K&C Phase 3 – Brief project essentials

Coupling radar-based estimates of forest information with biosphere models for improved carbon flux estimation

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Collaborators

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Project background

Quantification of ecosystem carbon pools is instrumental in determining the sensitivity of ecosystem fluxes to its driving forces, hence contributing to improved estimates of ecosystem carbon fluxes.

Biogeochemical models have been considered a robust approach for addressing these topics.

Models use a suite of observational data for modelling and parameterization. Contribution of remote sensing: spatial fields of biophysical parameters

ALOS PALSAR can provide valuable information on carbon pools:

- high resolution (actually VERY DETAILED for this type of application)

- decent accuracy (probably more than decent from the perspective of the user)

Project rationale

Integration of ALOS PALSAR satellite observations for biomass retrievals aims at bridging the gap between relevant spatial scales.

At the moment, models employ coarse-scale representation of biomass (kilometric scale). The improvements in carbon fluxes can be quite significant when accounting for finer spatial scale information,

Most significant improvements are expected in more heterogeneous regions, such are biome transition areas or areas where intense disturbance occurs.

Project objectives

The goals of this new K&C project are to:

- exploit JAXA's yearly mosaics of forest cover and time series of PALSAR image data to obtain high-quality estimates of forest parameters,
- provide biomass estimates to be fed into ecosystem models in correspondence of a number of sites with flux measurements to assess improvement in modelling (→ addressing carbon cycle science)
- support JAXA by evaluating SAR and forest datasets w.r.t internally produced datasets. Product merging (synergy) not excluded..

Project areas

	Name	Country	Lat (deg) Min/max	Long (deg) Min/max	Flux towers
1	Sweden	Sweden	55/70	10/24	3b, 4b
2	West Finland	Finland	21/26	60/63	2b
3	Krasnoyarsk Kraj	Russia	55/63	87/94	1b
4	Central Germany	Germany	50/53	9/15	1te, 2te, 3te, 4te
5	Para'	Brazil	0/-5	-57/-49	1tr, 2tr, 3tr
6	Rondonia	Brazil	-14/-8	-67/-59	4tr, 5tr

Project schedule – biomass map and assessment of C fluxes

Original (based on start in 2011 and end in 2015)

- April 2012: Sweden and west Finland
- April 2013: Krasnoyarsk Kray and Central Germany
- April 2014: Para' and Rondonia
- April 2015: Refined version for all areas

Updated (after signature of contract, data provision by JAXA, end in 2014 and clearer funding situation)

- March 2013: Sweden and west Finland
- July 2013: Krasnoyarsk Kray and Central Germany
- November 2013: Para' and Rondonia
- March 2014: Refined version for all areas

Project milestones

Definition of forest biomass retrieval algorithm: completion foreseen at the end of 2012.

Support to JAXA's global forest mapping effort

Forest products

Comparison of JAXA's forest cover and biomass base products against

- pan-boreal biomass map based on C-band SAR data
- biomass estimates derived from PALSAR data obtained through this project
- suite of biomass and land-cover datasets gathered within the framework of several currently ongoing research projects

Support to detect anomalies in mosaic data (SAR) is also provided.

Valuable information on data pools …. (remember the Russian Topo DEM?)

GEO-Wiki

Reference:http://www.earthzine.org/2012/06/09/observing-forest-biomass-globally/

Support to JAXA's global forest mapping effort

The PI does not own at the moment ground-truth data that can be shared.

As alternative, provision of several data layers (value added products) for verification and validation of JAXA's forest products has been proposed

- On ground measurements of forest parameters at Fluxnet sites
- Global DEM (3 arcsec): blend of SRTM, Russian topo maps, Canadian DEM and USGS DEM (Alaska), GTOPO-30
- Pan-boreal map of forest growing stock volume for year 2010
- Biomass maps produced within this project

Further datasets already provided by Co-Investigators through related K&C projects.

Deliverables

For each of the study areas, the following will be delivered

- A forest biomass map based on multi-temporal strip and on mosaic data.
- Improved/revised JAXA forest/non-forest and biomass maps. Deliverable consists of a stack of layers including EO-based land-cover and forest parameters.
- Results from integration model-data (following the generation of the biomass maps)
- Yearly feed-back to JAXA on quality of their products

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Data requested

- PALSAR mosaics of FBD data at 25 m

  - for understanding the basis for the derivation of the PALSAR base maps by JAXA

  - for setting up the biomass retrieval algorithm with L-band data

  - data shared with other K&C projects

- PALSAR K&C strip data (FBD and, if available, ScanSAR)

