



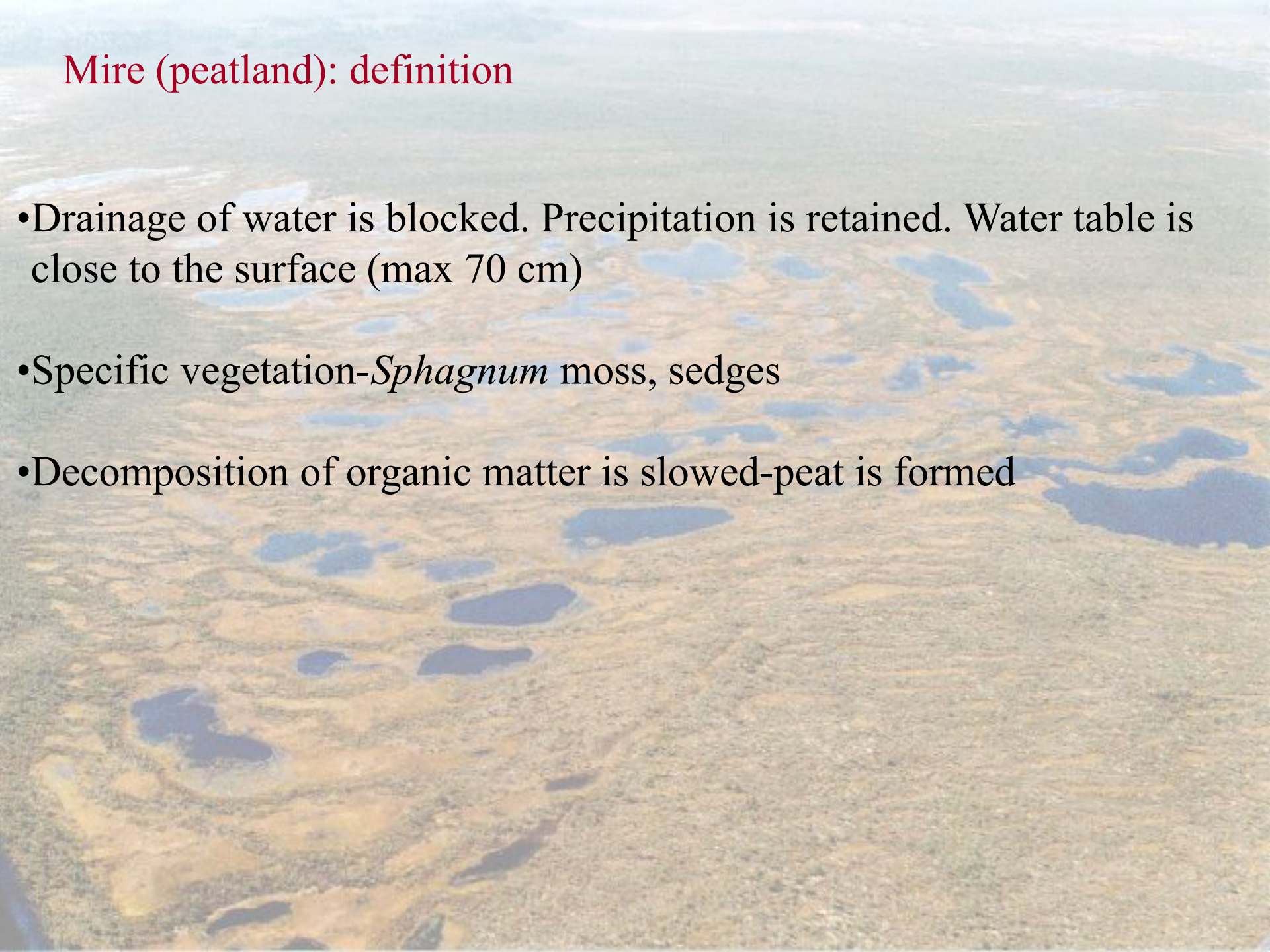
# Parameterization of mires in a numerical weather prediction model

