

# Mulch plastic in SURFEX

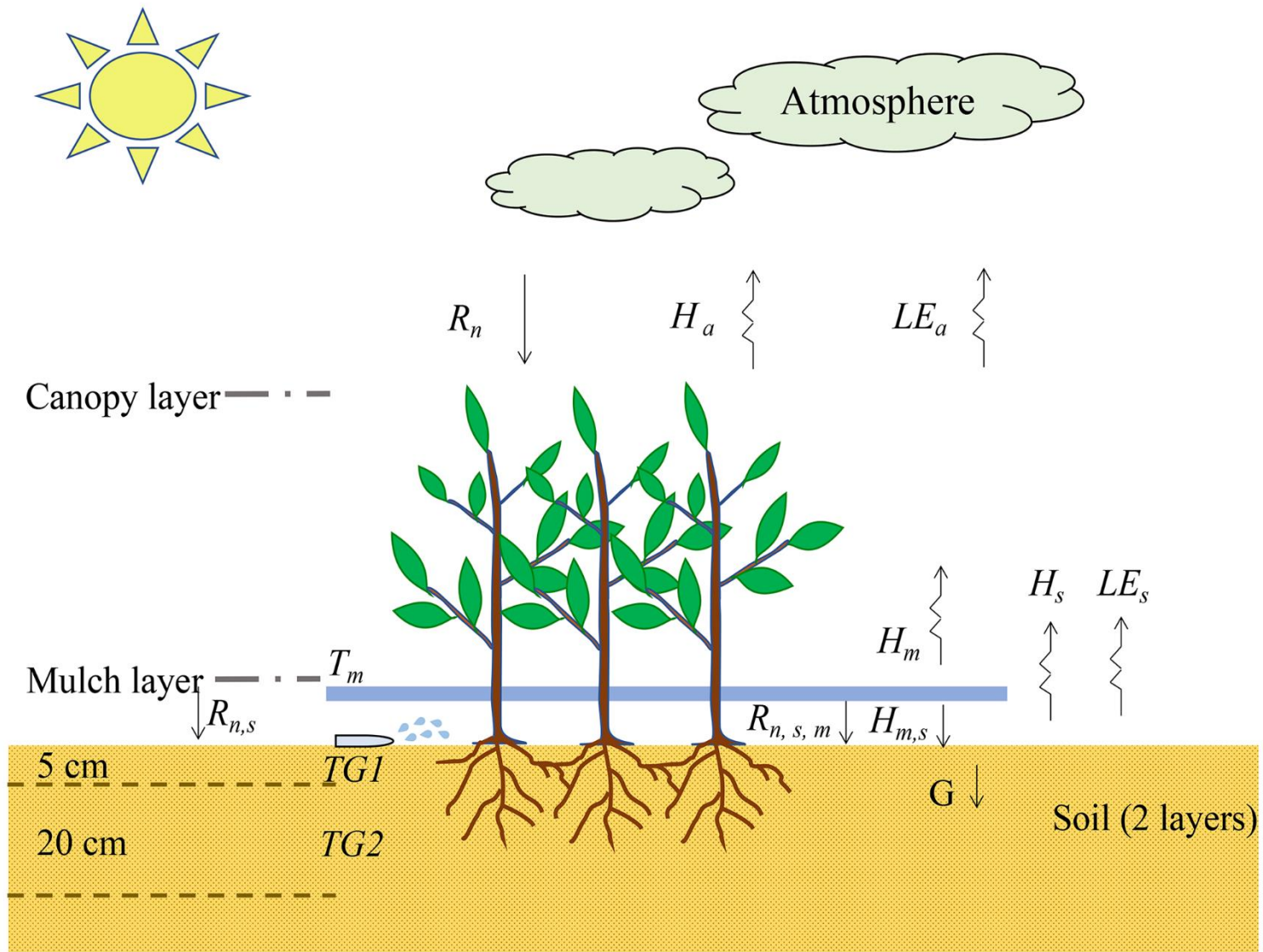
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*Ghent University*



# Mulch film plastic + Drip irrigation system



# ISBA – 2 Layer version + Mulch + Drip



**The energy balance for the plastic mulch layer:**

$$R_{n,m}^+ - H_m^+ - H_{m,s}^+ = 0$$

**Surface temperature equation** for the first layer  $T_s$  having a portion  $\delta_m$  of ground covered by the mulch and a portion  $\delta_v$  of irrigated vegetation:

$$\frac{C_s}{\Delta t} (T_s^+ - T_s^-) = R_n^+ + \delta_m H_{m,s}^+ - (1 - \delta_m) H_s^+ - (1 - \delta_m) LE_s^+ - \delta_v LE_v^+ - G_1^+$$

**Net radiation for the mulch as from** (Ham and Kluitenberg, 1994):

$$R_{n,m}^+ = S_{w,m}^+ + L_{w,m}^+$$

$$S_{w,m}^+ = \alpha_m (1 + \rho^* \tau_m \alpha_s) R_g^\downarrow$$

$$\rho^* = (1 - \alpha_s \alpha_m)^{-1} = 1 + \alpha_s \alpha_m + \alpha_s^2 \alpha_m^2 + \dots$$

$$L_{w,m}$$

$$= \varepsilon_m \left( 1 + \rho_{ir}^* \tau_{m,ir} (1 - \varepsilon_s) \right) R_{atm}^\downarrow - 2\sigma \varepsilon_m T_m^4 + \rho_{ir}^* \varepsilon_m \varepsilon_s \sigma T_s^4$$

$$+ \rho_{ir}^* \varepsilon_m^2 \sigma T_m^4 (1 - \varepsilon_s)$$

**Net radiation for the surface layer covered by a fraction  $\delta_m$  of mulch following (Yuan et al., 2019):**

$$R_n^+ = \delta_m R_{n,s,m}^+ + (1 - \delta_m) R_{n,s}^+$$

$$R_{n,s,m}^+ = S_{w,s,m}^+ + L_{w,s,m}^+$$

$$S_{w,s,m}^+ = (1 - \alpha_s)(\rho^* \tau_m) R_g^\downarrow$$

$$L_{w,s,m} = \rho_{ir}^* \varepsilon_s (\tau_{m,ir} R_{atm}^\downarrow + \sigma \varepsilon_m T_m^4 + \alpha_{m,ir} \varepsilon_s \sigma T_s^4) - \varepsilon_s \sigma T_s^4$$

**Surface albedo** is modified as in (Yang et al., 2012):

$$\alpha_s = \delta_m 0.324 e^{-0.0031 h_\theta} + (1 - \delta_m) \alpha_s$$

$h_\theta$  is the solar zenith angle.

