

GOFC-GOLD

Global Observation of Forest Cover and Land Dynamics



Land Cover
Project Office



European Space Agency
Agence spatiale européenne

GOFC-GOLD / Wageningen University research activities on Land Cover monitoring

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WAGENINGEN UR
For quality of life



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In Press, Corrected Proof — Note to users



Assessing global land cover reference datasets for different user communities

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Abstract

Global land cover (GLC) maps and assessments of their accuracy provide important information for different user communities. To date, there are several GLC reference datasets which are used for assessing the accuracy of specific maps. Despite significant efforts put into generating them, their availability and role in applications outside their intended use have been very limited. This study analyses metadata information from 12 existing and forthcoming GLC reference datasets and assesses their characteristics and potential uses in the context of 4 GLC user groups, i.e., climate modellers requiring data on Essential Climate Variables (ECV), global forest change analysts, the GEO Community of Practice for Global Agricultural Monitoring and GLC map producers. We assessed user requirements with respect to the sampling scheme, thematic coverage, spatial and temporal detail and quality control of the GLC reference datasets. Suitability of the datasets is highly dependent upon specific applications by the user communities considered. The LC-CCI, GOFC-GOLD, FAO-FRA and Geo-Wiki datasets had the broadest applicability for multiple uses. The re-usability of the GLC reference datasets would be greatly enhanced by making them publicly available in an expert framework that guides users on how to use them for specific applications.



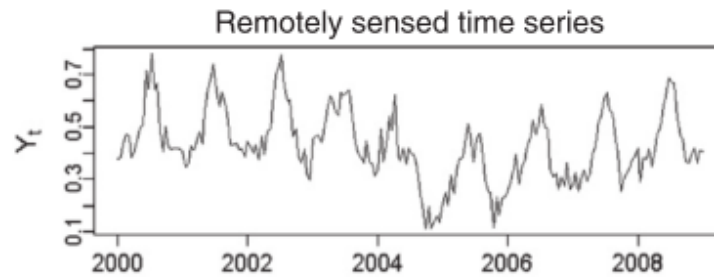
<http://www.gofcgold.wur.nl/>

Outline:

- Change mapping and monitoring
- In-situ measurements
- Integration of data streams

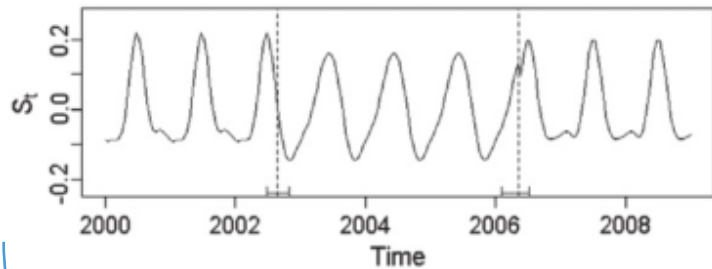
Breaks For Additive Season and Trend (BFAST)

