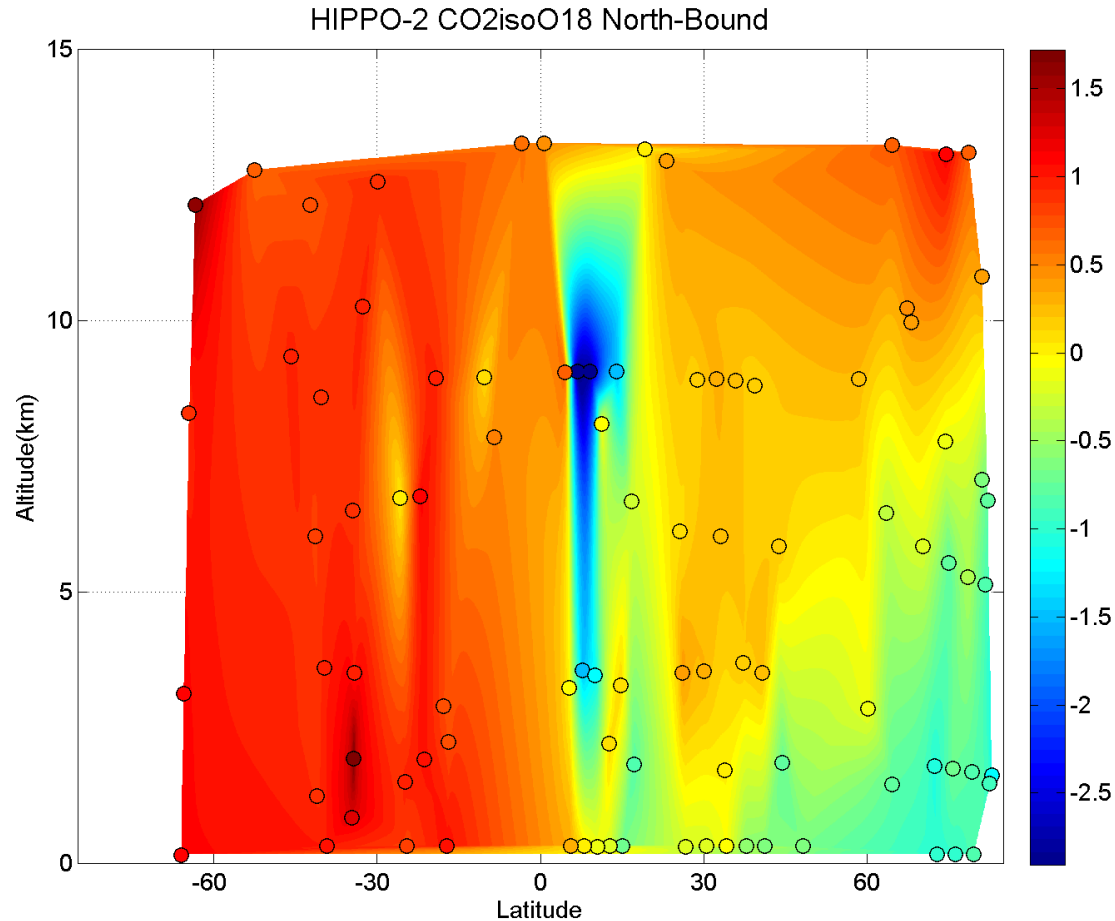


# The HIPPO and the $^{18}\text{O}$ in $\text{CO}_2$ mystery.



B. R. Miller, F. Moore, B. Vaughn, J. White and many others from CCGG, INSTARR and HATS

