SIBERIA II and NORTH

A project funded by the European Commission

Christiane Schmullius
FSU Jena, Germany

Status June 2005

SIBERIA-II Objective:

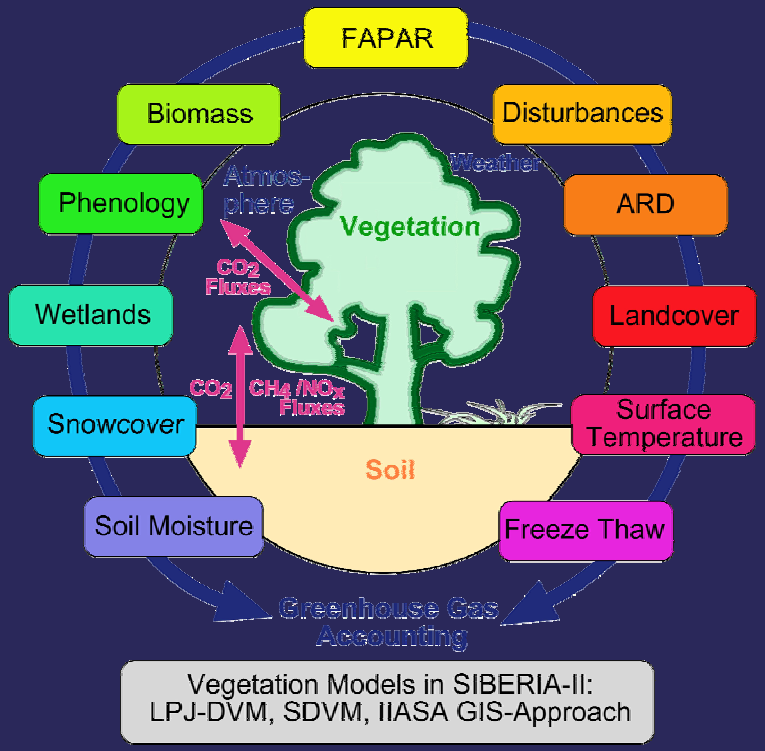
Develop multi-sensor concepts for Greenhouse Gas Accounting of Northern Eurasia

Project Region 3.2 Mio sqkm N-S transect to prepare climate change scenarios for the pan-boreal belt

Operational EO-Products for Greenhouse Gas Accounting

Greenhouse Gas Parameter = EO Product	Parameter Synergies	Main Sensor Operational!	Sensor Synergies (incl. Up- & Downsscaling) Improvement!	Source Years for SIBERIA-II	Pixel Size
ARD (only testsites)	Disturbances Landcover	Landsat TM	Multitemp. AVHRR ASAR ; JERS-1	90 vs. 2000	25m to 2km
Biomass	None	None	SIBERIA(-1) Map ASAR AP and repeat-pass coherence; NDVI (97-03)	1997/8 (Envisat03 / 04)	50m to 8km
Disturbances	ARD Landcover SnowCover	SPOT VGT	SIBERIA(-1) Map Multitemp. ASAR; AVHRR; ATSR-2, MODIS, MERIS	1990-2002, 2003 on a monthly basis	300m to 1km
FAPAR + LAI		MODIS	AVHRR, MERIS, VGT	2002, 2003	1km to 10km
Phenology	Landcover Snow Cover	MODIS	ASAR WS, AVHRR, MERIS?, SSM/I, VGT	98-03	1km to 10km
Freeze/ Thaw	Snow Extent Phenology, (Permafrost)	Quickscatt	(ASAR WS), MODIS, MERIS	1999-ongoing	(75m to) 10km
Land cover	Disturbances Waterbodies Biomass Phenologoy	MODIS	AATSR ASAR WS MERIS	2001-2004	300m to 1km
Snow Depth & Date of Snowmelt	Landcover Phenology	SSM/I	MODIS VGT	1988-02	1km to 25km
~~**Soil-moisture**~~ **(not operational)**		Scatterometer	ASAR WS	92-2000	25km
~~**Wetlands**~~ **Waterbodies**	Landcover (Permafrost)	ASAR WS	SSM/I	2004 (2003/04)	75

Lessons learned



Most important information from integrated Climate Change Earth System Observation :

Landcover and change,
Spatial-temporal wetland dynamics,
Above- ground biomass & long term changes.

