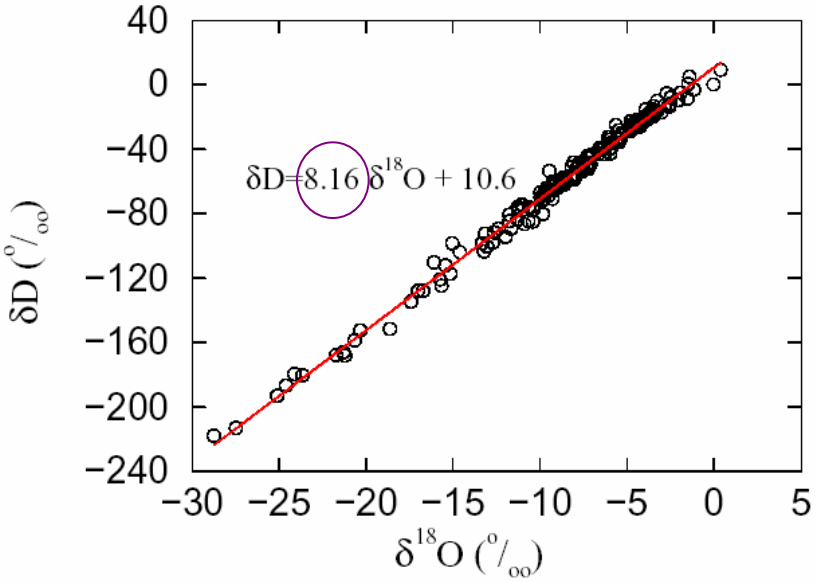
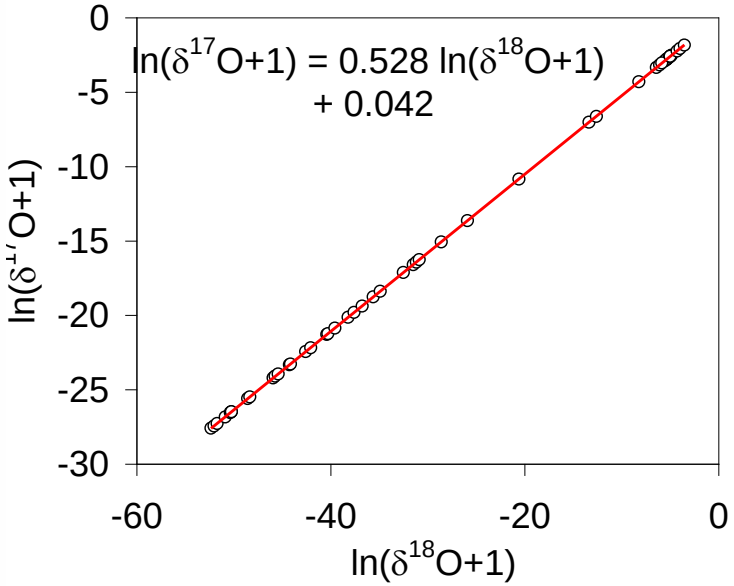
Possible added values of $^{17}O_{excess}$

The basics



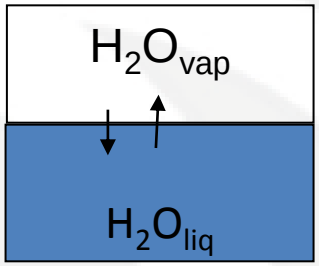


d-excess = $\delta D - 8\ \delta^{18}O$
(variations between -5 and 16‰)

$^{17}O_{excess} = \ln(\delta^{17}O+1) - 0.528\ \ln(\delta^{18}O+1)$
(variations between -20 and 60 permeg)

Different fractionations in the water cycle

Equilibrium



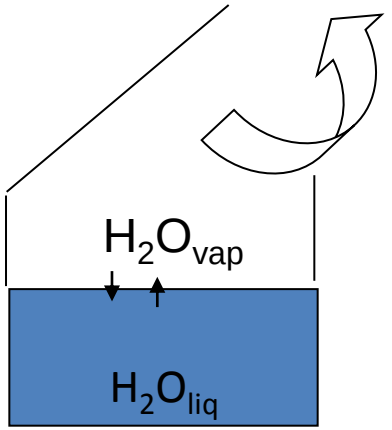
$$\frac{^{D}\alpha_{eq}-1}{^{18}\alpha_{eq}-1}=8$$

depends on temperature

$$\frac{\ln(^{17}\alpha_{eq})}{\ln(^{18}\alpha_{eq})}=0.528$$

does not depend on temperature

Kinetic (diffusion)



