Preliminary analysis of surface heterogeneity at site 2

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Site 2

Do the surface heterogeneities have an impact on the boundary layer behaviour during transition ?

3 large vegetated patches : moor, corn, forest
1,5km×500m

Measurements

- 2 TBs over moor and corn
- Meteorological and flux stations over the three patches
- Surface caracteristic measurements (T,q)

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   - Ground heat flux over moor and corn
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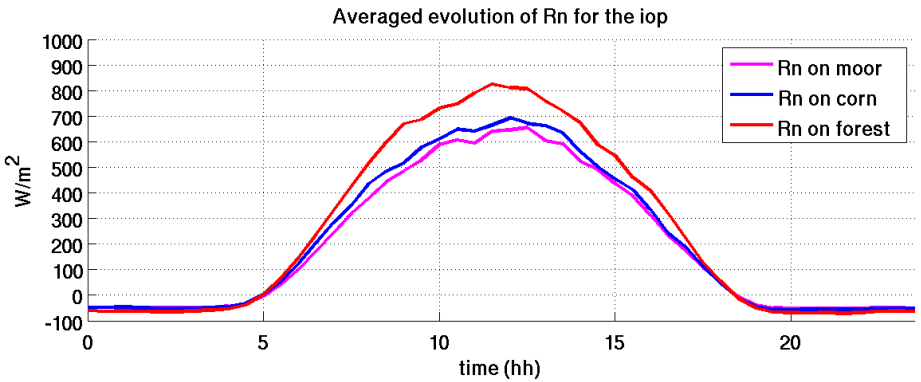
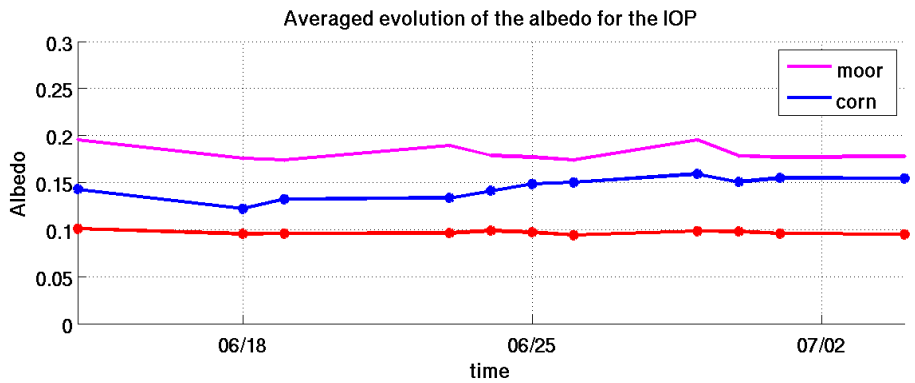
Radiation budget

Composite day over IOPs





NR

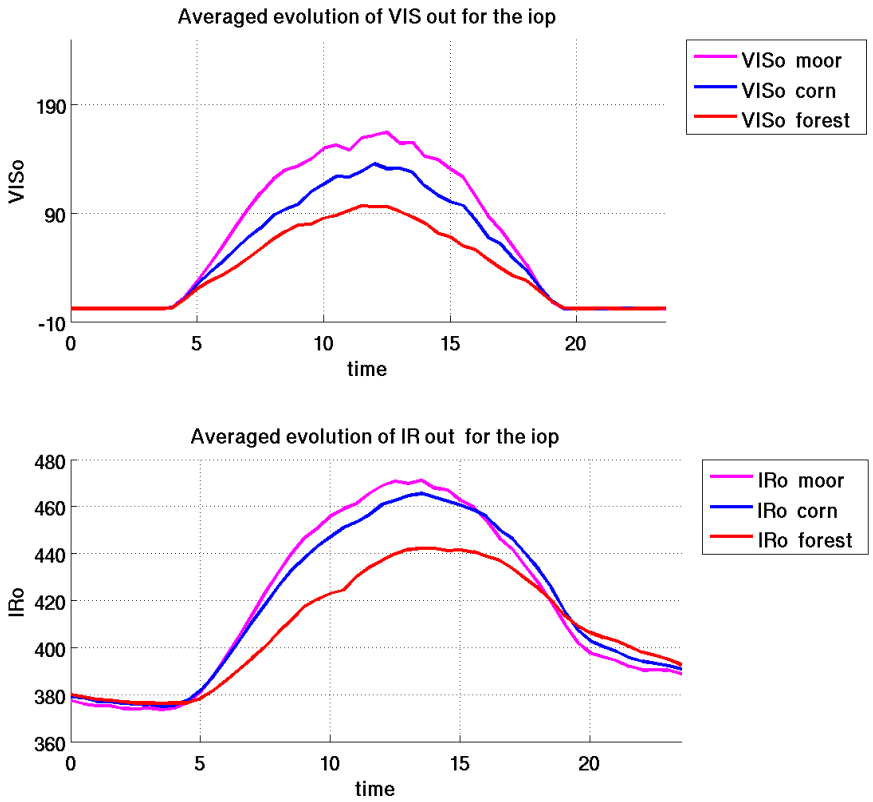
- $\sim$ the same net radiation over moor and corn
- larger NR over forest

