The Earth Observation Geo Spatial evolution : next technology challenges over the value chain and new business models

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e-GEOS

The ESA Earth Observation Φ-week
EO Open Science and FutureEO
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Space Technologies and Services – a new era

- The fast transformation of the space industry is largely driven by new service and applications made possible through innovations in launch and satellite manufacturing technology and in the incredible growth in the big data analytics processing and computational capabilities
- The state of technology within the satellite industry is evolving rapidly. On one hand, improvements in launch systems, sensors and other input technologies, and innovations such as the smallsat architecture are driving down costs.
- On the other hand, more sensors and a greater diversity of sensor types mean greater spatial resolution, higher temporal cadence, and richer spectral coverage. Fundamental ingredients for the EO and geo information domains to provide Information Products to traditional and emerging user communities

The Space Sector – from exploration to SDGs

- The Space sector has contributed to open new technological frontiers due to the extreme and demanding nature of operating in deep space environment as well as today to address new missions and innovative requirements and new markets for a new space economy on our planet Earth

The new Space Economy

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.

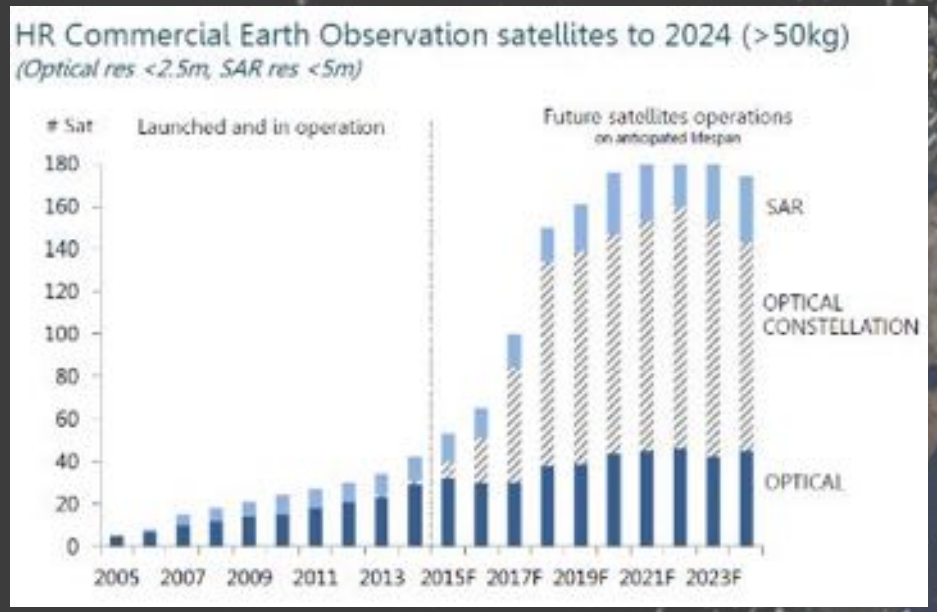
The company, founded by three former NASA scientists, has now signed an agreement to supply data to **Orbital Insight** Inc., which mines satellite imagery for trading tips for hedge funds.

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 Jim Crawford, a former **Google** executive who founded Orbital

Space Economy – Geo Information evolution



many satellites in orbit today and the number is growing fast

+66%

680

EO Satellite in orbit (2017)*

>1,740

Satellite expected (2017 – 2024)

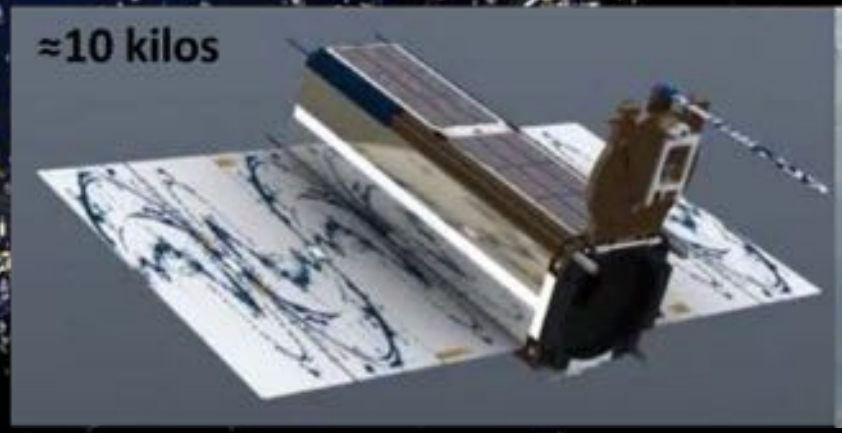
Frost & Sullivan's 2018 first quarter update of the 'Small Satellite Launch Services Market' estimates that over 11,000 small satellites will be launched by 2030. The central value proposition offered by these commercial players to end-users is real-time imagery and seamless global connectivity.

