ISIMIP sectoral report: biomes and regional forestry

Christopher Reyer, Potsdam Institute for Climate Impact Research

Leibniz Association

P I K

PROFOUND

cost
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

reyer@pik-potsdam.de
ISIMIP workshop 22/24-06-2016, Potsdam

Goals ISI-MIP 2.1

Model evaluation/benchmarking:

➔**Are current vegetation models able to reproduce observed responses to climate variability and extreme events at global and regional scales?**

➔**Comparison of regional and global vegetation models for selected sites?**

➔**multi-model climate change impact simulations**

➔**cross-sectoral analyses (e.g. heatwave 2013 across sectors)**
➔**do impacts on society add-up, multiply, cancel out?**

Biomes: Status

ISI-MIP: Global vegetation models and available runs

Model	Princeton 1971-2012	GSWP3 1971-2010	WATCH 1971-2001	WFDEI 1971-2010	Country
CARAIB*	(X)	X	X	X	BE
DLEM*	X	X	X	X	USA
JULES	X	X	X		UK
Hybrid	(X)	(X)	(X)	(X)	UK
LPJ-GUESS*	X	X	X	X	GER
LPJmL	X	X	X	X	GER
ORCHIDEE	X	X	X	X	FR
VEGAS*	(X)	X	X	X	USA
VISIT	X	X	X	X	JP
*new groups in ISI-MIP 2.1					

ISI-MIP: Status of biome papers

1. **Analysing the response of European ecosystems to droughts and heat waves within ISI-MIP2 simulations** (Francois et al.) ➜presentation
2. **Benchmarking of the ISI-MIP2 biome models** (Chang et al.) ➜poster
3. **Evaluation of terrestrial primary productivity estimated by biome models: benchmark for historical change and implications for human appropriation** (Ito et al.) ➜poster
4. **Evaluation of the simulated distributions and characteristics of natural vegetation by the ISI-MIP2 biomes models** (Friend et al.)
5. **Terrestrial ecosystem response to climate conditions: A retrospective analysis** (Rafique et al.) ➜poster
6. **Global evaluation of vegetation carbon residence times as simulated by ISI-IMP2 Global Vegetation Models (GVMs) using a data product based on satellite and eddy covariance flux measurements** (Rademacher et al.)
7. **Evaluation of simulated short-term impacts on vegetation carbon and its sensitivity to climate and extreme events** (Garcia Cantu Ros et al.)

Regional Forestry

Data for initialising, driving and evaluating forest models

- **reference dataset**

- **freely available and accessible**

- **input data for simulations as well as validation of forest models**

Data for initialising, driving and evaluating forest models

Long time series from ICP Forest Level-2, NFI, Fluxnet/ICOS:

- **Climate (observed, 4 ISI-MIP forcings)**

- **Soil**

- **Management**

- **Vegetation data (dbh, h, lai...)**

- **Fluxes**

➔**data paper with „benchmarking dataset" for forest models**
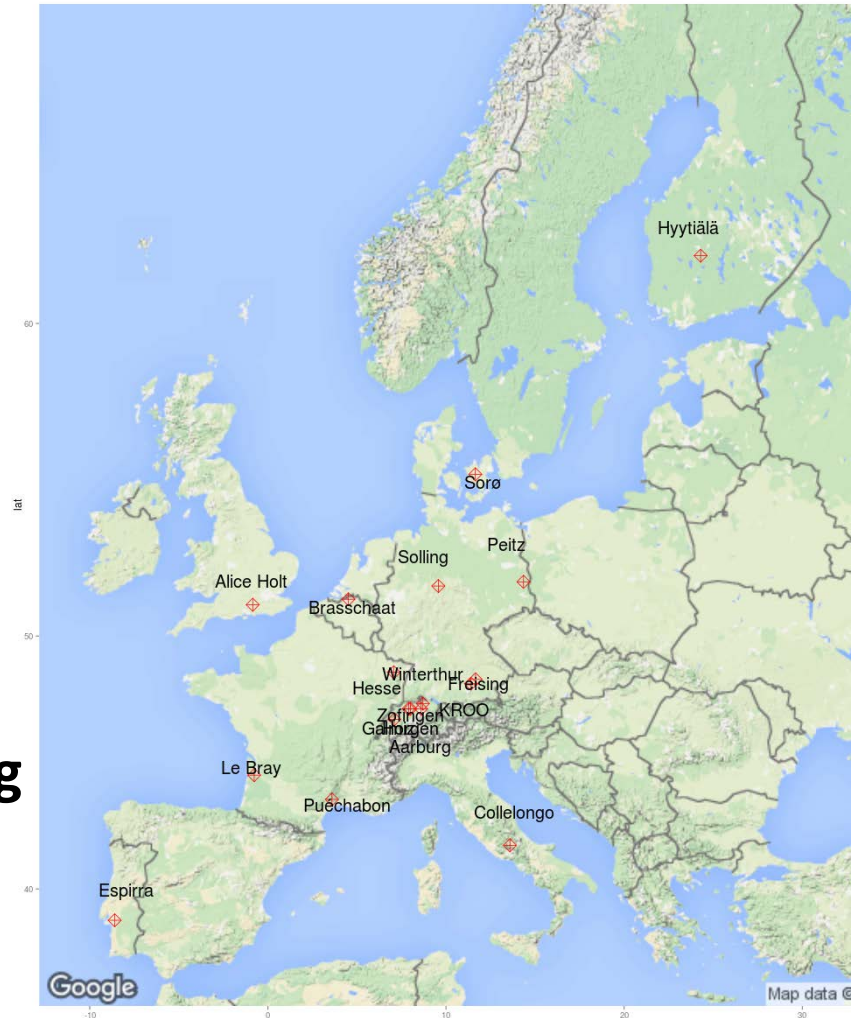
List of sites

	Site_ID	name1	name2	lat	lon	epsg	country	
1	3	BilyKriz	none	49.3	18.32	4326	Czech Republic	
2	4	Brasschaat	Brasschaat	51.3092	4.5205	4326	Belgium	
3	5	Collelongo	Collelongo	41.8494	13.5881	4326	Italy	
4	6	Espirra	Espirra	38.6394	-8.6018	4326	Portugal	
5	10	Hesse	Hesse	48.6742	7.0656	4326	Germany	
6	12	Hyytiala	Hyytiälä	61.8475	24.295	4326	Finland	
7	13	Kroof	KROOF	48.25	11.4	4326	Germany	
8	14	LeBray	Le Bray	44.71711	-0.7693	4326	France	
9	16	Peitz	Peitz (Eberswalde)	51.9166	14.35	4326	Germany	
10	18	Puechabon	Puéchabon	43.74139	3.595833	4326	France	
11	20	Solling_304	none	51.77	9.57	4326	Germany	
12	21	Soro	Sorø (DK-SOR)	55.485844	11.644616	4326	Denmark	

PIK

PROFOUND additions to protocol

- **develop model protocols for multi-model simulations (climate change, ISI-MIP)**

