ExpeER

Distributed Infrastructure for EXPErimentation in Ecosystem Research

Grant Agreement Number: 262060

SEVENTH FRAMEWORK PROGRAMME
Capacities
Integrating activities: Networks of Research Infrastructures (RIs)
Theme: Environment and Earth Sciences

> DELIVERABLE 9.3
>
> Preliminary model workspace and training workshop

Abstract:

A preliminary modelling workspace (the "Modelling Toolbox") was developed for ExpeER site owners and users and includes enhanced ecosystem models representing hydrological, biogeochemical and dynamic vegetation components and evaluation tools to provide scientific testing of hypotheses and extrapolation of results from the experiments (completed Month 40). The use of the workspace was demonstrated through involvement of site researchers and users at a workshop training course in September, 2014, presented at the ExpeER International Conference in Paris (completed Month 46).

Due date of deliverables: original M40 (+ 6 month extension) = M46

Actual submission date: deliverables completed M46; report submitted M51

Start date of project: December 1, 2010

Duration: original 48 months (+ 6 month extension) = 54 months

Organisation name of lead contractor: DTU

Contributors: Klaus Steenberg-Larsen, Bernard Cosby, Mikhail Mishurov, Per-Erik Janssen

Revision N°: V 0.1

Dissemination level:

PU Public (must be available on the website)	**[X]**
PP Restricted to other programme participants (including the Commission Services)	**[]**
RE Restricted to a group specified by the consortium (including the Commission Services) (precise to whom it should be addressed)	**[ ]**
CO Confidential, only for members of the consortium(including the Commission Services)	**[ ]**

Content

1 Executive summary

A preliminary Modelling Toolbox has been developed for ExpeER site owners and users and includes enhanced ecosystem models representing hydrological, biogeochemical and dynamic vegetation components and evaluation tools to provide scientific testing of hypotheses and extrapolation of results from the experiments. The Modelling Toolbox and examples of its features are presented.

The use of the preliminary Modelling Toolbox was demonstrated through involvement of site researchers and users at a workshop training course in September, 2014, presented at the ExpeER International Conference in Paris. Details of the Workshop are presented.

The two items above satisfy deliverable D9.3. The remaining deliverable on the project is D9.4, a final version of the model toolbox. A work plan is presented to achieve this final deliverable by April 2015.

2 Preliminary Model Workspace (the Modelling Toolbox)

2.1 Description of the Modelling Toolbox

The ExpeER Modelling Toolbox has been developed by WP9 to provide simulation and evaluation tools which allow ExpeER site owners to test hypotheses, extrapolate outputs, and visualize and understand results arising from their ecosystem experiments. The toolbox is constructed around three whole-ecosystem models which can be used to simulate ecosystem functioning and processes in response to experimental manipulation of forcing functions ranging from climate variables to land use management practices. These models (COUP, LPJ-GUESS and JULES) were selected to cover a range of spatial scales and process detail in their simulated outputs (Table 1).

Table 1: Summary of whole-ecosystem models in the WP9 Modelling Toolbox

	COUP	LPJ-GUESS	JULES
Purpose - Features	Quantification of basic hydrological and biological processes in the soil plant atmosphere system. The model simulates soil water and heat processes in many types of soils.	Dynamic global vegetation model for simulation of interactions between climate, atmospheric burdens of trace gases and vegetation, biogeochemical cycles and trace gas exchange.	Process-based model that simulates the fluxes of carbon, water, energy and momentum between the land surface and the atmosphere.
Scale – Spatial Unit	Spatial resolution: plot. However model can be run in distributed model representing any region.	Typically 10 minutes (Europe) or 0.5 degree (globe) but may also be applied at stand or plot scale.	Typically 1km for the UK or 0.5 degree (globe) but may also be applied at stand or plot scale.

The Modelling Toolbox itself is web-enabled and offers a menu-driven series of options to access information about each of the three models and to download or access executable versions and standard parameter sets for each of the models. Toolbox users can access guidelines and information to aid in selecting and implementing an appropriate model (or models) to examine questions or applications relevant to a particular ExpeER site. The Toolbox provides example outputs consisting of simulation results and intra-model comparisons for a series of applications using all three models to simulate ecosystem responses: a) to experimental manipulations at selected ExpeER sites; and b) to climate change scenarios along North-South and East-West transects in Europe.

The Modelling Toolbox provides a set of standard parameters for each ExpeER site in the form of preliminary inputs for each model for each site. These standard parameter sets are derived at the scale of the European transects study and provide for an easy first application of each model for any ExpeER site. The standard parameter sets have been applied to each of the sites with each of the models and the simulation results are available from the toolbox.

