









# EULAG (Eulerian / semi-LAGrangian fluid solver)

- LES model
- 3D parallelized
- Iterative pressure solver MPDATA (robust solver)
- Different features: steep topography, immersed boundaries, etc.
- TKE closure
- Surface fluxes forcing
- Subsidence forcing
- Radiative cooling
- Periodic boundary conditions in the horizontal
- Variable vertical resolution with  $\Delta z=5$  m at the surface;  $L_z=3$  km
- Different horizontal resolutions and domain sizes, dependent on the time of the day

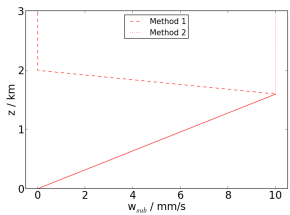
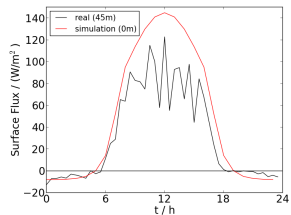
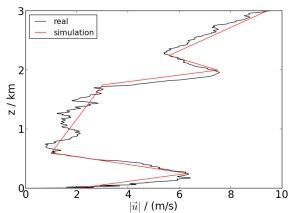
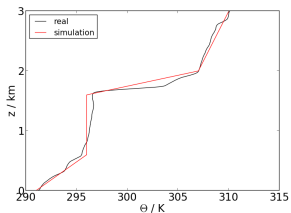
# Diurnal cycle method

night		day		night
SBL	e	CBL	f	SBL
$n=m=128$	s	$n=m=128$	e	$n=m=512$
$\Delta x=\Delta y=6.25\text{ m}$	i	$\Delta x=\Delta y=25\text{ m}$	s	$\Delta x=\Delta y=6.25\text{ m}$
$L_x=L_y=800\text{ m}$	r	$L_x=L_y=3200\text{ m}$	u	$L_x=L_y=3200\text{ m}$
$\text{procs}=8\times 8\times 4=256$	n	$\text{procs}=8\times 8\times 4=256$	s	$\text{procs}=16\times 16\times 4=1024$
	u		u	
	s		s	



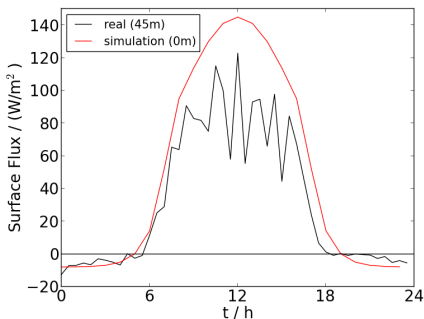


# BLLAST Simulation: set-up



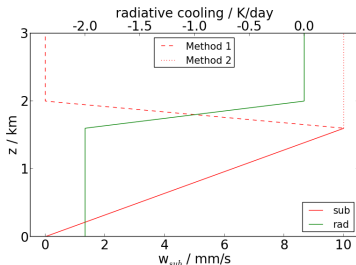


# Surface Flux Forcing



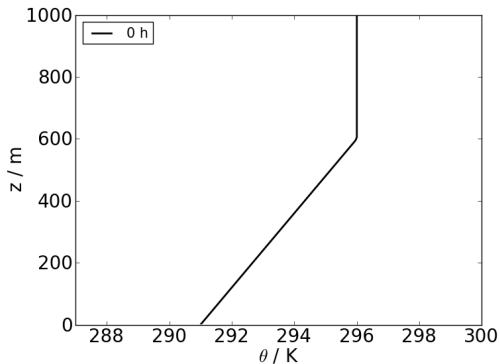
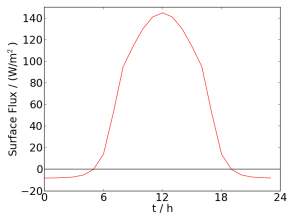
- real (45 m): average of the fluxes at 30 m, 45 m and 60 m from 60-m tower
- simulation (0 m): exponential flux distribution with height (300 m = e-folding scale)
- SHF profile: symmetric around 1200 UTC
- SBL → CBL: 4 h → 6 h; CBL → SBL: 18 h → 20 h