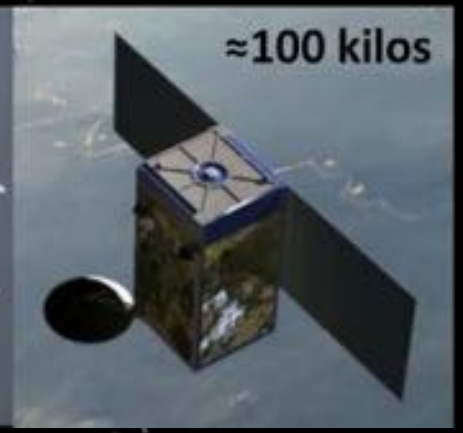
Space Economy – Geo Information evolution

evolution of large infrastructure (high end sensors few sats)

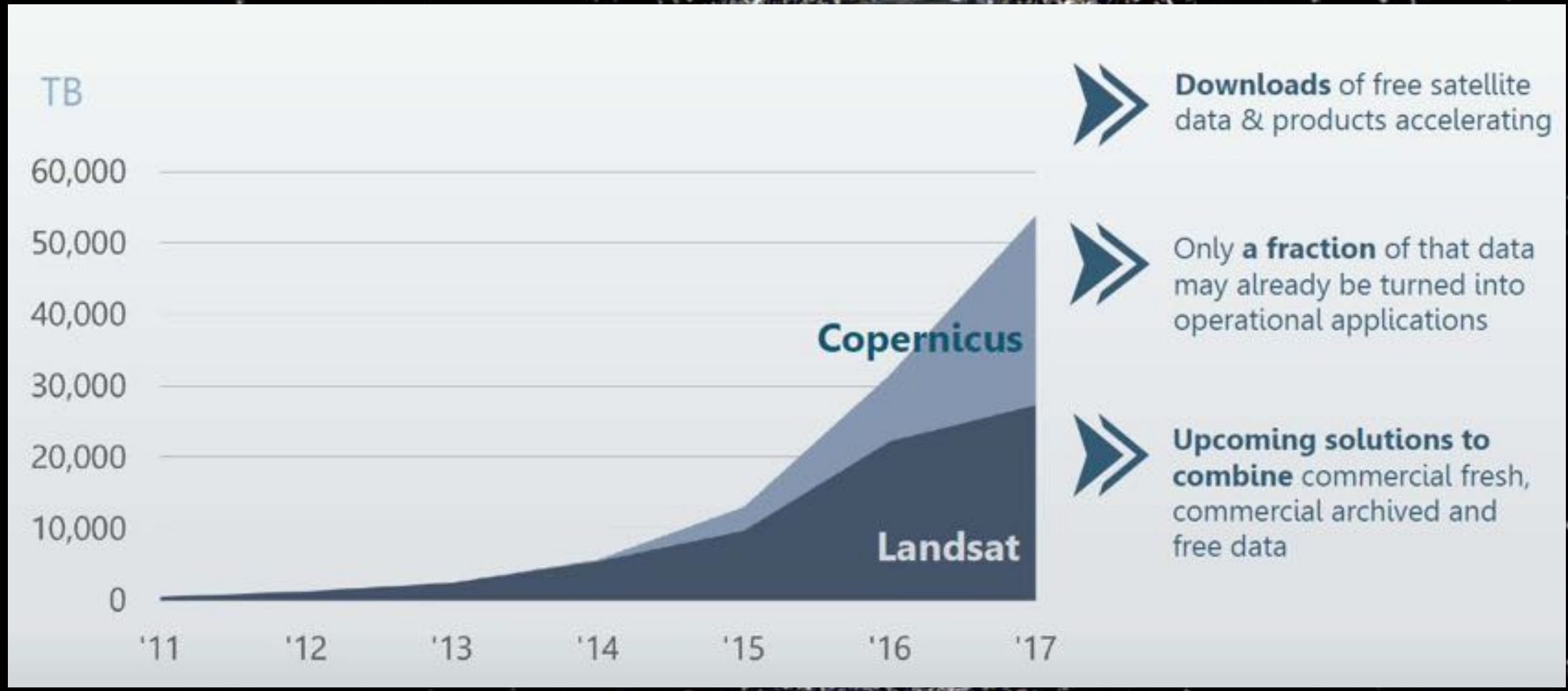
≈2 tons

emerging constellations (low end sensors/many sats)



