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A discussion on the paper "Vegetation induced changes in the stable isotope composition of near surface humidity"

By Kevin A. Simonin *et al.*, 2014

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Outline

1 Introduction

- In the coastal areas, the isotope composition of near surface water vapour is influenced by water vapour comes from ocean and terrestrial ecosystem (Trenberth *et al*., 2007; Ingraham and Taylor, 1991; Gerten *et al*., 2005).

- Rencent studies show that the influence of terrestrial ecosystems on atmospheric humidity is largely dorminated by plant transpiration (Jasechko *et al*., 2013), but how to quantify the relative contribution of plant transpiration to atmospheric humidity and the subsequent influence on condensation events is still unsolved completely (Bonan, 2008).

- The stable isotope composition, especially the *d*-excess parameter, is considered as a useful tool to understand better on changes in atmospheric water balance during evaporation and condensation (Craig, 1961; Dansgaard, 1964; Merlivat and Jouzel, 1979).

2 Objective

In this article, the authors use the *d*-excess parameter and associated theory to illuminate changes happened in the isotope composition of near surface water vapour influenced by the mixed evergreen forest canopy, during the day and night.

3 Methods

Site Description

Located in coastal Mendocino County, in northern California (39.729° N, 123.644° W).

The data has been collected from the year of 2007. In this artical the authors choose the data on 6th May and 24th Augest 2010.

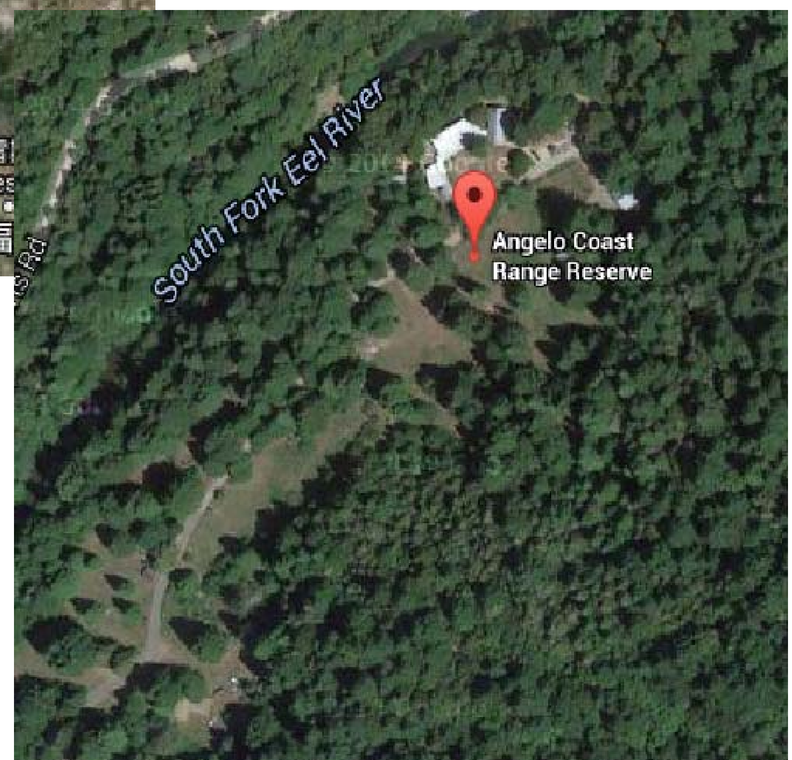


Figure 1.