  - One year of data (year: 2010) for multi-temporal retrieval of biomass

NOTE: data sharing with Co-Is of this project

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Status-quo of data

- PALSAR mosaics of FBD data at 25 m
  - Ordered and delivered (in August) for all study areas
- PALSAR K&C strip data (FBD and, if available, ScanSAR)
  - Ordered (in May), delivery still pending
- JAXA forest products not yet received
- Data layers to be used for this study are ready or available in almost final format

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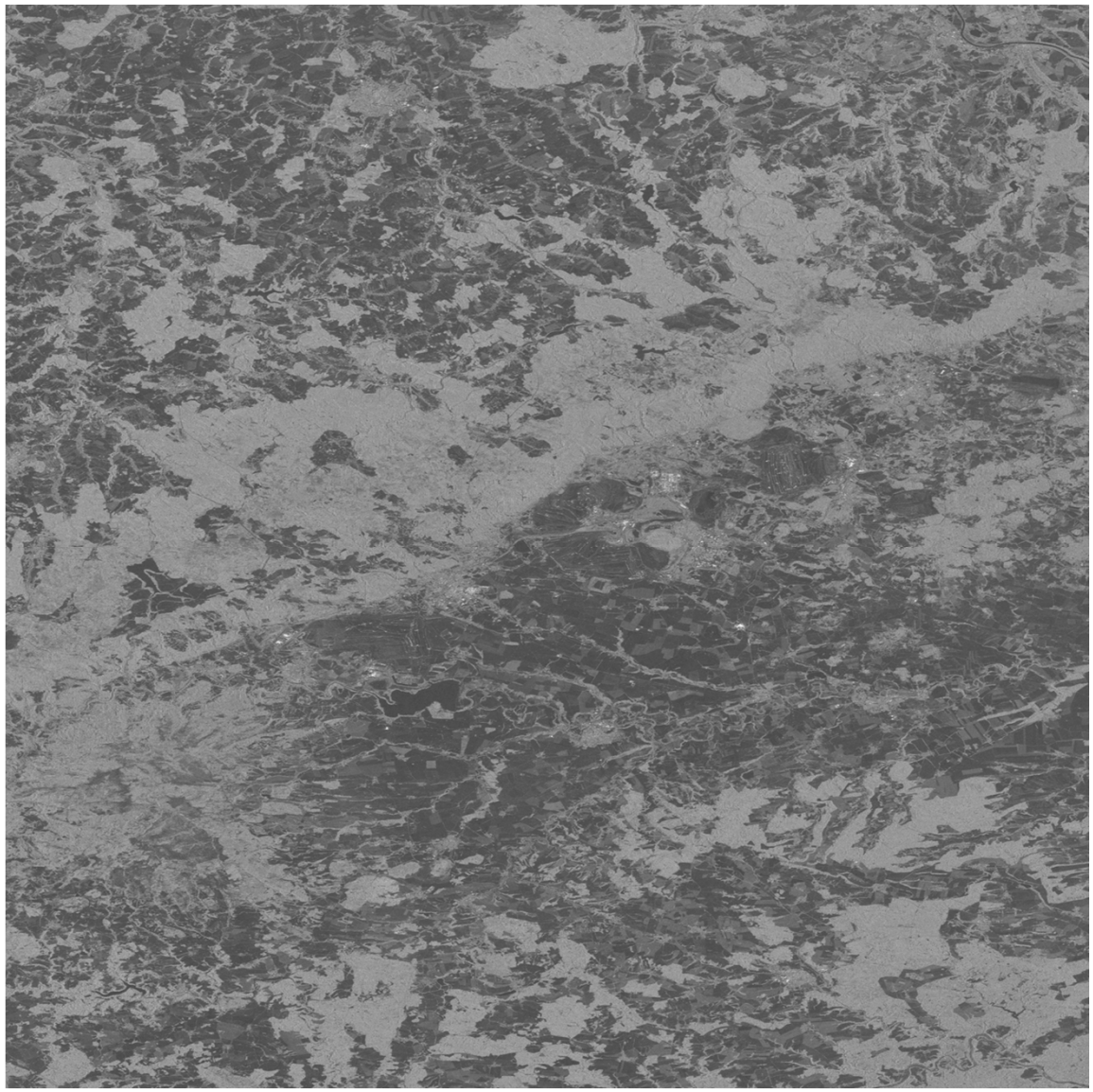
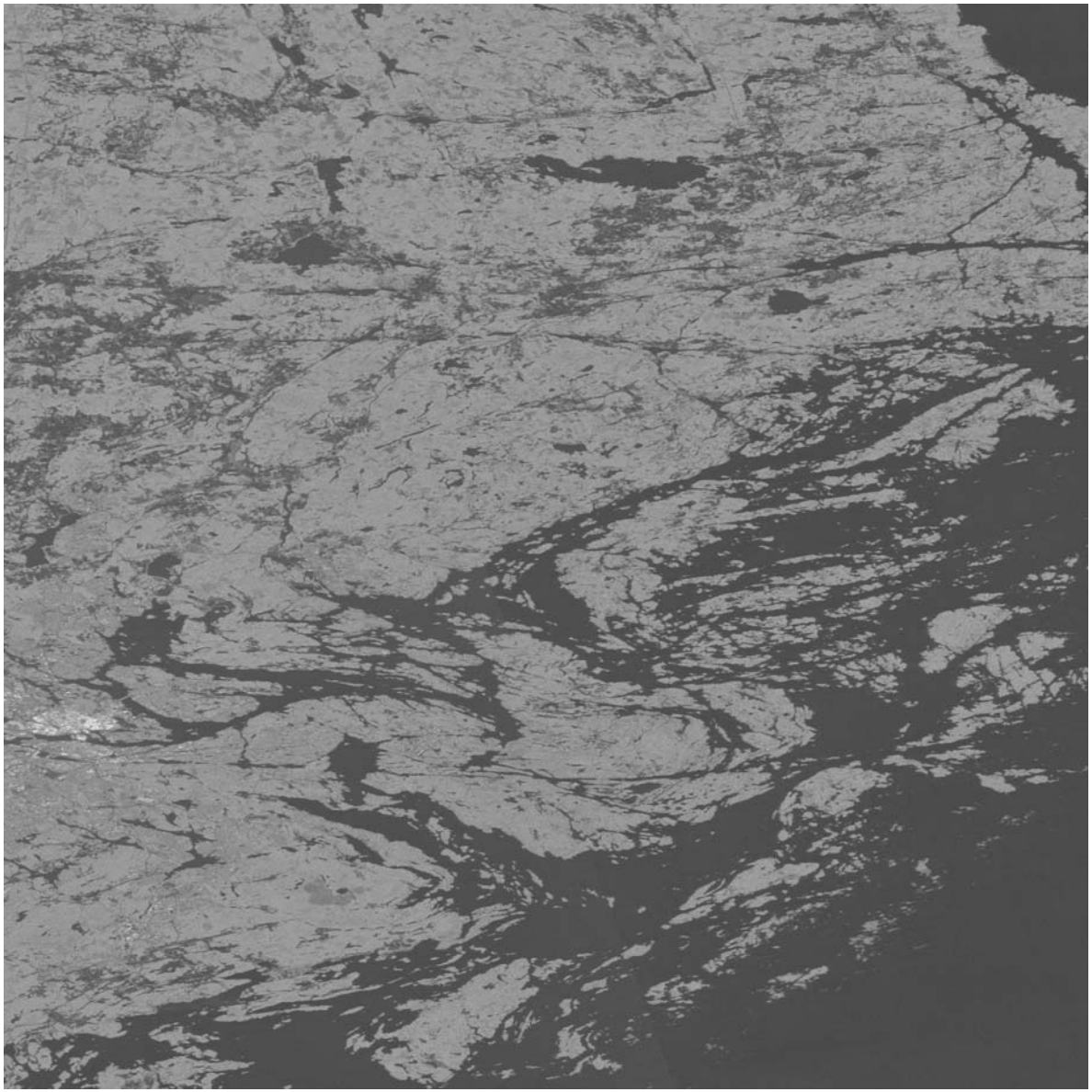


