Characteristic of maize land energy balance during maize growing period

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Abstract: Height and coverage of crop, such as maize, change greatly during its growing season. So it affects the surface energy balance differently in different growing stage. If we want to know the surface energy balance profoundly, it is indispensible to learn the relationship between crop and the surface energy balance. Equation (1) is the formula of the surface energy balances. Rn（2） is net radiation; H（3） is sensible heat flux; LE（4） is Latent heat flux; H_G（5） is soil heat flux. ΔH_S is heat storage rate of canopy and air below observing level; Q is other energy consumption.

$$R_n = H + LE + H_G + \Delta H_S + Q \quad \text{..... (1)}$$

$$R_n = S\downarrow + L\downarrow - S\uparrow - L\uparrow \quad \text{..... (2)}$$

$$H = \overline{\rho} C_p \overline{w' T_v'} \quad \text{..... (3)}$$

$$LE = L\overline{\rho}\overline{w'q'} \quad \text{..... (4)}$$

$$H_G = G_l + C_g \Delta Z \frac{\partial T}{\partial t} \quad \text{..... (5)}$$

S↓, L↓, S↑, L↑ are downward short wave and long wave radiation and upward short wave and long wave radiation. $\overline{\rho}$, C_p, L and Cg are air density, air specific heat capacity, vaporization latent heat and volumetric heat capacity respectively. w′ ,T′ and q′ are pulse value of vertical Velocity, air temperature and specific humidity. Gl is observed soil heat flux, ΔZ is soil depth and T is soil temperature。

ZhangYe oasis locates in the middle part of Heihe River Basin, northwest china. Maize is one of the typical crop types of ZhangYe oasis. YingKe station(lon: 100° 25′ E，lat: 38° 51′ N，alt: 1519m) observed the weather condition, soil parameters and flux of maize in ZhangYe oasis. Eddy covariance system observed Three-dimensional wind speed and density of CO_2 and H_2O 2m above ground and its frequency is 10Hz; Radiation system is 4m above ground, it include 4 components: downward short wave radiation, upward short wave radiation, downward long wave radiation and upward long wave radiation. Soil is divided into 6 layers (5cm, 10cm, 20cm, 40cm, 80cm and120cm), temperature and water content of each layer are recorded; air temperature and humidity are recorded at 2m and 10m above ground; Wind speed and direction are also observed. Radiation and surface observing system record mean value very 10min. Table1 shows the phenology of maize in YingKe.

Table1 The time table of maize phenology in YingKe

Sowing	Germinating	Jointing	Heading	Grouting	harvest
2008-4-20	2008-5-6	2008-6-20	2008-7-18	2008-8-5	2008-9-22

The following figures show the energy balance during different maize grows period in 2008. We can conclude from these figures that maize growing affect sensible heat flux and latent heat flux apparently. After maize germinating latent heat flux becomes larger than sensible heat flux. Sensible heat flux becomes larger than latent heat flux before maize germinating and after maize harvest.