3 Methods

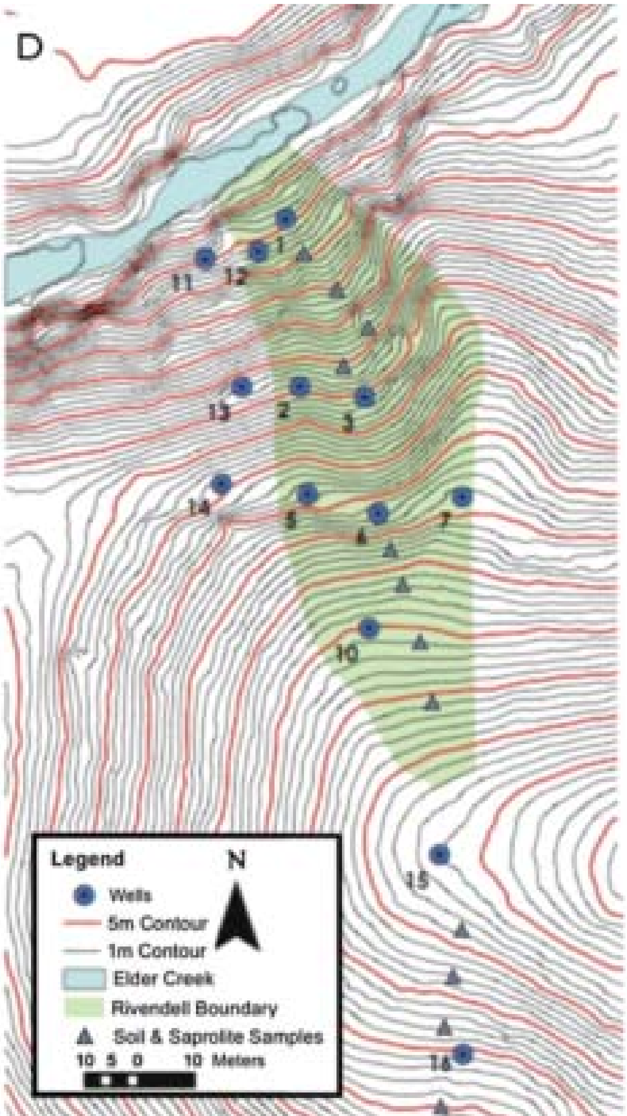


Figure 2.

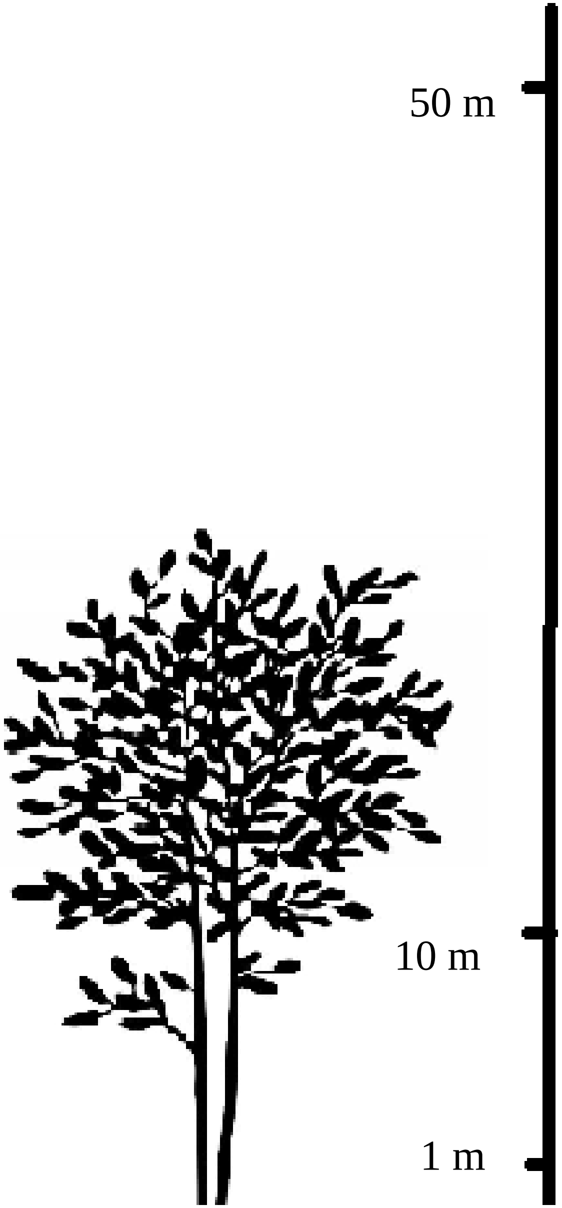
Microclimate stations monitor principitation, soil temperature, air temperature and relative humidity at well 1, 3 and 10.

