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

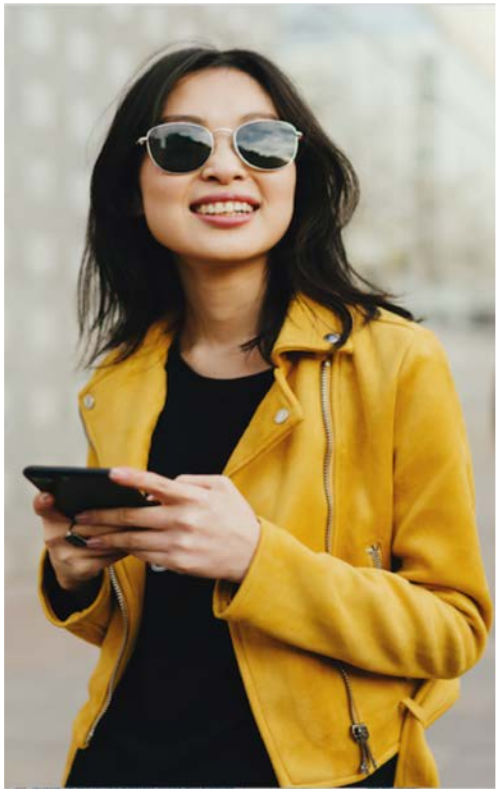
Gilberto Câmara – GEO Secretariat

Presented at South Africa Space for National Development Week 2019

The new digital economy

big data

Low access cost



massive use

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images: shutterstock

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The zero download model

Empowered users

Software

Results

Space agencies

open data

Cloud platforms

The promise of big data

image: Chris Holmes

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

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The promise of big data

Fires in Western and Southern Cape (2017)

What happens when we have access to all data?

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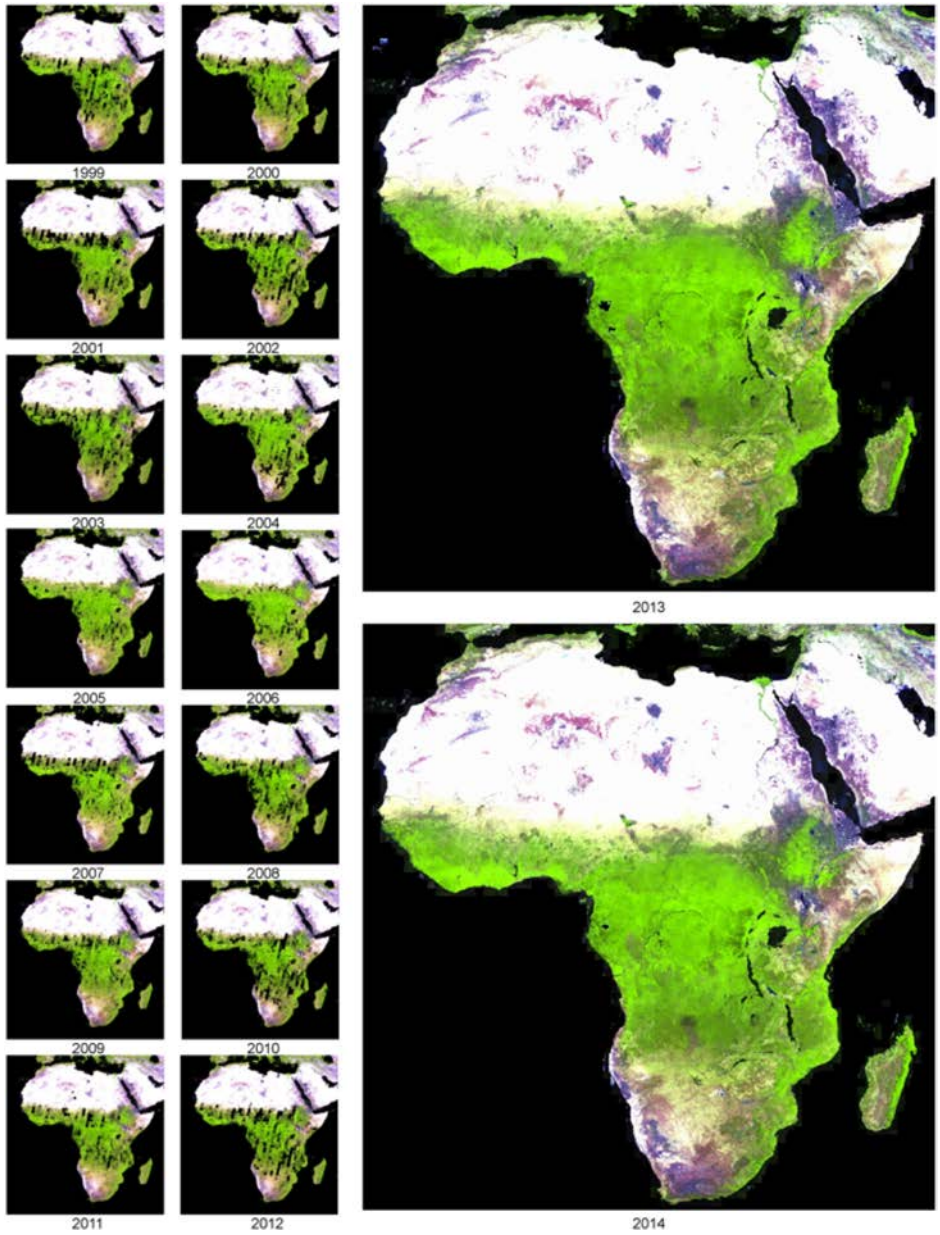
The promise of big data

ELSEVIER

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



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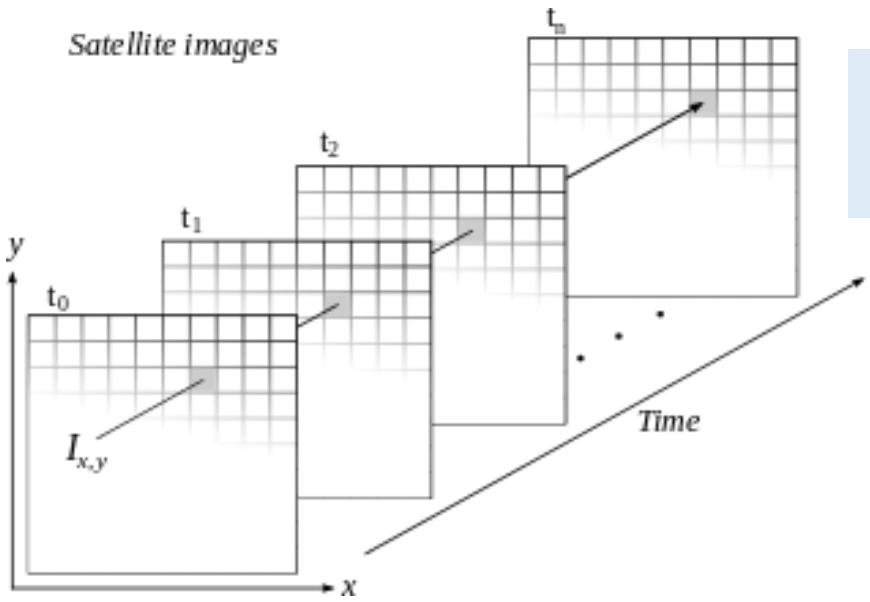
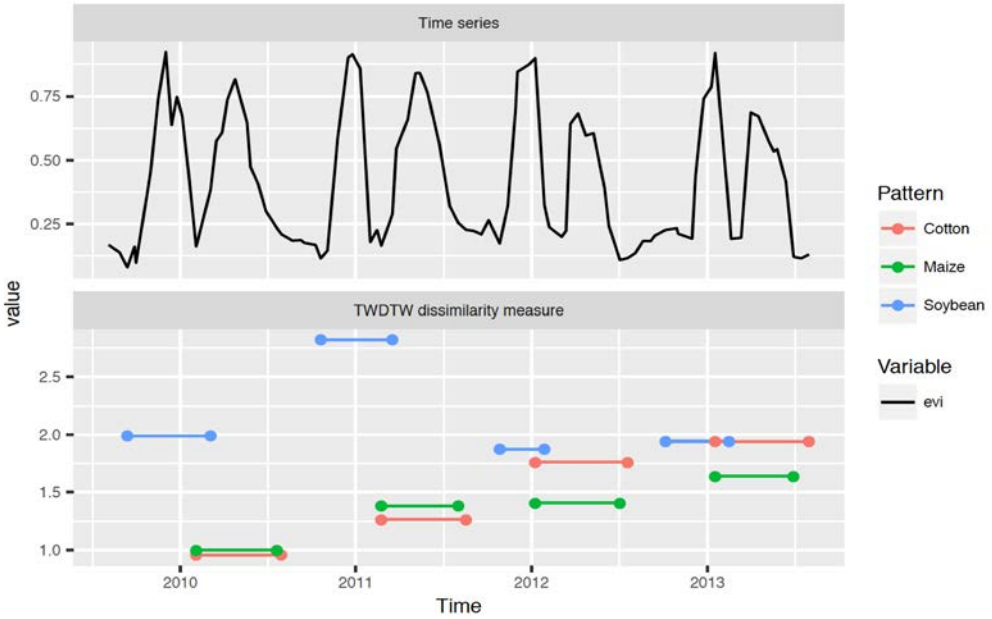
Space-first, time later or time-first, space later?