Jan.Verbesselt@wur.nl

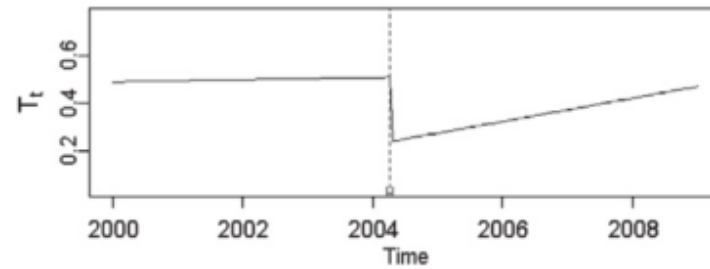


data

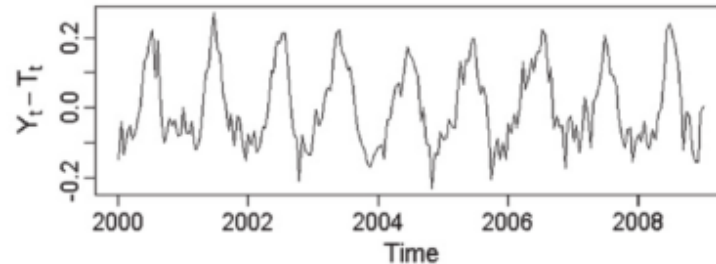
BFAST



seasonal



trend

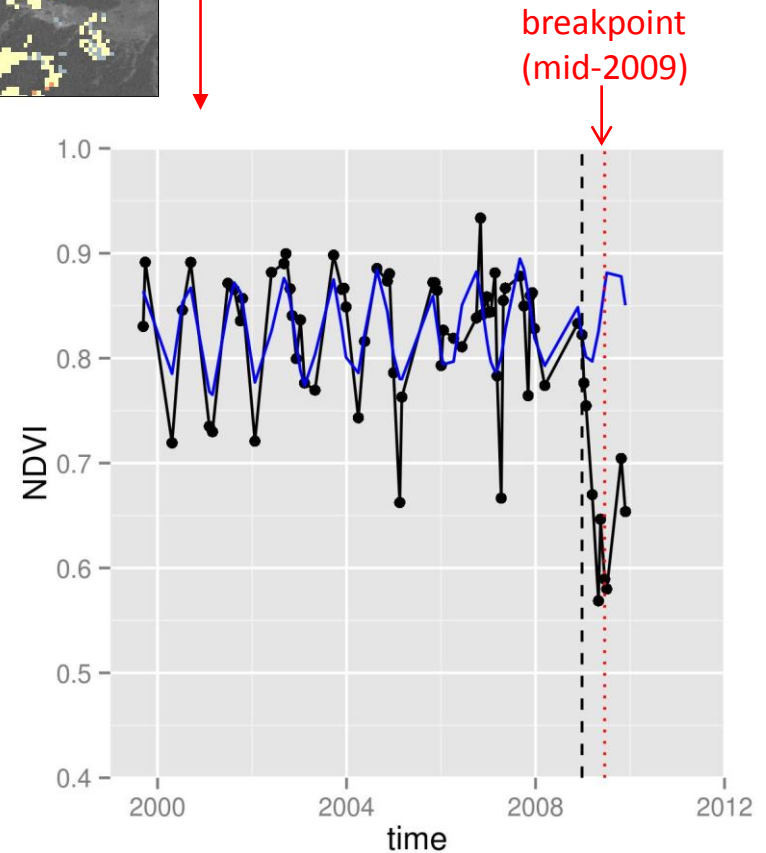
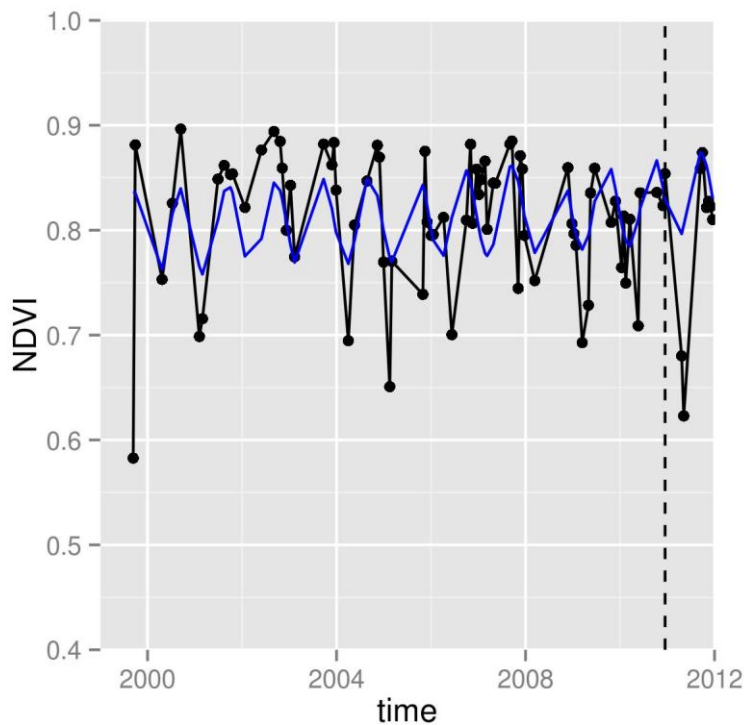
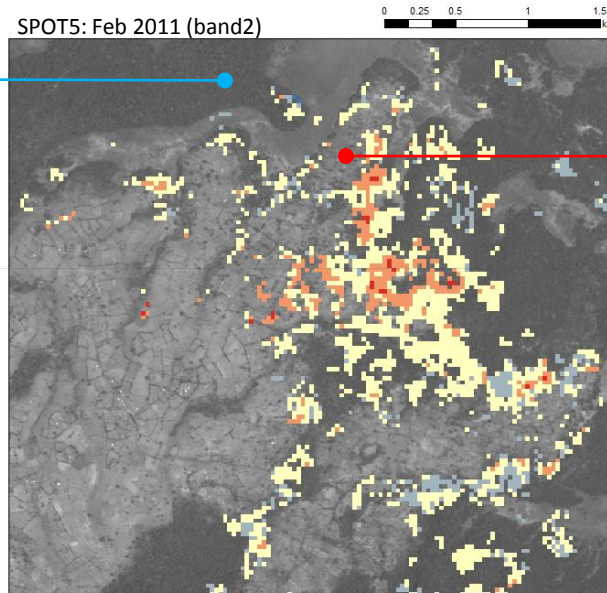


