

Q1: poor ETp estimator?

A1:

I changed my potential evapotranspiration model to a new formulation, which captures the four main meteorological variables (wind speed, radiation, humidity and air temperature) as suggested. All data related to ETp/ETa had been updated. The model is the FAO-56 (Allen et al., 1998) crop reference evapotranspiration (ET0) model. I calculated ETp in the specific form of ET0).

Q2: PET is declining?

A2:

The trend test is highly dependent on the time span of data used. During our study period (1982-2006), the over all transect PET upward trend is certain, this is agree with a recent PET study for China by using modified P-M method (The following figure, Liu Changming and Zhang Dan, 2011, Acta Geographica sinica, 579-588), although the PET showed downward trend for the whole study period of 1960 - 2007, but upward trend is significant during 1991- 2007.

Moreover, the upward PET trend can also be proved by pan evaporation (Epan) result, which increased averagely 7.94mm a-1 during 1992-2007 (Liu et al., Geophys. Res. Lett. 38, L13404. doi:10.1029/2011GL047929).

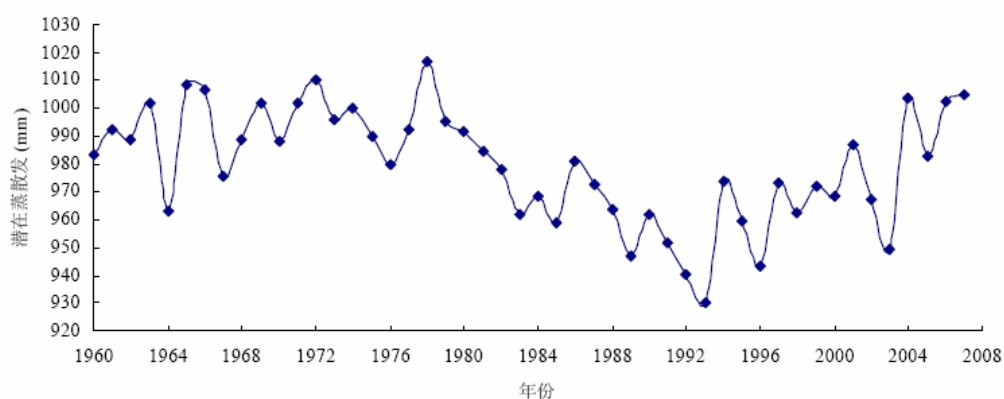


图6 1960-2007年潜在蒸散发变化趋势

Fig. 6 Changing trend of potential evapotranspiration between 1960 and 2007

The Y axis is PET.

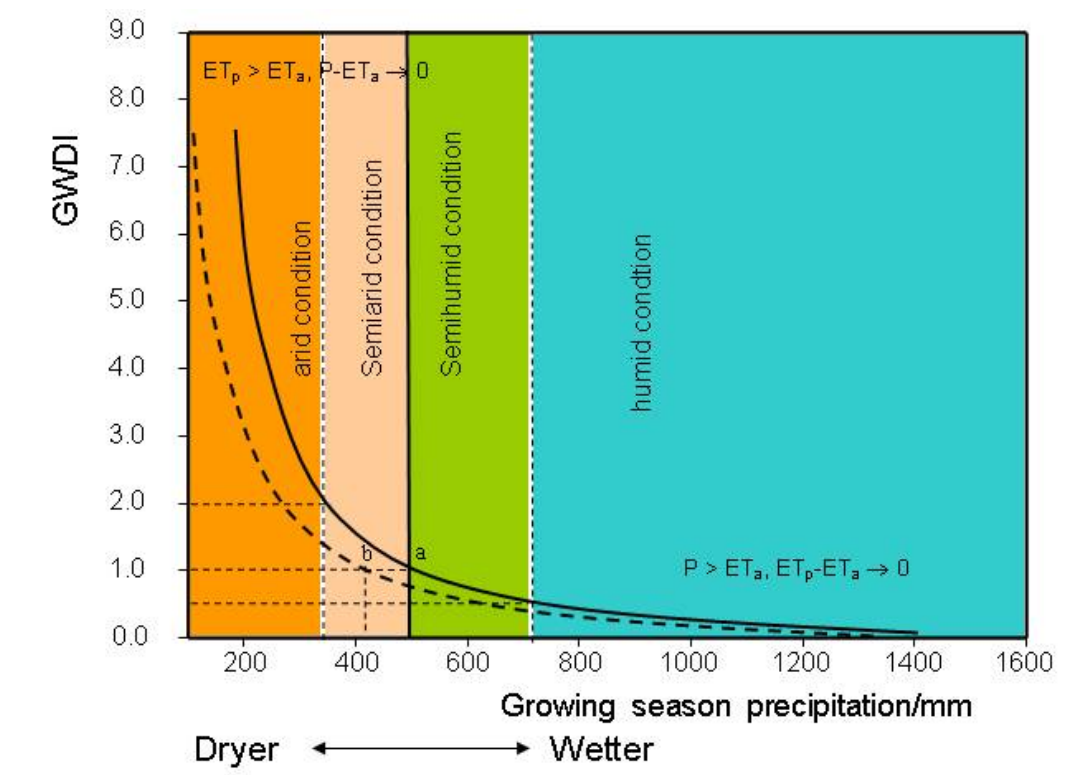
Q3: neglect of soil water storage?

A3:

Now I use a theoretical framework to explain this. The following figure and text is from a revised version ms.

GWDI is based on the following assumptions:

Assuming steady-state water balance, we chose not to define ecosystem water storage change (dSW/dt) and stream flow (Q) in GWDI for the three main hydrologic conditions: (i) arid condition, the soil water storage is usually very low, the interception evaporation, soil evaporation and plant transpiration are highly depend on within-growing season precipitation. (ii) humid condition, the soil water storage reaches maximum, ET_a becomes energy limited as described in Mcvicar et al.,(2012b). In the above two cases, the carry-over of water from the previous year(s) that available for plant transpiration, soil evaporation during the whole growing-season is assumed to be negligible (Richard et al., 2008). (iii) semiarid/semihumid condition, similar with 'equitant' climate, as defined by Mcvicar et al.,(2012b) according to dominant limitations (water or energy limitations) of ET_a typically vacillates seasonally. In this case, the dSW/dt maybe more influential than in the first two cases, but we still can assume the effect of soil water carry-over is short-term, within the first month of growing season, for the whole growing season is negligible.



The main advantage of using GWDI is that it captures not only the meteorological variables related to atmospheric evaporative demand (ET_p), but also the actual vegetation water assumption (ET_a). Unlike the aridity index (AI) defined as the ratio of P/ET_p (Budyko, 1974), GWDI explicitly takes ET_a into account, therefore the index allows for better diagnose of ecosystem water balance which may suggestive of long term vegetation activity change.