**Sensible heat flux between the mulch and the ground layer under the mulch**

(Ham and Kluitenberg, 1994):

$$H_{m,s}^+ = \frac{T_m^+ - T_s^+}{r_c}$$

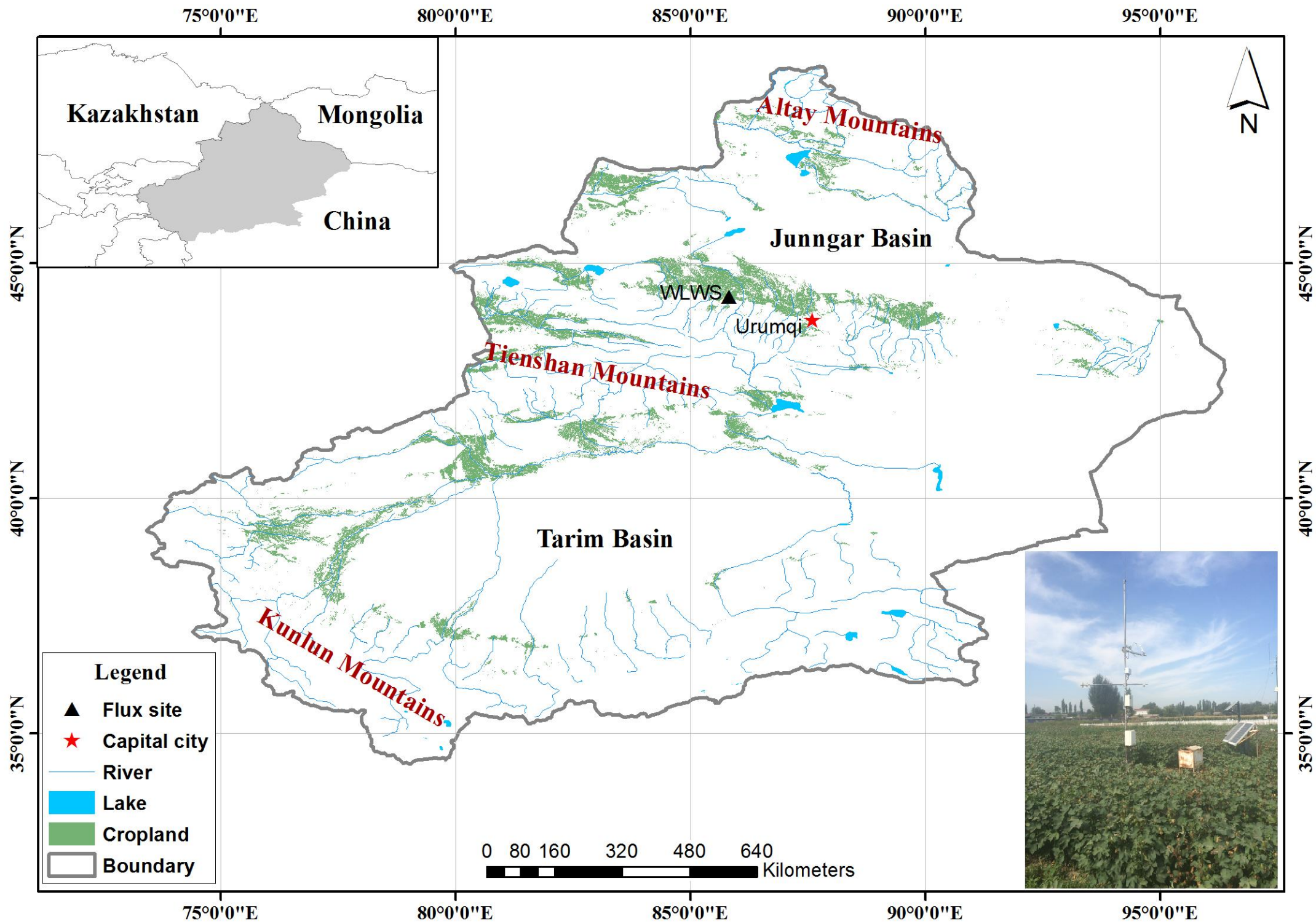
$$E_1 + E_2 T_m^+ + E_3 T_s^+ = 0$$

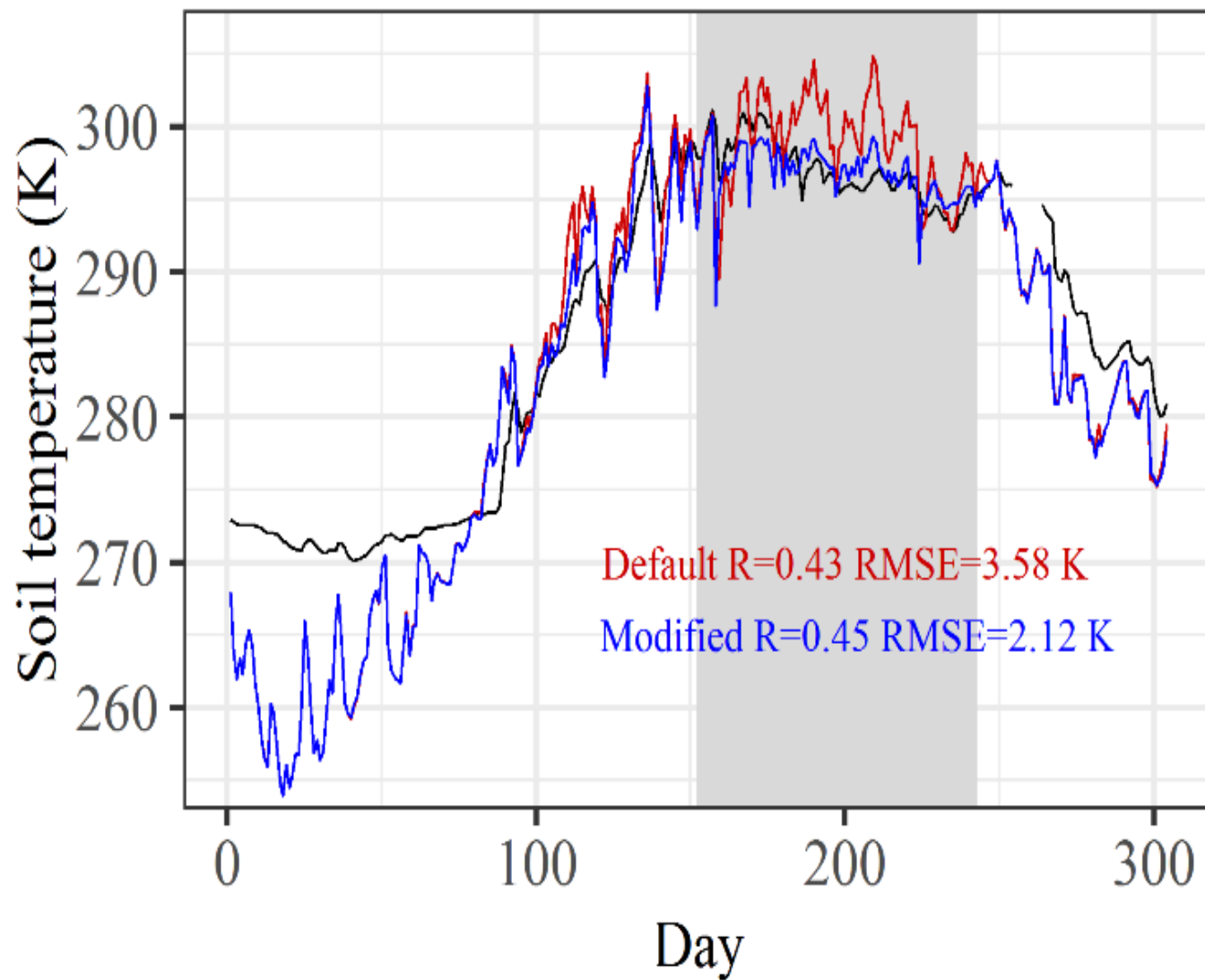
$$E_4 + E_5 T_m^+ + E_6 T_s^+ = 0$$

