Coordinate Sampling and Analytical Effort to Examine Interactions Between INPs and Rainout in Winter 2016 ARs in California

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Outline

I. Guiding research questions

II. Sampling network

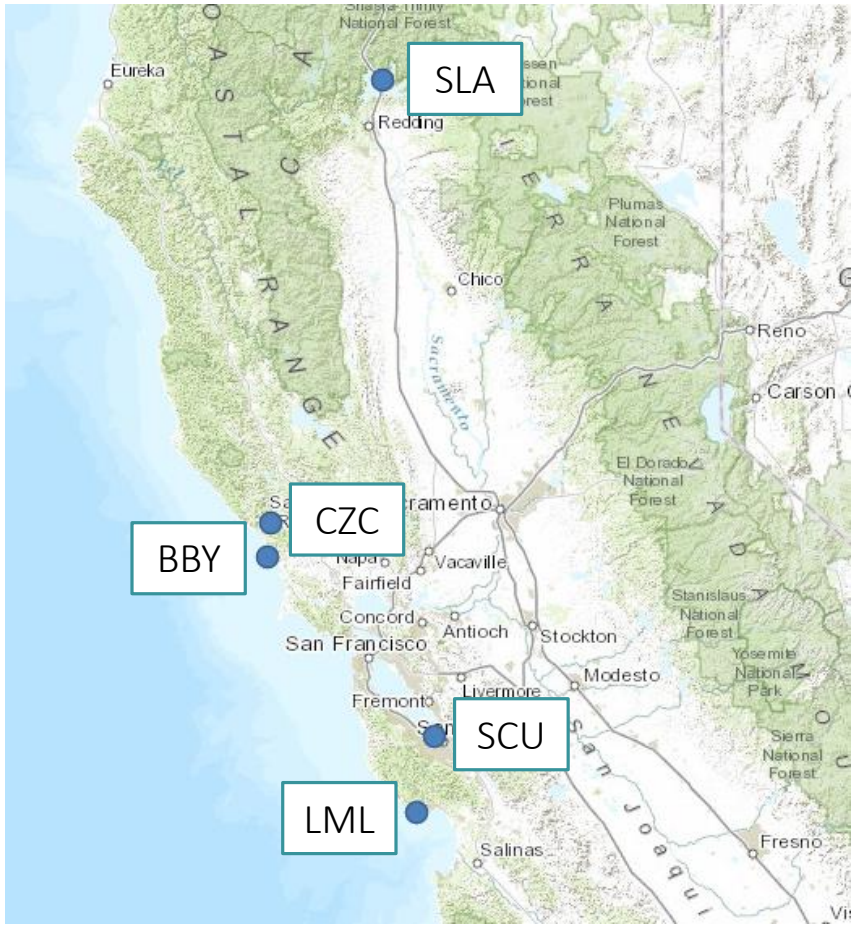
III. Preliminary results

I. Guiding research questions

1. What are the **stable isotope signatures** of extreme precipitation events and which macro- and micro-scale **dynamics** are responsible for producing them?
2. What are the moisture and aerosol **sources** during extreme precipitation events and how do these **change** within storms?
3. What are the **relationships** between aerosols and precipitation amount, efficiency and phase?