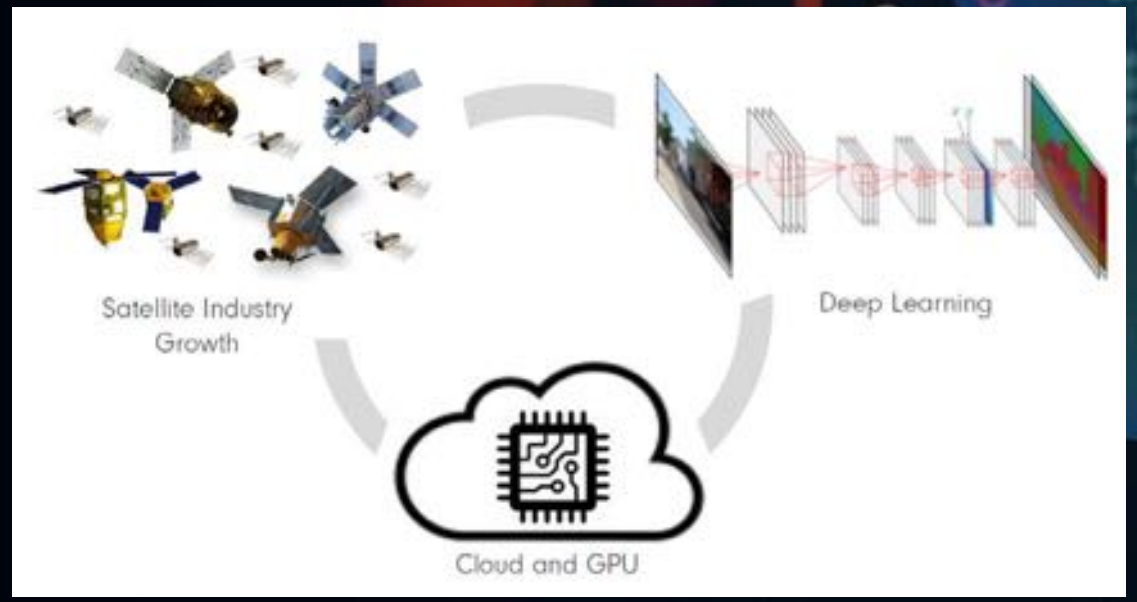


Space Economy – EO space data explosion



The new space race – global geospatial

- The possibility to complement Earth Observation space systems based on large space infrastructure and very high end performance sensors allows as well in Earth Observation to conceive very high revisit observation capabilities, in perspective to realize a quasi-persistent surveillance and in general to feed with an exponential growing amount of data a new class and generation of service and application platforms