presented to the HIPPO workshop, March 17, 2011

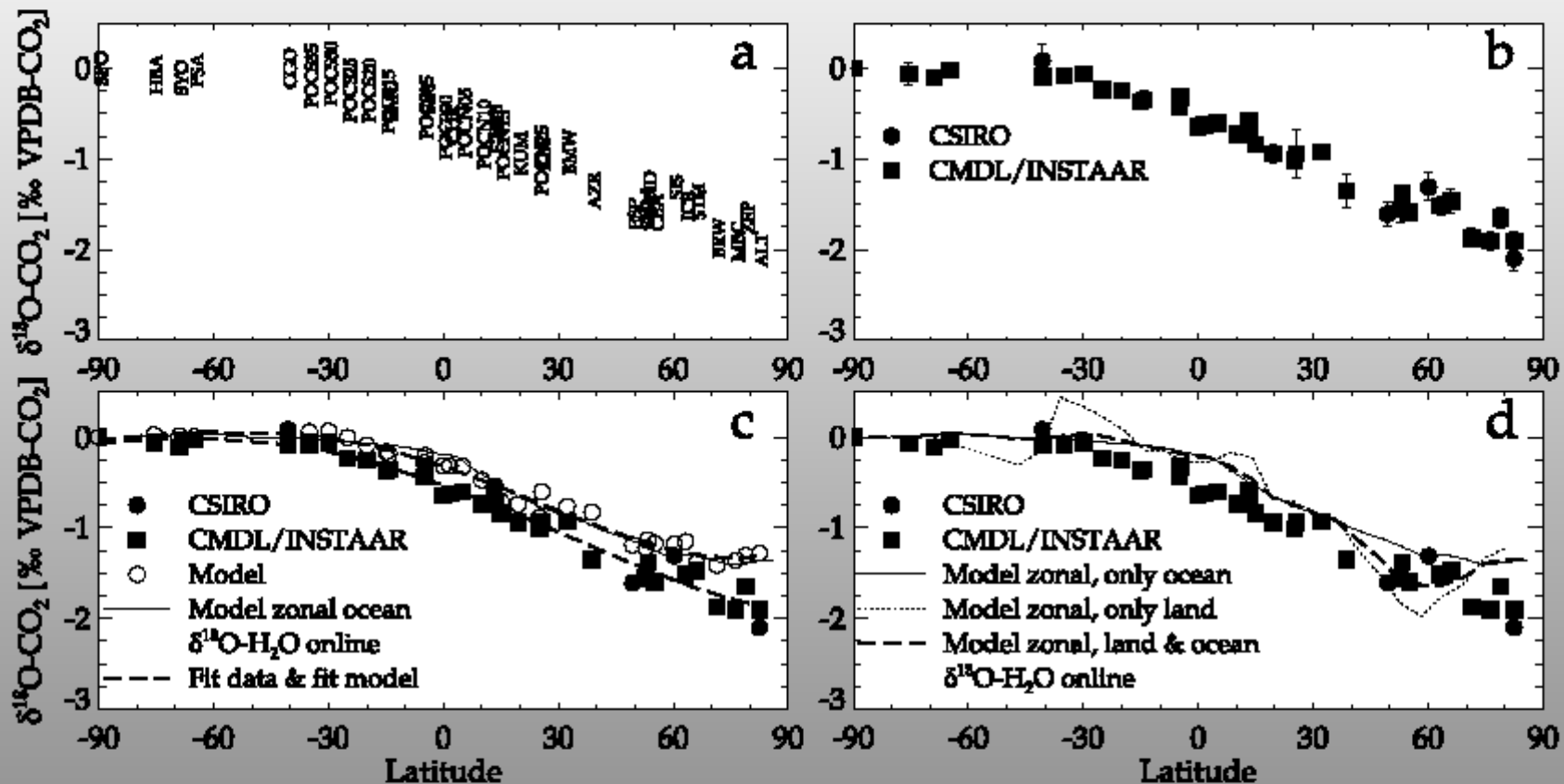
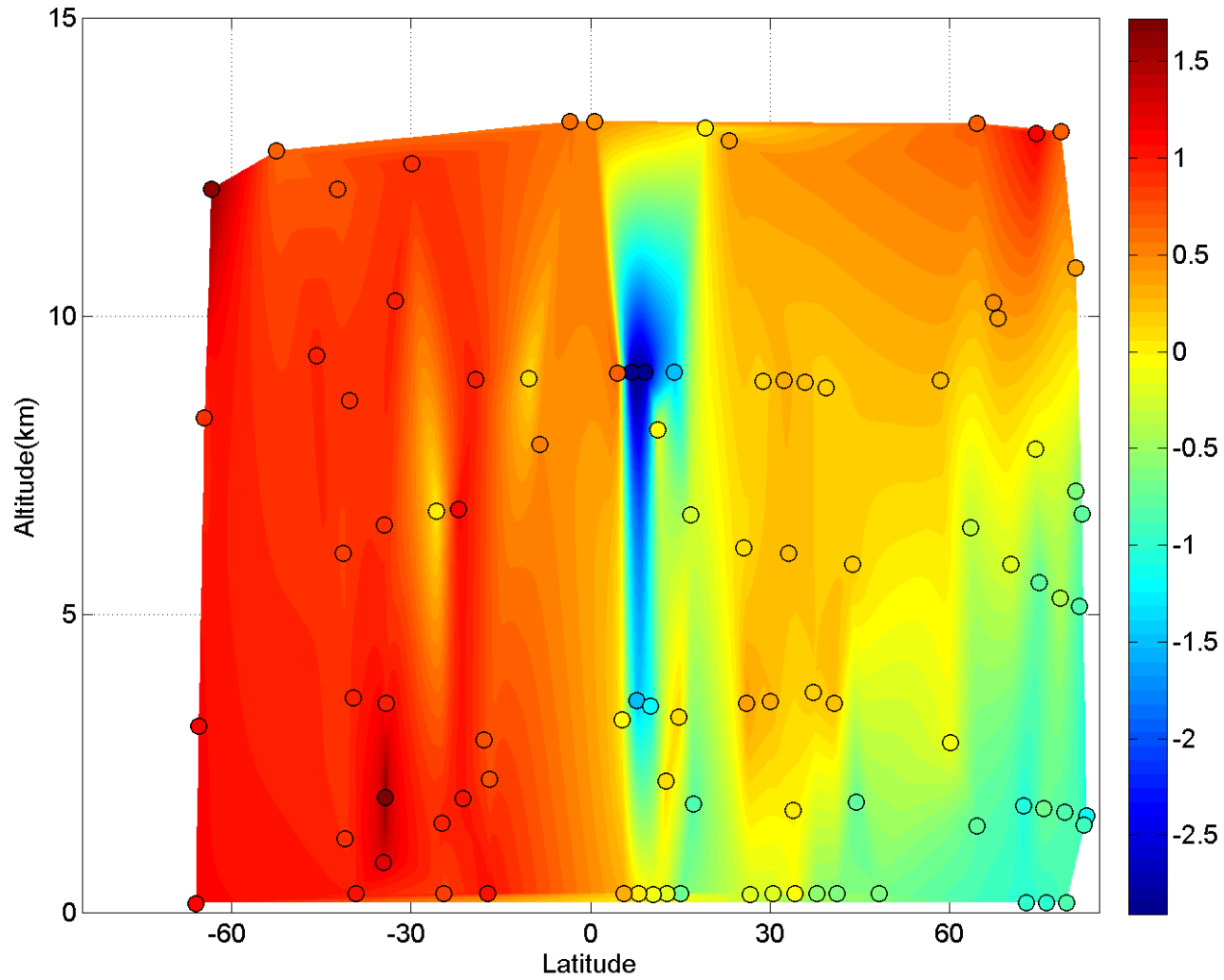
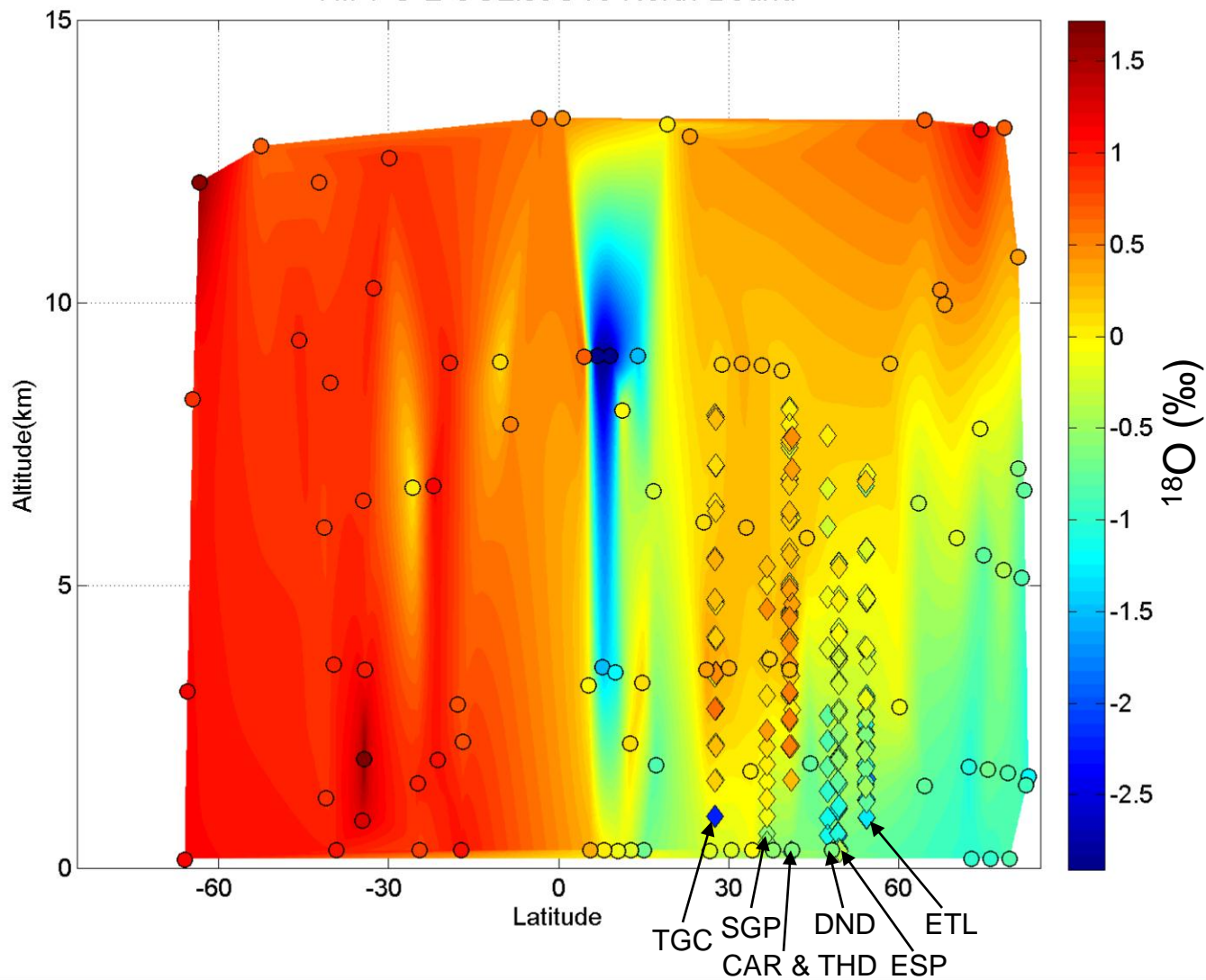