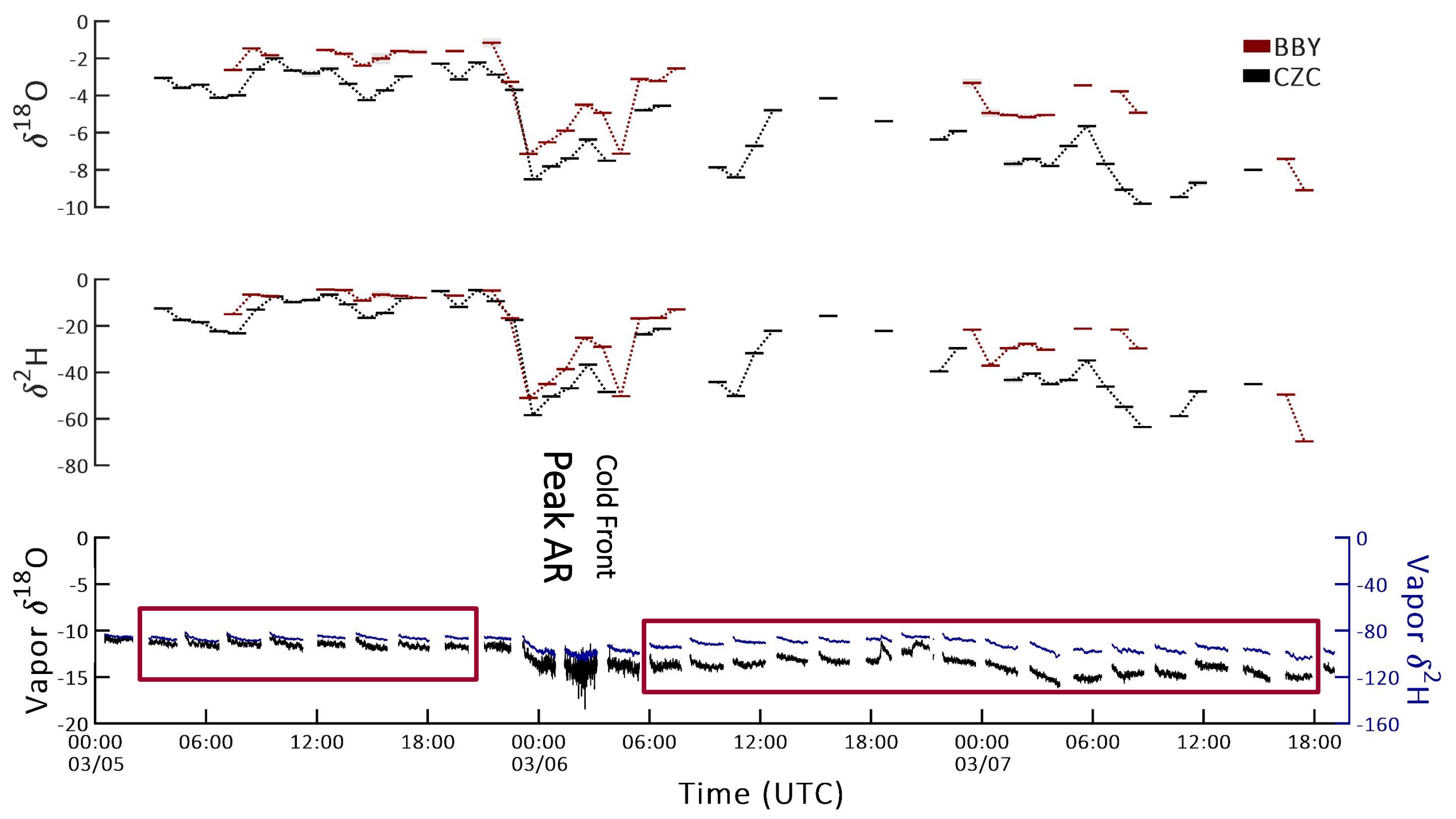
II. Sampling network

- Hourly integrated precipitation samples collected at five sites throughout California during December, 2015 – March, 2016
  - All rain events sampled at Santa Clara (SCU) and Santa Cruz (LML)
  - Three ARs sampled at Bodega Bay (BBY) and Cazadero (CZC)
  - March ARs sampled at Shasta Lake (SLA)
- Continuous ground-level vapor isotopic composition measured in real time at Bodega Bay for part of February and March

