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CONSORTIUM FOR SMALL SCALE MODELING
COSMO

WG3b:
Some additional aspects

Jean-Marie Bettems / MeteoSwiss

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

J. Schmidli[1], S. Böing[1], and O. Fuhrer[2]

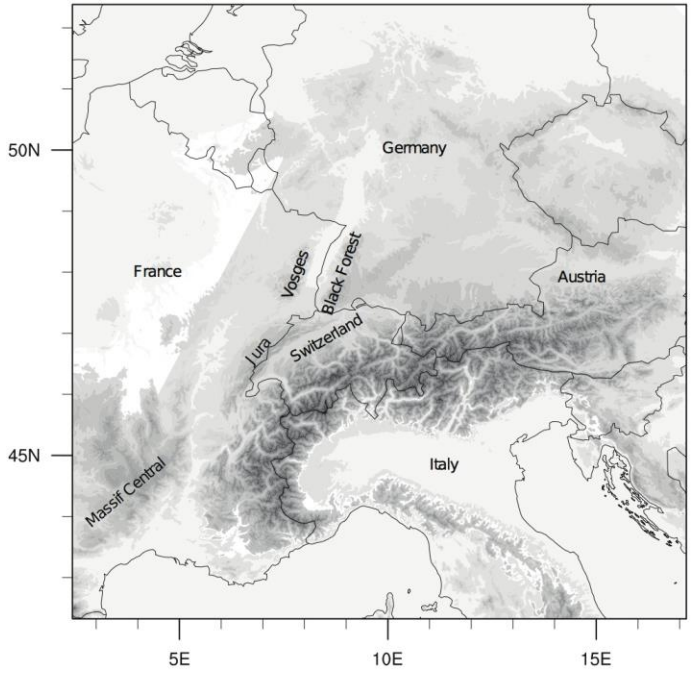
[1]ETH and [2]MeteoSwiss