remainder

Analysis tuning

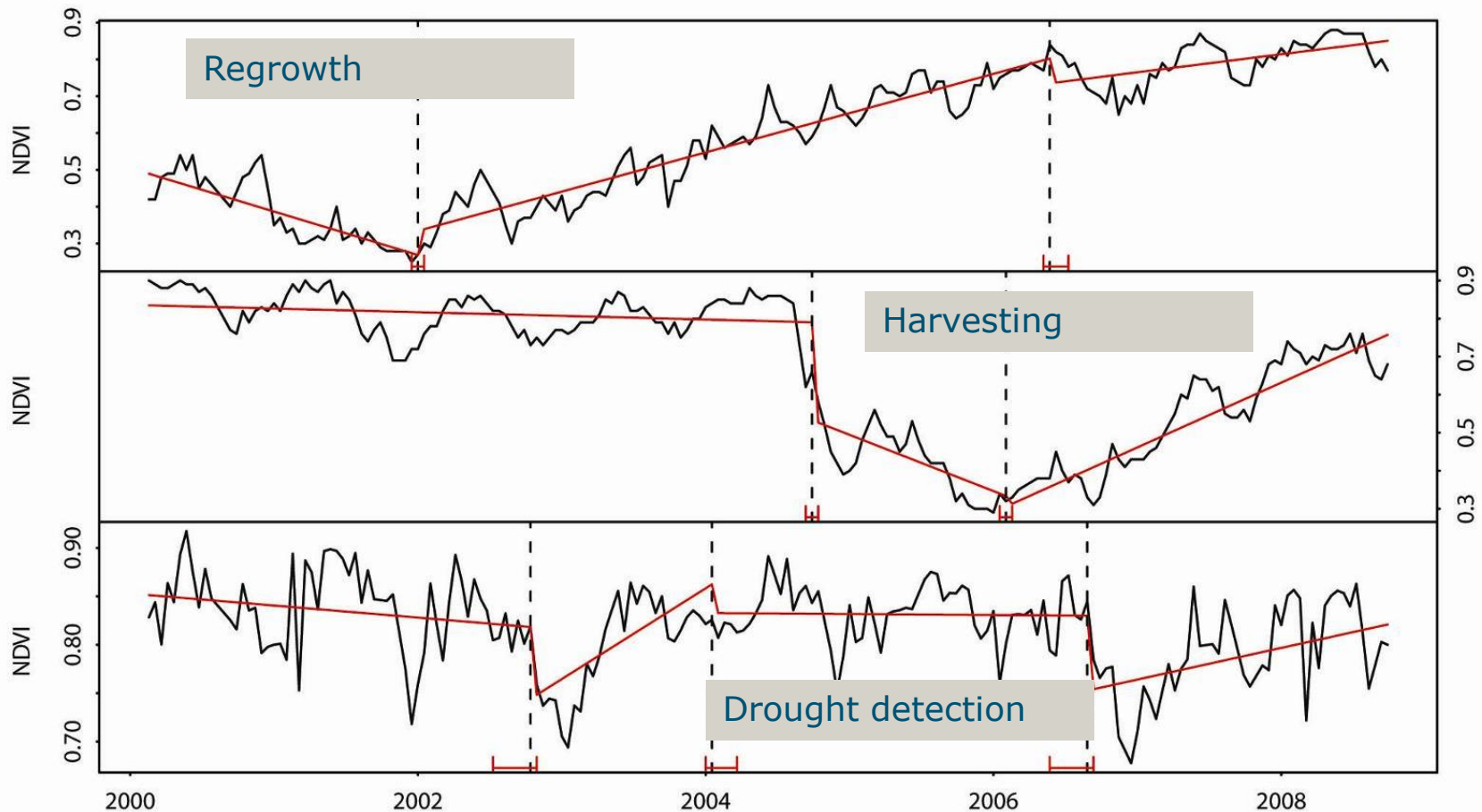
Benjamin.Devries
@wur.nl

Monitoring
Period:
2011-12



Breaks For Additive Season and Trend(BFAST)

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[@wur.nl](#)



