Executive Summary: Activities in the first year of the Integrated Project CarboEurope-IP (GOCE-CT2003-505572)

Main objectives of CarboEurope-IP

The overarching aim of CarboEurope-IP is to understand and quantify the present terrestrial carbon balance of Europe and the associated uncertainty at local, regional and continental scale. In order to achieve this goal, the project addresses three major topics:

1. Determination of the carbon balance of the European continent, its geographical patterns, and changes over time.
2. Enhanced understanding of the controlling mechanisms of carbon cycling in European ecosystems, and the impact of climate change and variability, and changing land management on the European carbon balance.
3. Design and development of an observation system to detect changes of carbon stocks and carbon fluxes related to the European commitments under the Kyoto Protocol.

Contractors involved

CarboEurope-IP integrates and expands the research efforts of 61 European universities and research institutes from 17 European countries as project contractors (Figure 1) and around 30 associated institutes from all over the world. The updated list of contractors is given at the end of this executive summary. The project is co-ordinated by Ernst-Detlef Schulze and Annette Freibauer (project manager), Max-Planck-Institute for Biogeochemistry, Jena, Germany. The four main scientific components of the project are led by

- Riccardo Valentini, University of Tuscia, Viterbo, Italy: Ecosystem Observations
- Philippe Ciais, Laboratory of Climate and Environmental Sciences (LSCE), Gif-sur-Yvette, France: Atmospheric Observations
- Han Dolman, Vrije Universiteit Amsterdam: Regional Experiment
- Martin Heimann, Max-Planck-Institute for Biogeochemistry, Jena, Germany: Continental Integration and Modelling

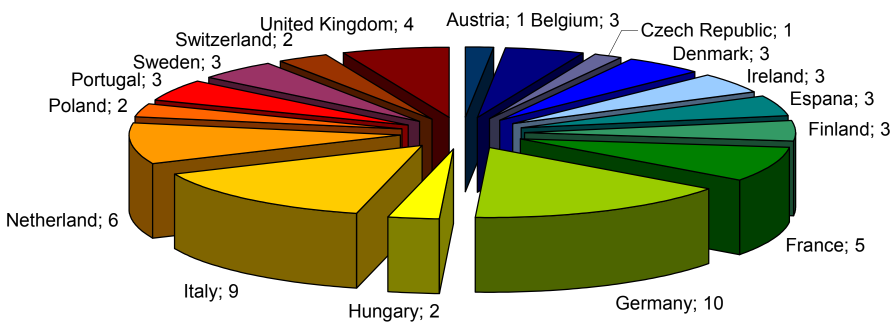

Figure 1 Countries of origin of CarboEurope-IP contractors

Contact details of Co-ordinator

Ernst-Detlef Schulze (Co-ordinator), Annette Freibauer (Project manager)
Max-Planck-Institute for Biogeochemistry
P.O. Box 100164
07701 Jena, Germany
Phone +49 3641 576164
Fax +49 3641 577100
E-mail dschulze@bgc-jena.mpg.de, afreib@bgc-jena.mpg.de

Project website: www.carboeurope.org

Work performed and results achieved

The move from a cluster of projects in FP5 to an Integrated Project has stimulated the collaboration among groups. For example, the soil sampling team would have never achieved its ambitious sampling target without the excellent local support of the groups responsible for the "Verification Sites". Also a much faster and complete data delivery than in the past and willingness to participate in overarching analyses was recognized.

In addition, several activities are still running in the frame of European FP5 projects. Whilst the results were available and discussed in CarboEurope-IP they are not reported here.

European heat and drought wave 2003 (Ciais et al., submitted to Nature)

In a joint effort of scientists from all major Components of the proejct, a bottom up analysis and first inverse analyses were performed of the immediate impacts of the 2003 heat and drought wave on the productivity of European ecosystems. We have found a large spike of abnormally high CO_2 values in the seasonal cycle of CO_2 during July-August 2003 indicating the presence of an abnormal source or lack of sink of CO_2. Several ecosystem models with different complexity are being used for the bottom-up analysis. Although the intensity and spatial patterns of the response of ecosystem differ among the models some consistent patterns can be seen. The combination of rainfall deficit and of high summer temperature had its greatest effect on temperate forests in France, Germany, Northern Italy, and in South Eastern Europe where high evaporative demand and strong water limitations had large impacts on carbon uptake. This coincides with areas with the strongest anomalies in rainfall and temperature where the vegetation was still in an active phase at the onset of drought. Preliminary results based on the model ORCHIDEE, eddy flux data and statistics, are presented in Figure 2.