Acknowledgments:
D. Lüthi, W. Langhans, C. Schär and the COSMO-1 team

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**

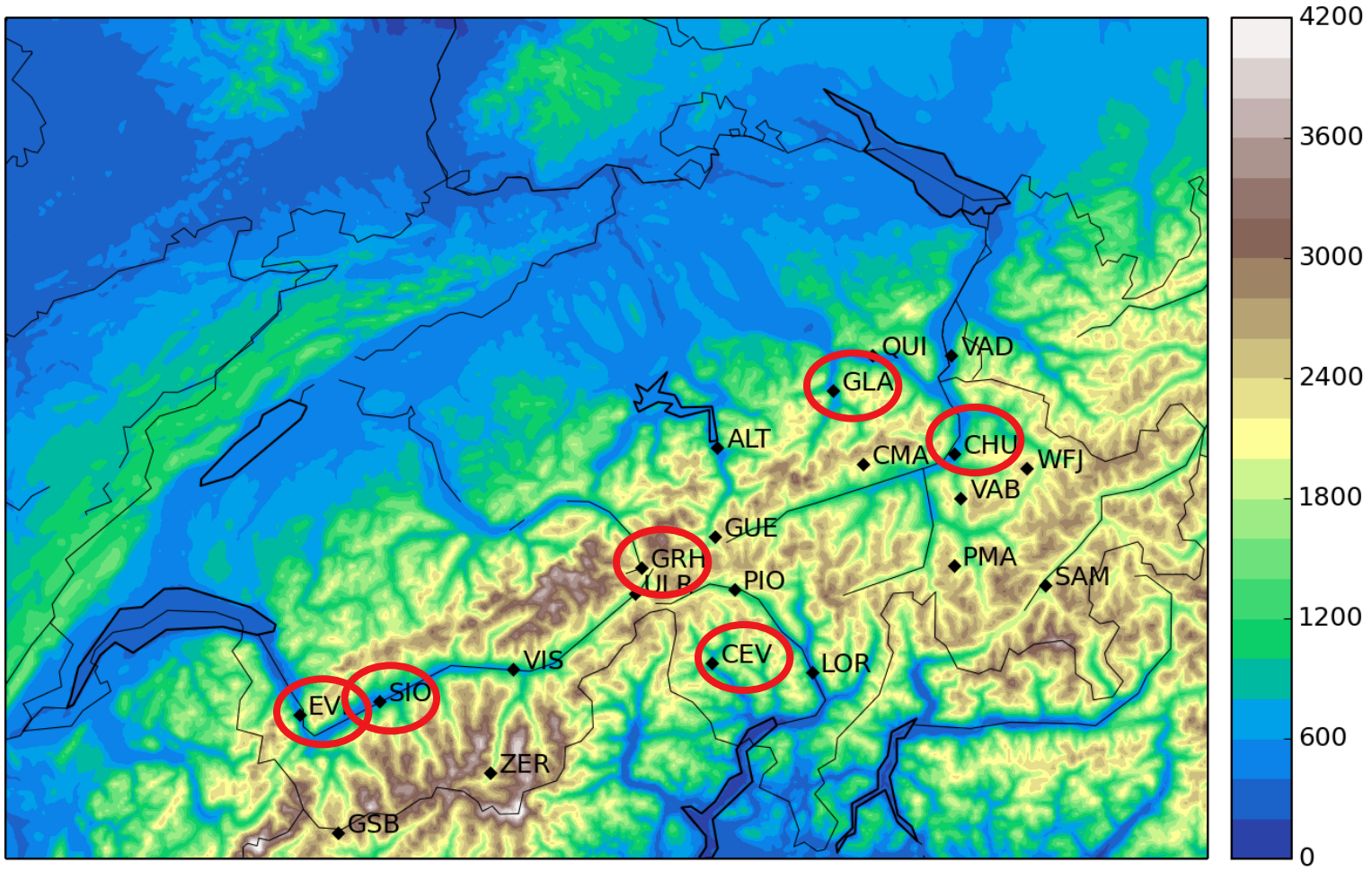
Low-resolution surface data

- 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

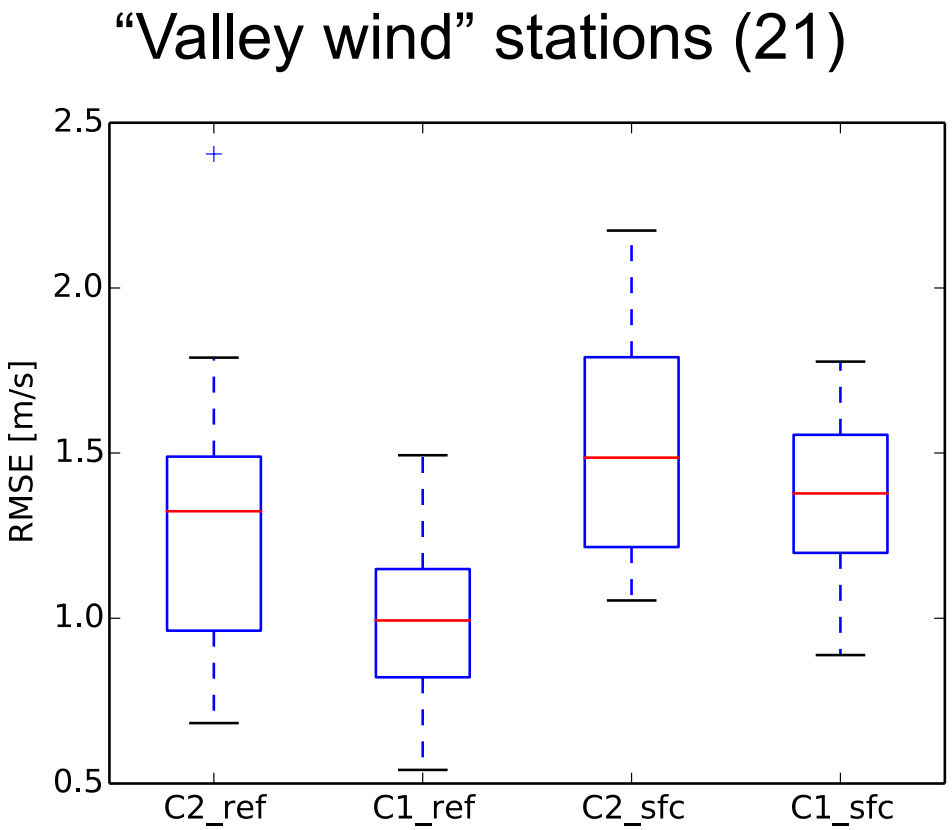