Well water: sampled on the morning at well 1, 3 and 10; measured by IRIS (model L1102-i, Picarro Inc., Sunnyvale, CA, USA).

Soil and saprolite water:
taken around midday;
On 6th May: sampled at 2 and 10 cm depths;
On 24th August: samples were collected to a depth of 100 cm, at about 8–10 cm intervals;
measured by IRIS ;

3 Methods

Leaf and stem water stable isotope:
sampled three times per day;
measured by IRMS.



Water vapour stable isotope:
measured by IRIS ;
three intakes installed at 1, 10, and 50 m;
switch time: every 20 min.

Figure 3.

4 Results and Discussion

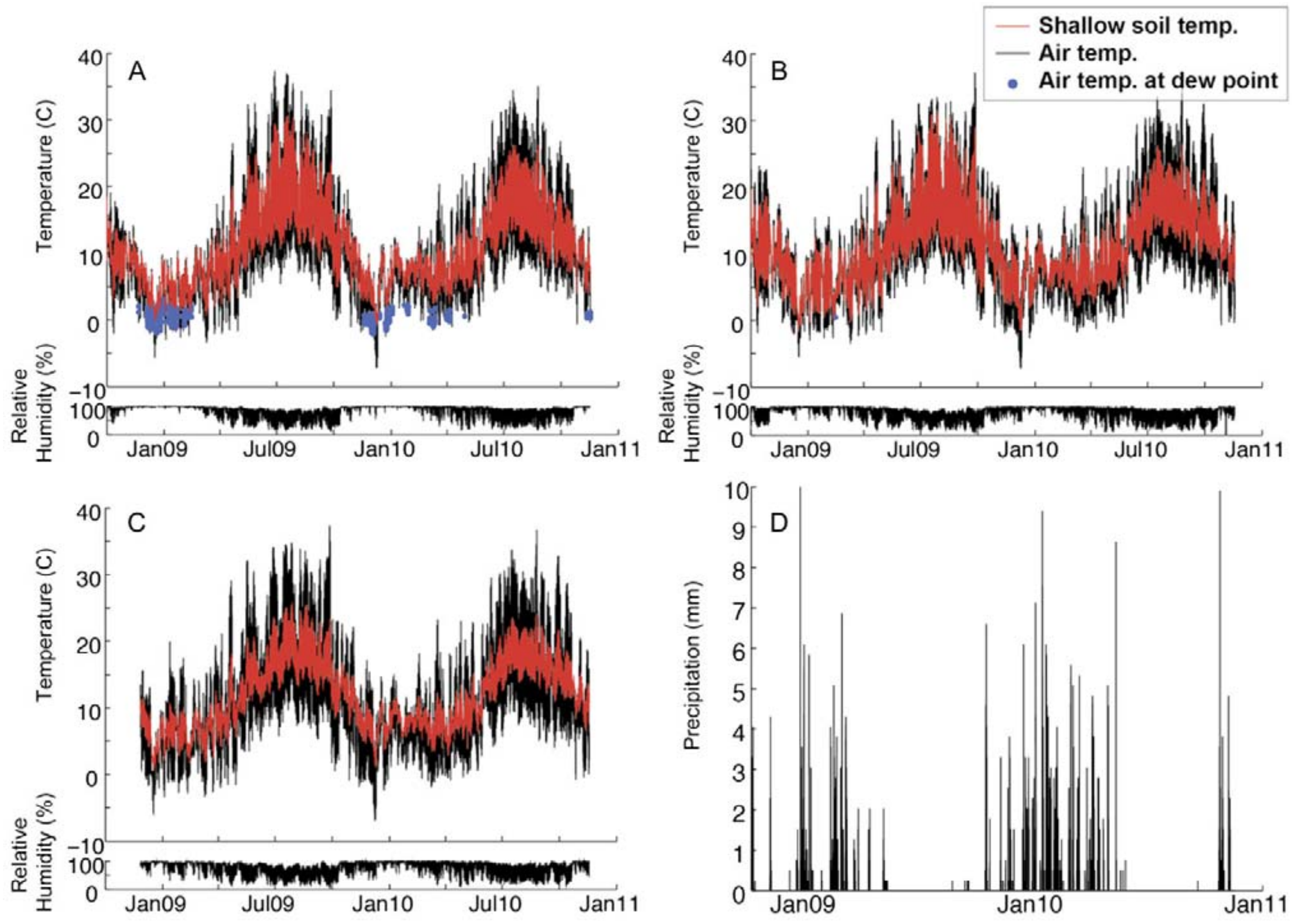


Figure 4. Variation in site meteorology from October 2009 to January 2011 (A) well 1, (B) well 3 and (C) well 10.