# Subsidence Forcing

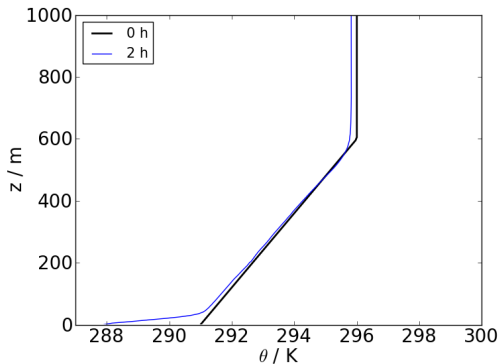
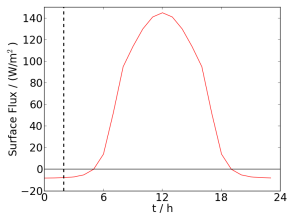


- Vertical profiles at 0000 UTC, 1100 UTC, 1658 UTC and 2254 UTC  
 →  $w_{sub}(0000 \text{ UTC} - 1100 \text{ UTC}) \sim 10 \text{ mm s}^{-1}$
- Linear increase of  $w_{sub}$  from the ground up to the residual layer
- Method 1: Linear decrease of  $w_{sub}$  up to the top of the inversion layer;  $w_{sub}=0$  in FA
- Method 2: Inversion layer and FA: constant  $w_{sub}$
- Subsidence applied on  $u$ ,  $v$  and  $\Theta$  or only on  $\Theta$  (moisture=0)
- Subsidence horizontally applied on each gp  $\Theta(i,j)$  or as large-scale process on  $\overline{\Theta(i,j)}$
- Radiative cooling of  $2 \text{ K d}^{-1}$  as additional forcing

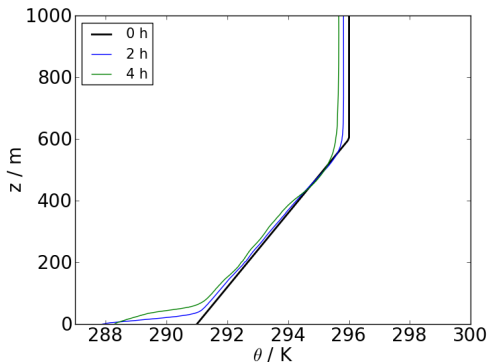
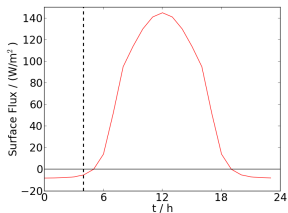
# First results: Temperature development



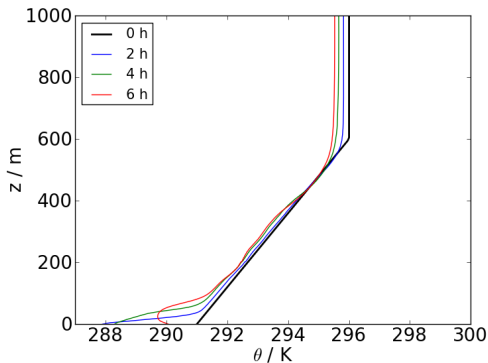
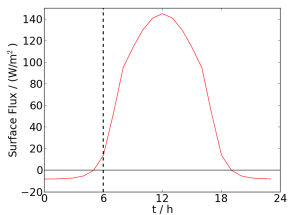
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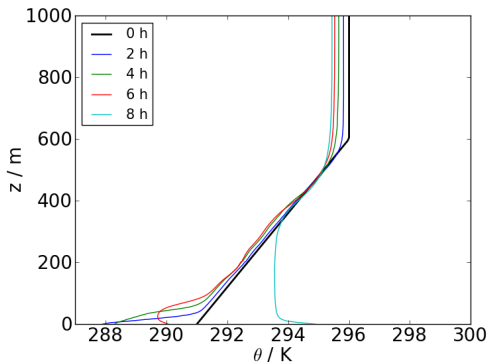
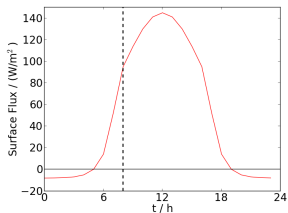
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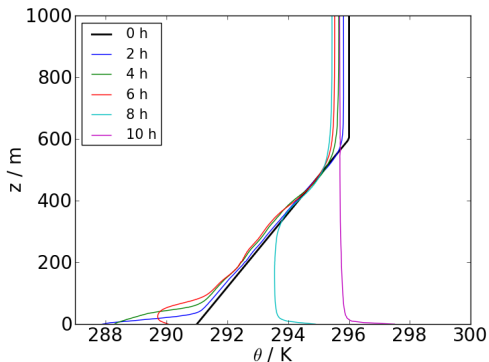
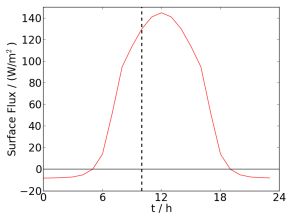
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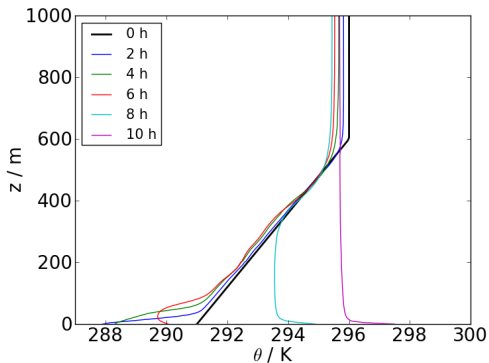


