# Monitoring HIRLAM with Cabauw data

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## HIRLAM 6.2

- 3D VAR analysis ,
- Digital Filter Initialisation ,
- Later Boundaries (6/3h)
- Semi Lagrangian advection 600/300sec,
- Grid 22 and 11 km
- 40 levels

## Physics schemes

- Radiation (Savijärvi)
- STRACO (Sass et al.)
- Turbulence CBR (Cuxart et al.)
- Surface scheme ISBA + surface analysis

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# Cabauw observations

**Mast measurements**

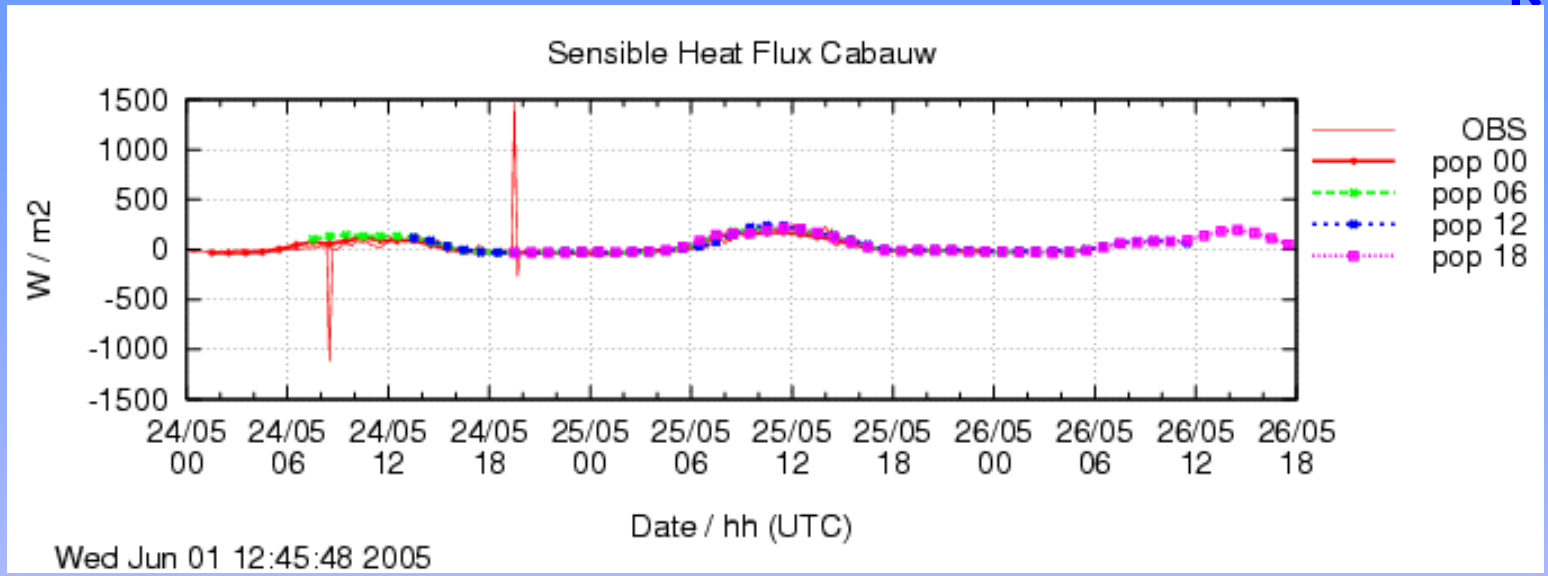