$$\frac{SW}{SW_{FC}} < Threshold$$

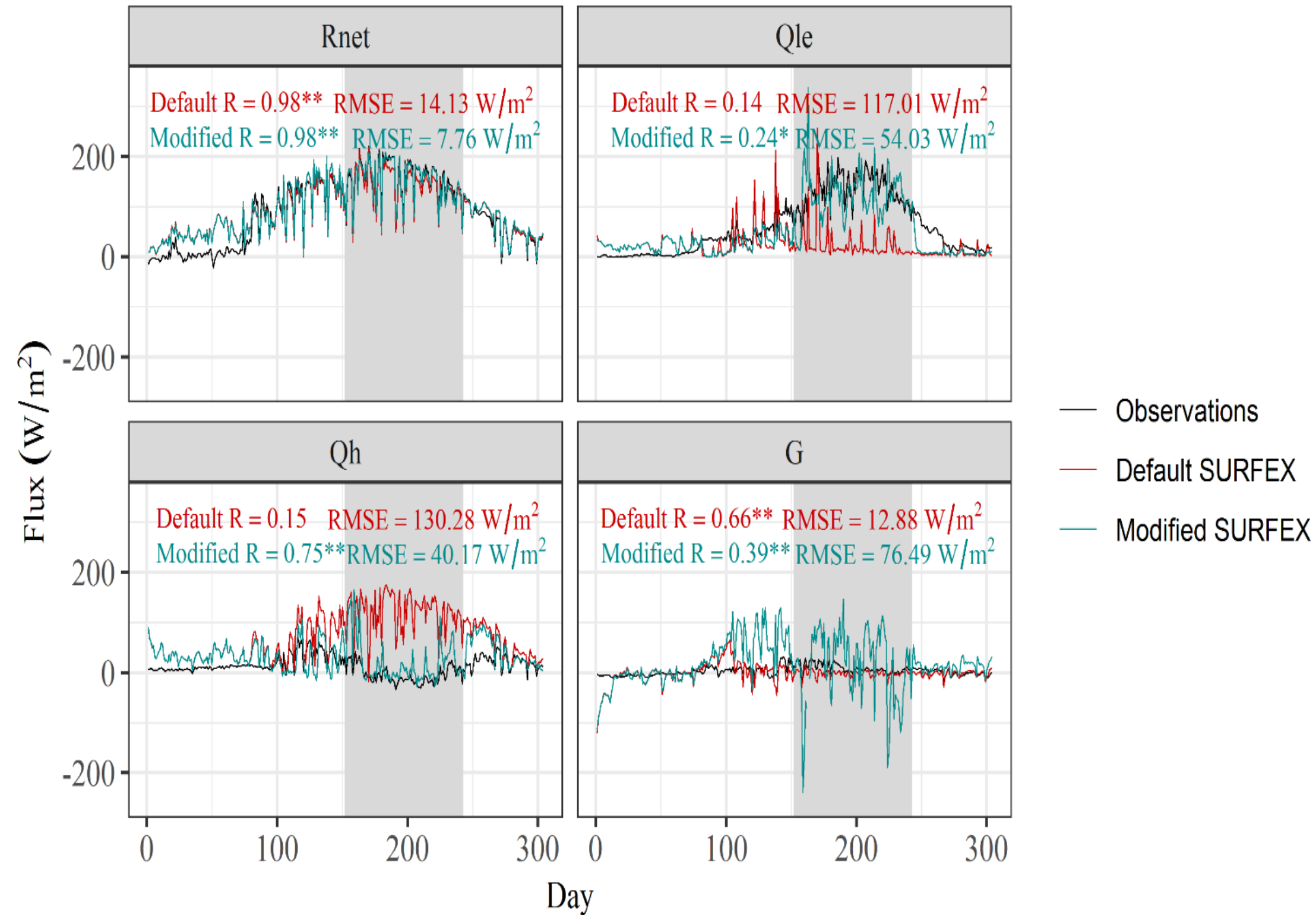
$$SW = SW_{FC} * \beta$$

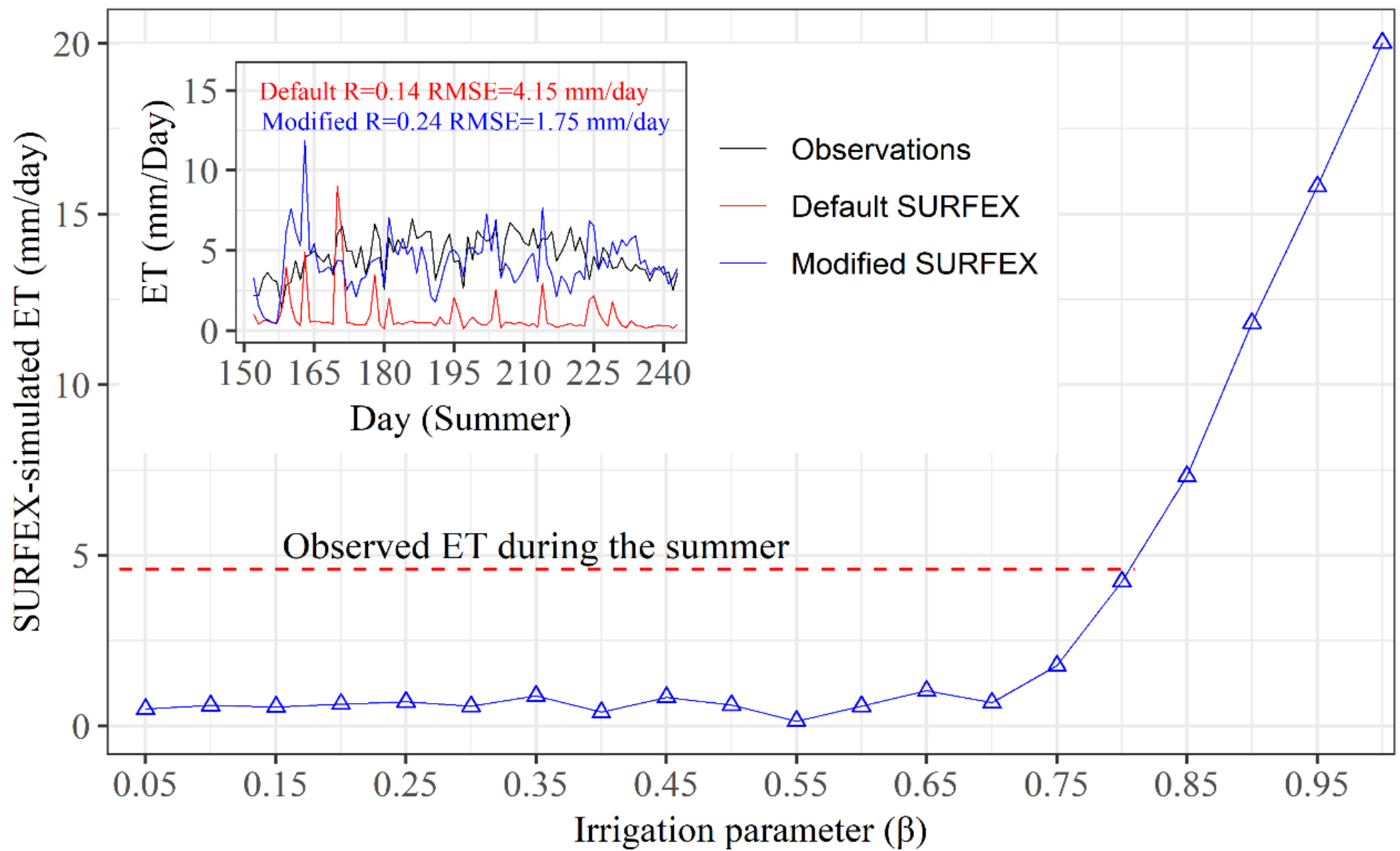
Compared to the flood irrigation, less irrigation, by the high water-saving drip irrigation technology will be applied to the soil layer to sustain crop growth without water stress than traditional flood irrigation practices that leading soil to saturation. Therefore, we designed the water demand factor  $\beta$  which ranges from 0 to 1, meaning no water was irrigated or the soil reached saturation moisture content after irrigation.