Error source assessment

Michael.Schultz@wur.nl

Commission error of forest loss

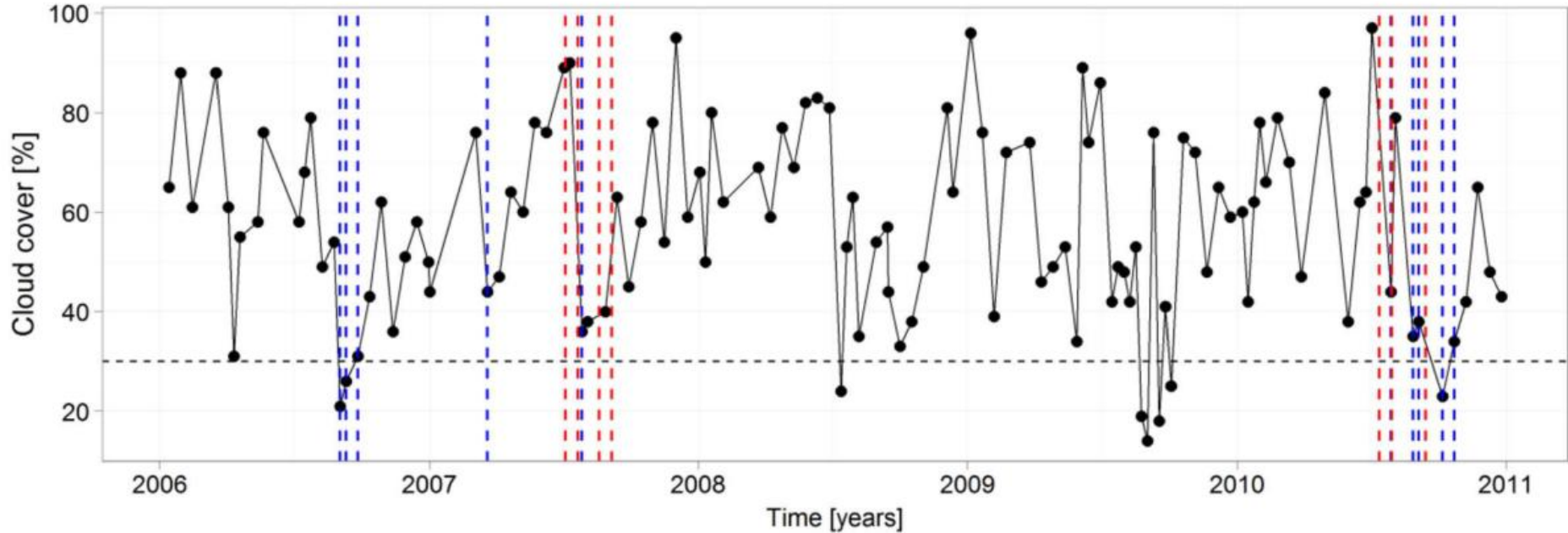
Domain	Brazil				Ethiopia				Vietnam				
	ATCOR2	ATCOR3	Ledaps	DOS	ATCOR2	ATCOR3	Ledaps	DOS	ATCOR2	ATCOR3	Ledaps	DOS	
<i>Data availability</i>	*1	-	-	-	-	-	-	0.1	0.3	0.4	0.3	0.3	
	*2	-	-	0.1	-	-	-	-	0.1	-	-	-	
<i>Atmosphere</i>	*3	-	-	0.1	-	-	0.1	0.1	0.1	0.1	0.1	-	
<i>Topography</i>	*4	-	-	0.1	-	-	-	-	-	-	-	-	
<i>Variance in data</i>	*5	0.5	0.6	0.5	-	-	0.1	0.1	-	-	-	-	
	*6	0.6	0.6	0.5	0.7	0.2	0.3	0.2	0.1	0.5	0.5	0.8	
<i>Edge effects*</i>	*7	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.3	0.2	0.3	
Prediction of error: R²		0.60	0.61	0.59	0.72	0.44	0.45	0.44	0.43	0.58	0.58	0.53	0.73
Commission error (%)		18.84%	19.45%	18.87%	41.89%	43.45%	43.01%	43.66%	60.34%	9.63%	9.41%	9.39%	32.24%

Omission error of forest loss

Domain	Brazil				Ethiopia				Vietnam				
	ATCOR2	ATCOR3	Ledaps	DOS	ATCOR2	ATCOR3	Ledaps	DOS	ATCOR2	ATCOR3	Ledaps	DOS	
<i>Data availability</i>	*1	-	-	0.1	0.1	0.1	0.1	-	0.1	0.1	0.1	0.1	
	*2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.1	0.1	0.1	
<i>Atmosphere</i>	*3	0.1	0.1	0.1	0.1	-	-	-	0.1	-	-	0.4	
<i>Topography</i>	*4	-	-	-	-	-	-	-	-	0.1	-	-	
<i>Variance in data</i>	*5	-	-	0.1	0.1	-	-	-	0.1	0.1	0.2	0.2	
	*6	0.1	0.1	0.1	-	-	-	-	-	0.1	0.3	0.3	
<i>Edge effects*</i>	*7	-	-	-	-	-	-	-	-	-	0.1	0.1	
Prediction of error: R²		0.07	0.11	0.14	0.07	0.20	0.19	0.19	0.34	0.29	0.46	0.43	0.75
Omission error (%)		12.01%	9.28%	9.53%	61.39%	18.12%	19.15%	15.73%	52.48%	17.65%	15.56%	17.78%	8.15%

Significance codes:

*** p < 0.0001
** p < 0.001
* p < 0.01
not significant



--- Radar observations

Biomass measurements

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[@wur.nl](mailto:Kim.Calders@wur.nl)

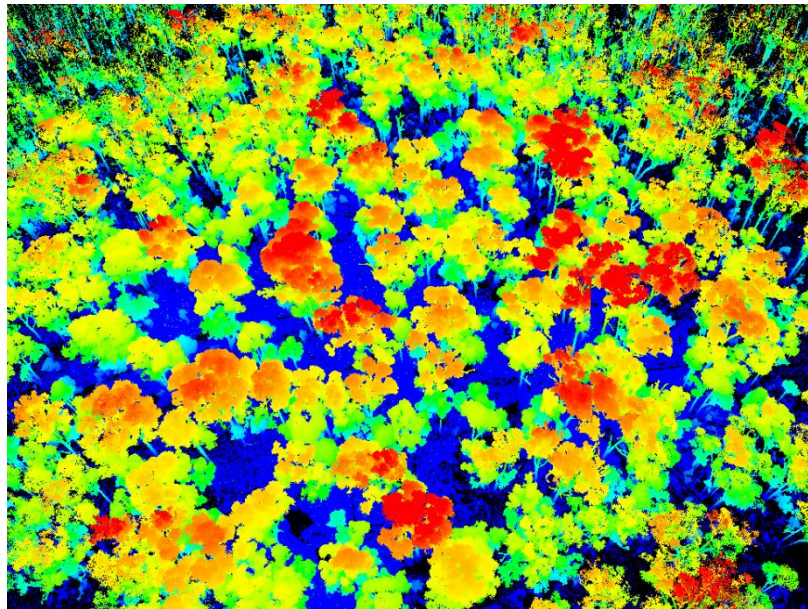
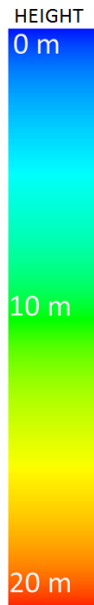
- show recent TLS video

