

# Vertical profiles of water vapor isotopic composition from in-situ measurements

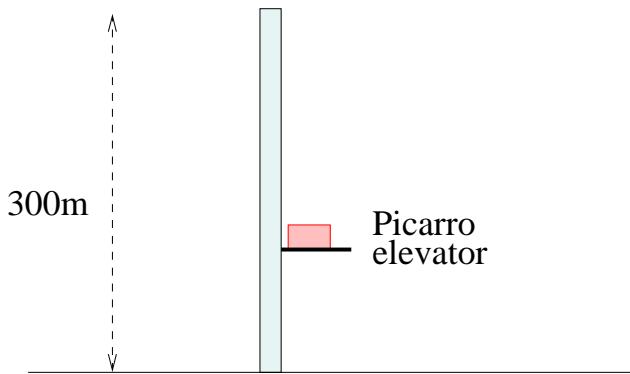
D Noone, C Risi, A Bailey, D Brown, N Buenning, S Gregory, J Nusbaumer, J Sykes, D Schneider, B Vanderwende, J Wong, Yannick Meillier and Dan Wolf

presented by Camille Risi  
CIRES, Boulder

Pre-basin meeting, 12 December 2010

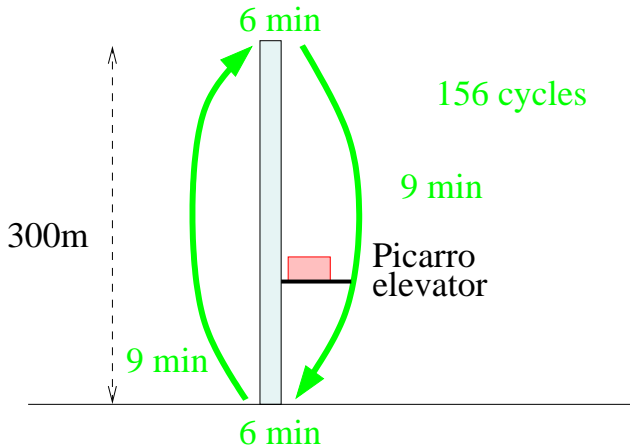
# Experiment set-up

15–18 February 2010  
Erie near Boulder, Colorado

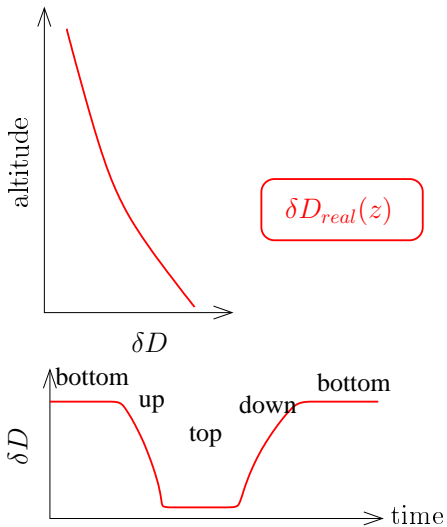


# Experiment set-up

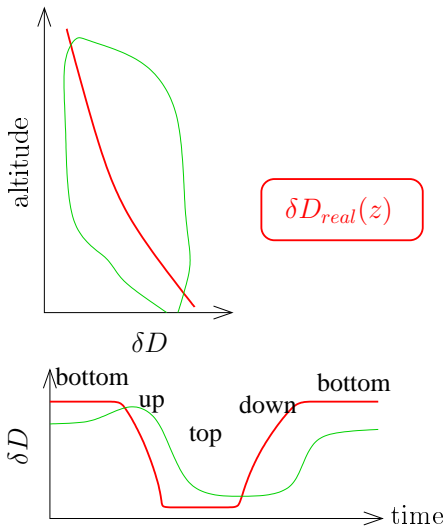
15–18 February 2010  
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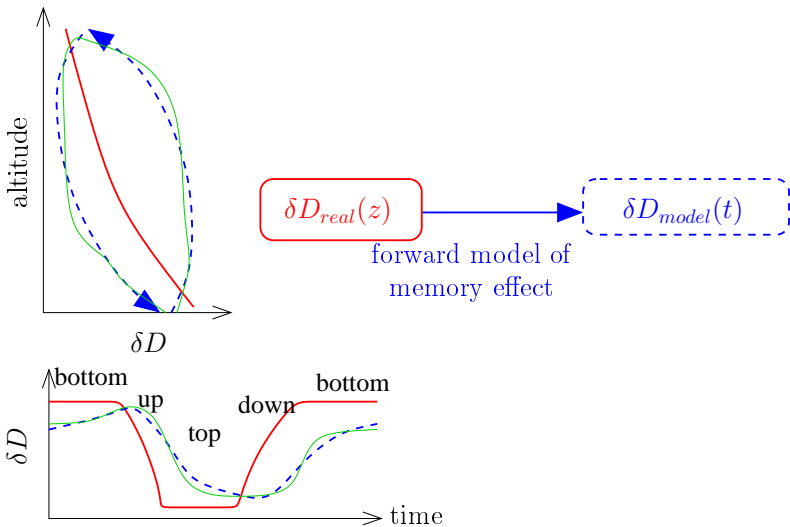
# Memory correction: principle