Check of SAR mosaic

- N51E13 (Germany)
- Quality high
- No visible artefacts



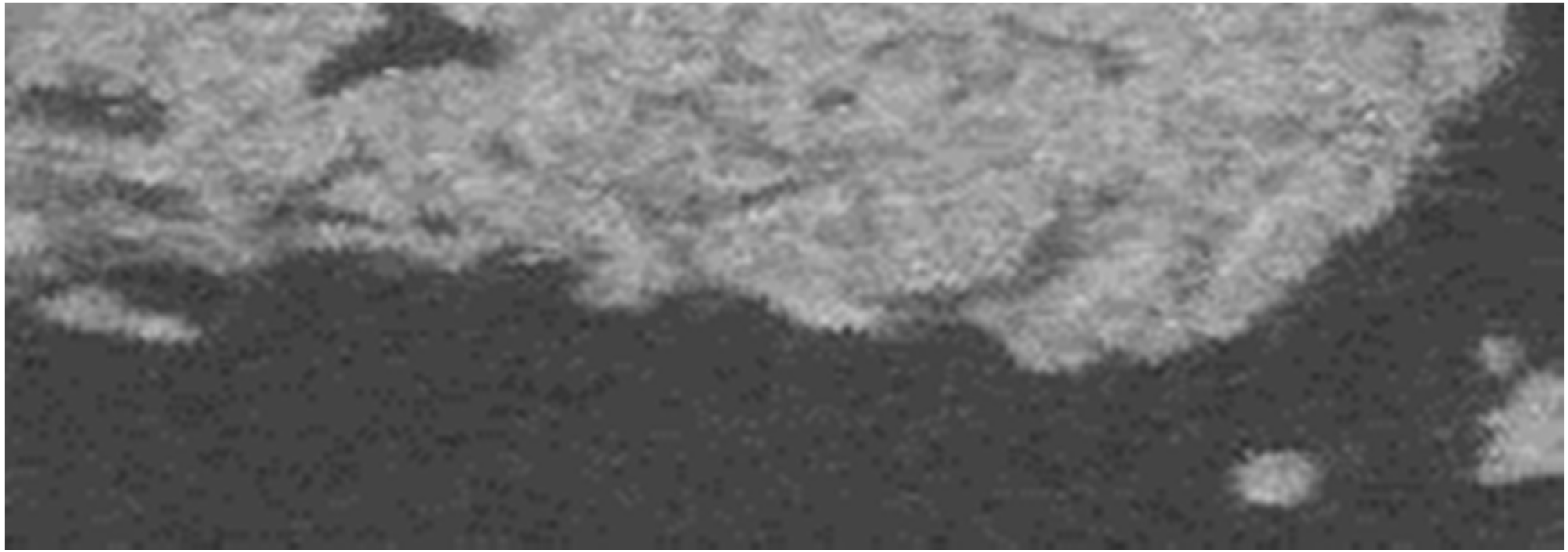
Check of SAR mosaic

