GlobBiomass WP5000
Regional Biomass Estimation

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GlobBiomass User Workshop
September 2017
FAO, Rome

Regional mapping

- The regional products are intended to provide the best possible estimates of biomass over a varied set of forest types for 2005, 2010 and 2015, as well as estimates of biomass change between epochs.
- Regional teams will use all data available and expertise from their respective regions
- These products will provide a reference against which the global product, which will be a single map for 2010, can be assessed.
- For all products a crucial second type of product will be maps describing the accuracy of the products.

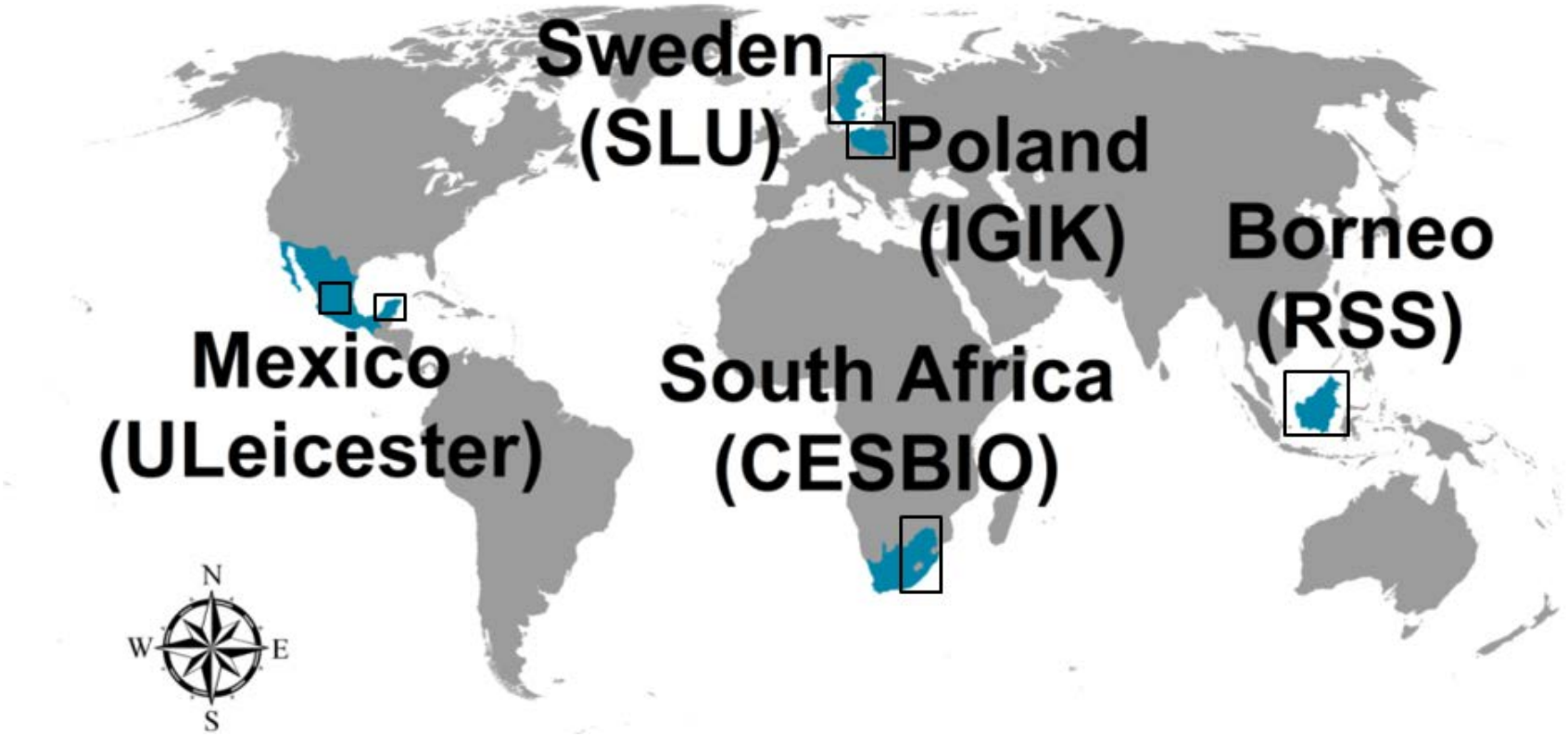
Progress Task 5

Activities / Deliverables	Dates	Progress
DA1 Product Development Method document to ESA	June/September 2015	✓
Guidelines on uncertainty and accuracy assessment for regional partners working note (input into D5 Validation protocol)	June/November 2015	✓
Regional algorithm developers meeting – Leicester	September 2015	✓
DA1 Input into the Algorithm Theoretical Basis Document	October 2015	✓
First versions of D11 Biomass 2010 epoch products	November 2015	✓
Submission D11 deliverable + readme file to ESA	December 2015	✓
Users Workshop & Second PM, feedback and way forward	February 2016	✓
Regional Mapping Issues – Videoconference	June 2016	✓