Component 1 Ecosystems

The overall goal of the CarboEurope-IP Ecosystem Component is to provide the carbon fluxes and carbon balance of major European landscape elements, and understanding of the controlling biogeochemical processes, as a basis for bottom-up assessments of the European carbon balance.

A dense network of ecosystem flux sites across European major land use types, biomes, and climate zones has been established. The network of 51 "Main Sites" (co-funded by CarboEurope-IP) and 52 "Associated Sites" (non-funded by CarboEurope-IP) has been made operational in the first year. Investigators have agreed on common measurement protocols for eddy flux data, additional ecosystem parameters and information about land use history which are essential to partition ecosystem NEE into important compartments and to study the effects of climate, land use and management on the ecosystem carbon balance.

Successful automation of the procedures for treating eddy flux data at one central data base represents a key achievement of the first project year. Automated standard consistency checks of data delivered to the Ecosystem Database and standard data processing procedures for quality flagging and gap-filling were developed and are now operational.

Improved standard meteorological quality tests and footprint analyses of the eddy flux sites were developed and are currently applied to the "Main Sites". In parallel, an intercomparison of eddy flux software is in progress. One advection experiment was conducted in the first year with a two-dimensional measurement set-up and results are being analysed.

At twelve Main Sites intensive soil sampling was performed in order to obtain detailed spatial information of soil C stocks, soil types and relevant soil physical and chemical characteristics.

Data analyses to derive model parameters and first model runs were performed. For croplands, first model results suggest that climate change will further increase the carbon losses from European croplands.