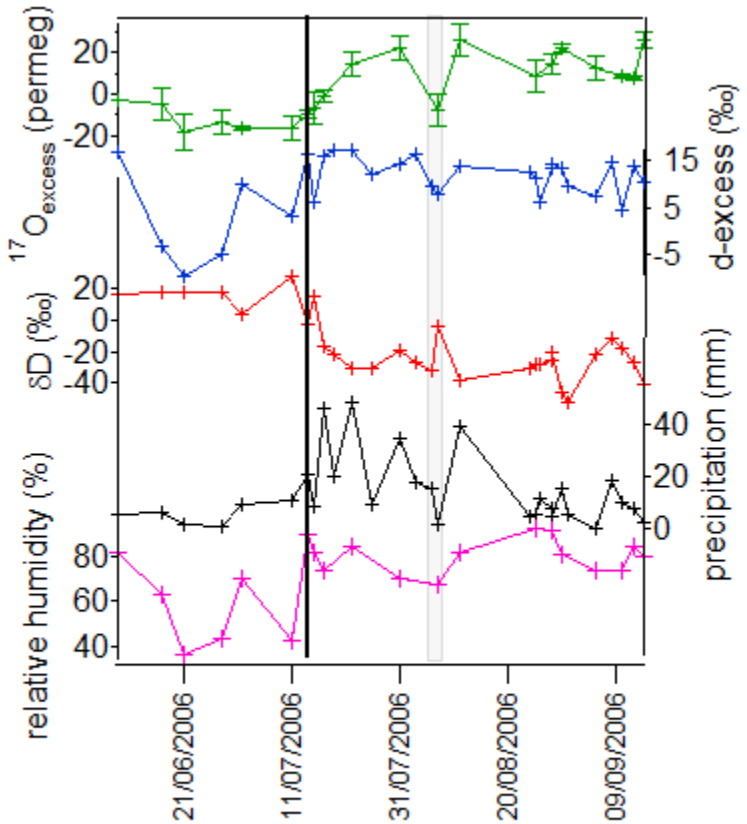
$$\frac{^{D}\alpha_{kin}-1}{^{18}\alpha_{kin}-1}\sim 1$$

depends on temperature

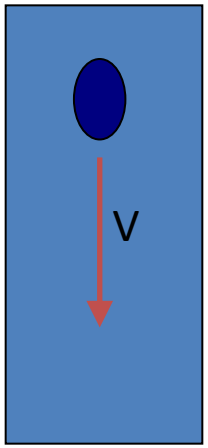
$$\frac{\ln(^{17}\alpha_{kin})}{\ln(^{18}\alpha_{kin})}=0.518$$

does not depend on temperature

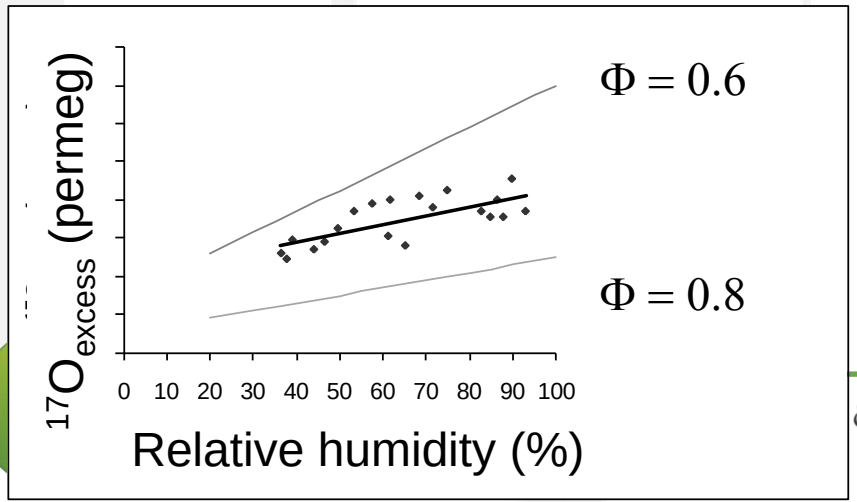
In the tropics



June 2006 September 2006



- **Reevaporation of a falling droplet (Stewart et al., 1975; Bony et al., 2008)**



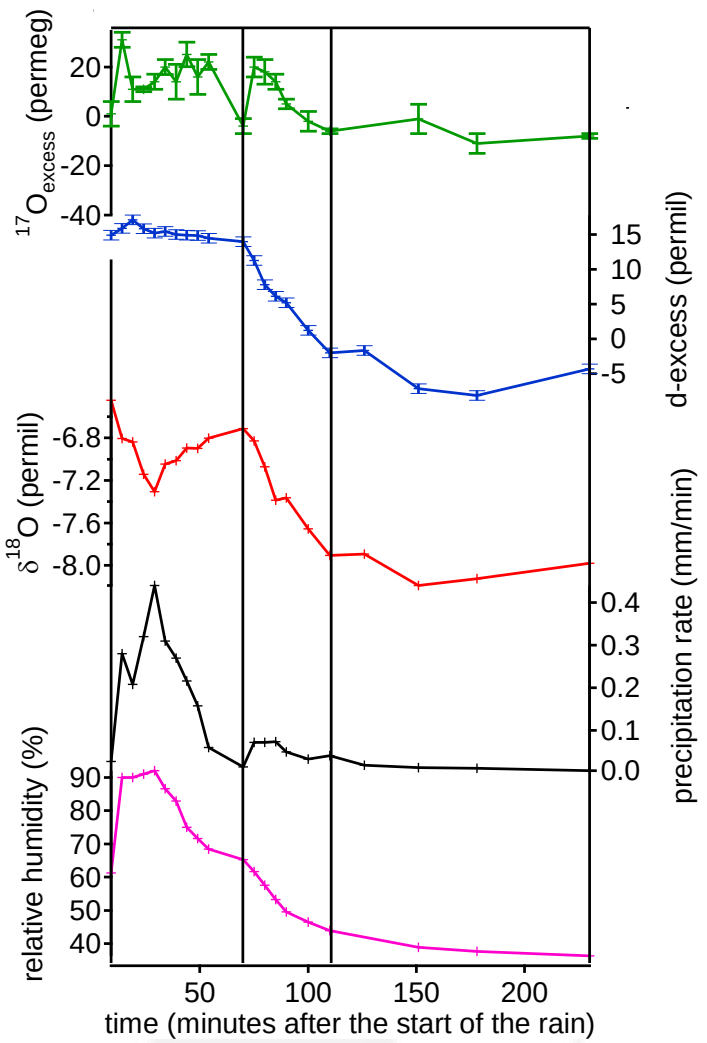
- ***h_{eff}*** **(relative humidity of the vapor around the droplet) is intermediate between *h_b*** **(rh of the surrounding air) and *h_s*** **(rh at saturation, i.e. *h_s*=1):**