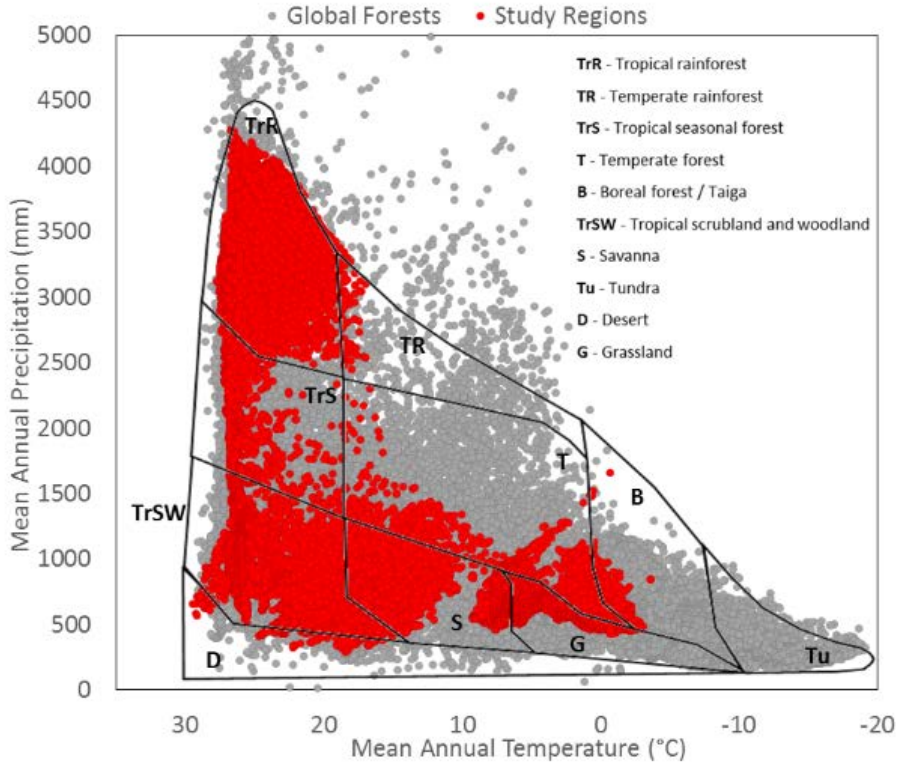
Progress Task 5

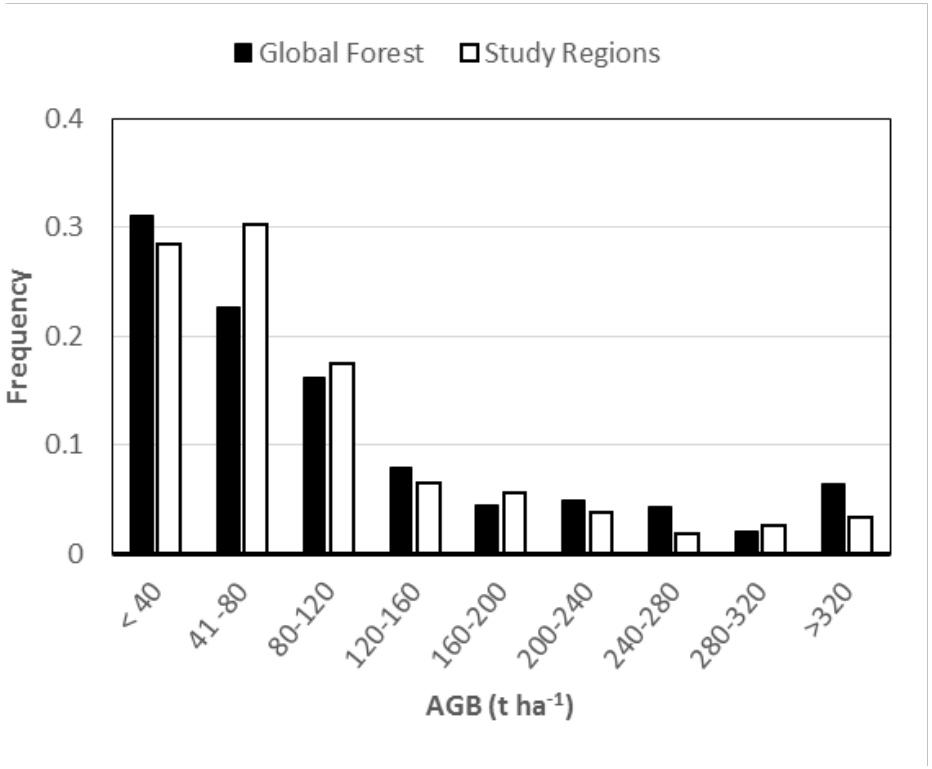
Activities / Deliverables	Dates	Progress
D12 Biomass 2000/2005 products	October 2016	✓
Round Robin light	March-April 2017	✓
D13 Biomass 2015 products	August 2017	✓
D14 Change maps	September 2017	
D15 Uncertainty Characterization	September 2017	

Study Areas


Sweden
(SLU)
Poland
(IGIK)
Borneo
(RSS)
Mexico
(ULeicester)
South Africa
(CESBIO)
N
W
E
S

Study Areas


Global Forests
Study Regions
TrR - Tropical rainforest
TR - Temperate rainforest
TrS - Tropical seasonal forest
T - Temperate forest
B - Boreal forest / Taiga
TrSW - Tropical scrubland and woodland
S - Savanna
Tu - Tundra
D - Desert
G - Grassland
TrR
TR
TrS
T
B
TrSW
S
G
D
Tu
Mean Annual Precipitation (mm)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
30
20
10
0
-10
-20
Mean Annual Temperature (°C)


Global Forest
Study Regions
Frequency
0.4
0.3
0.2
0.1
0
< 40
41 -80
80-120
120-160
160-200
200-240
240-280
280-320
>320
AGB (t ha-1)

