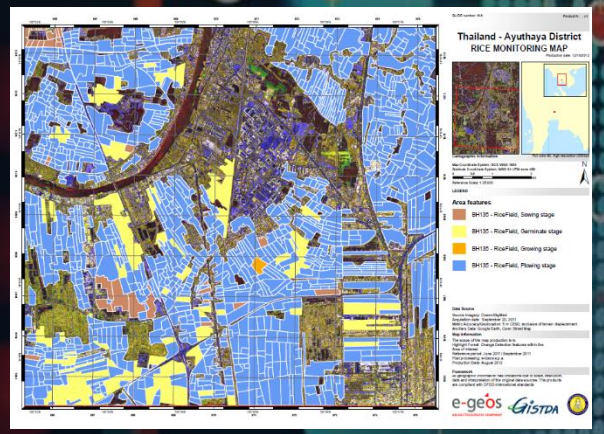




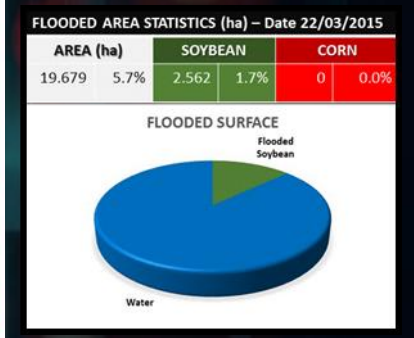








COUNTY	STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	ha	%	ha	%	ha	%	ha	%
Louise	593.10	11.65 %	1701.36	26.60%	197.82	3.09%	3904.28	61.04%
Ganado	121.28	8.50%	621.16	43.55%	41.50	2.91%	642.40	45.04%
Edna-Cordele	235.07	3.63%	439.04	6.79%	128.02	1.98%	5665.88	87.60%
Garwood	269.48	18.38 %	154.13	10.51%	65.80	4.49%	976.85	66.62%
Eagle Lake	320.15	15.30 %	251.59	12.02%	38.84	1.86%	1482.31	70.83%
East Bernard	308.68	6.32%	1268.32	25.95%	232.62	4.76%	3078.01	62.98%
Wallis	30.68	5.76%	111.41	20.92%	24.57	4.62%	365.76	68.70%
Orchard-Kendleton	176.85	4.99%	1034.47	29.17%	108.67	3.06%	2226.33	62.78%
Wharton	53.89	1.38%	3023.60	77.27%	61.59	1.57%	773.70	19.77%
Boling-Newgulf	138.91	5.76%	771.12	31.98%	50.07	2.08%	1450.90	60.18%
El Campo	706.78	8.57%	1968.89	23.87%	219.11	2.66%	5353.03	64.90%
TOTAL	2954.86	7.1%	11345.07	27.4%	1168.61	2.8%	25919.45	62.6%



- **No more images but information**, tailored according to end user needs and delivered in different formats

e-geos
AN ASI / TELESPAZIO COMPANY

PRECISION FARMING

What

McKinsey & Company

a technology-enabled approach to farming management that **observes, measures, and analyzes** the needs of individual fields and crops

With

a whole-farm management approach using **information technology, satellite positioning (GNSS) data, remote sensing and proximal data gathering** These technologies have the goal of optimising returns on inputs whilst potentially reducing environmental impacts

EUROPEAN PARLIAMENT

How

managing crop production inputs (seed, fertilizer, lime, pesticides, etc.) on a site-specific basis to **increase profits, reduce waste and maintain environmental quality**.

PRECISIONAg

Why

WIKIPEDIA
The Free Encyclopedia

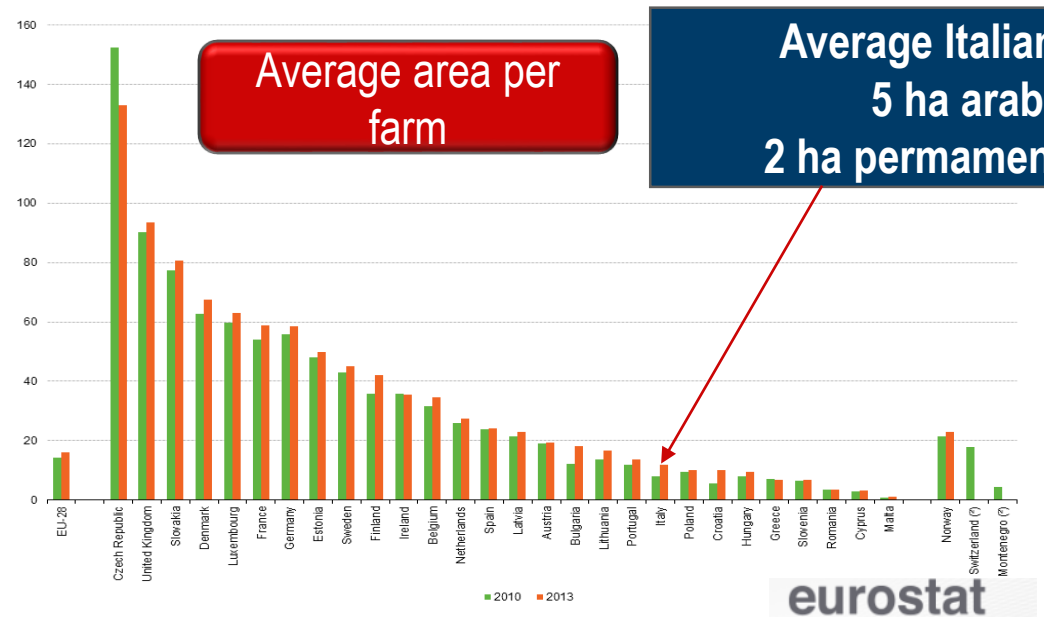
a farming management concept based on observing, measuring and **responding to inter and intra-field variability in crops**. The goal of precision agriculture research is to define a decision support system (DSS) for whole farm management with the goal of **optimizing returns on inputs while preserving resources**