Data availability

- Good EO data availability given existing technological capabilities
- Problems are repetition rates and long-term continuity
- In-situ data for validation severely missing

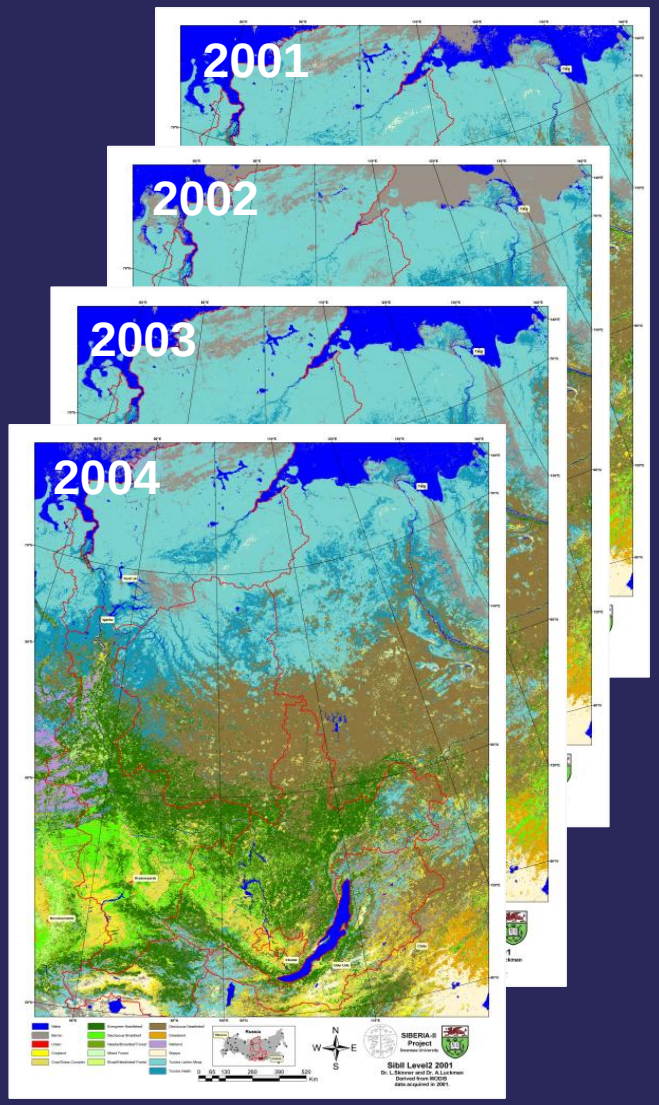
Data linkage

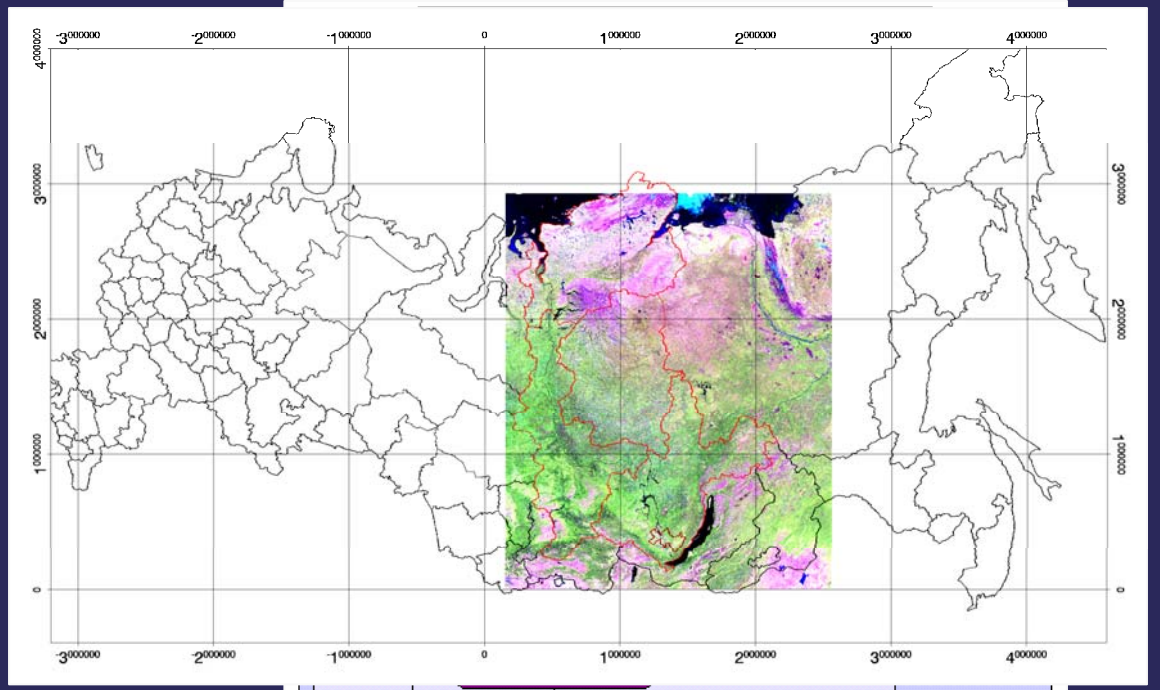
- Data integration with model attributes and spatial units not performed for all parameters due to missing in-situ information
- Interdisciplinary linkage of data and models is still ongoing