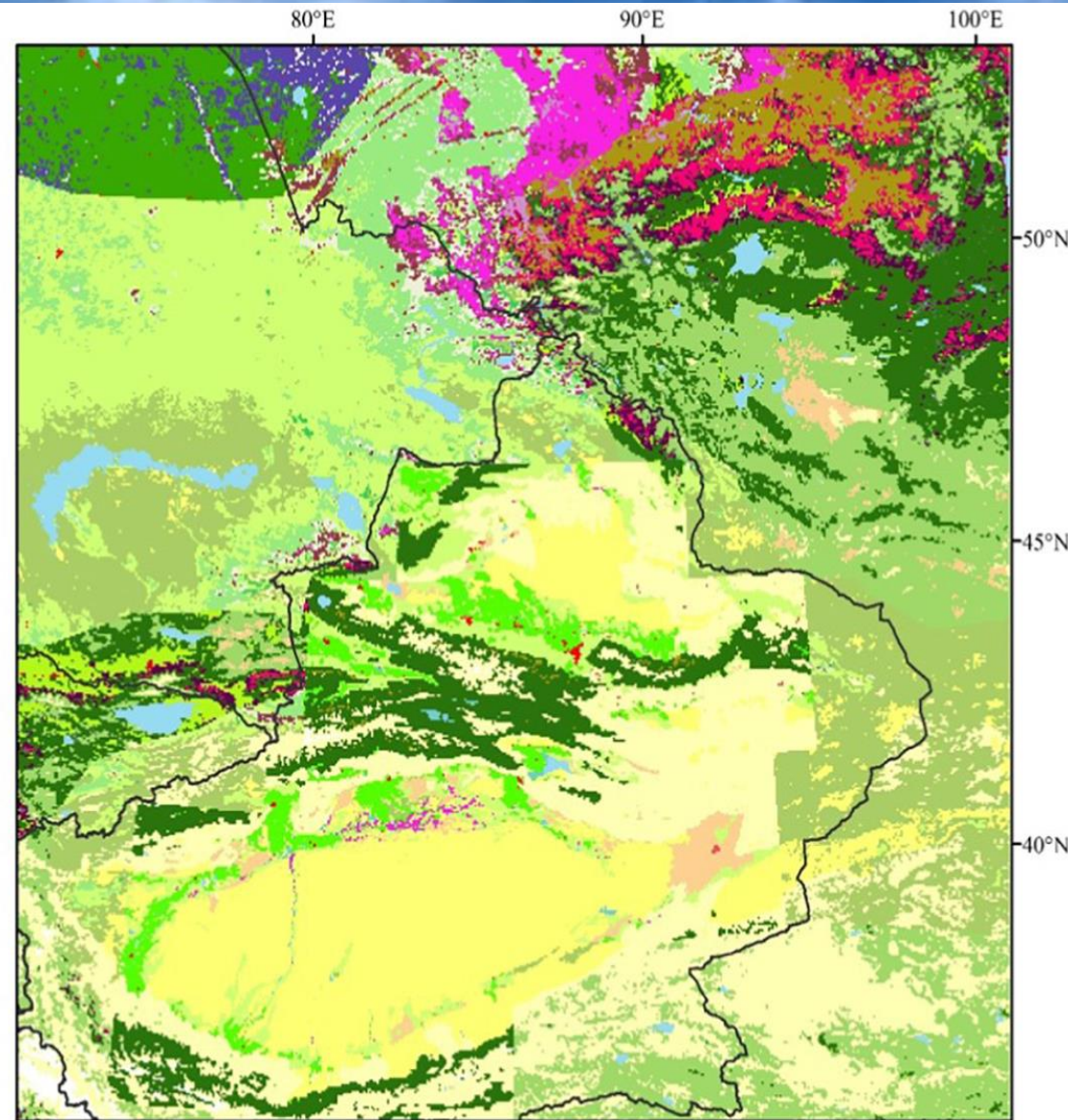
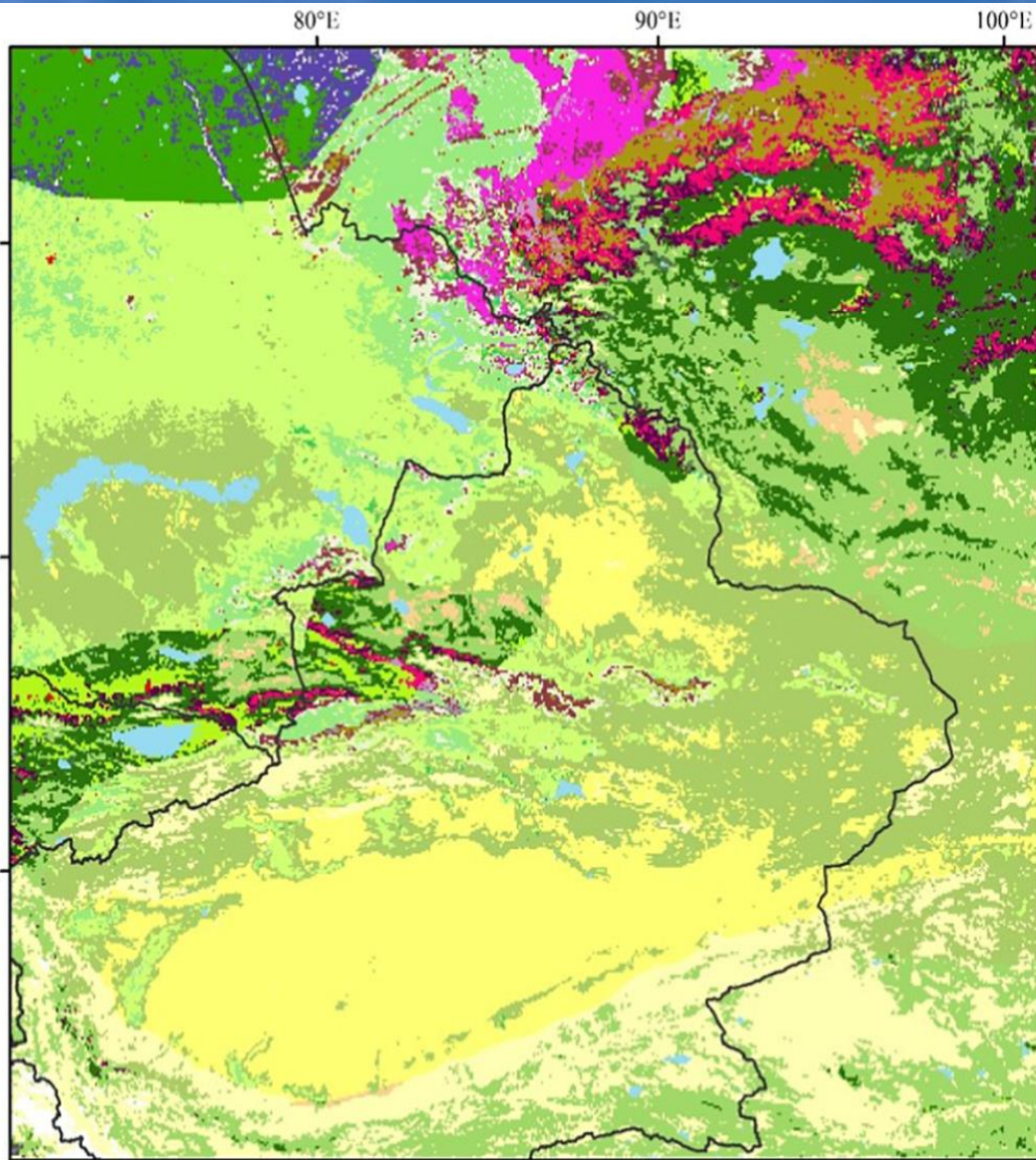
- Observations
- Default SURFEX
- Modified SURFEX