Fig.1 Distribution of energy in maize land before maize germinating

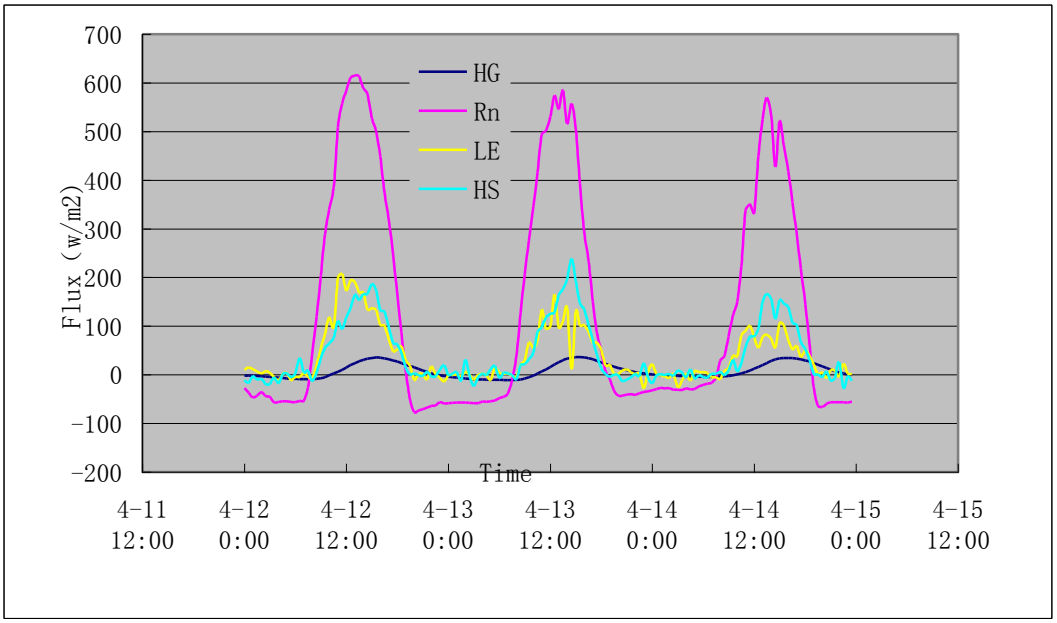


Fig.2 Distribution of energy in maize land before maize jointing

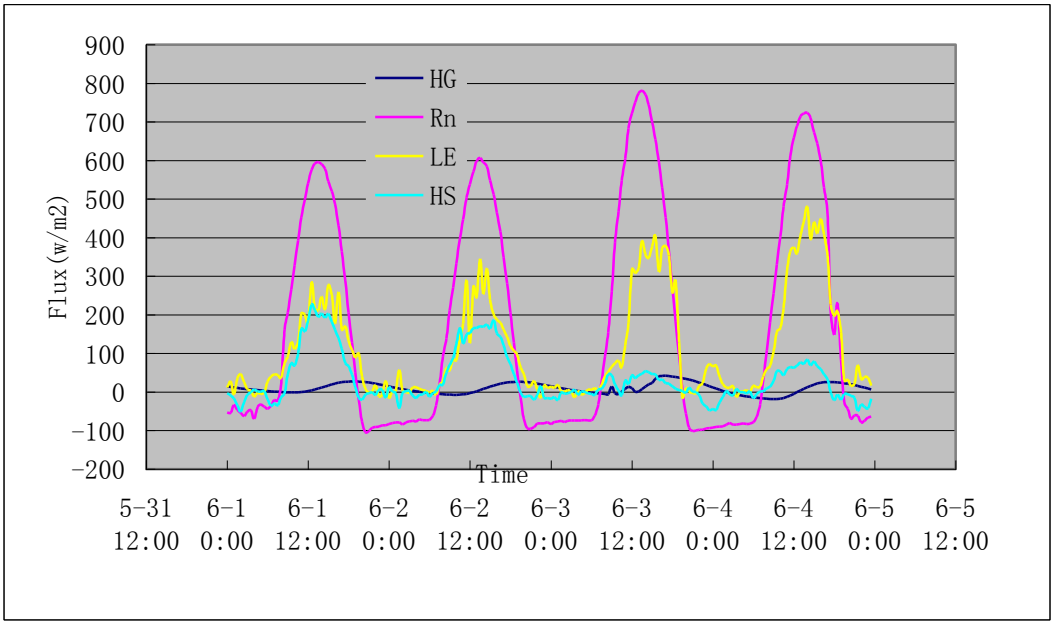


Fig.3 Distribution of energy in maize land before maize heading

