Deutscher Wetterdienst
Abteilung
Meteorologische Analysen und Modellierung

Minutes of the Results

Workshop COLOBOC/SOILVEG

Date: 01.03.2010	**Time: 14:30-19:30**

Location: BTZ Langen

Reference:

Participants:

Bettems (Bt, MeteoSwiss), Helmert (He, DWD), Asensio (As, DWD), Davin (Dv, ETHZ), Schomburg (Sb, U Bonn), de Morsier (Ms, MeteoSwiss), G. Vogel (GV, DWD), Lange (La, DWD), Will (Wl, BTU), Rozinkina (Rz, Roshydromet), Kazakova (Ka, U Moskow), Schättler (US, DWD), Duniec (Dc, IMWM), Ludwig (Lw, GKSS), Klehmet (Kl, GKSS), Schulz (Sc, DWD), Khodayar (Ky, IMK), Ahrens (Ar, U Frankfurt), Kalinka (Ki, U Frankfurt), Lorenz (Lz, ETHZ), Seneviratne (Sv, ETHZ), Schädler (Sd, KIT)

Distribution

Participants, COLOBOC mailing list, COSMO web site

Guidance: Bt	**Record: He, Bt**

Notes: version 0.1

Next meeting: COSMO General Meeting

T = Task / **I** = Information / **D** = Decision

TOP 1			**Responsible** **All**	**To settle until** **-**
Introduction (agenda, project status) (Bt)				

Bt and SV presented the agenda of the meeting with lectures of SOILVEG and COLOBOC activities followed by a general discussion.

TOP 2			**Responsible** **All**	**To settle until** **-**
SOILVEG Overview (Sv)				

The structure of the CLM SOILVEG group was presented by Sv. Important issues for current and future work in SOILVEG are

- Land energy and water balances
- Vegetation -CO2 interactions
- Role of soil moisture for extreme events
- COSMO/CCLM coupling
- Specification of soil properties in climate models
- Field experiments (e.g., SwissSMEX: Swiss Soil Moisture Experiment)

Activities on these points were given in following presentations.

TOP 3			**Responsible** **All**	**To settle until** **-**
Coupling of COSMO/CLM to Community Land Model: COSMO-CLM^2 (Dv)				

The application of the coupled COSMO-CLM2 in experiments was shown by Dv.
Using various validation datasets the impact of COSMO-CLM2 compared to COSMO-CLM was investigated for

- Surface radiation
- Bowen ratio
- Cloud cover
- Temperature and precipitation

Using a Resolution of 50km, the initial and boundary conditions from ERA40 reanalysis were used to simulate the period 1980-2006 (first 6 years used as spinup).

The interannual variability was also analysed and sensitivity experiments with specification of vegetation parameter were performed.

TOP 4			**Responsible** **All**	**To settle until** **-**
Role of soil moisture for persistence of heat waves (Lz)				

The impact factors of interannual variability of summer temperature in terms of heat wave duration index were investigated with CLM.
Severeal case studies were performed:

- CTL: control run, driven by ERA40 and ECMWFop
- IAV: Soil moisture (SM) prescribed, mean climatology from CTL
- PWP: SM prescribed, constant at plant wilting point
- FCAP: SM prescribed, constant at field capacity

TOP 5			**Responsible** **All**	**To settle until** **-**
Layered soil in TERRA (Ki)				

The implementation of non-uniform soil profiles in TERRA was investigated. Different external parameter data sets are required. A case study assuming different soil types below threshold depth was performed. For the soiltype rock, however no water transfer is considered in TERRA.
Problems with water table within hydrological active zone exist. New approach required?

TOP 6			**Responsible** **All**	**To settle until** **-**
Projects at U. Cottbus(Wi)				

The presentation focused on the optimal grid configuration parameters for TERRA (can be derived for a homogeneous soil from the analytical solution of the heat conduction equation). An upper soil layer thickness of 0.01 m is adequate for most applications. The soil depth required depends on the time scale of the simulation and a 20 m deep soil is sufficient for most applications.
Simulation Results of coarse grid climate simulations (50 km, 15 y) show at 0.11m depth for stretching factor 1.5 in comparison with a stretching factor 2.0 grid

1. no significant effect on the mean values
2. no systematic significant effects on monthly precipitation and 2m temperature.
3. significantly higher spatial and temporal mean wave amplitudes.

Grid stretching seems to be not relevant for the near surface atmospheric variability. However, the soil temperature dynamics might have a stronger influence at more realistic variability in the soil and at smaller space scales.

TOP 7			**Responsible** **All**	**To settle until** **-**
Projects at KIT (Sd)				

The SVAT model Veg3D was presented and comparisons with TERRA were given.
The coupling of Veg3D with CLM is possible. The application of Veg3D for simulation of soil water content, soil temperature, sensible and latent heat flux, and snow was shown and feedback effects of the SVAT model on radiation budget and precipitation were illustrated.

TOP 8			**Responsible** **All**	**To settle until** **-**
Software consolidation and new raw data sets for the COSMO external parameters (As)				

The current software system for the generation of external parameters at DWD (EXPAR) was presented by (As) with focus on the COSMO model.
A technical revision of EXPAR including the use of a version control system and the output of additional datasets (NDVI, EMISS, PRSMIN, Aerosol) was performed. Additional datasets (FR_LAKE, DEPT_LK) could now provided on demand, (depending on model domain).
NetCDF output (in addition to GRIB) was implemented and a comparison of EXPAR and PEP was given.