7 The convergence of IoT, cloud, and big data create new opportunities for self-service analytics

Space and Democratization

From data → Generating information → To customized platforms

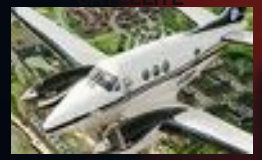


IMAGE CONTENT

REPORTS

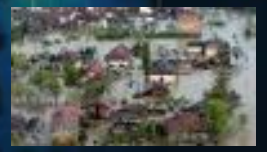
GEO CONTENTS

LAND

DEFENCE

MARITIME

AGRICULTURE



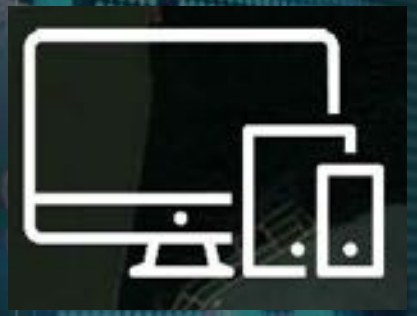
EMERGENCY

ENVIRONMENT

The new space race – global geospatial

global coverage

Frequent revisit



easy user driven access

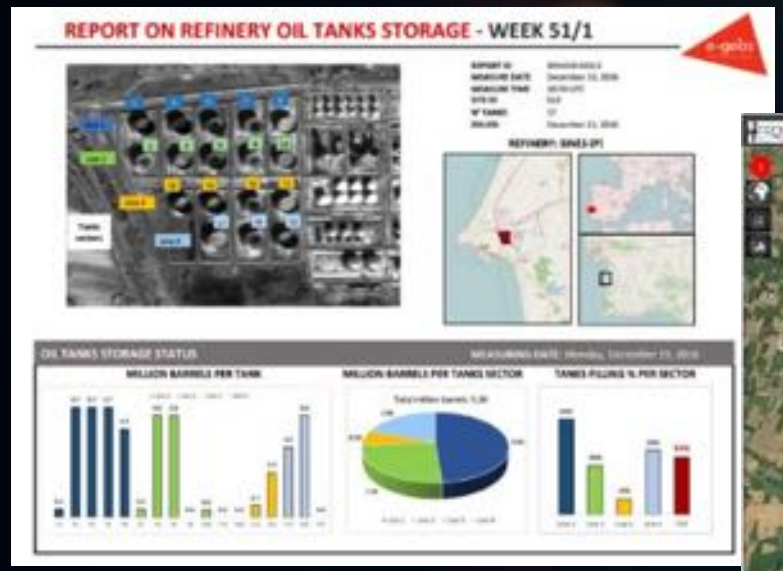
monitor daily

discover trends

deliver insight

Space and Democratization

From data → Generating information → To customized Information Products and BDA



THE VALUE CHAIN FOR THE NEW VALUE ADDED SERVICES

More value addition/processing to the raw data

High

Big data analysis

Information Products

Value Added Services

Data

Low

Services for Financial user comunity

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AU

AssetWatch

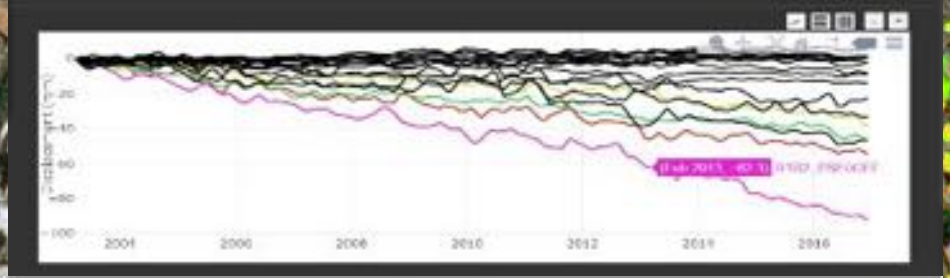
from punctual analysis to areal behaviours

1M+

Years of time series analysed

10+

Years of time series analysed at the same time



Statistics

Selected PS	2346
Measures	36
Starting date	20160508
Ending date	20170425
Velocity	Min: -29.9000 Max: 13.6000 Mean: -0.7389 mm/year
Height	Min: 1012.4000 Max: 1218.1000 Mean: 1084.4307 m
Velocity stdev	Min: 0.2000 Max: 1.1000 Mean: 0.4890 mm/year
Coherence	Min: 0.6400 Max: 0.8900 Mean: 0.7285

Filtering, Statistics and advanced analysis tools applied over hundreds of measuring points enables to move the analysis **from punctual analysis to areal behaviours**

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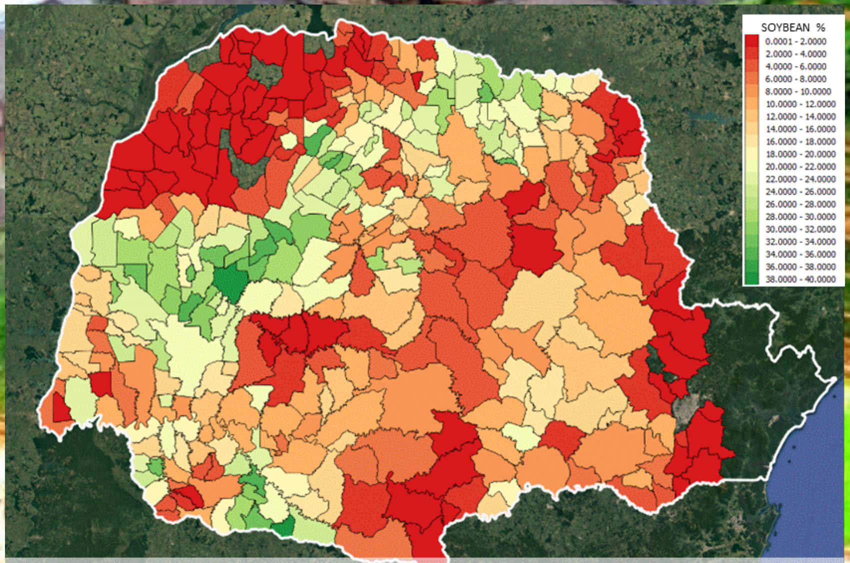
AGRICULTURE AND FOOD PRODUCTION

AgriGeo

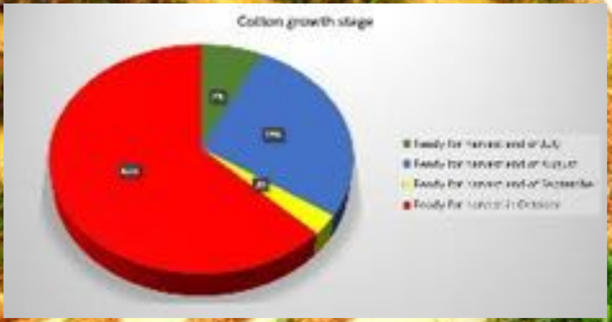
For supporting governments and farmers in the management of the **agricultural and food activities**, as well as the **crop lifecycle**

- **Precision farming analysis**
- **Crop monitoring reports, acreage and crop yield assessment, for early estimation, analytics monitoring services**
- **Agro-Environment Geo-Information Products**
- **Services of crop monitoring for claim management, funding\subsidies management, production processes**