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



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

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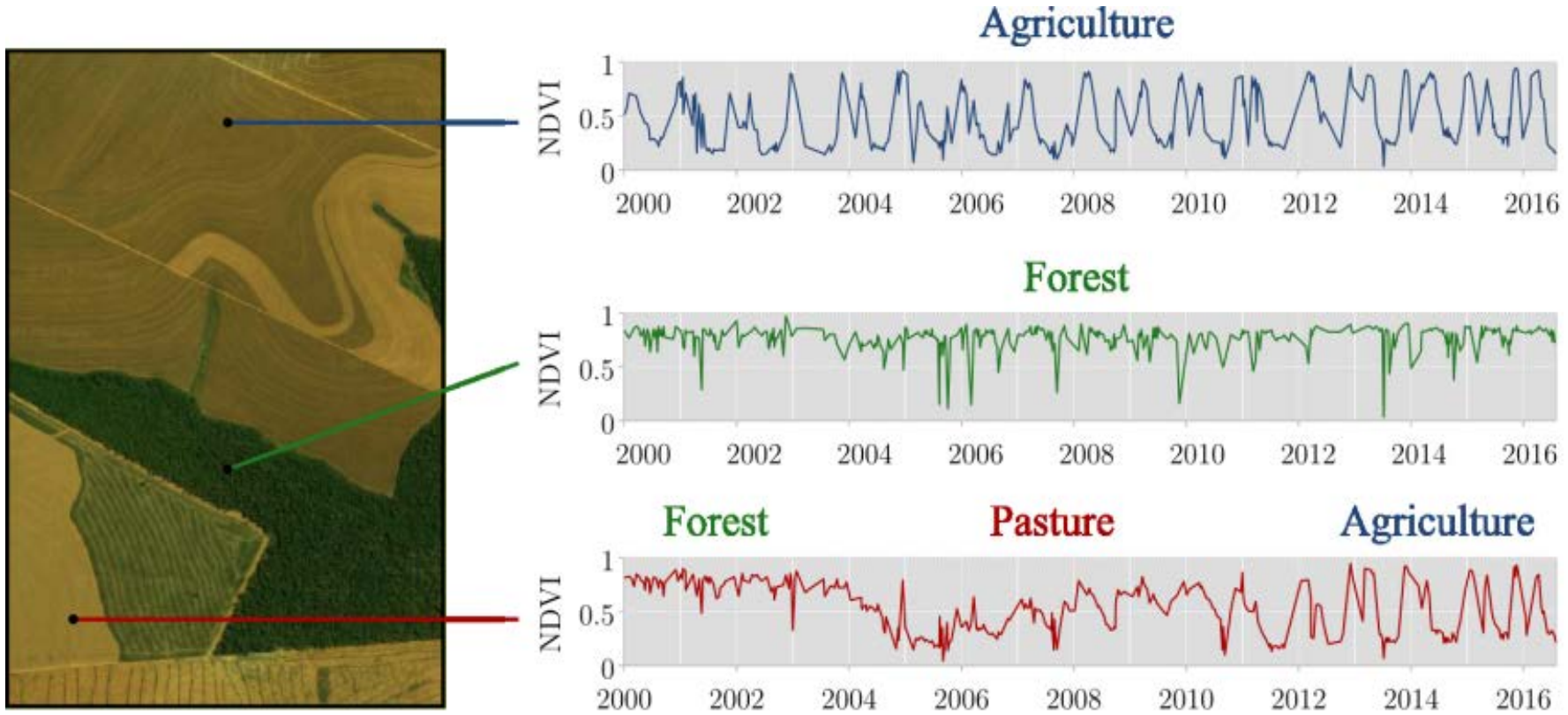
Land system trajectories