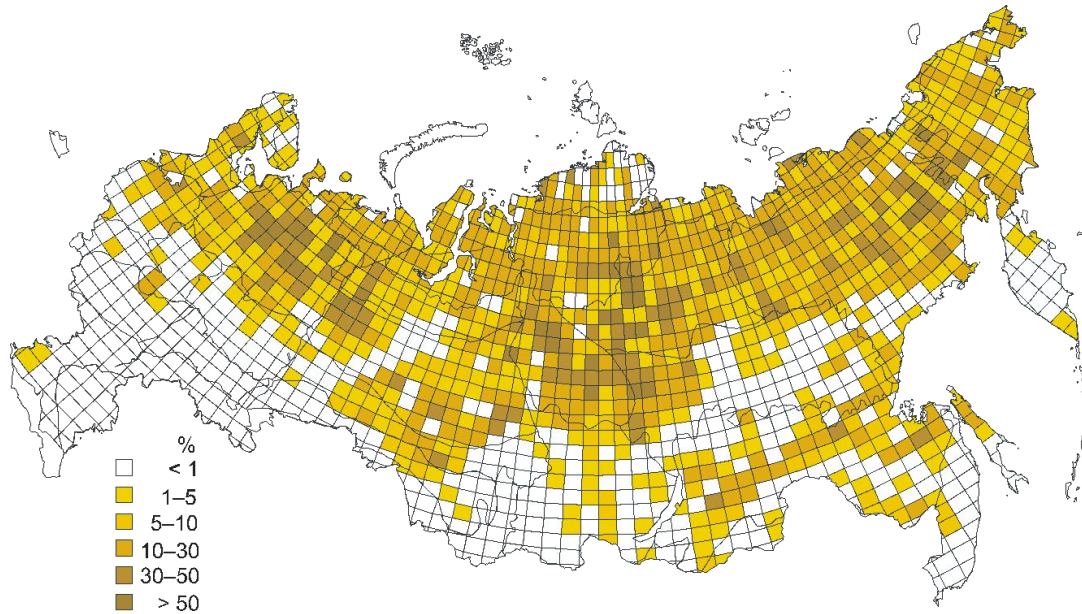
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## Mire (peatland): definition

- Drainage of water is blocked. Precipitation is retained. Water table is close to the surface (max 70 cm)
- Specific vegetation-*Sphagnum* moss, sedges
- Decomposition of organic matter is slowed-peat is formed





Mires have a specific:

- Heat balance
- Moisture exchange

The spatial distribution of mires in Russia from the GIS "Peatlands of Russia" (Vompersky et al., 2005).

## Global semi-Lagrangian NWP model SL-AV (Tolstykh, 2001)

- Operational NWP in Hydrometeorological Centre of Russia
- Resolution  $0.72^\circ$  lat и  $0.9^\circ$  lon, 50 vertical levels
- Dynamical core- semi-Lagrangian, semi-implicit, vorticity and divergence as prognostic variables, unstaggered horizontal grid
- Physical parameterizations- ALADIN/ALARO, including ISBA LSS
- In Siberia forecasts in summer are biased towards high air temperature and low relative humidity

# Modifications done to the SL-AV model to simulate mire heat and water balance

- Multilayer soil heat transfer model with heat capacity and thermal conductivity from Wania et al. (2009)
- Water balance with MMWH
- Two schemes to simulate evapotranspiration(1-Lafleur et al., 2005;2-Weiss et al., 2006)