4 Results and Discussion

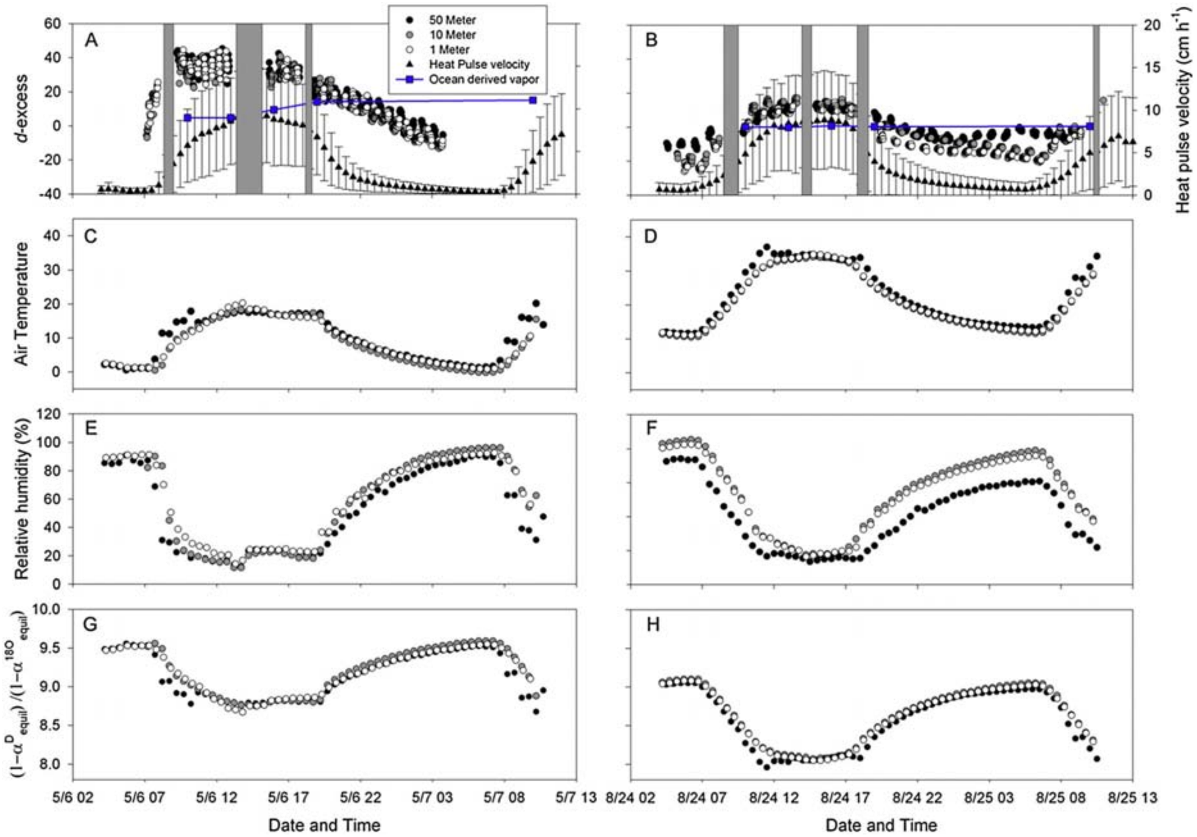


Figure 5. Diurnal variation in tree water use, the *d*-excess of atmospheric humidity, air temperature and relative humidity at 1, 10, and 50 m above the soil surface on 6–7 May (A, C, E and G) and 24–25 August 2010 (B, D, F and H).