**200,140,80,40,20,10m**

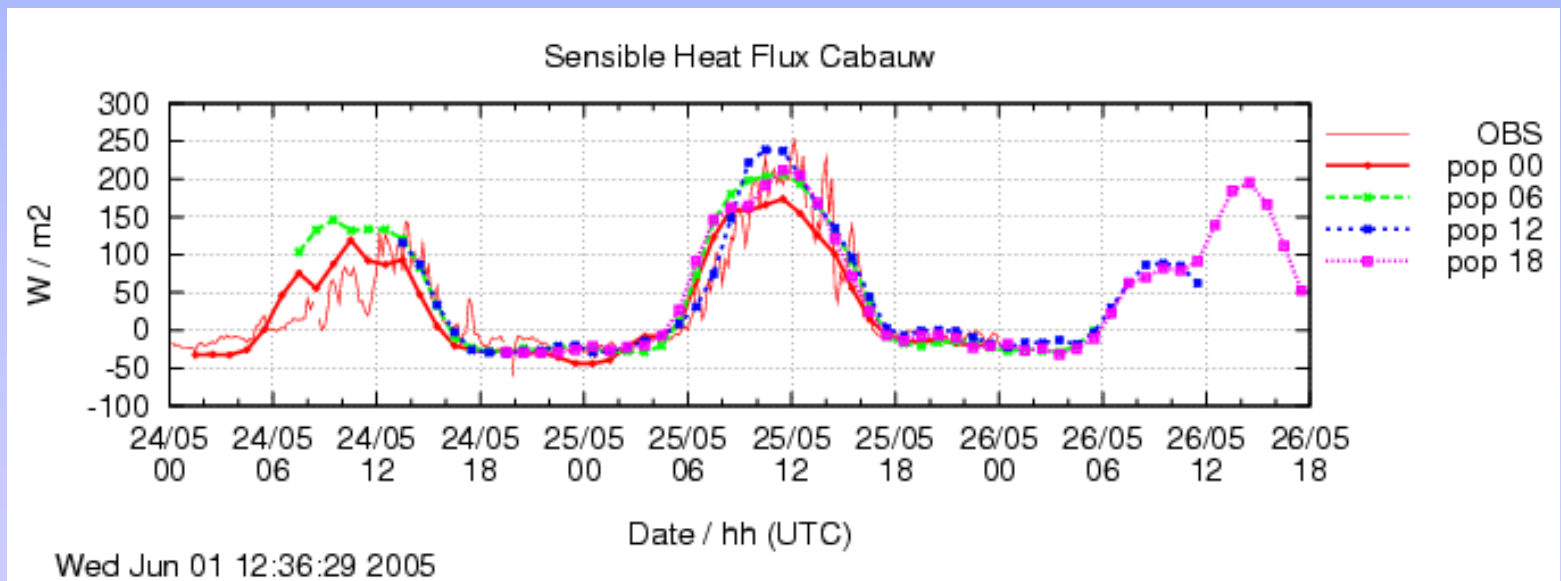
- **U,v,T,q**
- **fluxes**

**Surface measurements**

- **Radiation**
- **Soil variables**

# Quality control of turbulent fluxes

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# Removal of spikes

1. Averaging
2. Define thresholds
3. Calculate fluxes with an accurate model

## Method

Estimation of Surface Radiation and Energy Flux Densities from Single-level weather data

*Wim C. de Rooy and A.A.M. Holtslag, JAM 1999*

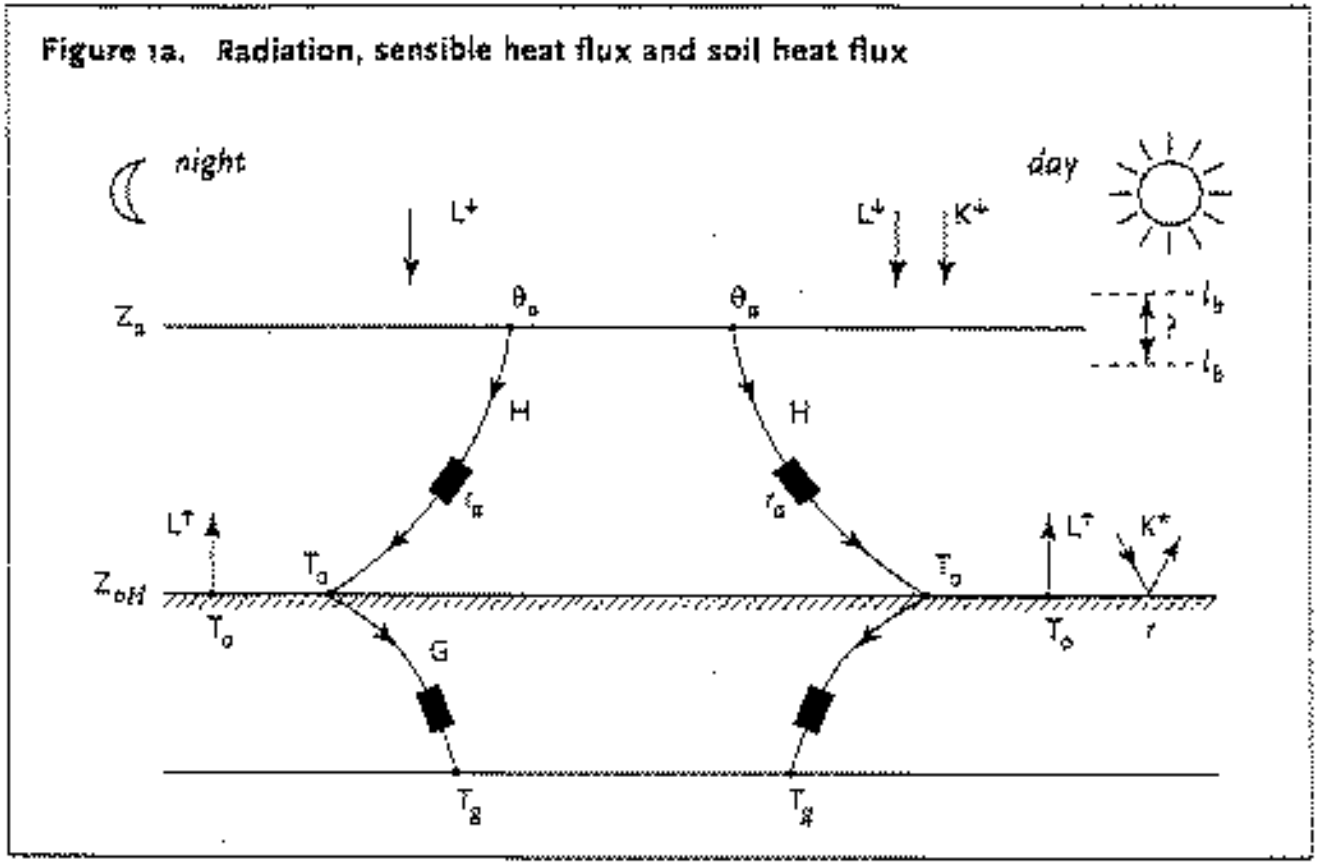
Input:

Shortwave radiation down
Shortwave radiation up
Longwave radiation down
Temperature 2m
Windspeed 10m
Relative humidity 2m

Output:

Sensible heat flux
Latent heat flux
Momentum flux

$$Q^* = K^* + L^{\downarrow} - L^{\uparrow} \qquad Q^* = H + \lambda E + G$$



$$u_* = \frac{ku_a}{\ln(\frac{z_{u_a}}{z_{0M}})}$$

$$r_a = \frac{1}{ku_{*meso}} \ln(\frac{z_{T_a}}{z_{0H}})$$

$$u_* = \frac{ku_a}{\ln(\frac{z_a}{z_{0M}} - \psi_M(\frac{z_a}{L}) + \psi_M(\frac{z_{0M}}{L})}$$

$$r_a = \frac{1}{ku_*}\left[\ln(\frac{z_a}{z_{0H}}) - \psi_H(\frac{z_a}{L}) + \psi_H(\frac{z_{0H}}{L})\right]$$

$$H = \frac{AD + B}{C + AE}$$

$$Q^* - G = D - EH$$

$$\theta_{*_{meso}} = \frac{-H}{\rho c_p u_{*_{meso}}}$$

$$L_{meso} = \frac{u^2_{*_{meso}} T_a}{kg\theta_{*_{meso}}}$$

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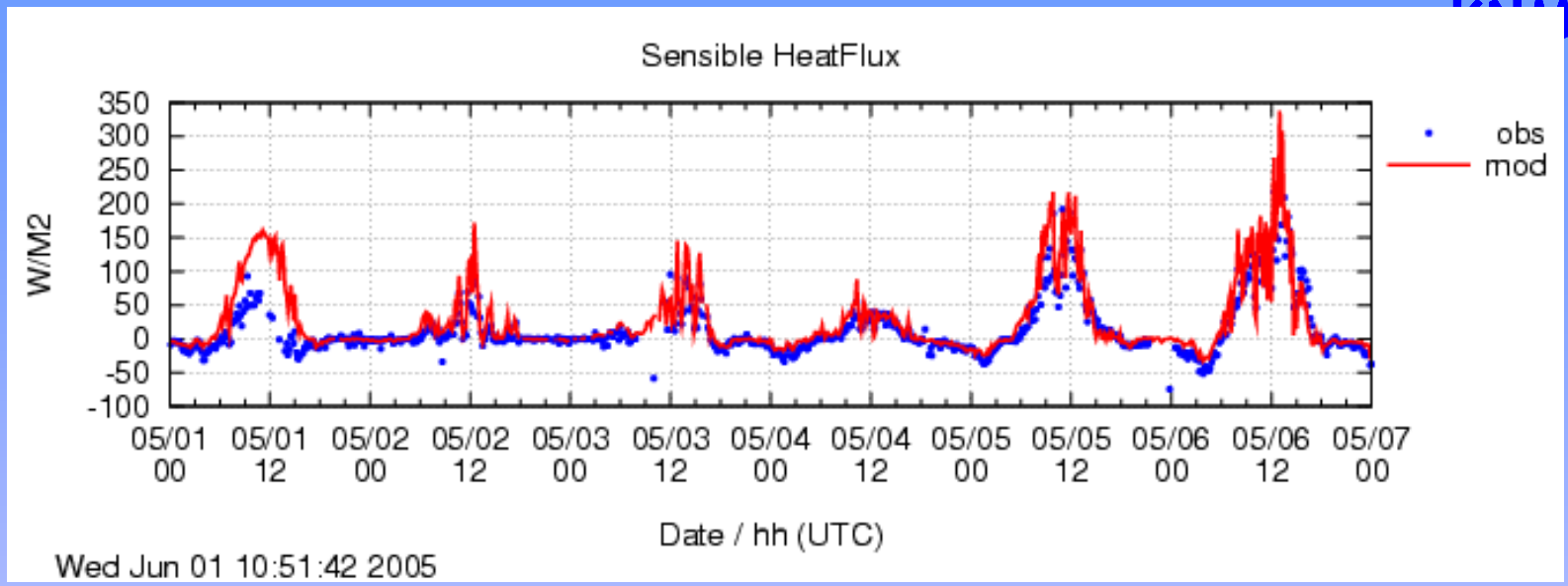
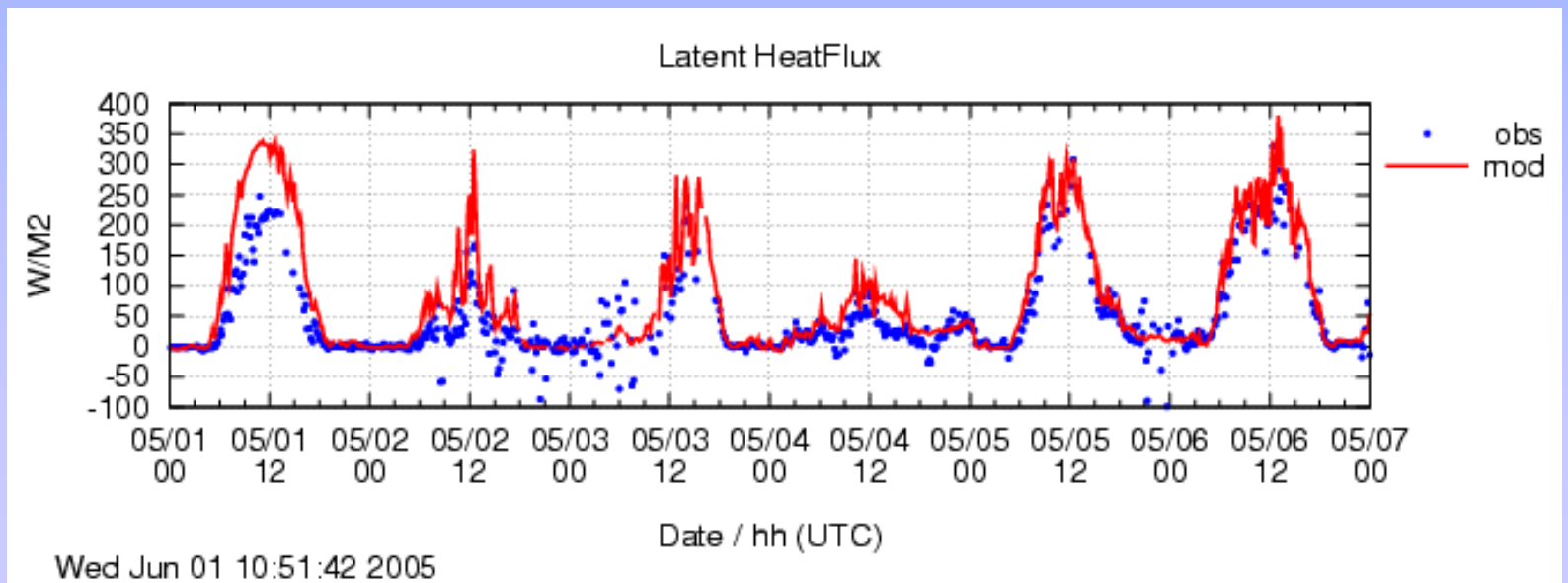
# May 2005 Cabauw