Study areas & Data collection

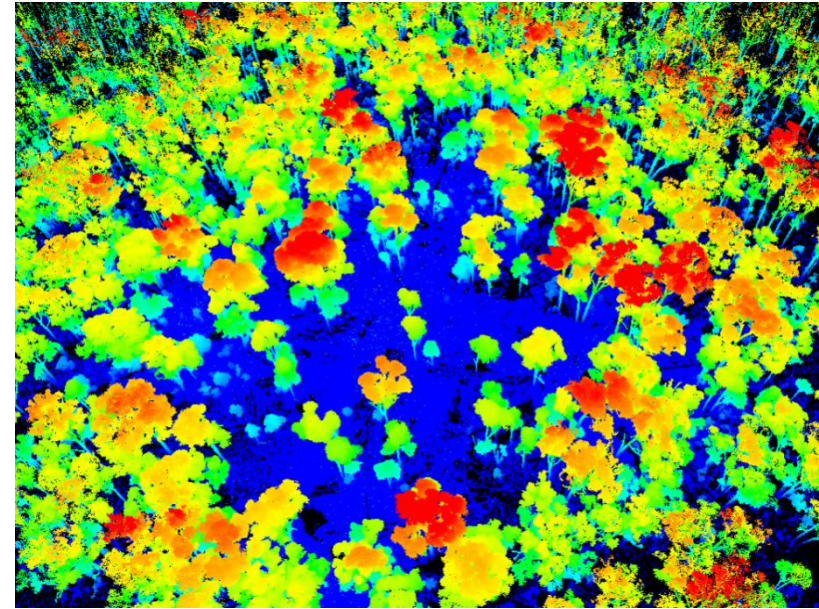
RIEGL VZ-400 TLS:

- multiple returns (up to 4)
- Fast: 1m30s / scan
- R^2 of 0.96 (vs. destructive measurements)

Pre-harvest



Post-harvest

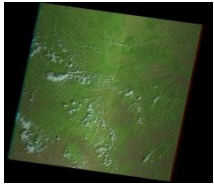


Rushworth, plot 7

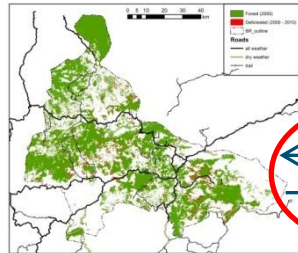


Integrating Data Streams

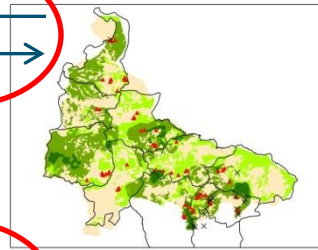
Earth Observation
time series data



Activity data



Cross-validation
& integration

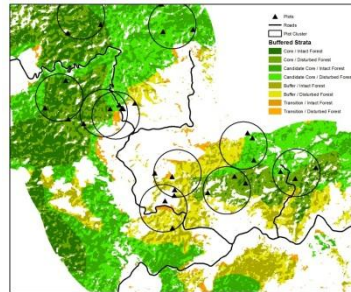


"Real Time" Monitoring

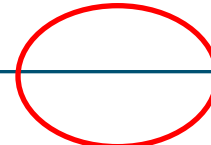
Local Ranger Data
(GPS, forms)



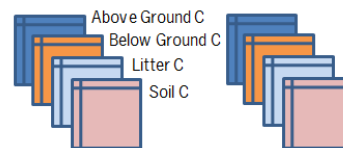
Emission factors



Targeted
Sampling



Forest inventory
data



C stock changes over time

Forest change
processes



Implementation
activities (REDD+)



