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Seasonality of tendency Bowen ratio in Vojvodina (Northern Serbia) orchards

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From the beginning of bud break, when first green leaf tips are just visible (*BBCH = 7), till time when second fruit falls (BBCH = 79) and maximum leaf area index is reached, there is rapid growth in orchards. Enhanced evapotranspiration in this period alters the surface energy budget partitioning by increasing latent heat flux relative to sensible heat flux. This in turn leads to measureable changes of daily air temperature and humidity tendencies.

Tendency Bowen ratio, B' is defined as

$$B' \equiv \frac{c_p \frac{\partial T}{\partial t} h}{L \frac{\partial q}{\partial t} h}$$

where c_p is the specific heat of air at constant pressure, L is the latent heat of vaporization, h is mixed layer thickness, $T$is air temperature and q is air specific humidity. In long term averages Fitzjarrald *et al.* (2001) identified onset of spring using one of two criteria: a) springtime minimum in the afternoon relative humidity and b) day when B' drops below 1. It is important to have in mind that, in any given year frontal passage, for example, can disturb air temperature and humidity tendencies associated with plant development.

In this study we tested two hypothesis: a) from relative humidity and tendency Bowen ratio variations over the season, it is possible to identify the moment when plants "take control" over water and energy budget in orchard and b) the rise of the tendency Bowen ratio over a few days or more that may result from dry conditions.

Continuous hourly measurements of precipitation, air temperature and humidity, within canopy, in eight apple orchards in Vojvodina region during 2013-2018 period, were daily averaged and used for afternoon relative humidity and tendency Bowen ratio analysis. Phenological observations (performed 1-2 times per week) and drought observations for 2018 are used to test these hypotheses.

*BBCH is numerical scale which is used to identify the phenological development stages of plants.

Fitzjarrald, D. R, O. C. Acevedo, K. E. Moore, 2001: Climatic consequences of leaf presence in the eastern United States. *J. Climate*, 14(4), 598-614.