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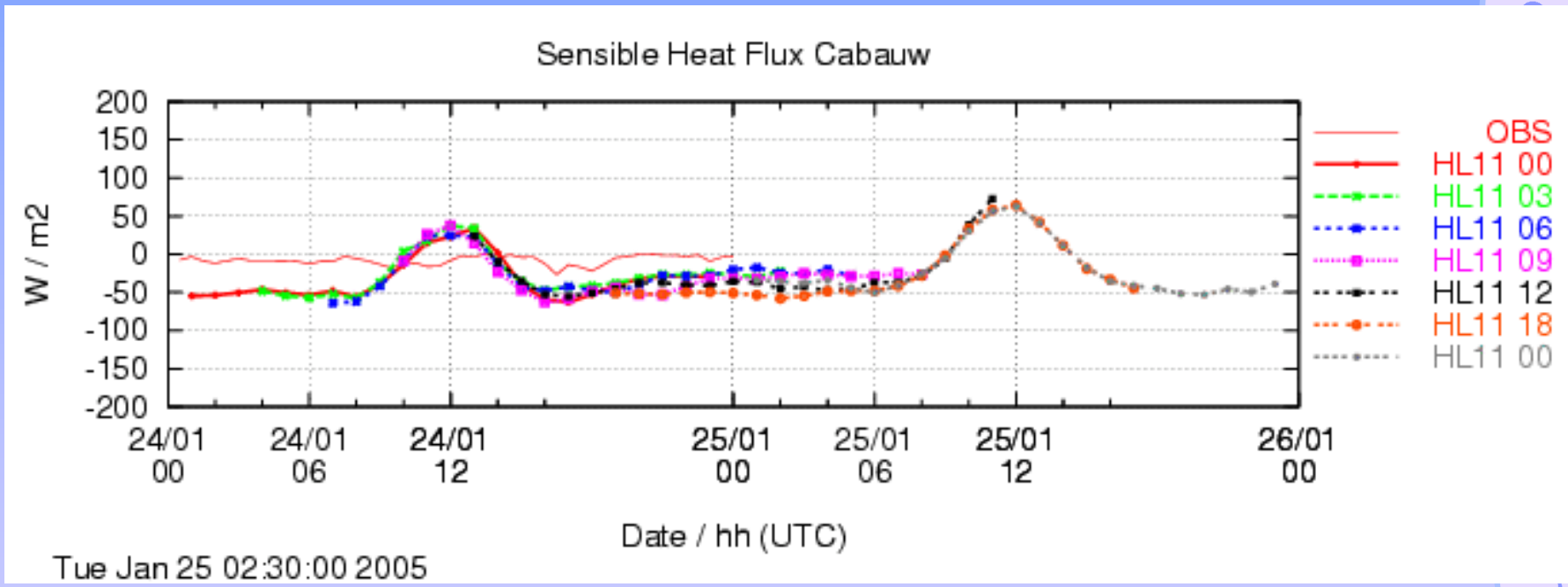
## But…

