

# Earth observations for national development: the promise of big data, the chain of trust, and the sharing of risk

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#### The new digital economy





images: shutterstock

**EARTH OBSERVATIONS** 

#### The zero download model



#### The promise of big data



image: Chris Holmes



Digital Earth Africa: 40 years of LANDSAT data available publicly in AWS



# The promise of big data

Fires in Western and Southern Cape (2017)



What happens when we have access to all data?





# The promise of big data



Remote Sensing of Environment Volume 185, November 2016, Pages 221-232

Mapping tree height distributions in Sub-Saharan Africa using Landsat 7 and 8 data





2014

#### Space-first, time later or time-first, space later?



Space-first: classify images separately. Compare results in time

Time-first: classify time series separately. Join results to get maps

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## Land system trajectories



"The transformations of land cover due to actions of land use"





graphics: Rolf Simoes



# The challenge of machine learning



SVM classification plot





# Vapnik on solving complex problems

Einstein said "when the solution is simple, God is answering". He also said "when the number of factors coming into play is too large, scientific methods in most cases fail". In the complex world of machine learning, one should give up explainability to gain a better predictability.



# Capacity development is part of institutional building







GEO Members need a strong investment in capacity development for big data



#### SITS – an R package for image time series



https://github.com/e-sensing/sits

# The chain of trust







## Earth observation is big news



#### "Our house is burning"



"Amazon must be protected."





#### How do they know?



# **Continuity and innovation**



NOAA-15

Suomi-NPP







Continuity: INPE Brazil (data since 1988)





# Sentinel-5P (CO estimates)



#### Crop Monitor for Early Warning: 2017 Uganda



"In the past we always reacted to crop failure, spending billions of shillings to provide food aid in the region. 2017 was the first time we acted proactively because we had clear evidence from satellite data very early in the season"

Martin Owor, Commissioner Office of the Prime Minister (OPM)

# Soy Moratorium in Amazonia





Sansa South African National Space Agency

# Soy Moratorium in Amazonia







## The chain of trust



17 18 19 20 21 22 23 24 25 26

32 33 34

28 29 30 31

27

Longitude [degrees]

# The sharing of risk



# The sharing of risk



"The state has often actively co-shaped markets, and taken high risks, before the private sector was willing or able. This is especially true in the innovation economy."







"Governments have always been lousy at picking winners... As the revolution rages, governments should stick to the basics: better schools for a skilled workforce, clear rules and a level playing field for enterprises of all kinds... Leave the rest to the revolutionaries." ('The Third Industrial Revolution', The

*Economist*, April 21, 2012).



"The road to free markets was opened and kept open by an enormous increase in continuous, centrally organized and controlled interventionism... Administrators had to be constantly on the watch to ensure the free working of the system."

Karl Polanyi, The Great Transformation, 1944

"The important thing for Government is not to do things which individuals are doing already, and to do them a little better or a little worse; but to do those things which at present are not done at all."

John M. Keynes, The End of Laissez Faire, 1926

source: Mariana Mazzucato

### What about the GPS?



# US\$ 5 billion (US Navy)

Globally available paid by the State





# Who's afraid of the MAGI?







#### The EU response to the MAGI





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#### The Australian response to the MAGI





#### What risks should be taken by the State?



# Putting it all together

The promise of big data 
capacity building and

The chain of trust

The sharing of risks

 capacity building and reproducibility

- strong institutions and transparency
- openess and longterm commitment





# Achieving reproducible knowledge



# Full replication by open science: vendor independence, avoid lock-in effect

# GEO Knowledge Hub: A Digital Library for EO Applications







# Why does GEO need a knowledge hub?



#### Building a global community, sharing methods and results, avoiding lock-in