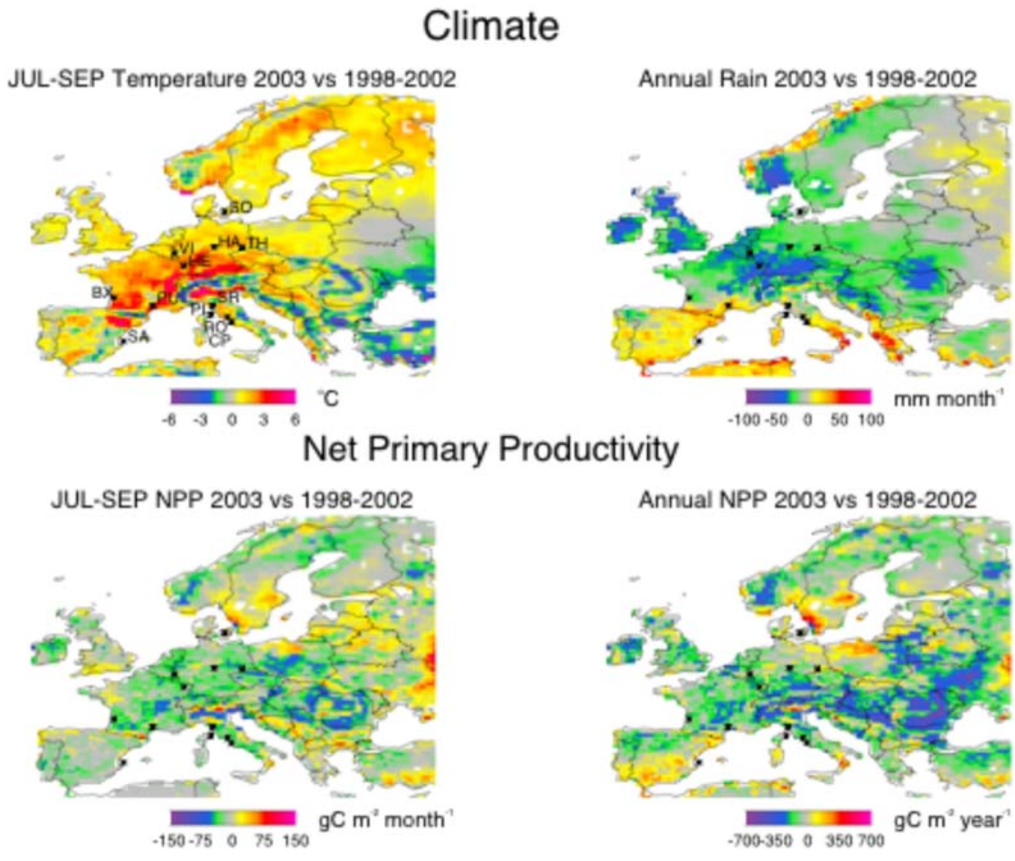

Figure 2 Changes in summer air temperature (average July to September). Changes in annual precipitation over Europe between 2003 vs. the average of 1998-2002. Simulated changes in summer NPP. Simulated changes in annual mean NPP in response to climate.

Component 2 Atmosphere

The overall goal of the CarboEurope-IP Atmospheric Component during the first year was to establish the atmospheric observing system that is needed to quantify the European carbon balance using inversion models and to measure atmospheric concentrations of CO_2 and tracers at high precision.

To meet that objective, we measure concentrations of atmospheric trace gases over Europe in a dense network, and operate a cooperative network of high frequency *in situ* CO_2 concentration measurements. In its final configuration, the network will consist of 12 existing ground level sites, some of them having been in operation for more than two decades, and of 8 new tall towers, where CH_4, SF_6, N_2O, and CO will be measured continuously in addition to CO_2. During the reporting period, 9 ground level sites have been operating as well as 2 tall towers as part of the ongoing CHIOTTO (FP5) project, while instruments were being built and sites equipped for the others. The half-hourly concentration data of CO_2, tracers and meteorology are reported to the Atmospheric Component database, linked to the Central Database.

We have established at many stations, data selection criteria enabling to assess the representativeness of one particular observation for regional and continental scale source determination. Yet, all the stations do not select data for background vs. local representativeness and this effort needs to be pursued in the next phase.

The TACOS (FP5) project has been running an intercomparison of high precision gas concentration measurements in the 5 laboratories involved in air sample analysis from flask measurements in Europe. We have been successful in determining differences in flask air measurements over the past few years for CO_2, CH_4, and isotopes. For CO_2 and CH_4, we put in evidence systematic offsets between laboratories, but these offsets were constant in time in all laboratories except for one and remained during the 3 years intercomparison program within the internationally recognized WMO precision targets. In addition, we now have built a primary scale for $^{13}C/^{12}C$ and $^{18}O/^{16}O$ isotope ratios in atmospheric CO_2 and installed a very high precision LOFLO analyzer for improving the detection of inter-laboratory differences of standard gases.

Component 3 Regional Experiment

The main objective during this period was to extend the model analysis of the data from flux aircraft obtained during the FP5 RECAB project data and to apply down scaling techniques (inverse models), to guide both the development of the data assimilation system and the planning of the experiments. This will lead to a "proof of concept" for the Regional Experiment that the regional distribution of carbon sources and sinks using a set of limited atmospheric observations.

In the first year the Vrije Universiteit Amsterdam has refined the inversion technique that has been used formerly in the RECAB project. The results can be considered as a preliminary version of the "proof of concept" that should be ready in month 18.

The year 2004 has seen substantial progress in modeling, both inverse and forward at regional scale. The aircraft measurements can also be extended to improve regional estimates of carbon fluxes. Our technical capability for measurements is now such that combined with the modeling capabilities we have good confidence that we will be able to determine the carbon balance of the target area with the accuracy promised in the Description of Work. A report detailing this will be available before the experiment. Several new techniques (FTIR) and models (BRAMS, STILT) are also now available within the project and will improve our capabilities.

Using the improved models it is now possible to perform regional inversion studies, currently still only for a few days, but this can be extended.