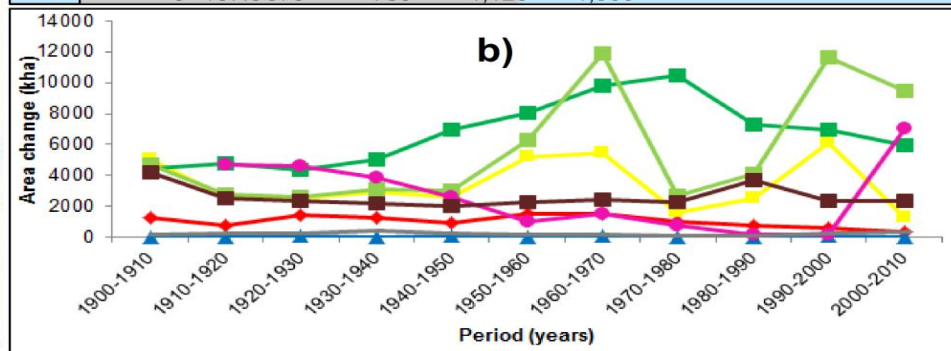
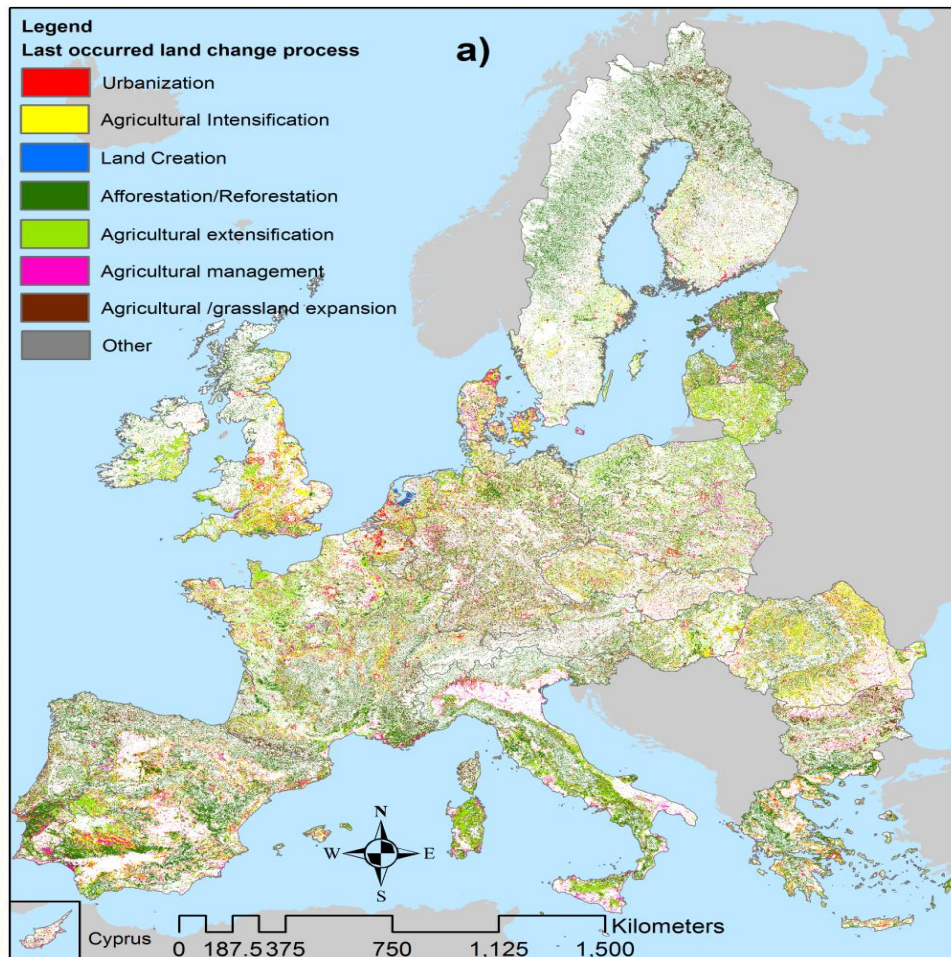
Arun.Pratihast@wur.nl