2016 Soybean Acreage Statistics at Municipality level

COUNTY	Cotton area	Flooded Cotton Area	
	ha	ha	%
[illegible]	[illegible]	59	1%
[illegible]	[illegible]	0	[illegible]
[illegible]	[illegible]	0	[illegible]
[illegible]	[illegible]	132	7%
Eagle Lake	2535	922	36%
[illegible]	[illegible]	[illegible]	21%
[illegible]	648	218	[illegible]
[illegible]	[illegible]	333	18%
Wharton	[illegible]	721	[illegible]
[illegible]	[illegible]	822	28%
El Campo	[illegible]	539	5%
TOTAL	41388	3452	[illegible]



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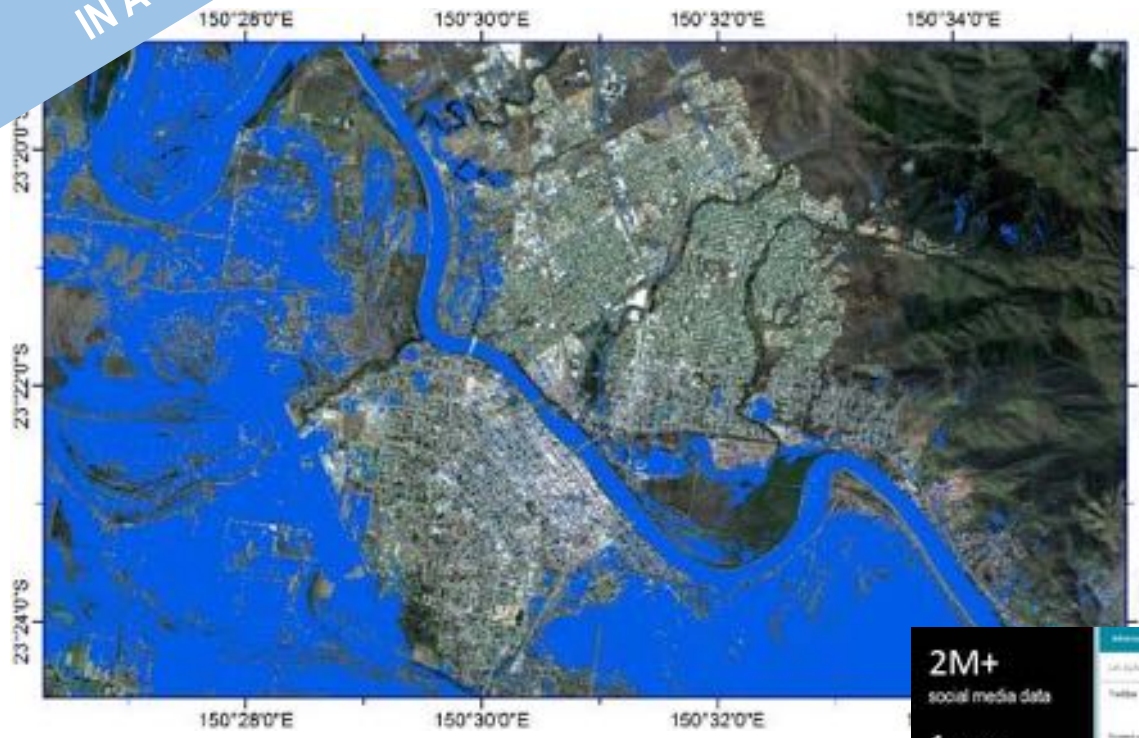
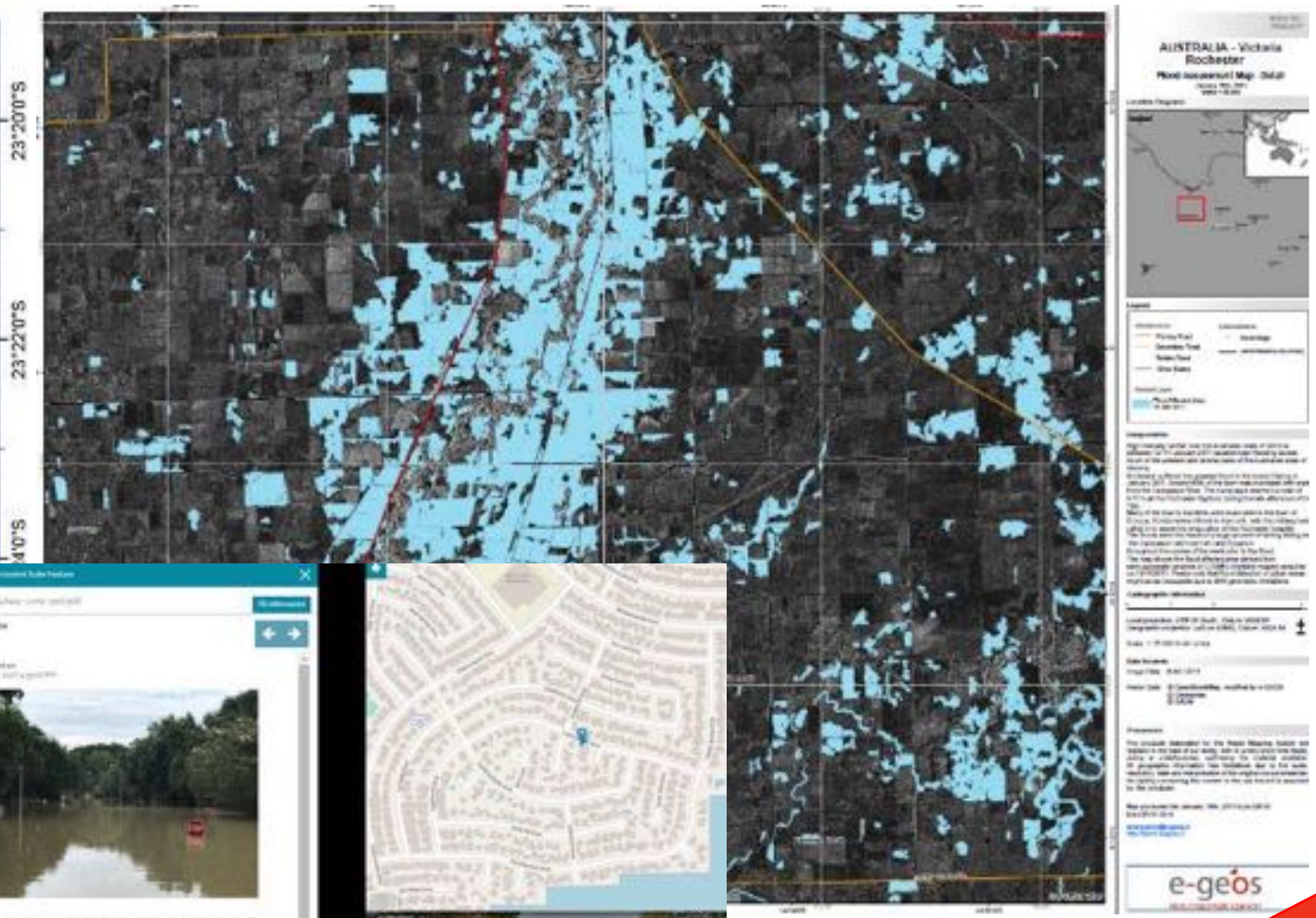
FLOODED AREAS EXTRACTION