Albedo

- α forest $= 0.1$
- α moor $= 0.2$
- α corn : increases from 0,13 to 0,17

Radiation budget over the 3 surfaces

Composite day over IOPs



- VISo : VISo moor > VISo corn > VISo forest linked with the albedo
- IR : IRo moor>IRo corn until 16 pm ($\sim 10 W/m^2$). Then, IRo moor<IRo corn
- IR : IRo moor, corn >IRo forest until 19 pm ($\sim 30 W/m^2$). Then, IRo moor, corn <IRo forest
- 07/01, 07/02, 07/05 : the inversion appears later, at 17pm.

Conclusion : intermediate position of the corn between moor and forest.

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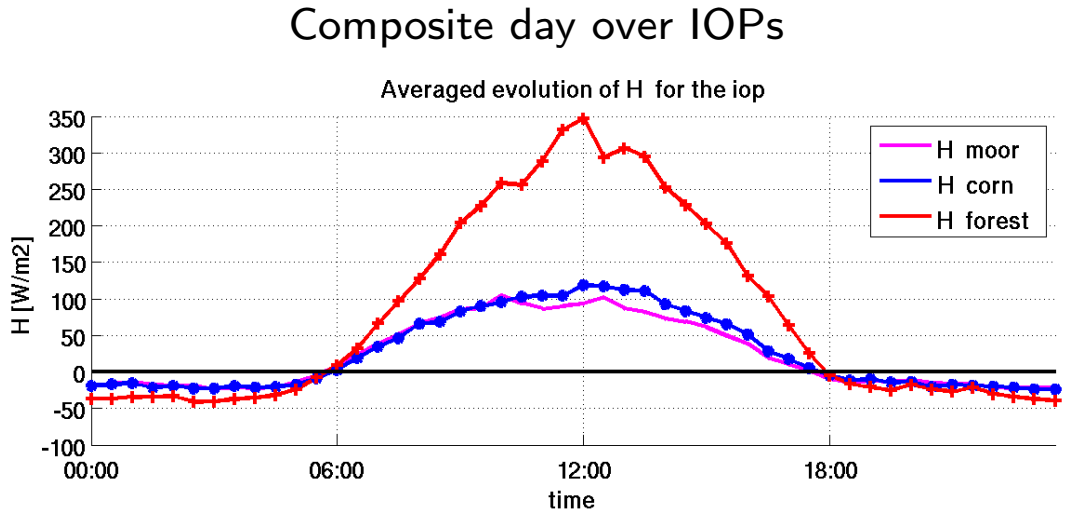
Sensible heat flux on moor, corn and forest