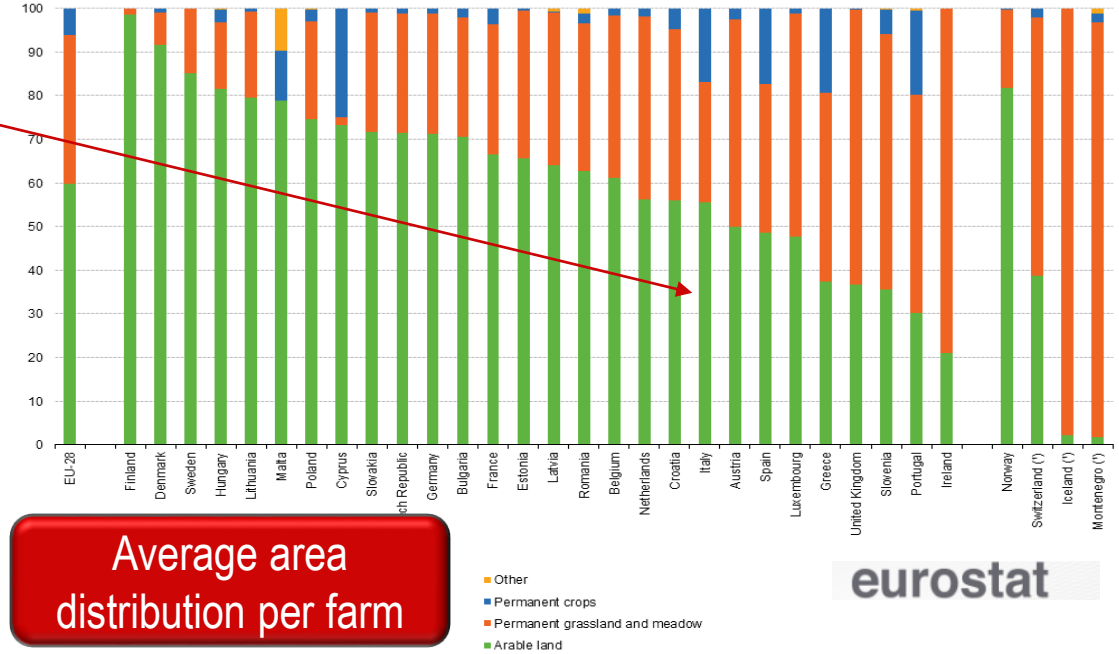
e-geos

ADOPTION OF EARTH OBSERVATION DATA FOR PRECISION FARMING

e-geos

ADOPTION OF EARTH OBSERVATION DATA FOR PRECISION FARMING



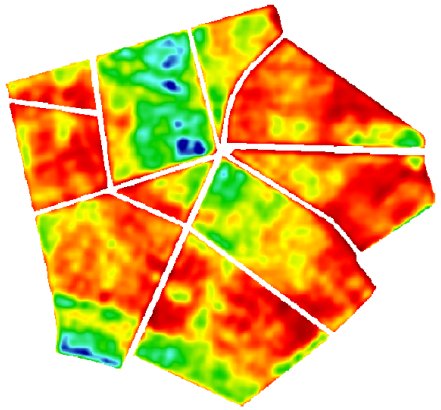


e-geos
AN ASI / TELESPAZIO COMPANY

ADOPTION OF EARTH OBSERVATION DATA FOR PRECISION FARMING

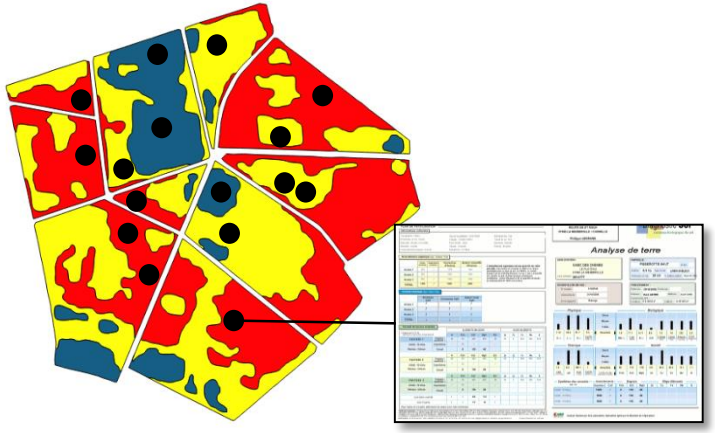
From satellite to fertilization in 4 steps