4 Results and Discussion

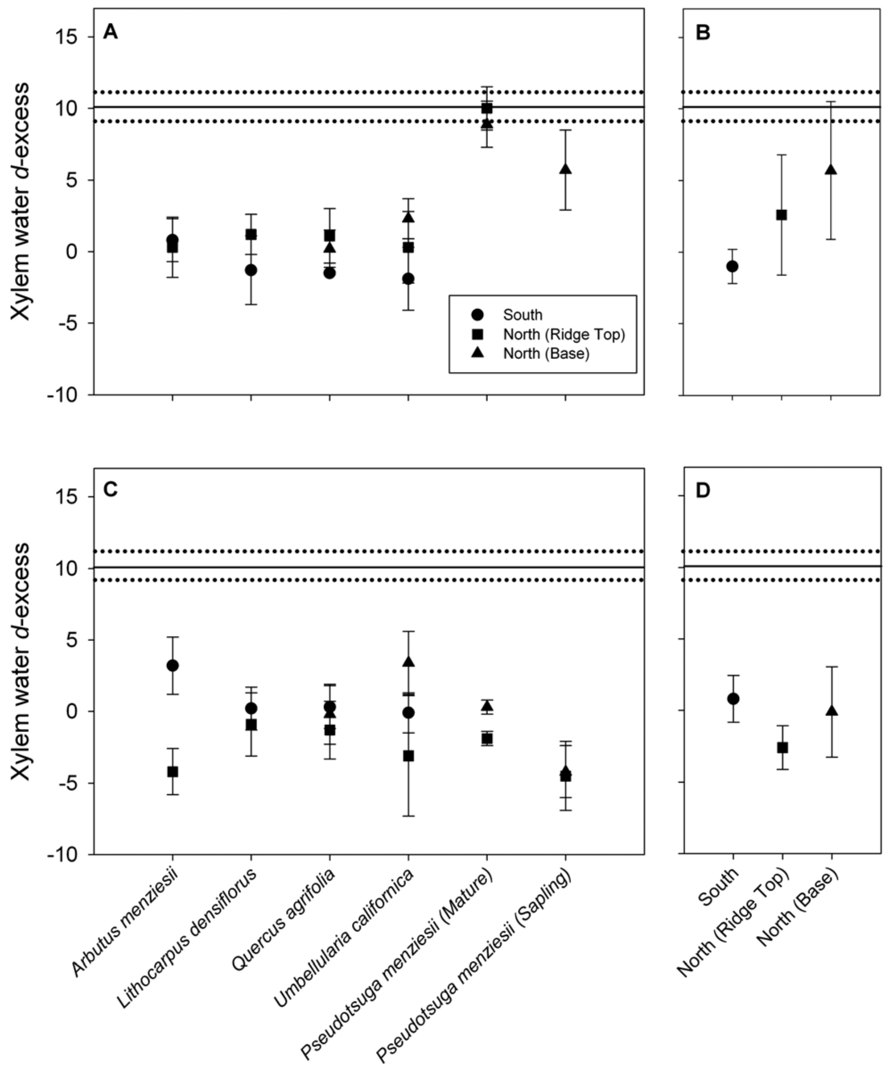
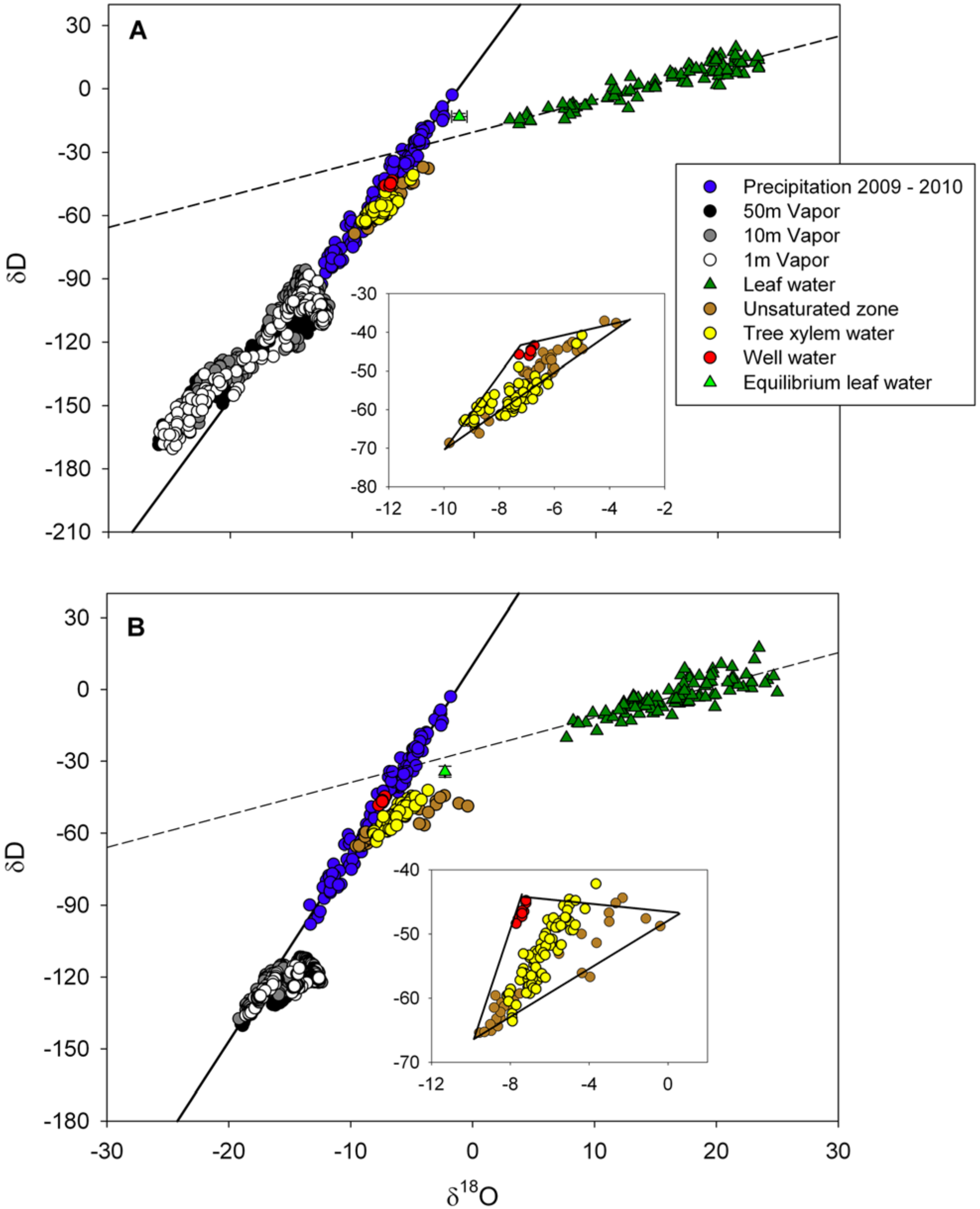


Figure 6. The *d*-excess of tree xylem water on (A, B) 6 May 2010 and (C, D) 24 August 2010 as related to position in the watershed (Means ± SD).