$$h_{eff}=\phi*h_s+(1-\phi)*h_b.$$

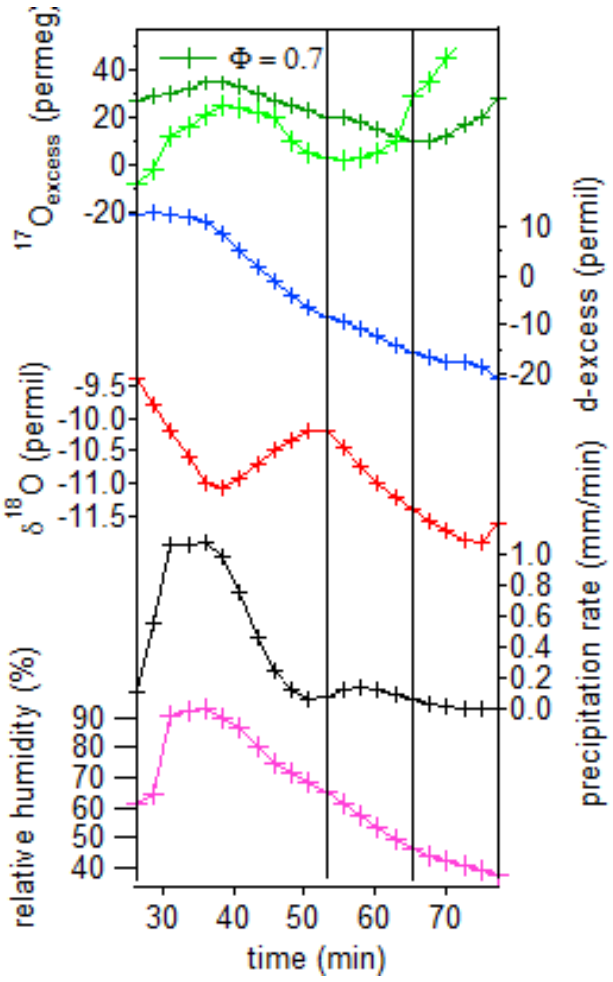
Risi et al., 2010; Landais et al., 2010

In the tropics

Data

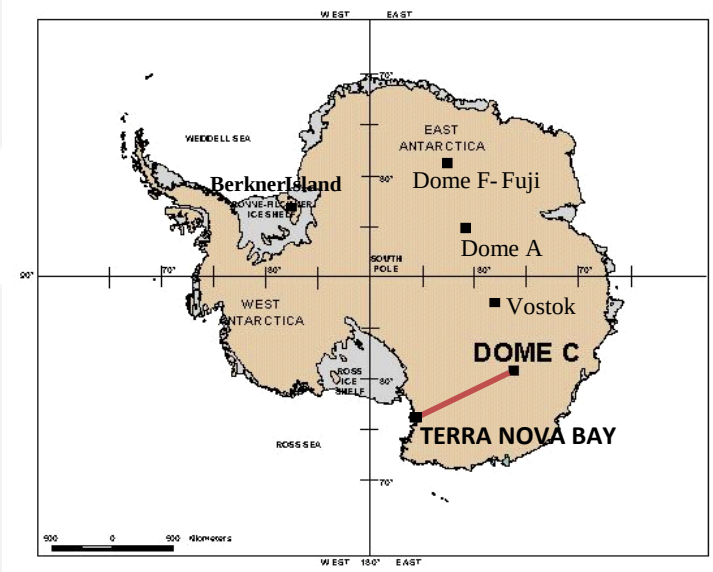


Model using $\phi = 0.7$



Risi et al., 2010; Landais et al., 2010

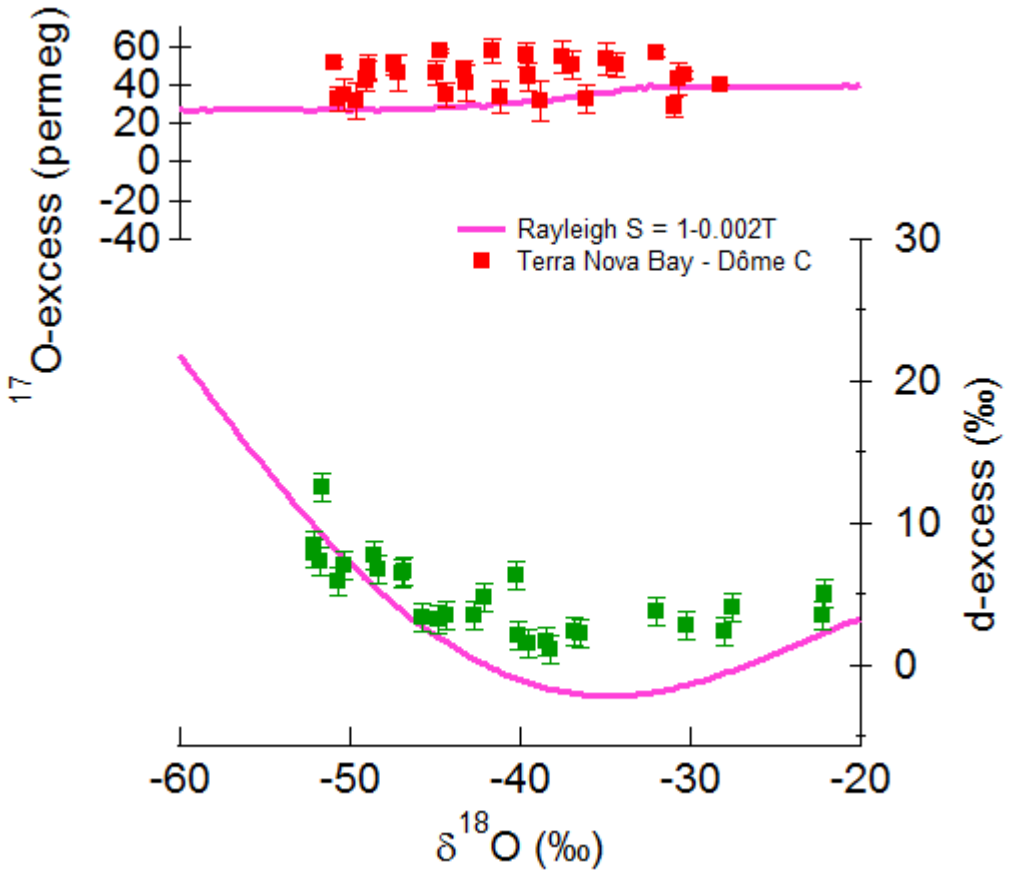
In the polar regions