TELESPAZIO
a LEONARDO and THALES company

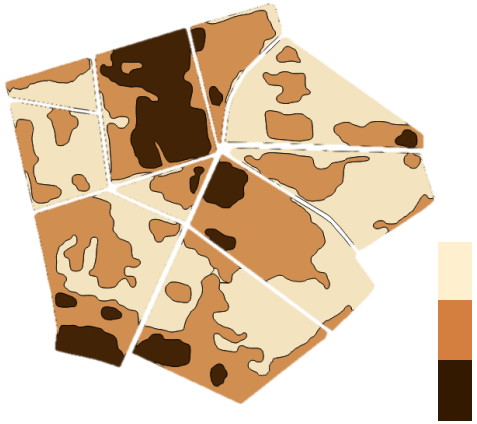


Vegetative expression mapping

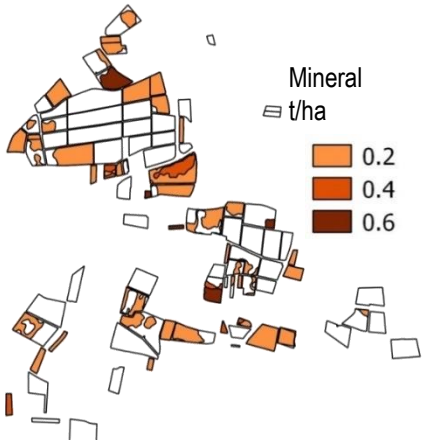
1.

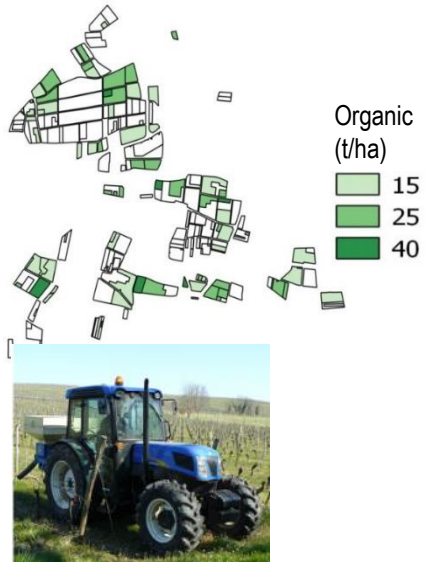


2. Optimised positioning of field surveys



3. Modulation map





4 Geolocated and modulated fertilization

e-geos

PRECISION FARMING COSTS

BENEFITS

- Cost savings
- Better yield

THE CHALLENGE OF EO DATA

- To enable low cost services based only EO data
- Low set-up and management costs
- Services that can be integrad with other data sources
- Supporting small/medium sized farmers

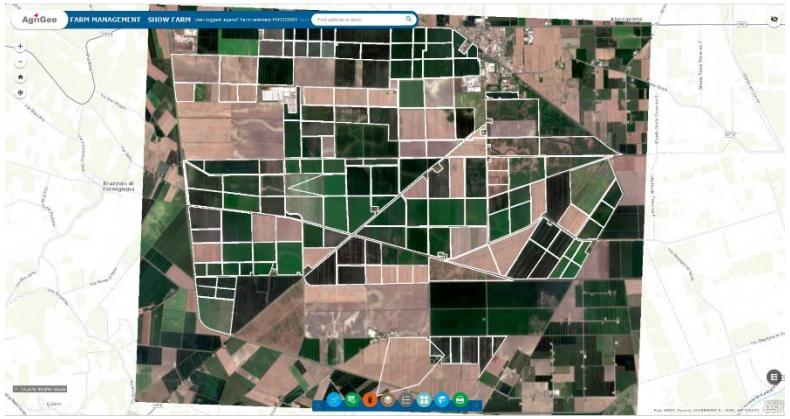
SET UP COSTS

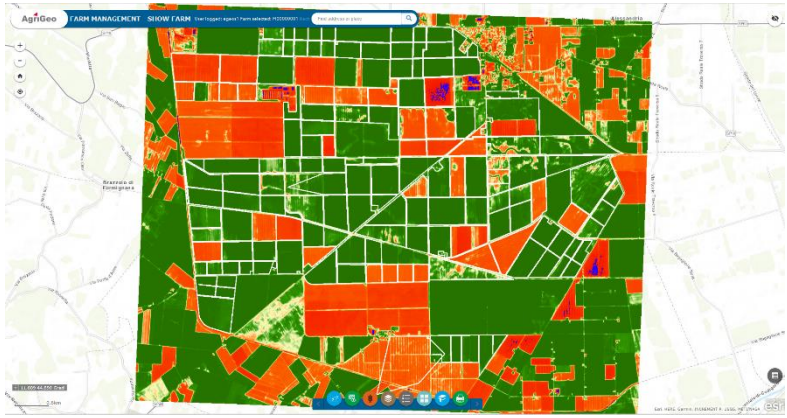
- Assisted guidance (2-4k€)
- Semi-automatic guidance (18-40k€)
- Semi-automatic guidance + VRT (28-50k€)