- Works well in Cabauw (grass)
- Adaptations for other vegetations and surfaces
- Stable conditions are problematic

# Monitoring

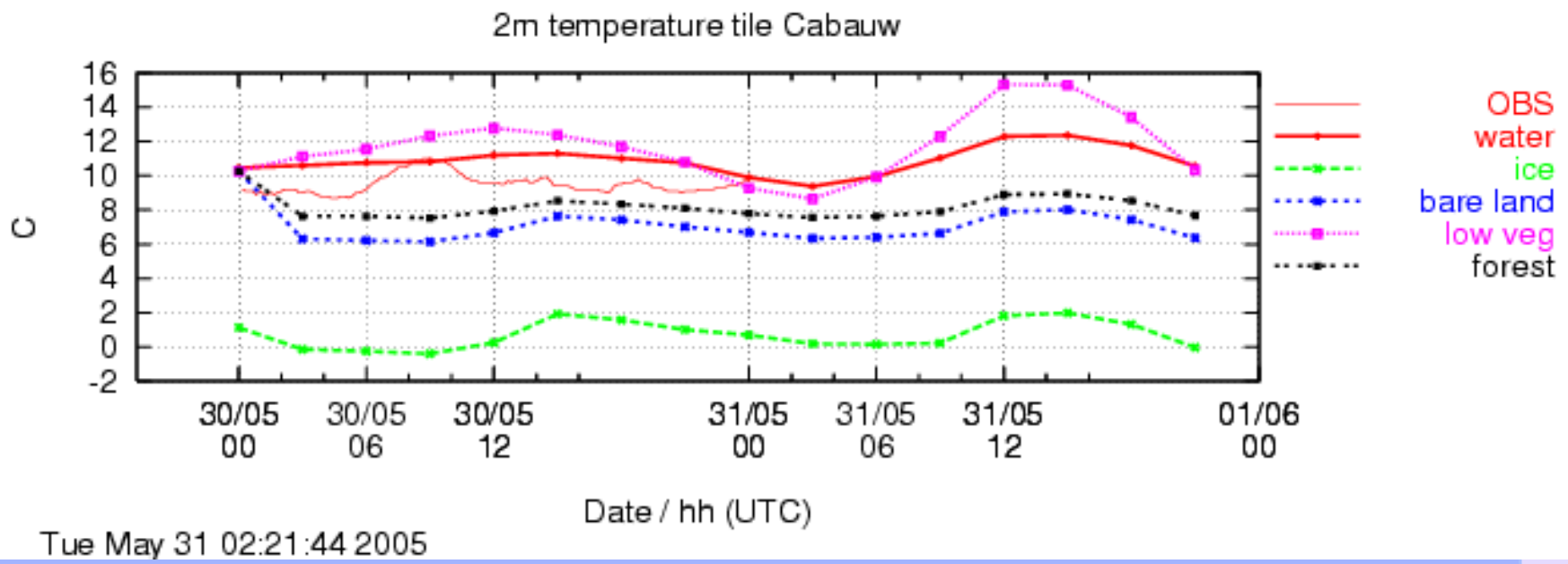
## FMI Monitoring of HIRLAM (Markku Kangas)