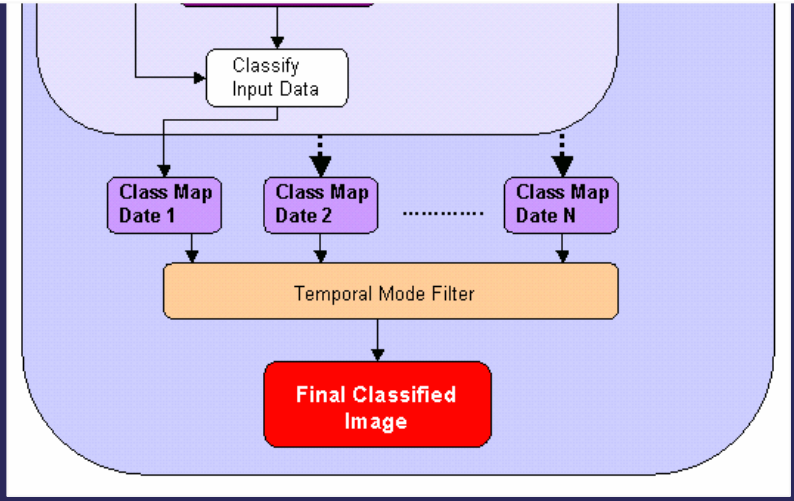
Data policies

- Results based on cost free EO data and availability of in-situ information
- All products will be made available
- Open data policy is essential!