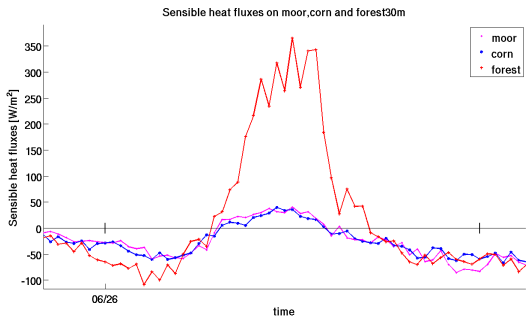
- From $\sim$ 6am to 18pm, Hf (300 W/m^2) >> Hm,Hc (100 W/m^2)
- At 12pm : Hf $\sim$ 3 Hm, Hc $\sim$ 1.25 Hm
- Until 10am Hcorn slightly <Hmoor
- Between $\sim$ 11h and 19h, Hcorn>Hmoor
- At night, Hf < Hc, Hm

Sensible heat flux

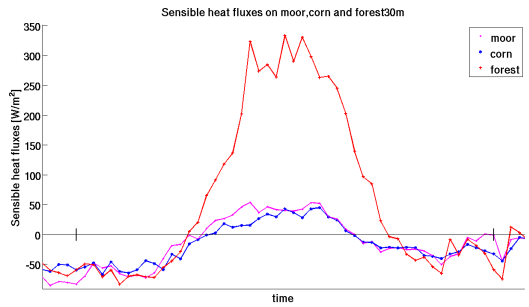
Exceptions

Hot days : 06/26, 06/27
$\longrightarrow$ Very weak fluxes
$\longrightarrow$ Hforest stays large
07/05 : Hm>Hc almost all the time