The intensive experimental campaign in South-West France is now planned for 16 May to 25 June 2005. An experimental plan detailing all the activities and procedures for briefings, flight planning etc. is almost finalized. It is expected to have at least one flux plane, one remote sensing aircraft and possibly two concentration measuring aircraft available during the campaign. At the surface two fixed towers will be complemented by at least three mobile towers sampling the major land use covers. A RASS/Sodar setup and a separate UHF windprofiler will probe the boundary layer properties. The atmospheric properties at the inflow of the domain will be measured at high instrumental resolution by a tall tower at Biscarosse. A second 20 meter tower more inland will sample the atmospheric concentration with somewhat less instrumentation (virtual tower).

Component 4 Continental Integration

Main objectives of the Integration Component are

1. to develop advanced modelling tools for estimating the spatially explicit continental carbon balance and its variability at a resolution of 10 to 50 km for at least the length of a Commitment Period, and
2. to test a multiple constraint approach by applying top down, bottom up and data assimilation methodologies to achieve the best possible estimate of the European carbon balance, its uncertainty and to determine the spatio-temporal variation in biospheric and anthropogenic fluxes over Europe

Auxilliary information about climate, ecosystem properties and biogeochemical drivers and harmonized, high spatio-temporal resolution are prerequisites for achieving the objectives. As a first step, the "Eurogrid" was defined based on the European Reference Grid in order to harmonize the areal extent, projection, resolution etc. based on which data products relevant for modelling are being produced. First products available encompass two FAPAR products and a georeferenced data product of soil properties. Spatially explicit forest carbon inventories are available for eight European countries.

The comparison of inverse model results initiated during FP5 was continued. We estimated fluxes and their uncertainties at the regional level for Europe, on a monthly basis using two global models TM3, LMDZ and three regional models REMO, HANK and DEHM which have high resolution in a limited domain over Europe. Results show a 0.2 GtC y^{-1} sink for the late 1990s for geographical Europe with, however, high uncertainty. This sink is in better agreement with bottom up result fluxes from Janssens et al. (Science 300: 1538-1542, 2003) than earlier estimates thus closing the gap between the two different approaches.

New inverse set ups to infer fluxes at higher spatial and temporal resolution than for the model intercomparison are being developed that will be able to accommodate continuous atmospheric concentration data.

Significant progress has also been achieved in development of bottom-up models, parameter optimization, and integration of land use in generic biosphere models.

List of publications related to CarboEurope-IP

The publications listed below result from scientific activities related to FP5 projects of the CarboEurope clusters and first activities within CarboEurope-IP. They are not an exhaustive list but those indicated to the co-ordinator.

Published papers in peer-reviewed journals

1. Anthoni, P. M., A. Knohl, A. Freibauer, M. Mund, W. Ziegler, O. Kolle, and E.-D. Schulze. 2004. Forest and agricultural land use dependent CO_2 exchange in Thuringia, Germany. Global Change Biology **10**:2005-2019, doi:2010.1111/j.1365-2486.2004.00863.x.
2. Berninger, F., E. Nikinmaa, P. Hari, M. Lindholm, and J.Meriläinen. 2004. Simulation of tree ring growth using process based approaches. Tree Physiology **24**:193-204.