4 Results and Discussion



$$\alpha_{equil} = R_{leaf} / R_v \quad (1)$$

Figure 7. The δD and δ18O of precipitation, atmospheric water vapour, water in the unsaturated zone, tree xylem water, well water and modelled leaf water in equilibrium with atmospheric water vapour prior to dawn for 6 May (A) and 24 August 2010 (B).

4 Results and Discussion

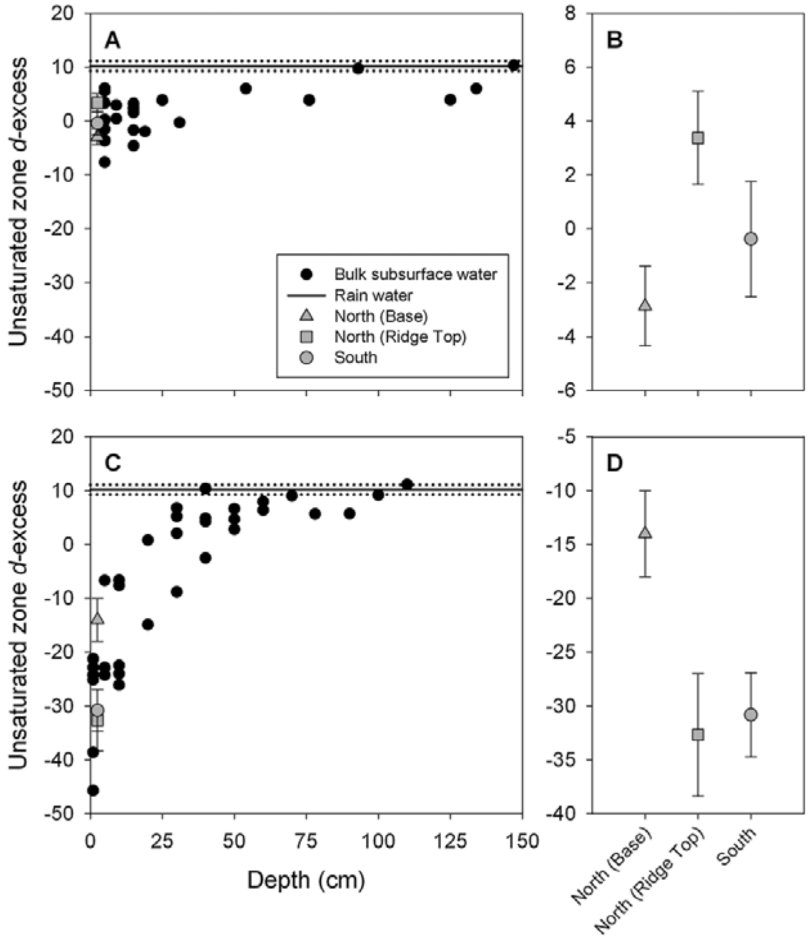


Figure 8. Variation in the d-excess of water in the unsaturated zone at depth (cm) for (A) 6 May 2010 and (C) 24 August 2010.

4 Conclusion

- Early morning the increace of *d*-excess within and below the forest canopy mainly becauce of the effect of entrainment. From late morning to midday, the increase of *d*-excess due to forest evapotranspiration increased.

- During the day time, the isotope composition of near surface water vapour changed by forest canopies by means of non-steady state isotope effects.

- At night, when the relative humidity approach 100%, the isotope composition of near surface humidity influenced by forest canopies via equilibrium effects.

- Condensation events can also have an influence on the distribution of the isotope composition.

THANKS!