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

graphics: Rolf Simoes

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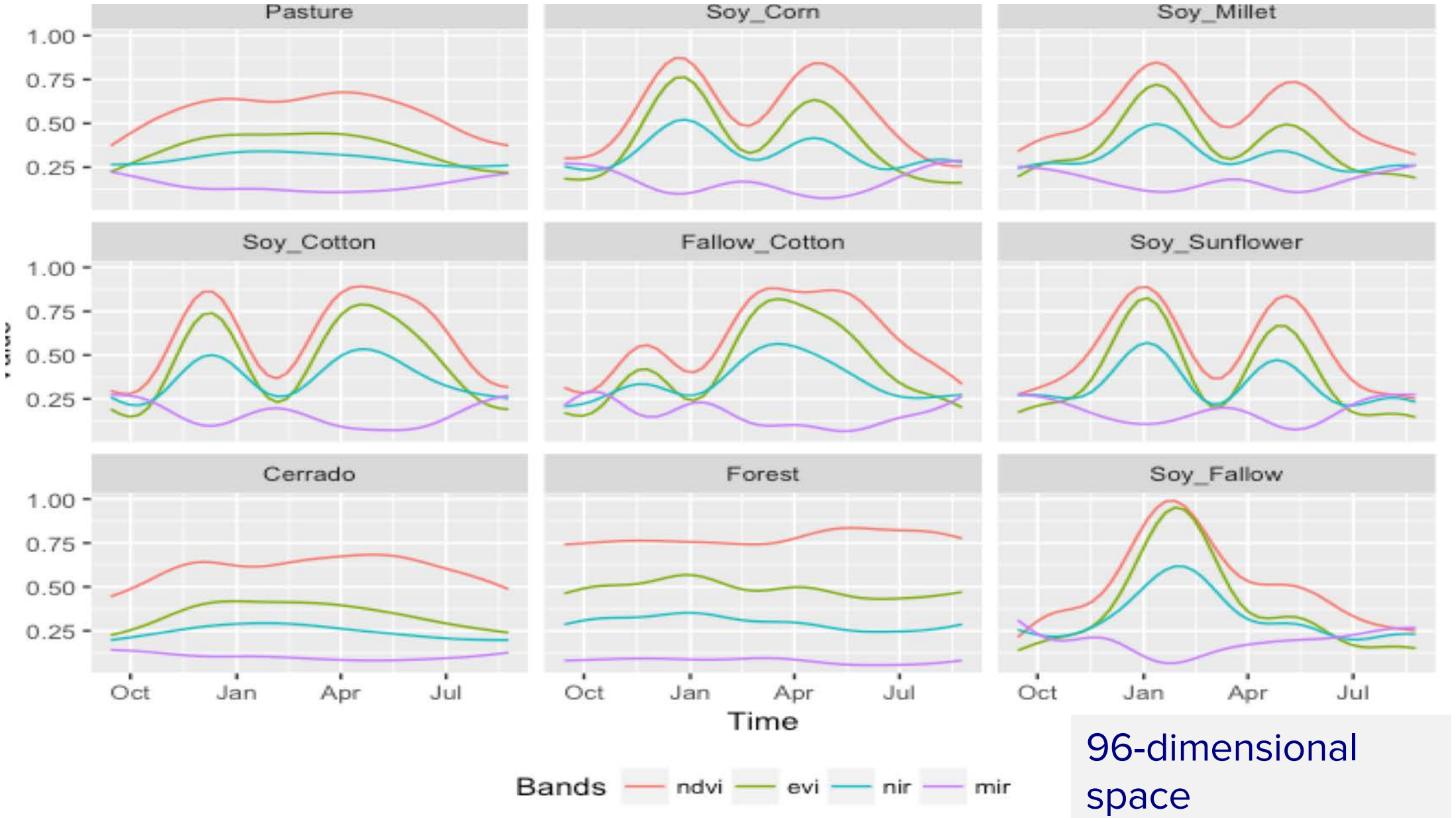
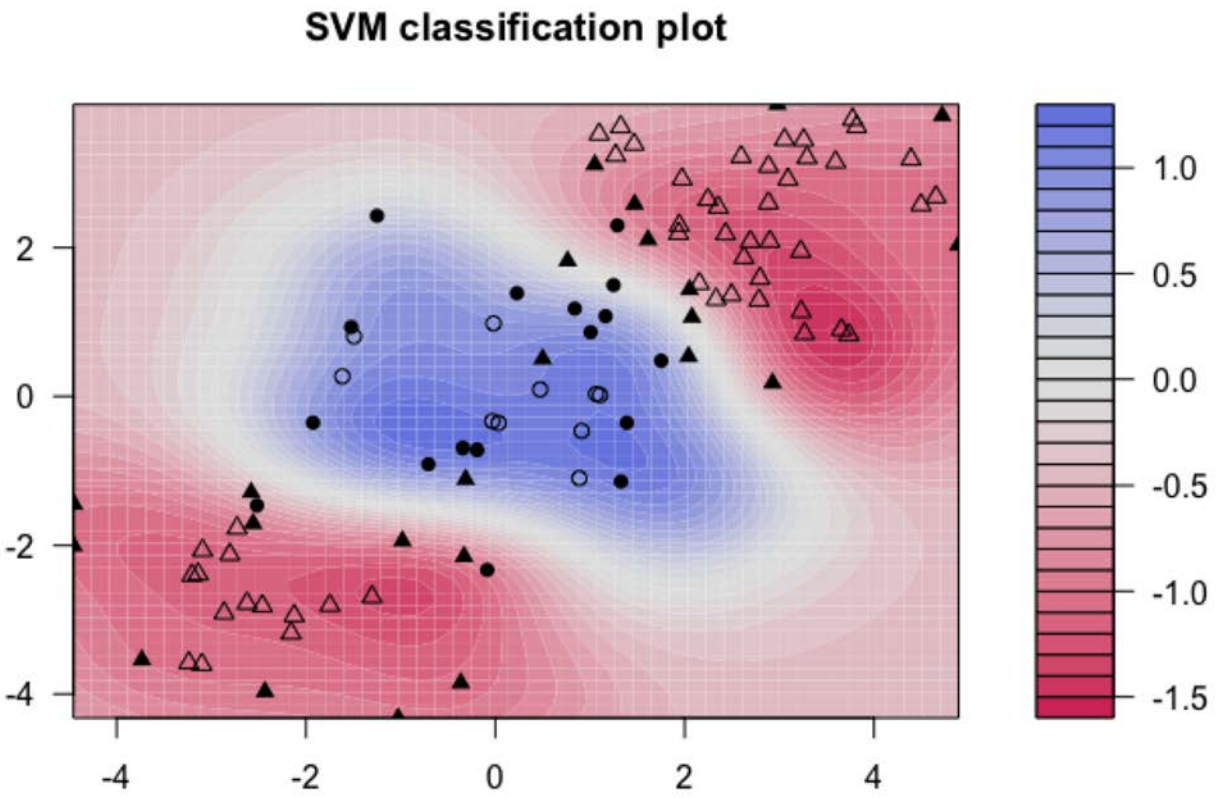


96-dimensional space

The challenge of machine learning



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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

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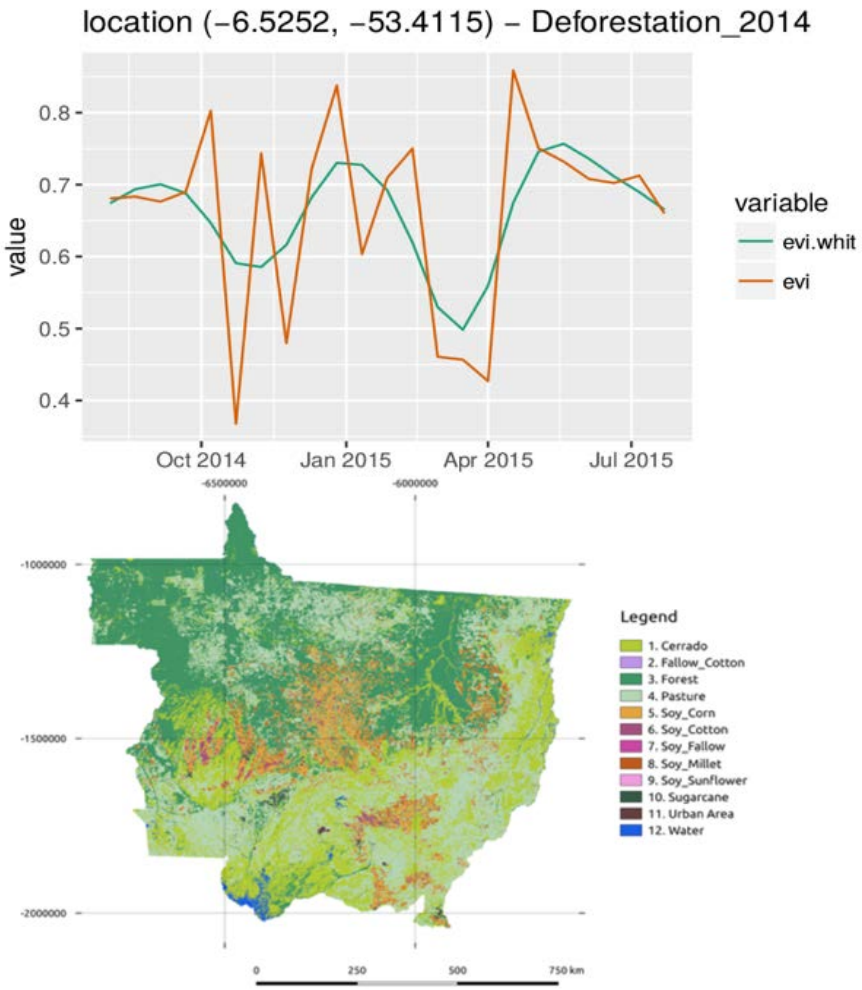
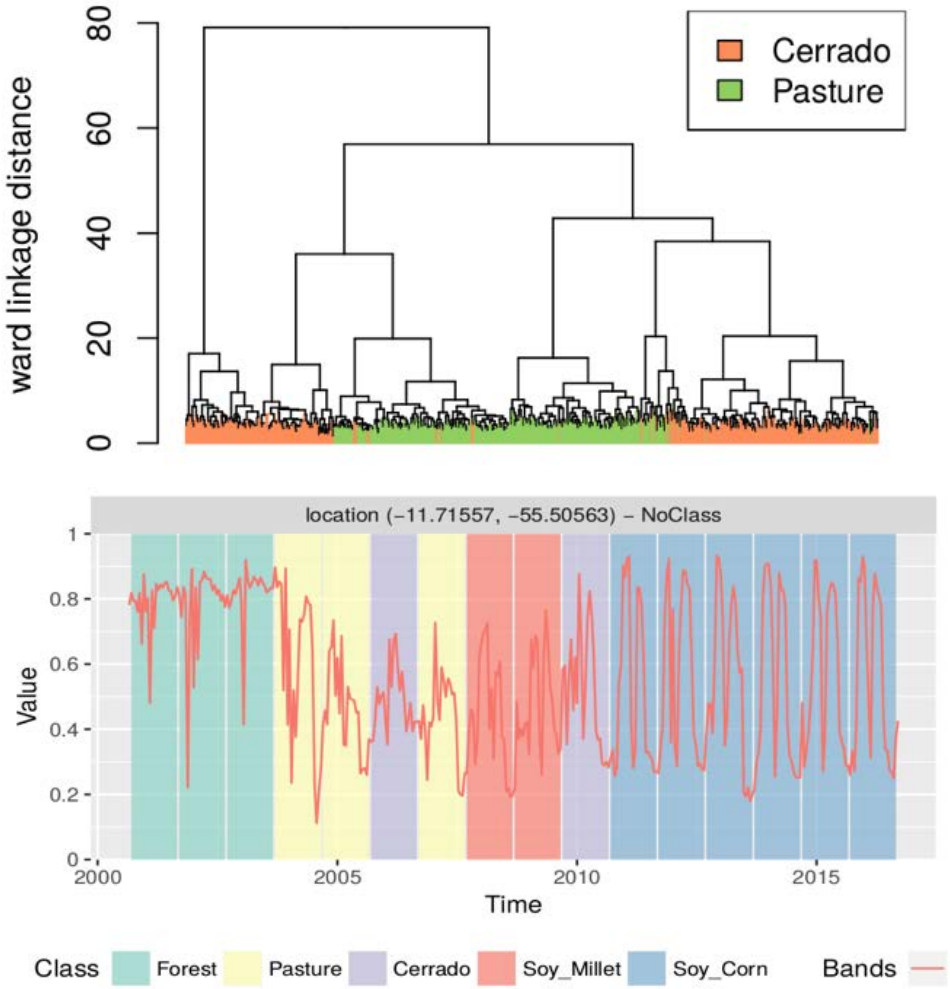
SITS – an R package for image time series





