A progress with PT Mire

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CONSORTIUM FOR SMALL SCALE MODELING
COSMO
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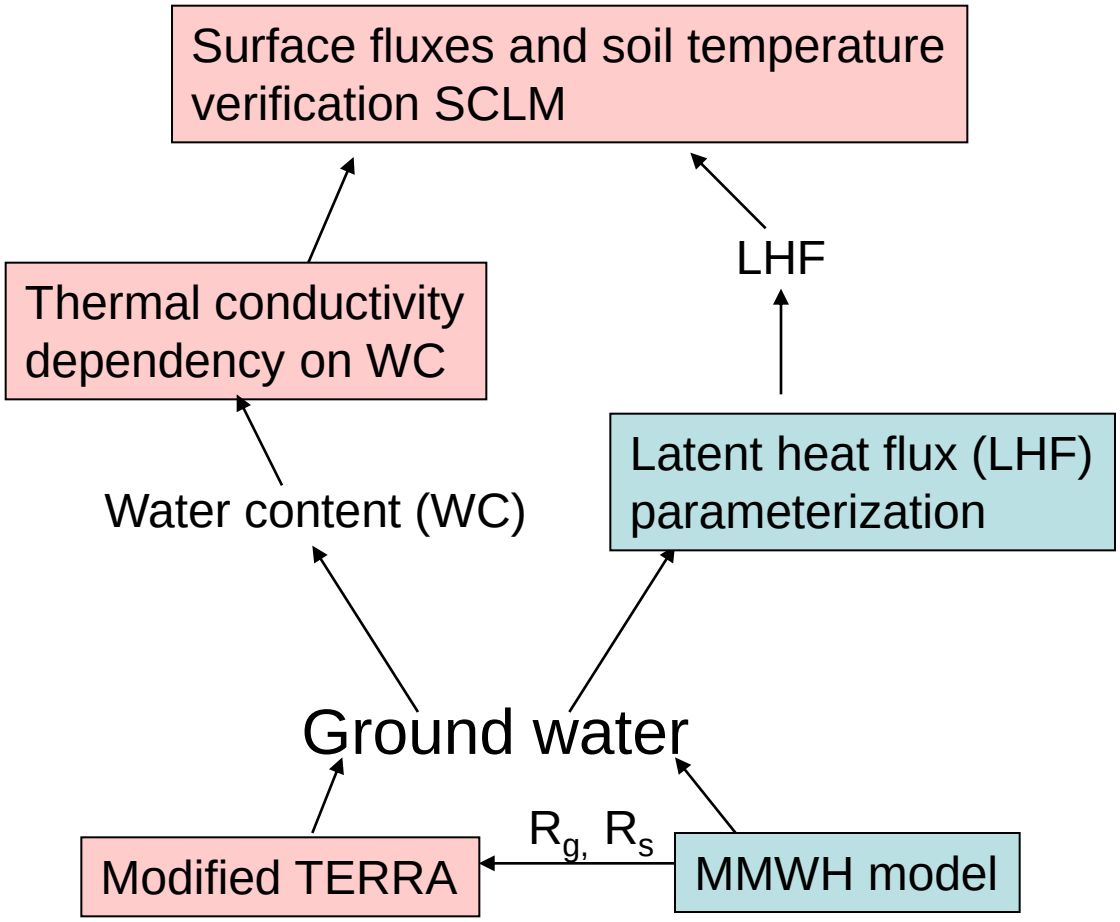
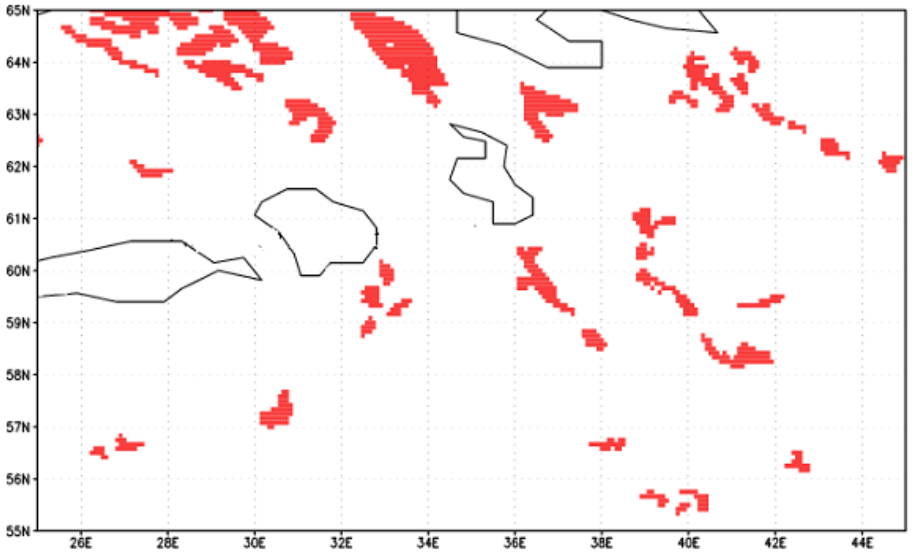
Priority task: mire parameterization