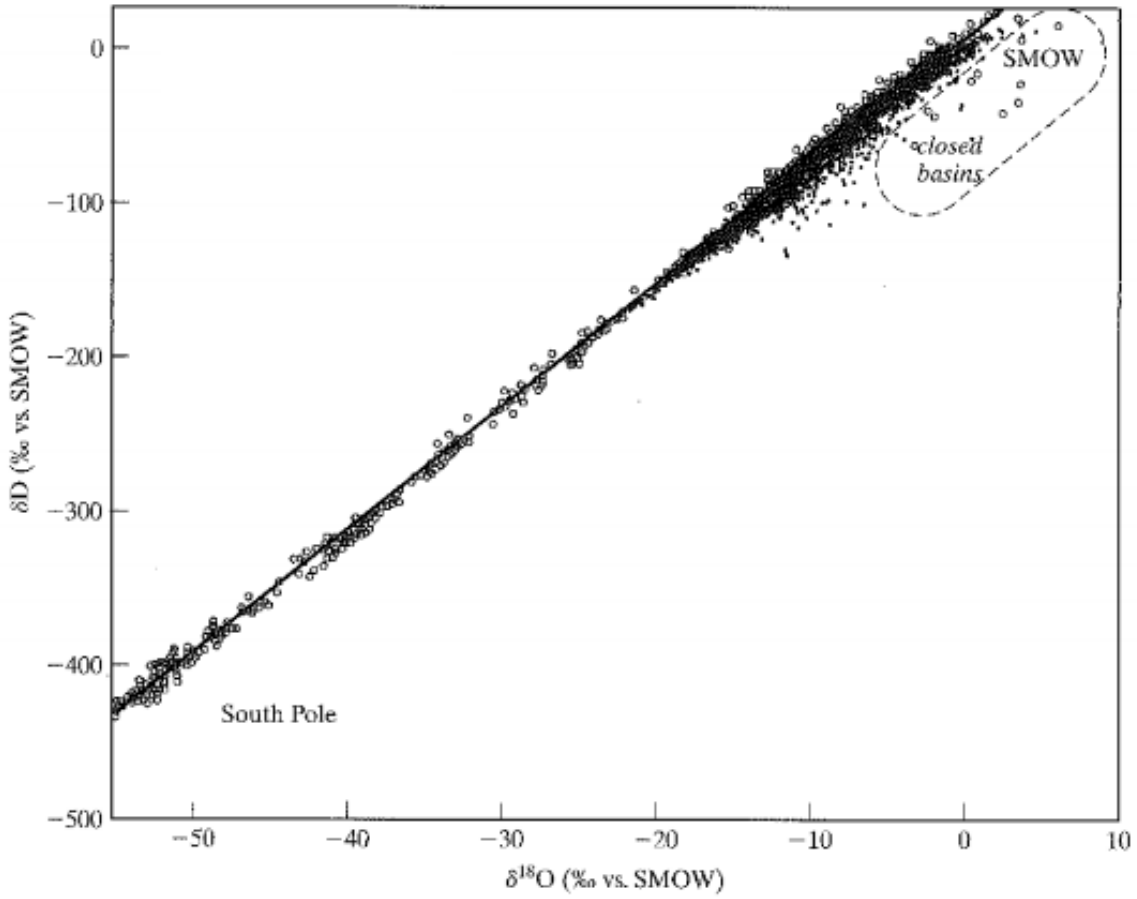


III. Preliminary results March 5-7, 2016 AR

A case study of Bodega Bay and Cazadero


BBY
CZC
$\delta^{18}O$
$\delta^{2}H$
0
-2
-4
-6
-8
-10
-20
-40
-60
-80
Peak AR
Cold Front
Vapor $\delta^{18}O$
Vapor $\delta^{2}H$
-5
-15
-120
-160
00:00
03/05
06:00
12:00
18:00
00:00
03/06
06:00
12:00
18:00
00:00
03/07
06:00
12:00
18:00
Time (UTC)