SIBERIA II land cover product



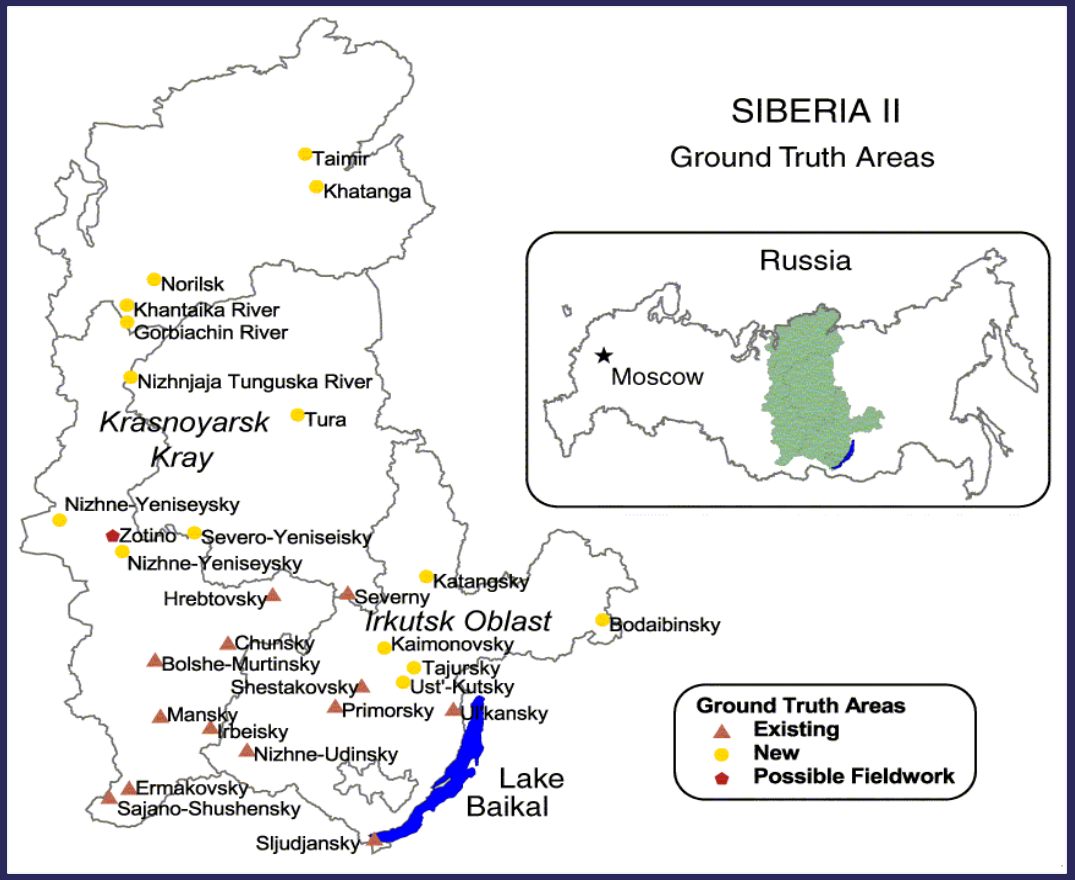




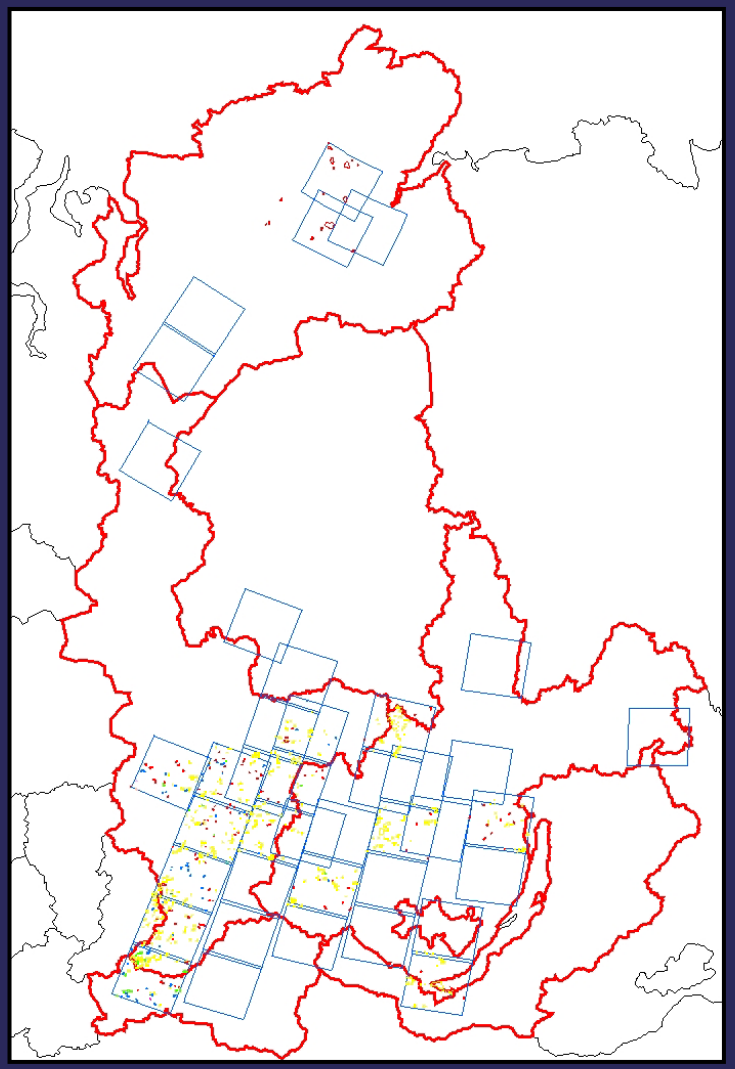
Multi-year MODIS 500 m product

Training and reference data

Local expert knowledge
- Landsat TM analysis
- Some classes from GLC2000
- Overall 1000 training polygons
- LCCS-based legend (GLC2000)