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

The chain of trust

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Earth observation is big news

"Our house is burning"

"Amazon must be protected."

How do they know?

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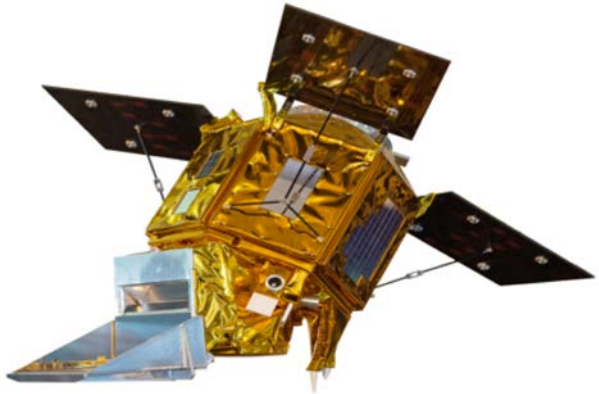
Continuity and innovation

NOAA-15

Terra

Suomi-NPP



Sentinel-5P

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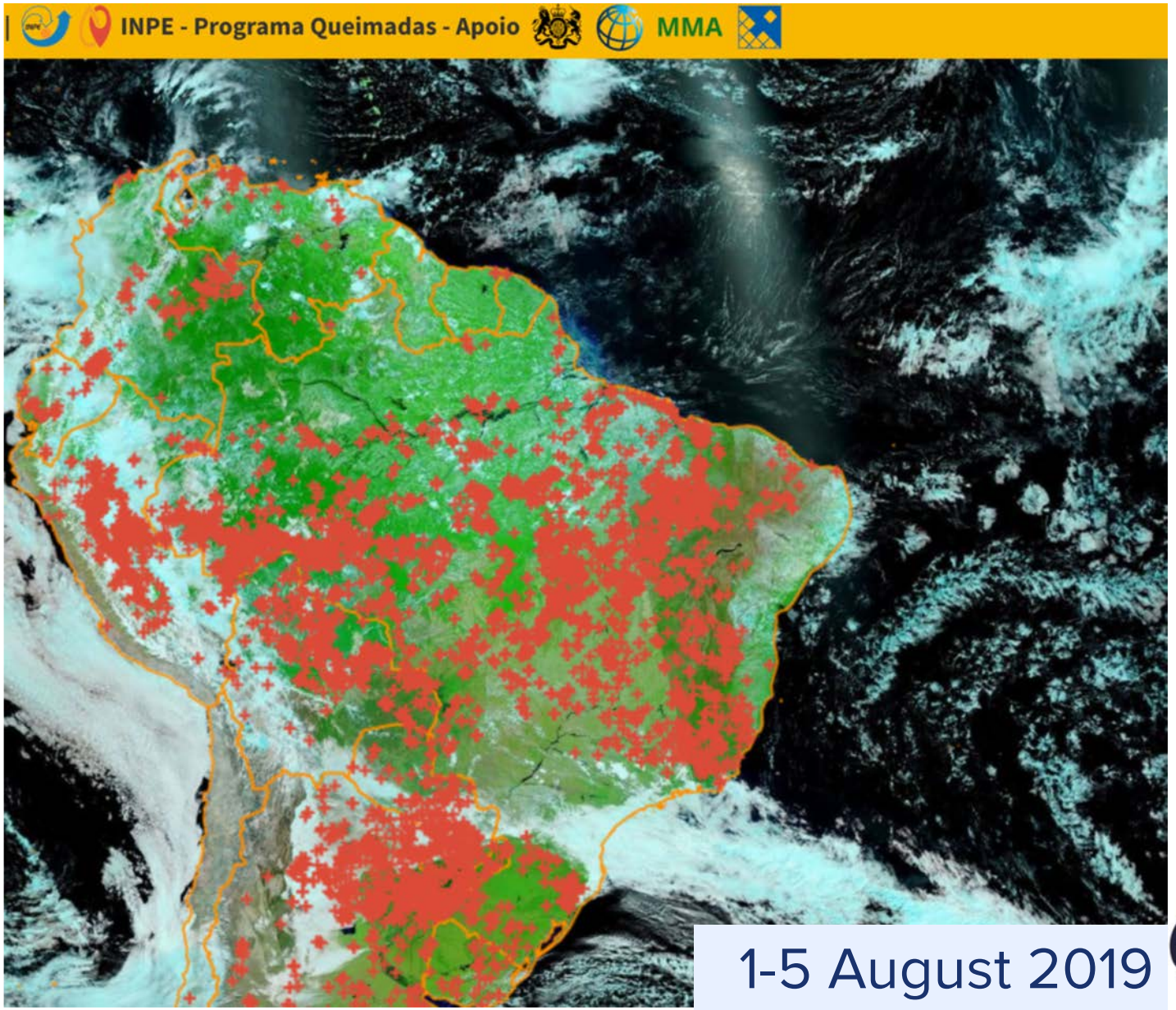
Continuity: INPE Brazil (data since 1988)



1-5 August 2019

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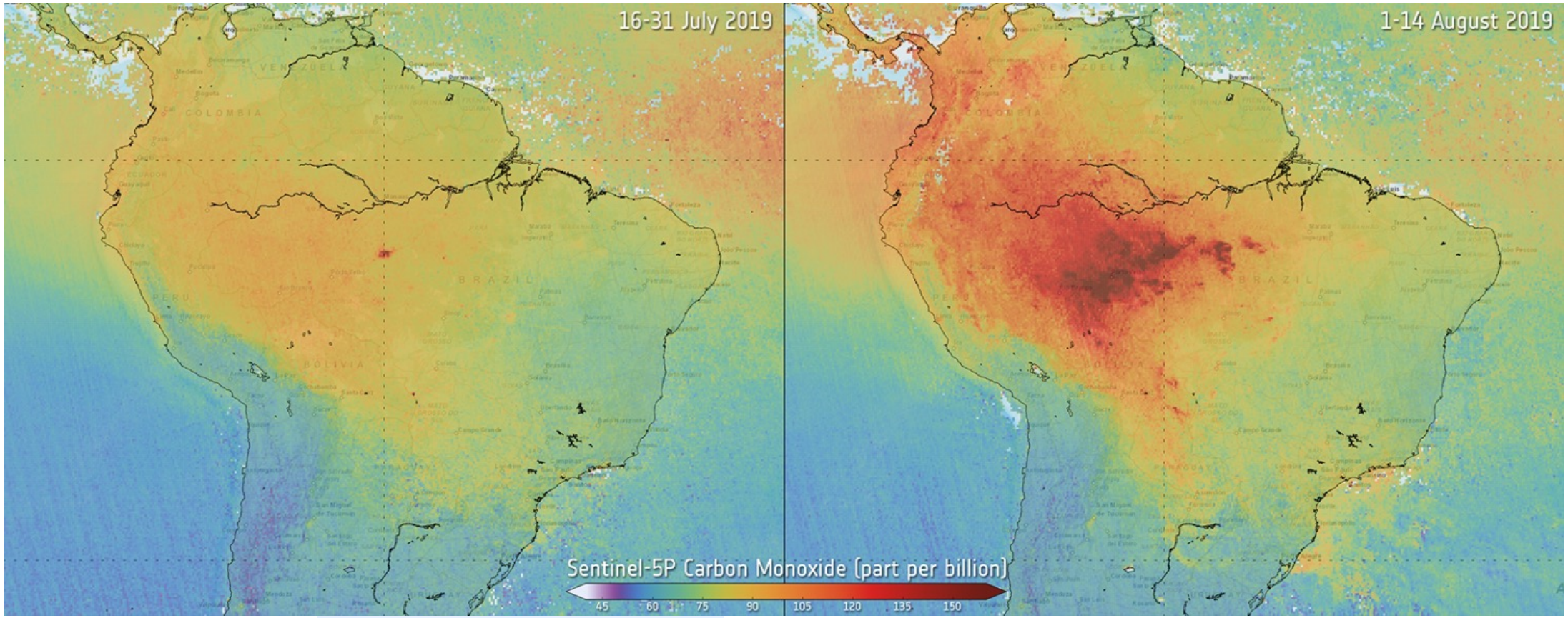
Sentinel-5P (CO estimates)