# ECOCLIMAP

# Updated ECOCLIMAP

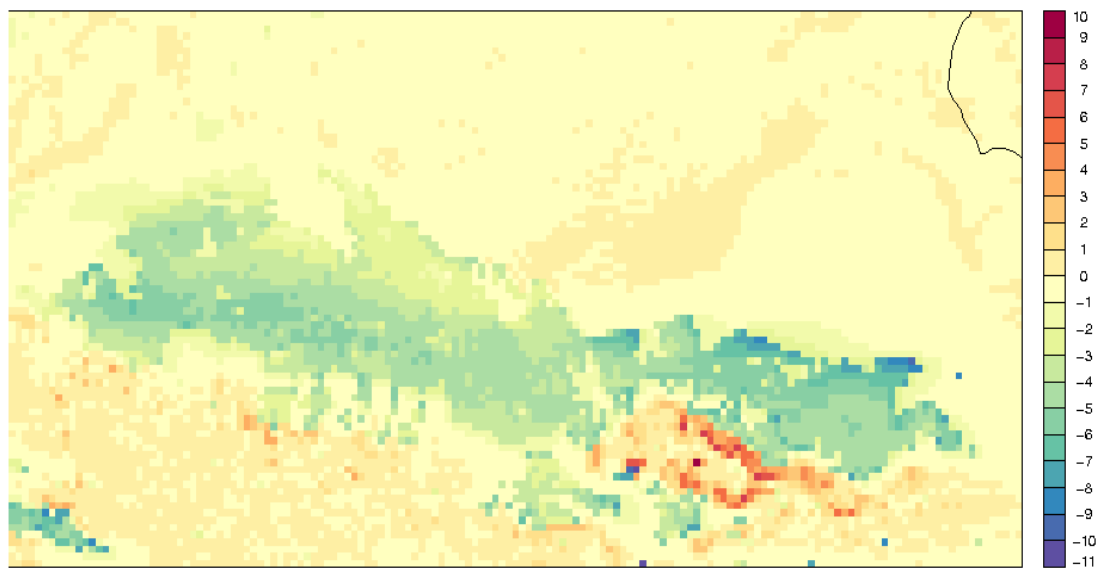


Land Use/Land Cover Codes



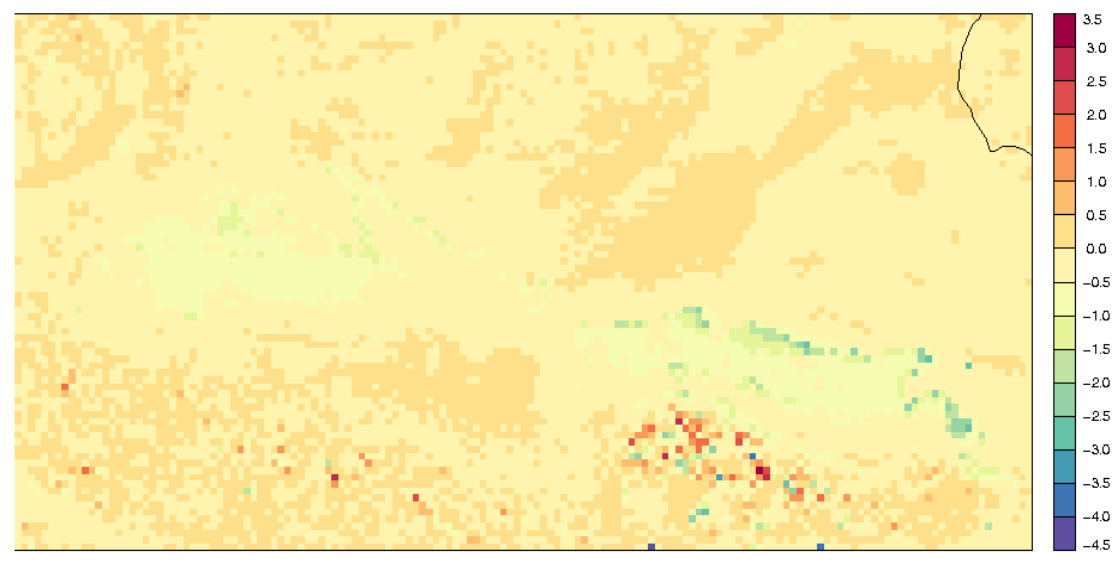
Cai et al. 2019

T2M\_16LT\_mulch\_default



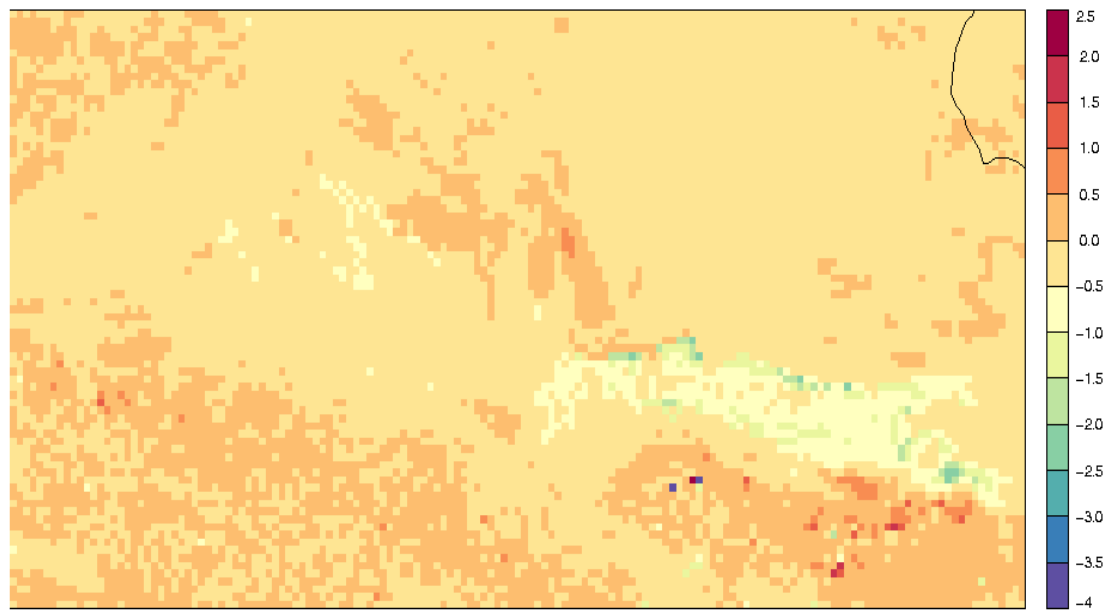
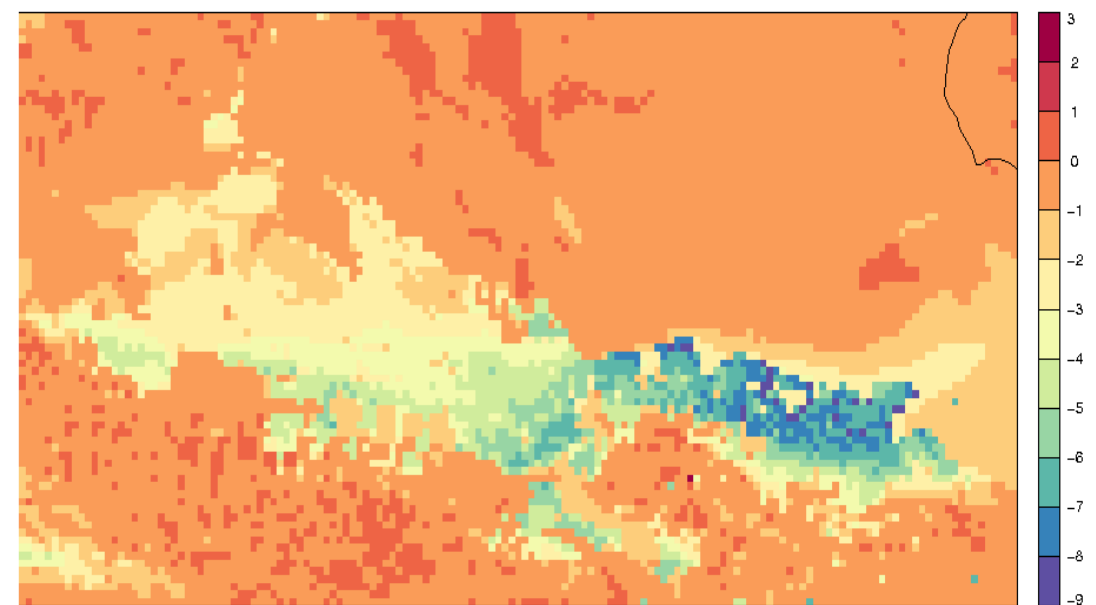
T2M\_02LT\_mulch\_default