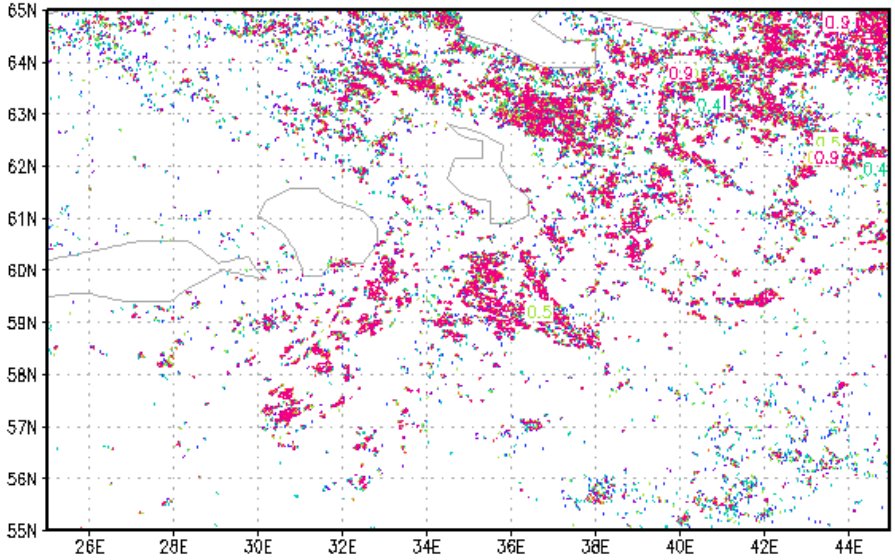


External parameter database: mire distribution. Example of St Petersburg region

COSMO, soil_type=8

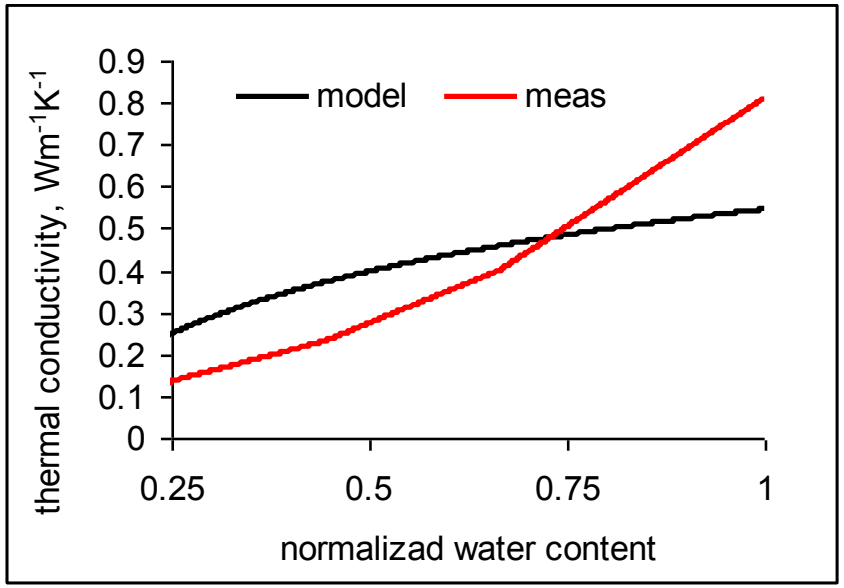


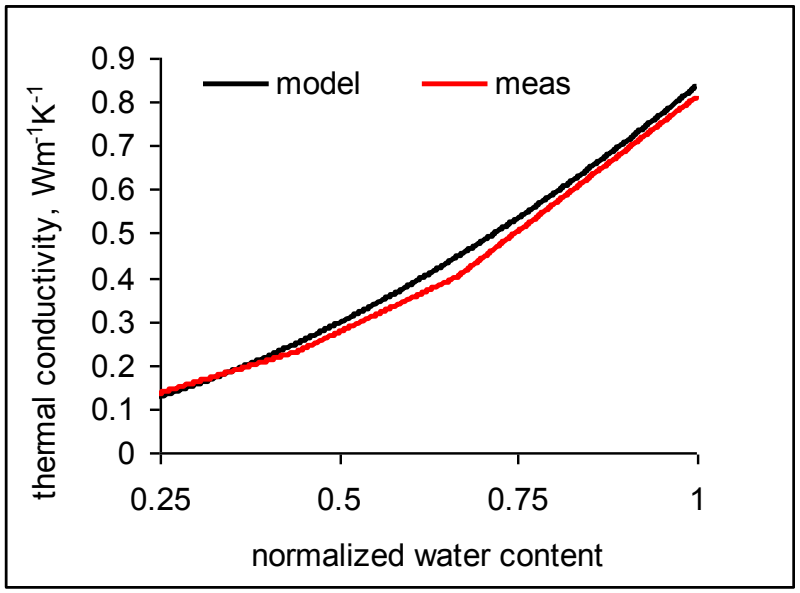
TERRA satellite image processing (Bartalev et al)



Peat thermal conductivity

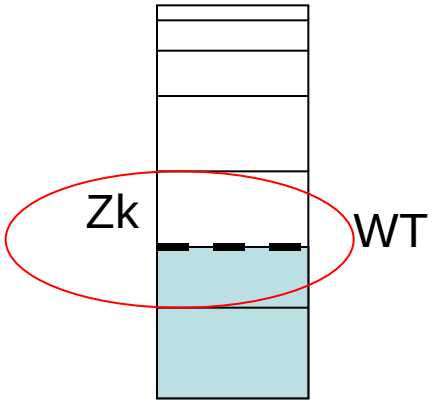
Johansen equation from TERRA used. Peat-specific parameters from Lawrence and Slater(2007), reverse problem solved to obtain Kersten number as a function of water content





Peat thermal conductivity as a function of normalized water content:
a) as in original TERRA parameterization,
b) according to new parameterization and observed.

