Minutes WG3b / SOILVEG meeting, 2014-03-20 Offenbach, D

Agenda

9h00 - 10h30 WG3b contribution (chair JM. Bettems)

J.Helmert, 30'	Recent developments in TERRA
A.Mazur, 20'	Experiments in soil physics - some parameterization aspects and validation
I.Rozinkina, 20'	Initialization of snow water equivalent
JM.Bettems, 20'	Other WG3b activities

11h00 - 12h30 SOILVEG contribution (chair W. Thiery)

S. Kothe, 20'	Update on recent TERRA developments in the CLM-Community
M. Breil, 20'	Update on VEG3D
H. Wouters, 20'	Update on URBMIP (cancelled)
JP. Schulz, 20'	New leaf phenology for TERRA

13h30 - 15h15 CALMO session (chair A. Voudouri)

15h45 - 17h30 COTEKINO session (chair C. Marsigli)

Minutes

J. Helmert: Recent developments in TERRA

- COSMO-EU runs in experimental set-up with new GlobCover land-use data set (this new external parameter dataset was presented by D. Luethi during the CUS). Improved LAI variability over Europe. Improved representation of land use in desert areas, although the new dataset leads to an overestimation of LHF (e.g. Sahara, Oman). The verification for one month shows that the skill of the new configuration is comparable to the operational configuration (GLC2000), but these results are only for one month.
- Revised infiltration: The current operational set up leads to drying out of root zone in COSMO-DE, which potentially leads to a LHF shutdown during summer. Solution: improving the infiltration parameterization. In particular, the soil water conductivity at saturation, originally a uniform parameter for the soil column depending only on soil type, is now also depending on the vertical level (Decharme, 2006). This leads to faster infiltration in topsoil, and decreased conductivity in the deeper layers. This new scheme could help to prevent a LHF shutdown.
- Harmonized World Soil Database (HWSD) and a new water transport scheme: HWSD is available in new EXTPAR 2.0. To implement HWSD the Rijtema (1969) approach is replaced by the Brooks and Corey model (now conductivity and diffusivity in TERRA are comparable to HTESSEL). The new scheme prevents further drying of already dry soils. A 15-year test was done with COSMO-CLM: the 2m T bias shifted its sign, the cold bias is now decreased. The horizontal resolution of HWSD is 1km.
- Tuning of ML snow scheme and snow albedo scheme in TERRA-ICON: 3-layer snow model, leading to improved daily temperature cycle in Antarctica.
- Discussion: It is easier to implement new developments in ICON than in COSMO, since ICON is still in its development phase (J. Helmert). A common physics library will solve this problem, it will include all the developments from TERRA-ICON, except the tile approach (J.-M. Bettems).

A. Mazur: Experiments in soil physics - some parameterization aspects and validation

- Limitations of the evapotranspiration parameterization of "bare" soil: Conclusions from Dickinson et al. (1986, BATS 2-layer scheme) describe the known limitations of evapotranspiration estimates from bare soil. Several new approaches were tested. (i) Darcian equation using a value of 0.5 for the 'a' parameter: 2m dewpoint temperature bias is reduced, and some improvement for the air temperature. (ii) Darcian equation depending on temperature using a value of 0.5 for the 'a' parameter: both temperature and wind speed forecasts improved for sandy soils. (ii) when setting a=2, results were not satisfying. (iv) finally, different values for different soil types was tested: a=-1 for clay, a=0.5 for sand, a=1 for loam. (v) Richardson

equation is implemented in four versions and currently being tested. Campbell's parameterization is also being tested at the moment in different versions.

- Soil moisture analysis, latent heat fluxes, and other measurement available at 61 sites over Polen. Validation of modified bare soil evaporation shows improved scores.
- The current work is planned to be finished by August and will be published. Next, plant coverage will be included in the TERRA code.

I.Rozinkina: Initialization of snow water equivalent

- Implementation of the lake parameterization scheme FLake in COSMO-Ru2: This also include a new structure of COSMO-Ru preprocessing. Tests were conducted for the Kazan region. No large influence was found for the summer temperature, but air wetness of the lowest levels is more sensitive, and here lakes influence a larger area. The model skill also improved for heavy precipitation and wind gusts when including FLake.
- Higher heat fluxes lead to convection in the lower atmosphere. Hence the fraction of low clouds are a good test field for the FLake parameterization. FLake has a definite impact of low cloud cover forecasts, leading to improved temperature projections. Comparison to satellite imagery shows that low cloudiness predictions by COSMO is not very realistic over lakes if FLake is not included.
- There is a temperature difference of 20°C over lakes during winter between the simulations with and without FLake! This is mainly due to the increased resolution in the regional model compared to GME: more lakes become resolved and if FLake is switched off, the initialization of the lake temperature originates from the nearest sea pixel.
- Snow aspects: Accurate fresh snow depth forecasts were needed in light of the 2014 Sochi Olympic Games. The new Snow Water Equivalent (swe) initialization shows a good correspondence between modeled and observed swe, this both for forest and bare soil sites (October 2013 – March 2014). The largest effect of the new approach is observed over regions with maximum swe, and over lakes.