- N60E18 (Sweden)
- Quality high
- Fuzzy shorelines

Sawtooth-like features along shorelines andcoastlines

More evident in the N-S direction

Particularly evident at higher latitudes



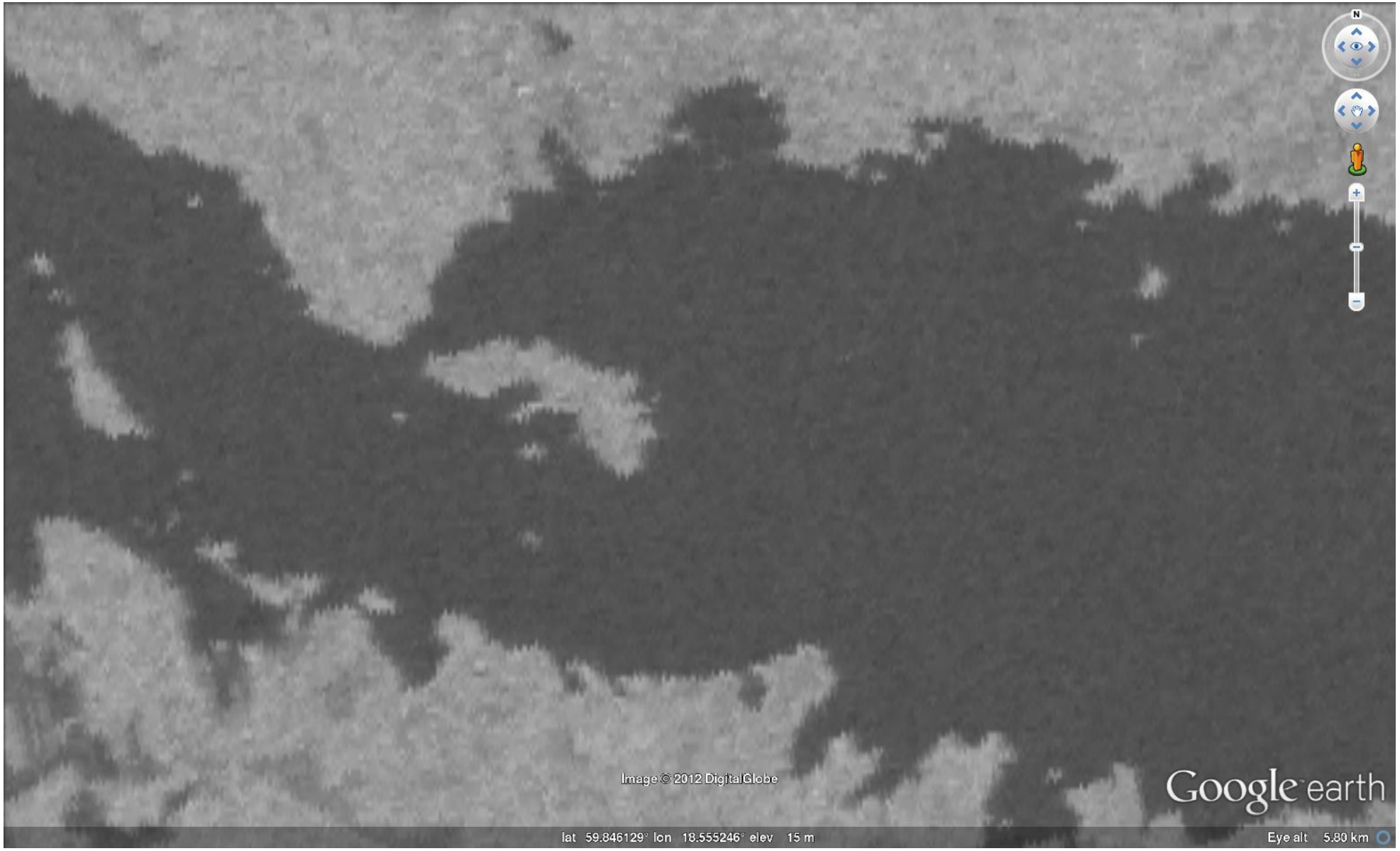
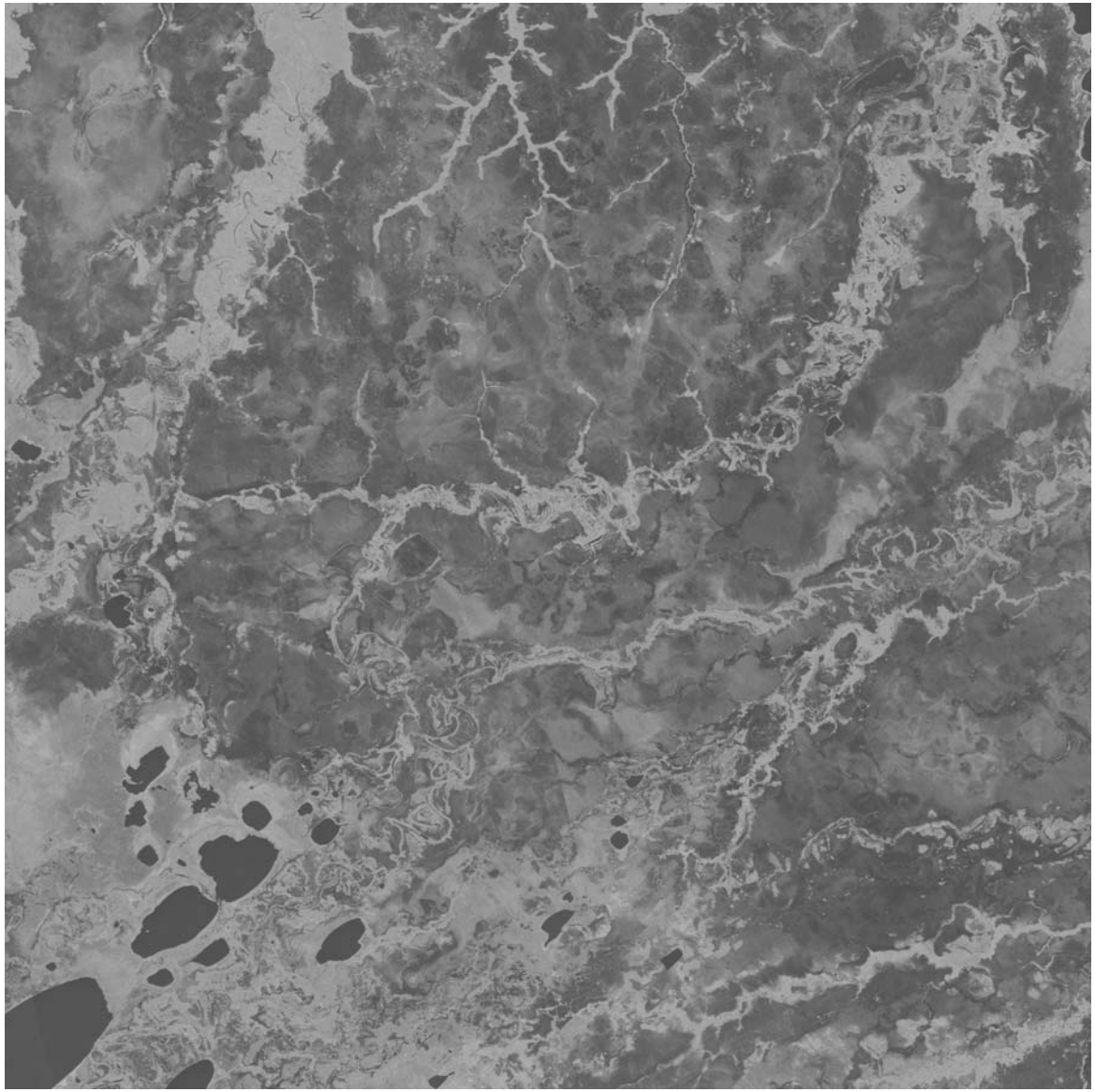
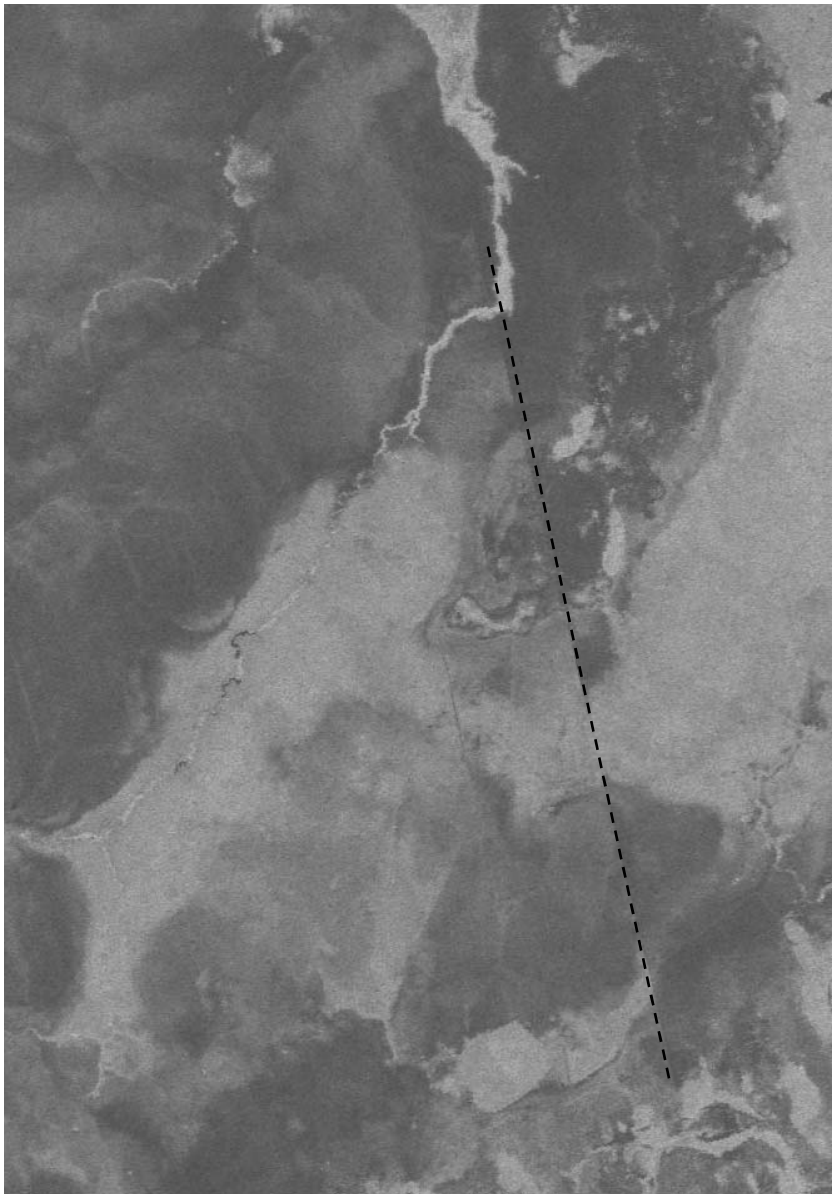