16-31 July 2019

1-14 August 2019

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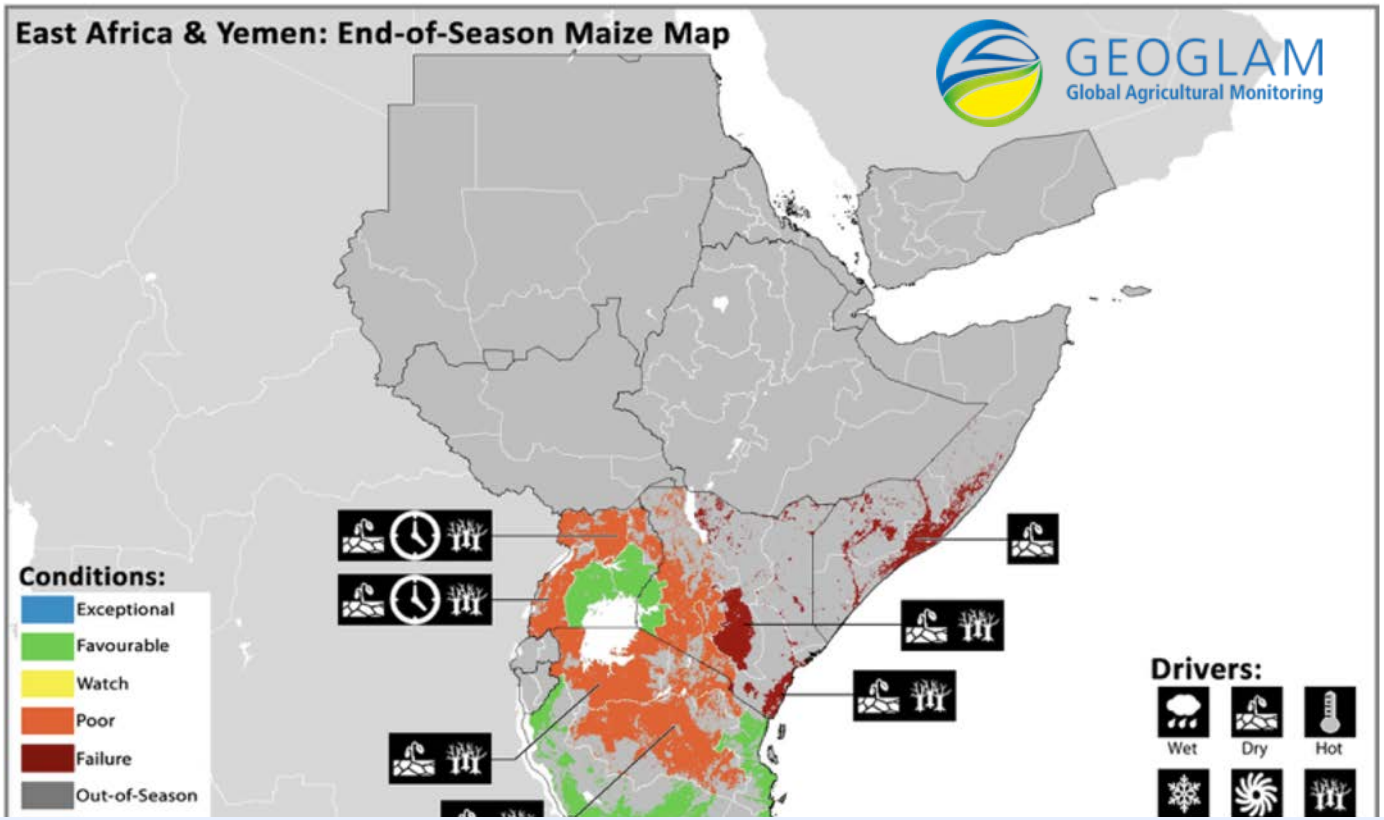
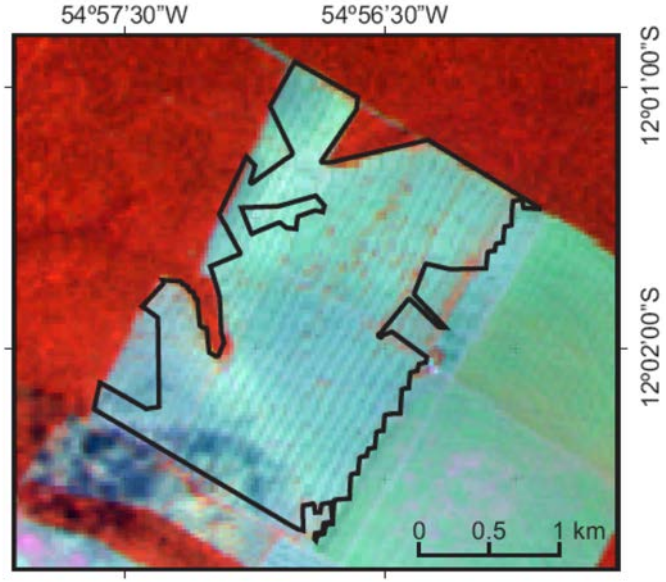
Crop Monitor for Early Warning: 2017 Uganda



"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



Deforestation polygons (INPE)

Soybean farms (ABIOVE)