“Valley wind” stations

“Top-six” stations



Mean maximum wind > 4 m/s → 21 stations

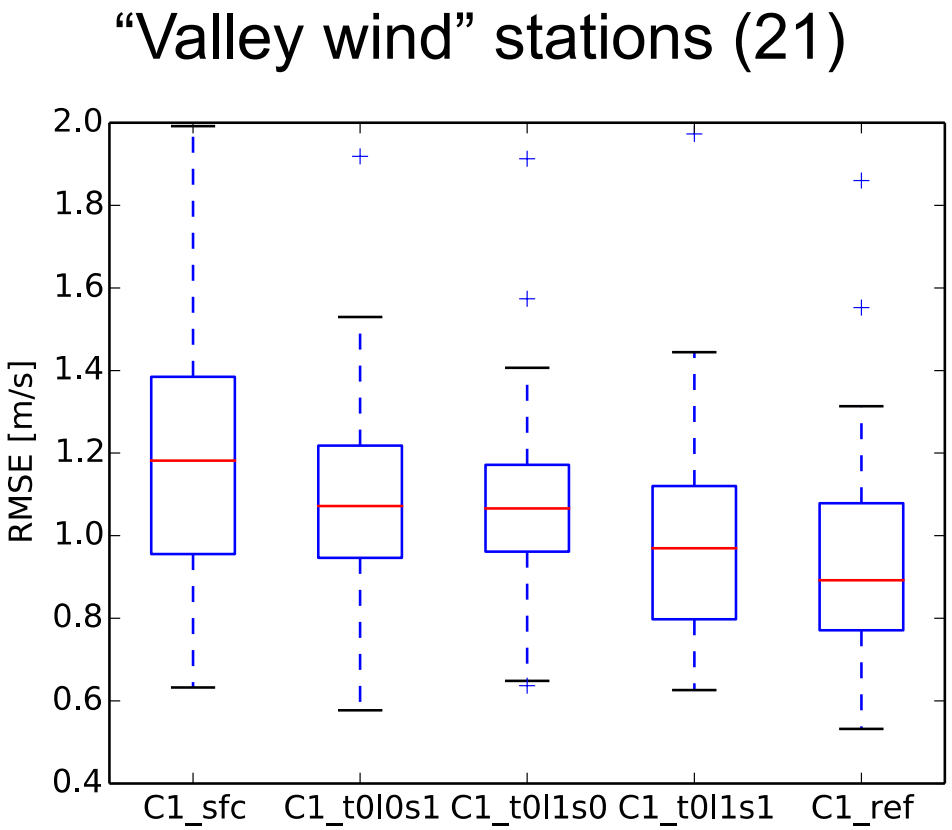
Influence of surface data



→ coarse surface data: Only minor improvement for 1km!

→ need high-resolution surface data for 1km simulation!

Influence of surface data
(soil, land cover, topography)