$$1 \quad ET = 0.427 \cdot PET, \quad \text{if } z_{wt} \geq 65$$

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

$$ET = 0.617 \cdot PET, \quad \text{if } z_{wt} < 25$$

ET-evapotranspiration

PET-potential ET

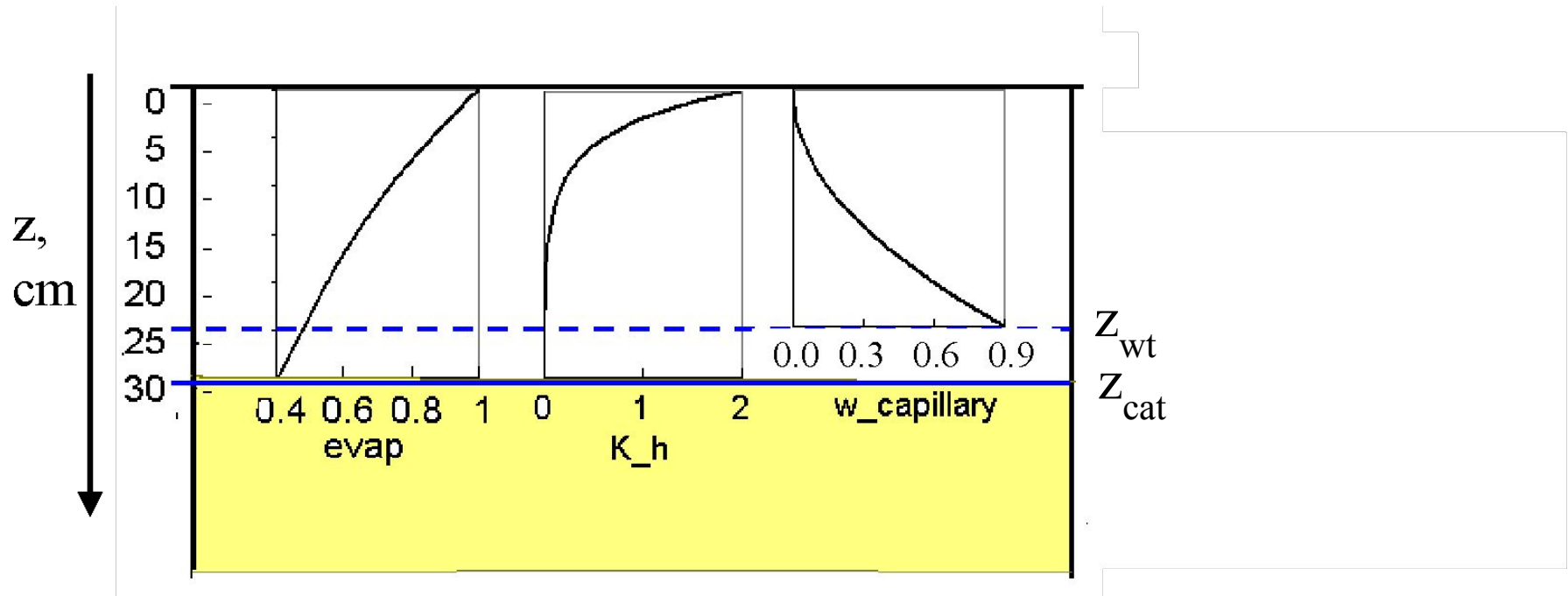
2

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

$$1, \quad \text{if } z_{wt} \leq z_L,$$

- Prescribed roughness length and albedo

# The Mixed Mire Water and Heat model MMWH (Granberg et al., 1999)

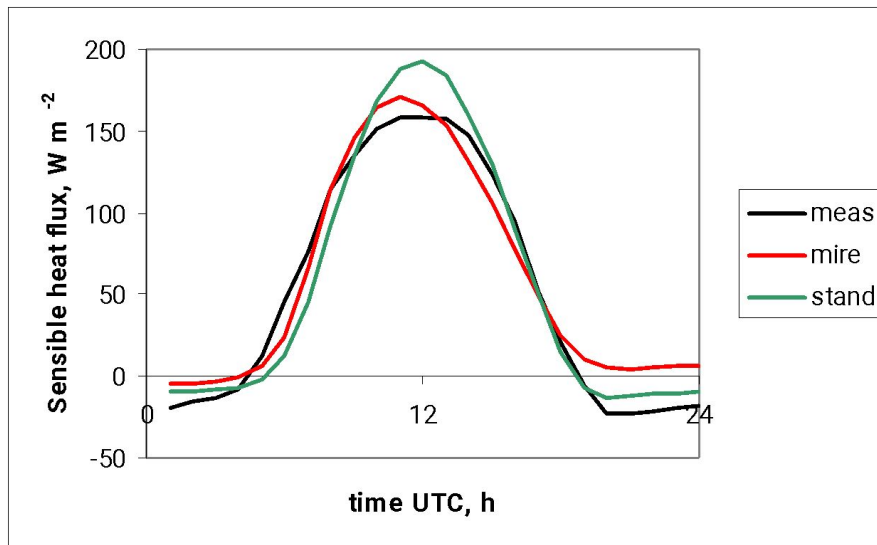


$$\Delta W = P - E - q,$$

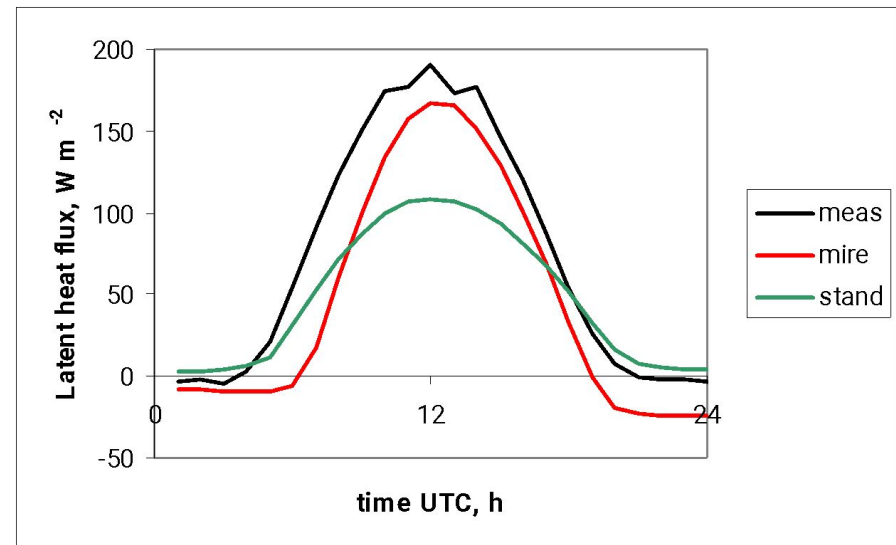
$$q = l_q \cdot i \cdot K_h (z_{cat} - z_{wt}),$$