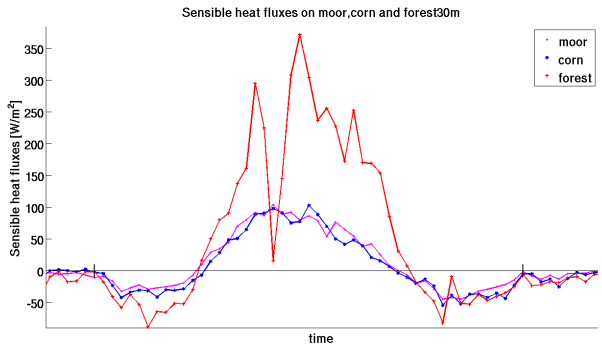
06/26



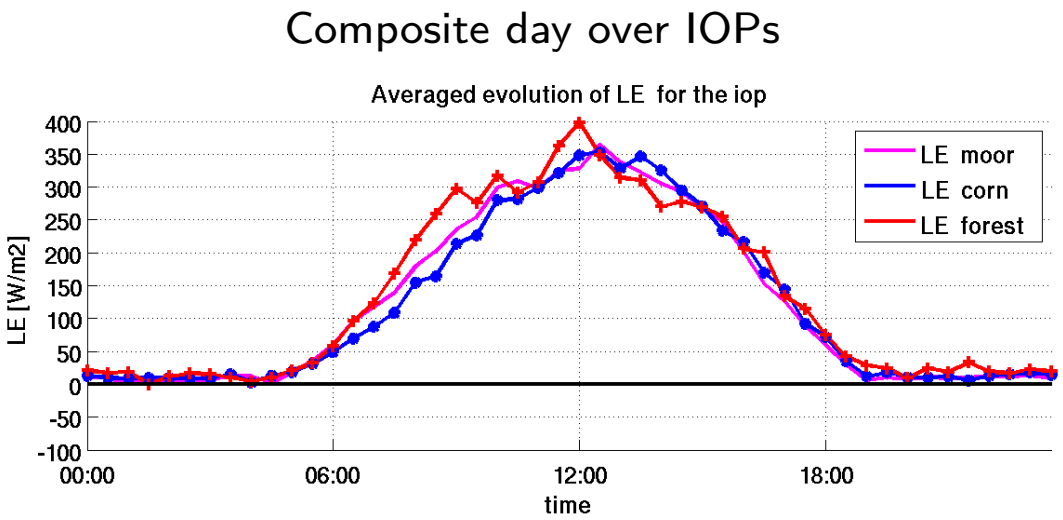
06/27



07/05



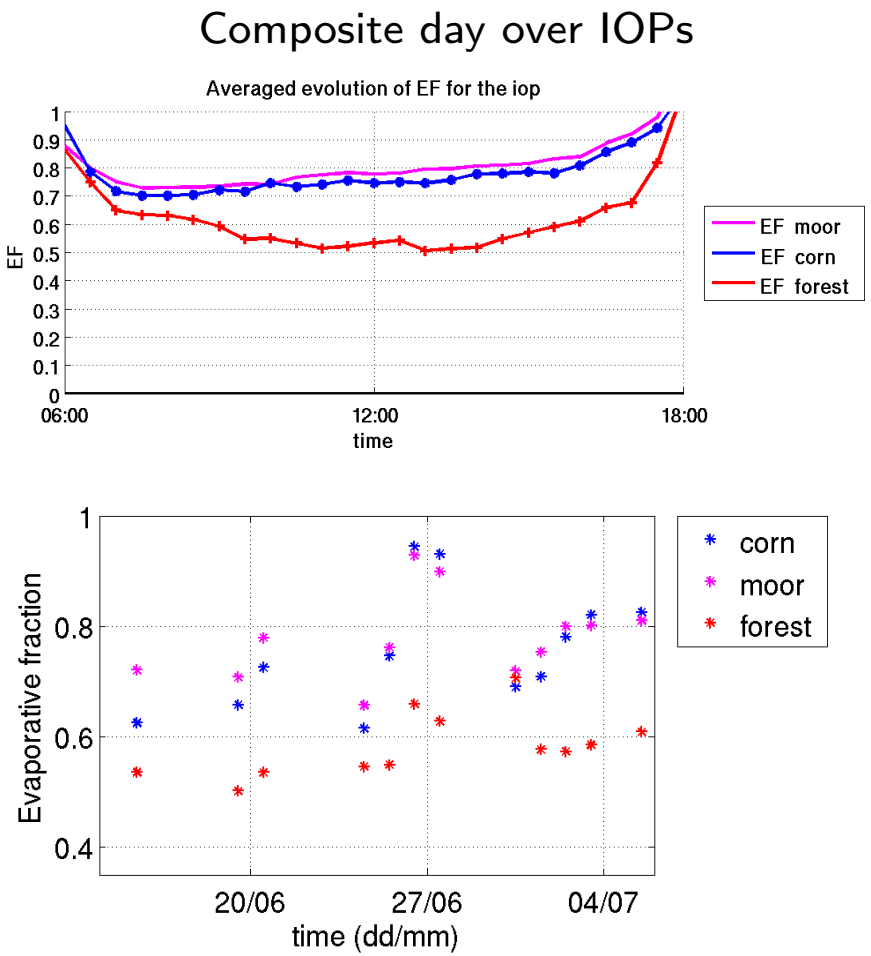
Latent heat flux on moor, corn and forest



- From 05h to 13−14h, LEf>>LEm>>LEc
- At 9am : Hf= 126%Hm, Hc=91%Hm
- During the transition : ∼ same fluxes but LEm<LEc

⇒ Less differences on LE than on H fluxes

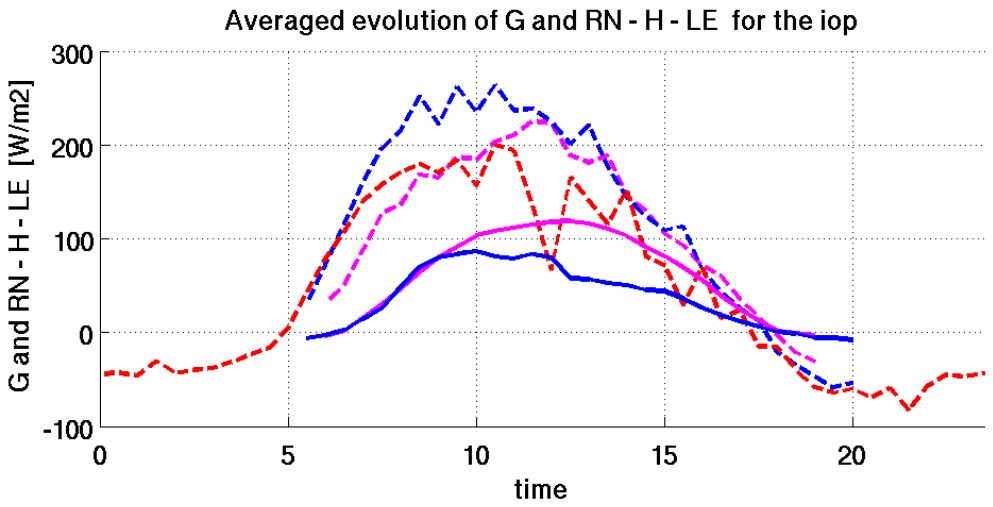
Evaporative fraction on moor, corn and forest