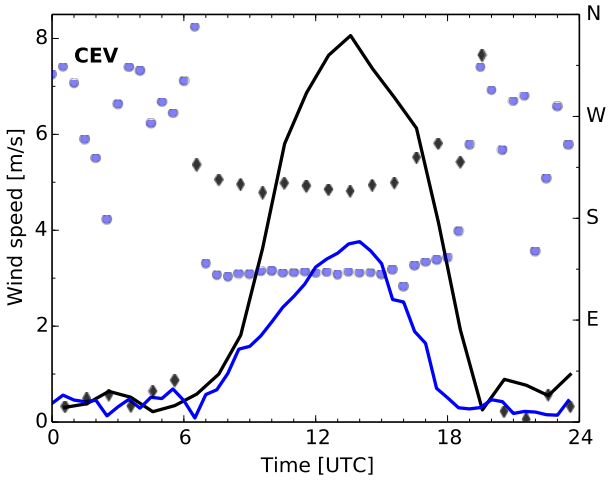


→ **All** three components (soil, land cover, topography) important

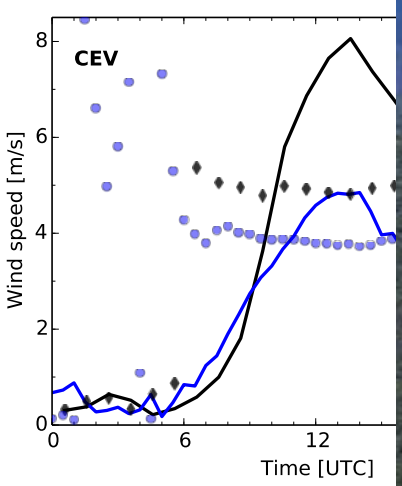
→ Similar contribution to improvement

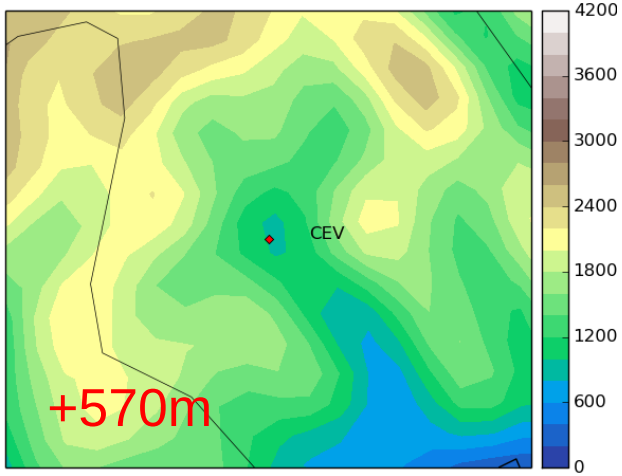
Cevio

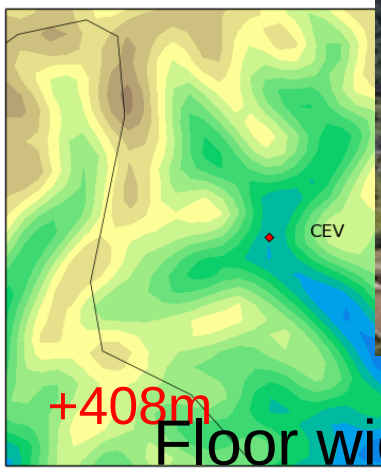
C2_ref



C1_ref







+230m

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**

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Urban parameterization

Urban parameterization

Three urban models available in COSMO-CLM

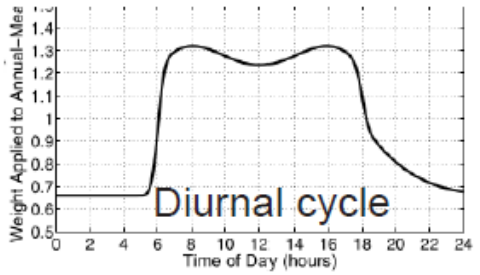
URBMIP – Inter-comparison study performed by the CLM community

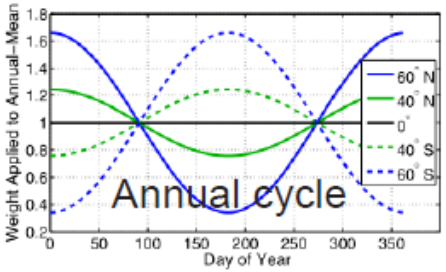
Name	TEB alongside TERRA_ML	TERRA-URB	TERRA-ML / BEP
Responsability	Kristina Trusilova	Hendrik Wouters	Sebastian Schubert
Features	inner building temperature snow model, water skin layer roofs/walls/roods, tiled urban fraction	Direct representation of the urban landcover in TERR-ML using a tile approach, new surface-layer transfer coefficients, thermal capacity, anthropogenic heat and impervious surface interception distribution	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
Input		Urban fraction (EEA), annual mean anthropogenic heat (NCAR)	Full 3D cityGML
References	Trusilova et al 2008, Masson 2001	Wouters et al. 2013, Wouters et al. 2012, Flanner 2010, Demuzere et al. 2008, De Ridder, 2012	Schubert et al. 2012, Martilli et al. 2002,Gröger et al. 2008
Aims	Urban climate of Europe and Germany	urban climate and its impact on Air-quality simulations Flanders Belgium	Urban climate of Berlin and Basel

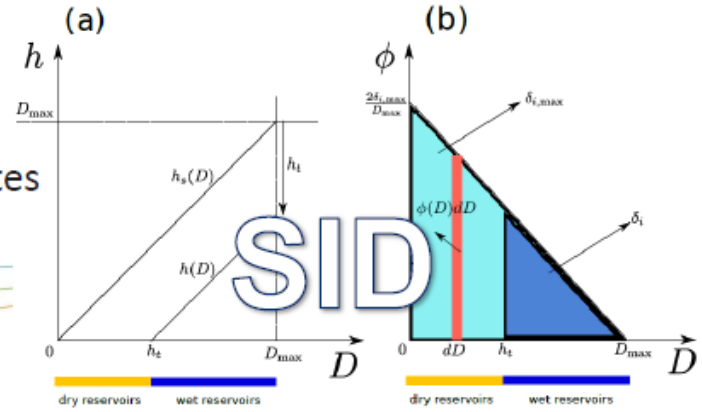
TERRA-URB (H. Wouters)