The Modelling Toolbox offers a user-friendly environment to assist ExpeER site owners with the development of simulation capabilities for their site. For example, as a tutorial for modelling at any ExpeER site, a user can download an appropriate standard parameter set and model(s), run initial applications for the site, and compare the results to the outputs stored in the toolbox. Comparing across the models at a site and utilizing the toolbox's guidelines for each model, the a user can then identify the refinements to the standard parameter sets that would be needed to fine-tune the preliminary parameters sets for the sites, thus improving the utility of the models for examining questions related to that particular site.

2.2 Using the Toolbox

The preliminary Modelling Toolbox is available at: http://michaelmi.nateko.lu.se/

2.2.1 Toolbox navigation.

The Toolbox offers user selectable details about the *models* available, giving summaries of the characteristics and specific features of each model. The Toolbox offers assistance in *model selection* which provides considerations to take into account and guidance documents for each model. The Toolbox maintains a library of *past simulations* that can be accessed as exemplars and/or tutorials in the application of each model.

Figure 1: Toolbox webpage showing navigation for Models, Model Selection and Past Simulations.
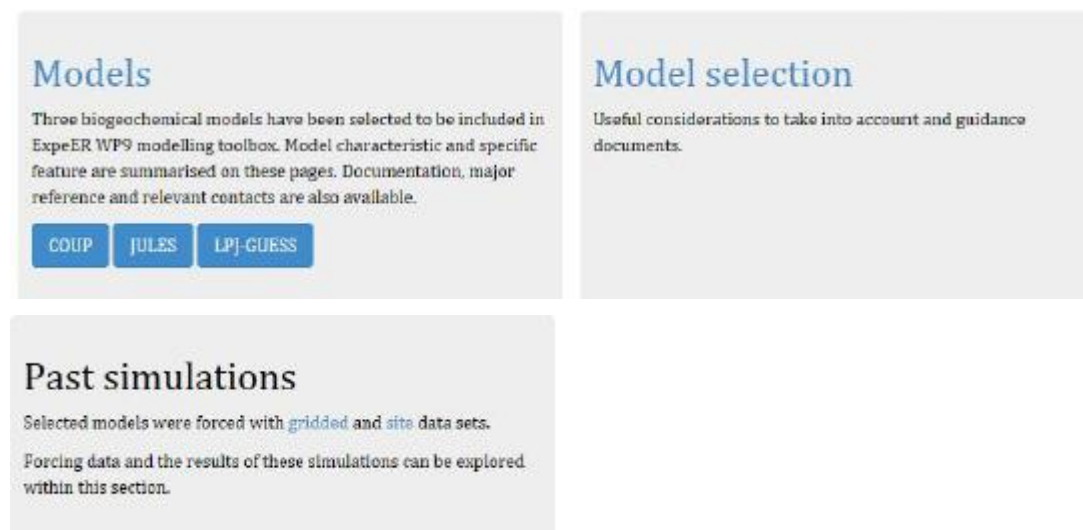
Video tutorials are available for Toolbox users which describe the models and their applications and offer advice and guidance in the appropriateness of each model for specific tasks (One Tutorial is currently available, the remaining two will be developed as part of the final deliverable D9.4)

Guests can access the website and browse the features available. Researchers can join obtain a username and password for the toolbox in order to download products and interact with the site.

2.2.2 Gridded Applications in the Toolbox

Gridded applications of all three models using global datasets are available in the Toolbox for North-South and East-West transects across Europe (including all grid elements containing ExpeER sites)