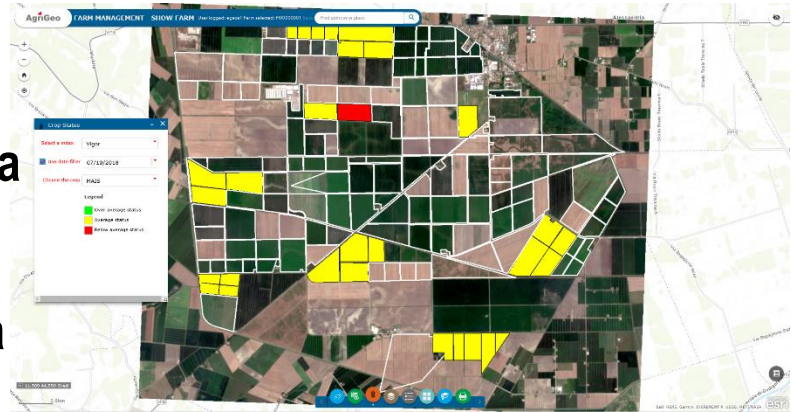
Source: Il nuovo Agricoltore

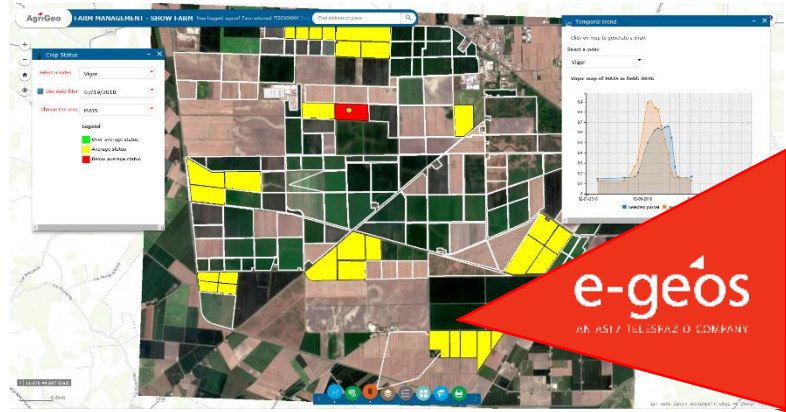
MINIMUM FARM SIZE FOR CORN

- Assisted guidance 15 ha
- Semi-automatic guidance 30-60 ha
- Semi-automatic guidance + VRT 40-80 ha