GREENPEACE

Certification

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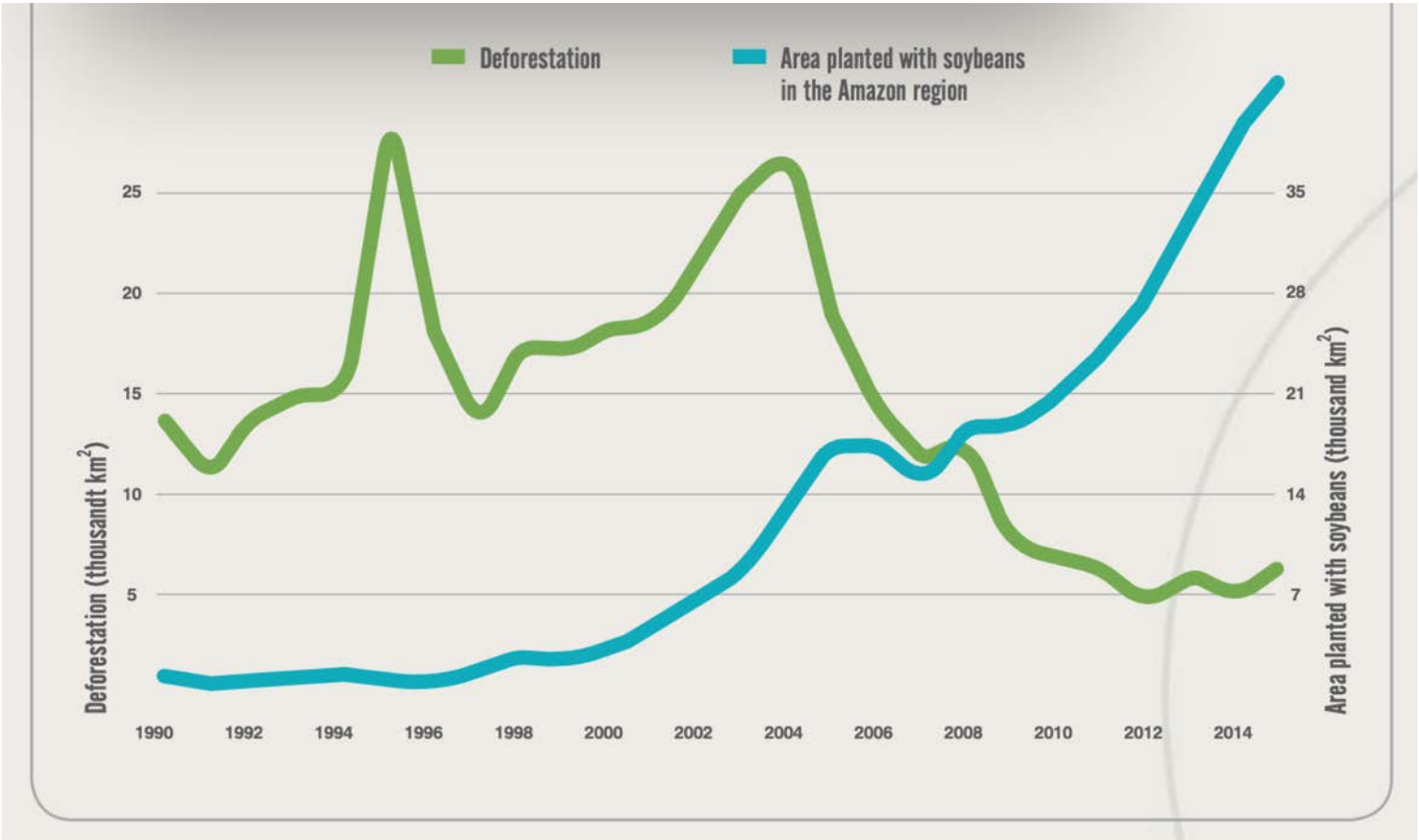
Soy Moratorium in Amazonia



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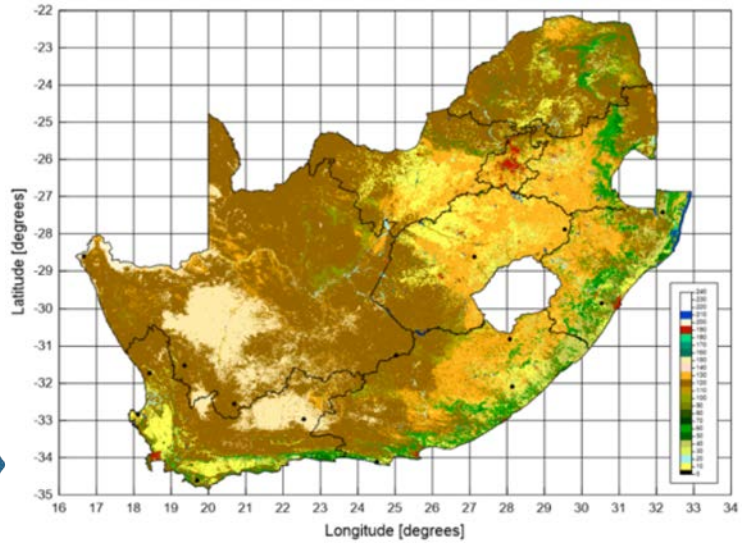
The chain of trust

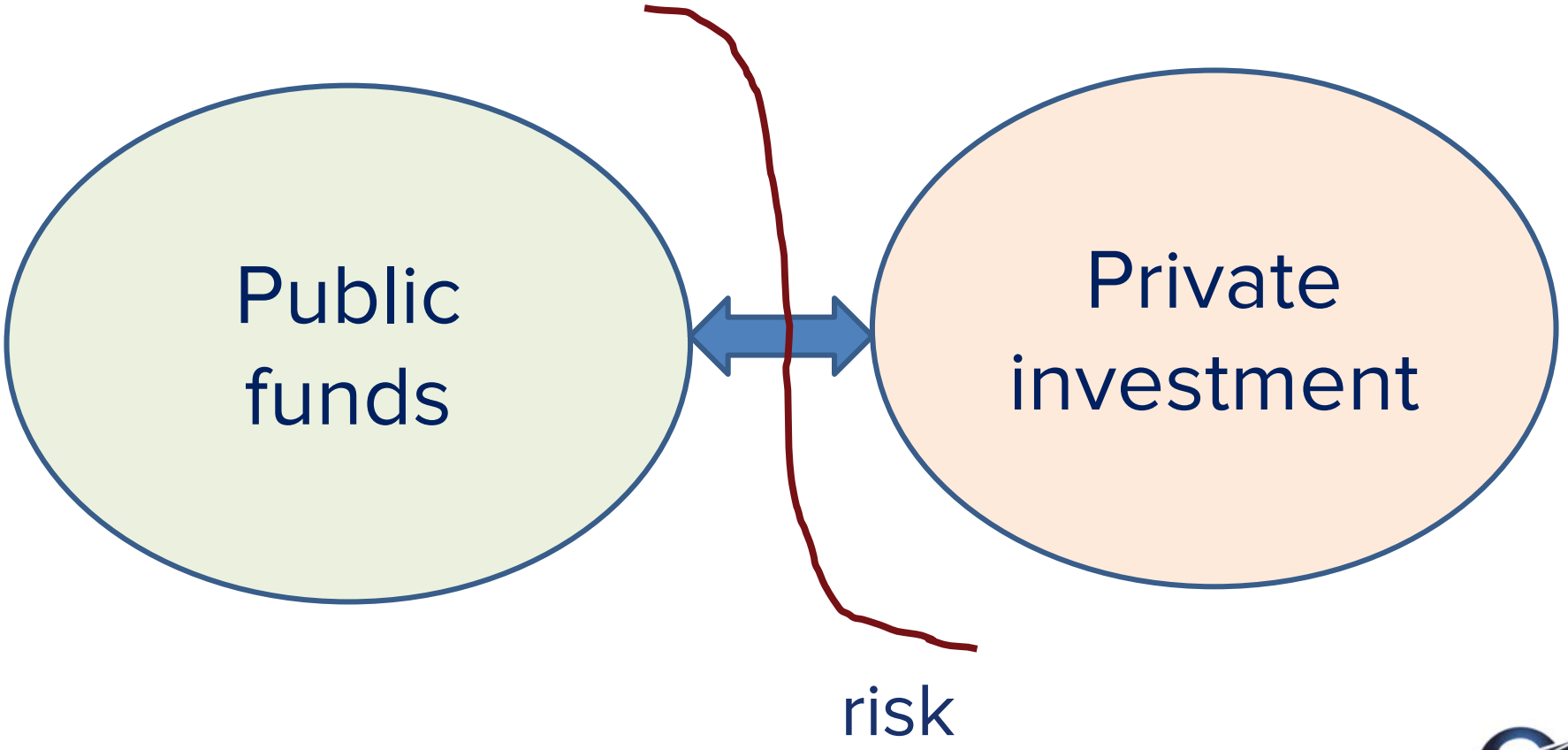
EO data

co-design

socially robust results



The sharing of risk



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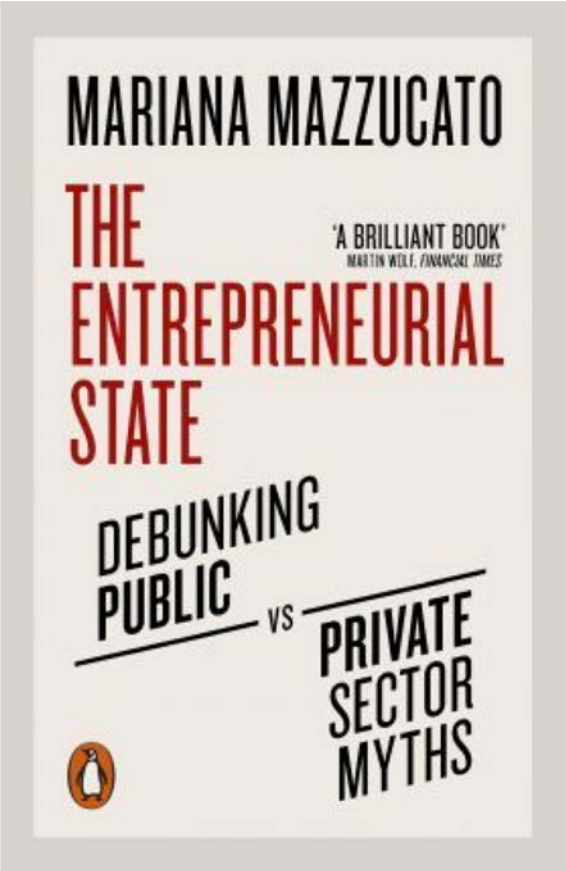
The sharing of risk



"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."