Formulation for the shallow WT



Weighted average between saturated and unsaturated water content in the layer Zk goes To Richards' equation

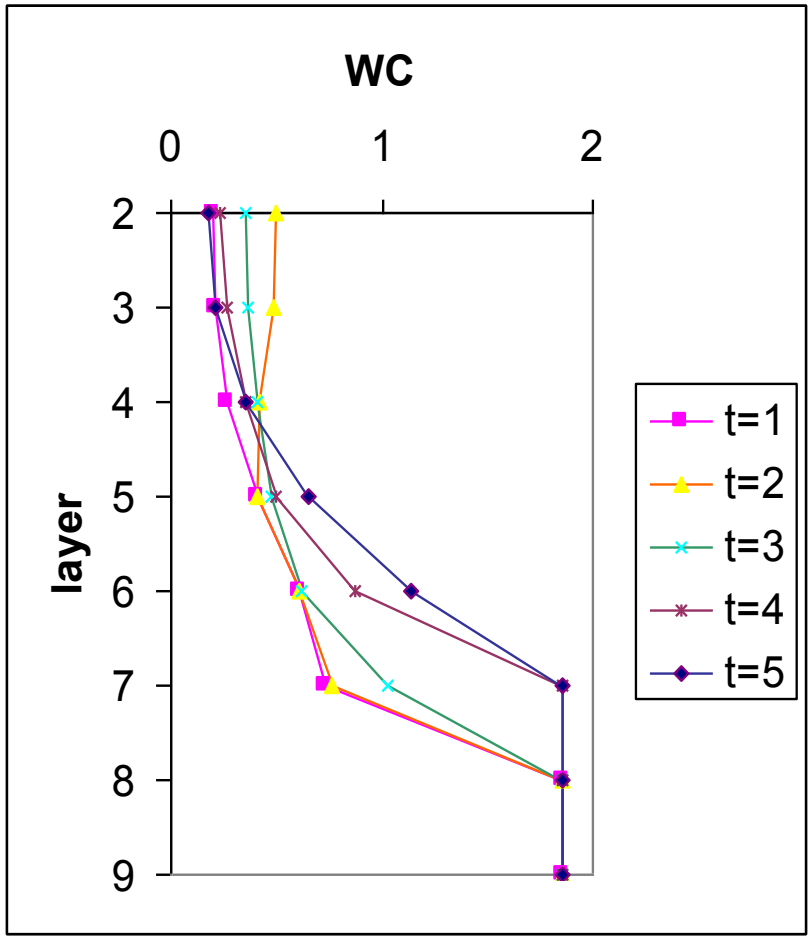
$\Delta W = Fleff - q,$

$\Delta GW = -\Delta W(\Theta sat - \Theta)$

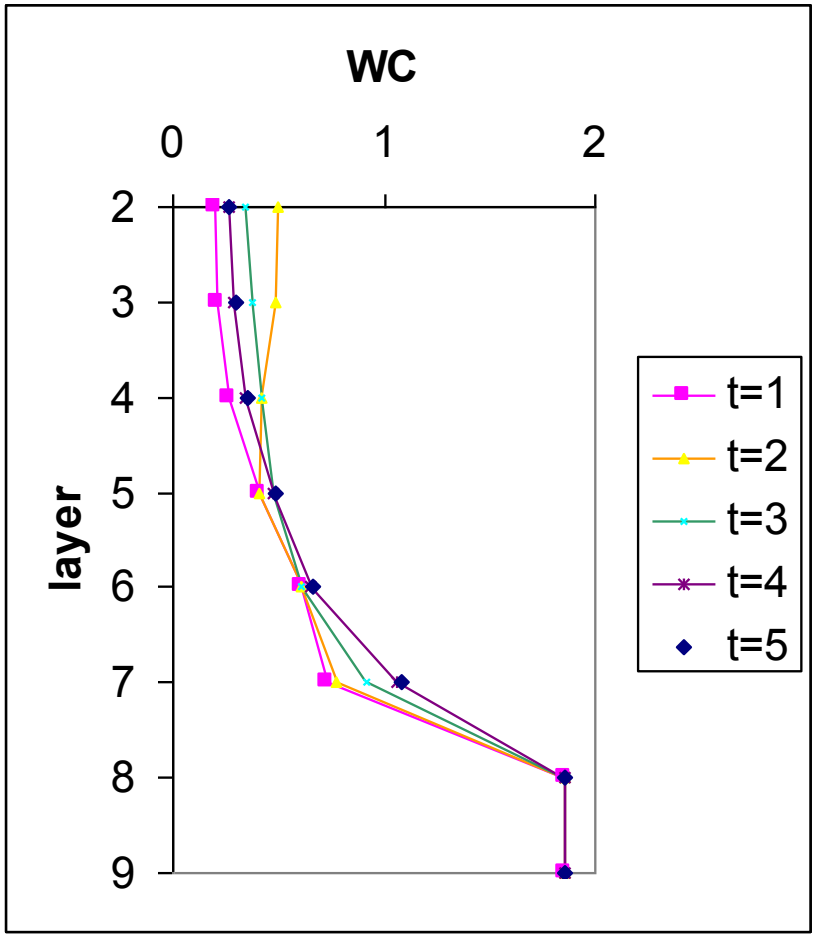
$q = lq \cdot i \cdot K\_h(zcat - zwt),$

