

SURFEX for ALARO

Rafiq Hamdi

Working on the interface: SURFEX <-> ALARO + TOUCANS

- ALARO with very high resolution (1~2km) requires new sophisticated turbulence/shallow convection scheme **TOUCANS**.
- TOUCANS calculates also third order moment terms (TOM), which interact strongly with surface fluxes (from SURFEX/ISBA), but since surface should stay externalised (Best et al.) → conflict
- Linking of the two schemes is needed without dramatic increase of complexity and numerical costs but keeping consistency

Working on the interface: SURFEX <-> ALARO + TOUCANS

- When increasing the horizontal resolution, it was found quite important to pay special attention to the way turbulence is triggered between the surface and lower model layer.
- Use tiling of the surface scheme in the turbulence scheme: some fraction of rough surfaces (urban areas) might start important turbulent behavior which would be escalated in the consecutive vertical development.
- Either do multiple solving for each tile (expensive) or to have an average lower boundary condition for a single solving.

Working on the interface: SURFEX <-> ALARO + TOUCANS

- Solution 1: take the average neutral drag coefficient from SURFEX: **PCDN** (momentum) and then calculate the **PCDNH** (thermal) using the stability function of TOUCANS (different from the one used in SURFEX). The stability functions of TOUCANS are valid at the surface and in the boundary layer. TOUCANS is very sensitive to this!

Implemented and tested during my stay in Prague (10-21 dec. 2012) for SURFEX/ISBA but...

What does mean an average neutral drag coefficient ?

Working on the interface: SURFEX <-> ALARO + TOUCANS

- Solution 2: Introduce the TOUCANS stability functions in SURFEX via the key LDRAG_COEF_ARP (drag.F90) and interface the averaged fluxes.

Then calculate $C_d = f(\text{fluxes})$

- Incompatibility when switching on CANOPY ! Different turbulent scheme.

aplpar

aro_ground_param

acptke

acdifus

vertical
diffusion calling
also soil routines

acdifv1

aro_ground_param

acdifv2

acdifv3

Correction of soil fluxes
by TOM flux differences
and update of upper air
fluxes

SURFEX 3 times !!!

acdifv3a

aro_ground_param

aplpar

~~aro_ground_param~~

acptke

acdifus

vertical
diffusion calling
also soil routines

acdifv1

~~aro_ground_param~~

acdifv2

acdifv3

Correction of soil fluxes
by TOM flux differences
and update of upper air
fluxes

SURFEX 1 time + storage
of drag coefficient and
multipliers for
correction after TOMs
from previous time step

acdifv3a

~~aro_ground_param~~

Stay at the CHMI: 22 February - 6 March 2015

This work is based on the reference (OP3) cycle 38T1OP3 from

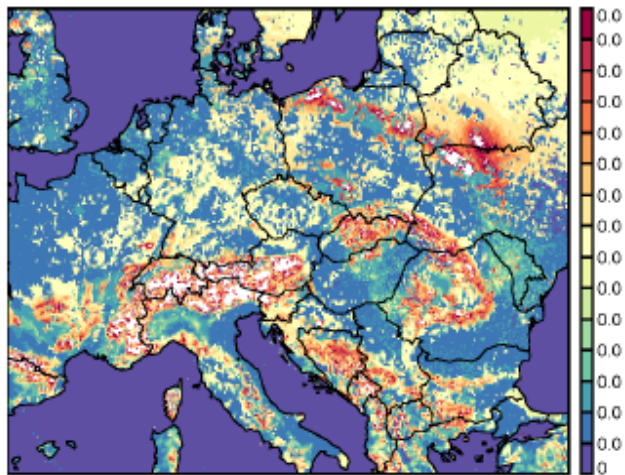
Ivan:

A copy is created under my account

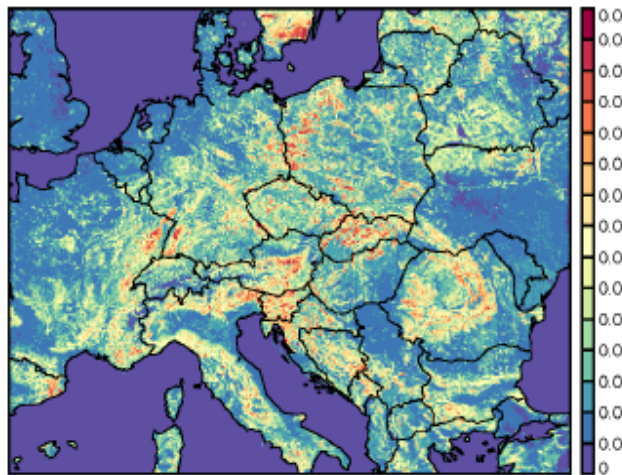
/worklocal/mma202/CY38T1OP3

Test has been done for the 03/03/2011 r06

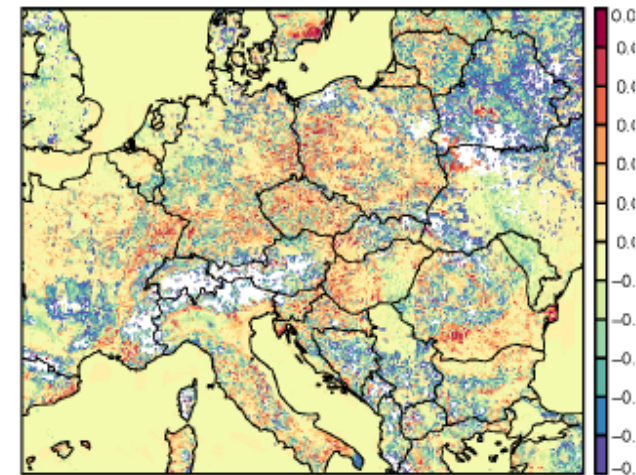
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S001RK_QCTEND
2011/03/03 z06:00 +6h



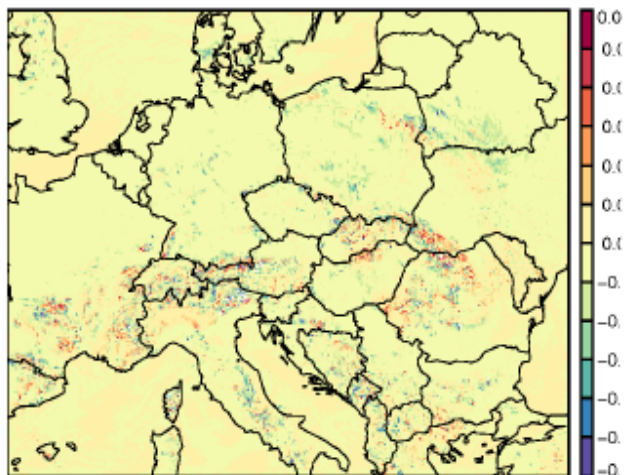
PCD : ALARO-TOUC+ISBA-2L
S001RK_QCTEND
2011/03/03 z06:00 +6h



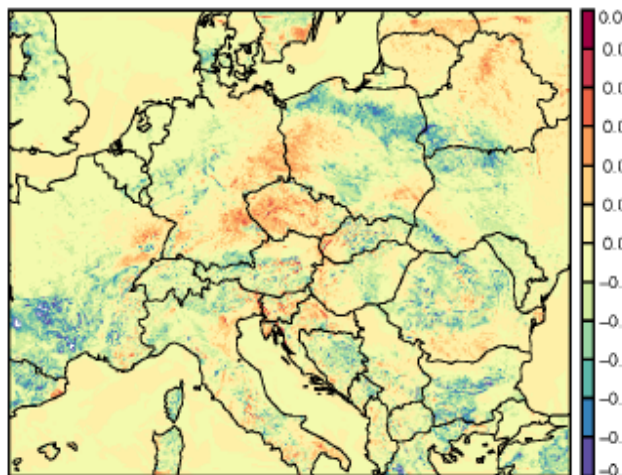
Difference to ALARO-TOUC
S001RK_QCTEND
2011/03/03 z06:00 +6h