$W$ -water content,  $P$ -precipitation,  $E$ -evapotranspiration,  $q$ -runoff,  $i$ -slope of the water table,  $K_h$ -transmissivity coefficient,  $l_q$ -lumped parameter

Components of the heat balance from the eddy-flux measurements, standard model simulation (stand), and simulation with a new model (mire). Degero Srormyr mire, Sweden

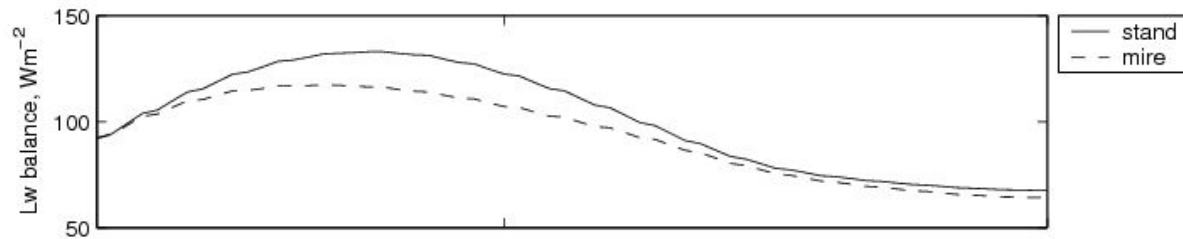


Sensible heat

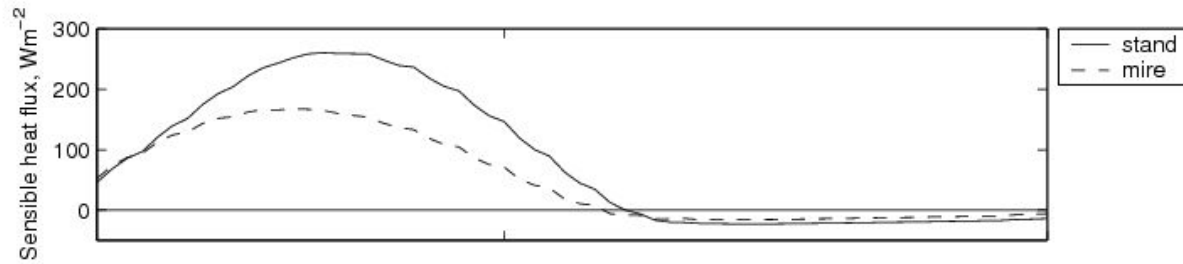


Latent heat

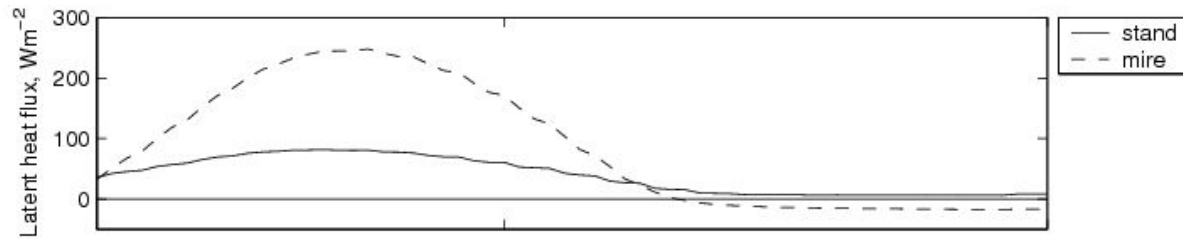
Components of the radiation and heat balance from the standard model simulation (stand), and simulation with a new model (mire).  
July-August 2008, “mire” grid cells only, Western Siberia