$\Delta\delta^{18}O$ (‰) = $1\times\Delta T_{site} - 0.3\times\Delta T_{source} + 0.02\times\Delta RH_{source} + 0.95\times\Delta\delta^{18}O_{ocean}$

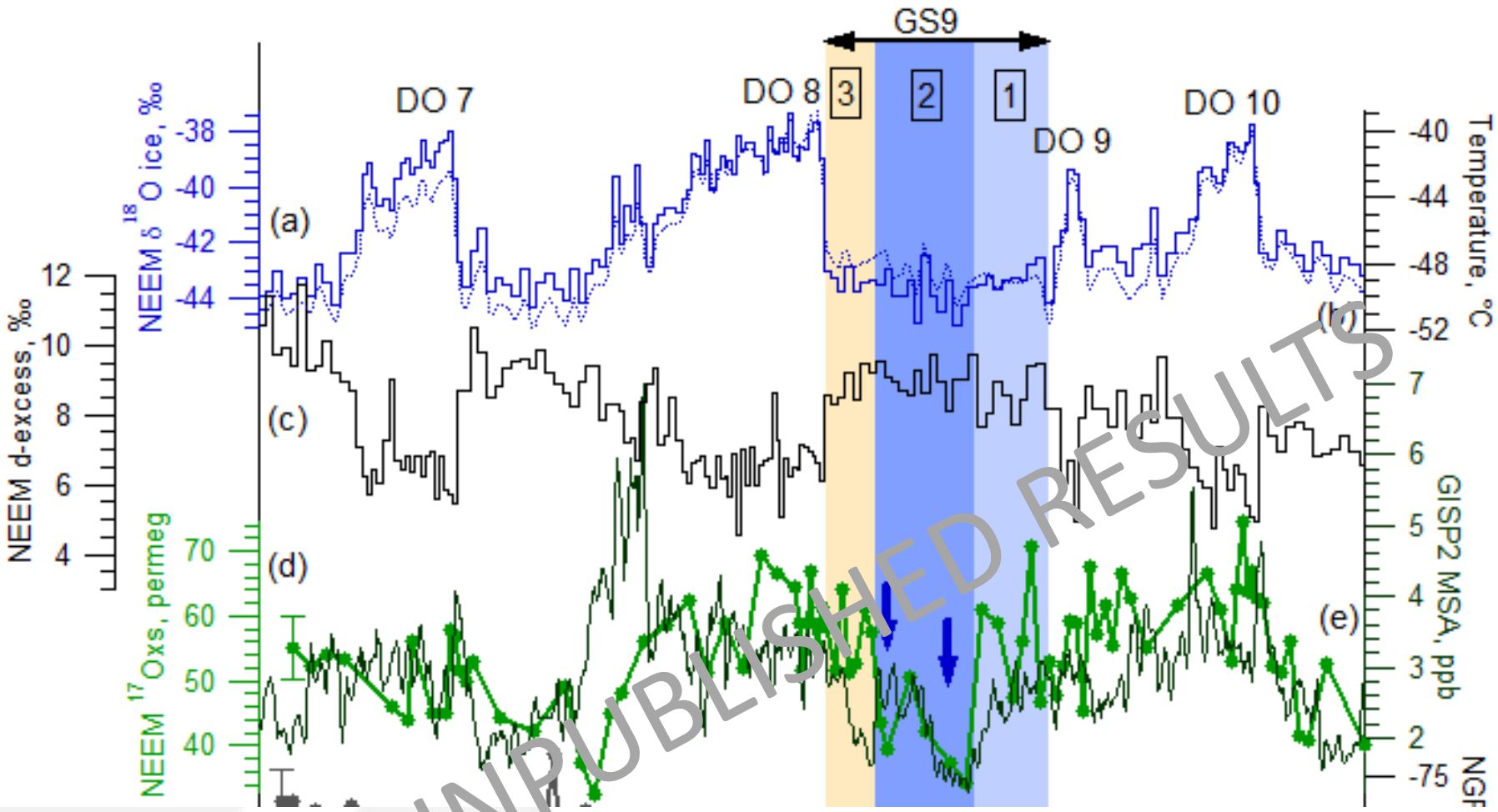
Δd-excess (‰) = $-1.1\times\Delta T_{site} + 1.5\times\Delta T_{source} - 0.38\times\Delta RH_{source} - 3\times\Delta\delta^{18}O_{ocean}$