- EFf $\sim 0.55 <$ EFc, EFm
- $0.6 <$ EFc, EFm < 0.9
- sharp increase of EF forest in late afternoon
- Variability of EF linked with roots depth ?
- Inversion between EFm and EFc after good weather periods

Ground heat flux over moor and corn

Composite day over IOPs



$$Rn = H + LE + G + S \overset{?}{+} res$$

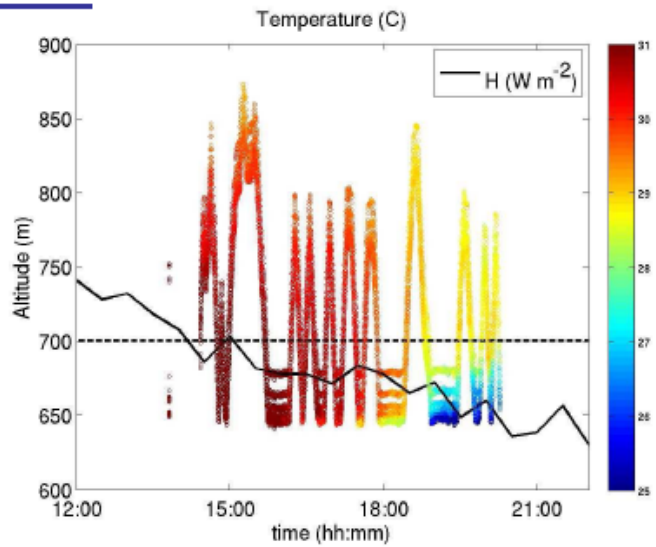
- Gm increases until 12pm
- Gc increases until 10am
- Until 9 :30am, Gm=Gc then Gm>>Gc

- The energy which is not absorbed by the ground is liberated through H.
- (Rn−H−LE−G) corn > moor ⇒ more heat storage within the corn canopy

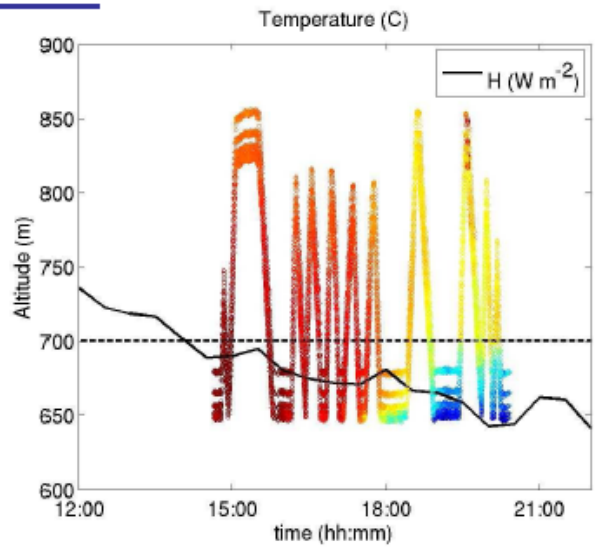
↪ A consequence on the stabilization during transition ?