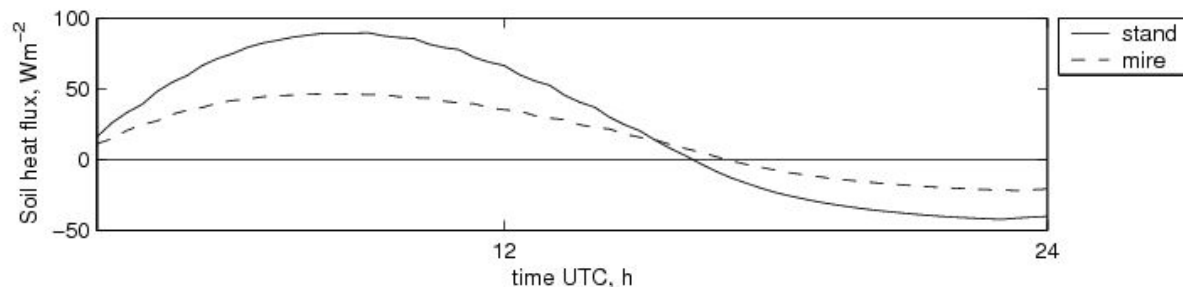
LW balance



Sensible heat



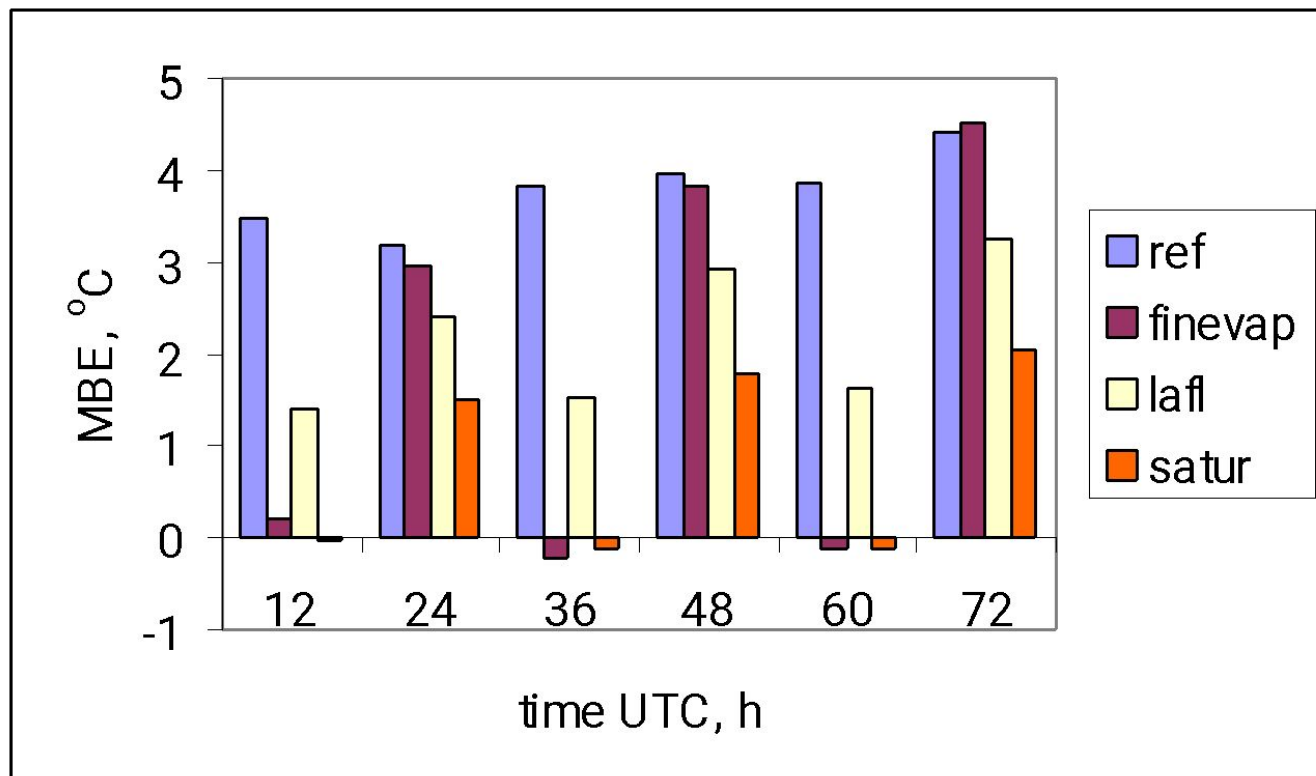
Latent heat



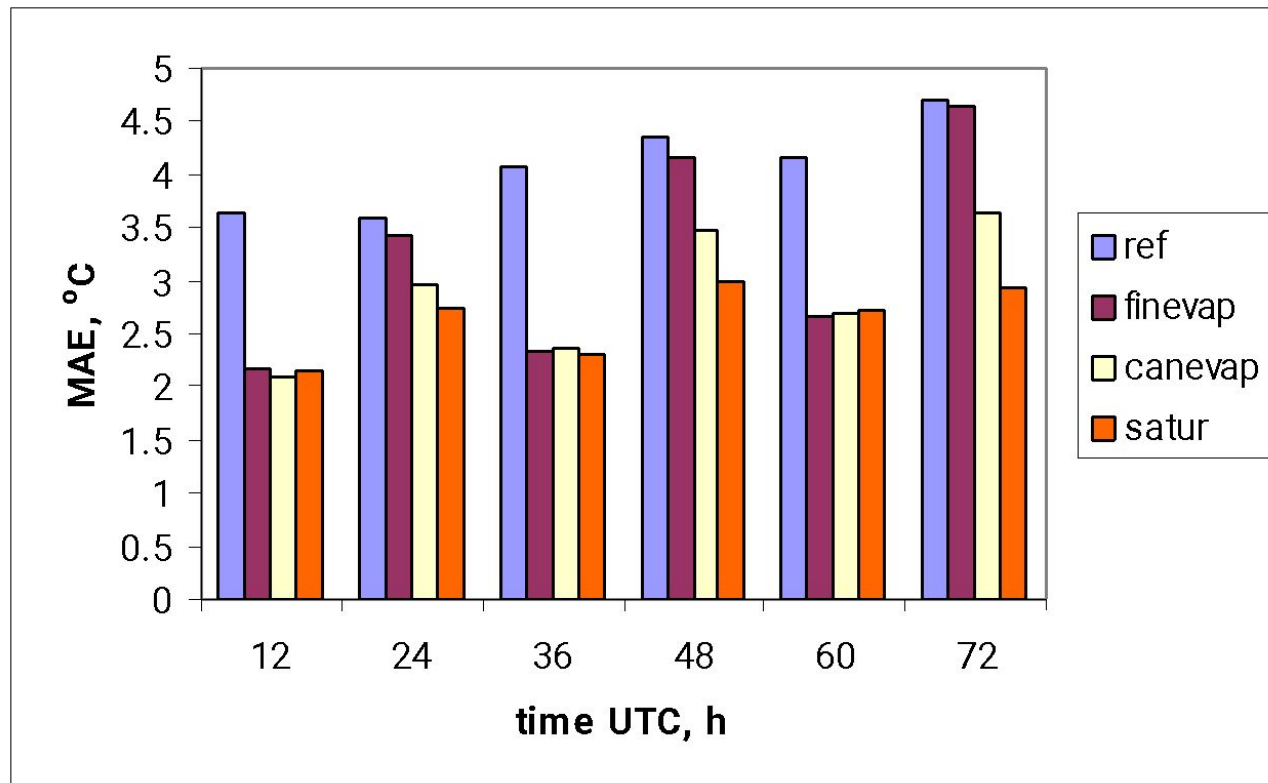
Soil heat flux



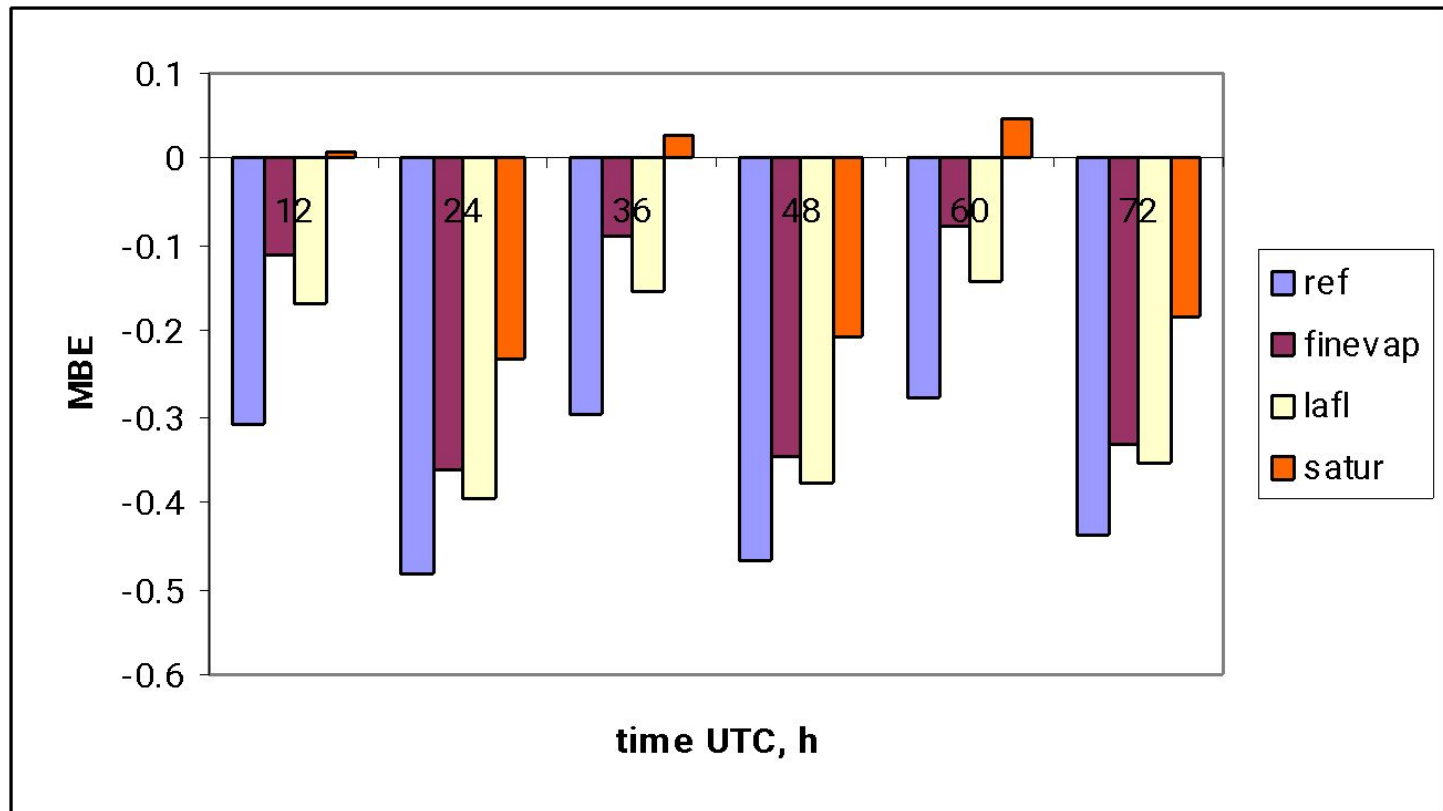
Mean bias error (MBE) for forecasted temperature °C, for the standard model (ref), for the saturated mire surface (satur) model, for the model with the Weiss et al. (2006) function for evapotranspiration (finevap), and for the model incorporating the Lafleur et al. (2005) function for evapotranspiration (lafleur). July-August 2008, “mire” stations only, Western Siberia



Mean absolute error (MAE) for forecasted temperature °C, for the standard model (ref), for the saturated mire surface (satur) model, for the model with the Weiss et al. (2006) function for evapotranspiration (finevap), and for the model incorporating the Lafleur et al. (2005) function for evapotranspiration (canevap). July-August 2008, “mire” stations only, Western Siberia