Figure 2A: Toolbox webpage showing gridded transect applications of the three models available in the Toolbox.
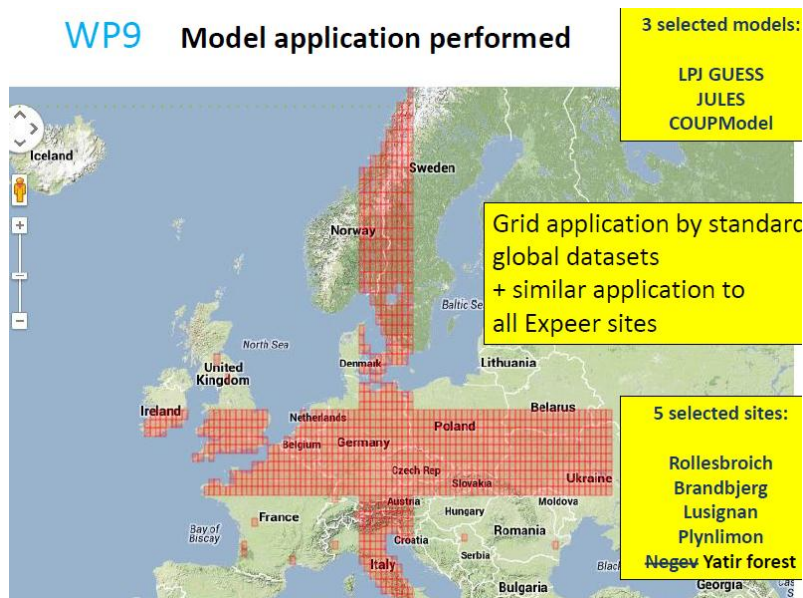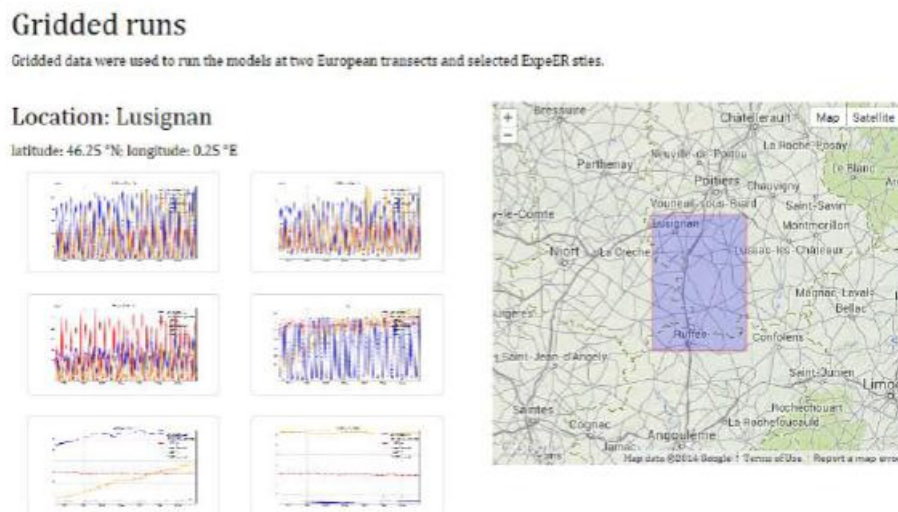

Figure 2B: Toolbox webpage showing gridded ExpeER site applications of three models available in the Toolbox

2.2.3   ExpeER Default Site-specific Applications in the Toolbox

Five ExpeER sites have been modelled using all three models and local detailed site data as exemplars of how the Toolbox can be applied to other ExpeER sites.

Figure 3: Toolbox webpage showing ExpeER exemplar site-specific applications.
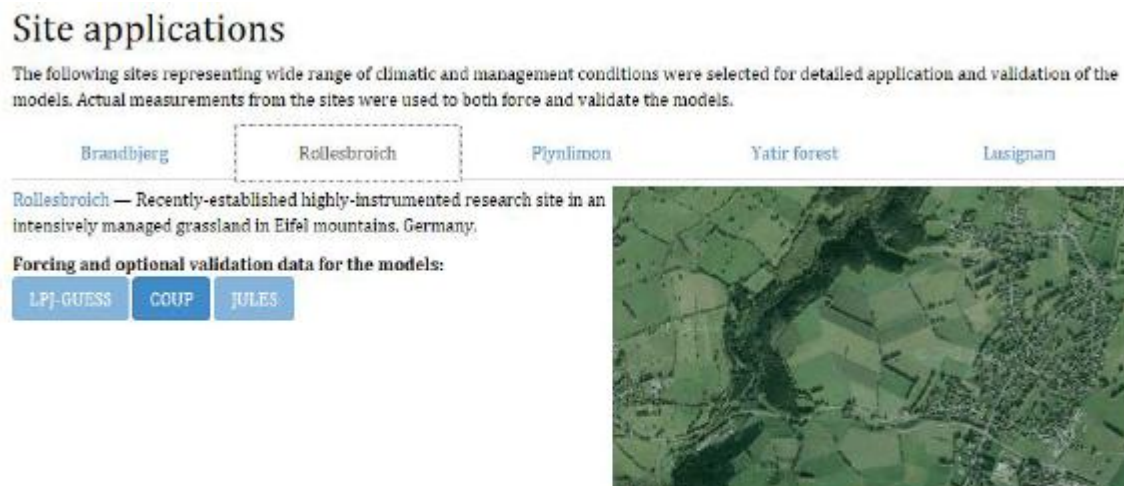
2.3 Example of Toolbox as a Resource for Projects at ExpeER Sites

