Keeling plot is a commonly used isotope-based method for partitioning evapotranspiration. The method relies on a series of simultaneous observations of concentrations and isotopic compositions of atmospheric vapor (c_v and δ_v respectively). Based on these data (or more exactly δ_v as y values and $1/c_v$ as x values), a linear regression line is built with its intercept value taken as the isotopic ratio of evapotranspiration (δ_{ET}). Once d_{ET} is determined, the relative contribution of transpiration to total evaporation (or F_T) can then be estimated (i.e. according to Eqn. 1 as presented in the manuscript), as long as isotopic composition of each component flux (δ_E and δ_T) is known, i.e., either through measurement or modeling.

The present study proposes an alternative method for estimating F_T. The new method is still rooted in the framework of Keeling plot framework and Eqn.1, but the final equation (see Eqn. 15 in the paper) for calculating F_T does not contain d_{ET} as an input variable, and so is different from the traditionally used Eqn. 1 in structure. The equation instead contains the keeling plot slope term k as well as the mean value of c_v and δ_v observations made in the time period over which the keeling plot is derived. The authors claim that the new method is more advantageous than the traditional method as it eliminates the need of estimating d_{ET}, which is known to be a variable that is highly susceptible to estimation error due to some inherent features associated with the keeling method. However, after carefully examining the derivation details I am sorry to say that the new method fails to deliver any new aspects as claimed by the authors. As a matter of fact, I feel that this new method is exactly the same as the old method, and in what follows I will outline my reasoning.

To begin with, I want to point out that the authors used Sine laws combined with graphical presentations of the relationships among δ_E, δ_T, δ_{ET}, δ_a and $1/c_v$ to come up with Eqn. 15 that appears novel at the first glance, yet, such use of somewhat complicated mathematical techniques seems unnecessary, as Eqn. 15 can actually be derived just by simply combining Eqn. 1 and Eqn. 2, as shown below.

We know that,

$$F_T = (\delta_{ET} - \delta_E)/(\delta_T - \delta_E) \qquad \text{Eqn. 1 (or Eqn. 1 in the paper)}$$

$$\delta_v = k*(1/c_v) + \delta_{ET} \qquad \text{Eqn. 2 (or Eqn. 2 in the paper)}$$

Note that Eqn. 2 can be further written into the following:

$$\delta_{ET} = \delta_v - k* (1/c_v) \qquad \text{Eqn. 2.1}$$

where k is the slope of the keeling regression line of δ_v versus $1/c_v$, and δ_v and $1/c_v$ represent the mean δ_v and $1/c_v$ observations respectively.

Inserting Eqn. 2.1 into Eqn.1, and rearrange, we obtain the following:

$$F_T = -k/[c_v(\delta_T - \delta_E)] + (\delta_v - \delta_E)/(\delta_T - \delta_E) \qquad \text{Eqn .3}$$

As is clear this equation is exactly the same as Eqn. 15 as presented by the authors.

Although Eqn. 3 (or Eqn. 15 in the manuscript) does not contain δ_{ET}, using this so-called new equation to estimate F_T actually would still require that d_{ET} be known, because Eqn. 3 is a result of insertion of the δ_{ET} formula (i.e. Eqn 2.1) into Eqn. 1. In other words the fact that δ_{ET} is not showing up in your final equation does not necessarily mean δ_{ET} is not needed in your calculation. As a matter of fact, there is no fundamental difference between the new and traditional methods. For example, in the traditional method, we firstly use a set of δ_v and $1/c_v$ values to estimate δ_{ET} based on the intercept of the linear regression, and then in the second step we insert the regression-derived δ_{ET} into Eqn. 1 to estimate F_T. Similarly, the execution of the Eqn. 3-based new method can also be divided into two steps: 1) estimation of δ_{ET} based on Eqn. 2.1; and 2) subsequent calculation of F_T based on the estimated δ_{ET} and Eqn. 1. The only slight difference between the two methods rests on how δ_{ET} is calculated. The new method would require that the slope term k be calculated from the Keeling regression line, and then using k, and the mean values of $1/c_v$ and δ_v to calculate the δ_{ET} either based on Eqn. 2 or Eqn. 2.1. Apparently, such a procedure is more tedious as compared to that involved in the traditional method in which δ_{ET} is estimated as the intercept from a single step of linear regression. Yet ironically, δ_{ET} estimated this way is in theory the same as that from the traditional method, for the exact reason as stated by the authors, that is, according to Hogg et al. (2005) the point that corresponds to the mean of $1/c_v$ and δ_v should fall exactly onto the regression line, which dictates that δ_{ET} calculated from the mean of $1/c_v$ and δ_v together with k (the linear-regression derived slope) must be the same as the intercept value. Therefore, I'm sorry to say that the authors' attempt to bypass the need for δ_{ET} parameterization was not successful, as the new method is virtually the same as the traditional one, except that it is less intuitive and more complicated to use.