Figure 4. Meridional gradient of  $d^{18}\text{O}\text{-CO}_2$  relative to South Pole. For simplicity, Figure 4a shows each MBL station's abbreviation centered over its mean value relative to South Pole; . . .

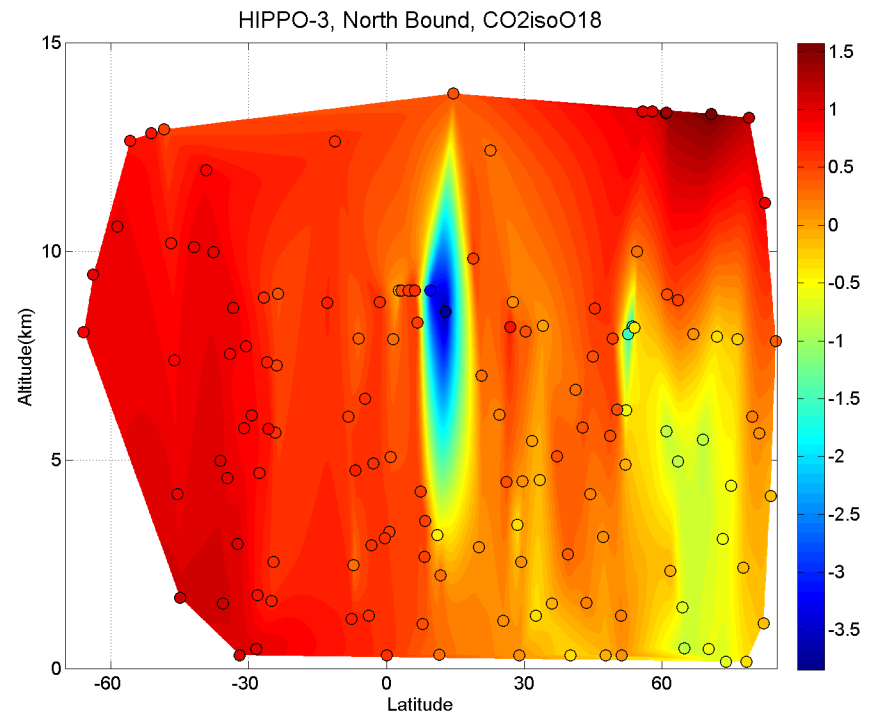
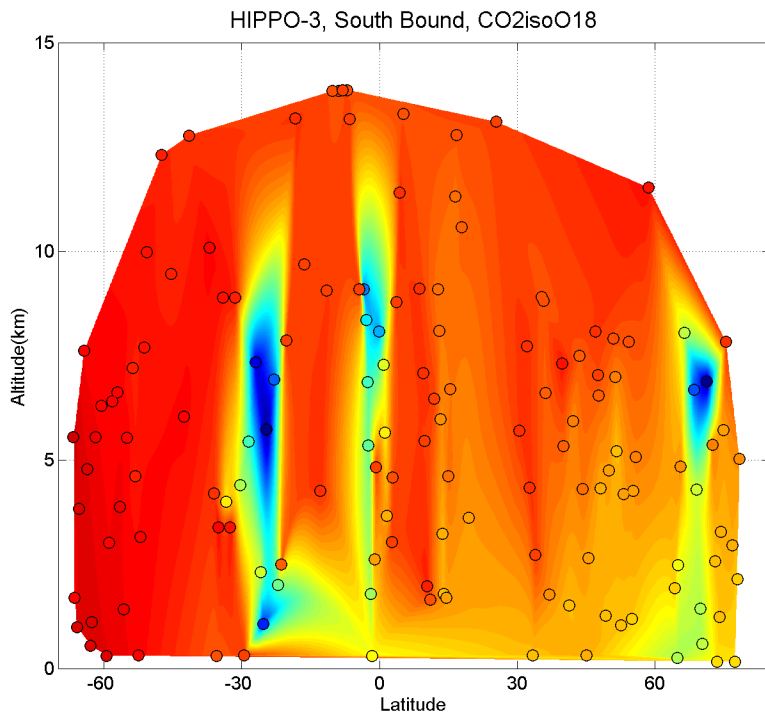
HIPPO-2 CO2isoO18 North-Bound