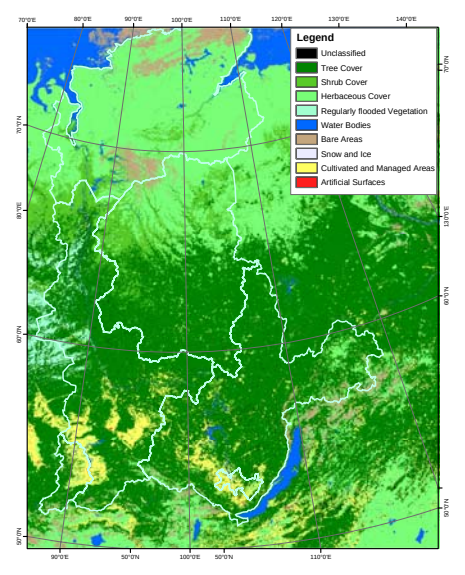
In situ data



Satellite data

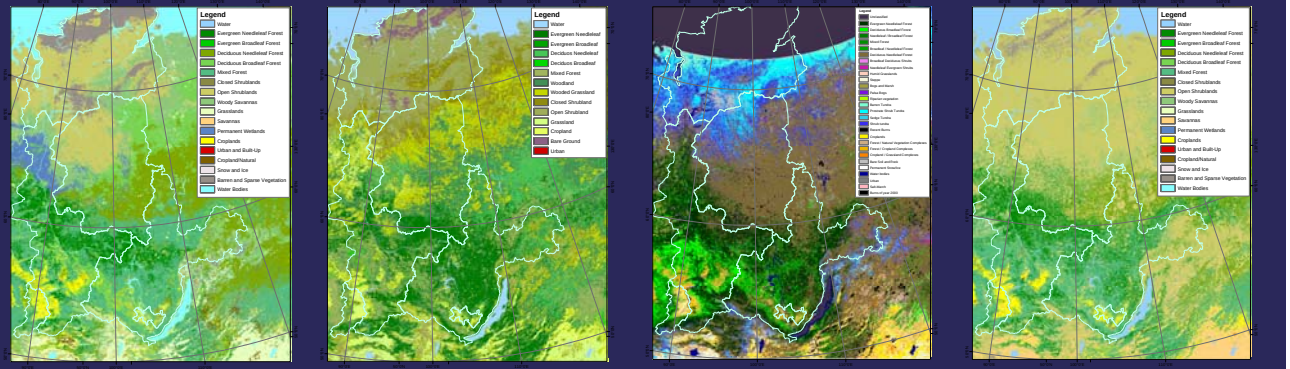
Dataset intercomparison

Sib II agreement map



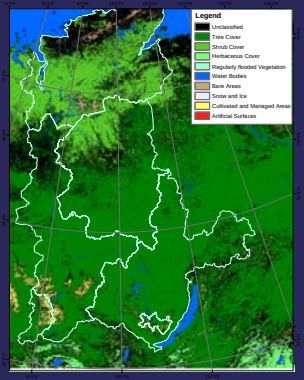
Class	Prod. Agr. (%)	User Agr. (%)
Tree Cover	78,18	99,09
Shrub Cover	12,36	38,48
Herbaceous	89,57	10,06
Water Bodies	83,35	98,14
Bare Areas	75,60	20,41
Cultivated and Managed Areas	74,30	19,78
Artificial Surfaces	37,28	40,68
	Overall Agr:	**66,55**

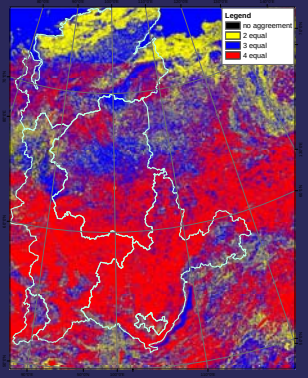
IGPB 1992 | UMD 1992 | GLC 2000 | MOD12Q1v4 2000



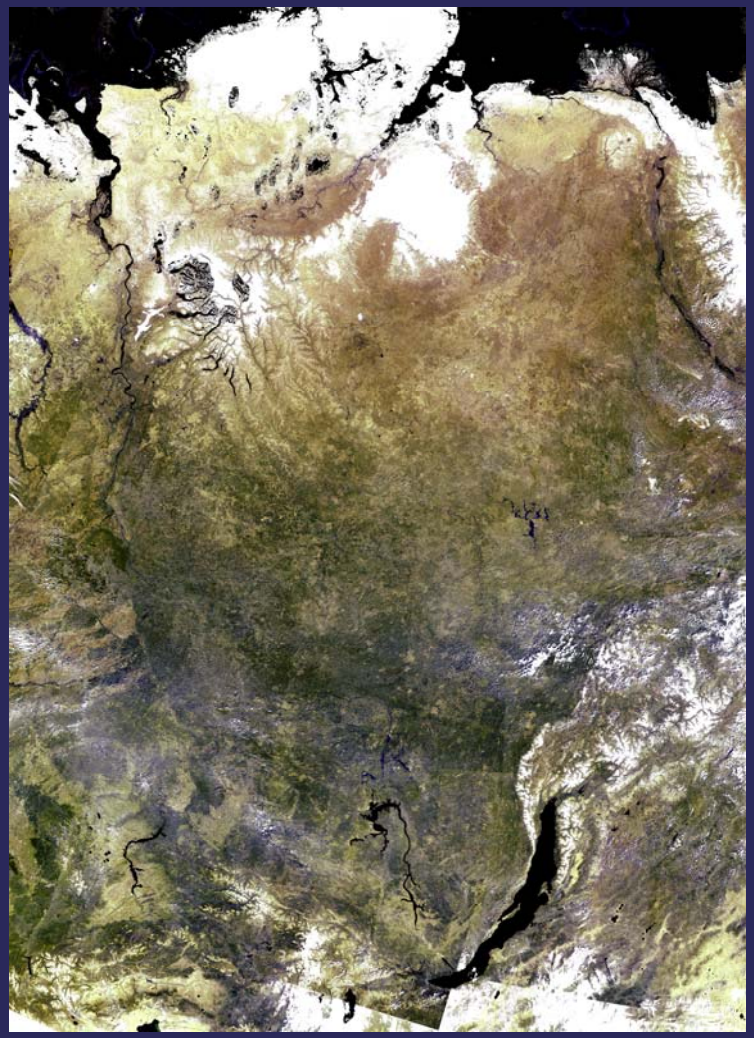
Translation of the different legends into a generalised LCCS compatible legend