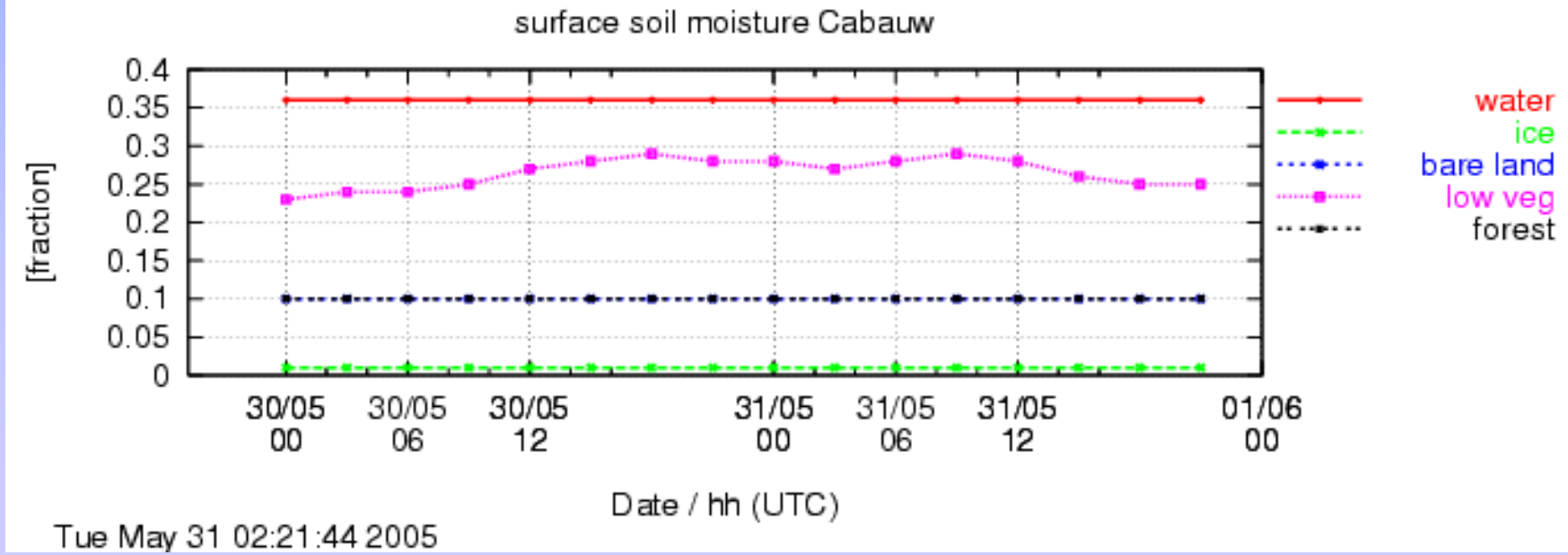



- Too much mixing to prevent excessive cooling

## Future work

- Collect more cases with problems
- Use more observations ( surface, higher levels)
- Study longer episodes
- Experiments with 1D/3D version of HIRLAM



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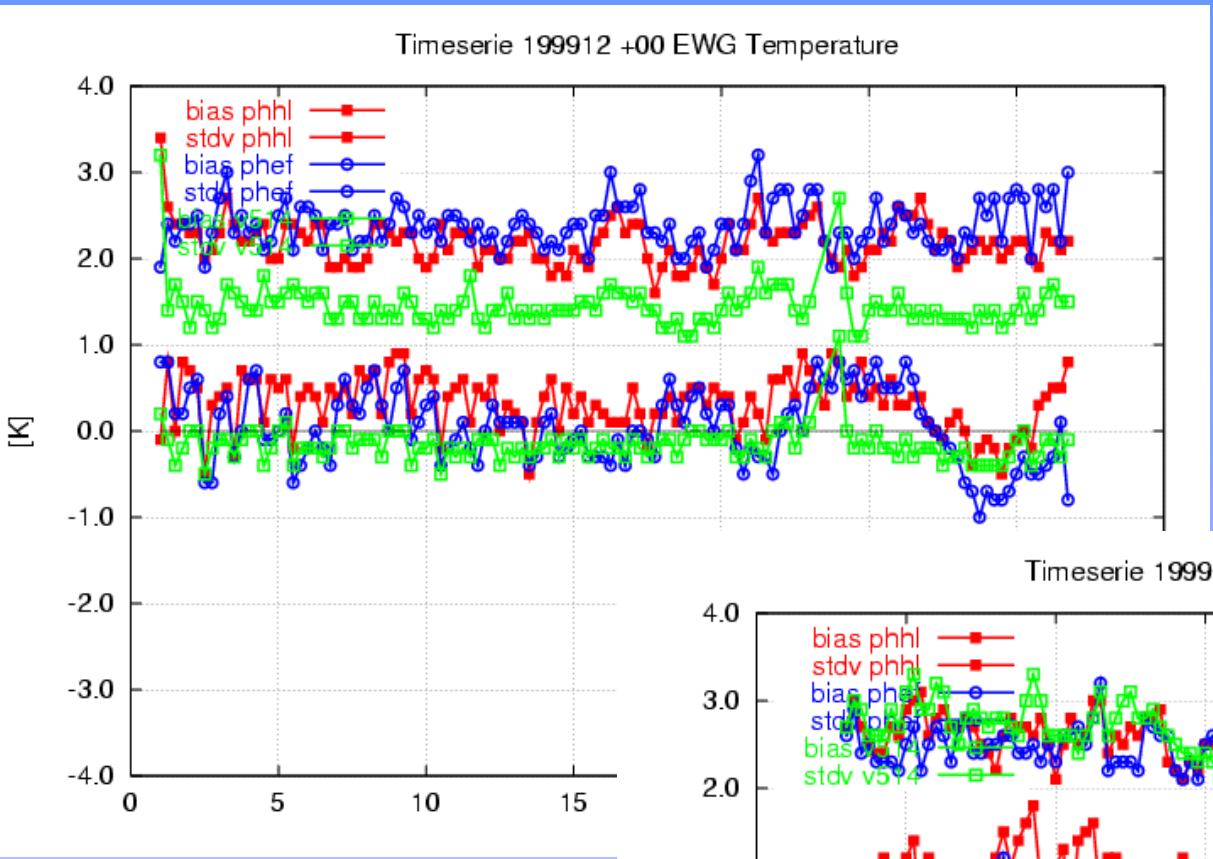