Image © 2012 DigitalGlobe
Google earth
lat 59.846129° lon 18.555246° elev 15 m
Eye alt 5.80 km



Check of SAR mosaic

- S13E67 (Brazil)
- Quality high
- Striping

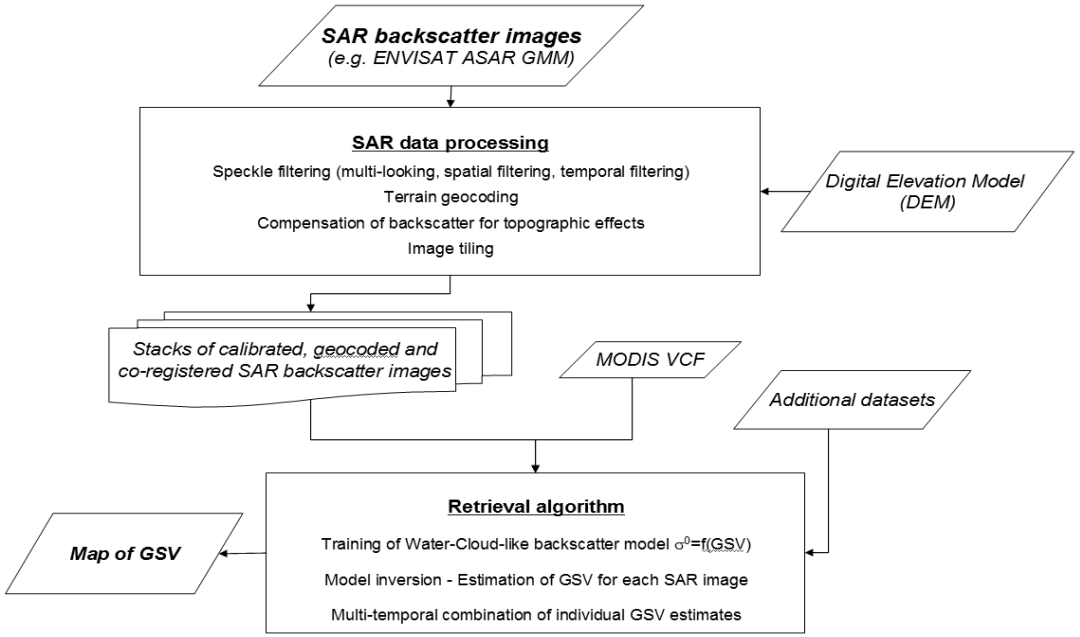


Striping effect stretches along the mosaic for about one third of the image

No evident reason why it affects only part of the mosaic and not the entire track length (assuming long strips being mosaiced)

GSV/AGB retrieval - BIOMASAR algorithm

- Algorithm exploits large datasets of SAR backscatter to estimate GSV (growing stock volume)
- Currently tuned to C-band, co-pol, 1 km, Envisat ASAR backscatter measurements
- Started adapting it to high-res, L-band, dual-.pol backscatter data
- Conversion of GSV to AGB using factors based on allometry (M. Thurner, MPI-BGC)