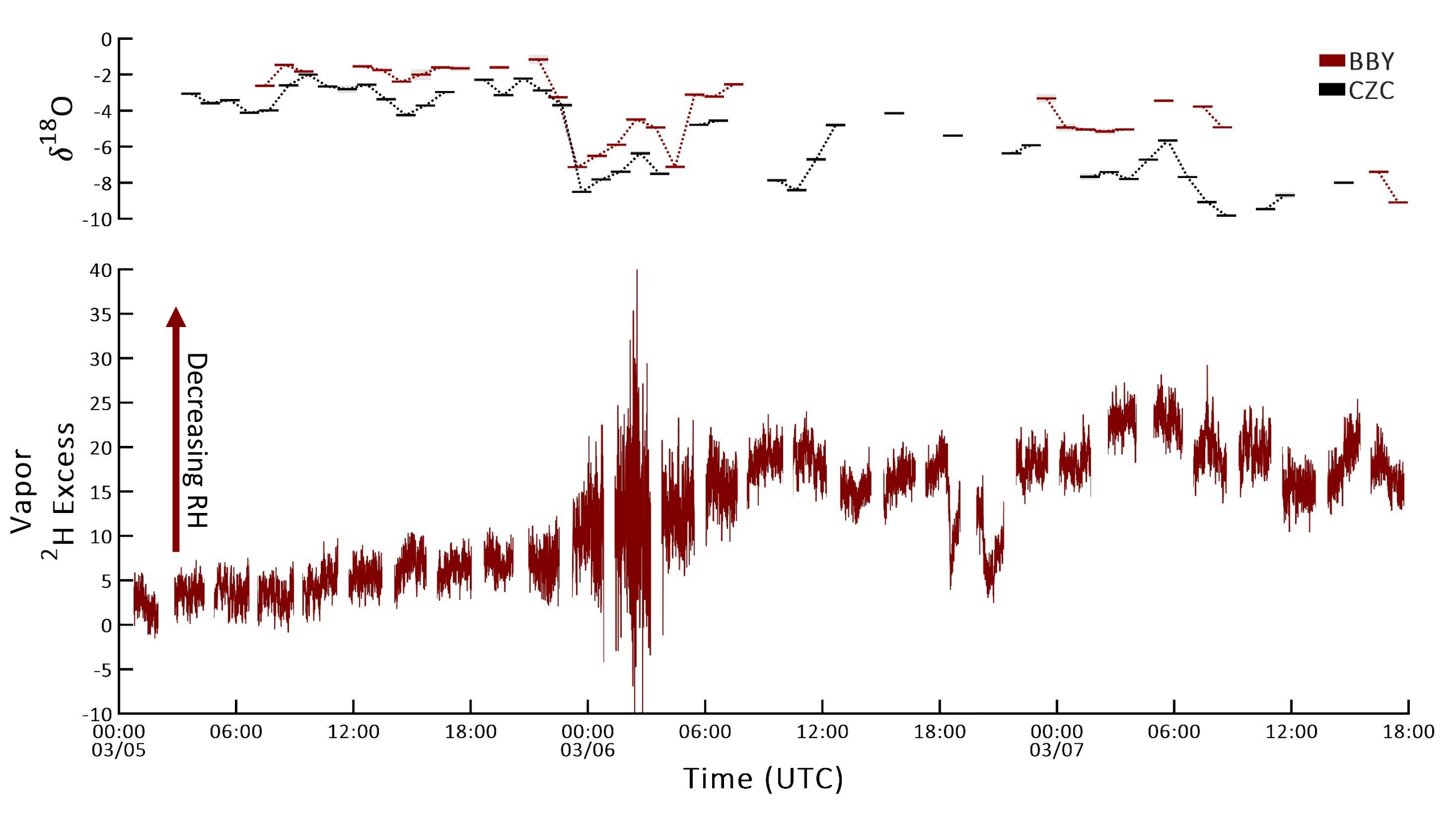
Deuterium excess (DE)