$\Delta^{17}O_{excess}$ (permeg) = $-1\times\Delta RH_{source}$



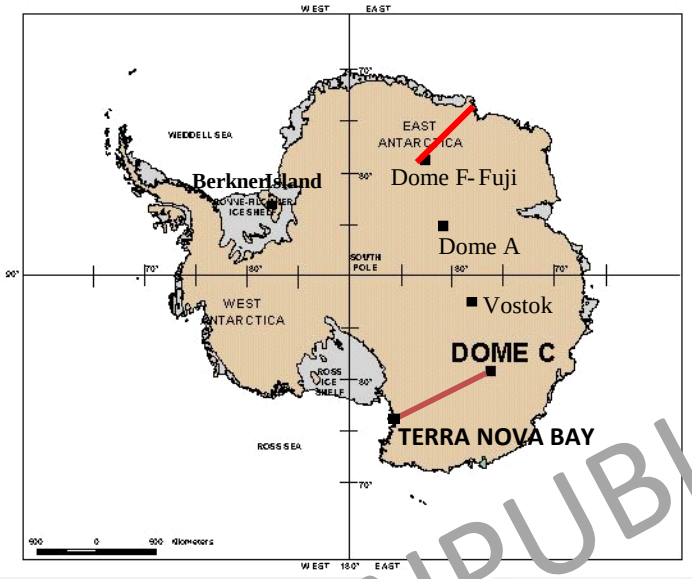
Landais et al., 2008

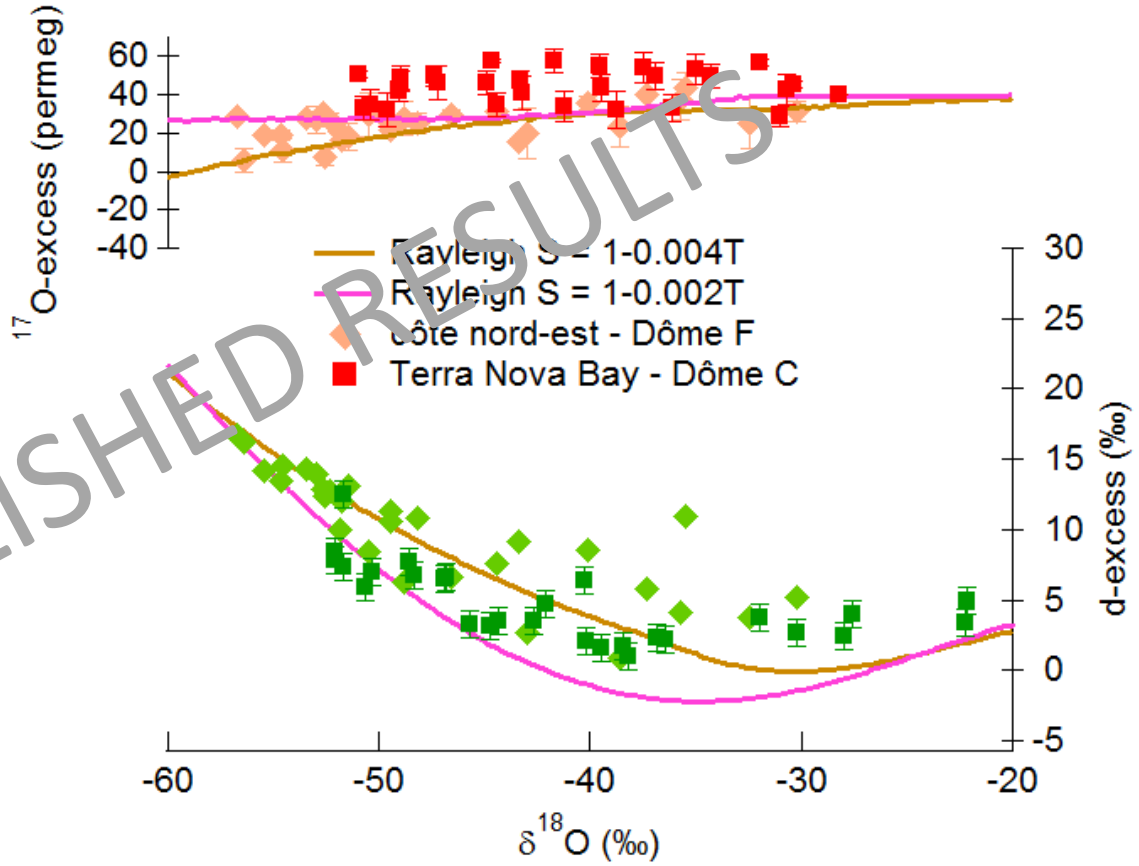