3. Carrara, A., I. A. Janssens, J. C. Yuste, and R. Ceulemans. 2004. Seasonal changes in photosynthesis, respiration and NEE of a mixed temperate forest. Agricultural and Forest Meteorology **126**:15-31, doi:10.1016/j.agrformet.2004.1005.1002.
4. de Arellano, J. V. G., B. Gioli, F. Miglietta, H. J. J. Jonker, H. K. Baltink, R. W. A. Hutjes, and A. A. M. Holtslag. 2004. Entrainment process of carbon dioxide in the atmospheric boundary layer. Journal of Geophysical Research-Atmospheres **109**: art. no. D18110.
5. Foken, T., M. Göckede, M. Mauder, L. Mahrt, B. D. Amiro, and J. W. Munger. 2004. Post-field data quality control. Pages 181-208 *in* X. Lee, Massman, WJ, Law, BE, editor. Handbook of Micrometeorology: A guide for Surface Flux Measurements. Kluwer Academic Publishers, Dordrecht.
6. Göckede, M., C. Rebmann, and T. Foken. 2004. A combination of quality assessment tools for eddy covariance measurements with footprint modelling for the characterisation of complex sites. Agricultural and Forest Meteorology **127**:175-188.
7. Granier, A., P. Berbigier, R. Ceulemans, T. Grünwald, B. Heinesch, A. Knohl, B. Köstner, D. Loustau, K. Pilegaard, M. Reichstein, T. Vesala, Q. Wang, and J. Tenhunen. 2004. The drought of 2003 in Western Europe: consequences on forest ecosystem functioning. Berichte Freiburger Forstliche Forschung **57**:42.
8. Janssens, I. A., A. Freibauer, B. Schlamadinger, R. Ceulemans, P. Ciais, A. J. Dolman, M. Heimann, G.-J. Nabuurs, P. Smith, R. Valentini, and E.-D. Schulze. 2004. The carbon budget of terrestrial ecosystems at country-scale - a European case study. Biogeosciences Discussions **1**:167-193.
9. Köstner, B., D. Gerold, T. Grünwald, and C. Bernhofer. 2004. Drought effects on carbon and water fluxes of Norway spruce (/Picea abies/) at the tree and stand level: comparison of 2003 with preceding years. Berichte Freiburger Forstliche Forschung **57**:41.
10. Kowalski, A. S., D. Loustau, P. Berbigier, G. Manca, V. Tedeschi, M. Borghetti, R. Valentini, P. Kolari, F. Berninger, U. Rannik, P. Hari, M. Rayment, M. Mencuccini, M. J., and J. Grace. 2004. Paired comparisons of carbon exchange between undisturbed and regenerating stands in four managed forests in Europe. Global Change Biology **10**:1707-1723.
11. Kulmala, M., T. Suni, K. E. J. Lehtinen, M. D. Maso, M. Boy, A. Reissell, Ü. Rannik, P. Aalto, P. Keronen, H. Hakola, J. Bäck, T. Hoffmann, T. Vesala, and P. Hari. 2004. A new feedback mechanism linking forests, aerosols, and climate. Atmospheric Chemistry and Physics **4**.
12. Longdoz, B., M. Aubinet, and L. M. François. 2004. Modelisation Of CO_2 Flux Exchanged By Forest Ecosystems : The impacts of radiation absorption by aerial wood and of canopy component temperatures. Agricultural and Forest Meteorology **125**:83-104. (F.I. 2003: 2002.2395).
13. Mäkelä, A., P. Hari, F. Berninger, H. Hänninen, and E. Nikinmaa. 2004. Acclimation of photosynthetic capacity in Scots pine to the annual cycle of temperature. Tree Physiology **24**:369–376.
14. Neubert, R. E. M., L. L. Spijkervet, J. K. Schut, H. A. Been, and H. A. J. Meijer. 2004a. A computer controlled continuous air drying and flask sampling system. Journal of Atmospheric and Oceanic Technology **21**:651 - 659.
15. Neubert, R. E. M., L. L. Spijkervet, J. K. Schut, H. A. Been, and H. A. J. Meijer. 2004b. A computer controlled continuous air drying flask sampling system. Journal of Atmospheric and Oceanic Technology **21**:651-659.

16. Perrin, D., E. Laitat, M. Yernaux, and M. Aubinet. 2004. Modelling of the response of forest soil respiration fluxes to the main climatic variables. Biotechnol.Agron.Soc.Environ. **8**:15-26.

17. Pumpanen, J., P. Kolari, H. Ilvesniemi, K. Minkkinen, T. Vesala, S. Niinistö, A. Lohila, T. Larmola, M. Morero, M. Pihlatie, I. Janssens, J. C. Yuste, J. M. Grünzweig, S. Reth, J.-A. Subke, K. Savage, W. Kutsch, G. Oestreng, W. Ziegler, P. Anthoni, A. Lindroth, and P. Hari. 2004. Comparison of different chamber techniques for measuring soil CO_2 efflux. Agricultural and Forest Meteorology **123**:159-176.