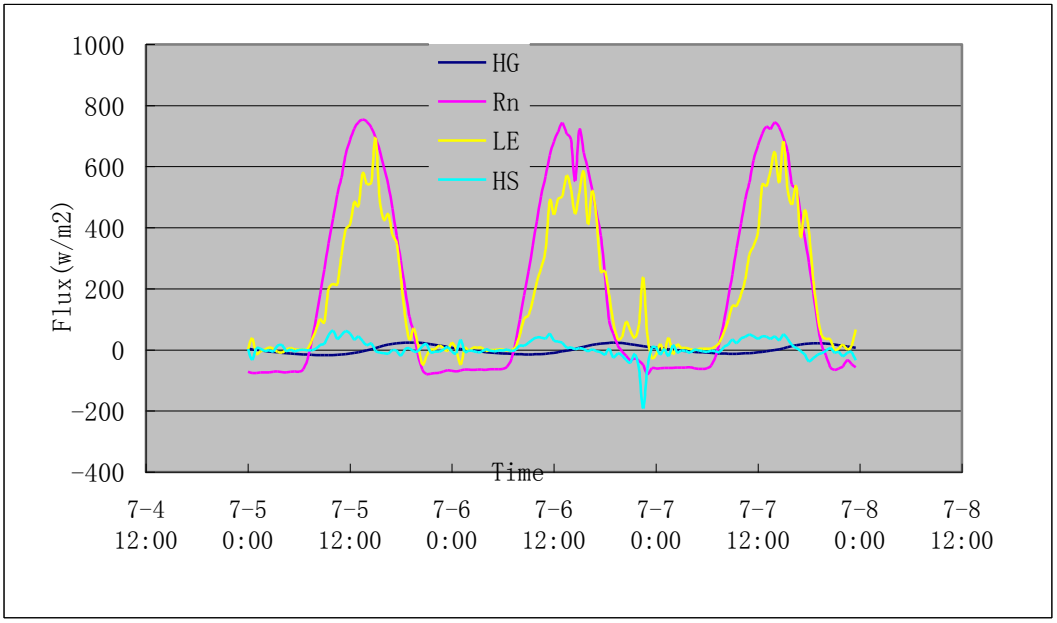


Fig.4 Distribution of energy in maize land before maize grouting

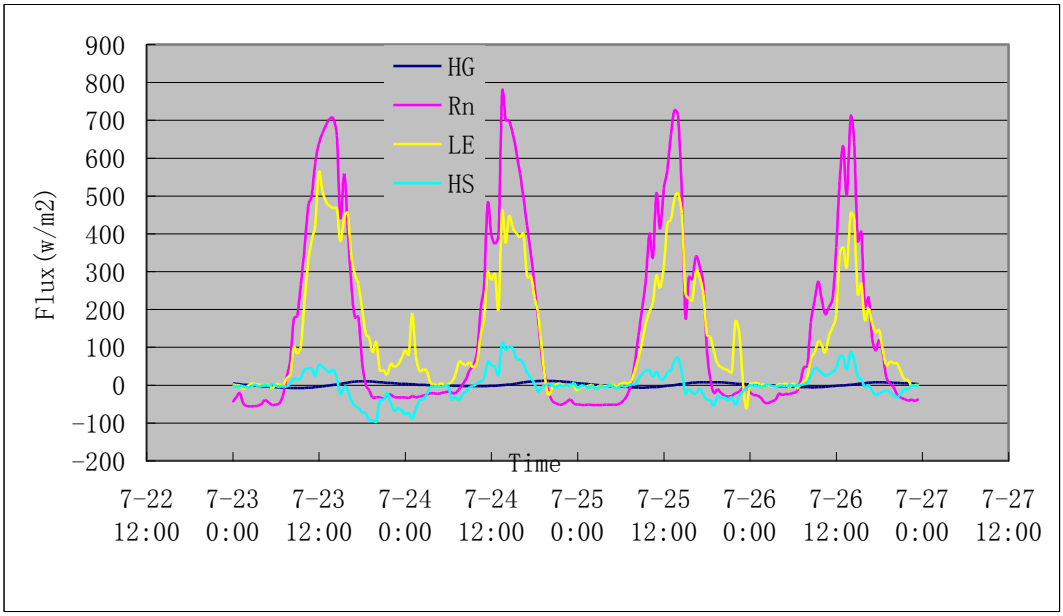


Fig.5 Distribution of energy in maize land before maize harvest

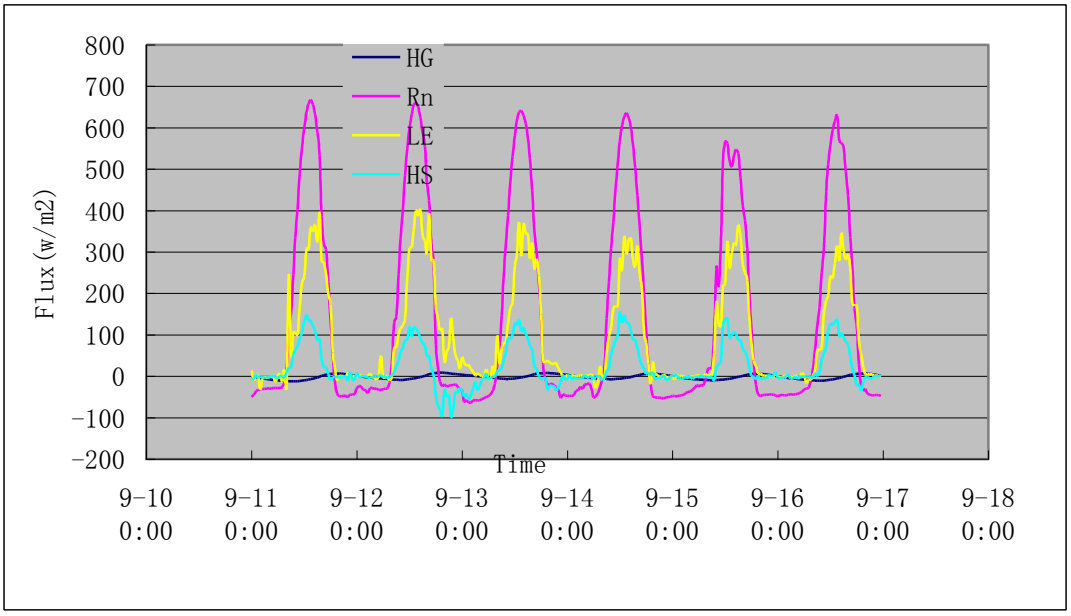