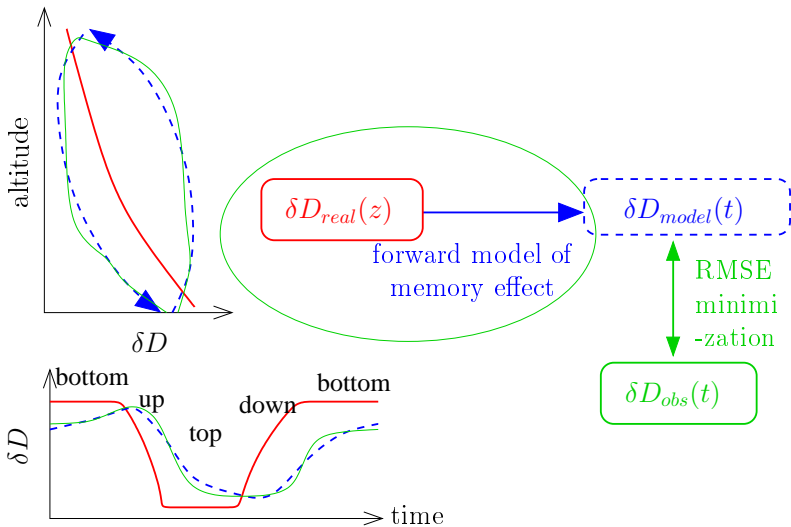
# Memory correction: principle



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# Memory correction: equations

For each up+down cycle,

$$\delta D_{model}(t) = \underbrace{\left(1 - \frac{\Delta t}{\tau}\right) \cdot \delta D_{model}(t - \Delta t)}_{\text{memory}} + \underbrace{\left(\frac{\Delta t}{\tau}\right) \cdot \delta D_{real}(t - T)}_{\text{lag}}$$



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$$\delta D_{real}(z) = \underbrace{\delta D_0 + \gamma \cdot z}_{\text{linear}} + \underbrace{B \cdot z_r \cdot \ln\left(\frac{z}{z_r}\right)}_{\text{log}} + \underbrace{A \cdot \exp\left(-\frac{(z-z_m)^2}{2 \cdot \sigma^2}\right)}_{\text{gaussian}}$$

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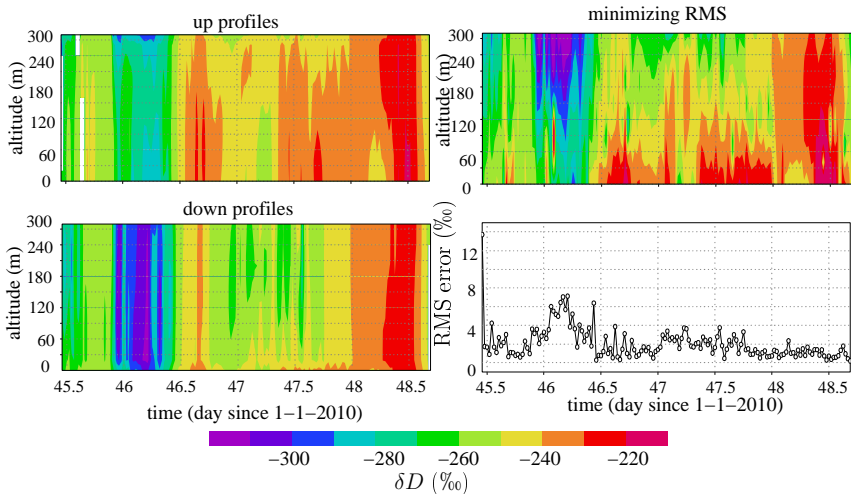
$$\delta D_{real}(z) = \underbrace{\delta D_0 + \gamma \cdot z}_{\text{linear}} + \underbrace{B \cdot z_r \cdot \ln\left(\frac{z}{z_r}\right)}_{\text{log}} + \underbrace{A \cdot \exp\left(-\frac{(z-z_m)^2}{2 \cdot \sigma^2}\right)}_{\text{gaussian}}$$

-> for each up+down cycle, we optimize 11 parameters:

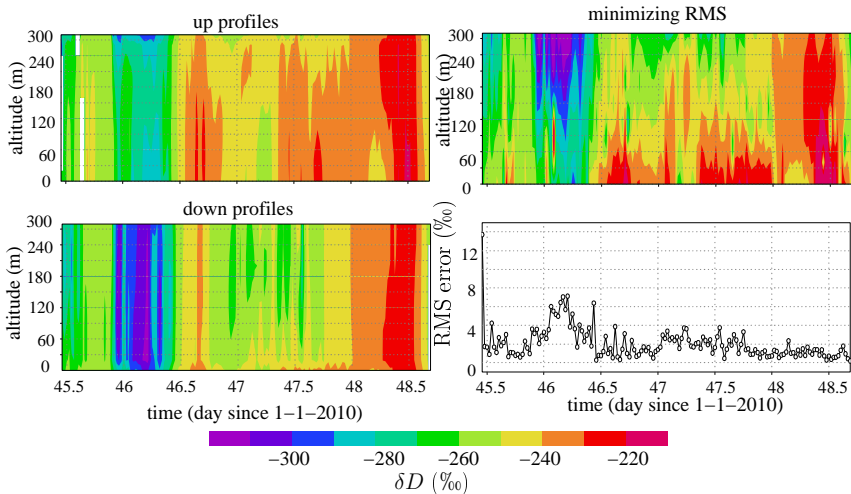
- ▶  $\delta D_0, \gamma, B, z_r, A, z_m, \sigma,$
- ▶  $\tau_{up}, \tau_{down}, T_{up}, T_{down}$

to minimize RMSE between  $\delta D_{model}$  and  $\delta D_{obs}$ .

# Memory correction: results

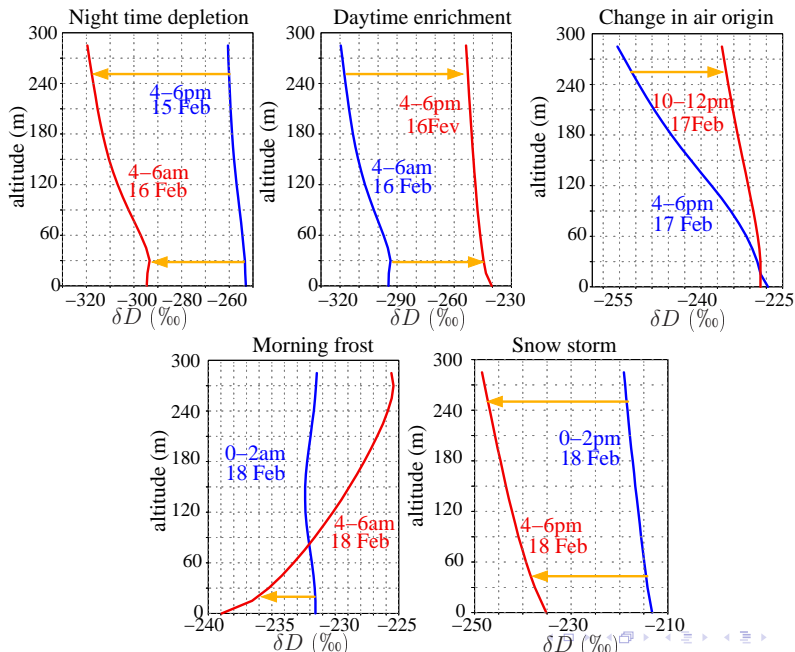


# Memory correction: results

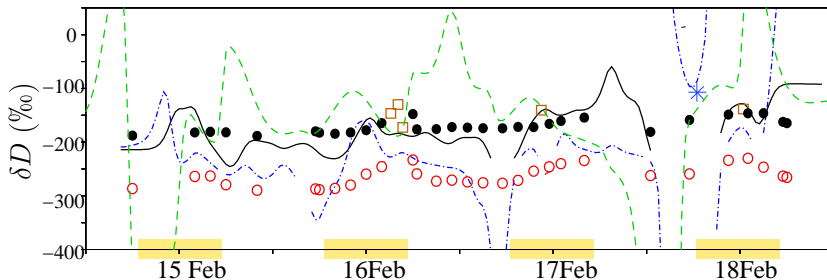


► memory:  $\tau \simeq 20\text{s}$ , lag:  $T \simeq 3\text{min}$

# Profiles depending on weather conditions



# Keeling plots



- vertical Keeling plot in the lowest 300m
- - - vertical Keeling plot in the lowest 50m
- - - temporal Keeling plot at the surface
- snow sample
- fractionating evaporation from snow samples
- \* frost sample
- mud or pond sample

# Keeling plots for evaporation