W, Θ -water content, *Fleff- gravitational water flux from the layer above minus capillary rise, q*-runoff, Θ sat-porosity, *i*-slope of the water table,$\cdot K\_h$-transmissivity coefficient, *lq*-lumped parameter

Results: water content in soil . March 2011



Ground water parameterization
GWstart=1.5 m



Standard run

Evapotranspiration parameterization

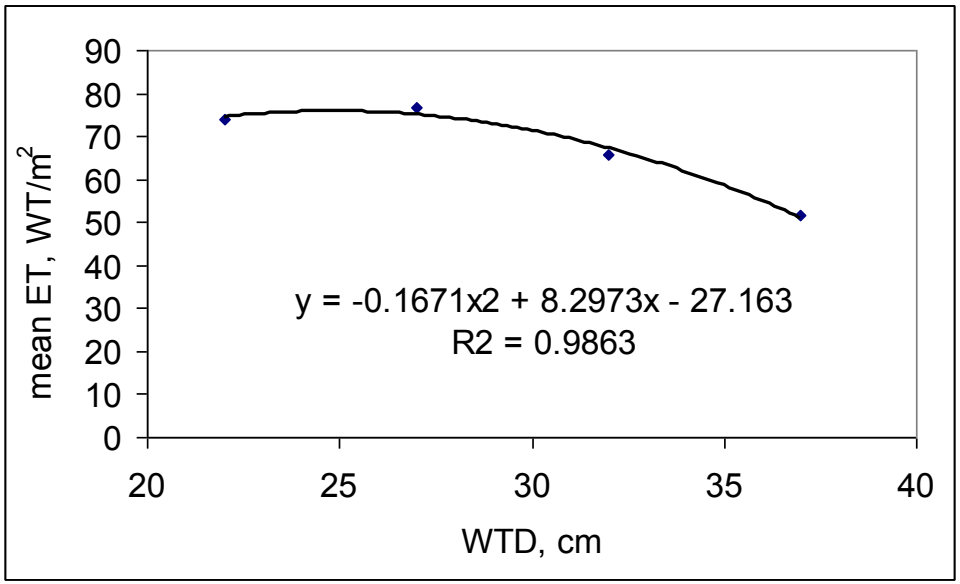
1

$$ET = 0.427 \cdot PET, \quad if \quad z_{wt} \geq 65$$
$$ET = 0.53 \cdot PET, \quad if \quad 25 \leq z_{wt} < 65$$
$$ET = 0.617 \cdot PET, \quad if \quad z_{wt} < 25$$