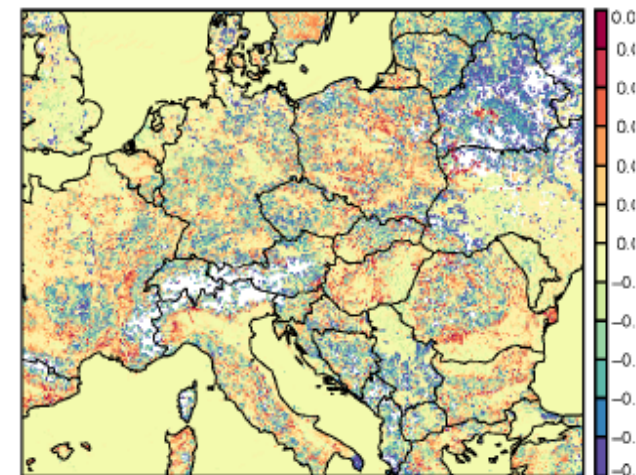
Difference to ALARO-pTKE
S001RK_QCTEND
2011/03/03 z06:00 +6h



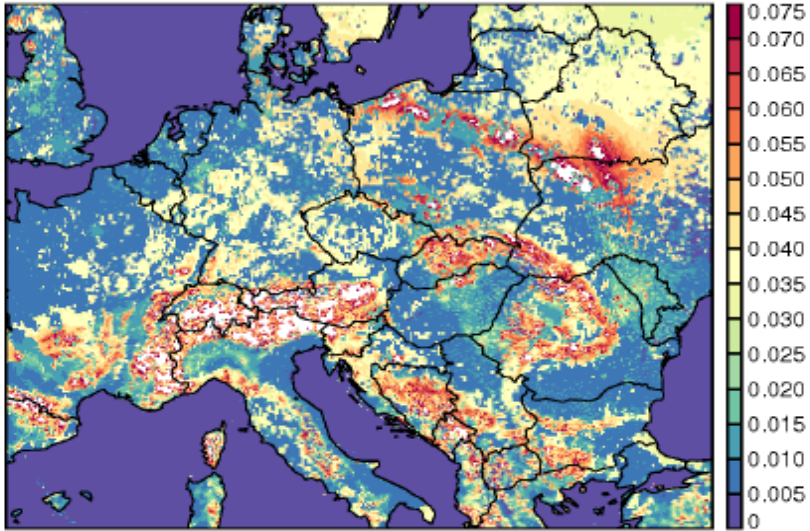
Difference to ALARO-pTKE+ISBA-2L
S001RK_QCTEND
2011/03/03 z06:00 +6h



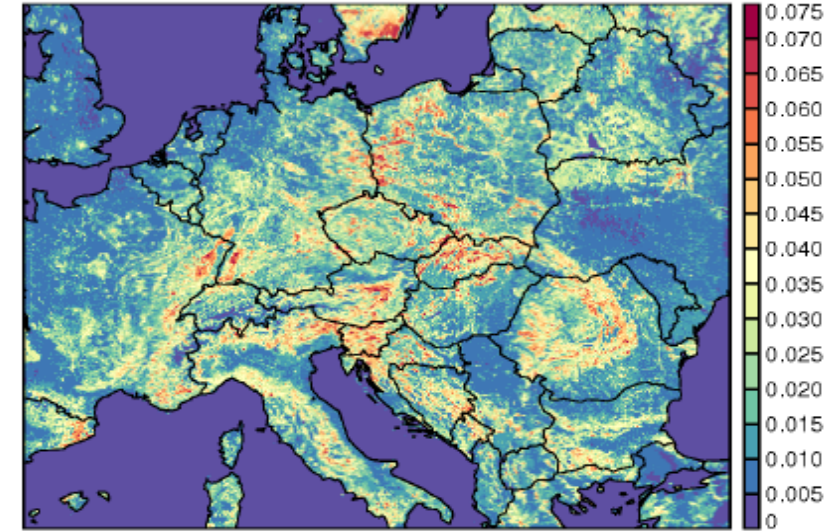
Difference to ALARO-pTKE
S001RK_QCTEND
2011/03/03 z06:00 +6h