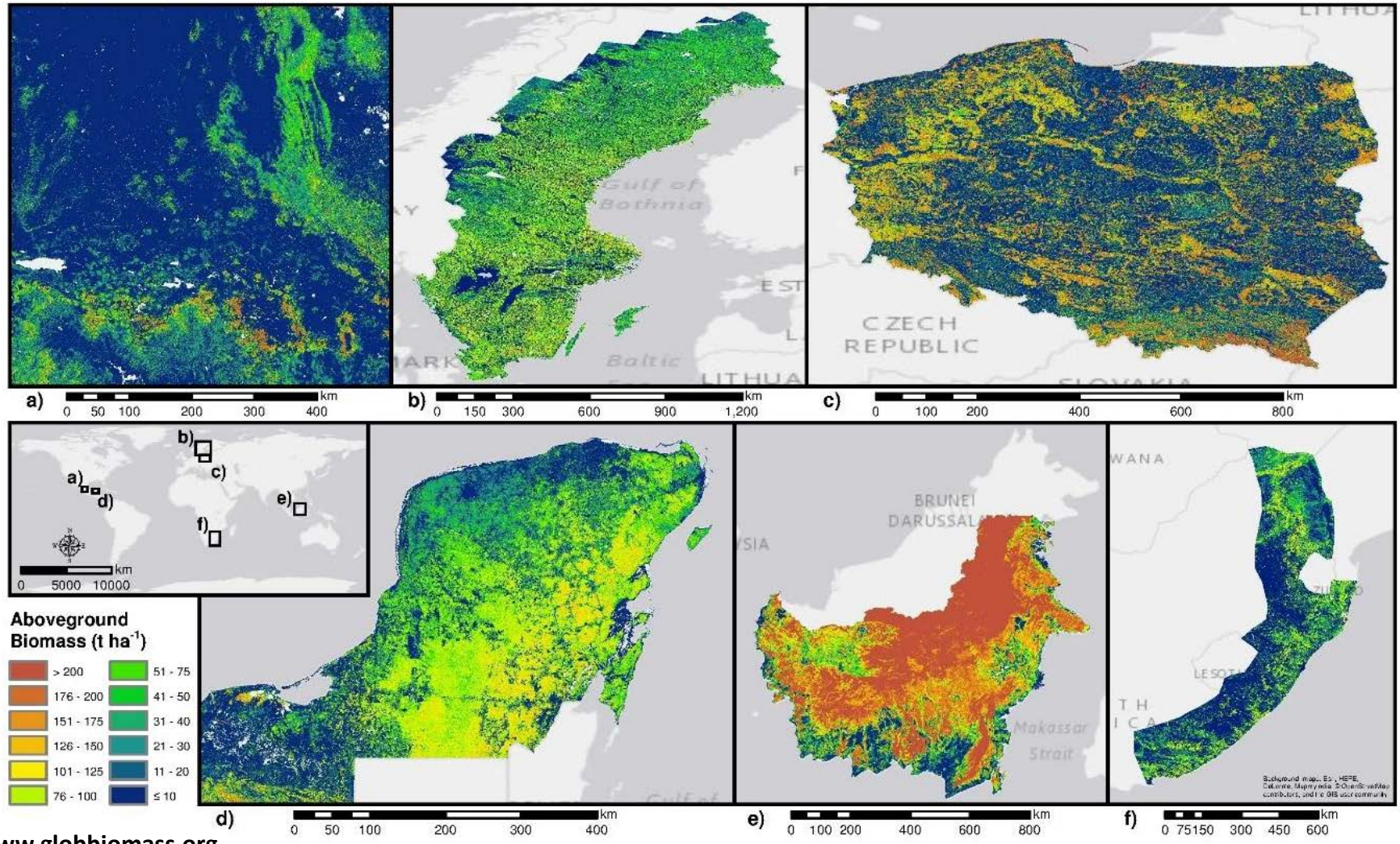
Regional Methods

Regional Map	Method	Reference data
Kalimantan Indonesia	Multiple Linear Regression	Field plots / LiDAR
Eastern South Africa	Bayesian inversion WCM + MIPERS	Field plots
Sweden	kNN / BIOMASAR-L	Field plots
Central Mexico & Yucatan peninsula	MaxEnt	Field plots
Poland	Random Forest	Field plots

Spatial Datasets

Regional Map	2005/07	2010	2015
Kalimantan Indonesia	ALOS PALSAR	ALOS PALSAR	ALOS-2 PALSAR-2, Sentinel-1
Eastern South Africa	ALOS PALSAR, Landsat PTC, SRTM	ALOS PALSAR, Landsat PTC, SRTM	ALOS-2 PALSAR-2, Landsat PTC, SRTM
Sweden	SPOT 4 and SPOT 5 / ALOS PALSAR	SPOT 4 and SPOT 5 / ALOS PALSAR	ALOS-2 PALSAR-2
Central Mexico & Yucatan peninsula	ALOS PALSAR, Landsat 7 & PTC, SRTM	ALOS PALSAR, Landsat 7 & PTC, SRTM	ALOS-2 PALSAR-2, Landsat 8 & PTC, Sentinel-1, SRTM
Poland	ALOS PALSAR mosaic, SRTM, Landsat 5	ALOS PALSAR mosaic, SRTM, Landsat 8	Sentinel-1, Sentinel-2, SRTM