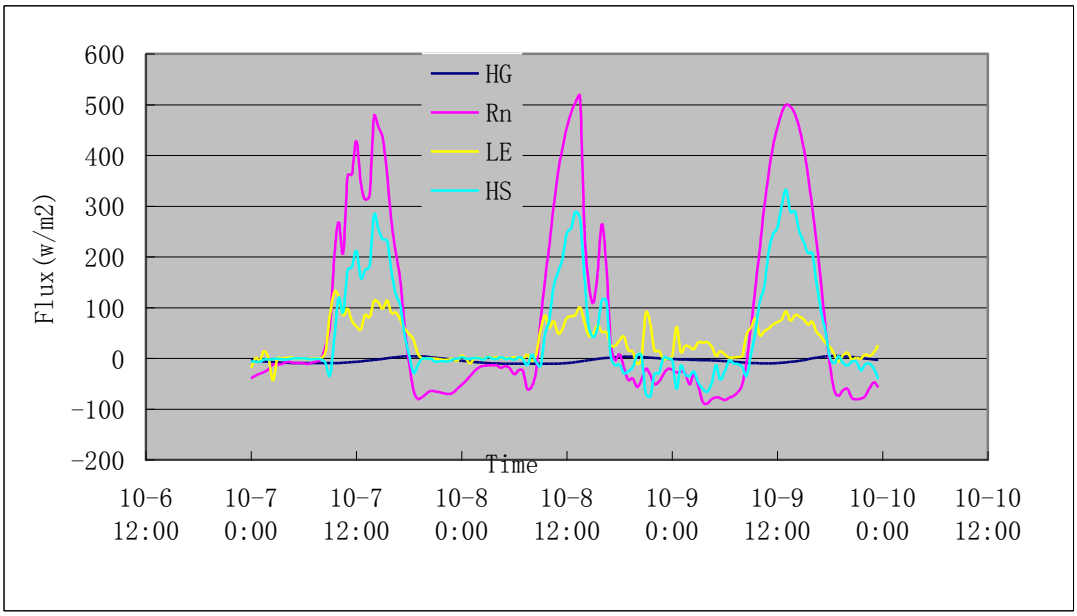


Fig.6 Distribution of energy in maize land after maize harvest



Keywords: energy balance; net radiation; sensible heat flux; latent heat flux; soil heat flux

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