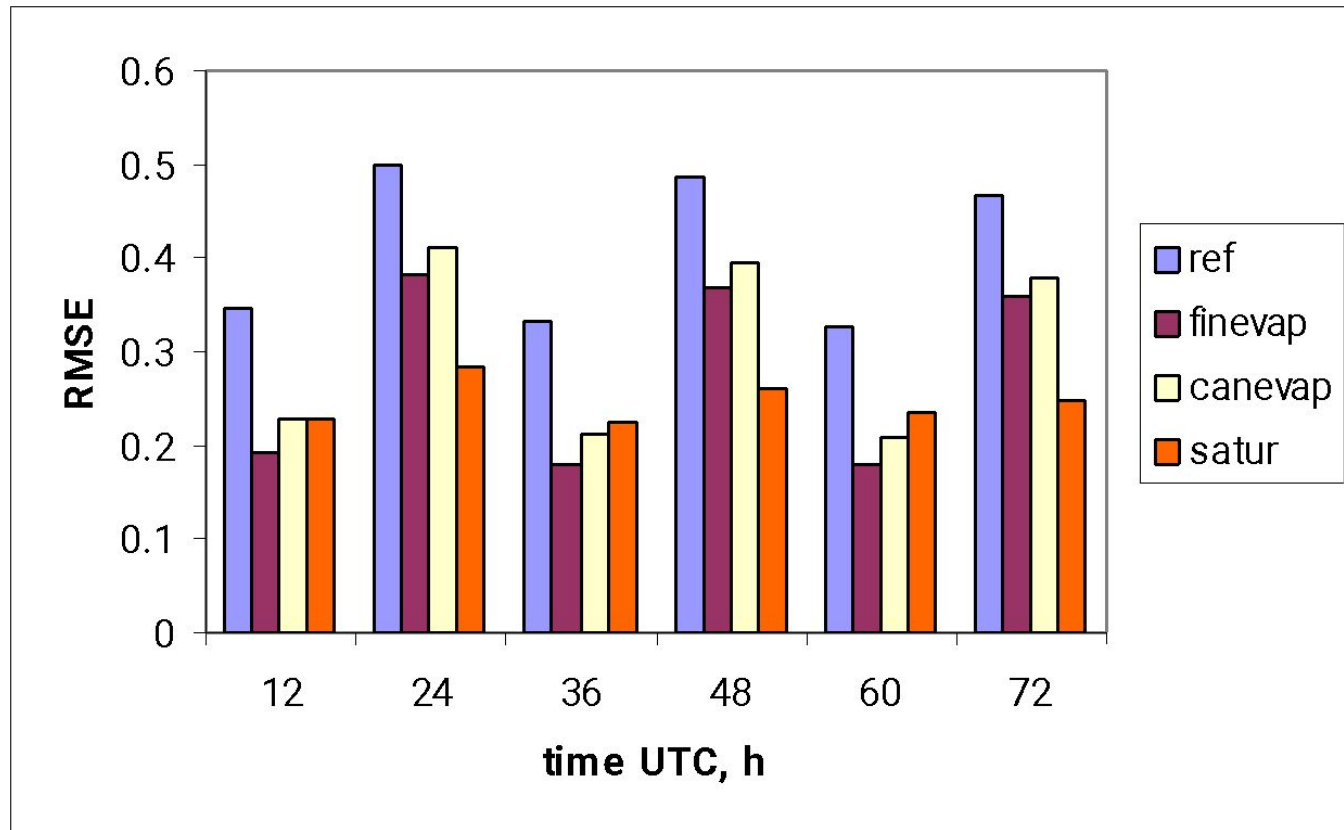


Mean bias error (MBE) for forecasted relative humidity, for the standard model (ref), for the saturated mire surface (satur) model, for the model with the Weiss et al. (2006) function for evapotranspiration (finevap), and for the model incorporating the Lafleur et al. (2005) function for evapotranspiration (lafle). July-August 2008, “mire” stations only, Western Siberia



RMSE for forecasted relative humidity, for the standard model (ref), for the saturated mire surface (satur) model, for the model with the Weiss et al. (2006) function for evapotranspiration (finevap), and for the model incorporating the Lafleur et al. (2005) function for evapotranspiration (canevap).

July-August 2008, “mire” stations only, Western Siberia



## Conclusions:

It is important to incorporate mires when forecasting weather in Siberia

Heat balance partitioning has changed

The mire parameterization has helped to reduce a large warm temperature bias in Western Siberia for the forecast for lead times of 12, 36 and 60h, but did not eliminate forecast bias for lead times of 24, 48 and 72h.

## Future plans:

- Testing the model for winter conditions (freezing and thawing)
- Investigating the effect of mire drainage on local and regional weather conditions

# Thanks for your attention!

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