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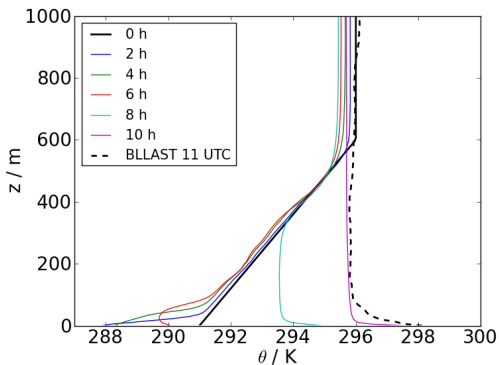


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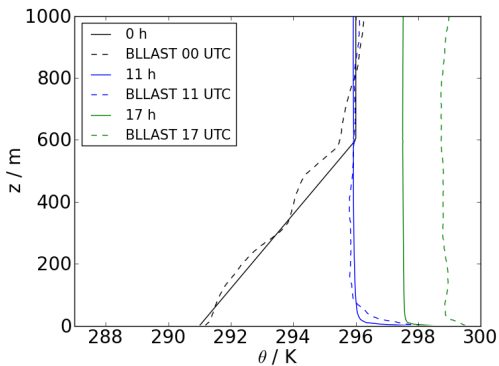
→ Transition from SBL to CBL.

## First results: Comparison to measurements



→ Comparison of the vertical  $\Theta$ -structure leads to a quite good result.

## First results: Comparison to measurements



- Quite good agreement for 1100 UTC.
- $\Delta\theta$  is 1 K of for 1658 UTC.

# Summary

## Preleminary results:

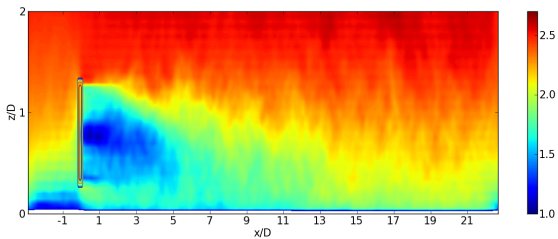
- Transition from SBL to CBL
- Agreement of  $\Theta$ -profile for 1100 UTC
- Underestimation of  $\Theta$ -profile for 1658 UTC (dry simulations)

## Work in progress:

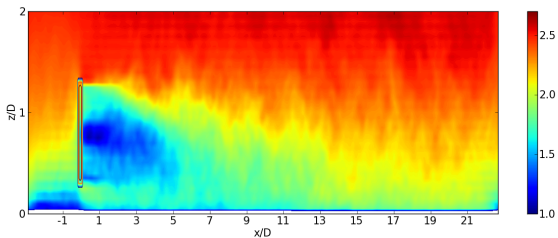
- e-folding scale for exponential surface flux distribution; drag parameter
- Subsidence process
- Transition from CBL back to SBL
- $\Theta$ -profile comparison for 2254 UTC
- Investigation of the spectra and the TKE parts



# Outlook

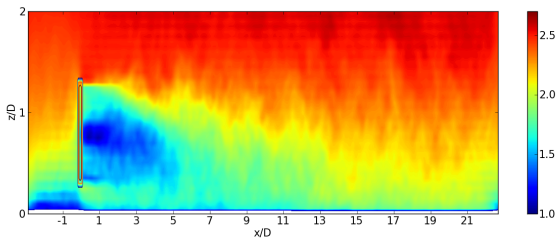


# Outlook



Investigation of the influence of a **WIND TURBINE** on the **ATMOSPHERIC BOUNDARY LAYER** (for complex terrain).

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**Thank you for your attention!**