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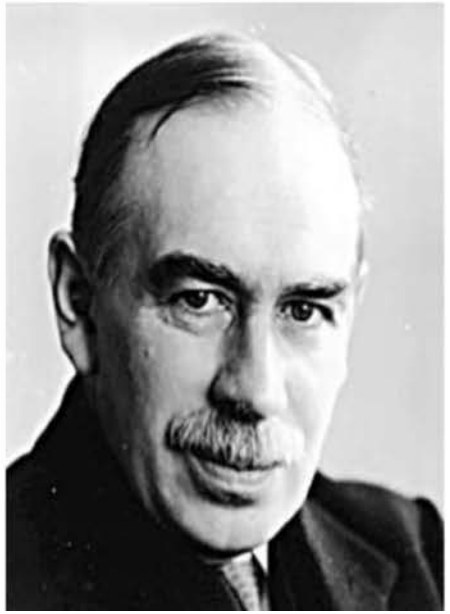
"**Governments** have always been **lousy at picking winners**… As the revolution rages, **governments should stick to the basics**: better schools for a skilled workforce, clear rules and a level playing field for enterprises of all kinds… **Leave the rest to the revolutionaries.**"

('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

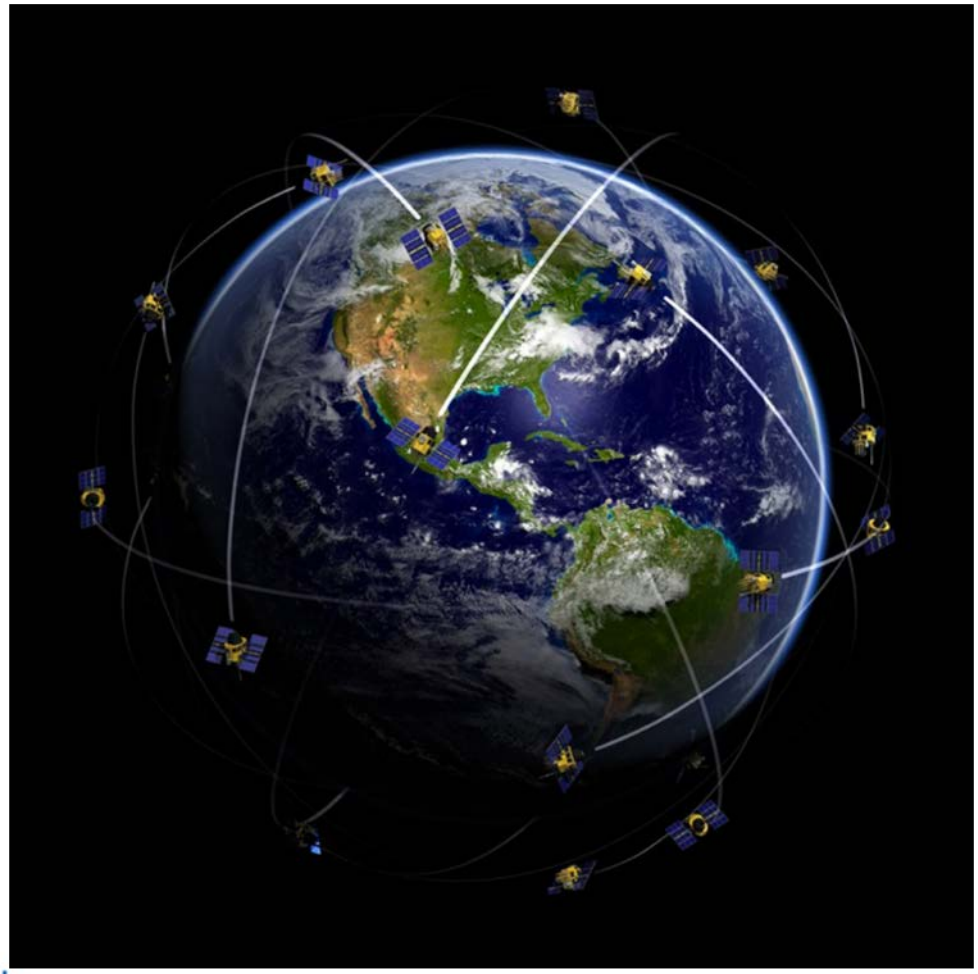


"The important thing for Government is not to do things which individuals are doing already, and to do them a little better or a little worse; but to do those things which at present are not done at all."

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

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Who's afraid of the MAGI?

Amazon Web Services: 4 PB for Digital Earth Africa

Google Earth Engine: US$ 3 million for GEO projects

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The EU response to the MAGI

high-risk, short-term, expected global gains

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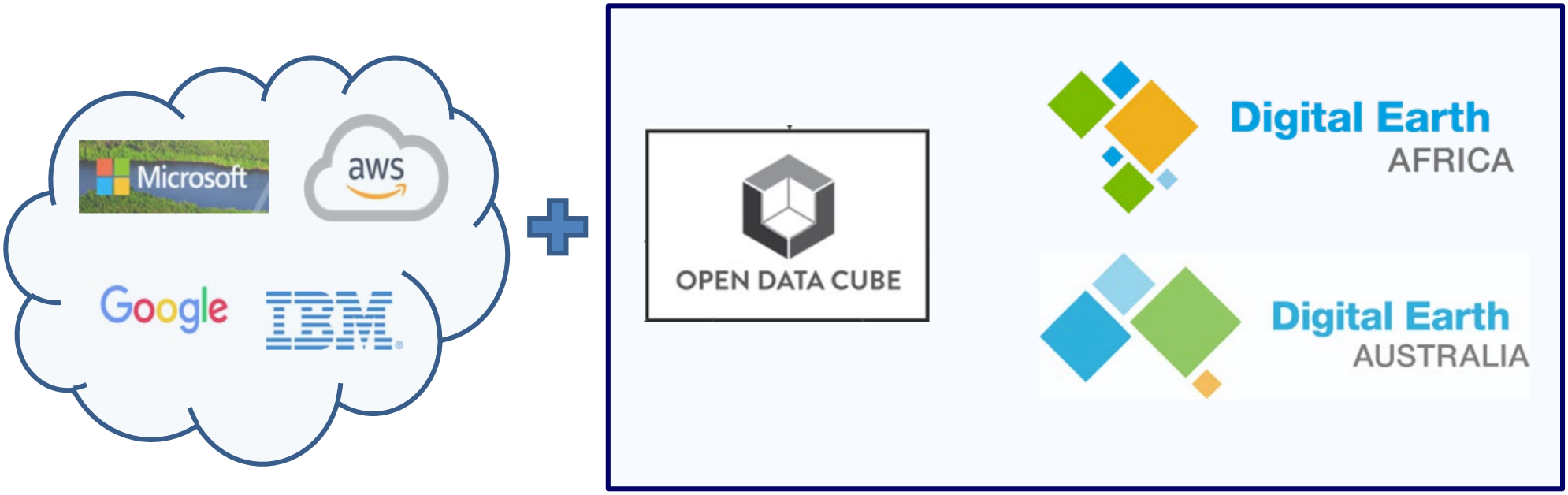
The Australian response to the MAGI



low-risk, long-term, expected local gains

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What risks should be taken by the State?