- develop advanced model protocols for more standardized model comparisons (parameter values, calibration techniques) ➔ with WG3
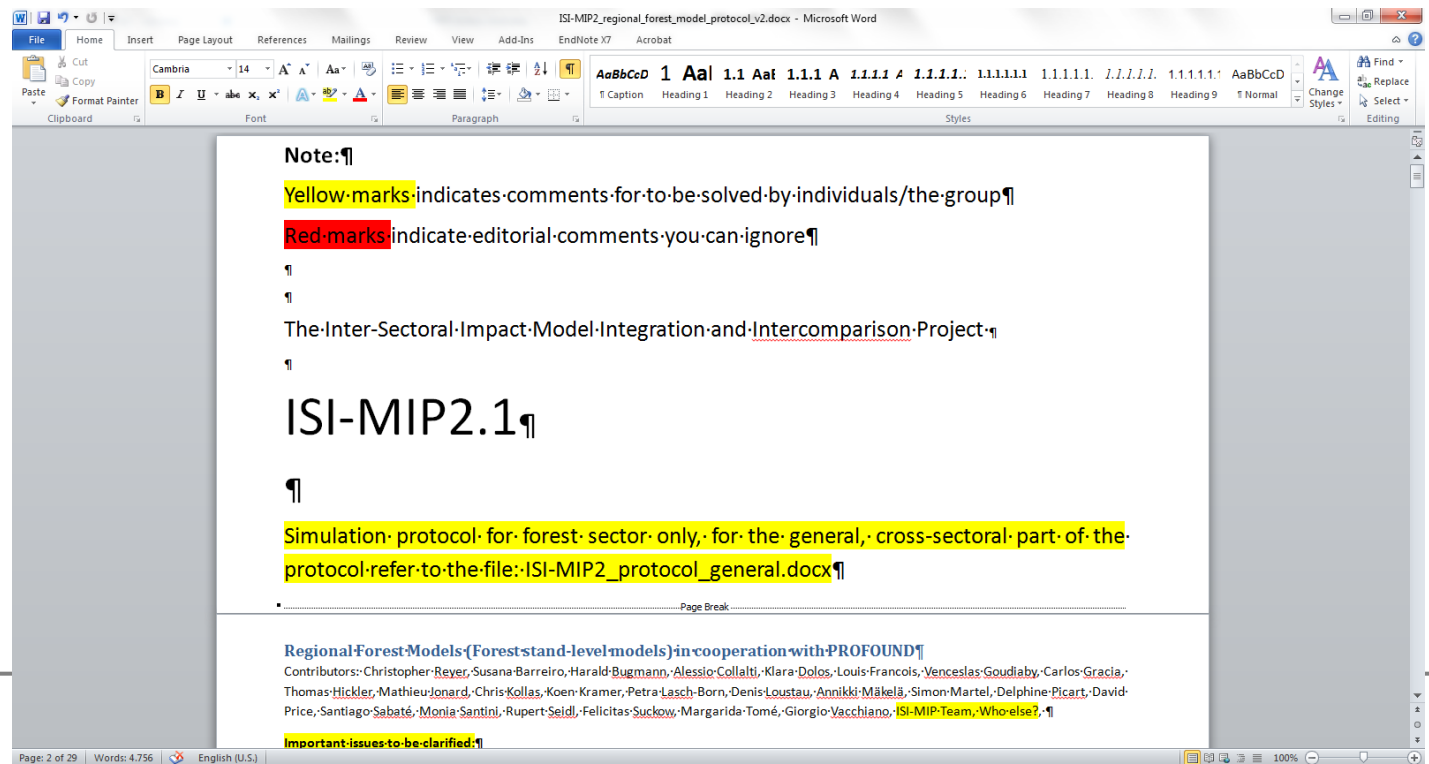
Forest models: Simulations

Experiment	Climate	Scenario	Management	Other Settings	#runs
1a) Historical, no disturbances	localclim, princeton, watch, gwsp3, watch+wfdei	-	man, nat	co2nodist	10
2a) Future, no disturbances	HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, GFDL-ESM2M, NorESM1-M	Rcp2.6, rcp4.5, rcp6.0, rcp8.5	man, nat	co2nodist noco2nodist	80
1b) Historical, disturbances	localclim, princeton, watch, gwsp3, watch+wfdei	-	man, nat	co2dist	10
2b) Future, disturbances	HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, GFDL-ESM2M, NorESM1-M	Rcp2.6, rcp4.5, rcp6.0, rcp8.5	man, nat	co2dist noco2dist	80

➔ **large numbers of runs**
➔ **models quite different (complexity, scope)**
➔ **potentially 10-15 models contributing and 10 more available/interested**
➔ **test runs available, simulations for 5-6 sites ongoing**

P I K

Regional Forestry Papers

1. **Key results of the ISI-MIP2 / PROFOUND model comparison** (Reyer et al.)
2. **A genealogy of European dynamic forest models** (Cailleret et al.)
3. **Major sources of uncertainties in the projection of European forests under climate change** (Cailleret et al.)
4. **Multi-model intra- and inter-annual variability comparison in carbon fluxes and biomass anomalies** (Collalti et al.)
5. **Growth, productivity and water consumption of trees and forests stands with particular regard to extreme events (droughts)** (Rötzer et al.)
6. **Probabilistic Risk Assessment** (Cameron et al.)
7. **Multi-model comparison of climate change mitigation effects of forest management across Europe** (Nadal-Sala et al.)
8. **Cross-scale comparison of PROFOUND/ISI-MIP2 forestry model simulation** (Steinkamp et al.)
9. **Photosynthesis and allocation under Co2const and co2inc (**Grote et al.)
10. **Climatic turning point** (Dolos et al.)
11. **Data paper** (Reyer/Dolos et al.)