18. Rannik, Ü., P. Keronen, P. Hari, and T. Vesala. 2004. Estimation of forest-atmosphere CO_2 exchange by direct and profile techniques. Agricultural and Forest Meteorology **126**:141-155.

19. Rebmann, C., M. Göckede, T. Foken, M. Aubinet, M. Aurela, P. Berbigier, C. Bernhofer, N. Buchmann, A. Carrara, A. Cescatti, R. Ceulemans, R. Clement, J. A. Elbers, A. Granier, T. Grünwald, D. Guyon, K. Havránková, B. Heinesch, A. Knohl, T. Laurila, B. Longdoz, B. Marcolla, T. Markkanen, F. Miglietta, J. Moncrieff, L. Montagnani, E. Moors, M. Nardino, J.-M. Ourcival, S. Rambal, Ü. Rannik, E. Rotenberg, P. Sedlak, G. Unterhuber, T. Vesala, and D. Yakir. 2005. Quality analysis applied on eddy covariance measurements at complex forest sites using footprint modelling. Theoretical and Applied Climatology: doi: 10.1007/s00704-00004-00095-y.

20. Sogachev, A., and J. Lloyd. 2004. Using a one-and-a-half order closure model of the atmospheric boundary layer for surface flux footprint estimation. Boundary Layer Meteorology **112**:467-502.

21. Sogachev, A., Ü. Rannik, and T. Vesala. 2004. On flux footprints over the complex terrain covered by a heterogeneous forest. Agricultural and Forest Meteorology **127**:143-158.

22. Sturm, P., M. Leuenberger, C. Sirignanon, R. E. M. Neubert, H. A. J. Meijer, R. L. Langenfelds, W. A. Brand, and Y. Tohjima. 2004. Permeation of atmospheric gases through Viton O-rings used for flask sampling. J. Geophys. Res. **109**:10.1029/2003JD004073.

23. Subke, J.-A., V. Hahn, G. Battipaglia, S. Linder, N. Buchmann, and M. F. Cotrufo. 2004. Feedback interactions between needle litter decomposition and rhizosphere activity. Oecologia **139**:551-559, DOI: 510.1007/s00442-00004-01540-00444.

24. Vesala, T., Ü. Rannik, M. Leclerc, T. Foken, and K. Sabelfeld. 2004. Flux and concentration footprints. Forward to the special issue. Agricultural and Forest Meteorology **127**.

25. Wang, Q., J. Tenhunen, N. Q. Dinh, M. Reichstein, T. Vesala, and P. Keronen. 2004. Similarities in ground- and satellite-based NDVI time series and their relationship to physiological activity of a Scots pine forest in Finland. Remote Sensing of Environment **93**:225-237.

26. Yuste, J. C., I. A. Janssens, A. Carrara, and R. Ceulemans. 2004. Annual Q10 of soil respiration reflects plant phenological patterns as well as temperature sensitivity. Global Change Biology **10**:161, doi:110.1111/j.1529-8817.2003.00727.x.

27. Zimnoch, M., T. Florkowski, J. M. Necki, and R. E. M. Neubert. 2004. Diurnal variability of $d^{13}C$ and $d^{18}O$ of atmospheric CO_2 in the urban area of Kraków, Poland. Isotopes in Environmental and Health Studies **40**.

Accepted papers in peer-reviewed journals

28. Aubinet, M., P. Berbigier, C. Bernhofer, A. Cescatti, C. Feigenwinter, A. Granier, T. Grünwald, K. Havrankova, B. Heinesch, B. Longdoz, B. Marcolla, L. Montagnani, and P. Sedlak. in press. Comparing CO_2 storage and advection conditions at night at different CARBOEUROFLUX sites. Boundary Layer Meteorology.

29. Berninger, F., L. Coll, P. Vanninen, A. Mäkelä, S. Palmroth, and E. Nikinmaa. in press. Effects of tree size and position on pipe model ratios in Scots pine. Canadian Journal of Forest Research.