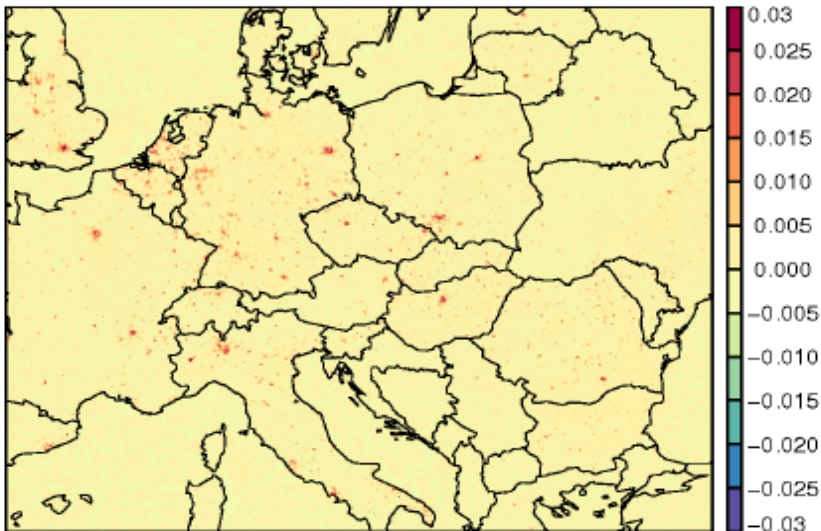
PCD : ALARO-TOUC
S001RK_QCTEND
2011/03/03 z06:00 +6h



PCD : ALARO-TOUC+ISBA-2L+TEB
S001RK_QCTEND
2011/03/03 z06:00 +6h



Difference to ALARO-TOUC+ISBA-2L
S001RK_QCTEND
2011/03/03 z06:00 +6h



ALARO-TOUC Versus ALARO-TOUC+ISBA-2L+TEB

This test is done with **LDRAG_COEF_ARP=.T**. And therefore with the TOUCANS stability functions used for ISBA and TEB within SURFEX.

- **To run ALARO-1 with TOUCANS and SURFEX the issue of the exchange coefficient should be solved.**
- **A solution was introduced in CY38T1OP3 interfacing the average drag coefficient PCD & PCDN calculated from SURFEX and to initialize its value for the first time step.**
- **The TOUCANS stability function were introduced in SURFEXv7.2 under the LDRAG_COEF_ARP key.**
- **This solution could be available for the next version of SURFEX V8+.**
- **A Flat-Rate stay is planned for 2016 to work further on this issue!**

SURFEX@HARMONIE system working week Bratislava, Nov. 2015

- **Intital non-surfex surface conditions from an ARPEGE-SURFEX run**
- **This was already solved for climate simulations (CMIP5), but with different SURFEX version.**
- **The set of e-suite ARPEGE files with SURFEX were made available by MF, however the procedure was not repeated successfully with those files yet.**
- **A report has been written by Olivier Giot on the implementation of this method.**



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- **ALARO-SURFEX coupling**
- **Solution made for Cy38T1OP3 has been ported to harmonie-40h1 but this was not working.**
- **The drag coefficients (PCD,PCDN) has been stored in an available RK gfl array which is not suitable as a final clean code.**
- **This will be implemented properly by Patrick as a surface field to propagate the value between time steps.**
- **Some bugs were found but still not working...**