Confusion matrix, agreement map and consensus map





Ongoing land cover activities



MERIS FR Siberia mosaic

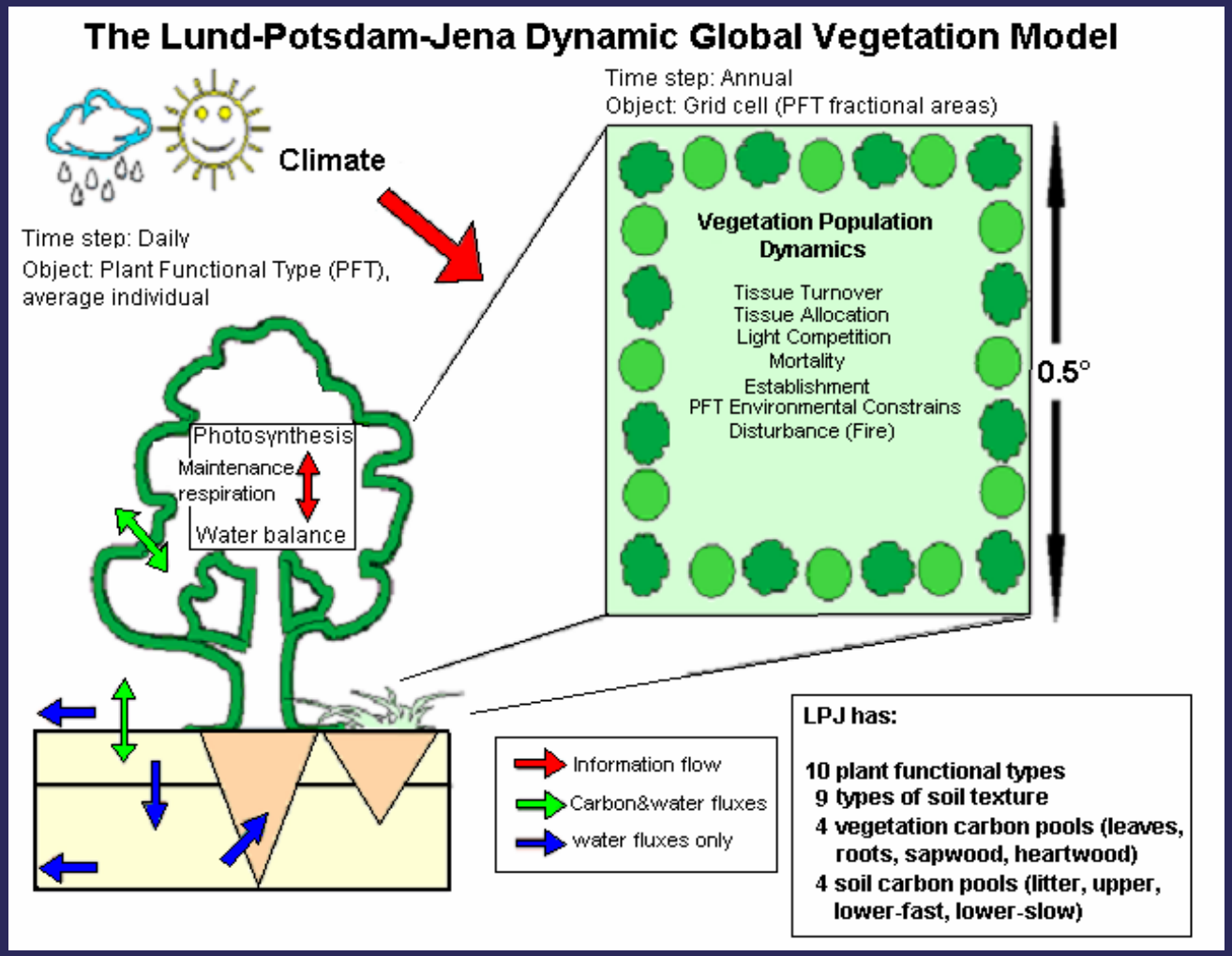
- Validation of land cover product with IIASA GIS database
  - Focus on forest types
- MERIS based land cover mapping
  - 300 m spatial resolution
- Harmonization between existing products and regional validation
- Land cover for parameterization, calibration and validation for vegetation models

EXPECTED KEY IMPROVEMENTS FOR GREENHOUSE GAS MODELING and ACCOUNTING FROM EO

Compiled by W. Lucht and the SIBERIA-II EO-Model Interface Splinter Group, ESRIN, Nov. 7, 2003	LPJ-Model **(Lund Potsdam Jena Dynamic Veg.Model)**	SDGV Model (Sheffield Dynamic Global Vegetation Model)	IIASA GIS Account (Int. Inst. of Applied Systems Analysis Geoinformation Syst.)
BASELINE pre-SIBERIA-II	stand-alone runs 1900-2100	stand-alone runs 1900-2100	previous results for 1990 from 88-92 avg.
EO-MODEL COMPARISONS → PROCESS IMPROVEMENT	Permafrost (from Freeze/Thaw) Snow PFT* parameters	Permafrost (from Freeze/Thaw) PFT* (Topography)	New semi-empirical models (eg for NPP) Process blocks include landscape properties
EO-ASSIMILATION INTO MODELS I → IMPROVEMENT OF SPATIAL CONSTRAINT "Land Cover (LC) vs. PFT*	Force Land Cover (for improved biomass patterns and C-balance)	Force Land Cover (for improved biomass patterns and C-balance)	Land Cover Disturbance pattern (incl. EO-fire) Wetland pattern
EO-ASSIMILIATION INTO MODELS II → IMPROVING SPATIAL-TEMPORAL CONSTRAINTS	fPAR assimilation (recent climate data crucial!)	fPAR assimilation (recent climate data crucial!)	Direct and indirect use of fPAR and LAI