30. Caldeira, M. C., A. Hector, M. Loreau, and J. S. Pereira. in press. Species richness, temporal variability and resistance of biomass production in a Mediterranean grassland. OIKOS.

31. Dellwik, E., and N. O. Jensen. in press. Flux-profile relationships over a fetch limited forest. Boundary Layer Meteorology.

32. Gu, L., E. M. Falge, T. Boden, D. D. Baldocchi, T. A. Black, S. R. Saleska, T. Suni, S. B. Verma, T. Vesala, S. C. Wofsy, and L. Xu. in press. Objective threshold determination for nighttime eddy flux filtering. Agricultural and Forest Meteorology.

33. Hölttä, T., T. Vesala, E. Nikinmaa, M. Perämäki, E. Siivola, and M. Mencuccini. in press. On relationships between embolism and xylem diameter variations in the field for Scots pine trees. Tree Physiology.

34. Jensen, N. O., T. N. Mikkelsen, E. Dellwik, and K. Pilegaard. in press. Inter-annual variation in carbon uptake by a deciduous forest and a comparison to the uptake of a coniferous forest in Denmark. World Resource Review.

35. Juurola, E., T. Aalto, T. Thum, T. Vesala, and P. Hari. in press. Temperature dependence of leaf-level CO_2 fixation -- revising biochemical coefficients through analysis of leaf three dimensional structure. New Phytologist.

36. Niemand, C., B. Köstner, H. Prasse, T. Grünwald, and C. Bernhofer. in press. Relating tree phenology with net ecosystem exchange at Tharandt forest. Meteorol. Zeitschrift.

37. Sogachev, A., O. Panferov, G. Gravenhorst, and T. Vesala. in press. Numerical analysis of flux footprints for different landscapes. Theoretical and Applied Climatology.

38. Vesala, T., T. Suni, Ü. Rannik, P. Keronen, T. Markkanen, S. Sevanto, T. Grönholm, S. Smolander, M. Kulmala, H. Ilvesniemi, R. Ojansuu, A. Uotila, J. Levula, A. Mäkelä, J. Pumpanen, P. Kolari, L. Kulmala, N. Altimir, F. Berninger, E. Nikinmaa, and P. Hari. in press. The effect of thinning on surface fluxes in a boreal forest. Global Biogeochemical Cycles.

