MS42: Component-kick off meeting – discussion of experimental approaches and responses

Minutes from C3 kick off meeting in Dragør 10-11th January

Participants:
Claus Beier, Håkan Pleijel, Lisa Emberson, Patrick Bueker, Rocio Alonso, Teis Mikkelsen, Elena Paoletti, Gina Mills, Juergen Burkhardt, Lucy Sheppard, Christof Ammann, Koen Kramer, Per Erik Karlsson, Chris Evans, Giacomo Gerosa

Venue:
Dragør Badehotel. Dragør, Denmark

Presentations gíven at the meeting will be made available at the Eclaire web site (please send to Claus)

Programme:

	Tuesday 9th Jan	**Wednesday 10th**
8.30–10.00	Welcome and settling of programme Overview of WPs, action points from Brescia and discussion of WP-outline (1 hour/WP) WP13 – Modeling (Chris)	Task meeting 1 – discussions and planning of future per WP
10.30–12.00	WP9 – Data mining (Gina) WP10 – Experiments (Claus)	Task meeting 2 - discussions and planning of future per WP
12.00–13.00	Lunch	Lunch
13.00–14.30	WP11 – Novel processes (Francesco) WP12 – Novel thresholds (Lisa)	Final discussions and decisions. Planning of future per WP and across WP. Work for 2012 and further. Interaction among WPs and with rest of Eclaire Integration between modellign and experiments
15.00–17.00	Data management (Klaus S Larsen) Discussion of WP plans and settling of actions for Wednesday	Closure and conclusions
18.00–20.00	Dinner	

WP 9 Data Mining Decisions and Actions

Three types of data will be found and analysed:

(1) Process-based data from the literature

Effects of O3 alone and in interaction with N and CO2 (1st priority), drought and temperature (2nd priority). See Table 1 for processes identified as useful and draft hypotheses for data collection.

(a) Stage 1 – design template – indentify process and sub-process parameterisations needed – input from WP12/13 needed. ***Action: GM to complete template by 1 April (with inputs from all)***

(b) Stage 2: collect data by ecotype, progress report/telecom mid June, ***Action: All to finish by 1 September***

(c) Stage 4: identify gaps – can they be filled by unpublished results?

(d) Stage 3: analyse data by process (and ecotype). ***Action: All to finish by 1 April, 2013***

(2) Process-based from unpublished results

(a) Stage 1: design template - simple template for this to collect info on treatments used, what measured (by tick box), how available data is etc. ***Action: GM to complete by 1 April 2012***

(b) Stage 2: Circulate data template within ECLAIRE community – ***Action: GM to compile replies by 1 September 2012***

(c) Stage 3: request selected data, and use in process-based analysis

(3) Ecosystem-scale data

(a) Analysis of ICP Forests level II data. Unfortunately none of the involved scientists were able to attend the Dragor meeting. Action: GM (with CE, LE and CB?) to arrange telecon to discuss proposed statistical analysis w.r.t. outcomes of Dragor meeting. [note JB - also include wax deterioration in analysis)

(b) Selection of data from ICP Forests for running of C3 models. ***Action: CE to liaise with WDV and MD.***

(c) Identify and collect datasets from other sources for model testing/running e.g. within NitroEurope, ICP EU Vulcan, EU Increase etc. ***Action: Kevin Hicks to do this in liaison with CE***

Use modified existing NitroEurope template as being developed by Sue Owen et al. with inputs from WP12/13 modellers as to what is essential and what is desirable.

Division of work

Change from original to, units person-months:

(1) Process type from lit review

- Crops: 4.3 (2.5 HP,1.8 GM)
- trees: 5.3 (1.8 PEK, 0.5 HP, 2.0 LS, 0.5 TM, 0.5 GM)
- grasslands 1.5 (GM)
- shrubs and peatlands: 1.5 (CB)

For all - staff time involves some input to (2)

(2) Process type from original data
GM to collate initially (with help from others in template design)

(3) ecosystem-scale
Forests – level II plots: 7(1.9 WDV, 5.0 MD)
other data sources, link person for ecosystem scale data sources for C3 modelling (KH)

(4) Coordination and template design: 1 (GM)