Further topics/open questions discussed:

- alternative sources of raw data (Soil, Albedo)
- fraction lake and lake depth
- area fraction in target grid element of each land use class
- filtering of orography (low-pass filter 2 dx)
- technical issues: Input/output file format (netcdf, GRIB2)
- source code management (version control system etc.) and distribution

TOP 9			Responsible All	To settle until -
Revision of the SVAT model TERRA in the COSMO model (He)				

Based on the use of new external parameters (Aerosol, PRSMIN, NDVI) and adaptions in the SVAT module TERRA, results of numerical experiments with COSMO-EU (with SMA) were presented. It was shown that the replacement of fixed aerosol distribution by monthly means decrease the aerosol optical depth. This results in higher surface net radiation fluxes. Objective verification shows that T2M-bias and surface pressure bias increased with this modification. An experiment with aerosol climatology, external emissivity, vegetation climatology (LAI, PLCOV), external minimum stomatal resistance and TERRA adaptions non-uniform root distribution, ground water with upward diffusion, and soil moisture dependent heat conductivity show the large impact of uncertainties in external parameter data sets on the results. This might be due to changes in resulting PRS/LAI ratio. The main impact is: less evapotranspiration, dry and warm PBL. In COSMO-EU SMA tries to compensate T2M-Bias that leads to a wet soil.

TOP 10			Responsible All	To settle until -
Local validation of experiments with COSMO-EU (GV)				

The impact of plant cover and rooting depth on temporal variation of soil moisture was compared for COSMO-EU experiment (w/o SMA) using exponential depletion of root density with depth, groundwater coupling, bare soil evaporation (Noilhan & Planton, 1989) against measurements and TERRA standalone for March and April 2009. Calibration of vegetation parameters with ratio of reflected photosynthetically active radiation to reflected global radiation together with lower minimum stomatal resistance leads to improved soil moisture evolution, bowen ration and accumulated evapotranspiration.

TOP 11			Responsible All	To settle until -
Snow modelling activities at RHMC (Ka)				

The performance of the multi-level snow model compared to the single level version was investigated for a research period March, 11-29 2009 in COSMO-RU

(The Russian-European plane is a suitable region for testing the snow cover parameterizations alone, without the influence of mountains effects, and for the long period of a snow covering). It was shown that T2m forecasts are sensitive to the change of snow scheme. Old and new versions mostly underestimate T2m up to 3.5 C, especially in big cities (Moscow, Sankt-Peterburg, Kursk). Daily errors of T2m forecasts are bigger then the night ones.
It was observed that south regions with thin snow cover or experiencing oscillations of snow cover are more sensitive to the snow scheme change for night periods (error reduction for T2m on 1-2 C). Although daily values of T2m (observations data) of melting period can be >0 C, model results –not, until there isn't a finish of snow melting completely. This leads to the extreme values of temperature bias (10-15 K) for both schemes! Furthermore, the impact of snow cover fraction on T2M was addressed.

TOP 12			**Responsible** **All**	**To settle until** **-**
Implementation of MOSAIC approach in COSMO (Dc)				

Experiments and tests with COSMO-MOSAIC is performed for several cases

2009.II.01 : low temperature-theground was frozen solid
2009.IV.22 : sunny/fair day
2009.X.16 : (analysis done) ground snow-covered
2009.XI.04 : windy day with precipitation
2009.XI.21 : foggy day

Using combination of several namelist switches (numerics/physics), the performance of COSMO-MOSAIC was investigated in terms of correlation coefficient, standard deviation, covariance, and variance compared to the operational model.

TOP 13			**Responsible** **All**	**To settle until** **-**
Status of other COLOBOC activities (Bt)				

The status of the COLOBOC tasks was presented. Ongoing important tasks are validation data exchange within SRNWP, realtime phenology, TERRA modifications, verification of multi-layer snow model, snow analysis, MOSAIC approach.

TOP 14			**Responsible** **All**	**To settle until** **-**

Minutes of the Results

General Discussion (Sv, Bt)

Two major points were discussed: “Is there a life after COLOBOC?” and “Long-term plans for SOILVEG” .

The first point is due to the end of the COLOBOC project at the next COSMO GM (09.2010 in Moscow). There is an agreement that work on the lower boundary condition will continue, but possibly with less resources and lower priority (priority task?).
For the question which aspects of the lower boundary condition should be improved in priority (e.g. soil depth, real time phenology, agriculture, leaf temperature instead of T2m, soil moisture analysis) a stronger coupling between land-surface physics activities and data assimilation was proposed (He).
The performed actions in COLOBOC resulted in more realistic parameterizations of physical processes in TERRA (e.g., vegetation development, minimum stomata resistance, soil heat conduction, snow treatment). However it was observed that the performance of the full NWP-system was not always improved as expected.
This could be due to the dependency of variables in the land-surface scheme of NWP models on the assimilation process (e.g., soil moisture).
It should be taken into account in evaluation of stand-alone land-surface schemes that the performance of several parameterization schemes (e.g., cloud microphysics, transfer scheme) could have impact on the performance of the SVAT model (He).
Therefore, a simple replacement of the land-surface scheme in the NWP-system does not solve these (nonlinear) dependencies and therefore would not lead necessarily to better NWP forecasts (He). Further improvements of the SVAT model TERRA should be tested with a single-column version of the COSMO model (with improved transfer scheme) and in NWP-mode (data assimilation, forecasts) of numerical experiments (He).

The SRNWP action “Sharing of Observations” was presented and it was asked for further data of European sites (Valdai?)