Updated list of contractors

No.	Code	Institute name	Country
01	MPI-BGC	Max Planck Institute for Biogeochemistry	Germany
02	UNITUS	U. of Tuscia, Dept. of Forest Environment and Resources (DISAFRI)	Italy
03	VU-A	Free U. Amsterdam, Dept. Geo-Environmental Sciences	Netherlands
04	CEA-LSCE	CEA, LSCE, Laboratory of Climate and Environmental Sciences	France
05	UEDIN	U. of Edinburgh, School of GeoSciences	UK
06	UABDN	U. of Aberdeen, School of Biological Sciences	UK
07	INRA	INRA - National Institute of Agronomic Research	France
08	FUSAGx	Faculty of Agronomic Sciences Gembloux (UPB)	Belgium
09	CNRM	Météo-France/CNRM	France
10a	CNR-IBIMET	CNR, Institute of Biometeorology	Italy
10b	CNR-ISAC	CNR-ISAC	Italy
10c	CNR-ISAFoM	CNR-ISAFoM	Italy
11	ECN	ECN - Energy Research Center of the Netherlands, Dept. Air Quality	Netherlands
12	UHEI-IUP	U. Heidelberg, Inst. for Environmental Physics	Germany
13	ALTERRA	ALTERRA (Wageningen University and Research)	Netherlands
14	JRC-IES	EC-Joint Research Centre, IES	Italy
15	JR	Joanneum Research	Austria
16	MET-OFFICE	MetOffice, Hadley Centre	UK
17	PIK	Potsdam Inst. for Climate Impact Research	Germany
18	APB	Autonomous Province of Bolzano/Bozen South Tyrol - Forest Department	Italy
19	CEALP	Centre of Alpine Ecology	Italy
20	CEAM	Foundation CEAM	Spain
21a	CEH-WAL	Centre of Ecology and Hydrology (CEH) - Wallingford	United Kingdom
21b	CEH-EDIN	Natural Environmental Research Council, CEH-Edinburgh	UK
22	CNRS-CEFE	National Centre of Scientific Research, DREAM CEFE CNRS	France
23	CTFC	Forest Technology Centre of Catalunya, Laboratory of Plant Ecology and Forest Botany	Spain
24	FAL	Swiss Federal Research Station for Agroecology and Agriculture (FAL)	Switzerland
25	FMI	Finnish Meteorological Institute, Air Quality Research	Finland
26	ILE	Acad. of Sciences of Czech Republic, Inst. of Landscape Ecology	Czech Republic
27	IST	Superior Technical Institute	Portugal
28	LUND	Lund U., Dept. of Physical Geography and Ecosystems Analysis	Sweden
29	RISOE	Risoe National Laboratory	Denmark
30a	SLU-DEER	Swedish U. of Agricultural Sciences, Dept. of Ecology and Environmental Research (DEER)	Sweden
30b	SLU-FS	Swedish U. of Agricultural Sciences, Dept. of Forest Soils	Sweden
30c	SLU-PE	Swedish U. of Agricultural Sciences, Dept. for Production Ecology	Sweden
33	SRON	SRON National Institute for Space Research, IMAU	Netherlands
34	SUN	Second U. of Napoli, Dept. of Environmental Science	Italy
35	TCD	Trinity College Dublin	Ireland
36	TUD	TU Dresden, IHM-Meteorology	Germany
37	TUM	TU Munich Dept. of Soil Science	Germany
38	UA	U. of Antwerp (UIA), Dept. Biology	Belgium
39a	UBT-MET	U. Bayreuth, Chair of Micrometeorology	Germany
39b	UBT-PE	U. Bayreuth, Chair of Plant Ecology	Germany

No.	Code	Institute name	Country
41	UCC	U. College of Cork	Ireland
42	SZIV	Szent István U. of Gödöllö	Hungary
43	UH-DPS	U. of Helsinki, Dept. of Physical Sciences	Finland
44	ISA-UTL	TU Lisboa, Superior Inst. of Agronomy	Portugal
45	UPOZ	U. of Poznan	Poland
46	UPS-Orsay	CNRS - U. of South Paris, Systematic Ecology and Evolution Unit	France
47	WUR-NCP	Wageningen U., Nature Conservation and plant Ecology	Netherland
48	MLU	Martin-Luther-U. Halle-Wittenberg, Inst. of Soil Science and Plant Nutrition	Germany
50	ULG	U. de Liège - LPAP	Belgium
52	CESI	CESI Business Unit - Environment	Italy
53	CIO	Center for Isotope Research (CIO); Rijks-U. Groningen	Netherlands
54	ELU	Eötvös Loránd University, Dept. of Meteorology	Hungary
55	ENEA	ENEA, Global and Mediterranean Environment Division	Italy
56	SU	Stockholm U., Dept. of Meteorology, Arrhenius Lab.	Sweden
57	UBARC	U. of Barcelona, Climate Research Group	Spain
58	UBECLIM	U. Bern, Physics Institute, Climate and Environmental Physics	Switzerland
59	UKRAK	U. of Mining and Metallurgy, Faculty of Physics and Nuclear Techniques	Poland
61	USTUTT-IER	U. Stuttgart, Institute of Energy Economics and the Rational Use of Energy	Germany
62	EFI	European Forest Institute	Finland
63	NERI	National Environmental Research Institute, Department of Atmospheric Environment	Denmark
64	LAWUF	Thuringia State Forest Research Station	Germany
65	SAUG	International educational projects	France
66	UKBH.GI	U. Copenhagen, Inst. of Geography	Denmark
67	UAV	University of Aveiro, Departamento de Ambiente e Ordenamento	Portugal
68	UCD	University College Dublin	Ireland
69	UHAM	Uni Hamburg	Germany
70	UBOL	Bologna	Italy