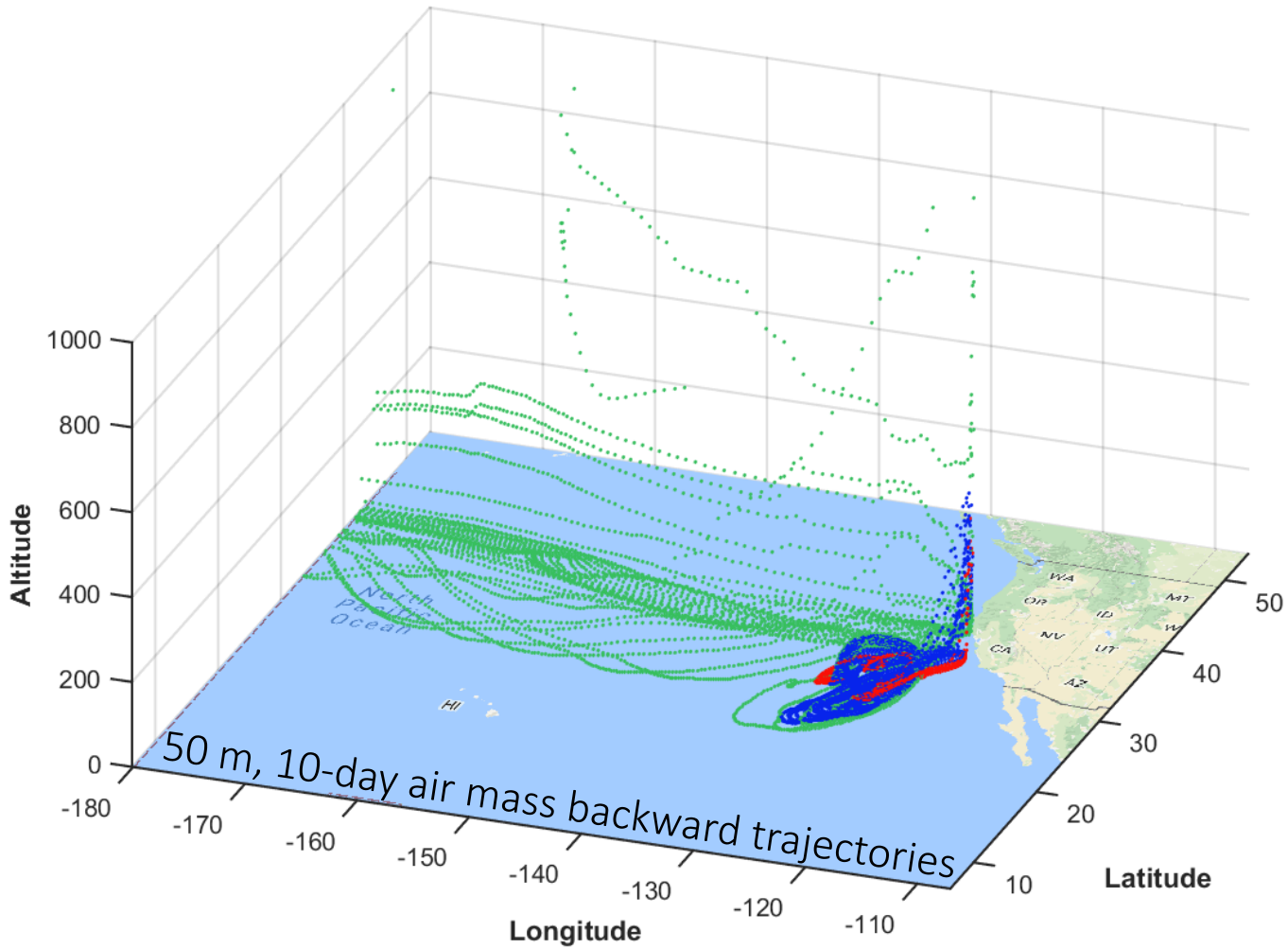


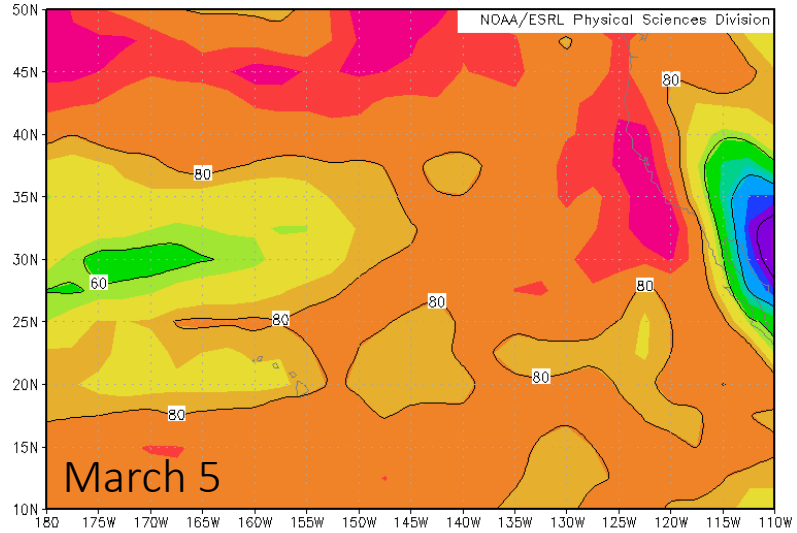
$$\delta D = 8 \times \delta^{18}O + DE$$

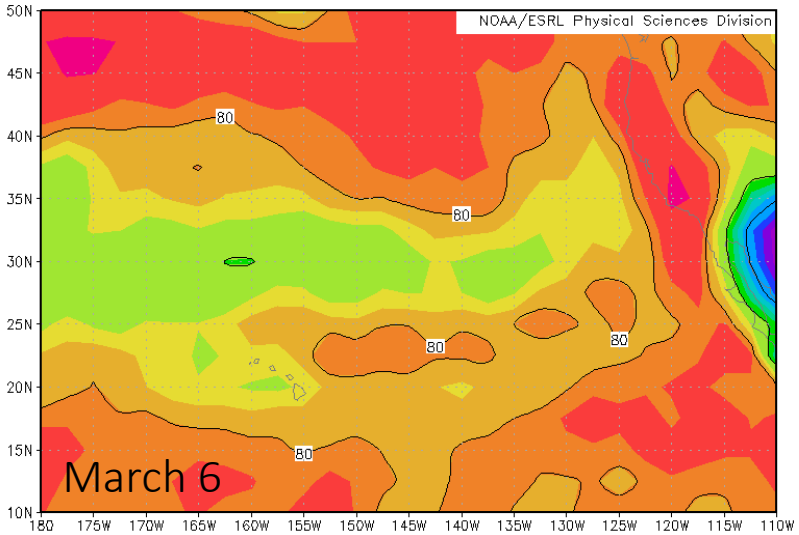
DE increases with increasing moisture deficit (1-RH)