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**)







vito vision on technology

10/07/2013

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?**

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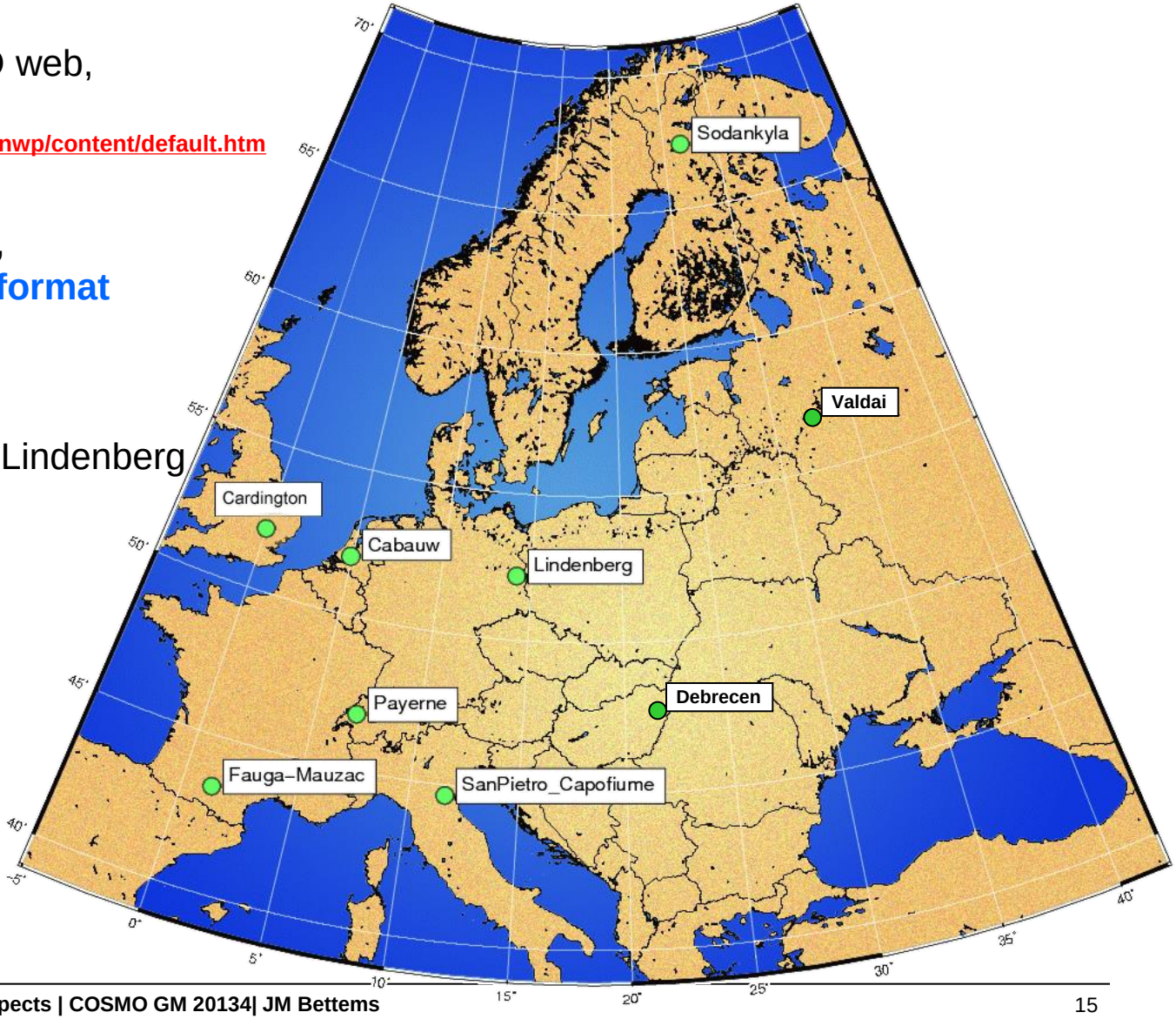
SRNWP data pool

Data pool action

- Access from COSMO web, password protected
  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

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!