T2M\_16LT\_drip\_default

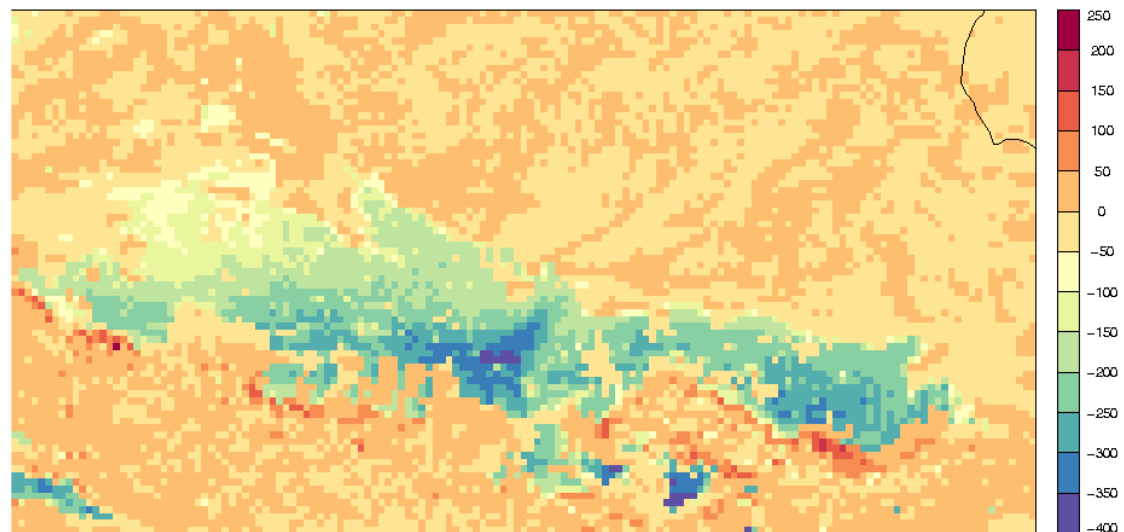


T2M\_02LT\_drip\_default

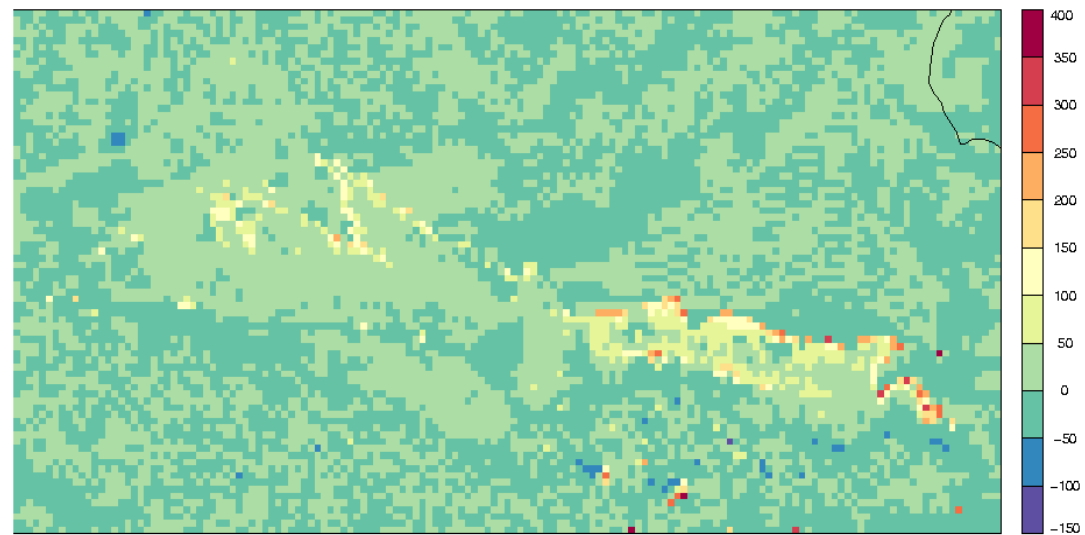
## 2nd June 2010 ERA-interim driven 4km run