AGB Epoch Maps



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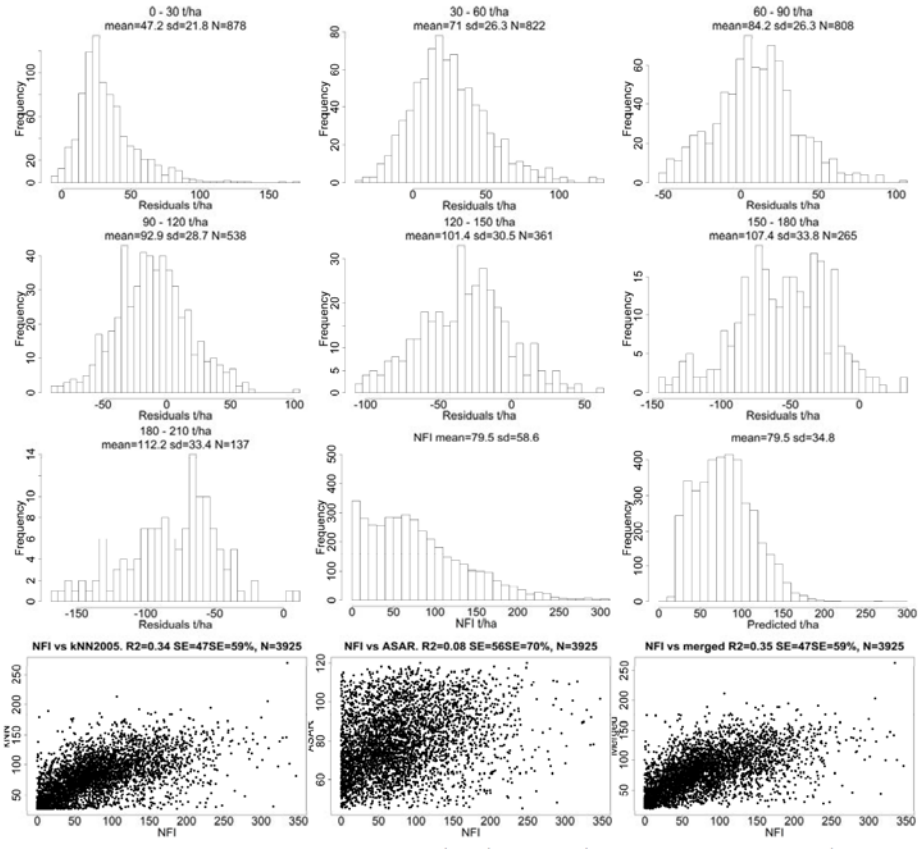
Validation

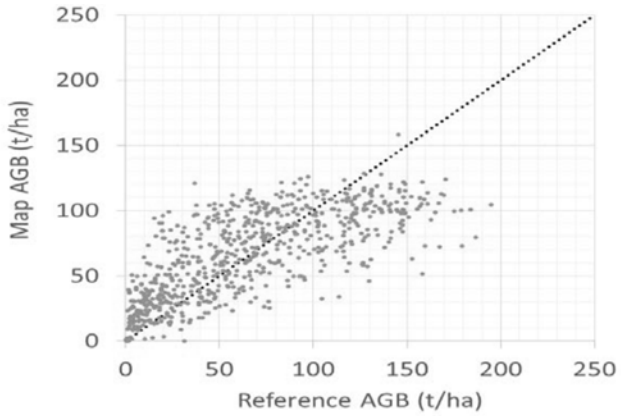
Example: Sweden

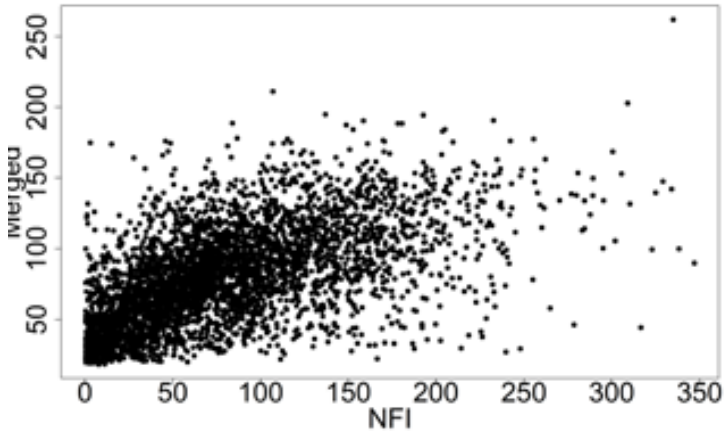
- Validation of AGB stratified by AGB class
- Bias varies with AGB class:
  - Low biomass has a positive bias
  - High biomass has a negative bias