Measuring, Reporting &
Verification

Land Cover Change

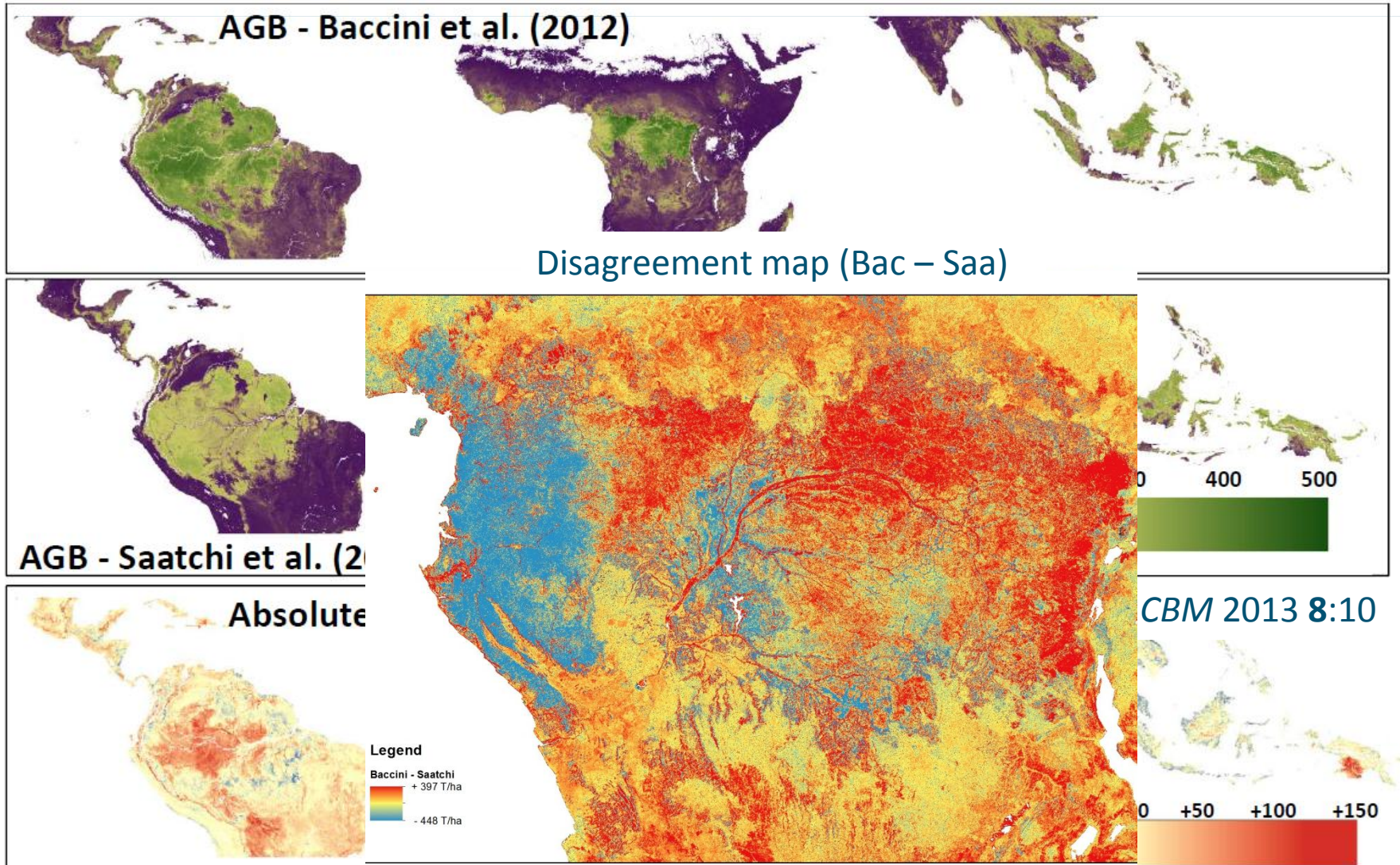
Richard.Fuchs@wur.nl

- Topic:
- Reconstruction of historic land changes in Europe and their impact on the climate (1900 – 2010)
- Area: Europe, @1 km res.
- Key findings
 - Double the amount of detected changes compared to any other historic reconstruction model (incl. climate report)
 - Assessment of land change processes



Availability & disagreement in pan-tropical biomass maps

Valerio.Avitabile@wur.nl



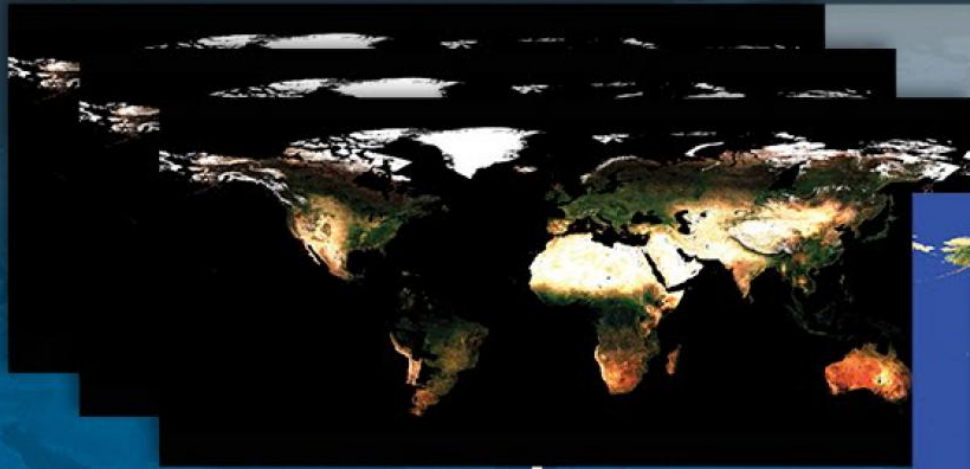
Collaborate with us !

