WG3b: Some additional aspects

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COSMO GM
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Accuracy of simulated diurnal valley winds in the Swiss Alps: Influence of grid resolution and land surface characteristics

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Experimental setup

Basic setup
• COSMO v5 @ 2.2 and 1.1 km
• Initialized with and driven by ECMWF analysis (25km)
• Soil initialized from 10-yr climate run with 2km resolution (N. Ban)
• Standard physics options (MY-PBL scheme, no horiz. diffusion)

High-resolution surface data
• ASTER topography (30 m)
• GC2009 land cover (300 m)
• HWSD soil type (1 km)
• Raymond filter for topography (def: cutoff ~5 dx)
→ C2_ref, C1_ref

Low-resolution surface data
• GLOBE topography (1 km)
• GLC2000 land cover (1 km)
• FAO DSMW (10 km)
• Raymond filter for topography (def: cutoff ~5 dx)
→ C2_sfc, C1_sfc
“Valley wind” stations

Mean maximum wind > 4 m/s → 21 stations

“Top-six” stations
Influence of surface data

→ coarse surface data: Only minor improvement for 1km!
→ need high-resolution surface data for 1km simulation!
Influence of surface data (soil, land cover, topography)

→ All three components (soil, land cover, topography) important
→ Similar contribution to improvement
Cevio

Floor width: 500m, depth: 1-1.5 km
Diurnal Valley Winds in the Alps

Conclusions

• Improved diurnal valley winds using COSMO-1!
  → but only with high-resolution surface data (soil, landuse, topo)
  → good skill for major valleys with COSMO-1

• Further improvement with less filtering of topography
Urban parameterization
# Urban parameterization

Three urban models available in COSMO-CLM

**URBMIP – Inter-comparison study performed by the CLM community**

<table>
<thead>
<tr>
<th>Name</th>
<th>TEB alongside TERRA_ML</th>
<th>TERRA-URB</th>
<th>TERRA-ML / BEP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsibility</strong></td>
<td>Kristina Trusilova</td>
<td>Hendrik Wouters</td>
<td>Sebastian Schubert</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>inner building temperature snow model, water skin layer roofs/walls/roofs, tiled urban fraction</td>
<td>Direct representation of the urban landcover in TERRA-ML using a tile approach, new surface-layer transfer coefficients, thermal capacity, anthropogenic heat and impervious surface interception distribution</td>
<td>Street canyon model advanced double-canyon radiation scheme, shadows, radiation trapping, roof/wall/ground fluxes; coupled with the PBL scheme not only through surface fluxes but also by means of energy and momentum fluxes in layers above the surface</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
<td>Urban fraction (EEA), annual mean anthropogenic heat (NCAR)</td>
<td>Full 3D cityGML</td>
</tr>
<tr>
<td><strong>Aims</strong></td>
<td>Urban climate of Europe and Germany</td>
<td>urban climate and its impact on Air-quality simulations Flanders Belgium</td>
<td>Urban climate of Berlin and Basel</td>
</tr>
</tbody>
</table>
**TERRA-URB (H. Wouters)**

**Short description**

» Urban upgrade of TERRA-ML -> TERRA-URB
  » Urban land-use class with specific surface parameters (*De Ridder et al. 2012; Demuzere et al. 2008*) for albedo, emissivity, conductivity, heat capacity. Implicitly accounts for urban morphology
  » New *surface-layer transfer coefficients* (*Wouters et al., 2012*) as a replacement for the Louis-type functions (*itype_tran = 1*)
  » *Brutsaert/Kanda* Bluff-rough thermal roughness parametrization
  » Anthropogenic heat (*Flanner 2009*)
  » Impervious Surface Water Interception Distribution (SID) for evaporation
  » It has been tested in offline mode for urban sites (Marseille, Toulouse and Basel)
TERRA-URB (H. Wouters)

Findings

- Urban parameterization in COSMO-CLM/TERRA-ML was successfully implemented and tested on 1km resolution over Belgium
- The temporal and spatial variatiability of the UHI intensity are very well reproduced
- Additional computational cost was negligible (+3% CPU-time)
- Number of needed extra parameters is small and readily available globally

- TERRA-URB is the best candidate for NWP applications
- SMC decision: discuss and decide on implementation of urban model in the official COSMO code taking into account URBMIP
TERRA-URB
Proposal for implementation (U. Blahak, H. Wouters)

• For the definitive implementation, a code version which contains the tile approach is needed, in order not to duplicate work (jmb: really ?)
• Plan a 2-day visit of Hendrik in Offenbach in October for code implementation and discussions on open issues:
  • Remaining technical issues
  • Perhaps tile approach issues?
  • Coupling to the TKE-based surface layer scheme (new development)
  • External parameters: which are the appropriate data sets for the urban fraction and the anthropogenic heat?
• After that, need to start testing

- Who could contribute/help to the implementation and testing?
- Should it be defined as a COSMO PT?
SRNWP data pool
Data pool action

- Access from COSMO web, password protected
  [http://www.cosmo-model.org/srnwp/content/default.htm](http://www.cosmo-model.org/srnwp/content/default.htm)
- Currently **9 sites**, data from **2006-2013**, in a **common ASCII format**
- **Soil, surface** and **BL** observations
- Work done at DWD / Lindenberg (C. Heret)
Data pool action

Status

- Data available from start of the action to end 2013 from Cabauw (NL), Capofiume (IT), Lindenberg (DE), Payerne (CH), Sodankyla (FI)
- Sites not updated since 2012 Fauga-Mauzac (FR), Cardington (GB)
- Almost no data for Debrecen (HU)
- New site Valdai (RU)
  … but no fluxes measurements, no soil measurements …

- How to improve the completeness of the data set? Resources …
- Status Valdai ?
Others

- Status **mire parameterization**
  - planning for implementation in official code?
- Status **phenology model**
  - to simulate the inter-annual variability of the vegetation start / end
  - visit of Jan Peter at MeteoSwiss for a talk & workshop with Reto?
- **Common COSMO/ICON library**
  - needed for using updated TERRA, multi-layers snow, tiles
  - time line for availability?
  - any tuning required?
- **Science plan**
  - atmosphere – wave model coupling as possible additional section
Thank you for your attention!