P I K

Timeline

- **First version of database officially released (summer/autumn 2016)**

- **Simulation Timeline:**
  - Start simulating peitz and kroof (Experiments 1a and 2a)
  - In April simulate 3-4 additional stands.
  - Summer/autumn: simulate all remaining sites.
  - Submission deadline for simulations is 20th of July through the ISIMIP data upload procedure.
  - Present first results at PROFOUND main meeting in Krakow end of September

P I K

General information:

reyer@pik-potsdam.de

http://www.cost.eu/domains_actions/fps/Actions/FP1304

http://cost-profound.eu/site/

http://www.isi-mip.org/

ISIMIP/PROFOUND Protocol: https://www.pik-potsdam.de/research/climate-impacts-and-vulnerabilities/research/rd2-cross-cutting-activities/isi-mip/for-modellers/isi-mip-phase-2/simulation-protocol

**Database:** http://cost-profound.eu/cloud/public.php?service=files&t=d2c71b8af6378dda6a80e5b706041b35

The R-Package (Github, preferred): https://github.com/COST-FP1304-PROFOUND/TG2/releases/tag/v0.1-alpha

The R-Package (non-Github): http://cost-profound.eu/cloud/public.php?service=files&t=4dfa24fc34bd19adabdd08fdef4803be
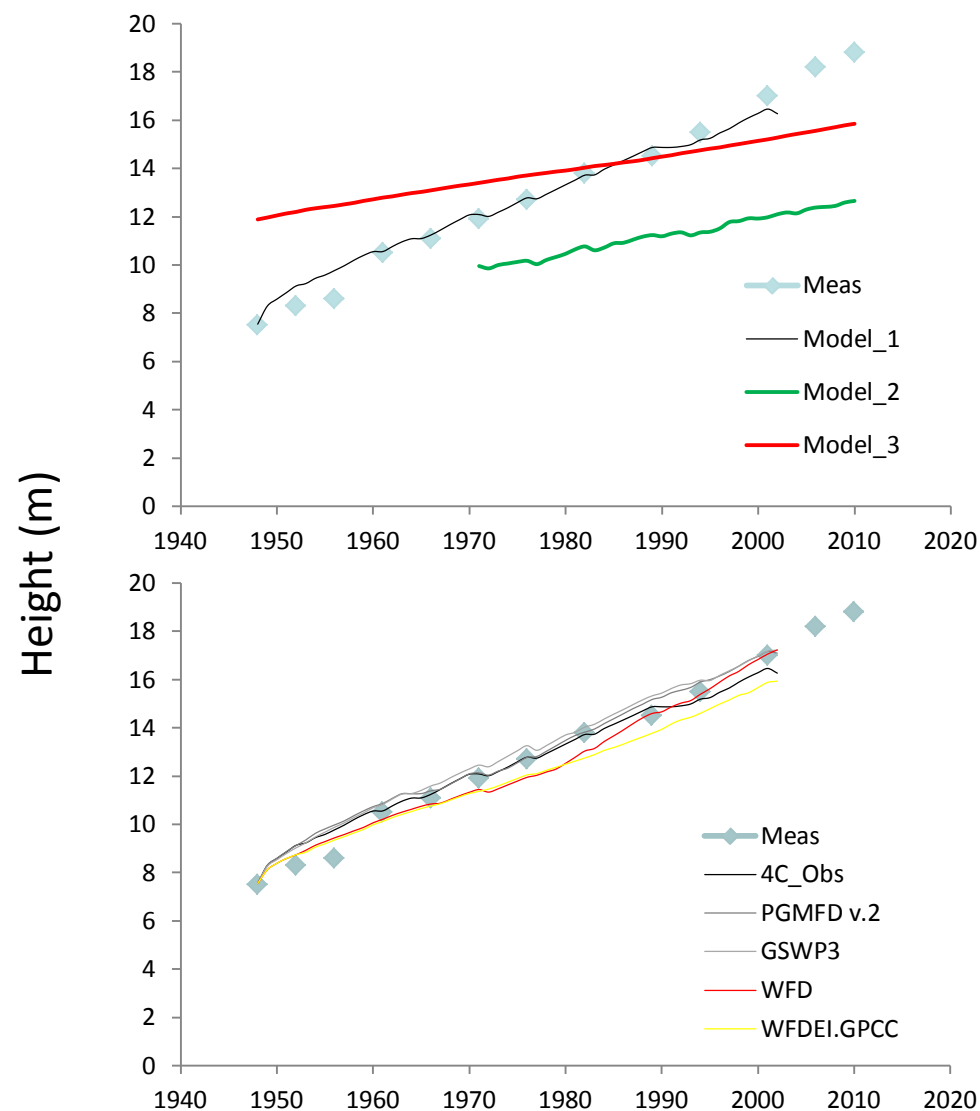
P I K