In the polar regions: NEEM Greenland



GUILLEVIC ET AL., TO BE SUBMITTED

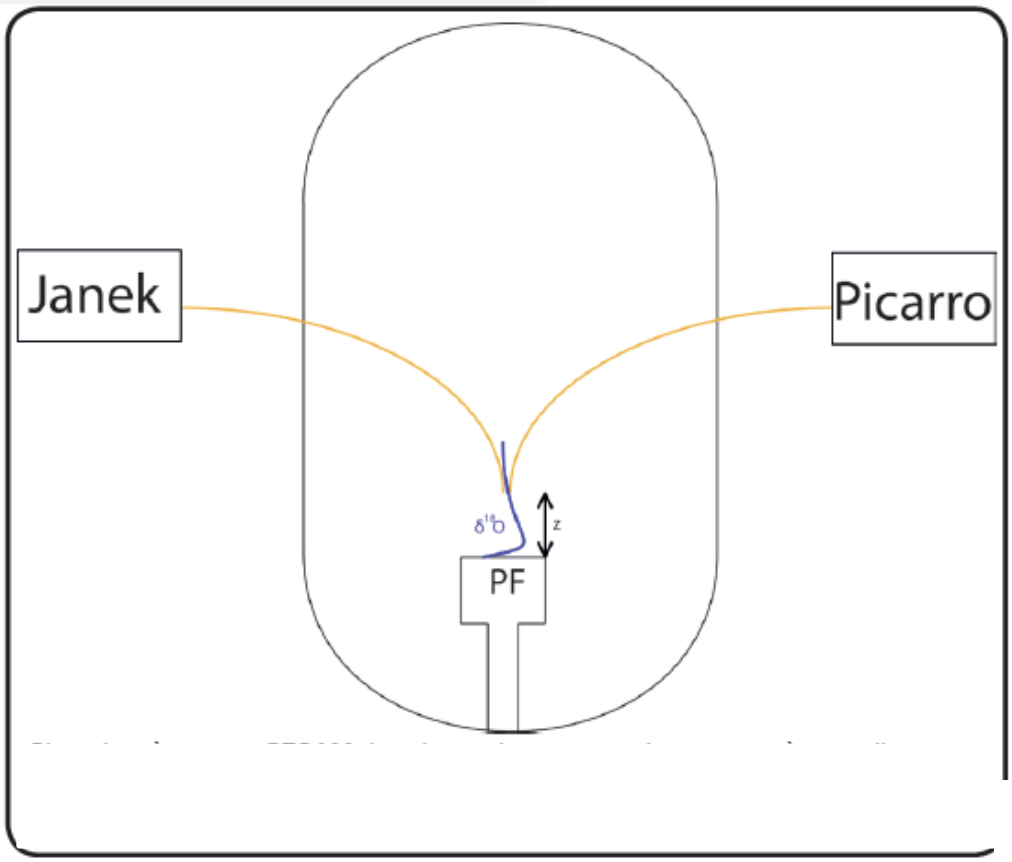
In the polar regions: toward very cold sites