Table 1: Processes and hypotheses (may be edited later) to test for data mining. Note: more specific list of search terms per process will be agreed upon by 1 April

No	Process	Hypothesis: O3, alone and in interaction with N, CO2 and where appropriate climatic stress ….	Notes	Solved by lit rev or new expts?
1	Stomatal functioning	….alters stomatal uptake of CO2 by (a) damaging guard cell membranes and/or (b) altering hormonal control of stomatal functioning and/or (c) by affecting internal CO2 concentration and/or (d) uncoupling of gs from Pn	Does each O3 interaction increase or decrease stomatal conductance – if so how does this happen? Also include costs of cavitation and embolism Protein turnover Anti-oxidants	both
2	Ozone detoxification	… is detoxified by a constant amount within plants	May not be possible yet to represent the dynamics of detoxn in models	Neither?
3	Components of photosynthesis	…modifies components of photosynthesis such as Jmax and Vcmax, light reactions, RuBisCo…. thereby reducing C fixation.	List processes to be investigated, e.g. what is the direction of change of slope	both
4	Phloem loading	…reduces phloem transport of C by reducing energy availability	Not much in the literature on this	Lit only
5	Repair respiration	…increases respiration to produce energy for repair processes	Impt for forests Includes cost of extra protein turnover and anti-oxidants	both
6	C allocation	…alters root and shoot biomass, their ratio, root turnover and other "architecture" effects, and for crops: harvest index and seeds	Build on what's new since previous meta-analyses and reviews	Mainly, lit. measured at end of expts if poss.
7	Senescence/growing season	..shortens growing cycles/lifetime by accelerating the progress of senescence	e.g. N results in earlier bud burst, are plants then more sensitive to early season ozone	Lit & expts
8	LAI	…decreases maximum leaf area index	Consider also timing of peak LAI. Currently needed in models - can this be avoided? Is there a surrogate a difficult to measure?	Measure in expts? May not be possible, Not too much in lit on this?
9	C inputs to soil and C processes in soil	…increases C inputs to soil by increased litter fall, altered C:N of litter and increased C exudation from roots , and.. …alters the turnover of old and new C, including impacting on CO2 release from soils and DOC losses from soil	If O3 increases C inputs to the soil, are all the usual processes (as studied by biogeochemists) then affected as currently known?	Expts to fill gaps

Decisions for WP10 (Claus Beier)

A "rough" list of response measurements were discussed and decided. The list includes the following parameters, which was believed to be relevant and important parameters useful to constrain and validate model outputs and yet feasible to measure at most sites:

Compartment	**Parameter - variable**	**Frequenzy**
Photosynthesis		Response functions including interactions
Plant C and N	Above ground biomass	Annual
	Root C and N	Annual
	Litter production	Annual
	Tissue C and N	Annual
Soil C and N	Soil respiration	Bi-weekly
	Bulk soil C & N	By horizon – Once (whole soil for pot experiments
	C and N leaching	Monthly

List of variables

The list has to be checked and commented by the modelers and by each site"experiment owner. ***Action: Check list of variables with modelers. Deadline for circulation 1st February. Deadline for approval 15th February. Responsible Claus Beier***

After the approval of the parameters, measurement protocols (method and timing) will be developed and circulated. ***Action: Measurement protocol. Deadline for first draft 1st March, responsible Claus Beier***

Independent of this, the experiments need to be documented. A draft for this will be circulated and must be completed by the site owners. ***Action: Call for documentation of experiments, Deadline 1st March. Responsible Claus Beier.***

Driving variables for model application must be submitted (preferably by the database system) by all field sites in order for modelers to apply their models (not responses to Ozone, which will come later). Data from non-field sites (OTCs and "artificial" ecosystems) need consideration by the modelers as to how they should be used. ***Action: Circulate request to data owners for data submission, Deadline 1st March, Responsible Claus Beier. Data submission, Deadline 1st June. Responsible Modellers (data request - Chris) and site owners.***

Decisions for WP11 (Elena)

Key questions and the threshold concept for each task were discussed and approved as follows:

- T11.1 Is N form important in affecting C sequestration and allocation ? Will the peatland continue to sequester C (GHG release) ? Threshold for N effects on biodiversity in terms of species cover in the bog
- T11.2 Does BVOC emission increase the potential for O3 uptake and ROS detoxification? Thresholds of emission that confer ozone tolerance
- T11.3 Which is the role of particulate in plant water control? Thresholds for the amount of particulate inducing 20% of change

Responsabilities and deadlines of the most coming commitments were discussed and approved as follows:

- ***T11.1 Parameterization of the impact of reduced and oxidised wet and dry N deposition on GHG and NOx fluxes, N immobilisation, natural vegetation types, species physiology, soil chemistry, and losses and allocation of C & N. Responsible: Lucy Sheppard (Month18)***
- ***T11.2 Quantification and parameterization of foliar O3 deposition under progressing drought and temperature stress. Responsible: Elena Paoletti (Month16)***
- ***T11.3 Quantification of minimum epidermal conductance under different loads of particles. Responsible: Juergen Burkhardt (Month12)***

Decisions for WP12 (Lisa Emberson)

A. Develop process based understanding of plant responses to pollutants and environmental conditions.

1. Develop flow charts describing key model processes

Identifying possible mechanisms by which O3 might be expected to impact on these processes; circulate to data miners (WP9) and other ecosystem modellers (WP13 & C4) for comment. ***Action: York, CEH Bangor, KK (ALTERRA) by end Feb***

The following key model processes would be investigated:

- Photosynthesis and stomatal conductance
- Respiration (maintenance and growth)
- C and N allocation, C to N ratio, both considering the impact of different water availabilities
- BVOC and relevance for O3 detoxification processes

These flow chart descriptors would be continually developed as new information becomes available. This information would come, i) from both the data mining, ii) from the 'modelling community' as information is gathered from a wider group of modellers and iii) from the experiments. Therefore the development of these flow chart descriptions would be an interactive process with the ultimate aim being that the final flow chart descriptions would be able to robustly describe the processes by which O3 and other pollutants and variables interact to affect these core model variables.

2. Identify important response parameters.
These would be both intermediate (e.g. change in photosynthesis) and final (e.g. change in biomass) response parameters. Defining these responses would identify measurements that should be performed within the experimental campaigns and also help in identifying model outputs that could be used to inform pollutant and climate change impacts on ecosystem services. ***Action: CEH Bangor, York and WP9 & 10.....by April***

3. Modify key model processes within DO3SE
The final flow chart descriptors would be used to modify key DO3SE modules. Where appropriate these modified modules (e.g. Photosynthesis) could be used to inform additional module modifications in the other ecosystem models used in WP 13 and C4. ***Action: York by Month 36***

B. Apply the DO3SE model for all experimental sites.

A list of required DO3SE model input data and parameterisations would be circulated to all experimental sites within WP10 & 11. ***Action: York by Month 6***

A provisional version of the DO3SE model would be applied for data obtained from experiments performed during 2012. This modelling would perform some sensitivity assessments and focus on providing O3 flux estimates for different treatment conditions. ***Action: York by Month 24***

A final application of the DO3SE model for all experimental sites would be performed with the new DO3SE model. ***Action: York by Month 40***

C. Development of new dose response relationships and novel thresholds [for discussion]

We still need to discuss how our improved understanding of the processes leading to plant and ecosystem response to pollutants under variable environmental conditions should be best applied in i) pollutant effect modelling and mapping and ii) ecosystem models.

For example, it might be possible to define new dose-response relationships and critical fluxes for O3 below which damage would not be expected to occur based on reanalysis of existing dose-response data with ECLAIRE experimental data added to this data pool, this re-analysis would use the new DO3SE model; as such these dose-response relationships and critical fluxes could start to bring in the effects of pollutant mixtures and environmental conditions (i.e. these would be modelled and mapped for Europe for a particular set of annual conditions). However, it would be imperative to discuss such possibilities with EMEP and RIVM to agree application methods for modelling and mapping of pollutant deposition and effects work across Europe. It may also be possible to define dose-response relationships and critical fluxes that specifically protect, and assess damage, of different responses such as C sequestration, crop yield, biodiversity etc.... These critical fluxes and thresholds would be novel since they would be able to incorporate the effect of pollutant mixtures and environmental variables on the response in question. The development of the dose-response relationships would also benefit from efforts in UoG to develop more statistically robust methods of defining regression analysis and trialling different detoxification thresholds. The latter work, especially in relation to laying down of plant biomass, could be crucial in determining how the photosynthetic process is modified in DO3SE as described in point A above.