The preliminary Toolbox has been used as a resource in a project examining differences in water balance between grassland and forest watersheds using long term data and two different models. The project "Water balance in grassland and forest watersheds" was carried out as part of ExpeER:

https://www.kth.se/en/abe/inst/2.12732/grupper/biogeofysik/research/water-balance-1.507367

 The site in this study is the Plynlimon ExpeER site in the UK. The models used are the Coup Model (in the Toolbox) and HBV (an external hydrological model not supported on the Toolbox). This application serves as an exemplar for the synergies between the ExpeER network and externals research interests that can be stimulated and developed using the Modelling Toolbox.

3   Training Workshop

3.1 Purpose of Workshop

One component of deliverable D9.3 includes the presentation of workshop and/or training sessions to involve ExpeER site researchers and users (and other interested participants) in the use and application of the WP9 Modelling Toolbox. A workshop was held on 26 September, 2014 in

conjunction with the ExpeER International Conference in Paris (Sept 24-25, 2014) to satisfy this deliverable.

WP9 joined with WP10 to present a joint workshop: "The ExpeER WP9-WP10 Joint Workshop on Multi-scale Ecosystem Modelling Tools including Data Assimilation". The workshop included six plenary sessions devoted to presentations and instructional material led by the WP9 and WP10 teams, with three sessions devoted to each work package. These were followed by parallel working sessions in which the workshop participants were allowed to access the tools and models provided by each WP for "hands-on" experience.

The three plenary sessions led by WP9 (in satisfaction of deliverable D9.3) were designed to demonstrate the Modelling Toolbox and were intended as an introduction and overview of the Toolbox. This session was open to all participants at the ExpeER Conference regardless of whether they had an immediate need for the toolbox or were merely interested for future reference. The material presented in these sessions is summarized in the next section.

This parallel working sessions were aimed at those participants who wanted some hands-on experience with the Modelling Toolbox and/or the chance to use their own data with the Toolbox. These individual sessions were conducted between the model representatives and those participants interested in applying a particular model at some site, using either the standard data sets in the Modelling Toolbox or their own data. To aid this process a teleconference virtual meeting room was opened from 1 September until the workshop (https://connect.sunet.se/expeer-toolbox/) to be used to exchange information between workshop participants and the toolbox modellers and potentially prepare data for model applications during the workshop.

3.2 Workshop Details

<u>When and where:</u>

26 September 2014, 8:30-16:00. UPMC, Salle de Conférence Tour 46, Niveau 2, couloir 46/56, 4 place Jussieu, Paris 75005

<u>Agenda:</u>

WP9 Modelling Toolbox session – 08:30 to 11:00

08:30-09:25   Session 1: An introduction to each of the ecosystem models in the toolbox including required inputs and simulated outputs (10 min each) and a comparative discussion of the suitability of each model for a variety of simulation tasks (15 min);

09:30-10:10   Session 2: An introduction to the toolbox web-interface including how the models, guidelines and information, standard parameter sets and pre-existing results can be accessed, downloaded, and manipulated (40 min).

10:15-11:00   Session 3: A summary of the application and comparison of the three models for the N-S and E-W transects of Europe (20 min) followed by a summary of the simulations from each model for the selected ExpeER sites (25 min).

11:00-11:30   Break with sandwiches, coffee/tea/water

WP10 Data Assimilation session – 11:30 to 14:15

11:30-12:25   Session 4: Why data assimilation? What are necessary inputs for a data assimilation approach? We will discuss the importance of data assimilation for spatial and temporal upscaling and future predictions. We will address strengths and limitations of the approach (role of uncertainties), as well as the main work flow.

12:30-13:40   Session 5: From in-situ measurements to assessments of carbon balances for landscapes and catchments, as well as for the regional and global scale: up-scaling in space and time of carbon fluxes and stocks using the CLM or ORCHIDEE global ecosystem model together with FluxNet data, in situ biomass measurement, satellite observations and atmospheric CO2 measurements.

13:45-14:15   Session 6: Implications of data assimilation work for the design of monitoring networks.

Parallel sessions – 14:30 to 16:00

14:30-16:00   WP9 Modelling Toolbox session: Follow-on hands-on session to learn more about the models and the Modelling Toolbox

14:30-16:00   WP10 Data Assimilation Tutorial session: Follow-on hands-on session to learn more about Data Assimilation techniques: How to proceed?