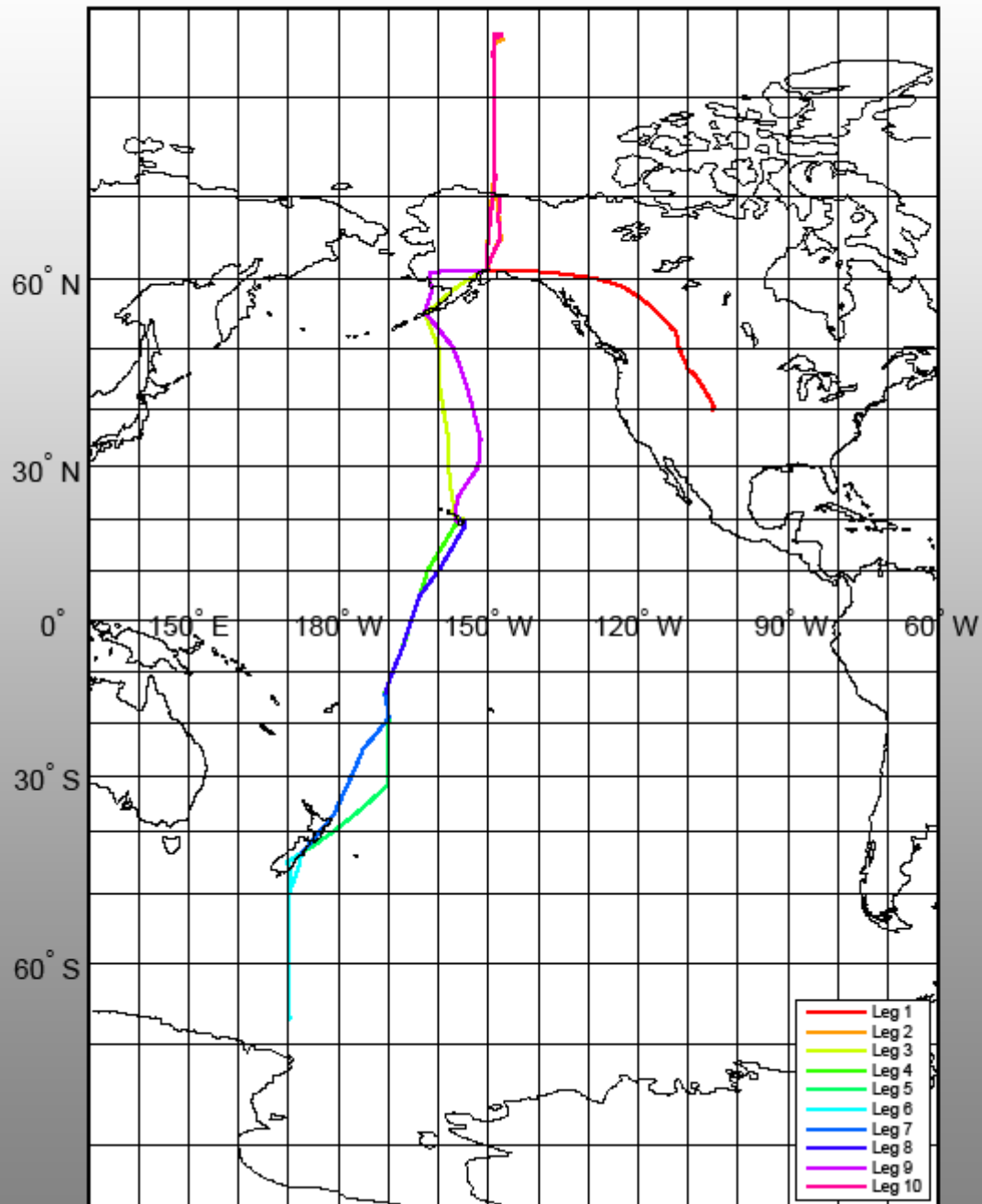
HIPPO-2 CO2isoO18 North-Bound



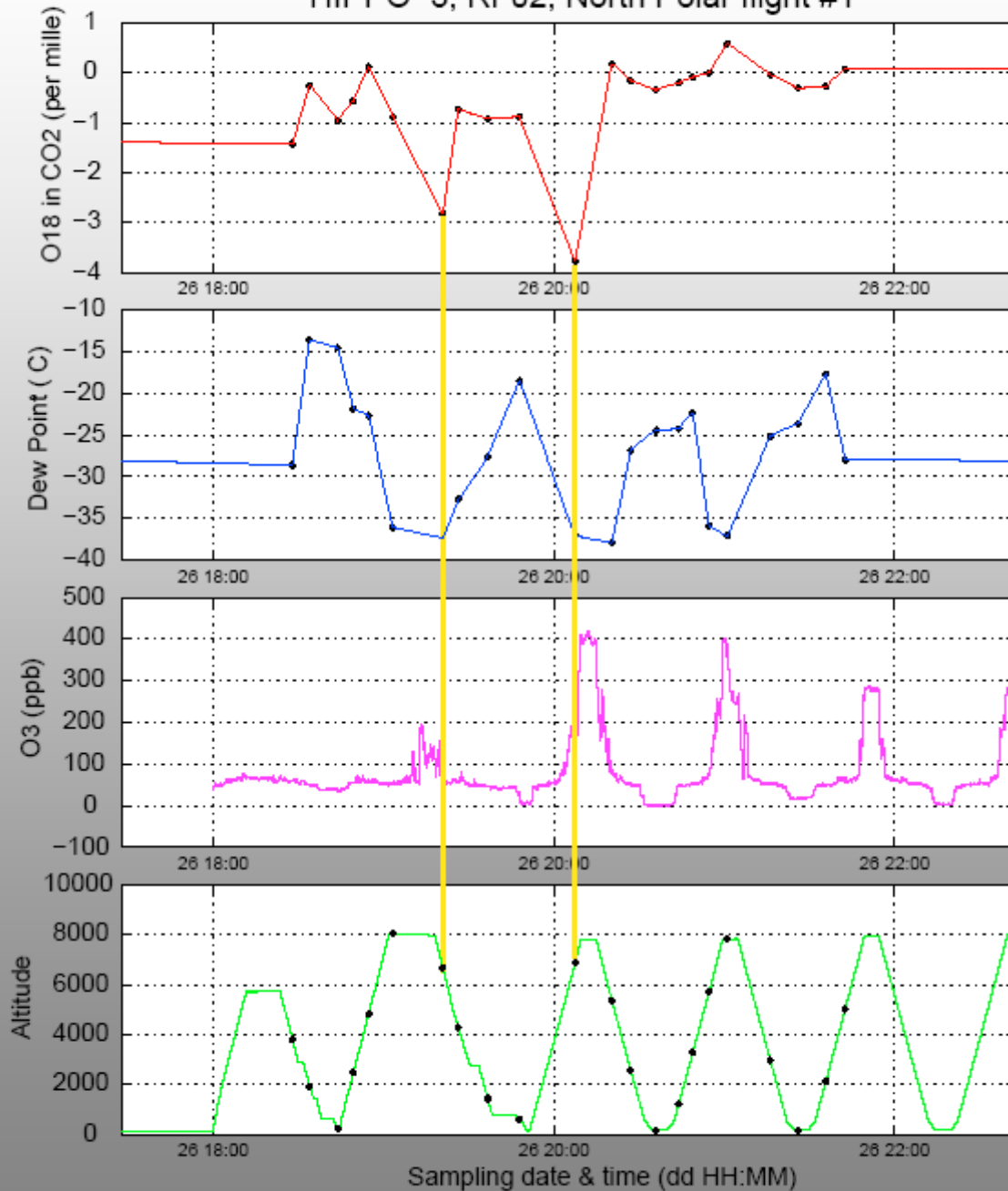
- Depletions in  $^{18}\text{O}$  in  $\text{CO}_2$  can occur at **both high and low latitudes**.
- Manifests most strongly in **mid-altitudes (5-10 km)**.
- $^{18}\text{O}$  “depletion features” are **transient**...
  - e.g., Latitude  $-25^\circ\text{S}$  feature disappeared within 6 days.