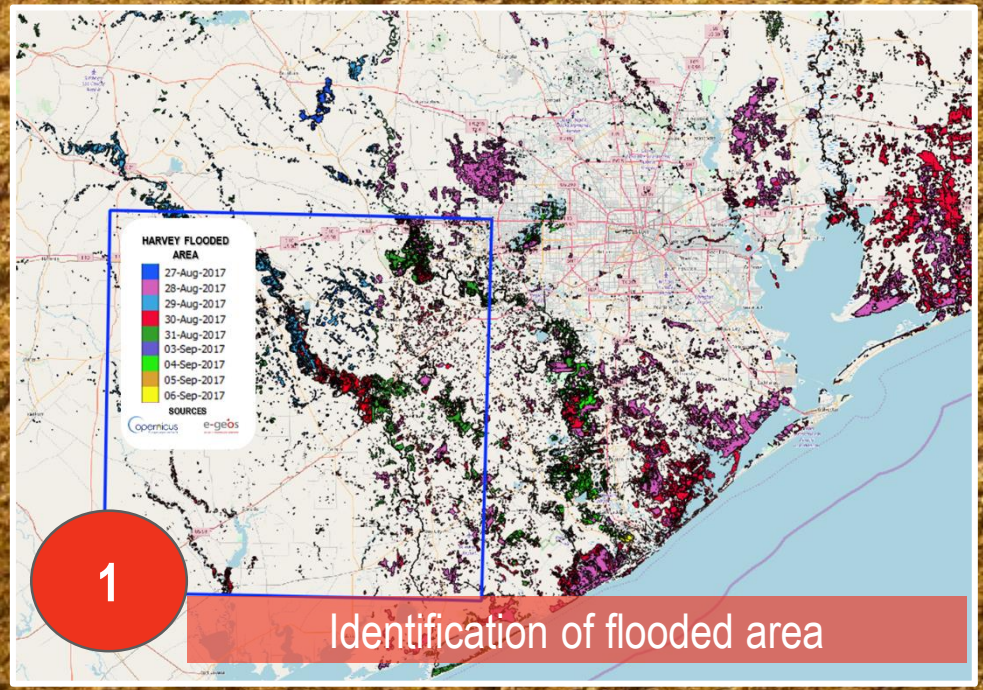






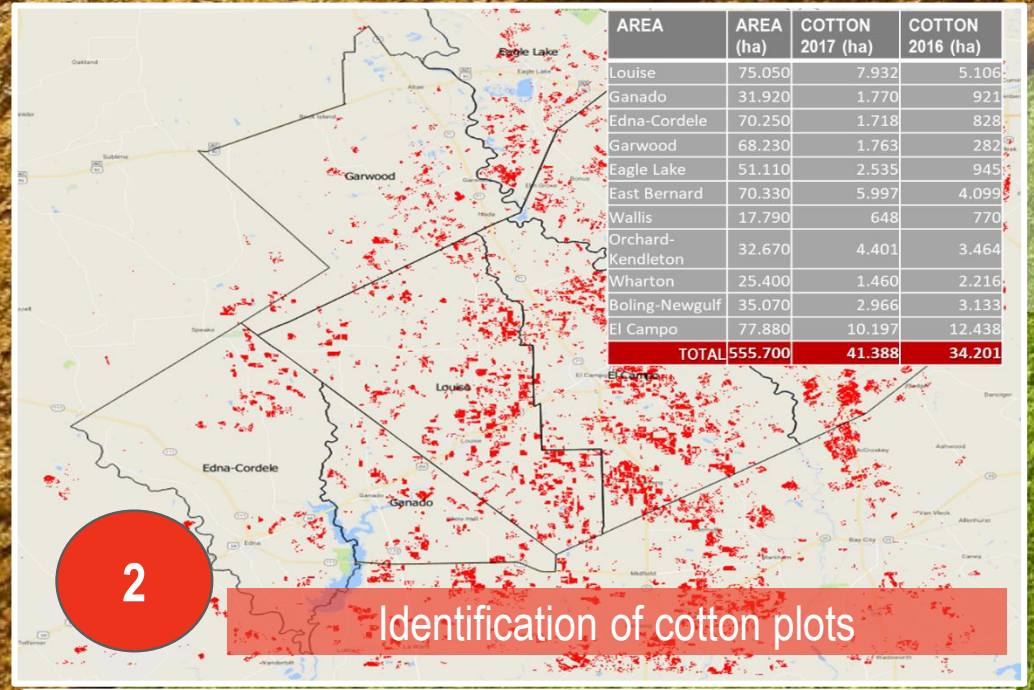


EO DATA FOR AGRICULTURE INSURANCE



1

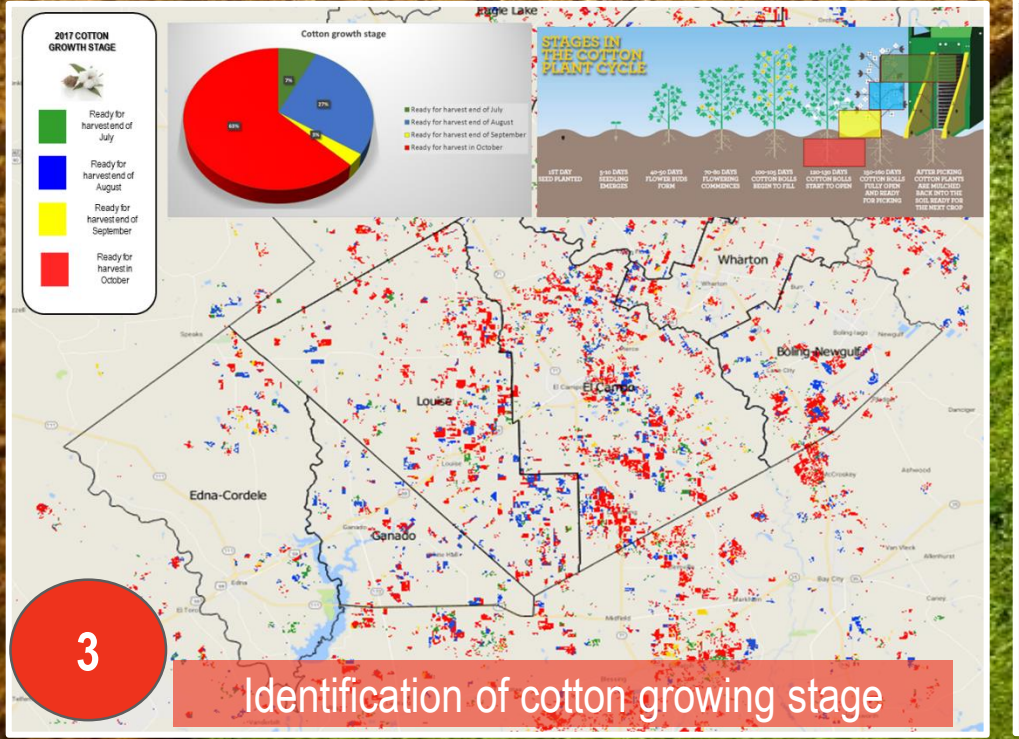
Identification of flooded area



AREA	AREA (ha)	COTTON 2017 (ha)	COTTON 2016 (ha)
Louise	75.050	7.932	5.106
Ganado	31.920	1.770	921
Edna-Cordele	70.250	1.718	828
Garwood	68.230	1.763	282
Eagle Lake	51.110	2.535	945
East Bernard	70.330	5.997	4.099
Wallis	17.790	648	770
Orchard-Kendleton	32.670	4.401	3.464
Wharton	25.400	1.460	2.216
Boling-Newgulf	35.070	2.966	3.133
El Campo	77.880	10.197	12.438
TOTAL	555.700	41.388	34.201