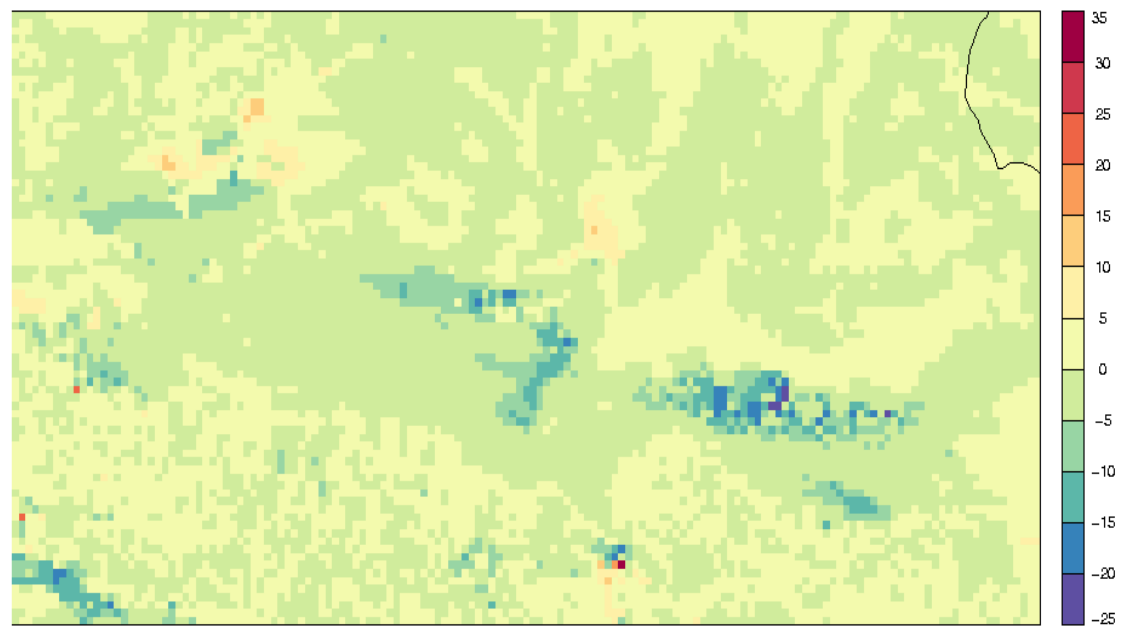
LE\_16LT\_mulch\_default



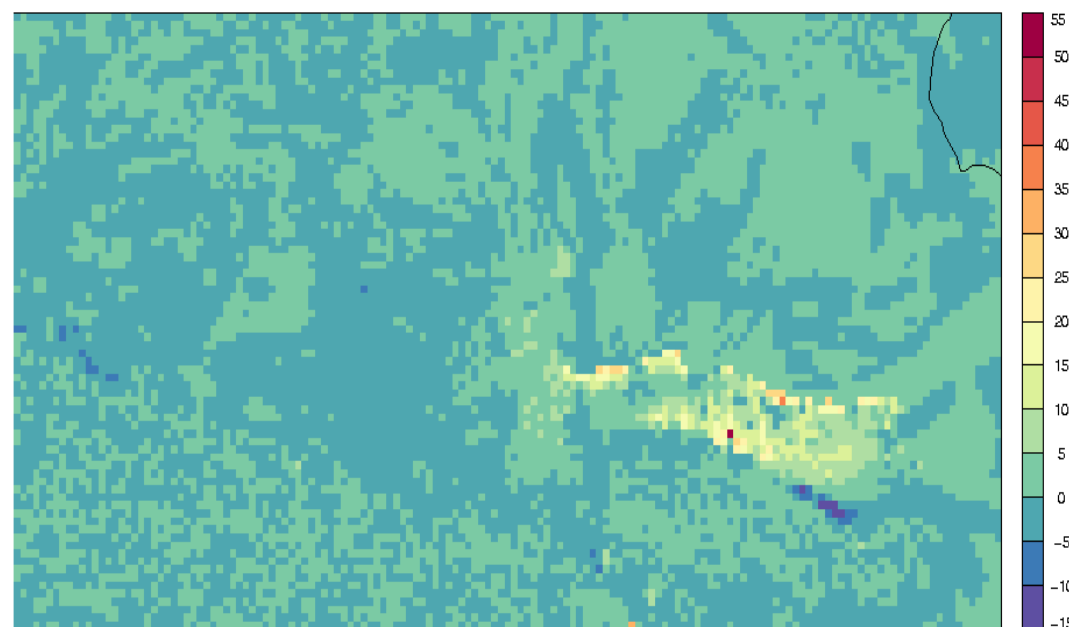
LE\_16LT\_drip\_default

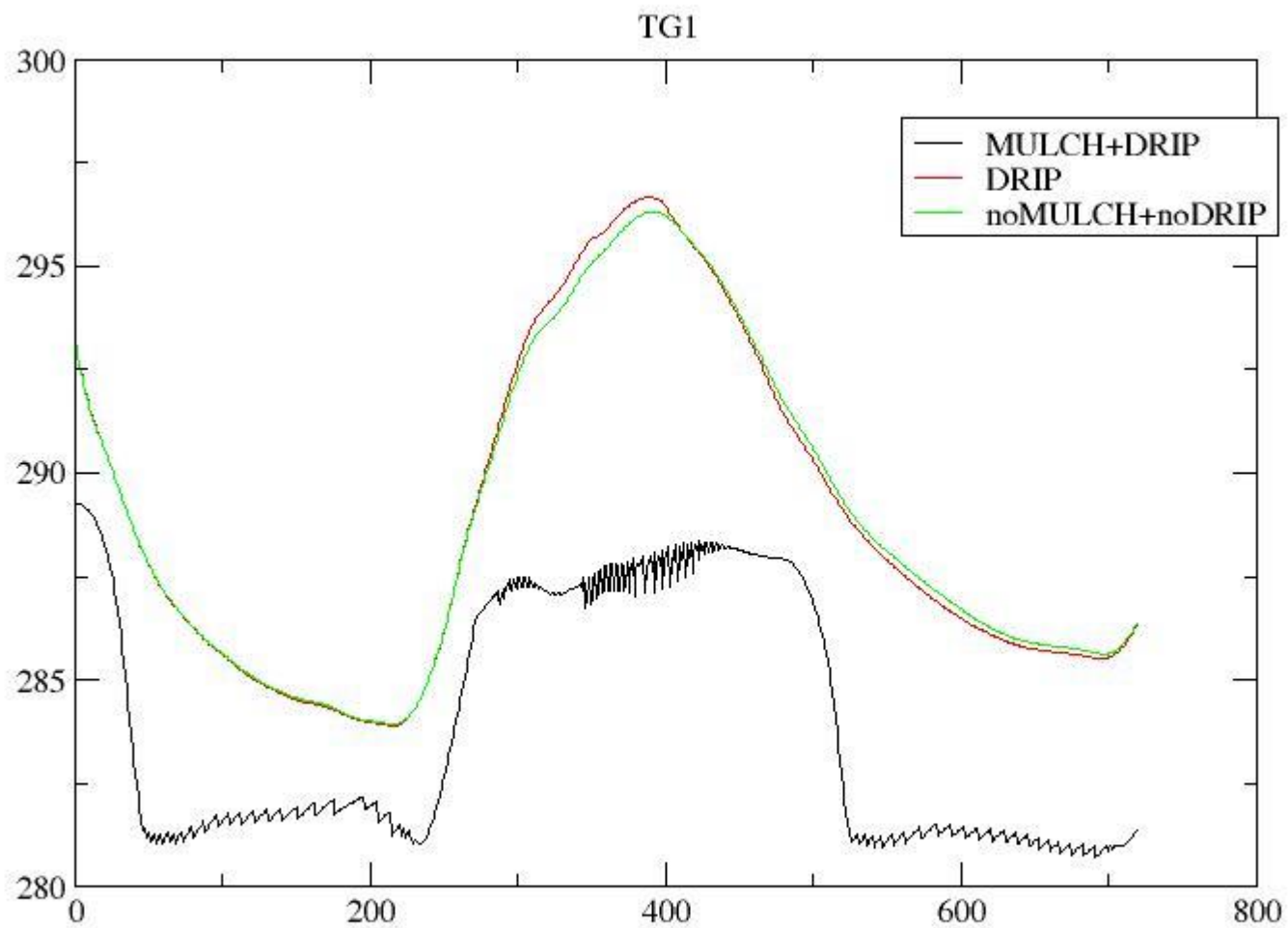


LE\_02LT\_mulch\_default



LE\_02LT\_drip\_default





*Thanks for your time and attention !!*



## References

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