The 26th of June

MOOR



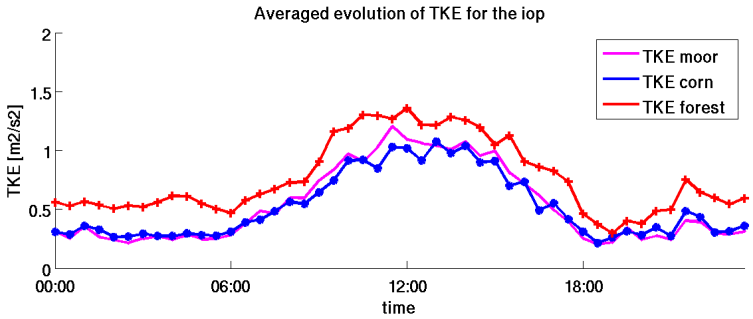
CORN



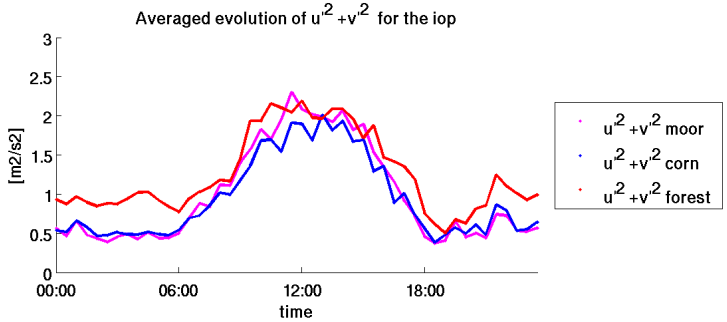
Lower ground heat flux in corn $\Rightarrow$ faster stabilization in the transition

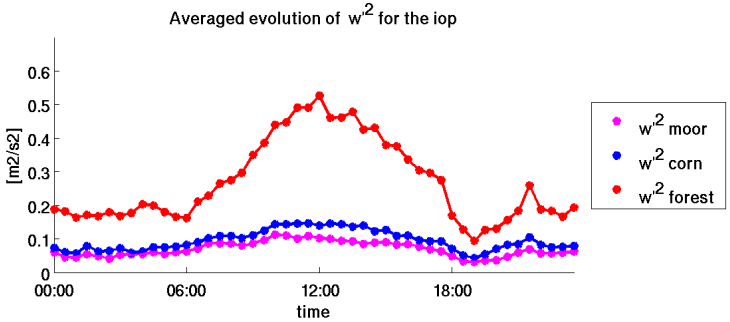
TKE

Composite day over IOPs



- TKE forest $>$ all the day
- TKEm $\sim$ TKEc (TKEc slightly $<$ TKEm between 8am and 16pm)
- Diurnal cycle on the TKE, not on the difference