3.3 Workshop Participants

First Name	Last Name	Organisation	Country
Jack	Cosby	CEH	United Kingdom
Pedro	Errecart	INTA - National Agricultural Technology Institute	Argentina
Harrie-jan	Hendricks-Franssen	Forschungszentrum Julich	Germany
Per-Erik	Jansson	KTH - Royal Institute of Technology	Sweden
Kristin Marie	Krewenka	University of Hamburg	Germany
Natasha	MacBean	LSCE - Climate and Environment Sciences Laboratory	France
Mir Hadi	Madani	KTH - Royal Institute of Technology	Sweden
Mikhail	Mishurov	Lund University	Sweden
Philippe	Peylin	LSCE - Climate and Environment Sciences Laboratory	France
Hanna	Post	Forschungszentrum Jülich	Germany

First Name	Last Name	Organisation	Country
Patricia María	Rodríguez-González	School of Agriculture, University of Lisbon	Portugal
Nimai	Senapati	INRA - National Institute for Agricultural Research	France
David	Turner	AEKOS - Australian Ecological Knowledge and Observation System	Australia
Yi	Yin	LSCE - Climate and Environment Sciences Laboratory	France

The workshop offered the opportunity for potential users to interact with the developers of the toolbox. Furthermore, the workshop was a good opportunity to further progress the corporation with WP10.

4 Next Steps

4.1 Remaining Deliverables

Remaining Deliverables

D9.4: Final version of the model toolbox

Work plan

•Finalize/ improve models for the 5 selected sites

•Making all the parameter library files down loadable in the toolbox

•Develop more specific video tutorials for each of the three models in the toolbox

•Finalize and submit planned papers

4.2 Future of the Modelling Toolbox?

The toolbox is currently at: http://michaelmi.nateko.lu.se/. As the Expeer project has no opportunity to offer long-term hosting it remains to be resolved what future the Expeer toolbox has. An option which would allow for further development would be

CEH (UK), which currently hosts a range of different data portals, e.g.:

•Environment Information Data Centre (EIDC)

•Integrated Data and modelling Platform for Catchment Management

•Wales Agri-Environment Monitoring and Evaluation Programme

•UK Landscape soil moisture network

4.3 Presentations related to Deliverables D9.3

Plenary Presentation at the ExpeER International Conference, September 2014.

"Confronting ecosystem models with real world experiment: a two way feedback loop"

Nimai Senapati, INRA, Poitou-Charentes, URP3F, Le Chêne -RD150, BP 80006, 86600, Lusignan, France

Plenary session 4, ExpeER selected output, 25/09/2014

Thursday25 Sept11:50

Posters at the ExpeER International Conference, September 2014.

Modelling ecosystem fluxes of carbon and heat to constrain parameters uncertainty for a grassland sites

Mir Hadi Madani[1], Per Erik Jansson[1]

[1]Department of Land and Water Resources Engineering, KTH Royal Institute of Technology, Teknikringen 76, Stockholm 10044, Sweden, E-mail: mhmadani@kth.se, pej@kth.se

Comparison of water balance components sensitivity and environmental changes in grassland and forest watershed based on hydrological modelling (COUP & HBV)

Mir Hadi Madani[1], Per Erik Jansson[1]

[1]Department of Land and Water Resources Engineering, KTH Royal Institute of Technology, Teknikringen 76, Stockholm 10044, Sweden, E-mail: mhmadani@kth.se, pej@kth.se

4.4 Planned Papers

Nimai Senapati, Per-Erik Jansson, Abad Chabbiand Pete Smith (in prep): *Modelling carbon, heat and water fluxes in managed temperate grasslands: Application of CoupModelin mowing and grazing systems.*

J. Wu, K.S. Larsen, A. Ibrom, C. Beier (in prep.):Effects of elevated CO2, warming and droughton future carbon balance of a Danish heathland ecosystem.

Mishurov, Blyth, Robinson, Martinez, Jansson(in prep): *Commonalities and discrepancies in ecosystem model predictions.*

Mishurov, Prost, McBean, Martinez, Jansson, Hendricks-Franssen (in prep): *Capturing water and C balance of a grassland site.*

J. Wu, K.S. Larsen, A. Ibrom, C. Beier, M. Mishurov, Martinez, …(in prep): *Carbon balances under future climates: a model-data fusion analysis from the CLIMAITE project*