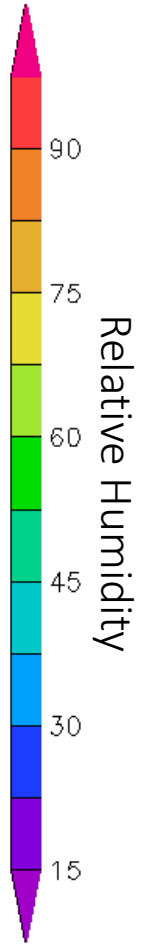
Sharp (2007)

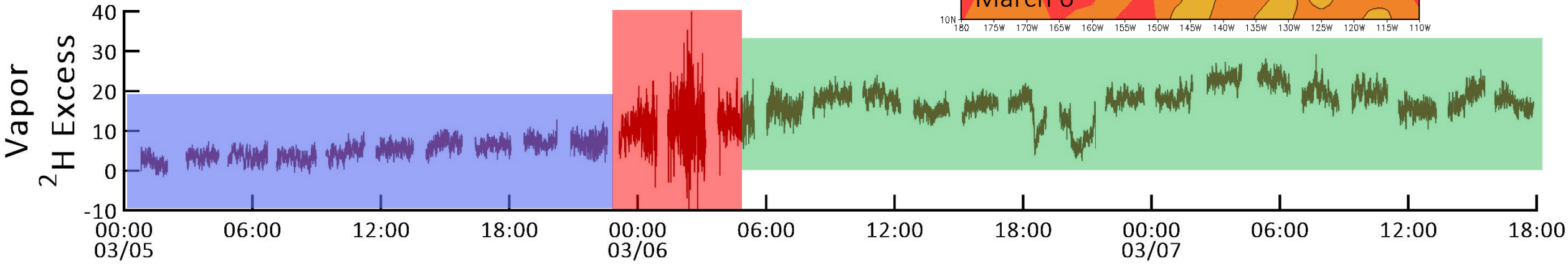

0
-2
-4
-6
-8
-10
$\delta^{18}O$
BBY
CZC
40
35
30
25
20
15
10
5
0
-5
-10
Vapor
^{2}H Excess
Decreasing RH
00:00
03/05
06:00
12:00
18:00
00:00
03/06
06:00
12:00
18:00
00:00
03/07
06:00
12:00
18:00
Time (UTC)


Altitude
1000
800
600
400
200
0
-180
-170
-160
-150
-140
-130
-120
-110
Longitude
10
20
30
40
50
Latitude
North Pacific Ocean
WA
OR
CA
NV
ID
MT
WY
UT
AZ
HI
50 m, 10-day air mass backward trajectories