*plant functional type

The Lund-Potsdam-Jena-Dynamic global vegetation model



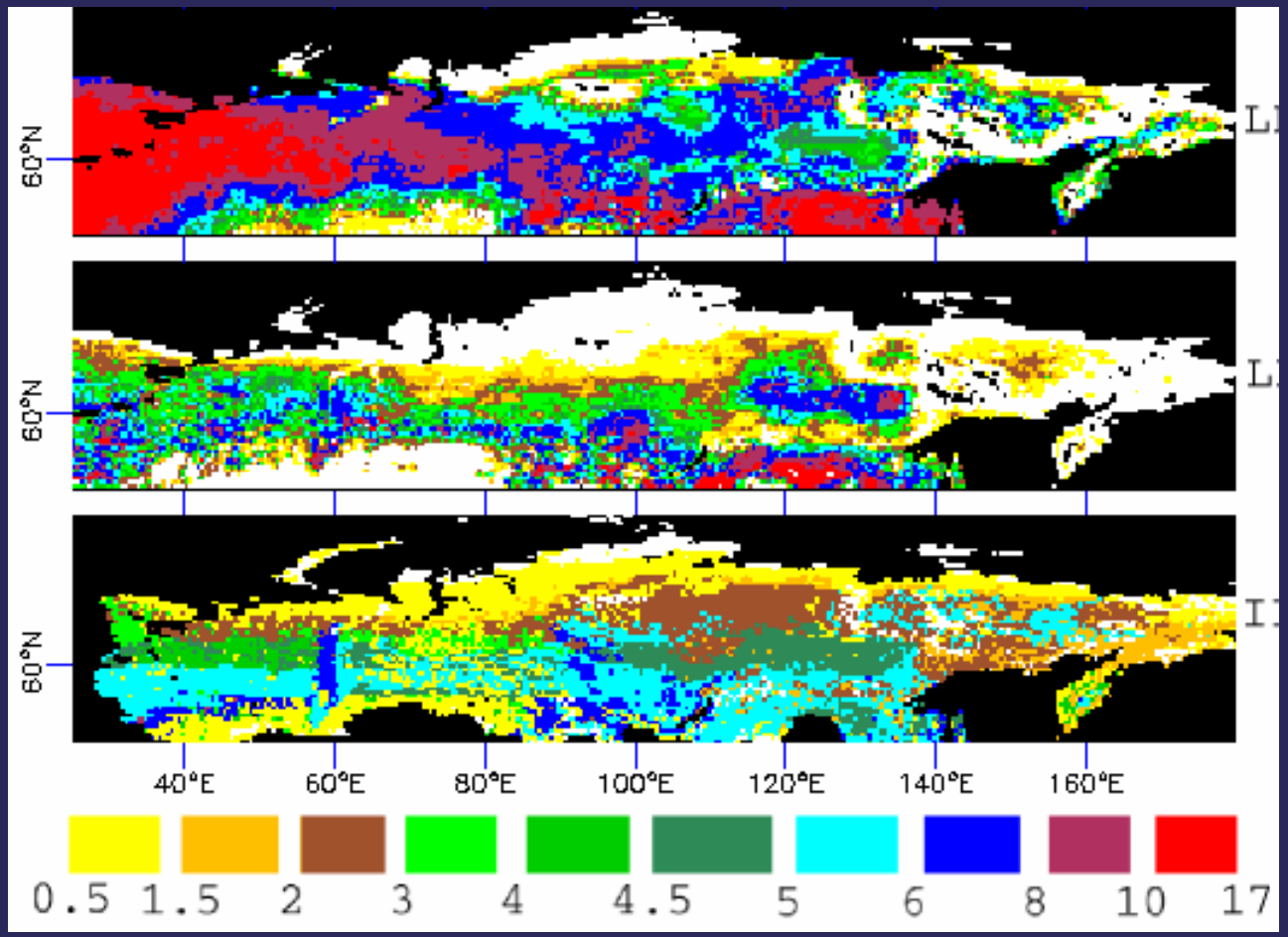
Sitch, S. et al., 2003, Evaluation of ecosystem dynamics, plant geography and terrestrial carbon cycling in the LPJ dynamic global vegetation model, Global Change Biology, 9, 161-185.