# HIPPO-3 (March-April 2010)

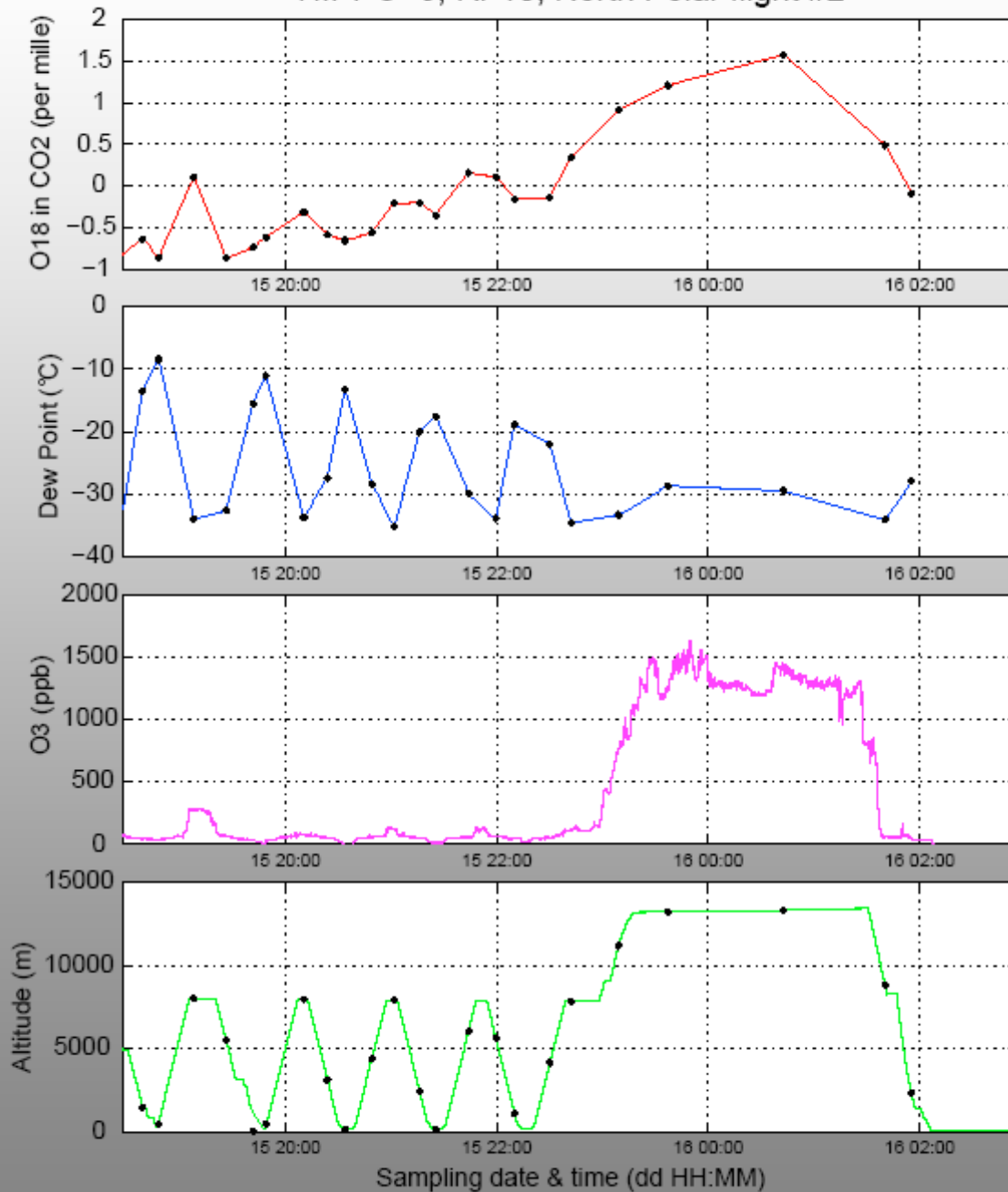


# HIPPO-3, RF02, North Polar flight #1



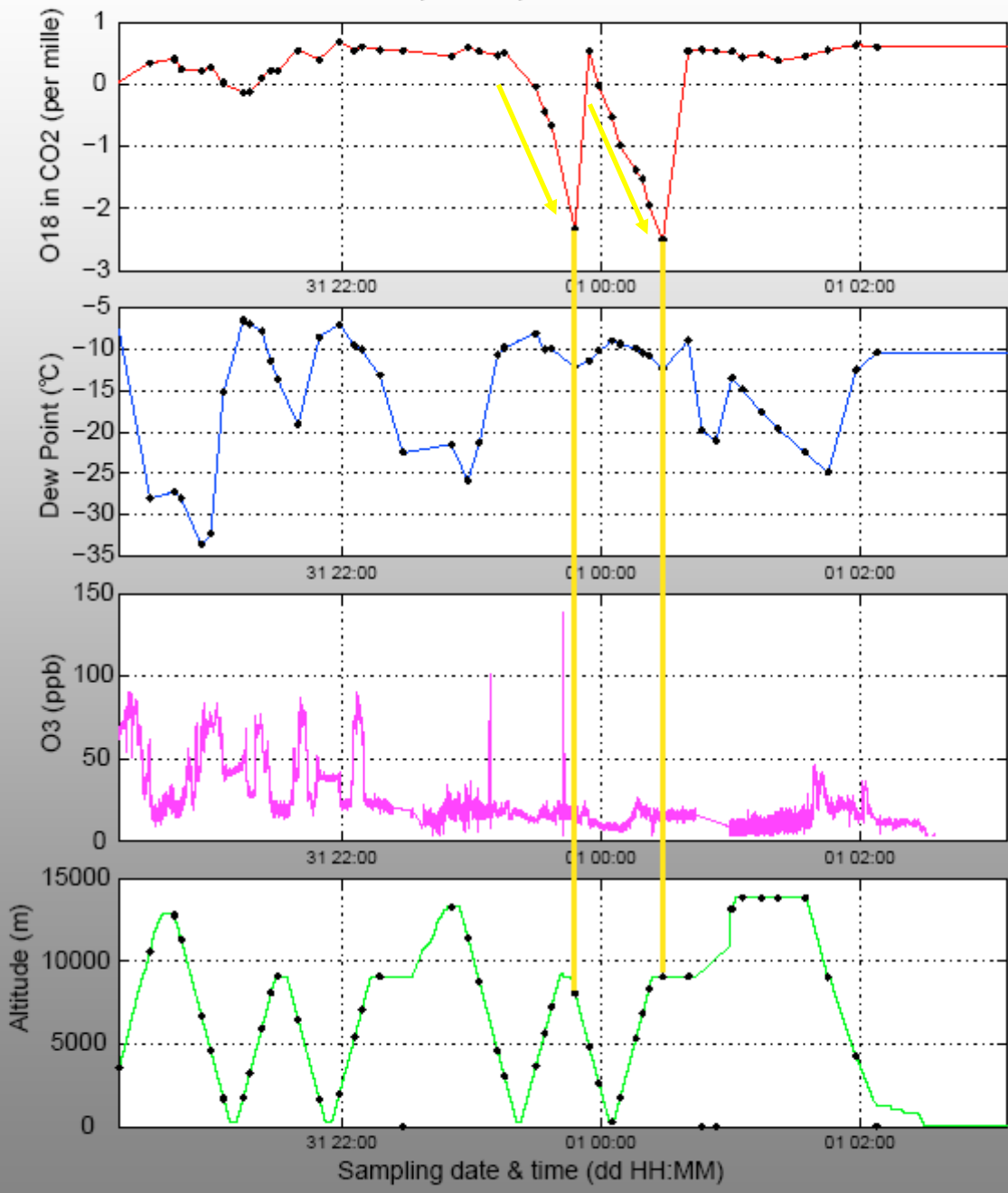
# HIPPO-3, RF10, North Polar flight #2

19 days after Polar flight #1

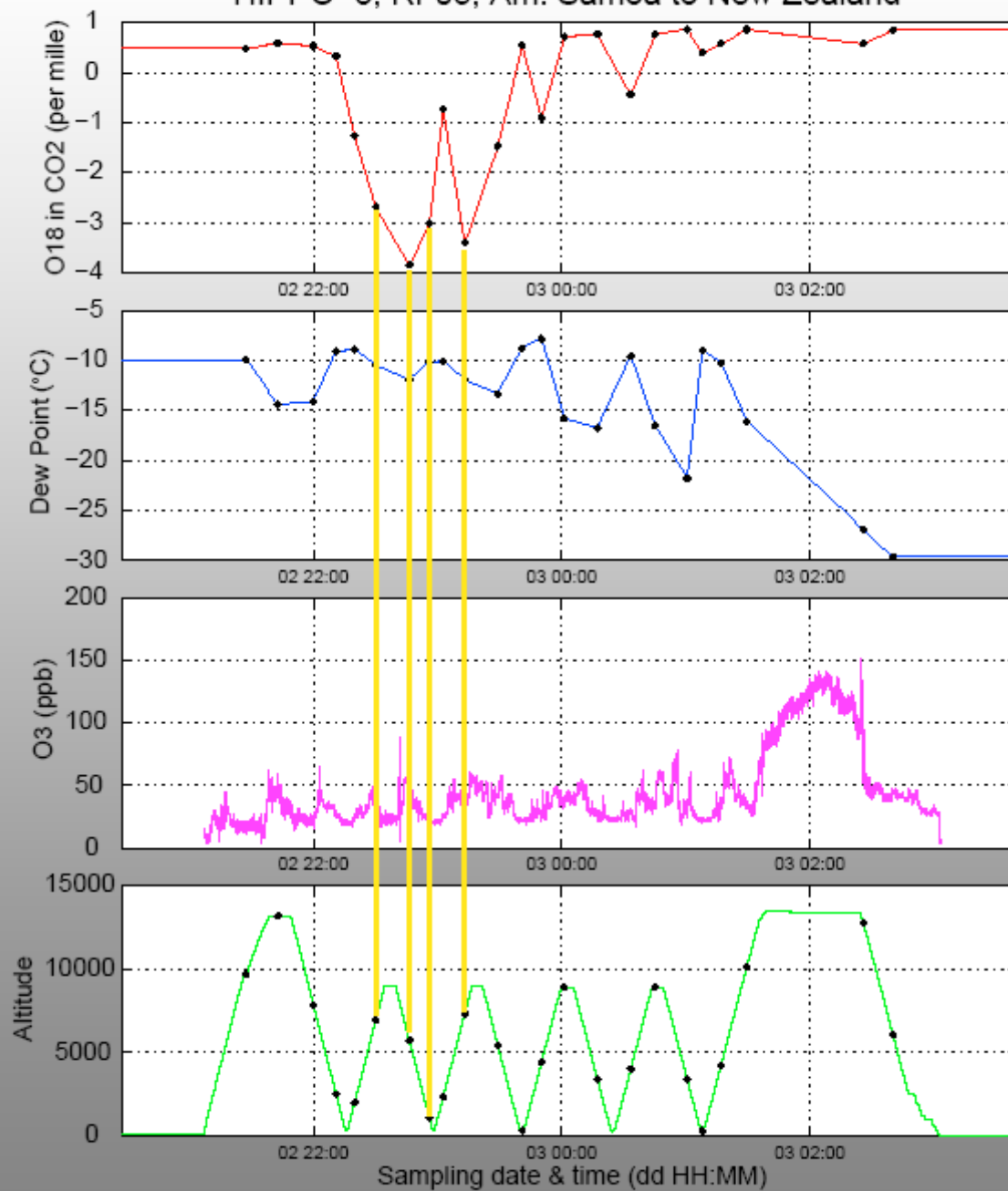




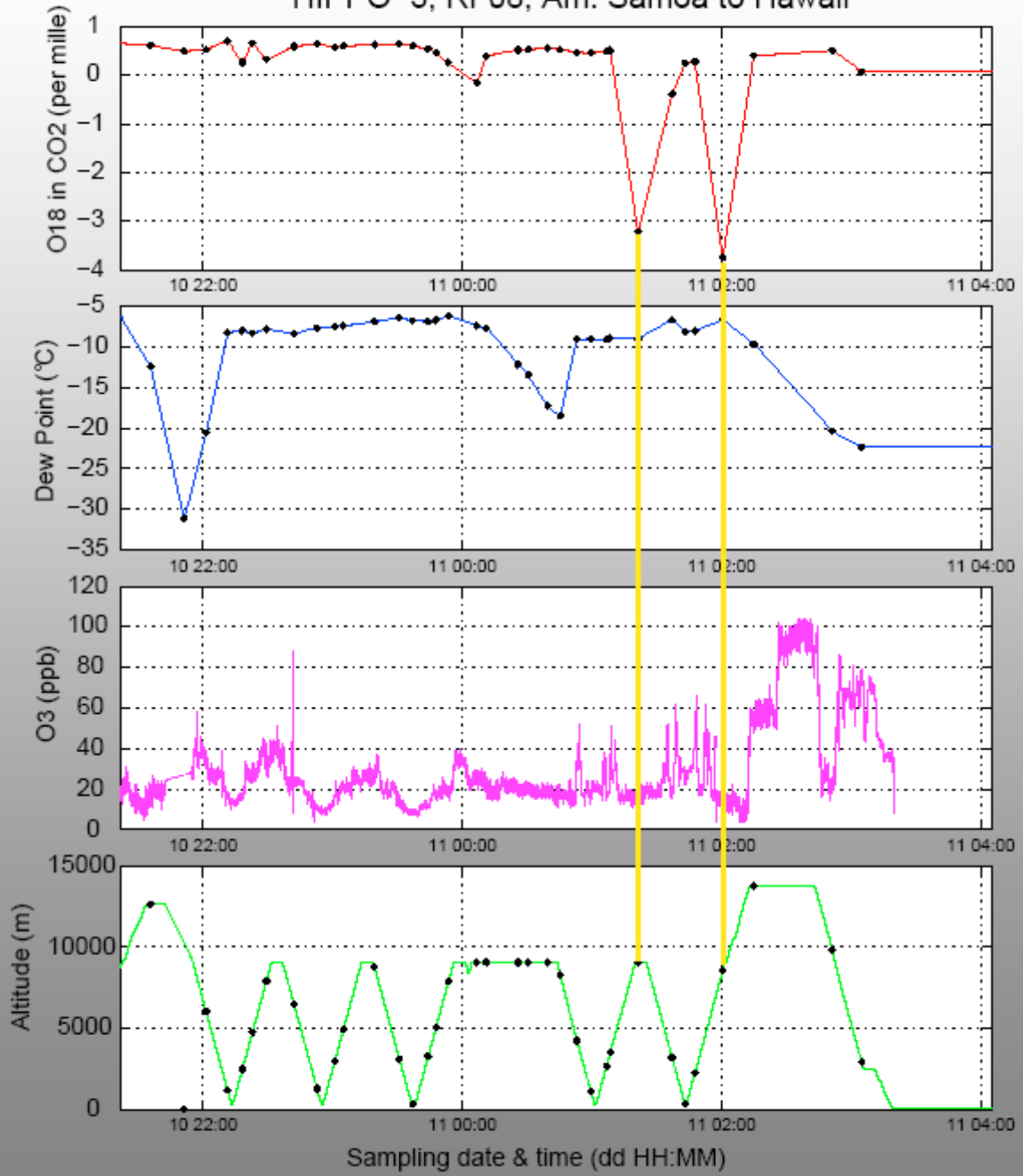
# HIPPO-3, RF04, Hawaii to Am. Samoa

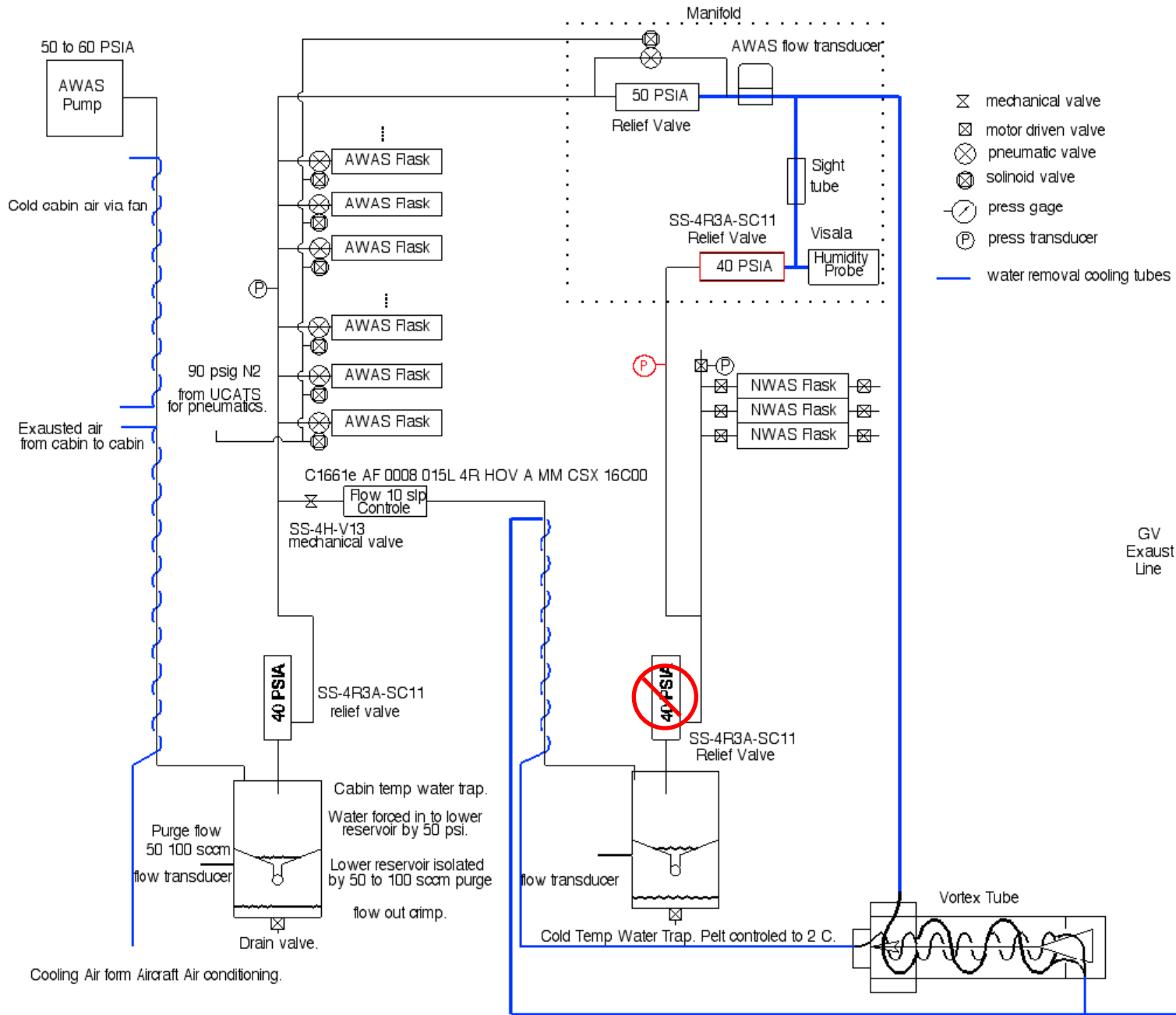


# HIPPO-3, RF05, Am. Samoa to New Zealand

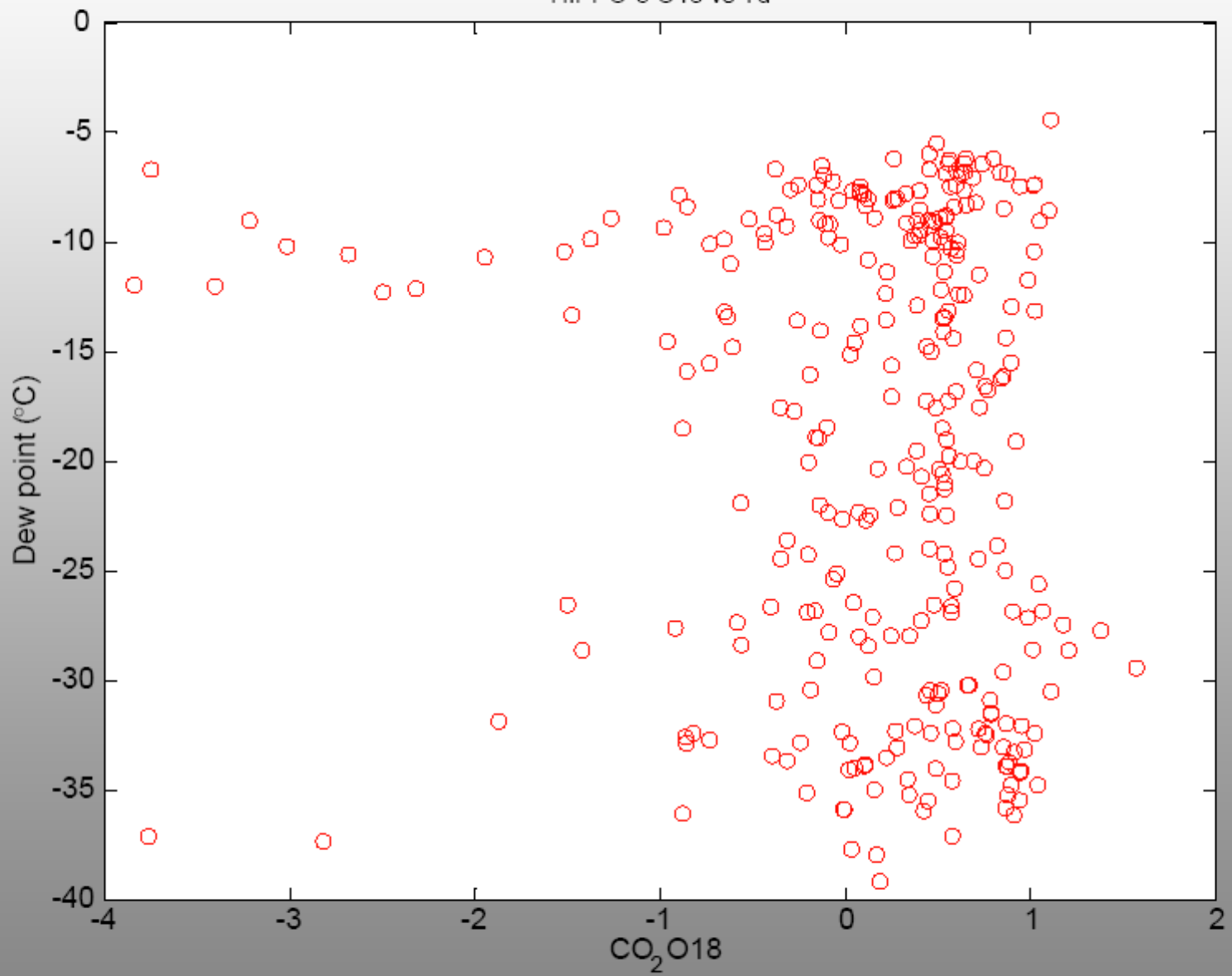