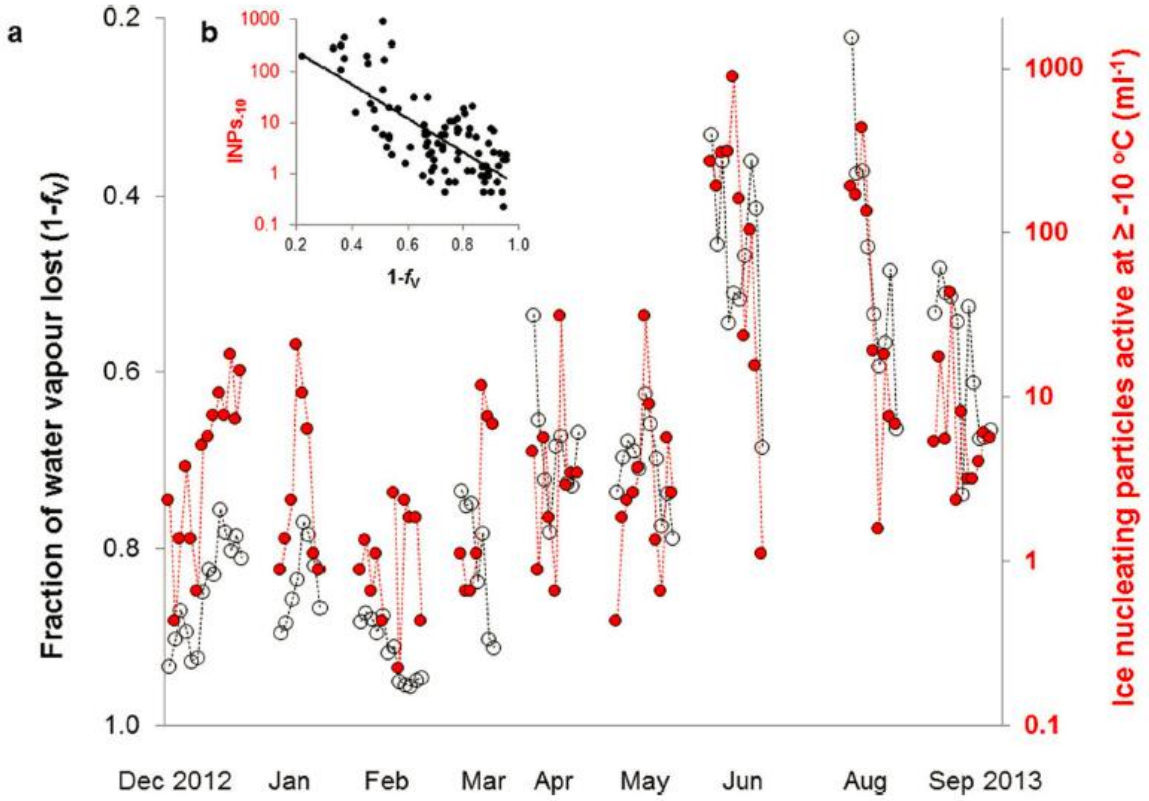

NOAA/ESRL Physical Sciences Division
March 5
50N
45N
40N
35N
30N
25N
20N
15N
10N
180
175W
170W
165W
160W
155W
150W
145W
140W
135W
130W
125W
120W
115W
110W
80
60