ET-evapotranspiration
PET-potential ET

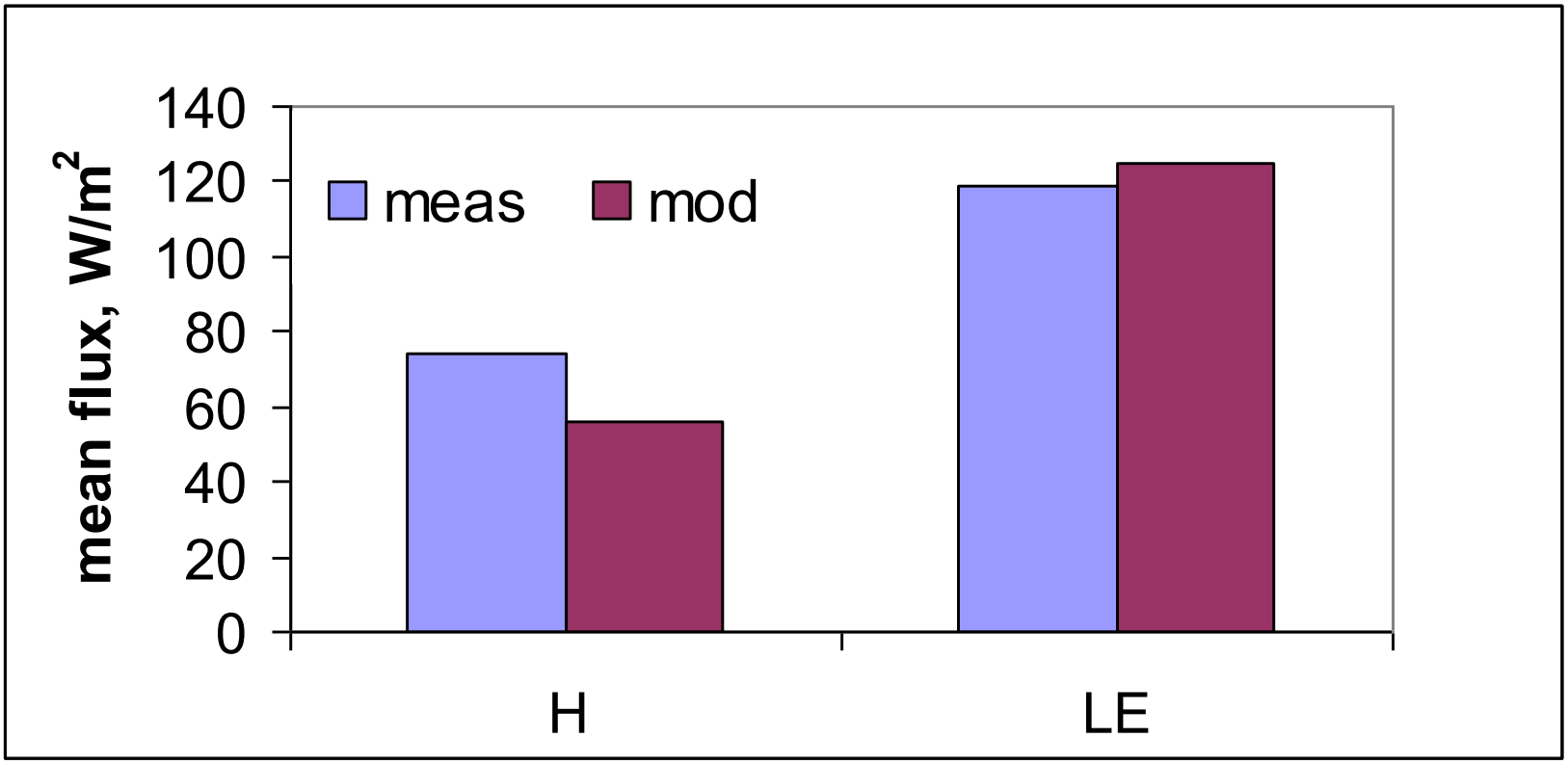
2

$$ET = PET \cdot m, \qquad m = s_0 + s_1(z_{wt} - z_L) + s_2(z_{wt} - z_L)^2 + s_3(z_{wt} - z_L)^3, if \ z_{wt} > z_L$$
$$1, \quad if \quad z_{wt} \leq z_L,$$