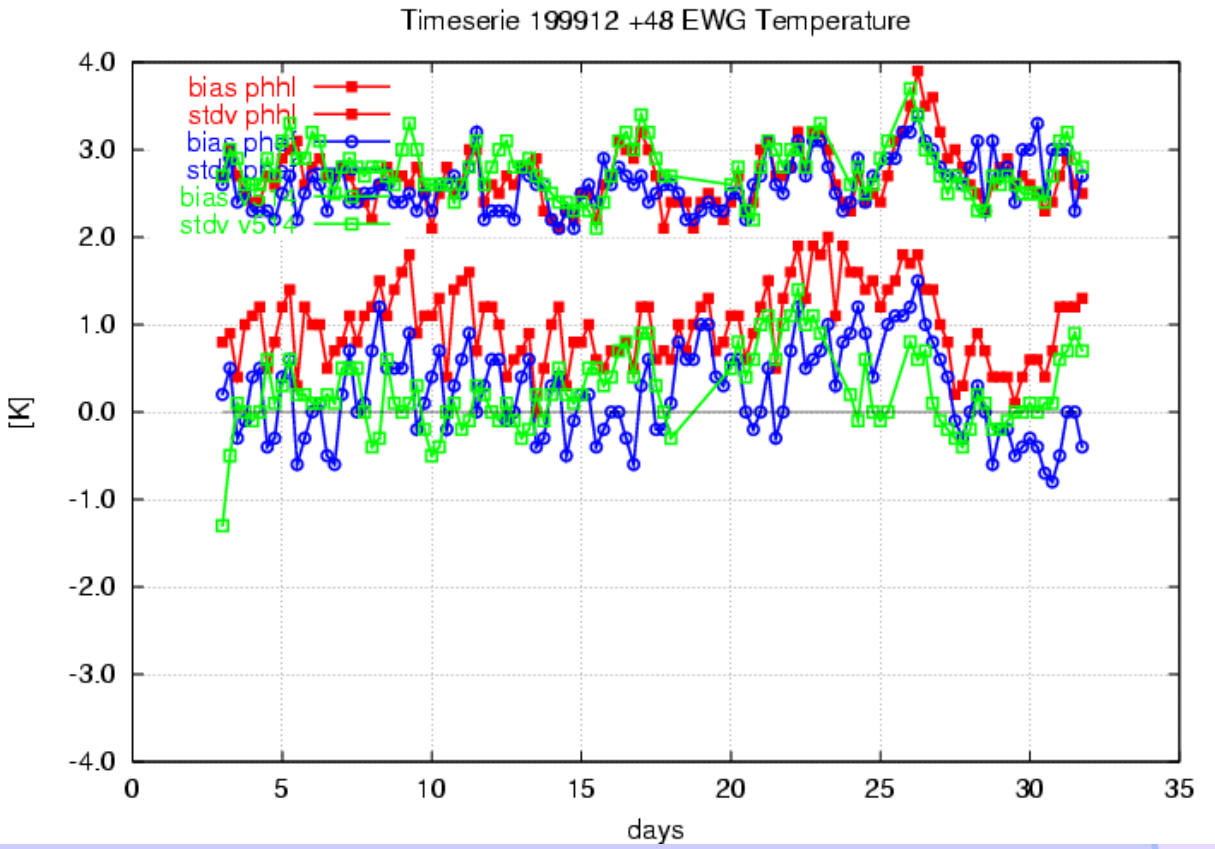


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## Error growth 2m temperature