- **Change detection and monitoring (BFAST):**
<http://bfast.r-forge.r-project.org/>
<https://github.com/dutri001/bfastSpatial>
[http://www.wageningenur.nl/en/Expertise-Services/Chair-groups/Environmental-Sciences/Laboratory-of-Geoinformation-Science-and-Remote-Sensing/Research/Integrated-land-monitoring/Change detection and monitoring.htm](http://www.wageningenur.nl/en/Expertise-Services/Chair-groups/Environmental-Sciences/Laboratory-of-Geoinformation-Science-and-Remote-Sensing/Research/Integrated-land-monitoring/Change%20detection%20and%20monitoring.htm)
- **WU terrestrial LIDAR scanning research:**
<http://www.wageningenur.nl/en/Expertise-Services/Chair-groups/Environmental-Sciences/Laboratory-of-Geoinformation-Science-and-Remote-Sensing/Research/Sensing-measuring/WU-terrestrial-Laser-Scanning-Research.htm>
- **GOFC-GOLD REDD sourcebook:**
<http://www.gofcgold.wur.nl/redd>

ESA – Climate change initiative

A new generation of satellite-derived global land cover products

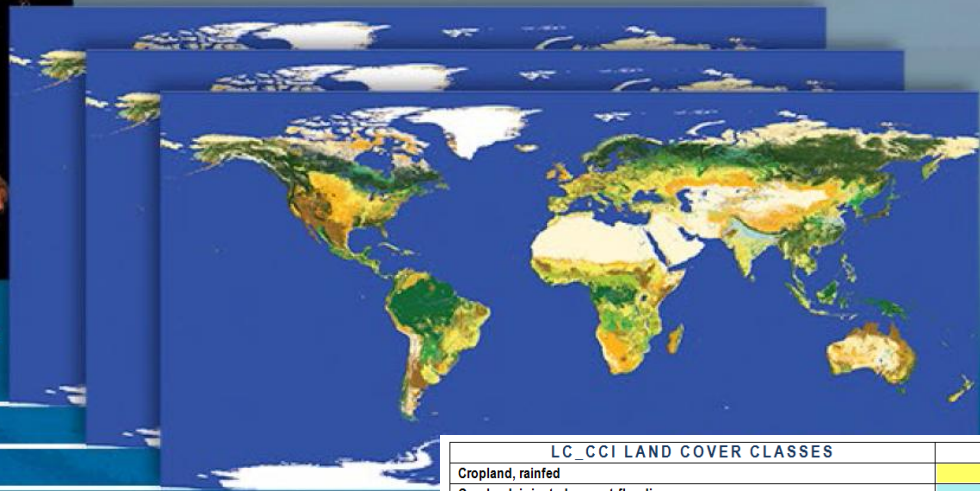
- 7-day composites time series of MERIS Full and Reduced Resolution over the whole archive (2002-2012)



CCI LC processing →

- 3 consistent global LC maps

1998-2002
2003-2007
2008-2012



LC_CCI LAND COVER CLASSES	
Cropland, rainfed	
Cropland, irrigated or post-flooding	
Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)	
Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (<50%)	
Tree cover, broadleaved, evergreen, closed to open (>15%)	
Tree cover, broadleaved, deciduous, closed to open (>15%)	
Tree cover, needleleaved, evergreen, closed to open (>15%)	
Tree cover, needleleaved, deciduous, closed to open (>15%)	
Tree cover, mixed leaf type (broadleaved and needleleaved)	
Mosaic tree and shrub (>50%) / herbaceous cover (<50%)	
Mosaic herbaceous cover (>50%) / tree and shrub (<50%)	
Shrubland	
Grassland	
Lichens and mosses	
Sparse vegetation (tree, shrub, herbaceous cover) (<15%)	
Tree cover, flooded, fresh or brakish water	
Tree cover, flooded, saline water	
Shrub or herbaceous cover, flooded, fresh/saline/brakish water	
Urban areas	
Bare areas	
Water bodies	
Permanent snow and ice	

Envisat MERIS Full & Reduced Resolution	2002-2012	300-1000m
SPOT-Vegetation 1 & 2	1998-2012	1000m
Envisat ASAR	2005-2012	Mainly Wide Swath Mode (150m)

ESA – Climate change initiative

- Recognized expertise on land cover over large areas
- If you are interested in joining the experience, contact Sophie.Bontemps@uclouvain.be
- GOFC-GOLD team Brice.Mora@wur.nl

Overview of Ongoing research projects

Donor	Ongoing research projects
EU	FP7 RECOVER: Science based remote sensing services to support REDD and sustainable forest management in tropical region (2010-14)
EU	FP7 GEOCARBON: Operational Global Carbon Observing System (2011-14)
EU	FP7 ROBIN: Role of biodiversity in climate change mitigation (2011-15)
EU	FP7 GHG Europe: Greenhouse gas management in European land use systems (2010-13)
EU	Marie Curie (IRG) – StrucCHANGE: Assessing vegetation structural change by integrating terrestrial lidar data and satellite image time series via radiative transfer models
WU	Ground based LIDAR for Remote Sensing Cal/Val (2010-14)
NORAD	CIFOR Global Comparative Study on REDD (2010-15)
ESA	Land cover CCI - global Land Cover ECV monitoring(2010-13)
Gov. of Norway	MRV support for the Government of Norway's International Climate and Forest Initiative (2010-13)
NABU	REDD+ monitoring and implementation at Ethiopia Kafa UNESCO reserve (2010-13)
BMBF	Land Use and Climate Change interactions in the Vu Gia Thu Bon River Basin/Central Vietnam - LUCCi (2010-2015)
Google	Near real-time global deforestation monitoring

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THANK YOU

Michael.Schultz@wur.nl

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