Biomass modeling – effects of land cover

LPJ-
No land cover

LPJ-
With land cover

IIASA
Forest inventory



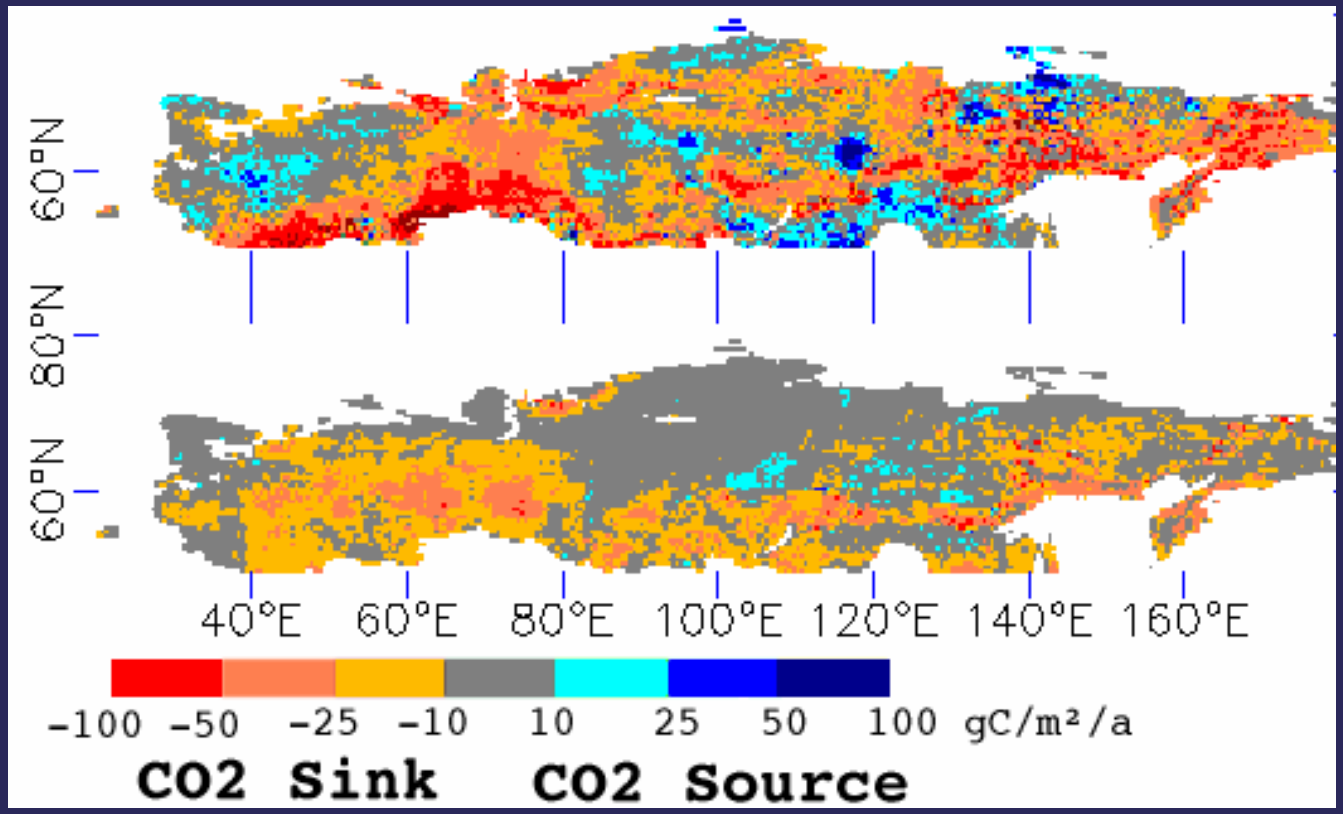
Biomass in kgC/m²
(1988-1992)

Improvement in biomass modeling by incorporation of satellite-derived land cover!

Mean carbon balance of Russia 1993-2003

LPJ-
No land cover

LPJ-
With land cover



Net Carbon Flux = NEP = Rh+FireC-NPP

With the constraint by land cover information:

- Less spatial variability.
- Russia's forests are simulated to mainly act as CO_2 sinks

NORTH

Objective: develop and implement a co-ordinated Observing and Forecasting System focused on the northern latitudes of the Earth

The **NORTH** Region comprises the whole northern hemisphere boreal biome as well as their coastal zones.

NORTH aims at:

- long-term, systematic, high quality, validated geo-observational products for monitoring and modelling key processes, many of which are unique to this region
- continuity of existing observation systems and improved European contribution to global observing needs
- a diagnostic and forecasting system for environmental change in the northern latitudes needed for adaptation and mitigation policies.

Summary

- Successful application of EO data for Mapping and Monitoring Siberia's land surface parameters and carbon/biomass Modeling
- Synergy between European EO data with other sources and data products
- Land cover challenges:
  - Flexible land cover definitions – LCCS
  - In situ data availability and reference for validation
  - Harmonization and interoperability
- All datasets will be made available
- Improved coordination and cooperation on the development, sharing and integration of land cover information, both in situ and satellite

Acknowledgment:

- European Commission for funding
- Land cover: Laine Skinner and Roman Gerlach
- LPJ modeling: Christian Beer and Wolfgang Lucht
- IIASA: Anatoly Shvidenko
- Siberia II coordinator: Maurizio Santoro
- … the whole Siberia II Team

More Information:

- SIBERIA II: www.siberia2.uni-jena.de/
- GOFC-GOLD: www.gofc-gold.uni-jena.de/