TG3 Status

- **ISI-MIP/PROFOUND simulation protocol is ready!**
- **3 modelling groups did test runs for first site (Peitz)**
- **Data available for more sites**
- **„Model Experiment Documentation" available**

P I K

Preliminary Results
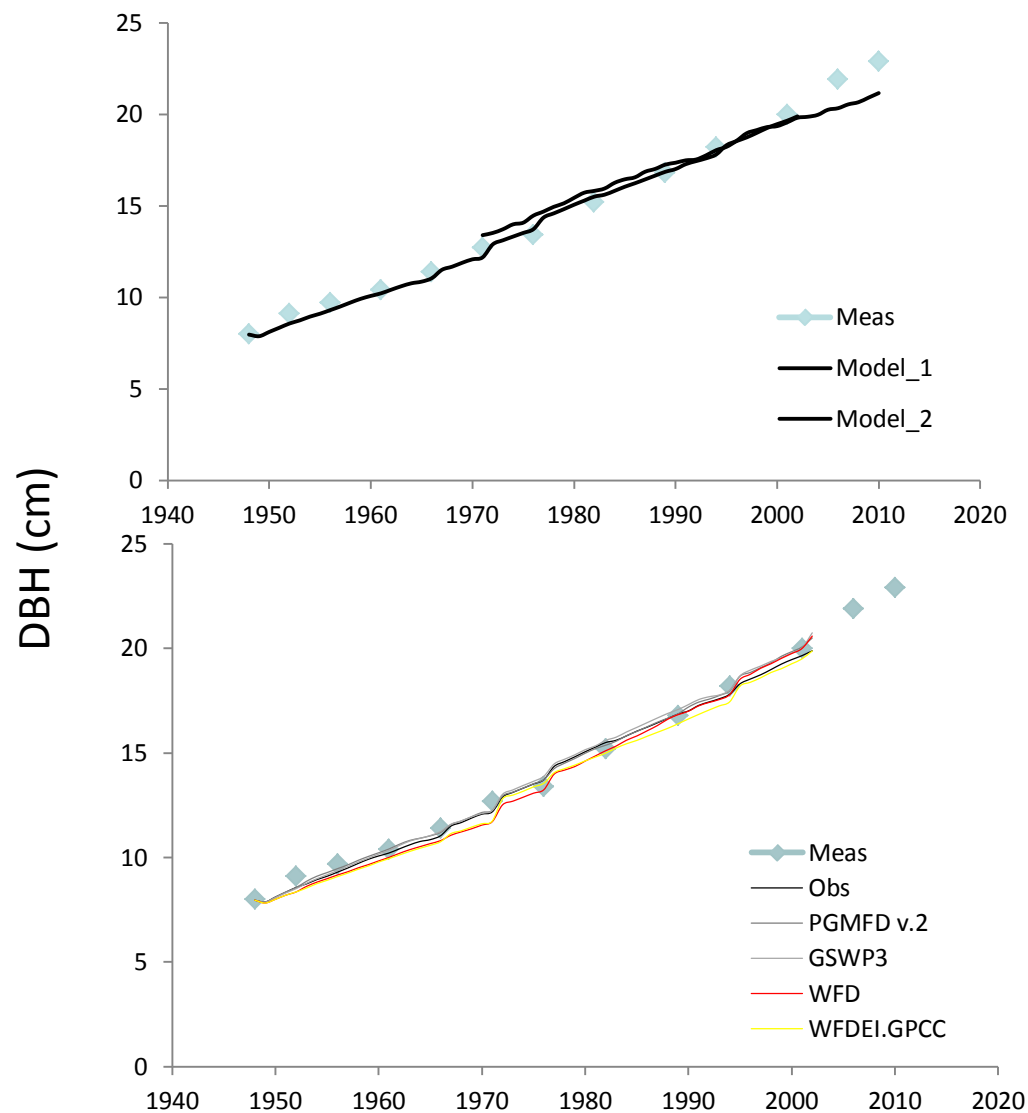
Preliminary Results

COST PROFOUND reimbursement

- **Sign the attendance list!**

- **Reimbursement is 80€/night, 20€/meal**

- **You can only claim a maximum of 2 meals/meeting or travel day minus the meals provided by the organisers.**

- **Never finish the claim before you attended the meeting („claim pending")**

SIGN THE LIST!

7.3 Forest models (regional, stand-level)

PROFOUND Contributors: Christopher Reyer, Susana Barreiro, Harald Bugmann, Alessio Collalti, Klara Dolos, Louis Francois, Venceslas Goudiaby, Carlos Gracia, Thomas Hickler, Mathieu Jonard, Chris Kollas, Koen Kramer, Petra Lasch-Born, Denis Loustau, Annikki Mäkelä, Simon Martel, Daniel Nadal I Sala, Delphine Picart, David Price, Santiago Sabaté, Monia Santini, Rupert Seidl, Felicitas Suckow, Margarida Tomé, Giorgio Vacchiano

P I K

7.3 Forest models: Management & forest dynamics

- **business-as-usual (BAU) management defined by data (e.g. stem numbers) and general management guidelines. Also for future runs.**

- **A "natural reference run (nat)" without any management has also been included in the experiments. The "nat"-run will help assessing the influence of forest management.**

Species	Thinning regime	Intensity [% of remaining basal area]	Interval [yr]	Stand age for final harvest
pisy	below	20	15	140
piab	below	30	15	120