FLOOD IN AUSTRALIA





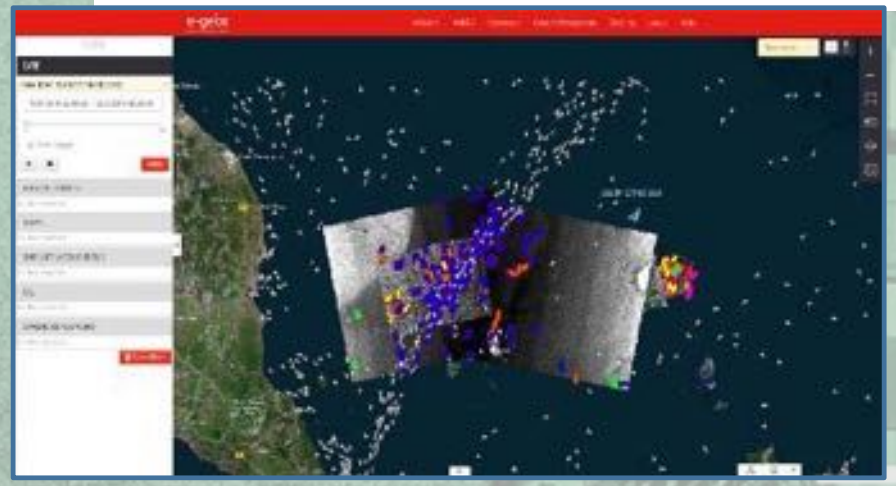
200+
Images Acquired

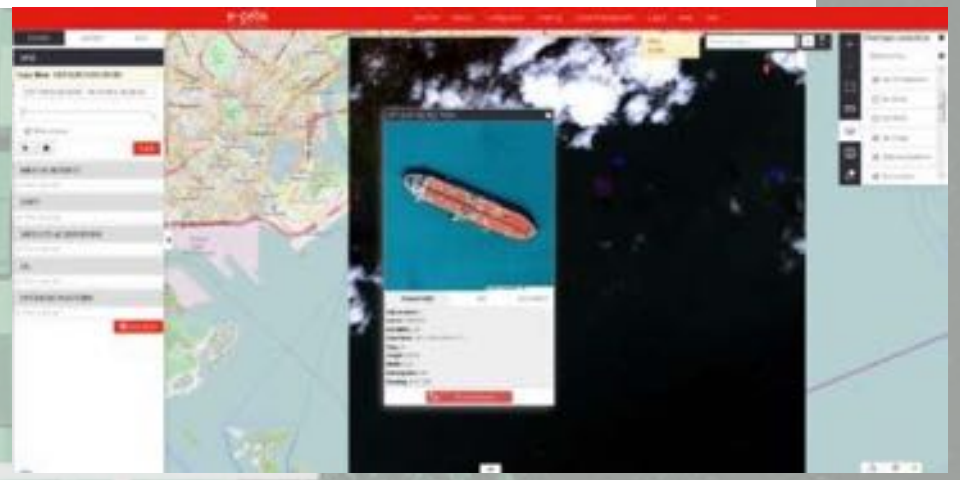
70+
Products generated and delivered

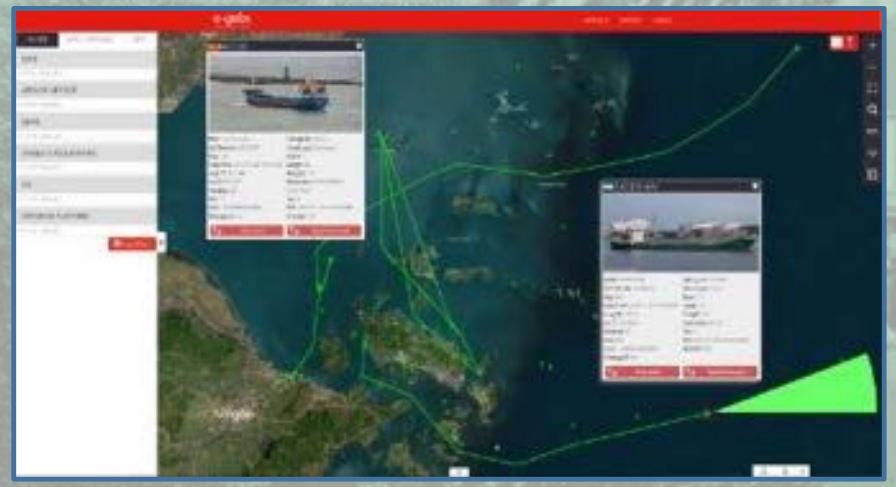
SEonSE
Smart Eyes on SEas

Complete and user friendly enviroment for data analysis

Integration of multi-source data for Maritime Awareness







AIS data, Vessel historical route and forecasting

Service Statistics

THE ECONOMY OF SHADOWS

OIL TANKS MONITORING

THE ECONOMY OF SHADOWS

OIL TANKS MONITORING

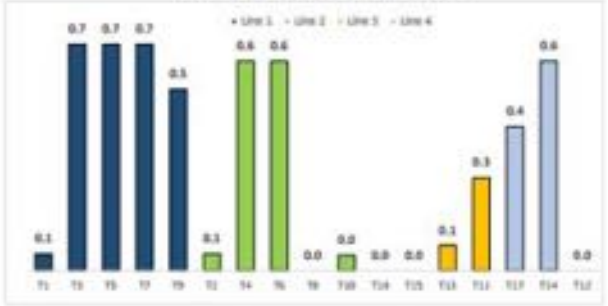
REPORT ON REFINERY OIL TANKS STORAGE - WEEK 51/1

REPORT ID	*BW-010-16511*
MEASURE DATE	December 19, 2016
MEASURE TIME	10:59 UTC
SITE ID	010
N° TANKS	17
ISSUED	December 21, 2016

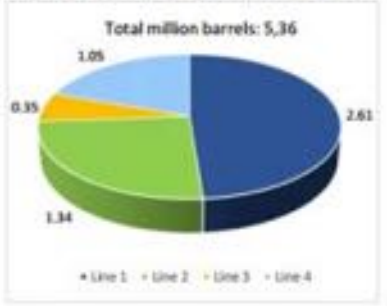
REFINERY: SINES (P)

OIL TANKS STORAGE STATUS — MEASURING DATE: Monday, December 19, 2016

MILLION BARRELS PER TANK



MILLION BARRELS PER TANKS SECTOR



TANKS FILLING % PER SECTOR

Geo Spatial paradigms and Business Models are fast changing

Biggest Trends in Satellite Earth Observation

- 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 existing and planned new assets through smart multi missions tasking platforms
- Convergence in the data analytics business for the EO
- Data derived information driven market
- EO Geospatial business as inherent part of IoT

(re)evolution if the entire eco-system (business, value chain, technology, partnership, public private cooperation, …)