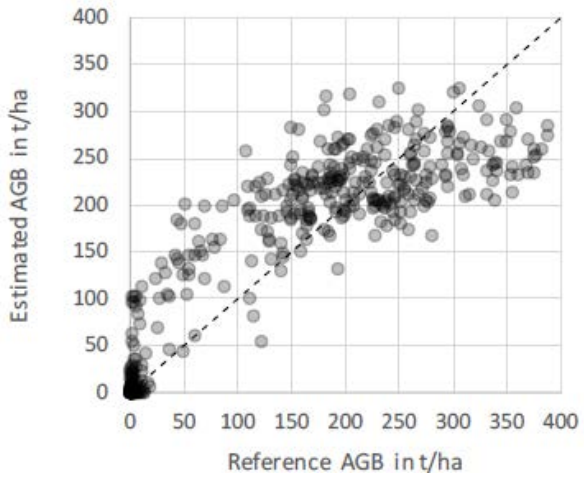
2005 epoch							
AGB classes (t/ha)	n	Average estimated AGB (t/ha)	Average reference AGB (t/ha)	RMSE (t/ha)	R^2	SD(error) (t/ha)	Bias (t/ha)
0-30	878	47	14	40	0.06	22	33
30-60	822	71	45	38	0.06	26	26
60-90	808	84	74	28	0.02	26	10
90-120	538	93	104	31	0.03	29	-11
120-150	361	101	134	45	0.00	31	-33
150-180	265	107	164	66	0.00	34	-57
180-210	137	112	193	87	0.00	33	-81
Overall	**3,925**	**80**	**80**	**29**	**0.35**	**29**	**0**