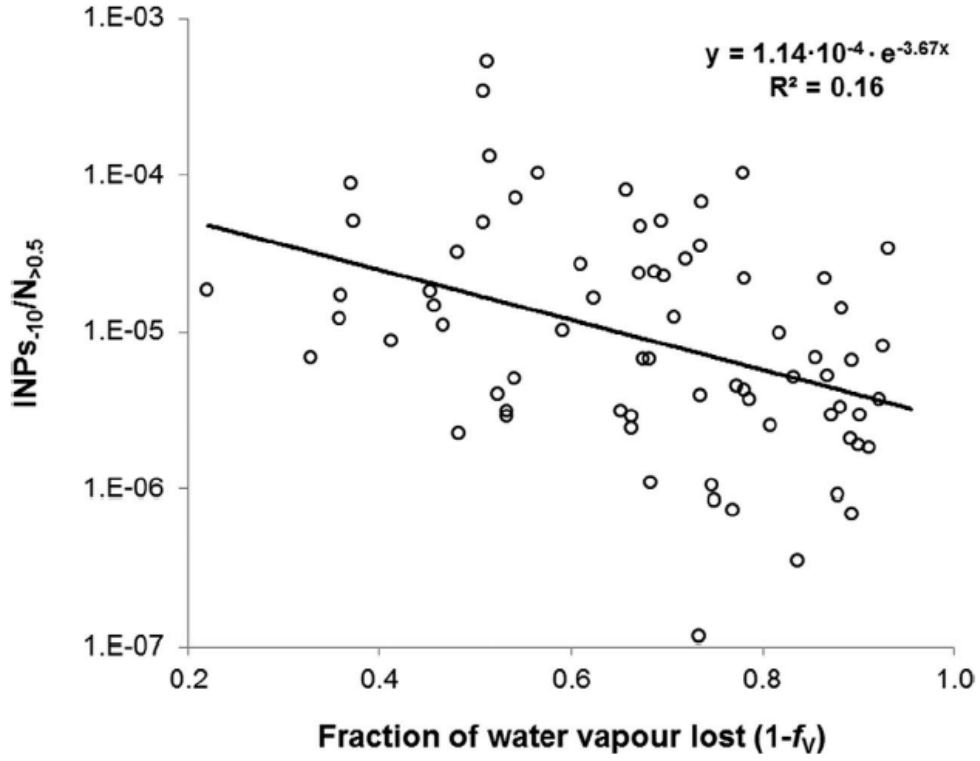

NOAA/ESRL Physical Sciences Division
March 6
50N
45N
40N
35N
30N
25N
20N
15N
10N
180
175W
170W
165W
160W
155W
150W
145W
140W
135W
130W
125W
120W
115W
110W
80

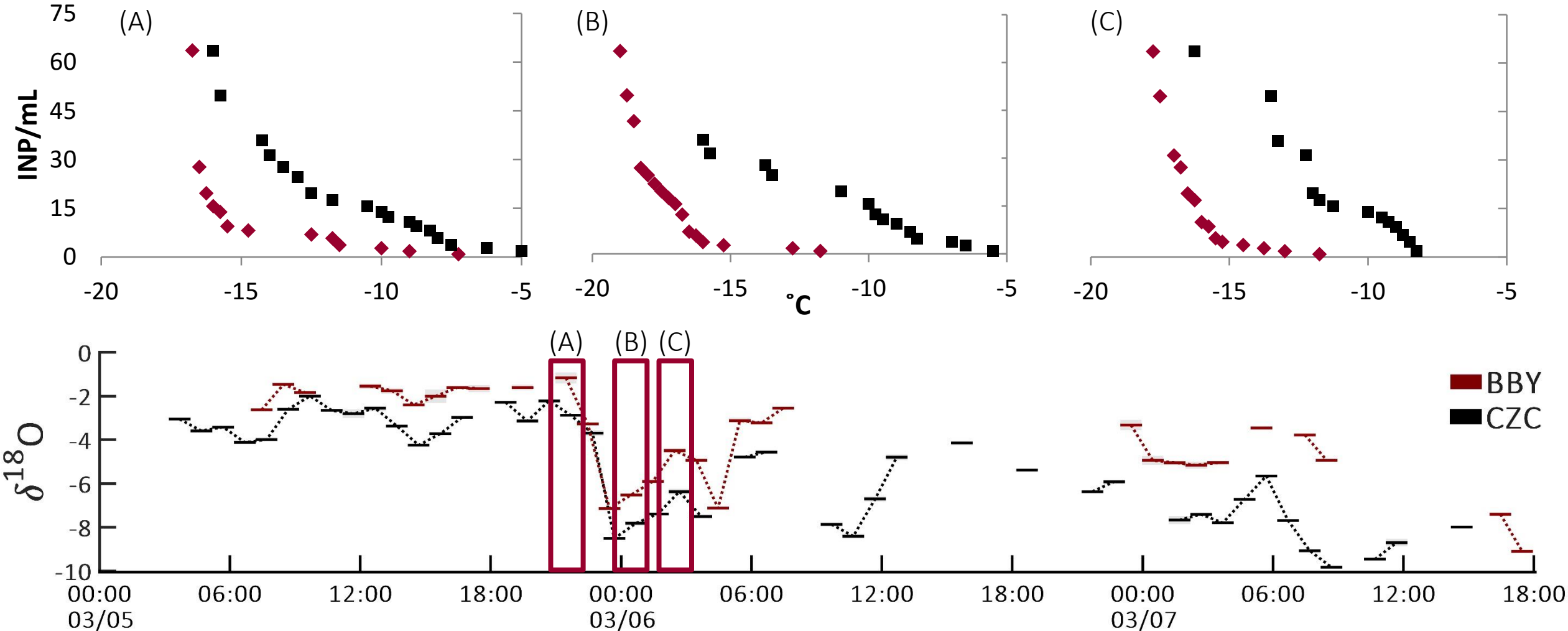

Relative Humidity
90
75
60
45
30
15


Vapor
2H Excess
40
30
20
10
0
-10
00:00
03/05
06:00
12:00
18:00
00:00
03/06
06:00
12:00
18:00
00:00
03/07
06:00
12:00
18:00

Aerosols and rainout in Switzerland





Stopelli et al. (2015)

Paired aerosol sampling