Resulting maps of risk and damage could be compared with regional applications of the ecosystem models (and particular outputs of these models) to inform the pollutant deposition modelling and mapping.

These issues will require further discussion, and can be informed as our understanding of the processes governing the responses improves.

These discussions would benefit from a meeting of York, IVL, UoG, RIVM Dave Simpson and Mike Holland possible in Goteborg in 2012 or early 2013.

Decisions for WP13 (Chris Evans)

Models to be applied initially on a site basis for C3 are:

Model	**Responsible person(s)**
DOSE	Lisa
FORSPACE-VSD+-EUMOVE	Koen, Luc
JULES-N14C-GBMOVE	Ed R, Ed T (with Lina Mercado for JULES)
DNDC-MOBILE	Klaus
LPJ-GUESS	Almut

There should be some flexibility and interaction between models. For example FORSPACE could also be linked to N14C, and the EUMOVE and GBMOVE biodiversity models could be interchanged. JULES and

the expanded DOSE will have some overlapping process descriptions, so interactions will be needed here to ensure consistency.

Other DGVM modellers in C4 will be encouraged to apply their models to the same sites – this should also include JULES, O-CN, CLM.

Ecosystem models will be applied to field experiments, but not 'artificial' experimental sites (e.g. pot-based experiments, open-topped chambers). Here, the aim will be to use dose-response relationships obtained from the experiments to develop and parameterise the models, which will then be run on comparable field sites – i.e. monitoring sites with broadly comparable vegetation, soils and geographic location

The DOSE model will be applied to all experiments.

Note that not all models are applicable to all ecosystem types.

ACTIONS

1. Most/all of **Chris Evans, Ed Tipping, Ed Rowe, Koen Kramer** (plus other Alterra modellers), **Almut Arneth, Klaus Butterbach Bahl and Lisa Emberson** (and/or Patrick Buecker) to attend ECLAIRE modelling meeting in Vienna on behalf of C3, ***March 22-23***
2. **Ed T, Koen (and colleagues), Almut and Klaus** to provide Chris with a (preferably short!) list of the 'essential' parameters they require in order to run their models, ***as soon as possible***
3. **Chris** to collate and circulate the list of priority measurements to support model parameterization and testing to the wider ECLAIRE ecosystem modelling group and to C3 data providers, ***by end of Feb***
4. **All WP13 modeller**s to comment on and add to WP12 flowchart of key processes, ***by end of Apr***
5. **Lisa** to contact Lina Mercado to discuss integration of process descriptions between enhanced DOSE model and JULES.
6. **Koen** to proceed with linking FORSPACE model to VSD+, aiming to use a modular approach that will permit other models to be substituted, e.g. N14C for VSD+.
7. **WP9 and WP10 participants** to identify some candidate field monitoring sites (from ICP Forests, NitroEurope etc) that can be considered analogous to the (non-field based) experiments in terms of vegetation, soils and geographic region, and which have sufficient measurement data to support application of ecosystem models.
8. **Chris and other WP13 modellers** to prepare a short report (C3 Deliverable 3.5.1), by end of Mar, to include:
   - Short model descriptions and references, including drivers and outputs
   - Table of prioritised data requirements
   - List of inputs required from other models and outputs to other models (where relevant)
   - Overall proposed modelling structure (which models linked and how)
   - (Possibly) some illustrative model runs or key conceptual relationships in the models
9. **All modellers** will undertake an initial application of the current version of their model to the selected testing sites. This is not expected to provide a full assessment of ozone x other driver

impacts at this stage, but should give an early indication of data suitability and model performance, and indicate any major requirements for new measurements, data or test sites, and also help to inform further model development and linking.

Future meetings

It is foreseen that a common meeting for C3 is needed in app. a years time to look at response data and to decide about the future strategy. This meeting could preferably be associated with the next annual eclaire meeting. Claus will check if that's possible.

WP specific meetings are decided by the WPs and informed to the rest of C3.

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