Empowered users

Software

Results

Space agencies

open data

Cloud platforms

Putting it all together

The promise of big data	➡	capacity building and reproducibility
The chain of trust	➡	strong institutions and transparency
The sharing of risks	➡	openess and long-term commitment

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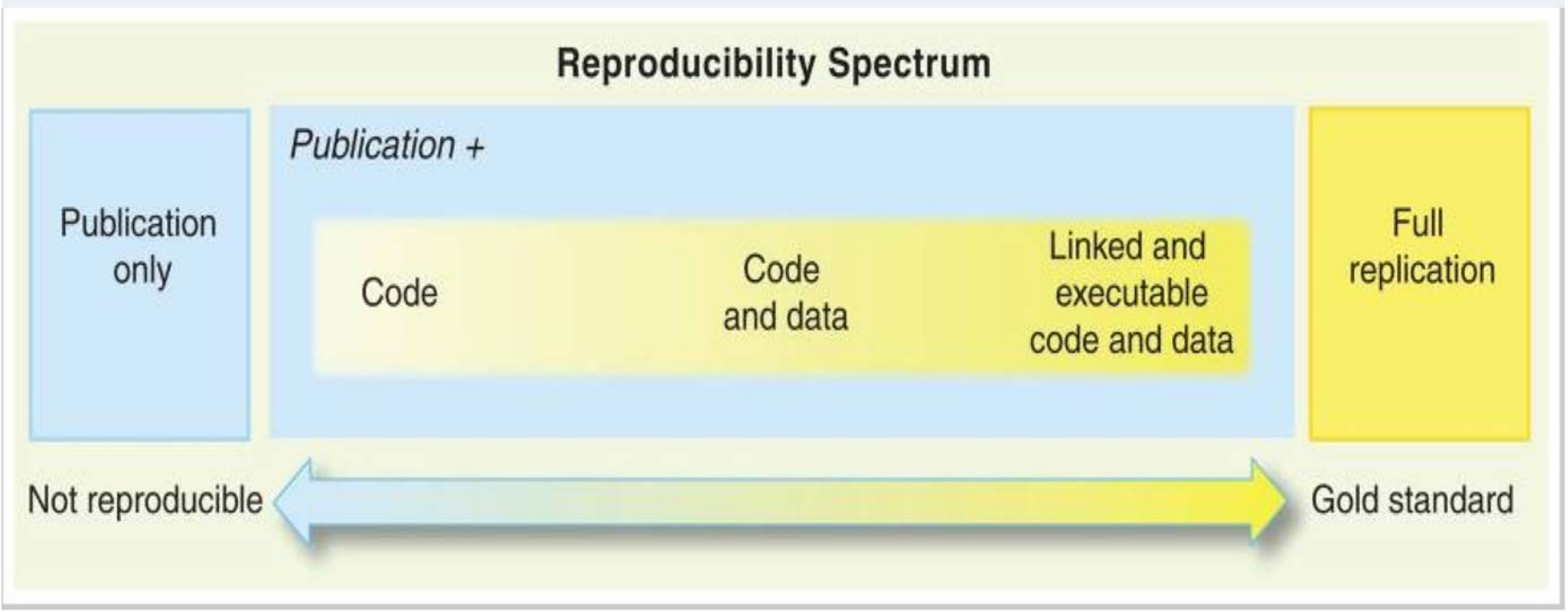
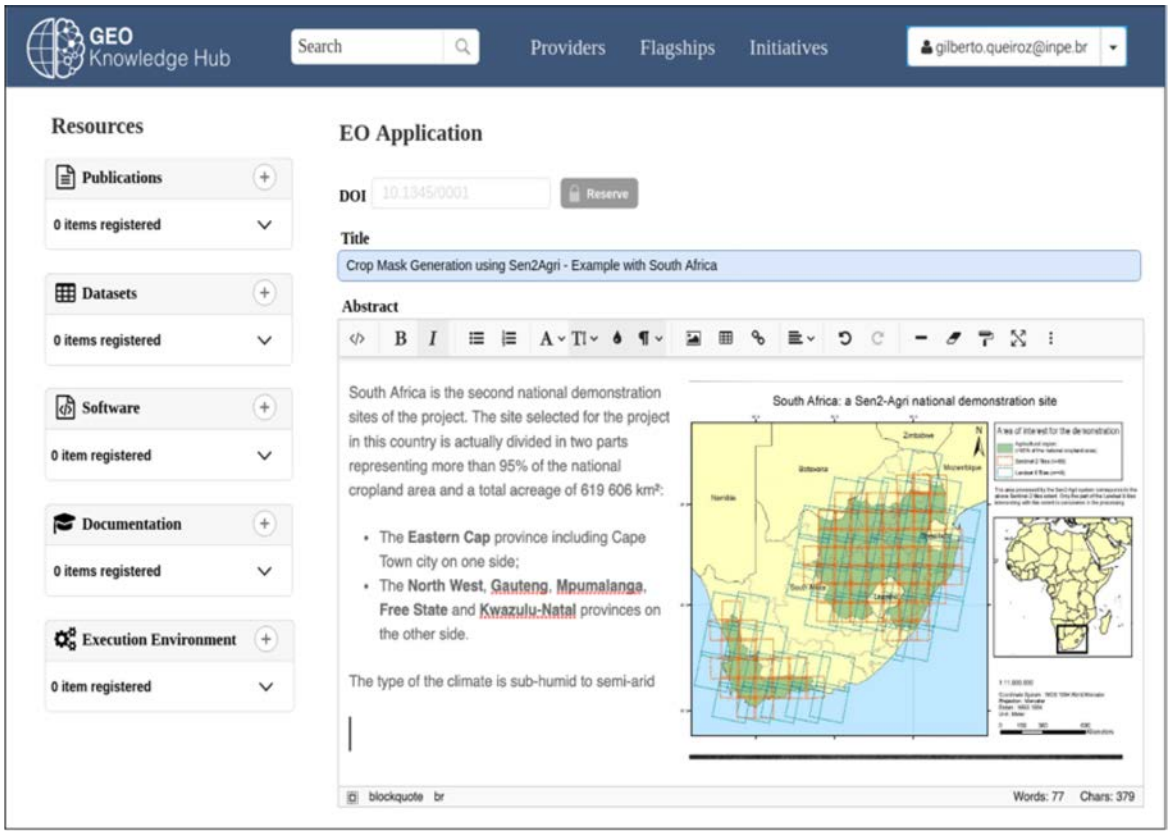
Achieving reproducible knowledge



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

GEO Knowledge Hub: A Digital Library for EO Applications



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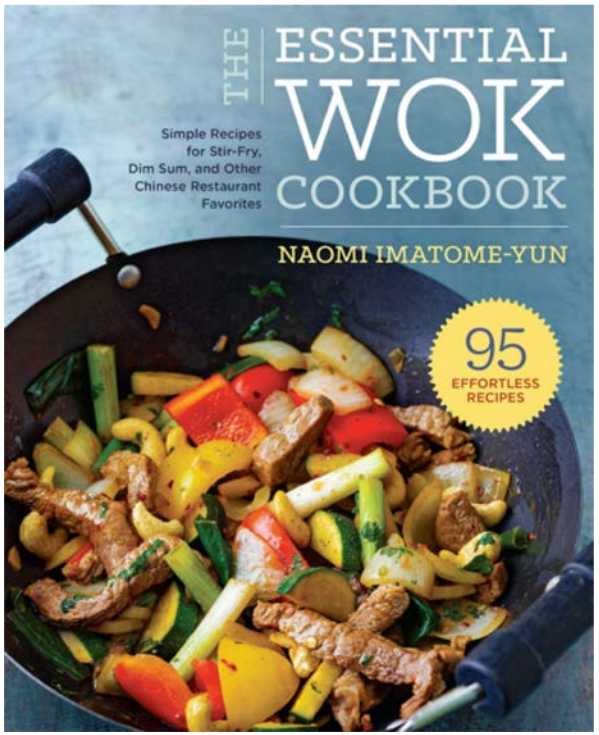
GEO Knowledge Hub

Why does GEO need a knowledge hub?



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