



WG Soilveg

Overview of TERRA activities and highlights

Rapporteur: Merja Tölle

Participants: Andreas Will, Oscar Brousse, Eva Nowatzki, Mario Raffa, Johann Zuger, Luxi Jin, Emmanuele Russo

FPS LUCAS

Phase 1: Continental scale, idealised experiments

- How sensitive are the regional climate models to LUC and how is this interrelated to the land-atmosphere coupling strength in different regions and seasons?

Publications:

Davin, E. L., D. Rechid, M. Breil, R. M. Cardoso, E. Coppola, P. Hoffman, L. L. Jach, E. Katragkou, N. de Noblet-Ducoudré, K. Radtke, M. Raffa, P. M. M. Soares, G. Sofiadis, S. Strada, G. Strandberg, M. H. Tölle, K. Warrach-Sagi, V. Wulfmeyer, 2019: Biophysical impacts of forestation in Europe: First results from the LUCAS Regional Climate Model intercomparison, *Earth System Dynamics*, DOI: 10.5194/esd-2019-4

Tölle, M. H., M. Breil, K. Radtke, H.-J. Panitz, 2018: Sensitivity of European temperature to albedo parameterization in the regional climate model COSMO-CLM linked to extreme land use changes, *Frontiers Environmental Science*, DOI: 10.3389/fenvs.2018.00123

Breil, M., D. Rechid, E. L. Davin, N. de Noblet-Ducoudré, E. Katragkou, R. M. Cardoso, P. Hoffmann, L. L. Jach, P. M. M. Soares, G. Sofiadis, S. Strada, G. Strandberg, M. H. Tölle, K. Warrach-Sagi, 2019: The opposing effects of afforestation on the diurnal temperature cycle at the surface and in the atmospheric surface layer in the European summer, (In Review)

Urban climate modelling

- Johann Zuger / AIT, **High Resolution Urban Climate**
- Sebastian Schubert and Luxi Jin / HU Berlin, **COSMO-CLM/DCEP-BEM**
- Oscar Brousse / KU Leuven, **Malaria in urban areas of sub-Saharan Africa**
- **Urban modelling groups are encouraged to exchange urban data for validation and evaluation!!!**

Vegetation and land surface

- DFG project at Uni Giessen with 2 PhD's, lead by Merja Tölle
 - Eva Nowatzki, working on **dynamic vegetation (phenology model) that accounts for seasonal influences and inter-annual variability**
 - Mingyue Zhang, working on **land surface data set (including winter and summer crop)**
- Jan-Peter Schulz / DWD, **bare soil evaporation improvements and introduction of skin temperature, reduction of ground heat flux** (effects of vegetation)
- Andreas Will / BTU, **support for vertically inhomogeneous soil types** (e.g. from HWSD or BUEK 200 data set) by re-writing the Richards equation.
- Juergen Helmert / DWD, **external parameters, new implementation of physical properties of soil (no look-up table)**

Snow modelling

- PT SAINT: implementation of new snow model in COSMO 6.0
- Project over Antarctica at KU Leuven, Nicole Van Lipzig
 - Postdoc, Sam Van den Broucke, working on **snow parameterization with COSMO-CLM²**

Other TERRA activities

- Matthias Raschendorfer / DWD, **re-formulation of surface processes** in the frame of PT ConSAT
- PhD thesis at ETHZ, Daniel Regenass
 - **Catchment water balance as a validation tool**
 - **Comparing Schlemmer et al. 2018 hydrology with standard hydrology**

Highlights

- Integration of TERRA_URB in default COSMO code, several tests for a range of cities, fixed bugs (COSMO-AEVUS)
- New runoff parameterization to be used for climate studies

Highlights

- Studies about land-atmosphere interactions from ensemble RCMs (FPS LUCAS):
 - Overview paper and sensitivity of RCM ensemble due to idealized vegetation cover simulations (FOREST, GRASS, EVAL): RCMs diverge considerably in response. Seem to be more related to differences amongst the terrestrial biosphere models than the atmospheric model.

Davin et al., 2019: Biophysical impacts of forestation in Europe: First results from the LUCAS Regional Climate Model intercomparison, Earth System Dynamics, DOI: 10.5194/esd-2019-4

Highlights

- Studies about land-atmosphere interactions from ensemble RCMs (FPS LUCAS):
 - Sensitivity study due to albedo parameterization in the RCM COSMO-CLM with idealized vegetation cover simulations: Albedo differences due to different vegetation covers. And due to the specified albedo parameterization in the model (especially seen in summer).
Mediterranean region: The albedo differences are higher between the diverse albedo parameterizations than between the different land covers in southern Europe in summer. The albedo parameterization is here a high uncertainty factor to estimate the impact of land use/cover change.

Tölle et al. 2018: Sensitivity of European temperature to albedo parameterization in the regional climate model COSMO-CLM linked to extreme land use changes, *Frontiers Environmental Science*, DOI: 10.3389/fenvs.2018.00123

Highlights

- Studies about land-atmosphere interactions from ensemble RCMs (FPS LUCAS):
 - Diurnal cycle and energy budget: T_2M not recommended for land use change studies since this diagnostic quantity does not reflect the occurring processes near the surface. Use surface temperature and temperature of first atmospheric layer instead.

Breil et al. 2019: The opposing effects of afforestation on the diurnal temperature cycle at the surface and in the atmospheric surface layer in the European summer, (In Review)

Science plan

1. Implementation of changing and more heterogeneous land cover with time
2. Include dynamic vegetation changes for climate time scales
3. Include vegetation and urban fabric changes in TERRA-URB
4. Improve urban input parameter database and fix bugs in rural areas (next AEVUS)
5. Include vertical inhomogeneous soil texture
6. Improve multi-layer snow model (coordination with COSMO needed)
7. Include carbon cycle; long term goal
8. Strengthen the use of observational data containing the full spatial/temporal variability