fasy	above	30	15	140
quro/qupe	above	15	15	200
pipi	below	20	10	45
eugl	below	30?	10	40?

7.3 Forest models: Management & forest dynamics

- **running simulations until 2100 will result in very old forests.**

➔ **If you harvest, please proceed after harvest as your model usually does, e.g. plant the same tree species again or allow for regeneration of the same species.**

7.3 Forest models: „Calibration"

- alterations to the model should be reported in the model experiment documentation ➔understanding of model results.

- model improvement driven by comparison to "PROFOUND TG2" data ➔avoid & report

- manual or automatic site-specific "tuning" of parameters should be avoided. The same "model" (i.e. also with the same parameter values) should be used in all simulations.

- model development needed to run a model at specific sites is welcomed (e.g. adjustment of phenology model to include chilling effects; fixing parameters for a new species). ➔ document

7.3 Forest models: Disturbances

- **If models simulate disturbances (bark beetle outbreaks or storm damage = "dist" runs) that can be switched on and off →experiments to tease out the influence of disturbances ("dist vs. nodist")**

7.3 Forest models: Co2-effects

- **increasing CO2 („co2") and constant CO2 („noco2") run**

Database structure & interface

□SQL Relational Database (SQLite)

□Physical data independence: no hierarchy

   □Main Tables

   □Secondary tables built on top

□A SQLite software / GUI

   □Browse Data

   □Export to other formats

□Any language that supports SQL

   □R

   □Python

   □Matlab