2

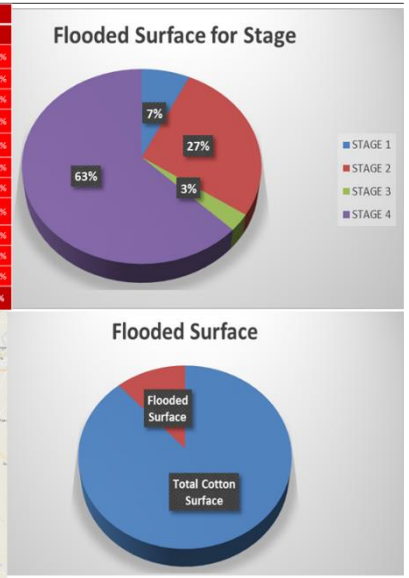
Identification of cotton plots

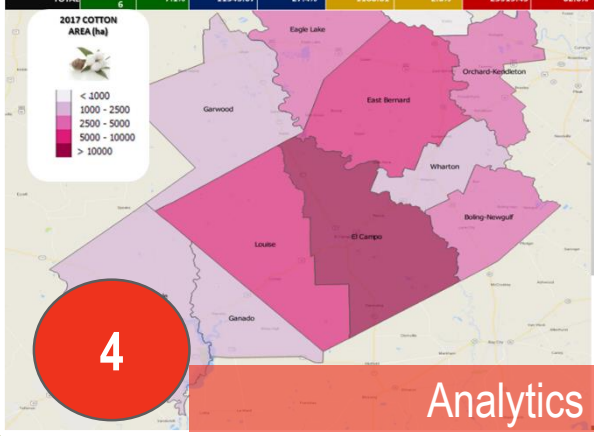


3

Identification of cotton growing stage

COUNTY	STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	ha	%	ha	%	ha	%	ha	%
Louise	593.10	11.65 %	1701.36	26.60%	197.82	3.09%	3904.28	61.04%
Ganado	121.28	8.50%	621.16	43.55%	41.50	2.91%	642.40	45.04%
Edna-Cordele	235.07	3.63%	439.04	6.79%	128.02	1.98%	5665.88	87.60%
Garwood	269.48	18.38 %	154.13	10.51%	65.80	4.49%	976.85	66.62%
Eagle Lake	320.15	15.30 %	251.59	12.02%	38.84	1.86%	1482.31	70.83%
East Bernard	308.68	6.32%	1268.32	25.95%	232.62	4.76%	3078.01	62.98%
Wallis	30.68	5.76%	111.41	20.92%	24.57	4.62%	365.76	68.70%
Orchard-Kendleton	176.85	4.99%	1034.47	29.17%	108.67	3.06%	2226.33	62.78%
Wharton	53.89	1.38%	3023.60	77.27%	61.59	1.57%	773.70	19.77%
Boling-Newgulf	138.91	5.76%	771.12	31.98%	50.07	2.08%	1450.90	60.18%
El Campo	706.78	8.57%	1968.89	23.87%	219.11	2.66%	5353.03	64.90%
TOTAL	2954.86	7.1%	11345.07	27.4%	1168.61	2.8%	25919.45	62.6%





4

Analytics delivery

Damage assessment based only on EO data

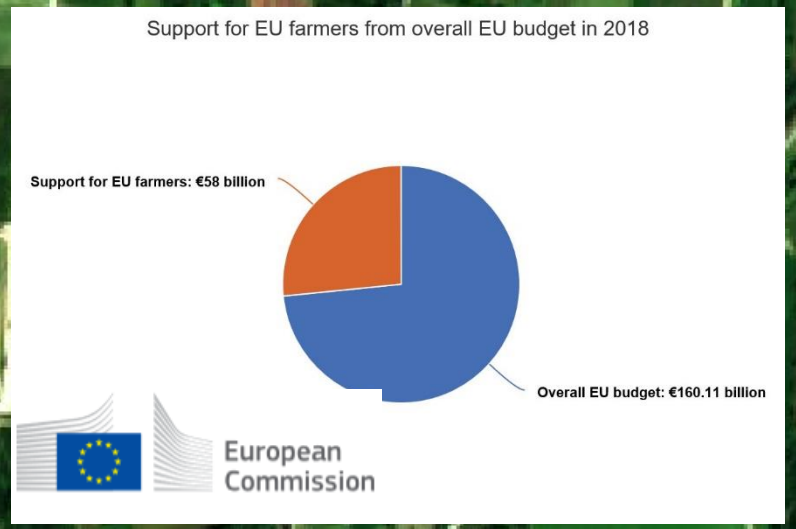
- Relevant reduction of surveys cost
- Introduction of parametric insurance contracts based on EO-provided information