# HIPPO-3, RF08, Am. Samoa to Hawaii



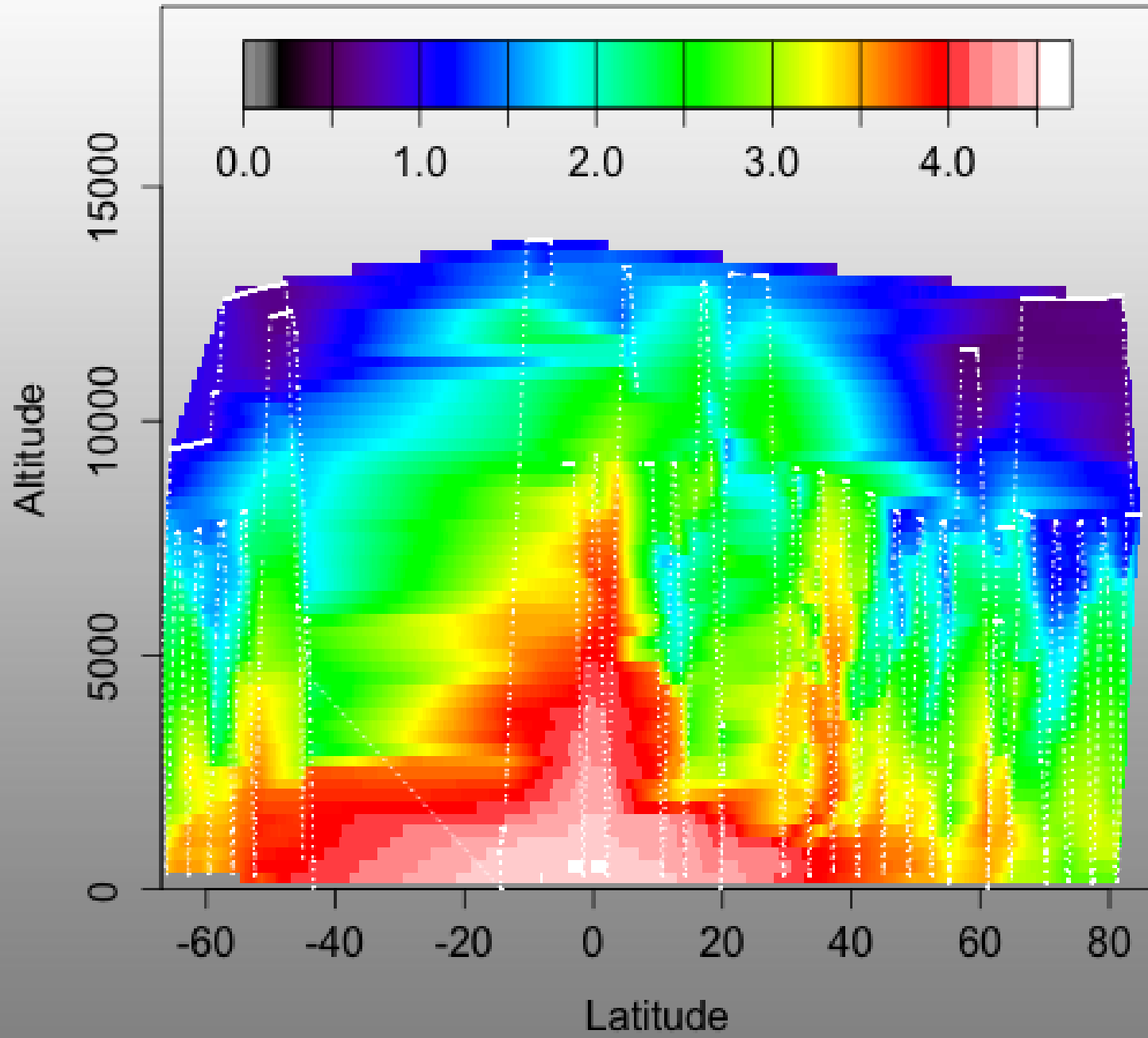


HIPPO-3 O18 vs Td



# log10.H2O.VX

Filts 2 3 4 5 6



## Ideas?

- Analytical artifact?
  - Alteration of the atmospheric  $^{18}\text{O}$  signature  $\text{CO}_2$  occurs during sampling?
  - Alteration during storage? Order one month exchange times possible.
- “Real” phenomena?
  - The  $^{18}\text{O}$  in  $\text{CO}_2$  signature of an air mass may be modified by exchange with depleted  $\text{H}_2\text{O}$  in clouds under “certain conditions”.

## Summary

- Depletion of  $^{18}\text{O}$  in  $\text{CO}_2$  observed in HIPPO-2 (11/2009) & HIPPO -3 (4/2010).
- Dewpoints of samples do not always correlate with  $^{18}\text{O}$  depletion...
  - e.g., high moisture & depletion but also low moisture & depletion.
- $^{18}\text{O}$  in  $\text{CO}_2$  “depletion features” are transient
  - features observed on the S-bound leg not observed N-bound
  - features persist between dives separated by 86 mins.
  - features may be ~500km in breadth.
- Uncertain at this time whether this is a **real phenomena** or simply an **analytical artifact**.

## Acknowledgements

CCGG/ESRL/NOAA, CIRES/CU, HATS/ESRL/NOAA, Harvard University, NCAR, RAF, Stable Isotopes Lab (SIL)/INSTAAR, UCAR