



Atmospheric CO₂ modelling at the regional scale : Application to the CarboEurope Regional Experiment

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The CarboEurope Regional Experiment Strategy (CERES) campaign took place in may and june 2005, in les Landes forest, in the south-west of France (Dolman et al., 2006). This experiment is one of the first which deals with the variations and the budget of atmospheric CO₂ at the regional scale in the frame of the European project CarboEurope. The important field activities included 10 surface fluxes sites installed all over the South-West on representative ecosystems (winter and summer crops, forest, fallow, vineyards…) as well as a 50m tower for high precision CO₂ concentrations measurements of oceanic air masses. Four instrumented aircraft have sampled horizontal and vertical variations of CO₂ within the first 2000 m of the atmosphere. A total of six Intensive Observations Periods (IOP), for 22 days have been triggered on alert according to the meteorological forecasting. These data allow the modeling of atmospheric CO₂ with the meso-scale non-hydrostatic meteorological model Meso-NH (Lafore et al., 1998). This meteorological model is coupled on-line with the surface scheme ISBA-A-gs (Interaction Surface Biosphere Atmosphere, Assimilation, Calvet et al., 1998). The SVAT scheme ISBA-A-gs calculates the surface energy fluxes as well as the surface CO₂ fluxes including carbon assimilation and ecosystem respiration. The surface-atmosphere exchanges take into account not only biospheric CO₂ fluxes but also anthropogenic sources. With this coupled model, Meso-NH / ISBA-A-gs, the 'golden' day of CERES, the 27th of may is modelled with a grid-nesting configuration at 10 km resolution for the larger domain and 2 km resolution for the small one. In fact, the 27th of may presents ideal condition for CO₂ regional modelling: high insolation with no cloud, high temperatures, light wind and a strong development of the boundary layer combined with intensive observations, including radio-sounding, aircraft measurement, surface measurements... This presentation shows the results of this simulation : the vertical and horizontal heterogeneity of the CO₂ fluxes and con-

centrations, the CO₂ budget calculation in the 2 km resolution domain. The simulation results are compared with the observations : surface fluxes over representative ecosystem, energy and CO₂ fluxes measured from aircraft, vertical profiles of CO₂ concentrations from aircrafts measurements.

- Calvet, J.C., J. Noilhan, J.-L. Roujean, P. Bessemoulin, M. Cabelguenne, A. Olioso, J.-P. Wigneron, 1998. An interactive vegetation SVAT model tested against data from six contrasting sites. *Agri. For. Meteor.*, 92, 73-95. - Dolman, A.J., J. Noilhan, P. Durand, C. Sarrat, A. Brut, A. Butet, N. Jarosz, Y. Brunet, D. Loustau, E. Lamaud, L. Tolk, R. Ronda, F. Miglietta, B. Gioli, M. Enzo, M. Esposito, C. Gerbig, S. Körner, P. Galdemard, M. Ramonet, P. Ciais, B. Neininger, R.W.A. Hutjes, J.A. Elbers, T. Warnecke, G.P. Landa, M. Sanz, Y. Scholz, G. Facon, 2006. CERES, the Carboeurope Regional Experiment Strategy in les Landes, South West France, May-June 2005; BAMS, submitted. - Lafore, J.P., J. Stein, P. Bougeault, V. Ducrocq, J. Duron, C. Fischer, P. Hérelil, P. Mascart, V. Masson, J.-P. Pinty, J.P. Redelsperger, E. Richard, J. Vilàguerau de Arellano, 1998, The Meso-NH atmospheric simulation system : adiabatic formulation and control simulations. *Ann. Geophys.*, 16, 90-109.