e-geos
AN ASI / TELESPAZIO COMPANY

EO DATA FOR SUPPORTING AGRICULTURE POLICIES

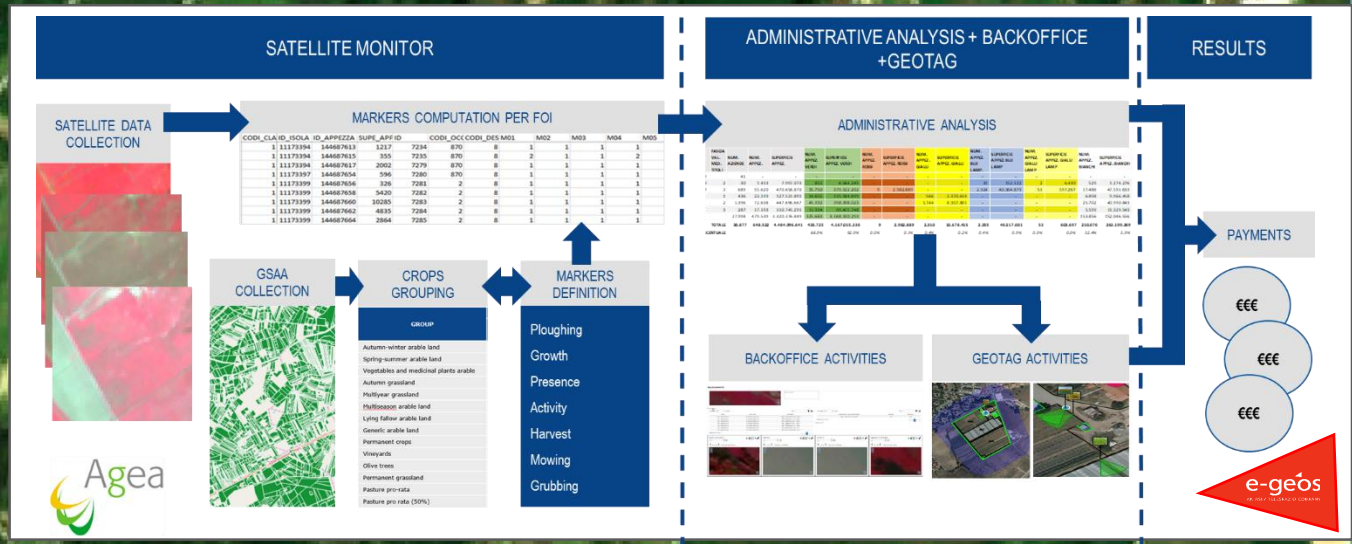
BENEFITS

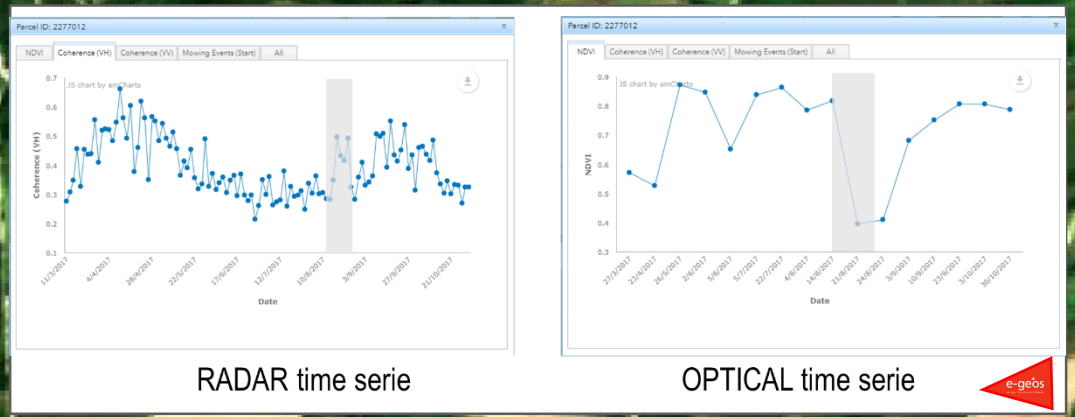
- support farmers and improve agricultural productivity, ensuring a stable supply of affordable food
- help tackle climate change and the sustainable management of natural resources
- maintain rural areas and landscapes across the EU