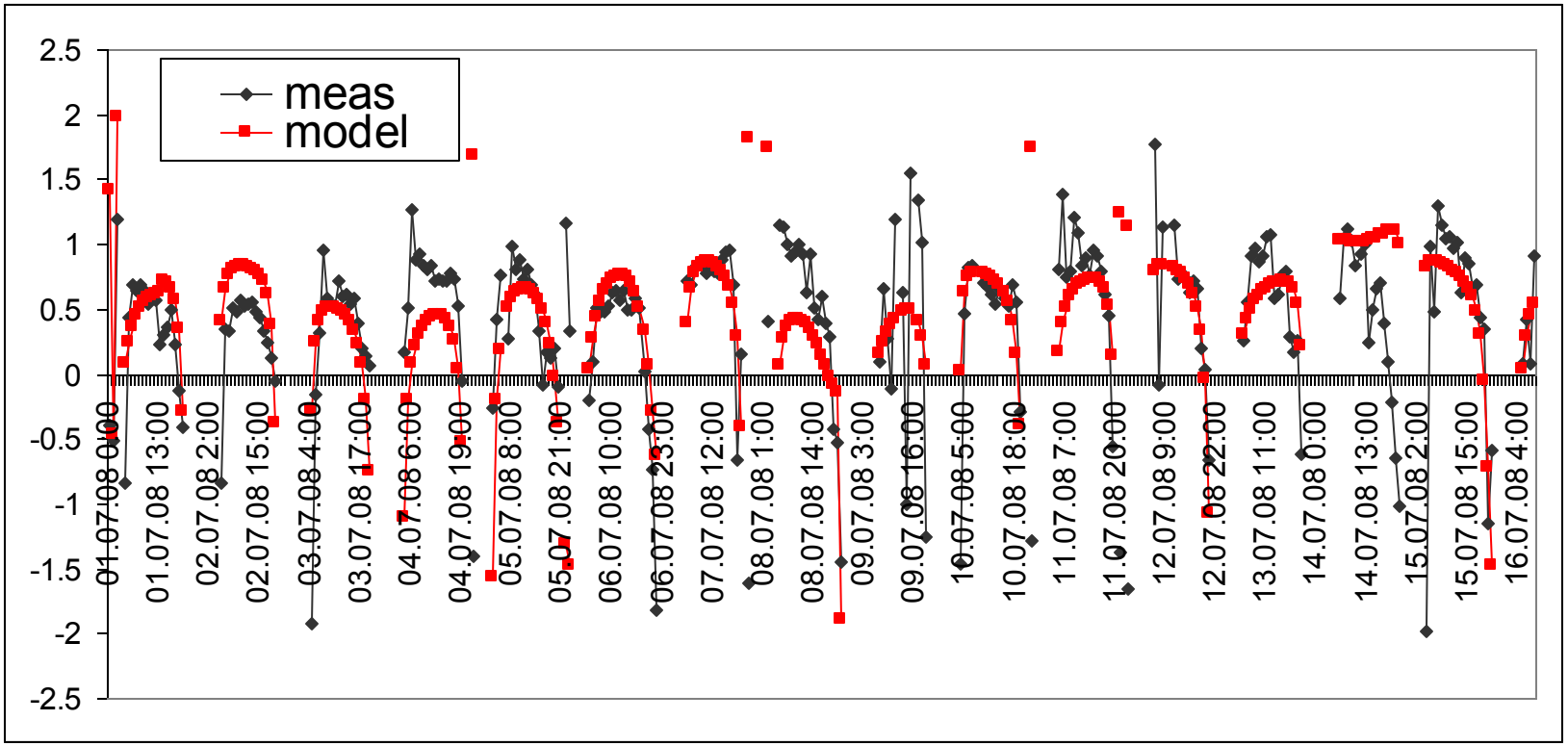


Measurements at Degero Stormyr mire, summer 2008

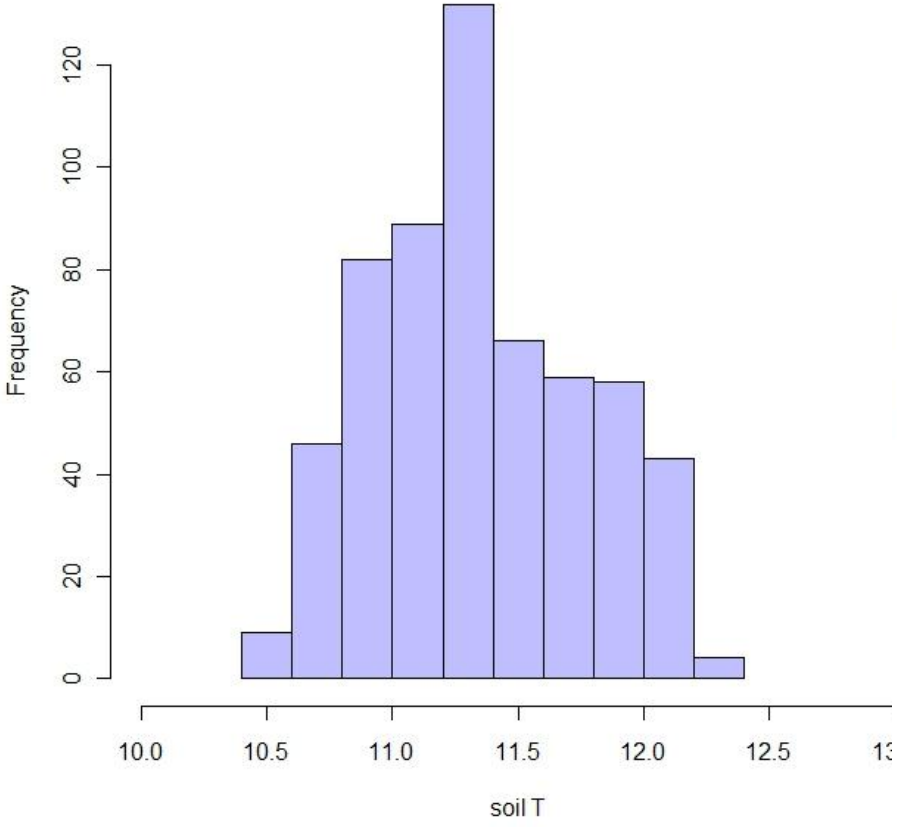
Results: surface fluxes at Degero Stormyr mire, July 2008, SCLM simulations