J.-M. Bettems: Other WG3b activities

- EXTPAR 2.0: This package is now an official COSMO software, and has been extensively tested at DWD, ETHZ, and Meteoswiss. The code is under version control, and the source code administrator is D. Luethi. Main features are: (i) ASTER DEM, (ii) topography corrected radiation, (iii) optional topography smoothing, (iv) support for scale separation, (v) HWSD, (vi) soil albedo, (vii) improved implementation of GlobCover, (viii) ECOCLIMAP (if you see a variable "xxx_12", then it comes from ECOCLIMAP), (ix) AEROCOM and MACC, (x) many bug fixes and code clean up.
- Next planned developments: EXTPAR 2.0 will become available through the CLM portal (D. Luethi), code interface will be made more robust, latest DWD developments will be merged.
- Data pool: Goal is to give access to data from different sites in one common format. Currently 9 sites contribute to this project. Data is accessible through the COSMO website, one year after time of observation. The Valdai site (RU) recently joined the project, but at the moment there are no fluxes, only many lake observations.
- Update WG3b web pages: Please contribute to this effort by sending your updates to J.-M. Bettems!
- COSMO release 5.2: Release possibly in Q1 of 2015. At the moment, there are two candidates for this update: (i) TERRA-URB (H. Wouters) is a fast urban parameterization scheme which requires very few additional external parameters. K. Trusilova could become the long-term responsible person for this part of the code. (ii) TERRA-MIRE is a parameterization of organic soil developed by A.Yurova.
- For new developments, it is important to follow the outlined protocol:
    - Prove usefulness of development ➔ 1st SMC decision
    - Implement, document and test your code, and find a responsible person ➔ 2nd SMC decision
    - Please contact J.-M. Bettems if you wish to implement new parameterizations in TERRA!
- Science plan: Respond to the question "What are the main goals of the COSMO developments and how do we want to reach them?". External review planned this spring. Final approved science plan is expected for September 2014. TERRA is chosen as the basis for further developments in the frame of NWP applications, but more advanced SVAT models will continue to be used for regular inter-comparison and validation studies.
- Call for new priority project: Besides the development of a canopy layer, two suggestions are made: (i) collaboration with hydrological community (e.g. river routine testing), and (ii) adapting TERRA for tropical conditions.

S. Kothe: Update on recent TERRA developments in the CLM-Community

- Soil thermal conductivity: Dependency of soil themal conductivity on soil water content (J.-P. Schultz). Status: finished, successfully implemented (switch: itype_heatcond). Evaluation based on the CORDEX-Africa set-up shows that the average DTR over Africa is increased when using this parameterization.
- Soil carbon cycle: A standalone version of a soil carbon cycle model uses TERRA output as boundary conditions. Status: A first version is now implemented in TERRA and tests are being conducted.
- Dynamic vegetation: It is intended that J.-P. Schultz will work on this topic. Status: planning phase.
- Vegetation phenology: See below, presentation by J.-P. Schultz.
- Urban parameterization: See URBMIP presentation by K. Trusilova. Status: Hendrik implemented the TERRA-URB scheme in TERRA-ML and tested it successfully for Berlin, Basel and Flanders (online).
- Soil temperature: Lower boundary condition. No heat flux condition at bottom. Deep soil temperature can adjust to atmospheric forcing (J. Tödter).
- BATS bare soil evaporation
- Prognosis of snow temperature: Predictor corrector algorithm.
- Snow surface temperature and Snow temperature appear as two different concepts in the documentation, but in the code there is no distinction.
- TERRA-ML standalone parallelization: Now available, and it significantly enhances code performance for large-scale applications.
- Transfer Scheme: implemented Louis-based scheme for transfer coefficients to have a consistent atmospheric layer in case of TERRA-offline. Without this there were many inconsistencies when running TERRA-ML offline (e.g. LHF very much overestimated, leading to oscillations) (J.-P. Schultz). J. Helmert suggests to use the Raschendorfer scheme for reasons of consistency.
- WATCH+TERRA: improved land surface initial conditions for COSMO-CLM.
- Please use COSMO standards for source code developments!
- New version of TERRA-ICON offline, including the tile approach: Such model would be very useful for many offline applications.
- Discussion: ICON will become available in an offline (i.e. TERRA only) version, J.-M. Bettems therefore proposes to switch to this framework rather than develop TERRA-ICON ourselves. J.-M. Bettems: we can better concentrate our efforts on improving TERRA within the ICON framework. J. Helmert: this version should be available this summer.
- The code containing the TERRA development can be provided by Uni Frankfurt, but they cannot offer any support... It is therefore decided that Uni Frankfurt will provide their code to the community but without further support (S. Kothe or J.-P. Schultz will do this through J.-M. Bettems).

M. Breil: Update on VEG3D

- VEG3D parallelization is now finished, tests show a perfect match between the parallelized version and the standard version.
- VEG3D is now coupled to COSMO-CLM via OASIS3-MCT.
- Sahel: seasonal cycle is much more dampened in VEG3D, i.e. much closer to observations. Improvement especially in West and Central Sahel, for the Guinea Coast the improvement is less clear. For this area, the root depth was tuned, which leads to some improvement during the dry period. Also a decadal simulation (1966-1975) shows the added value of VEG3D compared to TERRA. VEG3D has more skill, especially for T_2M, but also for TOT_PREC. The added value is due to a better representation of the vegetation.
- Internal slope mechanisms: now still in a testing phase, but this development is expected to improve the results.
- Bug fixes led to significant improvement of the results.

J.-P. Schultz: New leaf phenology for TERRA

- High-quality observational data shows the influence of latitude, altitude, year and continentality on leaf phenology in Germany.
- LAI in Terra is currently taken from a sinusoidal fit (done in int2lm) between a minimum and maximum value of LAI (from extpar). Hence the model cannot account for inter-annual variations in the growing season.
- Polcher (1994) captures the interannual variability, but has unrealistic weekly/daily variations in LAI.
- Knorr et al. (2010) does not have this problem anymore. Implementation of this parameterization very much improves the evaporation estimates, both for the inter-annual and daily cycle. Future work will be to

implement similar parameterizations for other vegetation classes (e.g. trees), and to test the new parameterizations in the 3D model.

- J.-M. Bettems expresses the need to better co-ordinate this work with the efforts made by R. Stöckli in this direction. J.-M. Bettems and J.-P. Schultz will further debate on this potential collaboration.