SATELLITE BASED SERVICES

- Farmers activity markers
- Crop confirmation





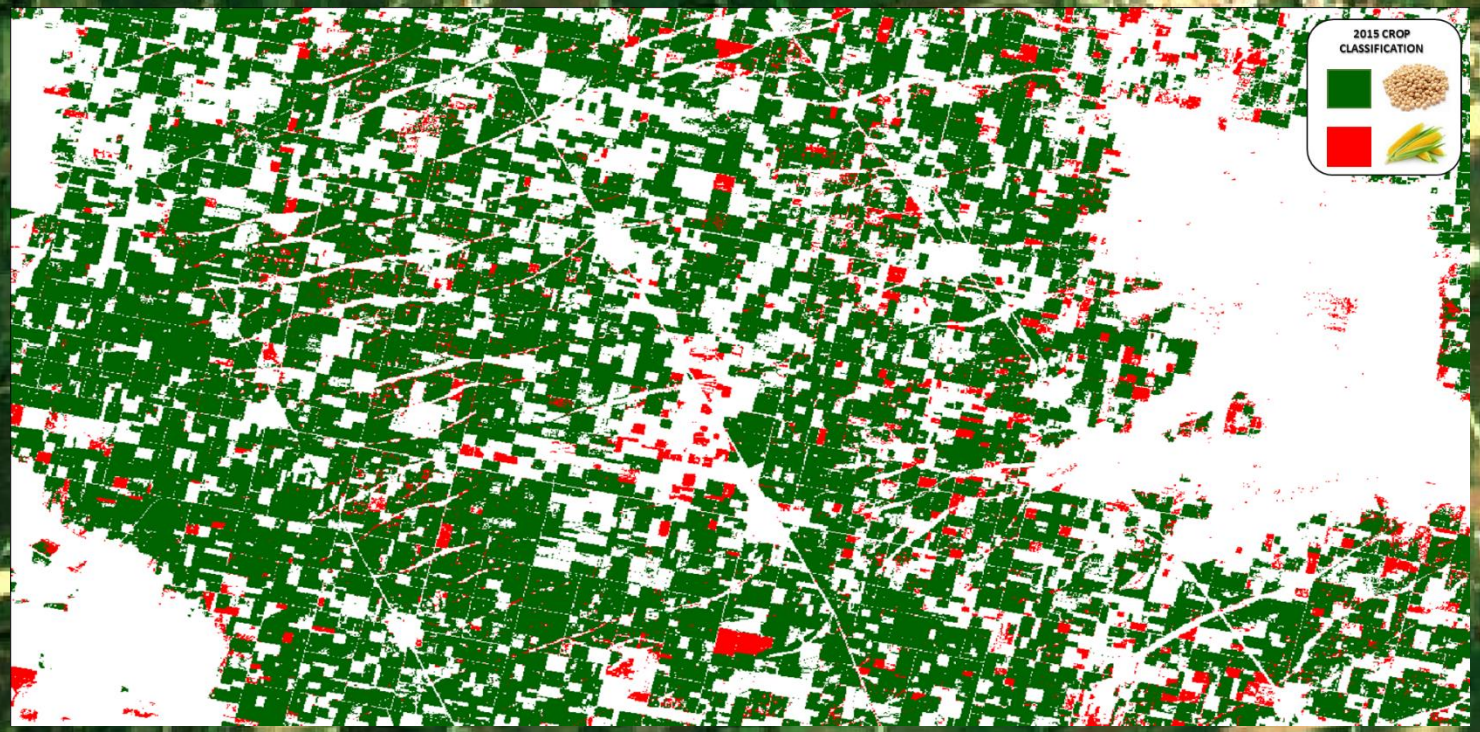
EO DATA FOR COMMODITIES TRADERS

BENEFITS

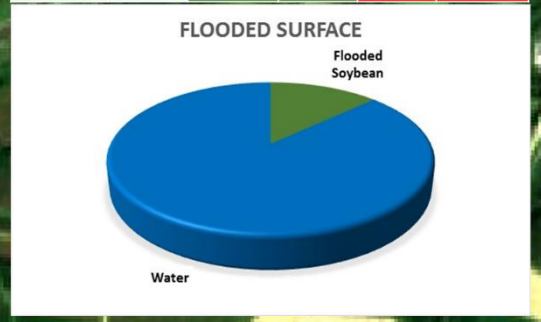
- Identifies acreage of valuable crops
- Identify crop conditions and availability that can have impact on market price
- Better planning crop transportation

SATELLITE BASED SERVICES

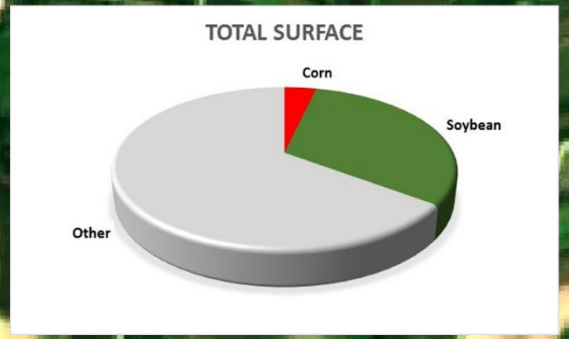
- Crop analytics
- Crop monitoring analytics



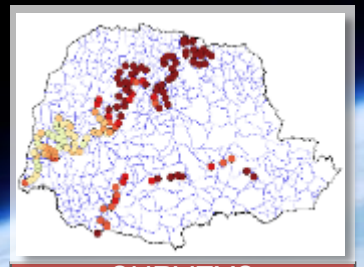
FLOODED AREA STATISTICS (ha) – Date 22/03/2015					
AREA (ha)		SOYBEAN		CORN	
19.679	5.7%	2.562	1.7%	0	0.0%



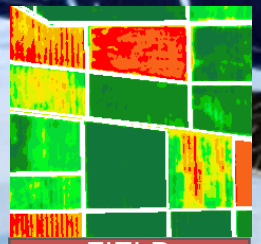
TOTAL AREA STATISTICS (ha)				
AREA	SOYBEAN		CORN	
343.258	108.458	31.6%	12.598	3.6%



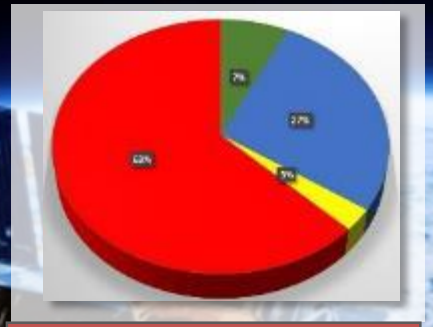
e-geos



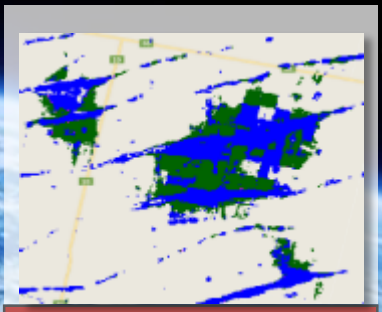
SURVEYS PLANNING



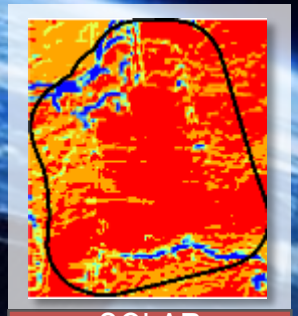
FIELD ANOMALIES



CROP ANALYTICS

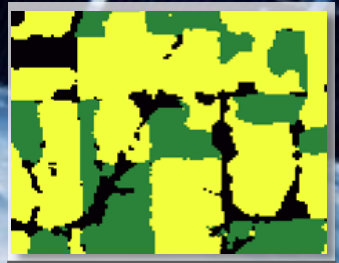


DAMAGE MAPPING



SOLAR IRRADIANCE

PRESCRIPTION MAPS



CROP MAPS

EU-CAP SERVICES

TAGGING

AgriGeo

IMAGING SERVICE

HISTORICAL ANALYSIS

CROP FIELDS COMPARISON

CROP MONITORING

CROP STATUS MAPPING

e-geos platform collecting all services dedicated to agriculture

WE SCAN THE EARTH

WE MONITOR THE CHANGES

WE GIVE MAPS & REPORTS