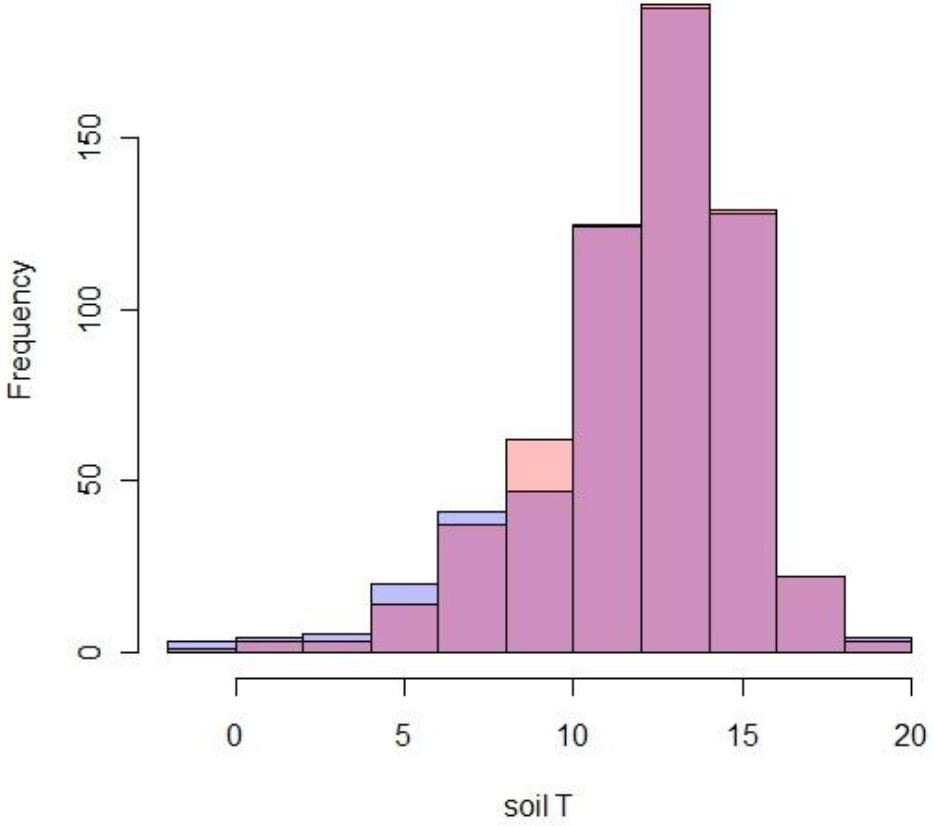


Results: Bowen ratio Degero Stormyr mire, July 2008, SCLM simulations

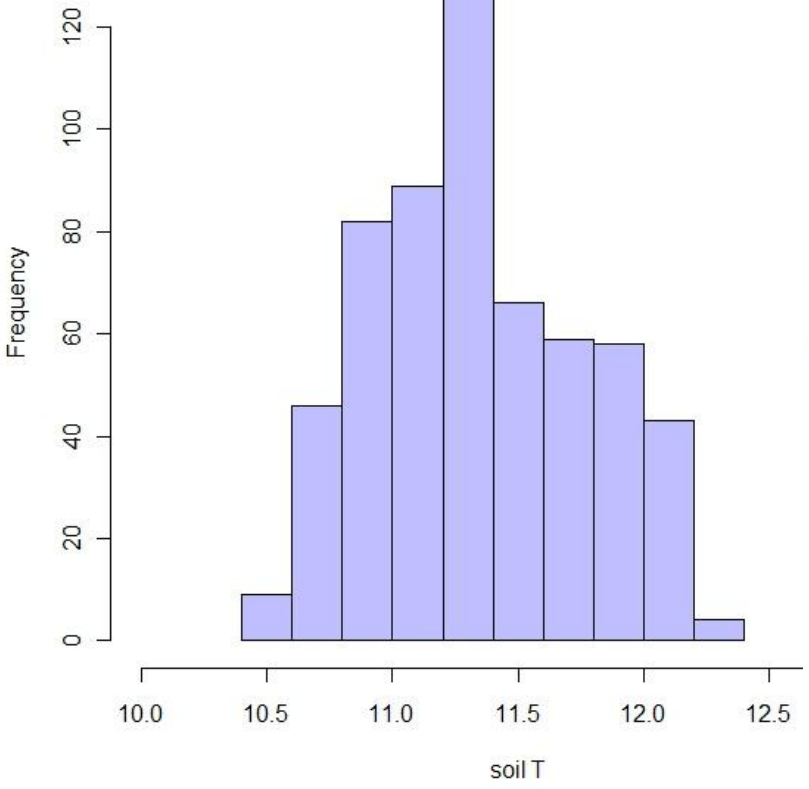


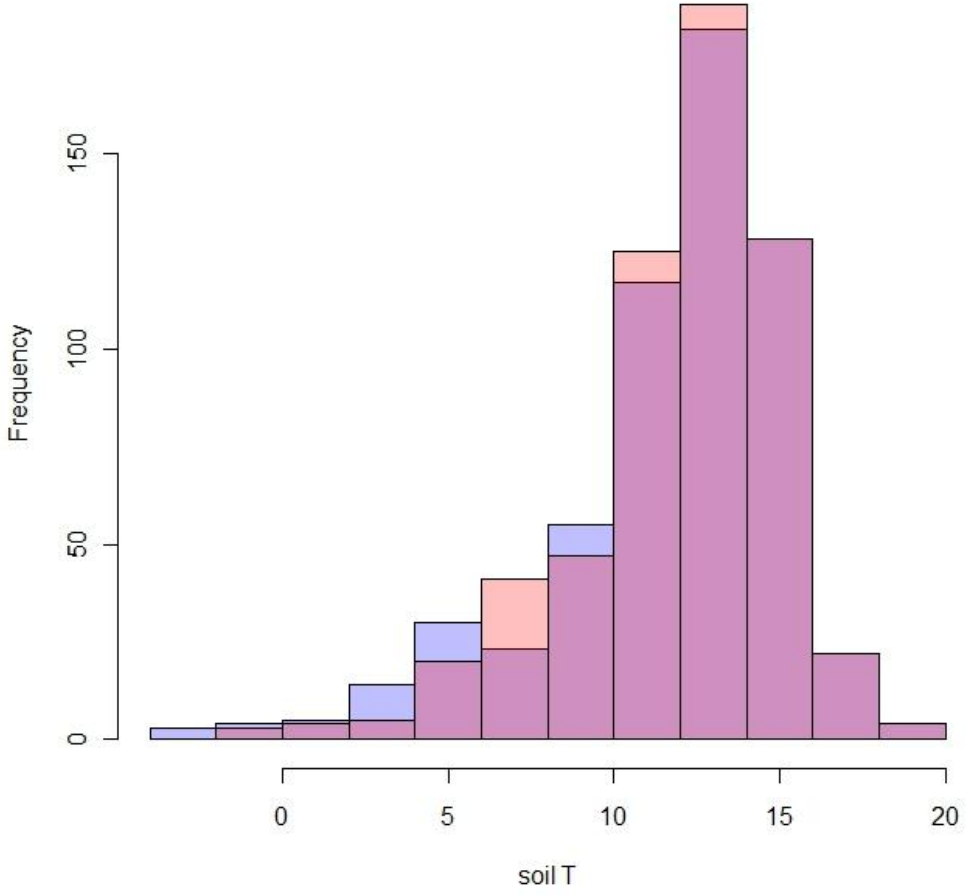
Results: soil temperature at 2 cm Degero Stormyr mire, July 2008, SCLM simulations. Effect of initialization