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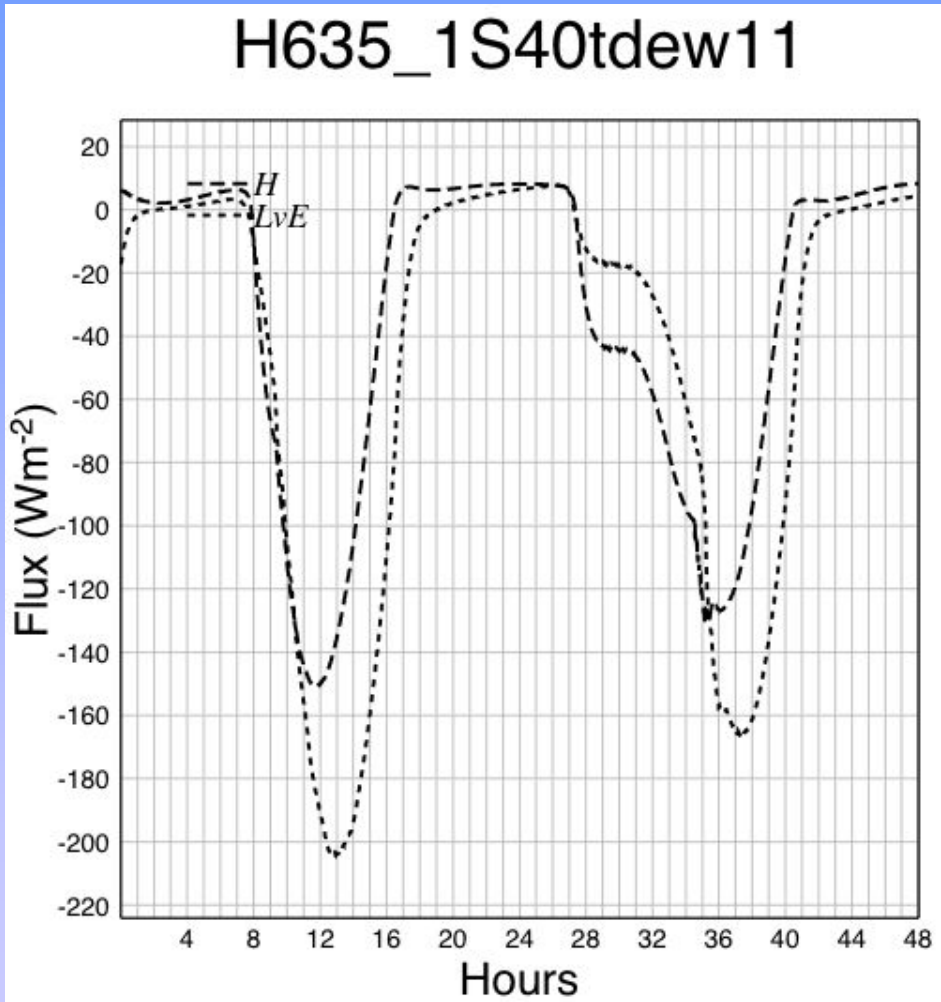
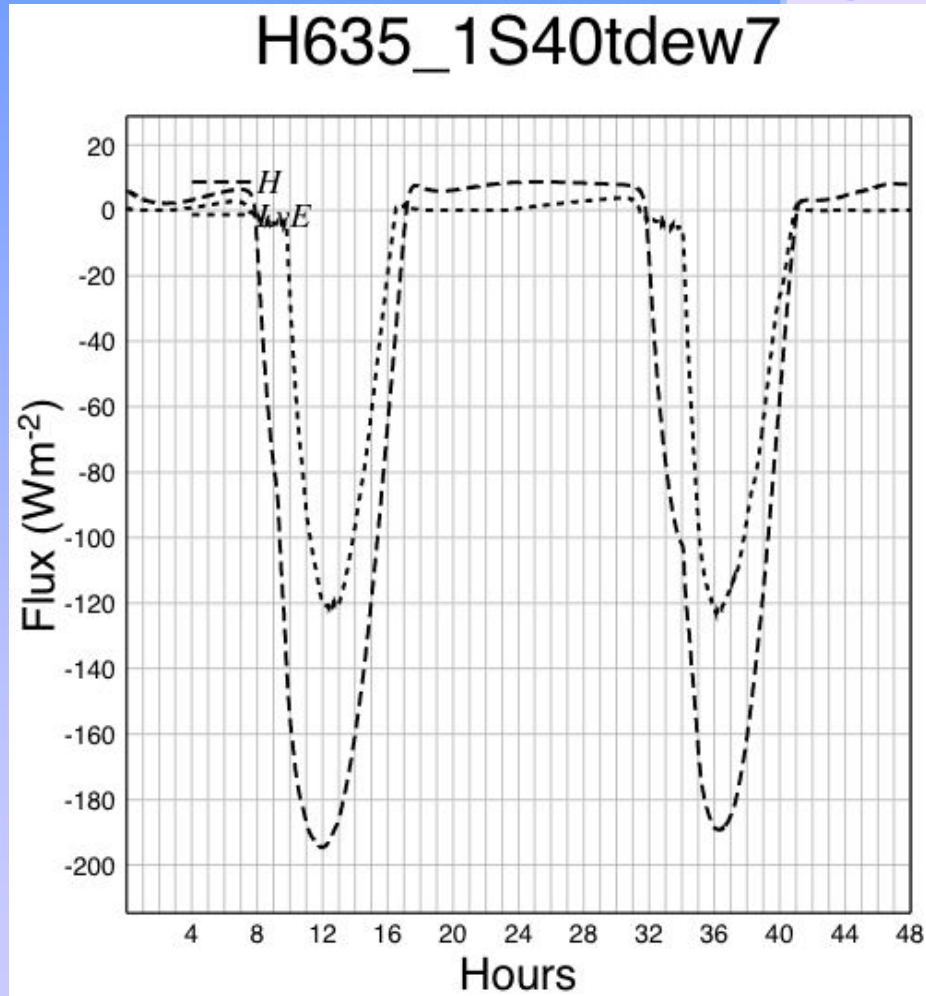
# Autumn problem (6.3.5a) Sander Tijm



# Thanks for your attention !!

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