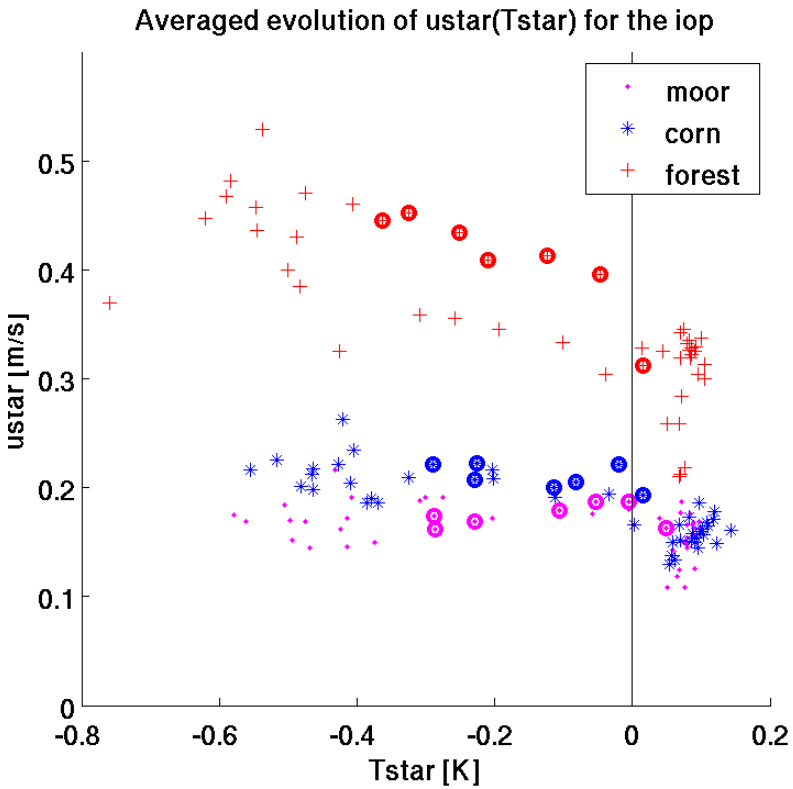
Diurnal cycle of the difference of TKE

- At night, in the morning : $\neq$ associated with $u'^2 + v'^2$
- During the day : only w'^2. Much stronger diurnal cycle on forest. Little diurnal cycle on moor and corn. Moor $<$ corn.

Question : Why $u'^2 + v'^2$ is different on forest than on moor and corn ?

Dynamical VS thermal instability

Composite day over IOPs



Definition :

$$u_\star = \sqrt{\overline{u'w'}^2 + \overline{v'w'}^2}$$

$$\Theta_\star = -\frac{\overline{w'\Theta'}}{u_\star}$$

- Thermal diurnal cycle
- Dynamical diurnal cycle on forest : more dynamical instability during transition
- More dynamical turbulence on corn than moor

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Conclusions, questions, in prospect ...

Conclusion

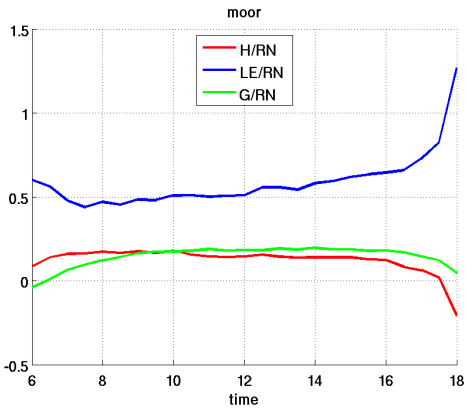
- Intermediate position of corn between moor and forest
- Large sensible heat flux over forest, even the hot days
- Less differences on LE fluxes
- Different ground heat flux between corn and moor : impact on the stabilization in the transition

In prospect

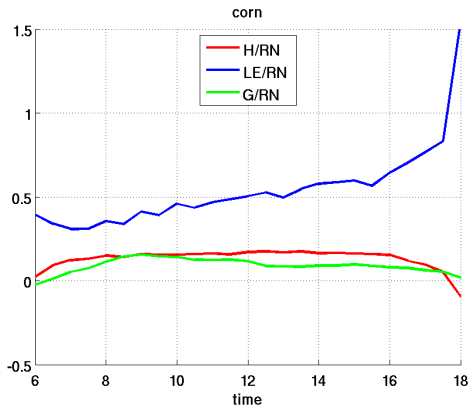
- Better understanding the role of the canopies
- Study of the convective scales : $w_\star$, $t_\star$
- Tethered balloons : characterize the structure of the lower part of the BL.

Conclusions, questions, in prospect ...

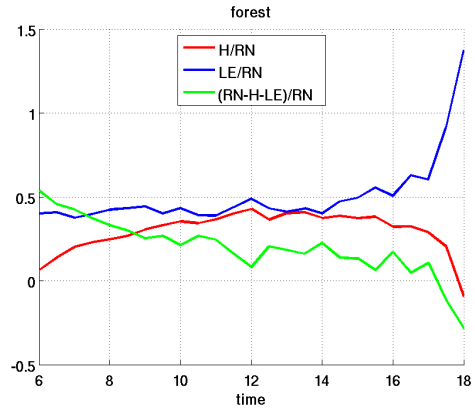
Moor



Corn



Forest



In prospect

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- Tethered balloons : characterize the structure of the lower part of the BL.

Thank you for your attention !