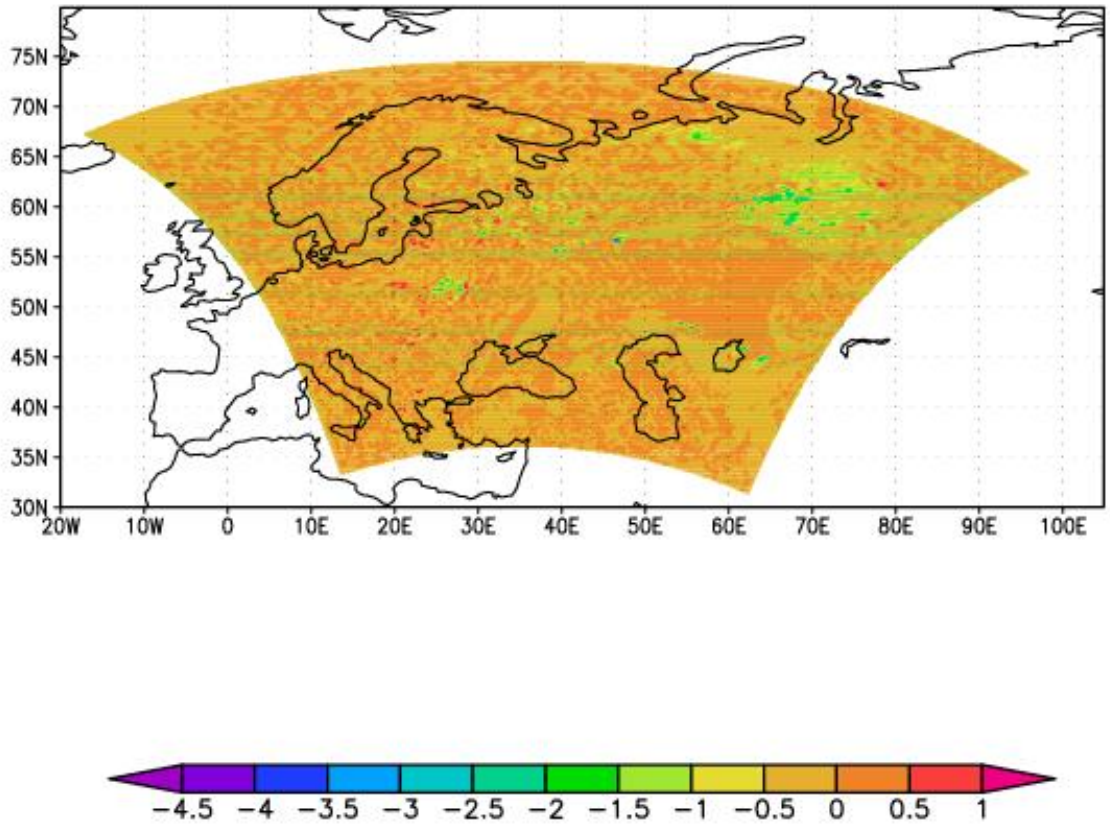


Results: soil temperature at 2 cm Degero Stormyr mire, July 2008, SCLM simulations. Effect of hydraulic diffusivity in the upper peat layer





Results of the tests with the mire parameterization in the 3D COSMO model



2m temperature difference between the modified (with the mire parameterization) and the standard COSMO model. 36h forecast, starting at 00 UTC, 10 August 2011, COSMO-RU domain

Conclusions

- In many areas in Russia mires are more numerous then indicated by soil_type=8
- The parameterization of soil water is very sensitive to initial conditions
- More advanced parameterization is needed for the vertical structure of hydraulic conductivity and diffusivity

Additional ideas arisen from the PT

- Varying depth lower boundary conditions could be use for the whole hydrophobic-dry soil gradient

- …but initialization scheme should be use to assimilate ground water depth data

- Draining and rewetting mires changes the regional climate
- Rice paddies are significant modifiers of the temperature regime in Asia

Thanks for cooperation and your attention!