GEOSPATIAL WORLD FORUM | GEO4IR

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THE BIG DATA PROMISE

GEO Big Data + IA + Analytics are changing the game in the data consumption

AI

Machine learning

Deep learning

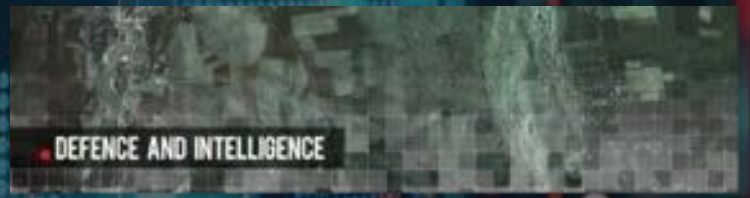
Automated action

Big Data

Self Program

Predictive Analysis

Prescriptive Analysis



From Earth Observation – static imagery to **pattern of life** monitoring

Thanks to Space Big Data, to faster revisit time offered in both radar and optical domain, we can answer to much more questions that in the past. The challenge is to design advanced algorithms to generate to process big data and to generate info reports for each vertical domain

Space Democratization

first space wave

Space as Political Power
Cold War

moon landing
1969

JFK Speech
1962

2nd space wave

Science and Exploration
Early Communicactions

inmarsat

1979

Navstar 1
1978

INTELSAT

3rd space wave

DAB DBS
HTS
Comms LEO/MEO
Earth Observation
Navigation
Systems

mid 90's

2007-
2010

COSMO SkyMed

mid 2010's

neWeb

Globalstar

4th space wave

Democratization
Sharing Economy
In Space

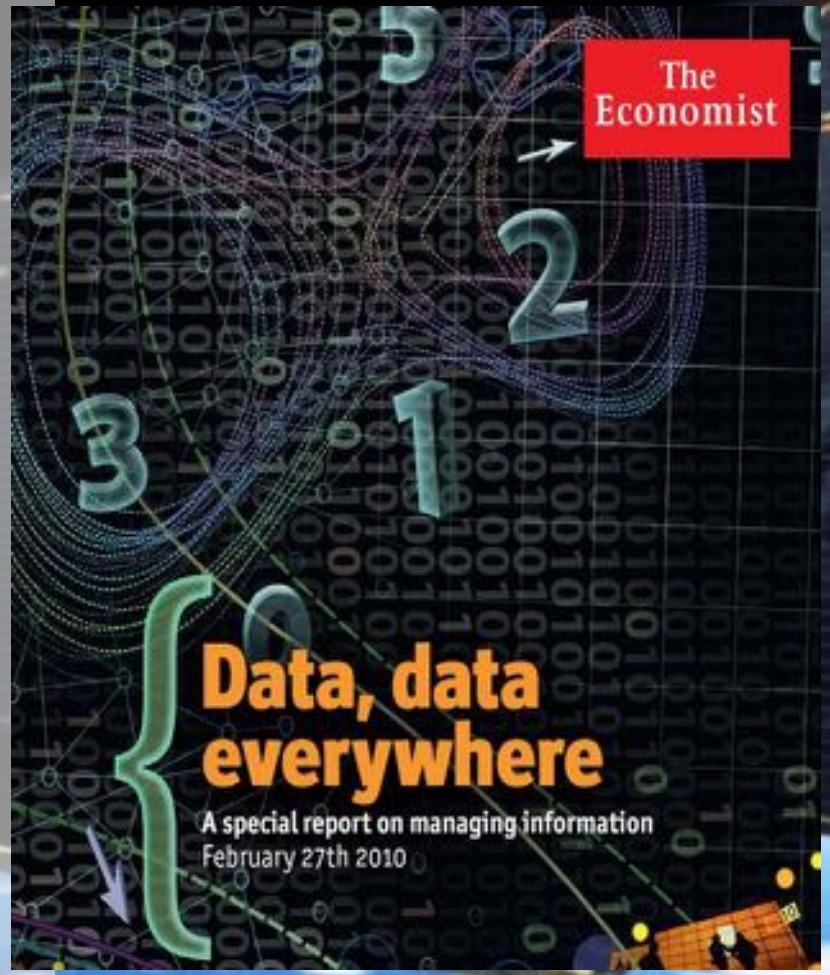
Earth Digital Twin

Pattern of life

e-geos

Space Democratization

- The space industry is fast moving to a new paradigm as consequence of breakthrough innovations in the space domain and in the data exploitation through a global connectivity infrastructure, incredible growing computing capabilities from mapping/imagery to continuous monitoring and information flow
- The evolution of a new class of satellites and constellations allows a new space economy, a space democratization based on a great number of new services to be offered
- New value propositions are enabled by paradigm shift in data and information exploitation through new data and services access platforms to address the need of a vast range of traditional and new users
- Customer base is moving to a wide community of users and Space dimension of IoT just started. IT will surely play a key role in this (r)evolution



WE SCAN THE EARTH

EYES ON THE EARTH

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