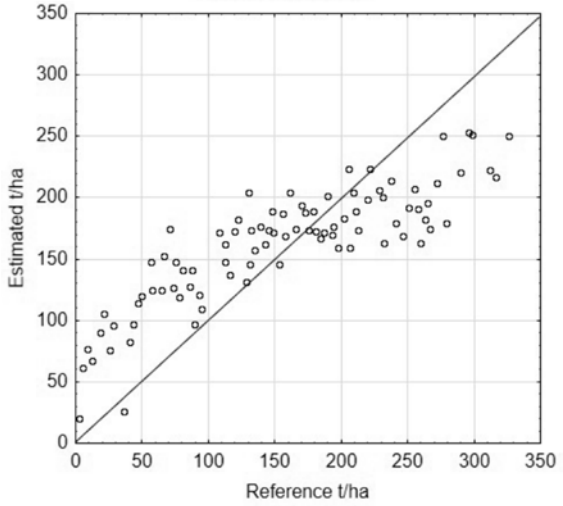


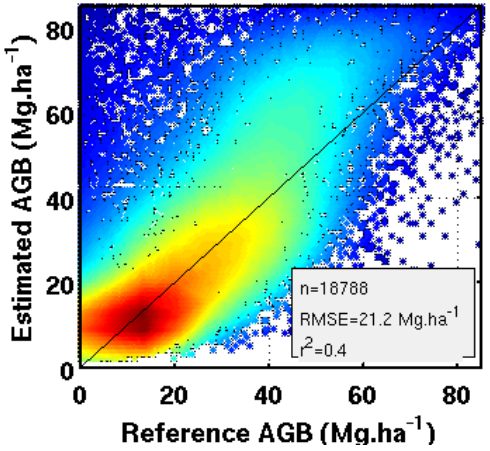
Bias on AGB estimation



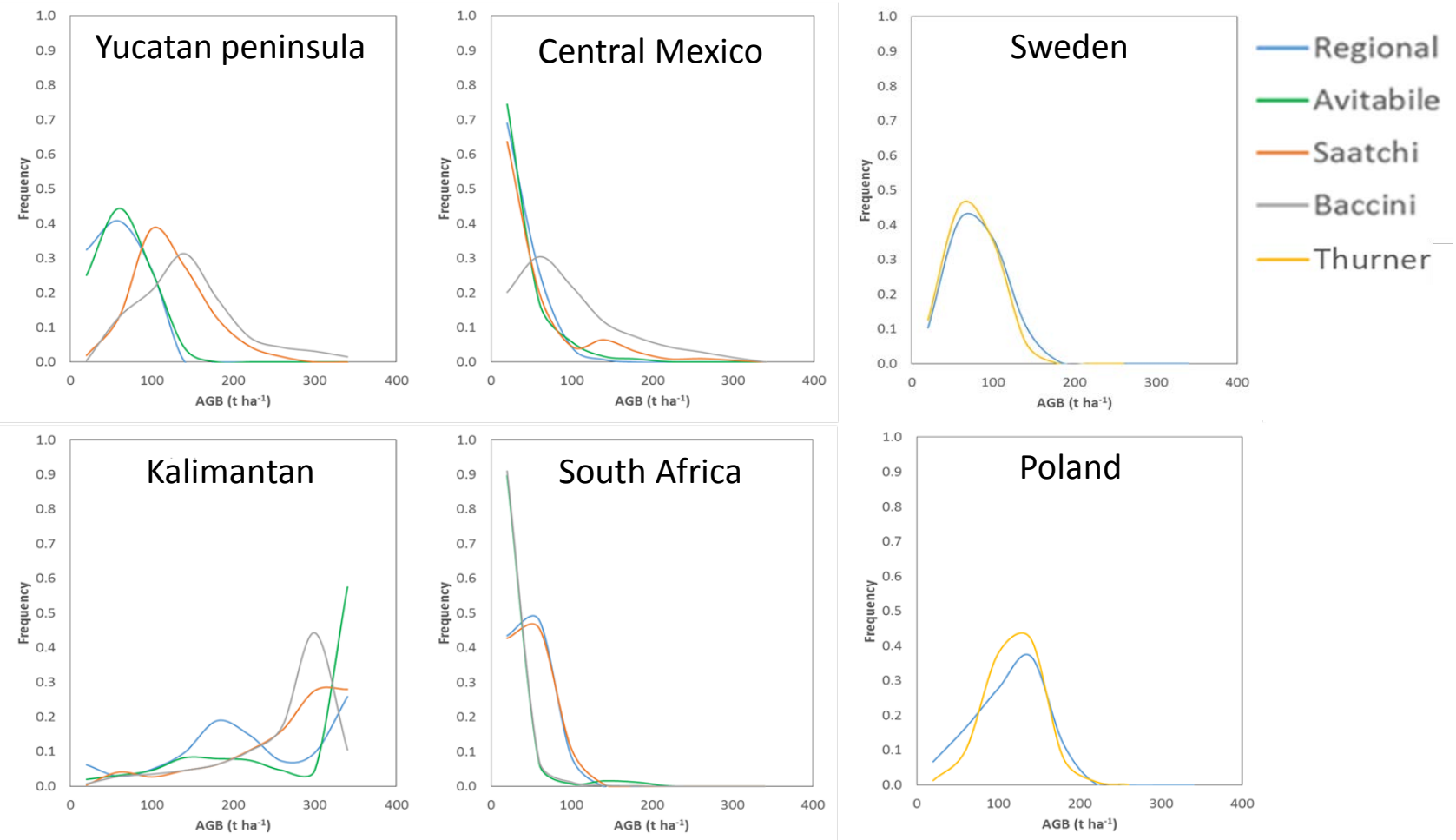




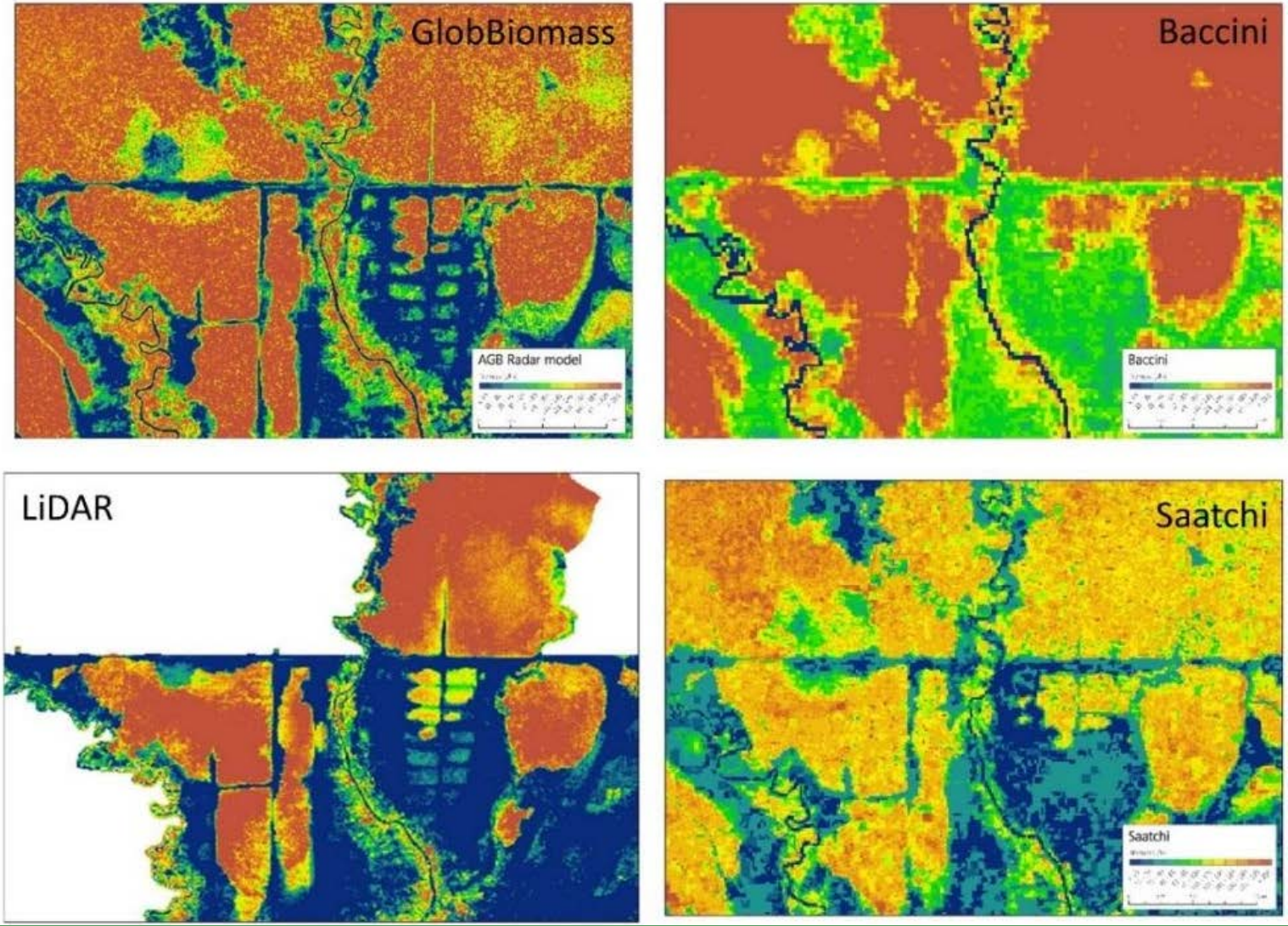




Comparison to global products



Comparison to global products



Example: Kalimantan, Indonesia

Conclusions & Outlook

- AGB maps for epochs 2005/07, 2010 & 2015 are available for all study regions
- Regional experts are contributing to improve the AGB maps
- Different methods for regional-scale forest biomass estimation give reasonable results, but present differences with previous global products
- All regional case studies chose radar and multispectral imagery, augmented sometimes by geomorphometric data from a DEM
- Some algorithms are 'data-hungry' and need hundreds or thousands of training sites (field plots), while others can be run with smaller training datasets
- A challenge for global biomass mapping is the regionally unbalanced availability of forest inventory plot data
- The AGB maps underestimate high AGB levels while low AGB levels are overestimated (due to signal saturation, etc)
- Uncertainty maps and biomass change maps are being completed

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