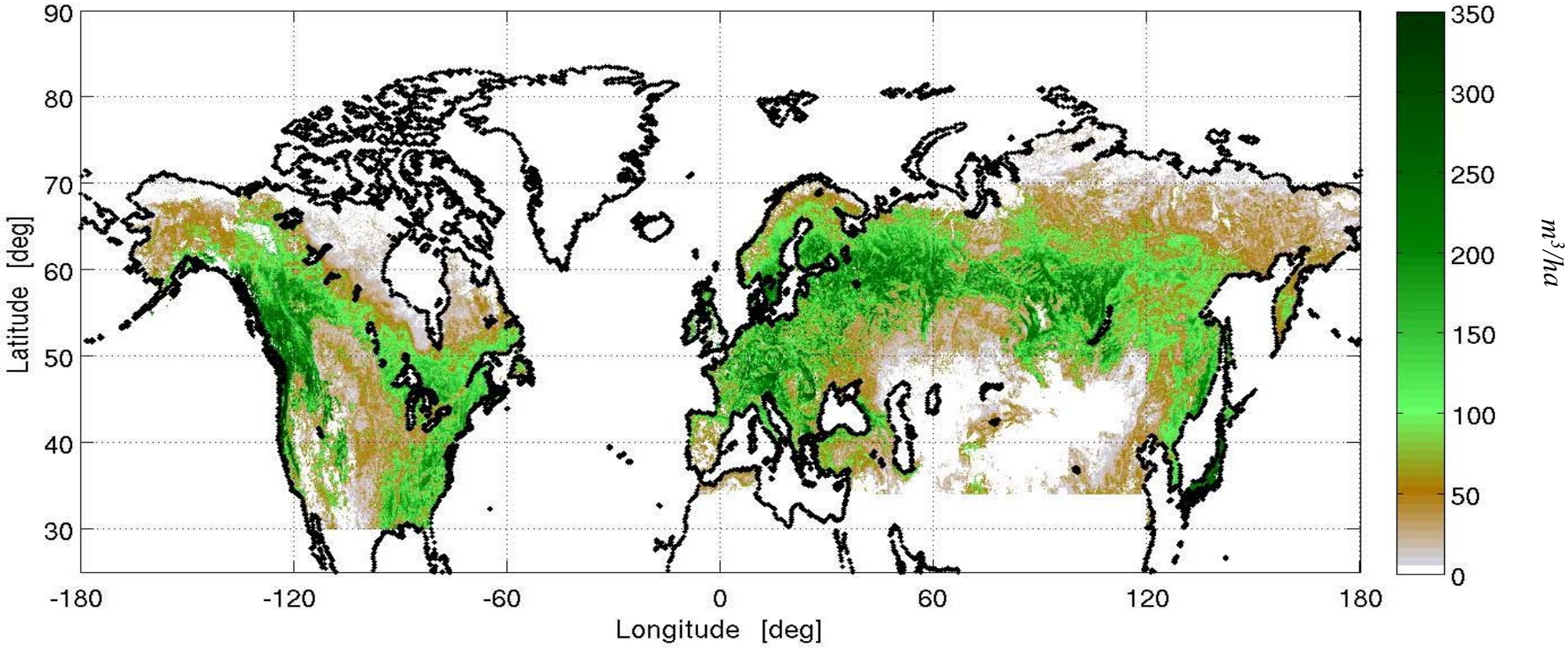


ALOS

K&C Initiative

An international science collaboration led by JAXA

Pan-boreal GSV estimate for year 2010 – Envisat ASAR



Based on 75 m and 500 m freely available Envisat ASAR ScanSAR data

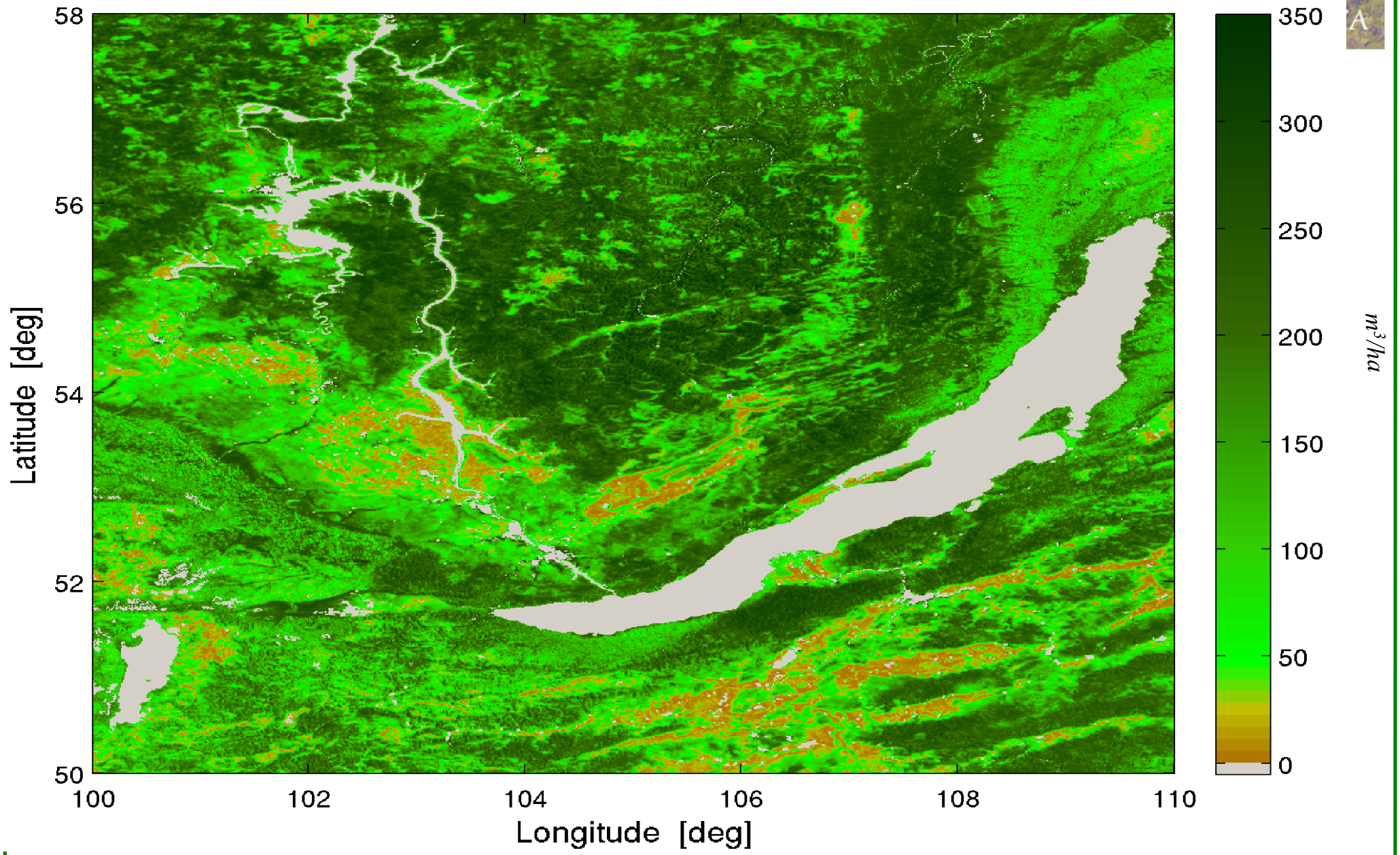
Scaling used to enhance contrast: GSV between 0 and 671m³/ha

Non-forest classes according to GlobCover Land Cover have been masked out

biomasar

support to science element

Forest GSV retrieved from Envisat ASAR



Summary and future outlook

- This project had a slow start but will catch up
- Reasons for delay
  - Unclear funding situation (now solved)
  - Delayed data delivery
- Mosaic data checked for quality, some issues reported at this meeting
- Biomass retrieval algorithm has been adapted to high-res L-band PALSAR data. Tests will follow as soon as the PALSAR strip data become available.
- Project team will share all datasets as soon as they are in final format

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