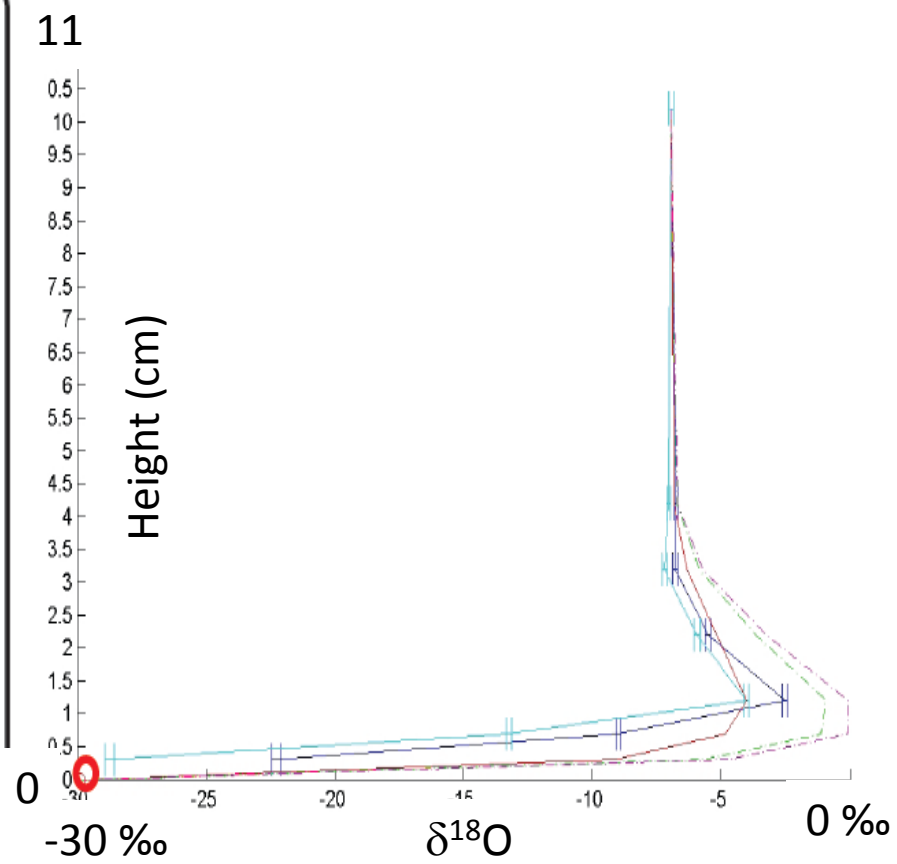




SARAH GUILBAUD, RYU UEMURA and others, unpublished data

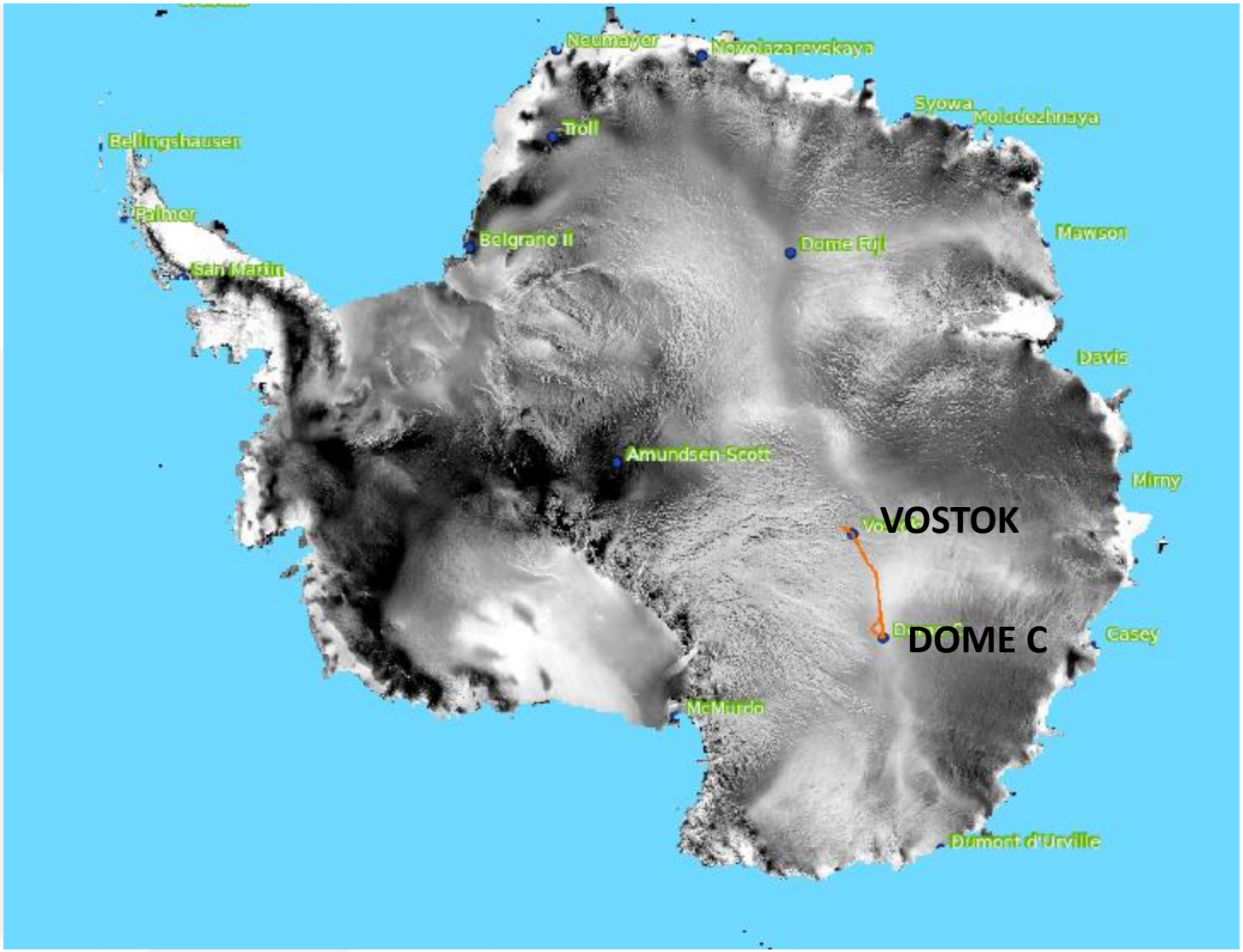
Laboratory experiments



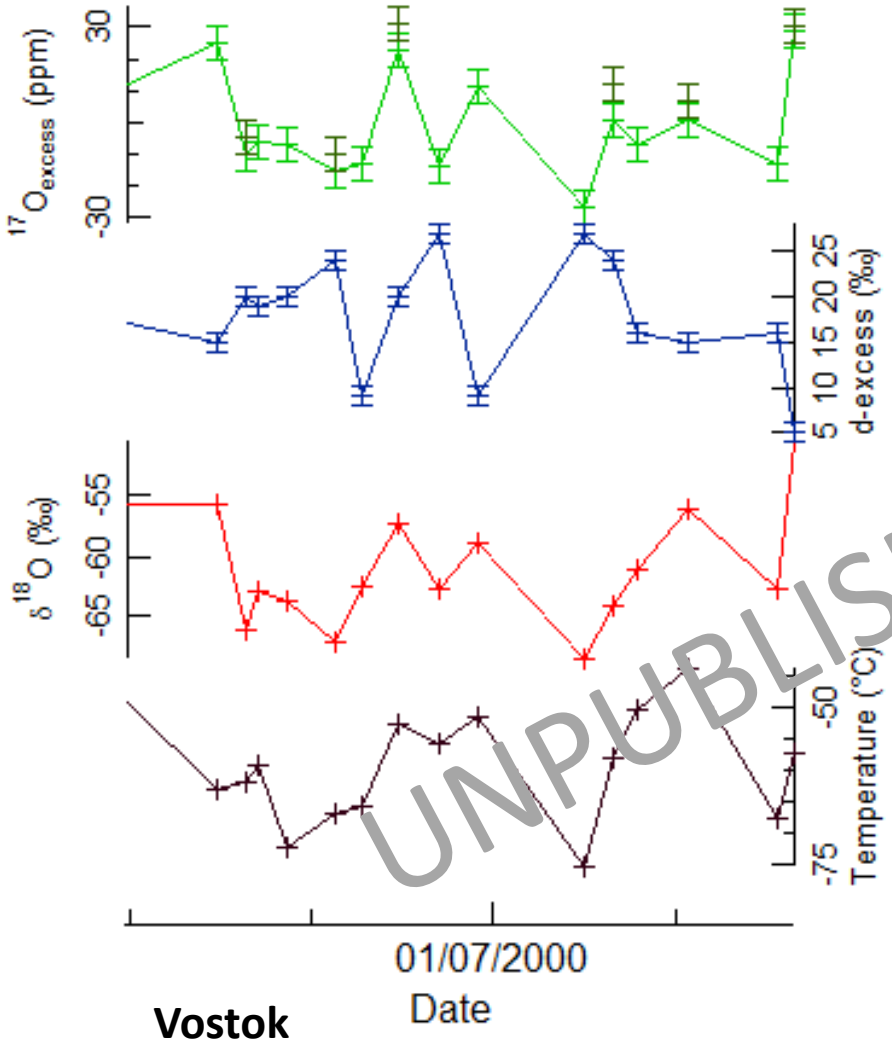


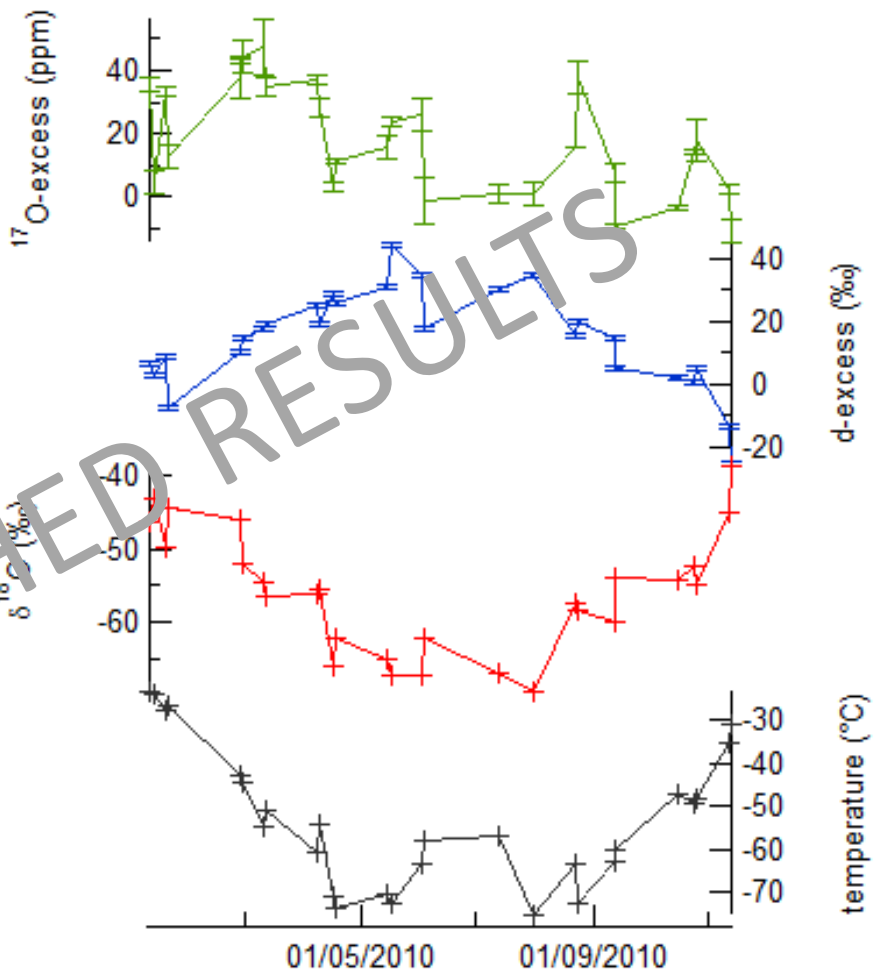
MATHIEU CASADO, JANEK LANDSBERG and others, unpublished data

Field experiments



Field experiments: precipitations





Vostok

Landais, Eykakin et al., 2012

Dome C: Barbara Stenni, Sarah Guilbaud and others, unpublished data